INSTRUCTION MANUAL

VULCANO SINTER LCD

FURNACE FOR CERAMICS, SINTERIZATION AND INFILTRATION

INSTRUCTION MANUAL

VULCANO SINTER LCD

1) receiving

The equipment is packed separately from the vacuum pump. Check the receiving of two boxes, if you have purchased the furnace and the pump.

When opening your equipment package, verify the general state of the packages, in case of visible damage, immediately complain with the currier service. We remind you that the good travels on the expenses and behalf of the purchaser and is insured by the currier company.

1 - 1) the Vulcano Sinter LCD contains:
A) An injected foam placed furnace.
B) A rigid blanket – I – Pic. – 5 – Item-(24).
C) A soft blanket.
D) A burn platform Pic.-4-Item (23).
E) A set of isothermal pins Pic.-5-item-(25).
F) Instruction manual.
G) Warranty term.

P.S.: In case you have purchased the furnace without the pump, do not consider the material related in the item (1-2).

1-2) The vacuum pump contains:
H) The vacuum pump.
I) A 1.5 N.P.T. hose.
J) Metallic hinges.
K) Isolating rubber feet for fixation (4 pieces).
L) Connection identification labels.

IMPORTANT

The VULCANO SINTER LCD furnace needs the vacuum pump always connected to the furnace even in the burns that do not use vaccuum as in the case of the sinterization/infiltration. In this operation the pump will be requested by the system S.A.LV. (Long Life Heating System), to help with the Air circulation in the interior of the muffle, increasing the heating durability (resistance).
ATTENTION: The non-observance of this procedure will interfere in the good work of the equipment and in the loss of warranty. Always keep the pump connected and in operation conditions.

VULCANO SINTER LCD
Furnace for ceramics, sinterization and infiltration of alumina-glass composites.

1) S.A.L.V. System
In your VULCANO SINTER LCD the technological advances are incorporated that made possible the same equipment perform perfectly 3 functions: traditional ceramics burn, alumina sinterization and infiltration.
The covering used In the aluminum oxide sinterization, when heated more than 500º C, eliminates by-products which are absorbed by the muffle that are released under vacuum contaminating the ceramics, provoking stains and cracks on the sinterization
Long periods in high temperatures (1.180º) in hermetic chambers (vacuum muffles) diminish the shelf life of the heating resistance. To avoid these problems, it was developed the long life heating system S.A.L.V. ® Pat. Req..
The metallic leagues used as heating resistance have in their composition elements that, when in contact with the air, form an oxide adherent layer that protects them against wearing.
The exclusive S.A.L.V. system developed and patented by EDG promotes an air flux in the interior of the quartz tube that sustains the resistance. This flux renovates and maintains the protective oxides layer, greatly increasing the shelf life of the resistance to high temperatures, promoting the constant cleaning of the muffle from the contaminant elements.
To withstand the high temperatures involved, the sensor (termopar) should be made of platinum, which, in its turn, is not adequate to low temperatures and speeds needed for the water elimination in the sinterization process.
A high level software was developed to compensate the limitations of the platinum to low temperatures.
Due to the characteristics of the sinterization process, new thermal isolating materials were used and an efficient ventilation system, to keep the careenage temperature and components within compatible values.

2) MAIN CHARACTERISTICS

Withstand resistance through quartz tube ;
Low thermal mass thermal isolation in vacuum molded ceramic blanket;
Long shelf life S.A.L.V. heating system;
Muffle ventilation in the sinterization/infiltration, eliminates stains and minimizes cracks;
Unlimited programs: Receipts that can go from (Cod. 001) to (Cod. 999) in a single bank, either for the ceramics as for the sinterization/infiltration;

Exclusive system of mobile muffle that eases the positioning of tasks in the burn platform, with linear closing and opening;

Management and controlling through dedicated microprocessor;

Easy visualization of the burn parameters;

Work environment temperatures of 1.100ºc for ceramics and 1.180ºc for sinterization/infiltration;

Maximum temperature limiting factor of 1.200ºC;

0,1 to 70º C/ min. decimal linear heating speed;

Thyristorized potency control;

0 to 30 minute ceramics burn time;

0 to 9 hours and 59 minute sinterization/infiltration time;

Visualization of decreasing burn times;

0 to 30 minute vacuum time with decreasing time visualization;

Piece drying times as well as programmable and independent (opening and closing of the muffle);

Security systems protect the equipment from operation errors;

Light and sound indication of all the phases of the process;

To avoid the heating of the environment and save energy, after 10 minutes without operation, an alarm will sound and a message “Protection” will be print in the panel, warning that the muffle will have to be automatically semi closed;

Fast cooling, low thermal density;

Working time totalizator;

Burn cycle totalizator;

Programming with MENU system and scrolling bar to navigate with fast access to all functions;

Low cost muffle substitution system;

Electronic and heating system forced ventilation that keeps the integrity of the components;

3) INSTALLATION

The numbers in parentheses refer to the following pictures.

Your VULCANO SINTER LCD should be kept far from curtains and other inflammable materials. An furnace is a heat generator that must be dissipated; otherwise there will be over heating of its components. Therefore, place the equipment in a ventilated place that allows free air flow.

It is advisable a 15 centimeter minimum distance between the furnace and any blockage that may prejudice ventilation.

Place your furnace away from taps or sinks that provoke water splashing on the equipment.

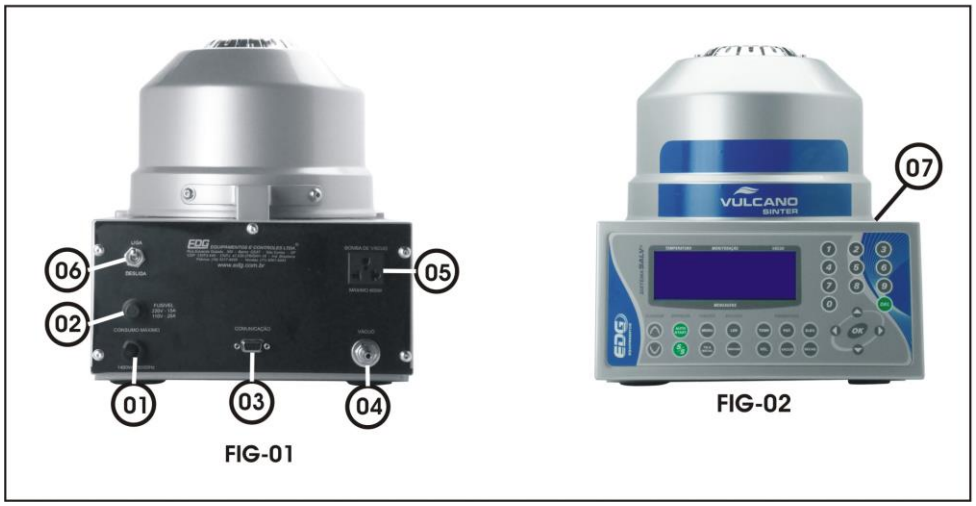


FIG-01

FIG-02

01 –Net/feeding cable tension identifier
02 – Fuse door.
03 –Serial communication for check up (technical assistance).
04 –Vacuum hose connection.
05 – Female plug for the mandatory vacuum pump connection.
06 – On/off general key.
07 –Muffle ventilation.

