

LOW TEMPERATURE LABORATORY ELECTRIC FURNACE

FD 420/300

CE

Operation Manual



The product conforms to the requirements of the European Union Low Voltage Directive 2006/95/EC, Electromagnetic Compatibility Directive 2004/108/EC, and Machinery Safety Directive 2006/42/EC.

PLEASE READ THIS MANUAL CAREFULLY BEFORE OPERATION 3, Hagavish st. Israel 58817 Tel: 972 3 5595252, Fax: 972 3 5594529 mrc@mrclab.com MRC.VER.01-8.12

1. PURPOSE

Low temperature laboratory electric furnace FD 420/300 is designed for heating or drying materials and stocks in the ambient air temperatures from $T+10^{0}$ C to 300^{0} C in static conditions.

2. EXPLANATION OF SYMBOLS AND MARKINGS

Explanation of markings



Position of the label of the product and explanation



Model:	60/300 LFN
IP20	No 000000
220 V	~ 50 Hz
2	,0 kW
50 kg	10 2008

Identification on the label	Meaning
Model : FD 60/300	Type of furnace, $60 - \text{total chamber volume } (60 \text{ dm}^3);$
	300 – nominal temperature (300°C).
IP 20	Degrees of protection provided by enclosures EN60529
No 0000000	Number of the product
220V	Voltage of power supply 220 V
~50 Hz	Frequency of electrical current, Hz
2,0 kW	Nominal power, kW
50kg	Weight of the product, kg
10 2008	Date of manufacture (month, year)
CE	Mark of compatibility to CE

	This symbol indicates important safety requirements disregard of which may cause risk to personal safety and /or to property. Before switching on the low temperature furnace, it is very important to read and follow all the instructions of this manual.
Attention	This symbol indicates the articles of the manual requirements which must be followed with great care in order to ensure the correct sequence of operations and prevent damage to the furnace and danger to operators.
(!)	This symbol indicates important information.

3. COMPLEMENT

The user is supplied with:

Name	Quantity	FD 420/300
Electrical furnace	pcs.	1
Shelves	pcs.	3
Passport	pcs.	1
User manual of	psc.	1
temperature		
controller		
Fuse	pcs.	2

4. SAFETY REGULATIONS

Use the electric furnace according to the requirements of "Users' technical safety operation rules of electric equipment".

The operator working with the electric furnace must be aware of the operation rules of electric equipment up to 1000V, is acquainted with safety regulations for operation of electric furnace, and is aware of the structure, operation principle, assembly and operation rules of the product.

Connect the electric furnace to the mains (power supply) that must have the grounding contact connected to the grounding circuit.



It is prohibited to operate the electric furnace if the grounding is insecure.



It is prohibited to operate the electric furnace if any of external protective shields is removed.



If the electric furnace is operated for a longer period of time, the external surfaces and the door may get hot. When opening the door of the hot electric furnace as well as loading/unloading it or when touching hot external surfaces, it is necessary to wear gloves.



Combustible or explosive materials or materials that can become combustible or cause explosion during thermal treatment must not be loaded into the low temperature furnace





The gas emitted during thermal treatment has to be directed outside through a ventiduct (according to the rules of existing requirements).



The room where the furnace is operated must have appropriate ventilation



It is forbidden to work in closed, not ventilated room



The room where several furnaces are operated must have special means of ventilation



In the event of obvious violations the work with the furnace must be immediately stopped. Maintenance can be performed by our service operator, our authorized specialist or a user who strictly follows our written maintenance instructions.

(!)	In the event the normal operation of the furnace breaks down, disconnect it from the power supply (the mains) and take measures to eliminate the defects.
	It is forbidden to use the furnace for any other purposes. The manufacturer is not responsible for damages arising from the use of the furnace not according to its purpose; the responsibility is carried by the user. Any work that can affect the safety of the furnace must be forbidden
	The existing rules of general safety and prevention of accidents should be applied.
	Only technically orderly furnace must be operated.



