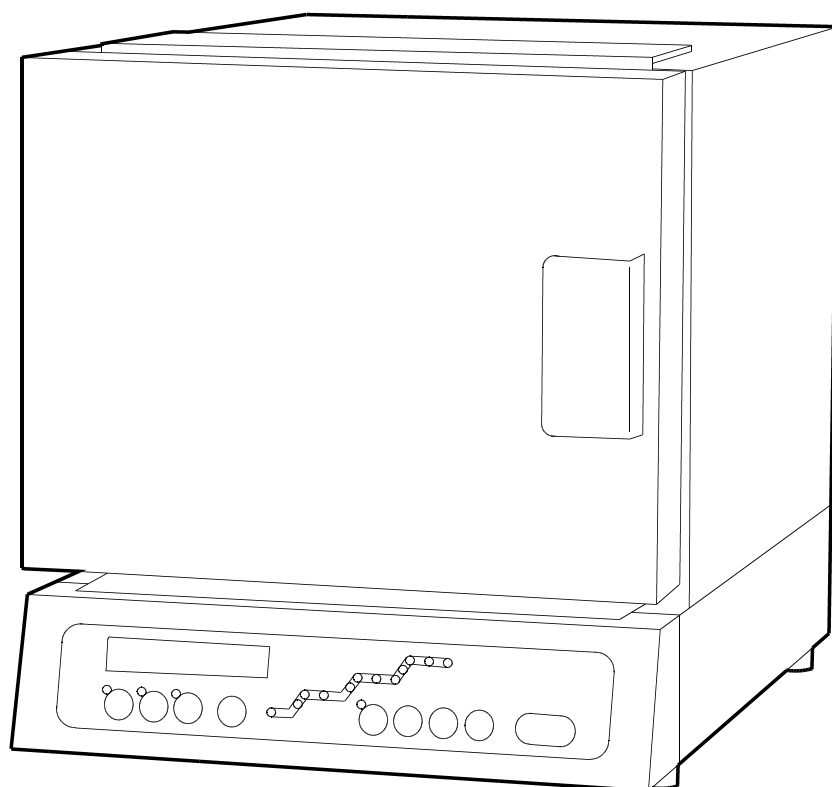# INSTRUCTION MANUAL

BURNOUT FURNACE

KDF 007 EX

We recommend you to carefully review the information contained
in this manual and follow the steps as outlined.
Keep this manual in an easily accessible place for references.

denken CO., LTD.

Contents

Safety Precautions

Marks and symbols are provided for safe uses of furnace in order to safe guard human injuries and damages on material resources.

⚠ **WARNING**	Symbolizes possible accident of mortality, heavy injury or fire
⚠ **CAUTION**	Symbolizes possible injury on human body or damage on material resources

Examples of Marks and Symbols

⚠	This mark shows "Precaution against Electric Shock"
🚫	This mark shows "Machine Opening is prohibited"
⬤	This mark shows "Instruction to unplug Power Cord off power outlet"

⚠ WARNING

Unplug	In case of the following abnormal state, unplug the main power cord to avoid fire and electric shock etc. and contact the dealer for repair. 1. Plug is smoking, smelling or sounding something strange. 2. Furnace frame is damaged. 3. Machine cleaning is required.
Do not open	Machine repair or modification by user is not recommendable to avoid fire, electric shock, or injury.

W1009300-2

⚠WARNING

Prohibited	We recommend you to take care of the followings. 1. Main power cord should not be bent or crushed under the furnace. 2. Keep distance of more than 20cm (8 inches) from peripheral equipment and surrounding walls and 1.5m (5 feet) up from ceiling. 3. Use the designated power voltage described on the name plate on the furnace back.
Contact with water prohibited	Do not allow water come in contact with equipment.
Wet hand prohibited	Do not touch plug or operate machine with your hand wet .
Contact prohibited	When you use tongs inside furnace for casting rings in and out, do not allow tongs to touch heating element.