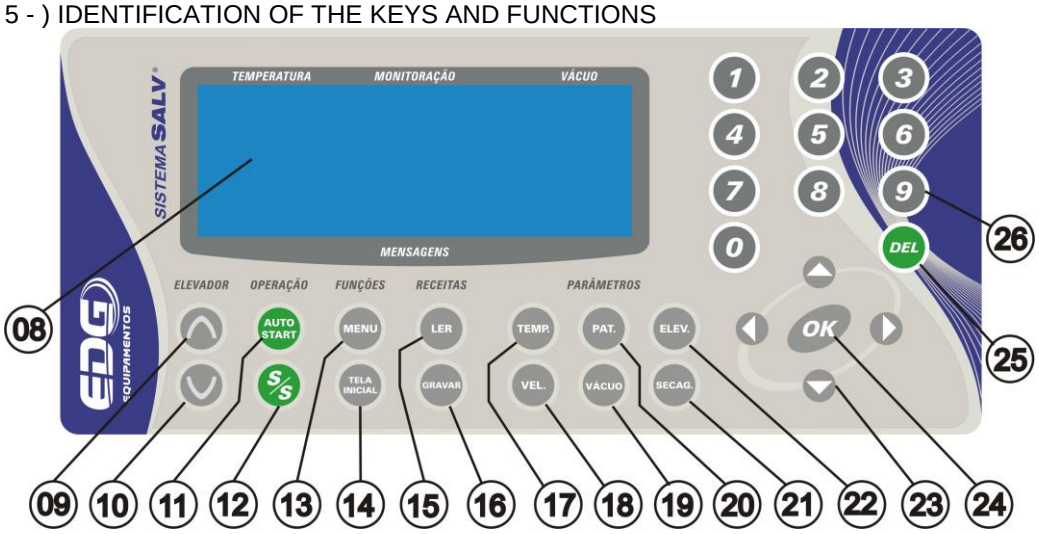
4.1) Verify if the tension of your network is the same as the indicated in your furnace label PIC. -1- Item (1).
4.2) Install the furnace in an exclusive electrical network using the 6mm^2 thread if your network is 110 volts or 4mm^2 for 220 volts.
4.3) Never connect the furnace in the same network where other furnaces, compressors, electrical taps or any other high consumption devices are connected.
4.4) Verify if the plug which the furnace will be connected is in optimum conditions, of good quality and with 20 amperes capacity.
4.5) Connect the earth terminal (round pin of the plug) to an earth rail and never to the neutral of the network.
The non-observance of the above items will interfere in the good work of the equipment, its warranty and on the operator safety.
4.6) It is advisable the use of a tension regulator only if your electrical network is very unstable. This can be verified when the lamps blink or constantly alter their intensity.
The recommended regulator transformer is the automatic autotransformer of saturated nucleus with at least 2Kw capacity.
Do not use regulators used in computers of any kind, they are not appropriate for this application.
4.7) Couple the vacuum hose to the furnace PIC – 1 Item (04) and the pump. Connect the feeding cable of the vacuum pump to the plug that is at the back of the furnace PIC – 1 Item (05)

5) CONTROL PANEL

5 – 1) The panel has a 4X20 digital display LCD with blue background, white writing, that allows easy identification of the programming functions and monitoring of the registries. It

indicates some messages of the process, of safety, such as system failure or error in the operation.
5 – 2) It has a membrane sensitive to the operator's touch, with sound and visual recognition, making the identification of its keys and functions easy.

5 -) IDENTIFICATION OF THE KEYS AND FUNCTIONS



5 - 4) Item (08) 4x20 LCD Display blue background, white writing.
5 - 5) Item (09) Elevator manual activation keys (OPEN) muffle, with ON/OFF logic (turn on/ off);
5 - 6) Item (10) Manually activation muffle elevator keys (CLOSE) with ON/OFF logic (turn on/off).
5 -7) Item (11) (AUTO /START) key burn automatic start.
5–8) Item (12) (START/STOP) key starts or interrupts the burn.
5–9) Item (13) (MENU) key for adjustments of the internal parameters.
5– 10) Item (14) (INITIAL SCREEN) key goes back to the general monitoring without altering any parameter, it restarts the original configurations.
5– 11) Item (15) (READ) key allows the loading of the databank recipes in the addresses (Cod. 001 to 9999).
5–12) Item (16) (RECORD) key stores receipts in the databanks in the addresses (Cod. 001 to 999).
(5– 13) Item (17) (TEMP) key allows programming the temperatures T01, T02, T03. maximum limit in 1180ºC.
5 – 14) Item (18) (VEL) key allows programming the heating speeds A01, A02, A03. minimum (00,1 ºC/mim) and maximum 70,0ºC/mim).
5–15) Item (19) (VACUUM) key allows programming vacuum times V01,V02 and V03. minimum (00: 00) zero, maximum (30:00) minutes .
5–16) Item (20) (PAT) key allows programming the burn times P01, P02, P03, minimum zero, maximum (09:59) hours.
5–17) Item (21) (SECAG.) key allows programming the drying in the beginning of the burn before initializing the elevator system. Minimum (00:00) and maximum (30:00) minutes..

5– 18) Item (22) (ELEV.) key allows independent programming of the elevator times, OPENS and CLOSES of the muffle, in the positions M=Manual, D= Direct, and of (1 to 9) minutes.
5 – 19) Item (23) (VERTICAL AND HORIZONTAL ARROWS) key allows the navigation through the screens and functions of the whole system, moving the cursor, selecting to the desired option.
5–20) Item (24) (OK) key allows the confirmation of selected item in the moment of navigation.
5 – 21) Item (25) (DEL) key allows the erase: recipes, process variables, typing mistakes.
5 -22) Item (26) Numerical keys from (0 to 9) allows the insertion of values directly in the recipe programming.

6) SYSTEM INITIALIZATION.

6–1) Plug the furnace to an exclusive good quality plug properly landed to a copper pole and never to the neutral, verify if the electrical network is compatible with your equipment voltage, verify the cable label or the back print of the furnace. Pic. 1 – item (01).
6–2) Turn on the general key Pic. 1 – item (06) and wait for the equipment initializations. In the initial screen a bar being sequentially filled out will be seen, indicating, step by step, all the equipment checking, according to the Ex.

6–3) Screen 1 in this moment the system verifies all the vital functions for the operation, and performs the initial configurations, it will appear the name of the product and the current version for the product historic control.

The program waits for 30 seconds for the air to come back to the muffle, in case it is with vacuum. And following this, the system loads the standard sinterization recipe and keeps waiting for a command from the operator to perform a new function.
6–4) Screen - 2 Monitoring the standard recipe of the company sinterization. Remember that in sinterization, the furnace only heats after receiving the command (start) sent by the operator, therefore, the registered temperature in the display will be close to the room one. Ex.of the Monitoring screen.

6–5) The furnace should not initialize without the ceramic fiber molded burn platform placed in the base, Pic – 4 item (23), otherwise the sealing ring and the base itself will suffer serious damage. Choose the kind of accessory to be used by the kind of work to be performed. Pic – 5

6–6) SINTERIZATION BURN AND INFILTRATION
Accessories:
-Use rigid blanket – I, item (24) on the platform item (23).

6–7) Conventional ceramic burn.
Accessories:
-Use a rigid blanket – I item (24) on the platform. Item (23).
-Use isothermal pins for the sustaining of the piece. Item (32).

OBSERVATION

Place the piece on the isothermal pins in a way that it could receive heat from all angles; this procedure improves the uniformity of the burn. Keep the piece in the thermal center.

7) CERAMICS RECEIPT PROGRAMMING

7–1) For better illustrate it, we will follow practical examples of recipes for conventional ceramics:

-Setting from the environment temperature, go to T01 = 420ºC which is the entry temperature of the work in the furnace.