The manufacturer's advice can not cover all issues, therefore the user is responsible for the heating impact on materials and their reaction as well as for the risk related with tests. Our advice will help to avoid possible dangers for people, the furnace and materials tested.

5. COMPOSITION AND TECHNICAL CHARACTERISTICS OF THE LABORATORY ELECTRIC FURNACE

5.1 Composition of the low temperature laboratory electric furnace





1	Door	9	Fan aperture	17	Shelf
2	Handle	10	Protective device against overheating	18	Shelf holder
3	Control knob of the fan valve	11	Fuse	19	Heating element
4	Switch	12	Breaker	20	Thermoinsulation
5	Revolution control of the fan	13	Power supply cord	21	Fan
6	Temperature controller	14	Thermocouple	22	Support
7	Panel	15	Seal profile	23	-
8	Frame	16	Chamber	24	-

5.2. Technical characteristics

		Measure	FD
			420/300
Nominal power	kW	6,2	
Voltage		V	380
Frequency		Hz	50
Exploitation class (EN6	50529)	IP20	IP20
Nominal chamber tempe	erature	°C	300
Number of phases			3
Ambience in the chamb	er		Air
Temperature fluctuation	s*	°C	±0,3
Limits of automatic tem	perature	°C	T+10 ÷300
control**	-		
Temperature	50°C	±°C	±0,7
distribution****	100°C	±°C	±2,5
	200 °C	±°C	±5,3
	300 °C	±°C	±7,4
Heating time from	300°C	min.	30
5°C to, not more			
than: :			
Dimensions of the	Width	mm	1000
chamber not less	Depth	mm	500
than:	Height	mm	860
Number of shelves		pcs.	3/7
(standard/max)			
Non-concentrated load of	Kg	15	
shelf			
Total limiting load	Kg	50	
Overall dimensions of Width		mm	1200
the furnace not more	Depth	mm	930
than: Height		mm	1200
Weight		Kg	155

*Temperature fluctuations at steady mode, without load. The value of the parameter is given after temperature AT controller has been chosen (see instruction manual temperature controller).

** Temperature control limits from the temperature (T+10°C) to 300°C. T- the ambient temperature of the room where the furnace is operated.

****Temperature distribution in the working space with forced convection when revolutions of engine are 100% (the fan revolution controller shows 10), at indicated temperatures.

6. PECULIARITIES OF OPERATION

Electric furnace has to be operated in a closed ventilated room following these requirements:

Electric ful	nuce hus to be operated in a crossed ventilated room rono wing mese requirements.
	- the base under the bottom of the electric furnace has to be horizontal
	(the allowed unevenness in the length of $1m$ is $\pm 1mm$.), hard, made
	of incombustible material;
	- height above sea level – up to 2000 m;
	- ambient temperature from $+5$ to $+40^{\circ}$ C;
	- ambient relative air humidity should not exceed 80% at the
	temperature of $+31^{\circ}$ C, and should not exceed 50% at the temperature
	of +40°C;
	- the voltage fluctuation in the mains (power supply) should not exceed
	$\pm 10\%$ of the nominal value;
	- the environment is not dangerous with respect to explosion, it does not
	contain a large amount of electrically conductive dust, water vapour,
	aggressive gas;
	- recommended to be placed under the exhaust ventilation cap;
	- the electric furnace should not be affected by vibration and shocks;
	- it is prohibited to exceed the nominal temperature, otherwise the
	service life of heating elements is shortened and the thermocouple
	might be damaged.

7. ASSEMBLY

Unpack the electric furnace and place it in the location prepared for its operation. Unscrew the supports and remove the transportation plates. Fix the supports. With the help of supports

adjust the position of the furnace. Put in the shelves. Connect the plug of the power supply cord to the mains (power supply) socket with the grounding contact connected to the grounding circuit. The voltage specified in the table of technical parameters should be in conformity with nominal voltage of the mains (power supply).