W009300-2

⚠CAUTION

🚫 Prohibited	We recommend you to take care of the followings. 1. Do not let the furnace door stay opened. 2. Do not use flammable spray or do not place anything flammable near the furnace. 3. Do not place furnace on an unsteady table or on a slanted place. 4. When you unplug do not give a strong pull at power cord.
❗	We recommend you to make sure of the followings. 1. Before you start using your furnace, make sure that the furnace heat is below 40　　and clean the dusts in the furnace. 2. When you find any defect on the furnace before you begin using we recommend you to stop continuing and contact your dealer. 3. Make sure that power is completely plugged into power outlet.
🚫✋ Contact prohibited	While in use or soon after use, do not touch the highly heated area of the furnace. Especially, the top surface is highly heated.
🔌 Unplug	When your furnace is not in use for a long period of time, we recommend you to unplug off the power outlet.

W1009300-2

Before you start using your furnace

When you unpack furnace carton package, please make sure the standard accessories are encluded and if you find any scratch or defect on furnace frame we recommend you to contact your dealer.

Standard Accessories	Ceramic Gas outlet	1 pc
	Instruction Manual	1 pc
	Ceramic tray	1 pc

We recommend you to save the carton and all packing materials. These can be used again when there is ever a need to ship or reship your equipment.

W1009300-2

Descriptions and Functions of each Component Part

Furnace front
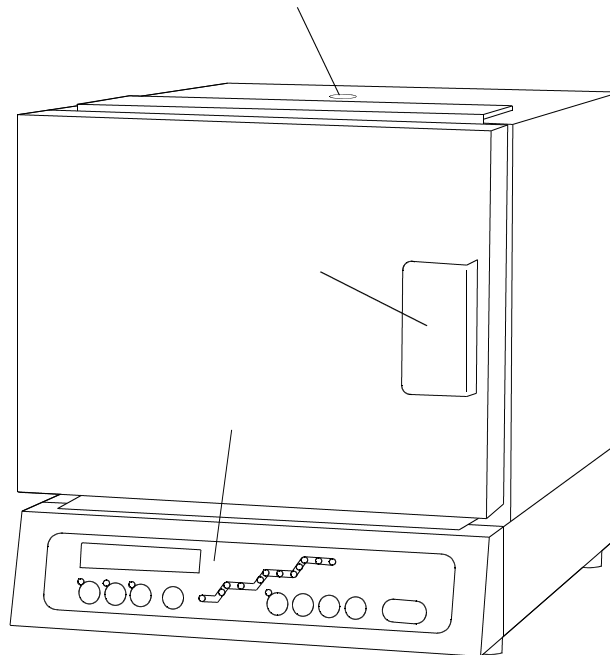
Gas Vent | Place the ceramic gas outlet provided for catalyst cleaner or exhaust fumes ventilator.

Door Knob | Pull the knob to open the door and push to close.

Operation Panel | Program operation, furnace temperature and program process are displayed.

Furnace Back

110V   120V   220V   240V

CLEANER OUTLET 300VA MAX
CLEANER FUSE 100-120V 125V M8A 200-240V 250V F2.5A
LINE PROTECTOR
LINE
WARNING For protection against risk of fire. Same type and ratings are recommended for replacement.
CAUTION Refer to manual for proper operation.
MADE IN JAPAN
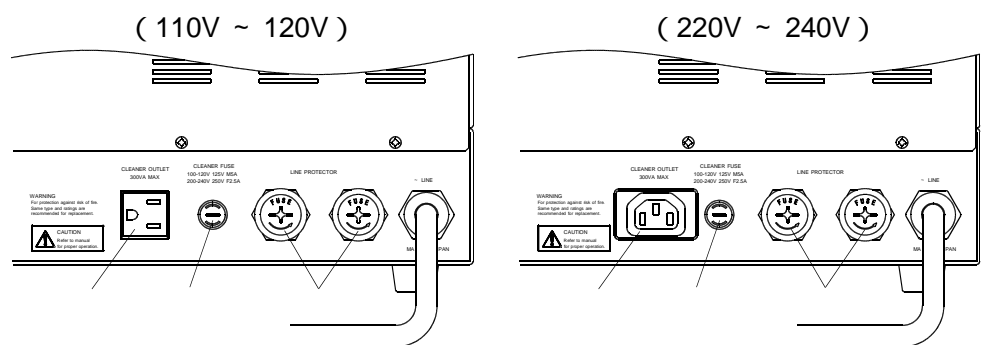
Socket | Power outlet to plug in catalyst cleaner or exhaust fumes ventilator. Use the designated power voltage of the furnace.