_Stay in this temperature until the operator's command to start the burn. Function START (12).

_The (drying) process of the piece should occur in two minutes' time, with the elevator stopped in the desired position by the operator.

-The muffle closing process (pre-heating) should take about three minutes.

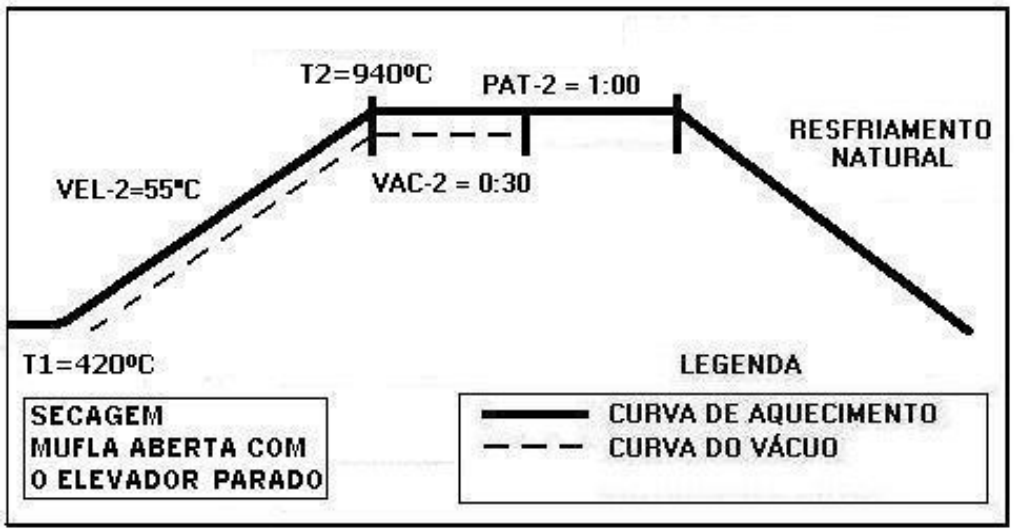
-The burn temperature is 940ºC. (T02).

-The heating speed between T01 and T02 should be 55ºC/minute.

-The vacuum should switch on in the muffle closing and switch off 00:30 seconds after the burn time has begun.

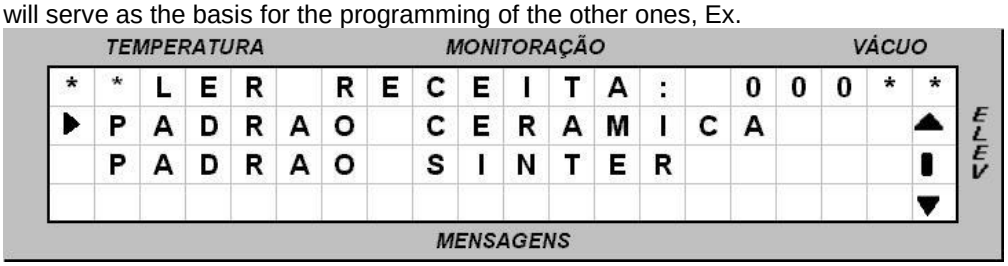
-Having finished the burn, the muffle opening will begin activating the elevator, this process should occur in 1 minute.

EXEMPLO DE RECEITA PARA CERÂMICA CONVENCIONAL									
TEMP-1 ºC	VEL-1 Fixo	PAT-1 Elevador	TEMP-2 ºC	VEL-2 ºC / min	PAT-2 min	VAC-2 min	SECAG. min	ELEV-PRÉ-AQUECIM. FECHA	ABRE
420	60	Na base	940	55	01:00	00:30	02:00	3	1



7–2) BEGINNING THE RECIPE PROGRAMMING

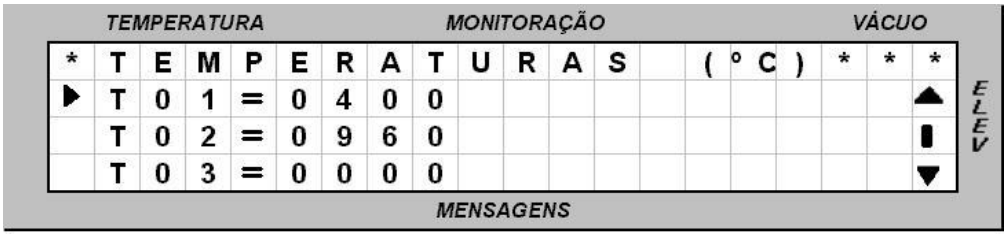
Pressing the READ (15) key select the recipe CERAMIC PATTERN, through the navigation keys (23) and confirm the option with the READ (15) or the OK (24) key. This recipe will serve as the basis for the programming of the other ones, Ex.



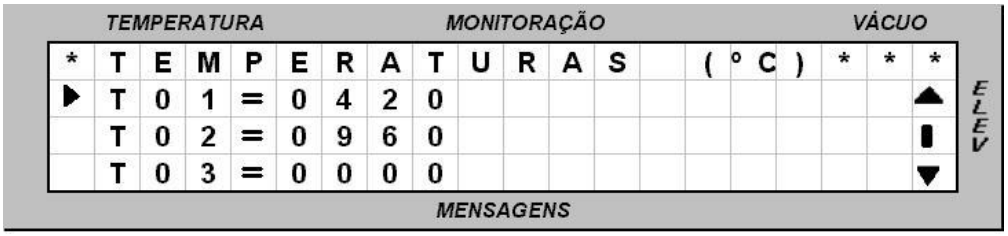
7–3) After the confirmation of the reading, the system goes back to the general monitoring screen, indicating in the messages field the name of the desired recipe, according to Ex.

7–4) Adjustment of temperatures – T01, T02, T03.

Press the TEMP (17) key, the display will show the temperatures programmed in the standard recipes of the factory. Ex.



7–5) Following this, press the navigation (23) keys and move the cursor over the T01 field, type on the numerical keyboard (26) the temperature of 420ºC. Ex.



7–6) Prooceed the same way with the temperature T02, type 940ºC and keep T03 in zero.

7-7) ADJUST THE SPEEDS A02 AND A03
OBS: Remember that for the ceramic recipes the speed between the room temperature and the T01 one is fixed in 40ºC/ minute.

7-8) Adjust the speeds, A02, A03.
Press the VEL, (18), the display will show the programmed speeds in the factory standard recipe. Ex.

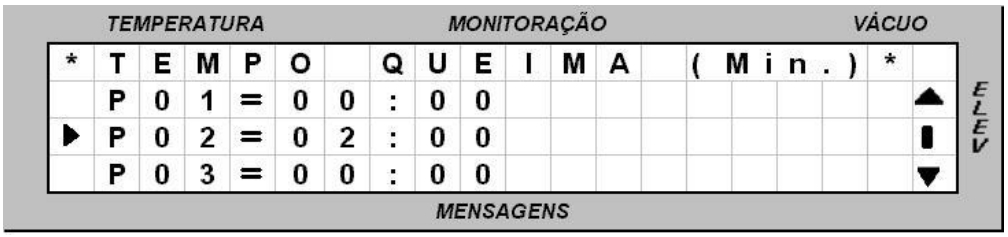
7-9) Following this, press the navigation (23) keys and move the cursor over the A02 field, type in the numerical keyboard (26) the speed of 55ºC/min. Proceed the same way with A03 keeping in zero. Ex.