8.PREPARATION FOR OPERATION

Before the first operation or if the electric furnace has not been in use for a long period of time and stored in humid conditions, it should be dried as follows:

- without load heat it up to the temperature of 100-150°C and maintain it for 2-3 hours;
- heat it up to the nominal temperature. Maintain for 1-2 hours.

The dried furnace can be operated.



While drying some smoke may appear but it has no effect on further operation of the electric furnace.

9.ORDER OF OPERATION

Open the doors of the electric furnace.

Put the load on the shelves leaving the spaces from the walls of 1/10 of the side for the better circulation of air.



The data indicated in technical characteristics were obtained in the working space.



A,B,C – dimensions of the chamber; a, b, c – spaces between the walls and the load;

$$a = A \ge 0,1$$

 $b = B \ge 0,1$
 $c = C \ge 0,1$

Working volume (space) $V = (A-2a) \times (B-2b) \times (C-2c)$

Close the door of the electric furnace.

Turn on the switch; the switching-on will be indicated by the pilot lamp that lights up.

Following the User Manual of the temperature controller set the necessary program and switch its execution on.

The speed of air flow can be adjusted according to the demand. 0 – means natural convection in the chamber (the fan does not work), 10 – means forced convection (the fan works at max. revolutions).





While decreasing the revolutions of the fan the temperature distribution in the chamber worsens.

The air change in the chamber can be adjusted according to the process in the furnace.



The fan valve is fully closed. The ambient air does not get into the chamber.

The fan valve is fully open. The ambient air gets into the chamber.

In the technical characteristics the change of air (times per hour) in the chamber is stated when the fan works at maximal revolutions and the fan valve is fully open.

If the value of the change of air is open, the temperature distribution in the furnace worsens.

After work switch off the furnace. The switching-off will be indicated by the pilot lamp that fades. When program ends the bell sounds. With thermocontroller E5CKT – the bell is switched off with button on the control panel.



10. MAINTENANCE

The electric furnace should be disconnected from the mains (power supply) and cooled.



Once in	six	Once per six months examine visually the wires and electrical connections.
months		If necessary, tighten the contact screws.
Cleaning		When the operation is over, clean the external surfaces of the electric
		furnace, except the marking, with a piece of cloth soaked in water. Clean out the
		scale from the heating chamber with a piece of cloth soaked in water.
Cleaning	of	Clean the fan apertures by the means of a vacuum cleaner.
the	fan	
apertures		

11. STORAGE

While loading and unloading the furnace, protect it from any shocks.

12. TRANSPORTATION

The electric furnace has to be transported only in closed transport at temperatures from - 50 to + 50°C; at the temperature of +25°C, the ambient relative air humidity must not exceed 80%;

You can transport the electric furnace by any means of closed transport, except the sea transport, but protect it from any movement and rough mechanical damages. The packaging does not protect the electric furnace from the effects of improper treatment.

13. WARRANTY

The manufacturer guarantees that the electric furnace meets the requirements of the company standards.

The guaranteed operating period is 12 months from the date of purchase of the furnace provided that the user follows the rules of storage and transportation and operation instructions, but not more than 24 months from the date of the manufacture of the furnace.

The defects that appear during the warranty period through the manufacturer's fault shall be eliminated at manufacturer's expense.

Failure	Reason	Removal method			
The oven can't turn on.	There is no rated power	To check the power supply			
	supply voltage				
	The fuse is burnt out	To change the fuse			
The oven can't heat.	The temperature controller is	To switch on temperature			
	not switched on	controller			
	Damaged heating element	Change heating element			
	Damaged thyristor relay	Change thyristor relay			
Heating time is longer	Low voltage of the power	To check the voltage of			
than determined	supply	power supply			
		To regulate tightness of			
	Door's close is not hermetic	door's close			
There is no exact	Temperature's regulator is	To switch on automatic			
automatic temperature	not regularized	selection of parameter (AT) (look to			
regulation		temp. regulation instruction for			
		users)			

14. THE MORE OCCURRED FAILURES AND REMOVAL METHODS

* If after switching on the protective device it triggers again, the furnace must not be operated. In that case the manufacturer or the manufacturer's representative should be addressed for the repairs of the furnace.