Sub Fuse | Fuse for catalyst cleaner or exhaust fumes ventilator.
In case of a circuit breaker trip caused by over power, fuse replacement of the designated voltage is recommendable.

Main Fuse | Fuse for main burnout furnace. In case of a circuit breaker trip caused by over power, fuse replacement of the designated voltage is recommendable.

W1009300-2

Descriptions and Functions of each Component Part

Operation Panel
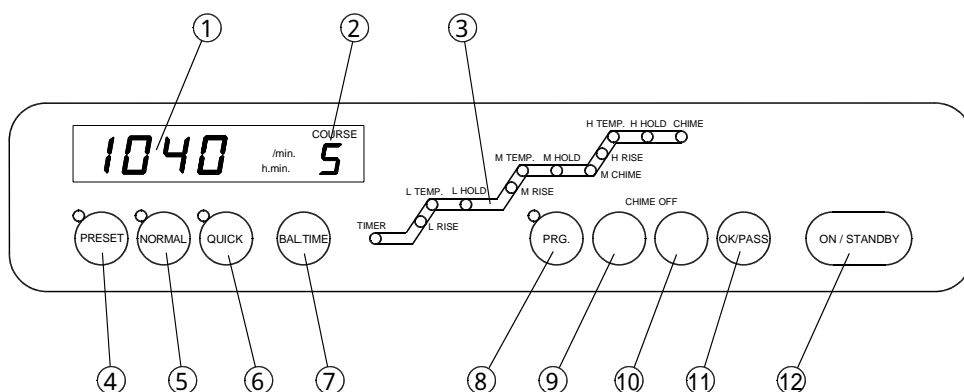
DISPLAY	Temperature, Heat Rise Speed and Hour/Minute are displayed. Lamp of unit measure is switched to the indication under process.
PROGRAM COURSE	Program course or the course under process is displayed.
PROCESS GRAPH	Program items are displayed when you store program and the process finished and current process are displayed during program operation.
PRESET	Press to store attempted time to activate program start.
NORMAL	Press to start normal firing operation on/off.
QUICK	Press to start quick firing operation on/off.
BAL.TIME	Press to display required firing time of the course or remaining time of the course on display.
PRG.	Press to store program or to confirm and press to revise the program under process or to confirm.
(Up)	Press to revise program course, to increase stored numerical values or to stop chiming.
(Down)	Press to revise program course, to decrease stored numerical values or to stop chiming.
OK/PASS	Press to set program storage or to proceed to next program item while you store program or press to skip the program under process while operating.
ON/STANDBY	Main power switch on/off.

W1009300-2

Installation

Power Outlet

We recommend you to plug main power cord to a dedicated power outlet in conformity with the designated voltage of main unit.

Location

We recommend you to locate the furnace on a steady and horizontal surface.
An environment off surrounding walls and peripheral equipment is recommendable.

> Note) We recommend you to set up your furnace 20 cm(8 inches) off the surrounding walls and 1.5 meters(5 feet) off lab ceiling and do not place any thing flammable near the furnace.

Main power cord should not be bent or crushed under the furnace.
We recommend you not to place anything on the heated top surface of the unit other than exclusive catalyst cleaner or exhaust fumes ventilator.

Accessories

We recommend you to put gas outlet provided in place into gas vent.
We recommend you to place ceramic tray provided inside of furnace muffle.