7-10) ADJUST OF THE BURN TIME – PAT, P02 AND P03

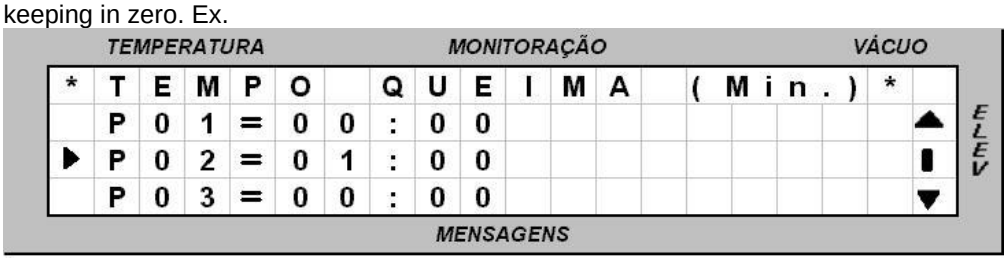
OBS: The burn times in the ceramic processes are indicated in minutes and seconds ex: 00:30 corresponds to thirty seconds; 05:35 corresponds to 5 minutes and thirty-five seconds. Remember that in ceramics and in T1 open muffle furnace, the P01 time is not counted.

7-11) ADUSTMENT OF THELEVELS, PAT. P02, P03.

Activate the PAT. (20) key, the display will show the programmed burn times in the factory standard recipe. Ex.



7-12 Following this, press the navigation (23) keys and move the cursor over the P02 field, type in the numerical keyboard (26) the time of (01:00 min.). Proceed the same way with P03 keeping in zero. Ex.



7-13) ADJUSTMENT OF THE VACUUM TIME – V02 – V03

7-14) Press the VACUUM (19) key, the display will show the programmed times in the factory standard recipe. Ex.

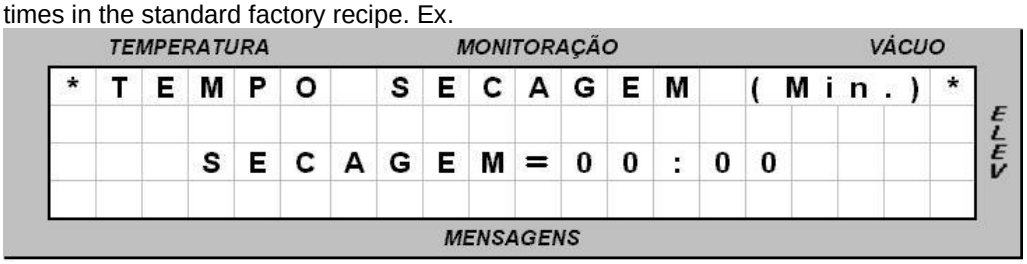
7-15) Following this, press the navigation (23) keys and move the cursor over the V02 field, type in the numerical keyboard (26) the (00:30 min.) time. Proceed the same way with V03 keeping in zero. Ex.

7 -16) OBSERVATIONS ABOUT THE VACUUM

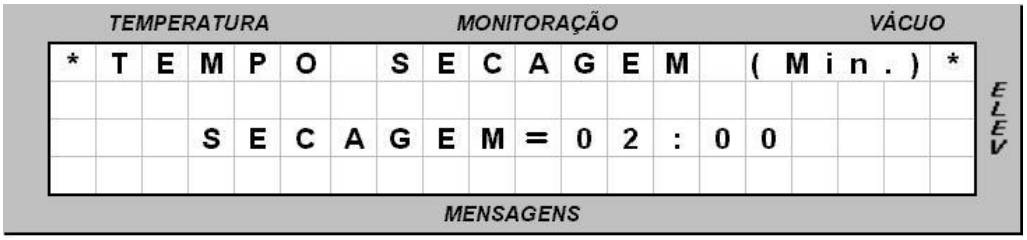
A) The vacuum time can never exceed the burn time, in case the attributed value to the vacuum time is superior to the burn time, the furnace will execute the vacuum time equal to the burn time.
B) The vacuum time equals to “00.01” (1-second) indicates that the vacuum will be performed in the heating ramp between T01 and T02 when the T02 temperature is reached, the vacuum will be switched off.
C) Vacuum time equals to “00.00” (zero) indicates that the vacuum will not be performed at any time of the burn.
D) Vacuum time over (1-second) Ex: “00.30” indicates that the vacuum will be performed in the ramp and in the level..

7-17) PROGRAMMING THE DRYING

Press the SECAG. (21) key, the display will show the programmed drying times in the standard factory recipe. Ex.



7-18) Following this, press the (26) numerical keys, insert in the field (DRYING=00:00) the time of (2 min.). Confirm the option by pressing the OK (24) key. Ex.



OBSERVATIONS: This function is used with the muffle open, where the operator can set the elevator manually in the adequate position for the drying through the keys (9 and 10).
The operation will only start after the START command (12). Having finished this drying time, the system places the elevator in movement to close the muffle.

7-19) PROGRAMMING THE ELEVATOR ENTRY/EXIT

The closing and opening of the muffle can be programmed independently. Ex.(CLOSE – 1) and (OPEN – D).

7-20) Press the ELEV. key (22), the display will show the open and close times of the elevator, programmed in the factory standard recipe. Ex.

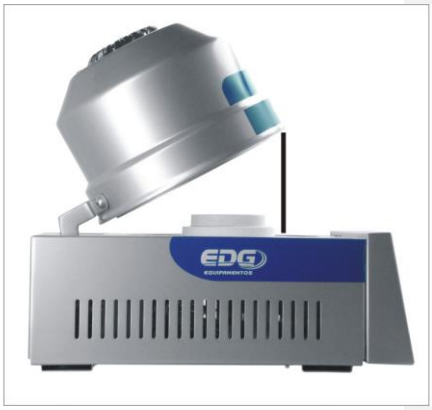
7-21) Following this, press the navigation (23) keys and move the cursor over the field CLOSE in the item-3. Confirm with the OK (24) key the closing time of the muffle in (3 min.). After the confirmation, the selected item will have to be written besides the CLOSE (3) message. Proceed the same way with the OPEN function. Program (1 min.) for the exit of the piece. Ex.

7-22) In the manual (M) position, there will be no time countdown for the closing. In this option, the elevator will only move through the manual activation performed by the operator, in the item manual command arrows (9 and 10).

7-23) In the (D) direct position, the elevator will move in a continuous, non-stop way, until it completes the total journey in the two options, OPEN and CLOSE.

7 -24) The other positions (1,2,3,4,5,6,7,8,9) are programmed in minutes, according to the following table.

TABELA DO ELEVADOR AUTOMATICO						
ABRE / FECHA					TEMPO APROXIMADO	
A	M	.	F	M	Acionamento manual	
A	D	.	F	D	Percurso contínuo	
A	1	.	F	1	1	Minuto
A	2	.	F	2	2	Minutos
A	3	.	F	3	3	Minutos
A	4	.	F	4	4	Minutos
A	5	.	F	5	5	Minutos
A	6	.	F	6	6	Minutos
A	7	.	F	7	7	Minutos
A	8	.	F	8	8	Minutos
A	9	.	F	9	9	Minutos



7-25) The maximum aperture of the elevator system is around 120mm, measured from the tray until the upper side of the muffle. With an approximate inclination of 30 degrees..

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Formatado: Fonte: 12 pt, Cor da fonte: Preto, Inglês (EUA)

Formatado: Fonte: 12 pt, Cor da fonte: Preto, Inglês (EUA)

8) PROGRAMMING SINTERIZATION/INFILTRATION RECIPE

Ex. Sinterization/Infiltration – Process description

8-1) The piece to be infiltrated/sinterized is placed in the burn platform and should dry for 1 minute.