15. ASSESSMENT TECHNIQUE OF THE PARAMETERS OF THE LABORATORY ELECTRIC FURNACE

Assessment is performed when the fan works at maximum revolutions and the valve of the fan is closed. Parameter is given after temperature AT controller has been chosen (see instrukcion manual temperature controller).

The parameters that are tested:

1. Testing of the nominal temperature and temperature stability without load when the low temperature laboratory electric furnace is heated to the nominal temperature.

2. Temperature distribution in the working space without load when the low temperature laboratory electric furnace is heated to the nominal temperature.

TESTING METHODS

All tests are performed when the low temperature laboratory electric furnace is heated to the nominal temperature and works in the mode of steady temperature, i.e. when the temperature of the furnace corresponds to the nominal temperature and temperature fluctuations reach minimal values (e.g. 300 ± 1^{0} C).

1. The testing of the nominal temperature and temperature stability without load when the low temperature laboratory electric furnace is heated to the nominal temperature is performed as following:

In the cold furnace the pilot thermocouple is fixed as closely as possible to the working thermocouple. The time period of the testing of the nominal temperature and temperature stability is 1 hour. The readings of the control device have to be registered, for example, every 10 minutes.

The estimation of the nominal temperature:

The sum of all registered temperature values is divided by the number of records made. The result must be from 299 0 C to 301 0 C. The temperature stability is estimated at the same time. If during the temperature testing the result is positive, that means that the temperature stability conforms to the requirement 300 ± 1^{0} C.

2. The testing of the temperature distribution in the working space without load when the low temperature laboratory electric furnace is heated to the nominal temperature is performed with the help of pilot thermocouples and the device showing temperature. No fewer than five thermocouples should be used. Thermocouples have to be arranged at the distance of 1/10 (for example, if the length of the wall is 380 mm, the thermocouple has to be not closer than 38 mm from the wall) from each wall and one thermocouple has to be put in the centre of the chamber. For fixing of thermocouples we recommend to make a welded frame. The results are estimated according to the formula.

The estimation of the temperature distribution in the working space: maximum testing temperature from one point minus minimal temperature from another point divided by two.

The temperature distribution must be not higher than $\pm 2,0^{\circ}$ C.

All instruments and thermocouples used for testing must be assessed, metrologically tested and be of not lower than the first class of accuracy.

16. ELECTRIC DIAGRAMME

FD 420/300



6.2 kW 1

Name of component	Piece	Article indentification	Туре	Manufacturer	
Q	1	Circuit breaker, 13A	S263 - 13 B	ABB	
S	1	Switch ; 16 A	OT16 ET3	ABB	
F	1	Fuse (2A ,M			
TC	1	Thermocouple , type "J "		THERMO-EST	
Р	1	Temperature controller	E5CK-T (E5CN;3208;3216)	Omron; Eurotherm	
SR	1	Solid-state relay	G3PB - 415B -3-VD	Omron	
M1,M2	2	Fan	AWP-03	Aspa	
E1,E3	3	Heating element	ENGLU 400-0,5;1;2/220B		
KM**2	1	Contactor	A 9 - 30 - 10	ABB	Option
S1**2	1	Thermal fuse	KNTP8814.02 ; 320*C	Metra blansko a.s.	Option
VR	1	Controller	FC1 A	Linoma	Option
T**3	1	Timer	MIL72E/1digi20	GRASSLIN	Option

17. OVEN TESTING RECORD

The laboratory model FD 420/300 was tested and correspond company standards requirements.

Serial No _____

Produced _____

Control department seal and signature _____

Code of the product _____

Attention!

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In the line of continuous improvement insignificant design amendments may be introduced without notice in this publication.