Power Switch On

When the unit is set up press the | ON/STANDBY | button.
| ㅁ ㅁ ㄱ | appears on the display for a while, and then current muffle temperature is displayed.

> The unit is now in Standby mode.

💡 Hint　When the unit is plugged to power outlet, a tiny lamp on the right below of the Program Course is illuminated to show the unit is powered on.

Two-Stages Program Operation

Two-Stages Program Storage

Program Example ; In general, ring molds are heat treated under two-stages firing program. Suppose you store a firing program on Program Course 5 as follows.

Course	5
Preset	8 hours 30 minutes
L Rise	6　/min.
L Temp.	300
L Hold	1 hour
M Rise	11　/min.
M Temp.	700
M Hold	1 hour 30 minutes
Chime volume	High（2）

1. Turn the power switch on and press the ☐ ☐ to set ⑤ on the program course and press the | PRG. | button to continue.

L Rise lamp is illuminated	2. Press the ☐ ☐ to set ⟨ 6 ⟩ /min. on the display and press the OK/PASS button to continue.
L Temp. lamp is illuminated	3. Press the ☐ ☐ to set ⟨ 3 0 0 ⟩ on the display and press the OK/PASS button to continue.
L Hold lamp is illuminated	4. Press the ☐ ☐ to set ⟨ 1 . 0 0 ⟩ hour.min on the display and press the OK/PASS button to continue.
	5. M Rise, M Temp., M Hold are programmable in the same way as done in the above procedures.
M Chime lamp is illuminated	6. You have the M Chime lamp being illuminated but at this process press the OK/PASS button.

> **Hint** H process is not necessary in this two-stages firing program. Set M chime volume to omit H process and the unit is able to start operation.

H Rise lamp is illuminated	7. In this example, H process is not in use and enter ⟨ P A S S ⟩ on the display and press the OK/PASS button to set. When H Rise lamp is illuminated, press the ☐ ☐ button to display ⟨ P A S S ⟩.
Chime lamp is illuminated	8. Press the ☐ ☐ button to display ⟨ o n - 2 ⟩.

⟨ o F F ⟩ Chime off
⟨ o n - 1 ⟩ Lower chime volume
⟨ o n - 2 ⟩ Higher chime volume

> **Hint** Select M or H chime lamp to enter chime sound volume.

Program storage on Preset	When you program Preset time , firing program starts operating when the set time is past. In the program example shown above, the program starts after 8 hours 30 minutes. Press the PRESET button in the Stand-by mode and press the ☐ ☐ button to program ⟨ 8 . 3 0 ⟩ on the display.

> Note) On the program course where no program is stored preset time is not available to set.

Press the PRG. button and press the OK/PASS button to confirm in sequence the stored program contents of the course on display. Press the PRG. button again and the furnace returns to standby mode.

Two-Stages Program Operation	1. While the furnace is in standby mode, press the ☐ ☐ button to select your attempted program course.
	    (In this program example, you selected course 5)
	2. Press the NORMAL button.
	        L Rise lamp blinks to start program operation.

Preset Time	When you program Preset time, press the PRESET button prior to pressing the NORMAL button. In this example, with ⟨ 8 . 3 0 ⟩ on the display, press the NORMAL button and Timer lamp on the Process Graph blinks. When the stored Preset time is reached, the furnace starts operating from L process.

WI009300-2

Three-Stages Program Operation

This three-stages firing function will help you for a simultaneous firing of christobalite and phosphate type of investment which differ in each final temperature.
Generally L process is used in common for both types of investments due to the same temperature and hold time. We recommend you to program firing temp. of christobalite investment on M process and that of phosphate investment on H process.