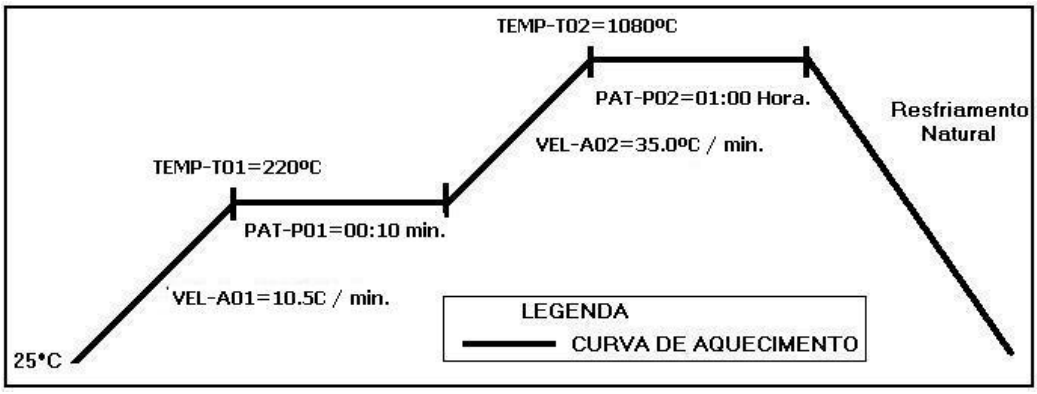
From the room temperature, go until T01=220ºC with a speed of 10,5 c/min. Stay in this temperature for 10 minutes.

Then, raise the temperature until T02 in 1.080ºC with speed of 35ºC/min. Stay in this temperature for 1 hour. The exit of the piece should occur in 9 minutes.

OBS. The sinterization/infiltration processes do not use vacuum.

EXEMPLO DE RECEITA PARA SINTERIZAÇÃO											
TEMP-1 ºC	VEL-1 ºC / min	PAT-1 H / min	TEMP-2 ºC	VEL-2 ºC / min	PAT-2 H / min	TEMP-3 ºC	VEL-3 ºC / min	PAT-3 H / min	SECAG. min / seg	ELEV-PRÉ-AQUECIM. FECHA	ABRE
220	10.5	00:10	1080	35.0	01:00	0	00.0	00:00	00:00	1	9

Below we have the graphic related to the sinterization recipe curve. Ex.]



8-2) INITIALIZING THE RECIPE PROGRAMMING

Press the READ (15) key select the STANDARD SINTER, through the navigation (23) keys or OK (24). This recipe will serve as the basis for the programming of the other ones. Ex.

8-3) After the confirmation of the reading, the system goes back to the general monitoring screen, indicating in the message field the name of the recipe read. Ex.

8-4) Temperature adjustments – T01, T02, T03.

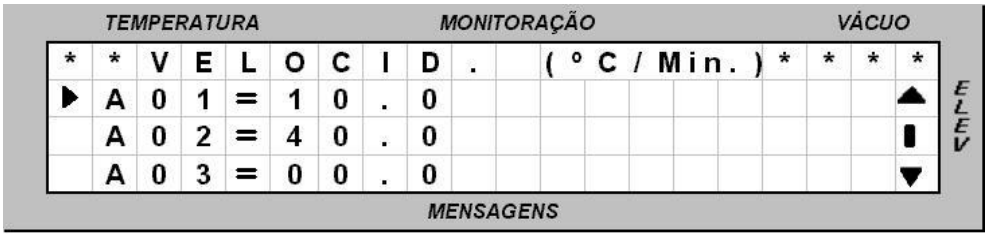
Press the TEMP (17) key, the display will show the programmed temperatures in the factory standard recipe. Ex.

8-5) Following this, press the navigation (23) keys and move the cursor over the field T01, type the temperature of 220ºC in the numerical keyboard (26). Ex.

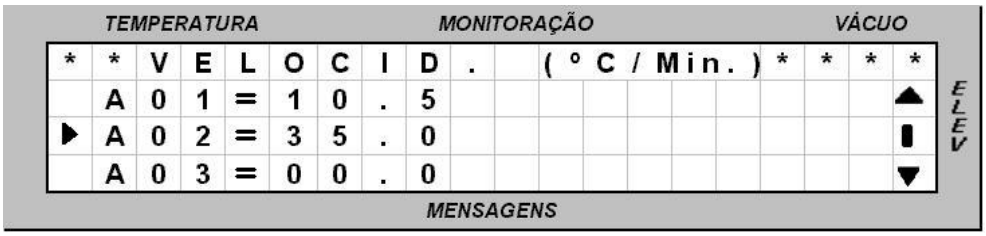
8-6) Proceed the same way with the T02 temperature, type 1080ºC and keep T03 in 0.

8-7) SPEED ADJUSTMENT, A01, A02, A03

Press the VEL. (18) key, the display will show the programmed speeds in the factory standard recipe. Ex.



8-8) Following this, start the navigation (23) keys and move the cursor over the field A01, type the speed of 10.5ºC/min. in the numerical keyboard (26). Proceed the same way with A02, typing 35.0ºC/min. Keep A03 in zero. Ex.



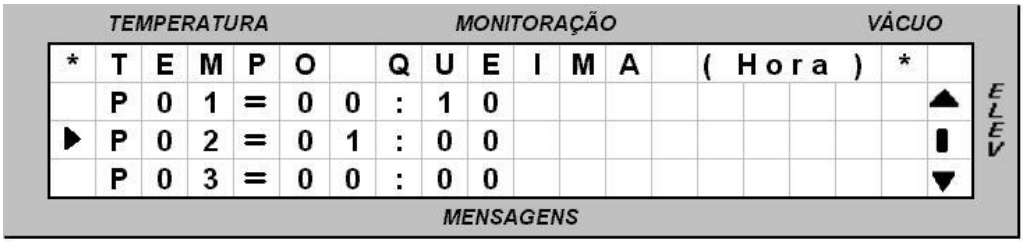
8-09) BURN TIME ADJUSTMENT – PAT, P01,P02,P03

OBS: - The burn times in the sinterization processes are indicated in hours and minutes. Ex: 01:30 corresponds to 1 hour and 30 minutes; 02:35 corresponds to 2 hours and thirty-five minutes.

8-10) Levels adjustments, PAT, PO1, PO2, PO3.

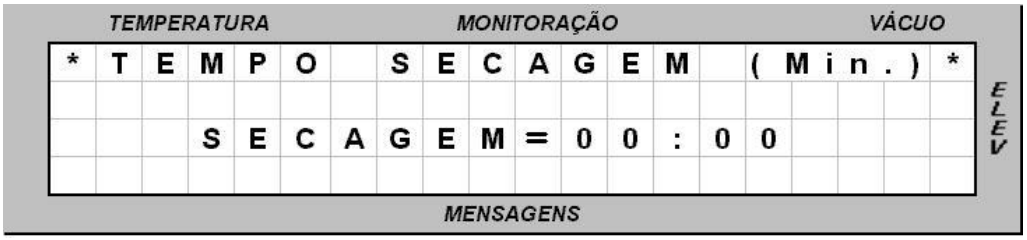
Press the PAT. (20), key the display will show the programmed burn times in the factory standard recipe. Ex.

8-11) Following this, press the navigation (23) keys and move the cursor over the P01 field, type the time of (00:10 Min.) in the numerical keyboard (20), Proceed the same way with P02, type (01:00 Hour). Keep P03 in zero. Ex.