Program Example ; Suppose you store a firing program on course 4.
When the christobalite investment firing program is finished, M chime sounds and remove the ring mold for casting process. Continue to proceed to H casting temp. of phosphate investment until chime sounds.

```
Course           4
Preset           8 hours 30 minutes
L Rise           6    /min.
L Temp.          300
L Hold           1 hour
M Rise           11   /min.
M Temp.          700
M Hold           1 hour 30 minutes
M Chime          Low (1)
H Rise           8    /min.
H Temp.          800
H Hold           1 hour 30 minutes
Chime volume     High (2)
```

Three-Stages Program Storage

1. When the furnace is in standby mode, press ☐ ☐ to set `4` on the program course and press the PRG. button.

2. Store the programs on L and M processes.
   (Refer to two-stages program storage)

M Chime lamp is illuminated

3. When M chime lamp on the process graph is illuminated, press the ☐ ☐ button to display `on - 1` and press the OK/PASS button.

H Rise lamp is illuminated

4. Press the ☐ ☐ to set `8` /min. on the display and press the OK/PASS button to continue.

H Temp. lamp is illuminated

5. Press the ☐ ☐ to set `800` on the display and Press the OK/PASS button to continue.

H Hold lamp is illuminated

6. Press the ☐ ☐ to set `1.30` hour.min on the display and press the OK/PASS button to continue.

Chime lamp is illuminated

7. We recommend you to program higher chime volume. Press the ☐ ☐ button to display `on - 2` and press the OK/PASS button to set.

   When the program is stored correct, repress the PRG. button to return to standby mode.

| Program Storage on Preset | When you program Preset time , firing program starts operating when the set time is past. In the program example shown above, the program starts operating after 8 hours 30 minutes. Press the | PRESET | button in the Stand-by mode and press the ☐ ☐ button to program | 8.30 | on the display. |

Note) On the program course where no program is stored preset time is not available to set.

Press the | PRG. | button and press the | OK/PASS | button to confirm in sequence the stored program contents of the course on display.
Press the | PRG. | button again and the furnace returns to standby mode.

Three-Stages Program Operation

1. While the furnace is in standby mode, press the ☐ ☐ button to select your intended program course.
   (In this program example, you selected course 4)
2. Press the | NORMAL | button.

L Rise lamp blinks to start program operation.

3. When the stored M Hold time is finished, M chime blinks and the programmed low chime keeps sounding.
   Hint   Press the ☐ ☐ button if you want to stop the chime sounding.
4. Remove the christobalite ring mold out of the furnace for casting process.
5. Press the | OK/PASS | button to proceed to H process.

Note) If the | OK/PASS | button is not pressed, M Temp. keeps holding without proceeding to H process

6. When H process is finished, chime lamp blinks and the chime keeps sounding in higher volume.
7. Remove the phosphate ring mold out of the furnace for casting process.
   Repress the | NORMAL | button to release the normal firing program.

Hint   The storage of high or low temperature on each L. M. H. temperature is not limited. You are allowed to store higher temperature on M than you store on H temperature. In this case, the temperature cooling speed will depends on the same heat rise speed stored.

Quick Firing

This mode is to put the invested ring into muffle chamber that reached in advance the programmed firing temp. to help proceed quickly to casting process.

Note) If the investing material is not suitable for quick heatup, a hasty heatup is risky to cause breaking of the investing material due to thermal expansion.

Operation of Quick Firing Program

Choose the programmed course of two-stages or three-stages firing and press the | QUICK | button. Heat goes up toward the highest temperature programmed in the process at the highest rise speed. When the heat reaches the target temperature, furnace performs programmed hold time and chime sounds with the volume programmed on the final stage when hold time is over.

Note) Even in case of quick firing operation, program contents remain unchanged.

W1009300-2

Other Operations While Program in Process

Program Pass Operation	While a program is in process, press the OK/PASS button to skip the program in process and proceed to next program item.
Balance Time	While you press the BAL.TIME button, the remaining time until the end of the Hold time of the final process appears on the display.

> Note) Depending on program contents or numbers of firing ring molds, the balance time on display sometimes may differ from actual balance time. This is roughly estimated time for the sake of convenience.

Cease of Chime Sound	Press the ☐ ☐ button if you want to stop M chime or final chime while the chime is sounding.
Program Confirmation or Revise while program in process	
	1. Press the PRG. button during the program operation.
Program lamp is blinks	2. Press the OK/PASS button in sequence to make sure the stored program correct. When you need to change the stored program, display the item and press the ☐ ☐ button to change the program.
	3. Press the blinking PROG. button to release the program confirmation/revise mode.

   If no button operation is done in about 5 seconds, the furnace returns to the original operation display.

Pre-stored Programs

The following programs are pre-installed on Course No. 7, 8 and 9 when shipping. We recommend you to use the programs with your investment. The values of each program are revisable with your program storage in program mode.

Course	7	8	9
Investment	Christobalite	Phosphate	Simultaneous firing of christobalite and phosphate investment
L Rise	6	9	6
L Temp.	3 1 0	3 1 0	3 1 0
L Hold	0.3 0	0.3 0	0.3 0
M Rise	1 0	1 2	1 0
M Temp.	7 1 0	8 1 0	7 1 0
M Hold	1.0 0	1.0 0	1.0 0
M Chime	O F F	O F F	o n - 2
H Rise	P A S S	P A S S	1 5
H Temp.			8 1 0
H Hold			1.0 0
Finish Chime	o n - 2	o n - 2	o n - 2

Initial Program Set Mode

When the unit power is off, press the $\boxed{\text{ON/STANDBY}}$ button while you press the $\boxed{\text{PROG.}}$ button to set the following programs.

Safety Hold time
Key entry sound volume
Temperature calibration

Safety Hold time

This function is to cease supply of current to muffle heater to prevent negligence of power switch off when a certain amount of time passed after program finish. Initial value of 5 hours is stored.

When the unit power is off, turn the power switch on while you press the $\boxed{\text{PROG.}}$ button to display $\boxed{5\ F\quad 5}$.
Press the $\boxed{\ }\ \boxed{\ }$ button to revise the initial value.
0　9 hours is available to set. If you store the $\boxed{5\ F\quad c}$ the function of Safety Hold Time is off.
Press the $\boxed{\text{OK/PASS}}$ button to proceed to the　Key Entry sound volume　.

Key Entry Sound Volume

Press the $\boxed{\ }\ \boxed{\ }$ button to choose key entry with sound or soundless.
The sound volume set of program finish chime is unavailable

$\boxed{O\ F\ F}$　　　　Both key entry and error chimes soundless
$\boxed{o\ n\ -\ 1}$　　　　Key entry chime sounds but error chime soundless
$\boxed{o\ n\ -\ 2}$　　　　Both key entry and error chimes sound

Initial set value : $\boxed{o\ n\ -\ 2}$

Press the $\boxed{\text{OK/PASS}}$ button to proceed to the next item　Temperature Calibration

Temperature Calibration

Based on 750　, you can calibrate furnace temperature on display in the range of ± 20　with $\boxed{\ }\ \boxed{\ }$ button.
Initial set value : $\boxed{5\quad 0}$ (± 0　calibration not available)

When the muffle temperature is considered 10　lower against the temperature on display, we recommend you to set $\boxed{5\quad 10}$ (+10　).

Press the $\boxed{\text{OK/PASS}}$ to make sure of the initial value set.

Press the $\boxed{\text{PRG.}}$ button to release the initial value set.

Error Messages and Troubles

When you have the errors and troubles as mentioned below, we recommend you to follow the instructions shown on each item.