8-12) PROGRAMMING THE DRYING

In this example of recipe there is no open mouth drying programming. Keep in zero. The drying first occurs in the first heating ramp T01.



8-13) PROGRAMMING THE ELEVATOR – ENTRY/EXIT.

The closing and aperture of the muffle can be programmed independently. Ex.(CLOSE - 1) and (OPEN – D).

8-14) Press the ELEV. key (22), the display will show the elevator Open and Close times, programmed in the factory standard recipe. Ex.

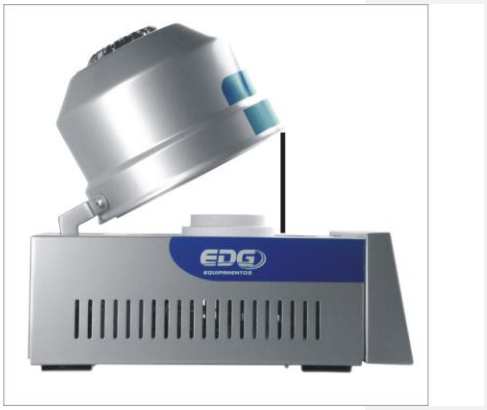
8-15) Following this, press the navigation (23) keys over the CLOSE field on item-D. Confirm with the option OK (24) the option (D), muffle closing time (Direct). After confirming, the selected item should be written besides the message CLOSE (D). Proceed the same way with the OPEN function. Program (9 min.) for the exit of the piece. Ex.

8-16) In the manual position (M), there will be no time countdown for the closing. In this option, the elevator will only move through the manual start performed by the operator, in the item manual command arrows (Open-9) and (Close-10).

8-17) In the position (D) direct, the elevator will move continuously without intervals, until it completes the total journey in the two options, OPÉN and CLOSE.

8-18) The other positions (1,2,3,4,5,6,7,8,9) are programmed in minutes, according to the following table.

TABELA DO ELEVADOR AUTOMATICO						
ABRE / FECHA					TEMPO APROXIMADO	
A	M	.	F	M	Acionamento manual	
A	D	.	F	D	Percurso contínuo	
A	1	.	F	1	1	Minuto
A	2	.	F	2	2	Minutos
A	3	.	F	3	3	Minutos
A	4	.	F	4	4	Minutos
A	5	.	F	5	5	Minutos
A	6	.	F	6	6	Minutos
A	7	.	F	7	7	Minutos
A	8	.	F	8	8	Minutos
A	9	.	F	9	9	Minutos



8-19) The maximum aperture of the elevator system is around 120mm, measured from the tray until the lower muffle face. With an approximate inclination of 30 degrees, as shown in the picture above.

09) RECORDING RECIPES

Having finished the programming process we will save the recipe in the databank.

We have to define a mandatory code number for the recipe that can be (Cod. 001 to Cod.999) All the recipes will be grouped in an unique bank, ceramic and sinterization recipes, listed in recording order. We can also put a name for the recipe if you wish, it is not mandatory, in the case of the code, it is indispensable.

9-1) Press the RECORD. (16) key, the display will show the virtual keyboard key, where the cursor will be blinking over the field (Cod. 000). Ex.

9-2) In our example, we will type the number (1) in the field (Code: 000) through the numerical keyboard (26). Now we will also insert the name of the recipe, moving the cursor to the field of (Virtual keyboard – ABCD…), through the navigation arrows (23). Select the first letter desired for the name, (O) of OPAQUE. Confirm the option with the OK key (24), the selected letter will be written in the field of the (NAME: O…). Proceed the same way until you complete the whole name. Ex.

9-3) To confirm the recording, start the RECORD (16) key, a sound alarm will indicate that the process was completed. Then it will go back to the monitoring screen where the name of the code number and the recorded recipe will be written in the message field. Ex.

OBS: - The factory standard recipes, Ceramics and Sinterization will not be able to be altered. They do not have a code number, are exclusive and serve as basis for the creation of others. The other recipes can be excluded, altered and recorded over the same code number. In order to do this, a new screen will be shown in the display, requiring the confirmation of the alterations. Ex.

10) READING RECIPES

10-1) Start the READ. Key (15) the display will show the general screen of the databank, where all the recorded recipes will be, and will be listed according to the recording order. The two first ones are the ceramics and sinterization standard recipes, which will serve as basis for the creation of other ones. Now, choose the kind of work, in our case “Pattern ceramics”, by using the navigation (23) keys, move the cursor to the left of the indicated recipe. Ex.

10-2) Confirm the option with the READ (15) key or with the OK (24), the system loads the indicated recipe, showing the standard monitoring screen. Ex.

10-3) Let's read another example, the previously recorded OPAQUE recipe. Press the READ (16) and find it in the databank, using the navigation (23) keys. Ex.

10-4) the recipes that are found in the databank receive an identifying label written in parentheses. The letter (C) corresponds to the ceramic recipe. The letter (S) corresponds to the sinterization recipes. This way, in spite of being in the same databank, they are independently identified by the type of work. Confirm the reading pressing the READ (15) key or the OK (24), the display will show the monitoring of this recipe. Ex.

11) SYSTEM MONITORING

11-1) All the burn control variables can be checked and altered even during the process, it is not allowed to modify the times that are being performed, though.

11-2) To verify the contents of the programmed variables, as well as the parameters in general, just press the desired key and check the data recorded. The content will be print in the display for approximately 20 seconds and then the display will show the real temperature of the furnace. In case you wish to alter any variable, it will be able to be done at this time during the 20 seconds. The control will assume the new values immediately and will start to perform the new programmed instruction.

11-3) The general monitoring screen shows all the information of the phases step by step, as well as the operation messages and the mistakes that happened during the burn. In this example the screen indicates the T2 process variables. T2 temperature, A2 speed, P2 level, V2 vacuum, close muffle F (1=min.), open muffle A (D=Direct) and several messages (**Level**). Ex.

11-4) In the message field, several information will be indicated, and the most common ones are listed in the following table. Ex.

*	*	*	I	N	I	C	I	A	R		Q	U	E	I	M	A	*	*	*
	.	.	S	E	C	A	G	E	M		=		0	0	:	0	0	.	.
					.	.	.	R	A	M	P	A	.	.	.				
				.	.	.	P	A	T	A	M	A	R	.	.	.			
.	.	.	F	E	C	H	A	N	D	O		M	U	F	L	A	.	.	.
.	.	.	A	B	R	I	N	D	O			M	U	F	L	A	.	.	.
.	.	.	.	.	.	.	.	S	T	O	P	.	.	.	.	.	.	.	.
.	.	.	F	A	Z	E	N	D	O			V	Á	C	U	O	.	.	.
.	.	D	E	S	F	A	Z	E	N	D	O		V	Á	C	U	O	.	.
.	.	.	.	.	.	P	R	O	T	E	Ç	A	O	.	.	.	.	.	.
.	.	.	.	.	A	U	T	O		S	T	A	R	T	.	.	.	.	.

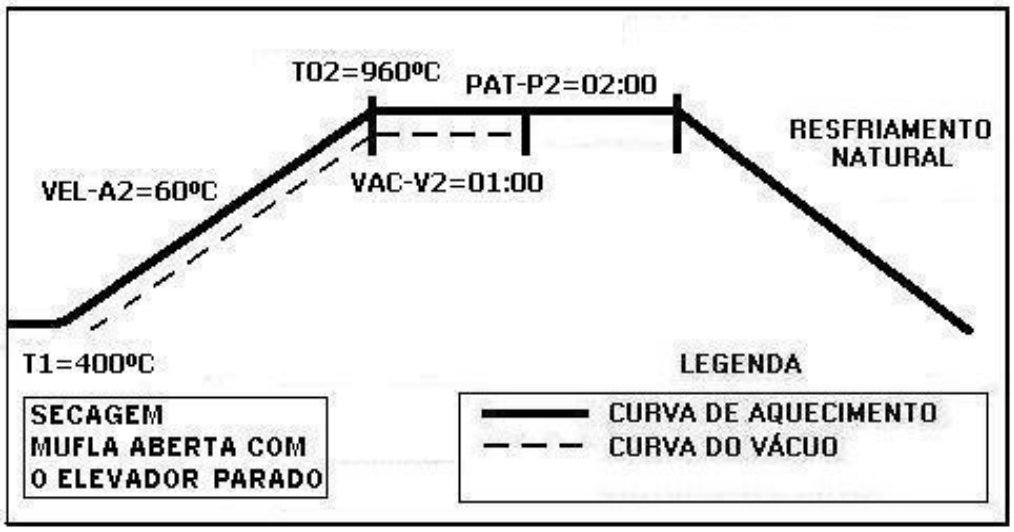
12) STEP BY STEP BURN PERFORMING

12-1) Switch the general key PIC.1 item (06). Wait for the furnace to perform the checking and perform the initial configurations according to what has been described in the topic (6). System initializations.

12-2) Read the ceramic standard recipe. Ex.

RECEITA PADRÃO PARA CERÂMICA CONVENCIONAL									
TEMP-1 ºC	VEL-1 Fixo	PAT-1 Elevador	TEMP-2 ºC	VEL-2 ºC / min	PAT-2 min	VAC-2 min	SECAG. min	ELEV-PRÉ-AQUECIM. FECHA	ABRE
400	40	Aberto	960	60	02:00	01:00	00:00	1	D

We can observe the curve of the recipe in the graphic below.



Press the READ (15) key, choose the kind of work (Pattern ceramics) by pressing the navigation (23) keys, confirm the reading process by pressing the READ (15) or the OK (24) key to complete the operation. Ex.

12-3) After the ceramic recipe reading, the furnace will initialize the heating searching for the TO1=400ºC, where it will be stabilized waiting for a command by the operator. Ex.

12-4) In this moment, put the piece to be burned, properly placed in the isothermal pins, Pic.-5 item (25) on the rigid blanket –Pic.5 Item (24) and put it on the burn platform Pic.-4 item (23) . Following this, wait for the temperature to reach T01=00ºC to start the burn. Ex.

12-5) With everything ready we can start the burn by pressing the S/S key (Start/Stop). The elevator automatic system will fulfill the determined programming in the standard recipe (1 – Min), to close the muffle in the F (close muffle) pre-heating phase, where the piece comes progressively closer to the heat, while keeping the T01=400ºC temperature. Ex.

12-6) With the furnace closed the vacuum system will be started (pump on), the display will indicate the digital vacuum, it should stay at least (-20 pol Hg.) for the furnace operate normally. Ex.

12-7) In this phase the furnace passed from the T01level (open muffle) to T02 ramp (close muffle) heating at 60ºC/min. until it reaches the T02=960ºC, where it should keep burning for 2 min.PAT-PO2= (02.00) with vacuum for 1-min. VAC-VO2 = (01.00).

Heating ramp. Ex.

Level with times in decrement. Ex.

12-8) At the end of the vacuum time, the pump will be switched off and the message (Undoing vacuum) will be print, while it waits for the return of the AIR to the chamber. Following this, the elevator automatic system will begin the piece removal according to what has been programmed in the “A” function (D-Direct).

Switching off the vacuum system. Ex.

Opening the mufle at the end of the burn. Ex.

12-9) In this last phase the temperature lowers naturally until it reaches T1=400 again where it will stay, waiting for the next instruction. Ex.

13) AUXILIARY FUNCTIONS

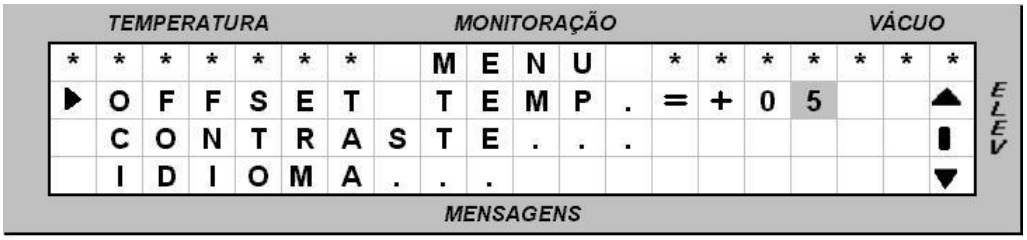
13-1) MENU FUNCTION.

This MENU (13) allows the access to sub-groups of useful internal functions, which are not part of the recipe parameters, but complement the resources available for the product. They are: OFF-SET TEMP., CONTRAST, LANGUAGE TECHNIC.

13-2) MENU FUNCTION.

This key OFFSET TEMP: This key allows the furnace operator to alter the final temperature, being (+10ºC) or (-(10º) in a total of 20ºC. This adjustment is done by soft in the cases that the furnace seems to be above or below the ideal burn point.

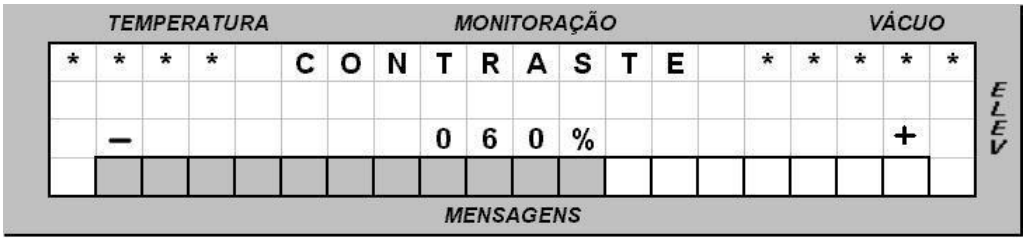
The furnace temperature is calibrated in the factory in the thermal center of the muffle, in the tip of the isothermal pins placed on the rigid blanket – Pic. (?). However, a slight adjustment can be done for more or less, adjusting the variable content value called (OFFSET TEMP). When the furnace is burning too much, above the ideal, the value should be positive Ex. (+5) and when it is not burning, below the ideal, the value should be negative. Ex. (-5).To perform the adjustment, just start the MENU (13) key. The cursor will be blinking in the OFFSET field, insert the desired value through the numerical keyboard (26) and change the signal positive (+) or negative (-), through the horizontal navigational arrows. Confirm the option with the OK (24) key, the adjustment will be completed. EX.



13-3) CONTRAST ADJUSTMENT

Press the MENU (13) key and through the navigation arrows (23) move the cursor to the CONTRAST function and confirm with the OK (24) key. Ex.

Now adjust the intensity of the display contrast desired for more or less, through the horizontal navigation arrows. Confirm with the OK (24) key. Ex.



13-4) LANGUAGE ADJUSTMENT – Start the MENU (13) and through the navigation arrows (23) move the cursor to the function LANGUAGE and confirm with the key OK (24).Ex.

Now adjust the desired language, through the vertical navigation arrows. Confirm the option with the OK (24) key. Ex.

13-5) TECHNICAL MENU – These adjustment functions are meant for the technical users, service centers or for strictly authorized people by the EDG according to qualified technical orientation, who will be able to monitor or alter the internal control parameters, in case it is necessary.