Items	Possible Causes of Troubles	Recommendable Measures
Power fails to switch on	When the lamp on the right below of Course display fails to illuminate, main power is not supplied to the furnace	Make sure that power cord is plugged or main fuse is blown or not
$Err2$	Computer memory loss	Repair is recommended
$Err6$	Thermocouple breakdown	Replacement of thermocouple is recommended
$Err9$	Abnormal muffle heatup	Repair is recommended
$Er11$	Thermocouple is abnormal or heater breakdown	Repair is recommended
	When operation starts with furnace door opened, $Er11$ may occasionally be displayed.	Operation with furnace door closed is recommendable for safe operation.
Furnace surface is hazardous when touched	The earth line may not be grounded or insufficiently grounded	Sufficient grounding is necessary
Slow Heat Rise	Firing of plenty ring molds will slow heat rise	This is not abnormal
	As temperature rises high, heat rises slow	This is not abnormal
A low noise sounding from the heater	When muffle heat is still low, a low noise will sound	This is not abnormal
Temperature is not rising. Muffle heatup is slow.	Muffle heater breakdown	Repair is recommended
Catalyst Cleaner is not working	Catalyzing is of no effect	Replacement of catalyst is recommended
	Sub fuse is damaged	Remove the cause of trouble and fuse replacement is recommended
Exhaust fume ventilator is not working	Sub fuse is damaged	Remove the cause of trouble and fuse replacement is recommended

W1009300-2

Optional Equipments

Catalyst Cleaner
KDF-ES7S,
KDF-ES71
KDF-ES72

The gasses and bad smells produced while heat treating ring molds are dispersed by catalyst cleaner (Platinum Catalyst) . Plug the power cord of cleaner to the dedicated power outlet on the back of main unit to operate together with the unit. Platinum Catalyst , KDF-ES71 and KDF-ES72, large types than compact sized KDF-ES7, are provided for increased capacity of gas disposal and good for quick firing programs.

Exhaust Fume Ventilator
KDF-VF71
KDF-VF72

Exhaust fumes are ventilated out of labs through the ventilation hose of 2.5 meters long provided. Plug the power cord of ventilator to the dedicated power outlet on the back of main unit to operate together with the unit.

Main Specifications

Voltage ranges	AC110V, 120V, 220V, 230V, 240V±10%, 50/60Hz
Wattage	1.1kW, 1.3kW, 1.1kW, 1.2kW, 1.3kW
Wattage on standby	Approx. 1.8W
Furnace weight	18kg
Muffle chamber	120(W)×110(H)×220(D) mm
Exterior dimensions	300(W)×330(H)×430(D) mm
Socket output	3A max
Max. temperature	1100
Room temperature	10 40 , humidity 30 90%RH
Program storage	10 programs
Temp. stages on graph	1 3 stages

Program items and scopes of Program storage	Preset timer	0 99hours 50min. (per 10min.)
	L rise	PASS, 1 20 /min. per 1 ,FULL
	L temp.	0 1100 per 1
	L hold	0 9hours 59min. per 1min.
	M rise	PASS, 1 20 /min. per 1 ,FULL
	M temp.	0 1100 per 1
	M hold	0 9hours 59min. per 1min.
	M chime	OFF, Low, High
	H rise	PASS, 1 20 /min. per 1 ,FULL
	H temp.	0 1100 per 1
	H hold	0 99hours 50min. (per 10min.)
	Chime	OFF, Low, High

Standard accessories	Instruction manual	1 booklet
	Gas outlet	1 pc
	Ceramic tray	1 pc

The specifications are changed without prior notice, in case the furnace is in need of quality improvement.

Table of Program

Course	0	1	2	3
Process / Investment				
L Rise /min.				
L Temp.				
L Hold hour/min.				
M Rise /min.				
M Temp.				
M Hold hour/min.				
M Chime				
H Rise /min.				
H Temp.				
H Hold hour/min.				
Finish Chime				

Course	4	5	6	7
Process / Investment				
L Rise /min.				
L Temp.				
L Hold hour/min.				
M Rise /min.				
M Temp.				
M Hold hour/min.				
M Chime				
H Rise /min.				
H Temp.				
H Hold hour/min.				
Finish Chime				

Course	8	9		
Process / Investment				
L Rise /min.				
L Temp.				
L Hold hour/min.				
M Rise /min.				
M Temp.				
M Hold hour/min.				
M Chime				
H Rise /min.				
H Temp.				
H Hold hour/min.				
Finish Chime				

W1009300-2