These functions will be released though PASSWORDS and COUNTER PASSWORDS given with technical follow-up by the company. Ex.

OBS: further details with the service technical manual

13-6) DEL FUNCTION – This key erases the variable contents, as well as whole recipes and it also goes back the last wrongly typed digit, in the moment of typing in the virtual keyboard. We will then erase a recipe called OXIDATION from the general databank. Press the READ (15) key, move the cursor to the name of the recipe to be erased, through the navigation keys (23). Ex.

Then, start the DEL (25) key, a confirmation screen is written in the display, move the cursor to the (YES) option and confirm the option with the OK (24) key. Ex.

13-7) AUTO/START FUNCTION –This key allows the beginning of the burn even before the furnace reaches the programmed temperature for T01. When started, the program fulfills the heating ramp from the environment temperature 25ºC, until it reaches the entry temperature T01=400ºC of the piece. In this moment a sound alarm is emitted, indicating the closing of the muffle and the beginning of the burn. This function can also occur in the cooling ramp between one burn and the other, in the end of the process, while waiting for the return of the temperature to T01.

IMPORTANT – The piece to be burned should be properly placed on the isothermal pins stuck in the rigid blanket – I (24), on the burn platform (23), before the AUTO/START command because the burn will automatically occur. A message will be written on the display when the function is being activated. Ex.

13-8) S/S FUNCTION – START/STOP FUNCTION – (12)

This key has double function, to begin or interrupt the burn, being the furnace needing to be in the T01 entry temperature of the piece. To interrupt it is necessary that the burn is underway. A message will be written on the display when the function is activated, and the temperature returns to the one programmed in T01. Ex.

13-9) – ELEVATOR MANUAL COMMAND

The OPEN (09) and CLOSE (10) Keys of the panel, manually activate the elevator and over write the automatic functions programmed in the ELEV. Key (22). These keys work as an interrupt key, on the first SWITCH ON touch, and they keep activated, on the second SWITCH OFF touch and keep deactivated.

13-10) – VIRTUAL KEYBOARD ´This keyboard will only be seen when the RECORD (16) key is on. The aim is to be able to insert and alter letters and alphabetic symbols to the names of the recipes to be recorded. Add the RECORD key and observe the display. Ex.

In the following we will give an example of how to insert the OPAQUE name via virtual keyboard. Use the navigation (23) keys and move the cursor over the letter (O), confirm this option by starting the OK (24) key, the first letter will be written after the field (NAME:O). Proceed the same way with the other letters until you complete the whole name which will be able to reach the maximum of 15 characters. Ex.

13-11) – INITIAL SCREEN– This key has the function to activate the main monitoring screen, whenever it is desired to leave any function without altering its content. It is very used when we are checking a recipe programming and it is not needed to alter anything, and then it returns to the general monitoring screen, through the INITIAL SCREEN.

13-12) FAST COOLING.

In certain occasions, it is necessary to lower the TO2 temperature, returning fast to T01, and then speeding up the time between burns. Proceed as the following.

Open the muffle completely, allowing the forced ventilation used in the chamber cooling to be able to circulate in the mouth of the muffle, propitiating the fast exchange of heat.

13-13) PROTECTION – REST POSITION

After 10 minutes without operation your equipment enters in rest position. The muffle closes automatically to the rest point to an approximate height of (3 centimeters away from the

muffle), keeping like this until the next burn. A sound alarm will warn the operator the function will be activated. A “PROTECTION” message will be print on the display. This procedure helps to save energy and avoids unnecessary environment heating. In case you do not want this function to be habilitated, just dislocate the elevator (1 centimeter) in the close ward for the function be deactivated.

13-14) PROCESS HOUR TOTALIZATOR.

The furnace is equipped with a device that adds the burn hours. From the moment the S/S key is activated the used time is stored in an internal clock. This device is important, for the muffle control and other reposition pieces shelf life. The access to this function is restricted to the technical use.

13-15) BURN CYCLE TOTALIZATOR

This equipment is dotted with a device that adds the number of performed burns, aiming to concentrate information of repetitive use for the durability analysis of the pieces and accessories used in the furnace. The access to this function is restricted to the technical use.

14) ALARMS AND MESSAGES

To avoid damage to the equipment and programming mistakes, several safety devices act on the prevention of system flaws. The messages and the error codes will be indicated on the display.

14-1) ERROR-001 – “TERMOPAR FLAW” (sensor)

The display will show the code and error message and will abort the execution process; a sound alarm will sign the flaw. Look for the authorized service network. Ex.

14-2) ERROR-002 – “ELEVADOR CLOSES” – OBSTRUCTION.

It indicates that the movement of the elevator in the closing muffle ward was obstructed for an object preventing its total course. An electrical failure could also have occurred. In this case, look for the authorized service network.

14-3) ERROR-003 - /’ELEVATOR OPENS” – OBSTRUCTION

It indicates that the elevator movement in the opening muffle ward was obstructed by an object, preventing its total course. An electrical failure could also have occurred. In this case, look for the authorized service network.

14-4) ERROR-004 - “Heating speed equals to zero”.

It indicates that some speed field has assumed zero content, which is not permitted, when there is programmed temperature. To solve the problem, start the speed key VEL. (18) and type a different value from zero.

14-5) ERROR-006 – “ALTERATION OF THE STANDARD RECIPES”

The fields of the standard recipes can not be altered. Record the new recipe in another available positioning in the databank.

14-6) ERROR-007 – “MAXIMUM TEMPERATURE LIMIT”.

The temperature has gone up the maximum allowed with vacuum (1.100ºC) for this application,. Verify the program.

14-7) ERROR-008 – “UNDUE VACUUM” – OBSTRUCTION.

The system was not able to liberate the vacuum. Probable electrical failure in the solenoid system. Look for the authorized service network.

14-8) ERROR-009 – “IMCOMPATIBLE SOFTWARE VERSION”

The program version update is not compatible with the product. Ask for information with the factory.

14-9) ERROR-010 – “LOSS OF VACUUM DURING THE PROCESS”

Verify if the vacuum pump hose is well connected, check the pump feeding cable, plug and pig nose should be perfectly connected with use conditions. It can also have occurred a muffle internal leaking. Look for the authorized service network.

14-10) ERROR-021 – “SALV system” – Air does not circulate.

Flaw in the vacuum pump, the system could not circulate the air in the muffle in the long sinterization burns, preventing the operation of the SALV system. Check the hose, and the feeding cable.

14-11) ERROR-022 – “SALV system “– has formed vacuum.

The muffle was totally closed during the sinterization process, preventing the air circulation. Verify the elevator articulation system and if it is necessary regulate the end of the high course, with specialized technical assistance. Look for the authorized service network.

14-12) ERROR 023 – “INVALID PASSWORD”

The password use has been invalidated for this function, try again.

14-13) ERROR-024 – “error in the termopar calibration”

The system has detected that the temperature scale is out of the termopar actuation range. Look for the authorized service network.

OBSERVATIONS: The numbers of errors that were not listed above are not part of this product.

15) SPECIFICATIONS:

-110 or 220 feeding. 50/60 Hz. On request.

-Maximum consumption 1.700 Watts.

-20 amperes fuse for 110 volts, 15 amperes fuse for 220 volts.

-Operation maximum temperature 1.100ºC with vacuum.

Operation maximum temperature 1.180ºC without vacuum.

Equipment dimensions

_Width 290mm

-Height 320mm

-Depth 400mm

-Net weight 10.5kg

Package dimensions:

-L = 360mm X A = 420mm X P = 500mm

-Gross weight 13kg

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IMPORTANT NOTES