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Operation and Maintenance Manual
APE 800 and APE 800a Burn-out Furnaces

Programming guidelines

Kielce 2008

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Table of contents:

The manufacturer reserves the right to change the text of the present instruction manual without warning.

1. Industrial safety instructions

To assure safe and easy machine operation, attention should be paid to the basic security measures.
The present instruction manual contains the most important precautions.
Everybody who operates the machine must pay attention to security measures above all.

1.1. Responsibilities of the company using the machine

The company is obliged to assure such conditions in which the machine is operated by the people who:
- have been informed about security measures
- have read and understood the manual and have confirmed that by their signatures

The company must also monitor if the staff obey all the orders and instructions.

1.2. Responsibilities of the staff

People who have been trained to operate the machine are obliged to:
- pay attention to security measures
- pay special attention to the instructions connected with warnings which are mentioned in this manual.

1.3. Dangers while operating the furnace

The furnace was designed and constructed according to the newest technological and security standards.
The machine can be used only when its technical condition is perfect. The usage of the device which is at variance with its purpose leads to the considerable risk of threatening the lives of people operating the machine, and also of the damage to the machine as well as the manufactured products.
Disruptions which have negative influence on the safety of the machine operation must be removed immediately. The machine cannot be used until all erros are removed.

1.4. Organizational measures

Protective equipment for the staff must be provided by the purchaser. All security devices must be checked before the machine is in use.

The furnace must operate under the fully operational travelator which is connected to the unobstructed chimney flue, far away from any flammable materials.

1.5. Industrial safety devices

Before each start of the machine install the following devices and check their function:
- main switch that can be closed, which ensures that unauthorized people will not turn the machine on;
- safety lids.

1.6. Removal of safety devices

Safety devices can be removed only when the main power generator is disconnected.

1.7. Security measures

The instruction manual should be put in a visible place, in the vicinity of the furnace. In addition, general and specific rules connected with accident prevention and environment preservation must be provided.
All signs which can be found on the machine should be legible.

1.8. Operating the machine

Only trained staff can use the machine.
Specify who is responsible for:
- operation
- turning on
- preparation of the machine
- maintenance and repair of the machine

Apprentices can operate the machine only under the supervision of a trained worker.

1.9. Security measures while normal machine operation

The furnace can be used only when all security devices work properly. At least one time a day the machine should be checked in case of any damages.

The furnace should be equipped with the metal pliers with insulated handle and temperature resistant protective gloves.
The room where the furnace is in operation should be equipped with the first-aid kit containing pharmaceutical preparations used in treating burns and fire extinguisher for electric appliances.

1.10. Dangers connected with the presence of electric energy

- all works concerning electric devices and machine power supply can be done only by an authorized electrician engineer;
- the side lids should be always closed. Only authorized experts can work with opened lids;
- all loose connections and damaged lines must be immediately replaced. Do not use the machine before the replacement;
- all works while the devices are turned on can be done only when it is necessary.

1.11. Structural changes in the machine

The furnace cannot be enlarged or modified without the authorization of the manufacturer. The written authorization is necessary to perform any modifications of the machine.
Faulty parts must be immediately replaced.
Only original spare parts can be used. The manufacturer does not take the guarantee into consideration if the spare parts used are not original.

1.12. Activities of special attention

Staying in the vicinity of the working furnace, especially while its door is opened, requires particular caution on account of high temperature inside the furnace chamber.

1.14. Guarantee

Argenta company cannot maintain the service warranty or be responsible for people's injuries or any damage of the machine when they are caused by the following factors:

- improper usage of the machine
- improper assembly, settings, operation or maintenance of the machine
- operating the machine in which there are some damaged and/or not working security devices
- disregarding the instruction manual
- unauthorized structural changes in the machine
- insufficient inspection of worn out parts
- natural disasters.

1.15. Responsibilities

Only the factory manager, whose plant the machine was installed in, is responsible for the safety of workers.

2. Intended use of the furnace

The furnace is intended for heating and drying trays (metal moulds) which are applied in the process of jewellery casting with the use of stay-in-place wax method.
The construction and technical parameters of the furnace enable to use it for all casting mass which are available on the market.
The application of temperature program selector enables the control of the heating process with the priority of temperature over the time. It is possible to programme two independent programs with sixteen sections in each one.

3. Furnace design – general comments

The furnace is constructed of two joined units which constitute one entity. The first unit is a furnace which consists of a steel (or stainless steel – depending on the order) construction, a heat insulation layer (40 mm) on each wall of the chamber, electric and resistance heaters and a thermocouple which is placed in the heating chamber. The second unit is a temperature program selector with the semiconductor joining element.

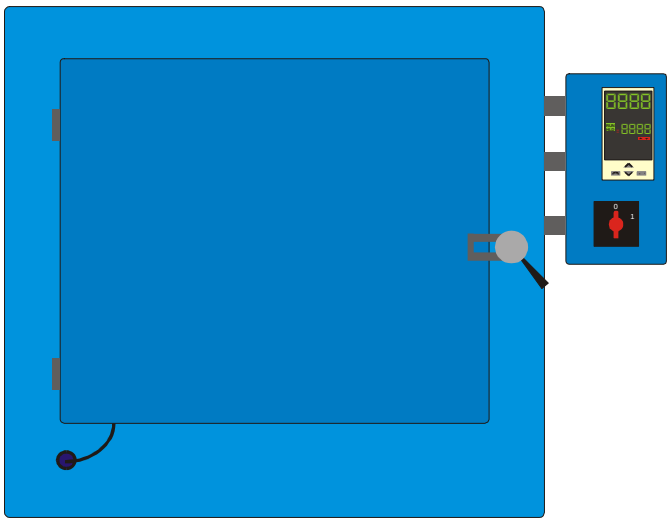


Fig.1. Reference drawing of the furnace

The furnace is equipped with the set of heatproof ceramic tiles which constitute the panelling of the furnace ground. Its purpose is to protect the heatproof fibre from damage.

***WARNING**: Provided socket may resemble a three-phase socket, but its application and connection is completely different.*

***WARNING**: Using metal trays as the furnace floor protection is impermissible. It cannot be allowed to let wax remnants cover the furnace floor.*

***WARNING**: The furnace structure allows the wax to soak into the bottom part of the furnace chamber.*

***WARNING:** Cooling down the furnace chamber with the use of fans or other appliances extorting air circulation is impermissible.*

***WARNING:** Burnt out trays should be previously dried in the drier in order to remove the casting wax.*

4. Basic technical parameters of the furnace

Nominal voltage	230V / 50Hz
Nominal power	2800W
Anti-electrocution protection	PE
Degree of protection	IP21
Maximum work temperature	800 °C
Maximum temperature increase	10°C/min
Amount of programmes	2
Amount of cycles in the programme	16
Furnace chaber dimensions	APE800: **400 x 450 x 270[mm]**
	APE800a: **280x300x230[mm]**
Outer dimensions	APE800: **700 x 640 x 530[mm]**
	APE800a: **500x530x570[mm]**
Integral mass of the furnace	APE800: **43kg**
	APE800a: **38kg**

5. Electric connection of the furnace

The furnace connection can be performed only by a qualified electrician and only with the application of all security measures. The furnace is powered with the use of a three-wire power grid with a single-phase current. The machine is equipped with a reinforced, single-phase plug and a suitable socket.

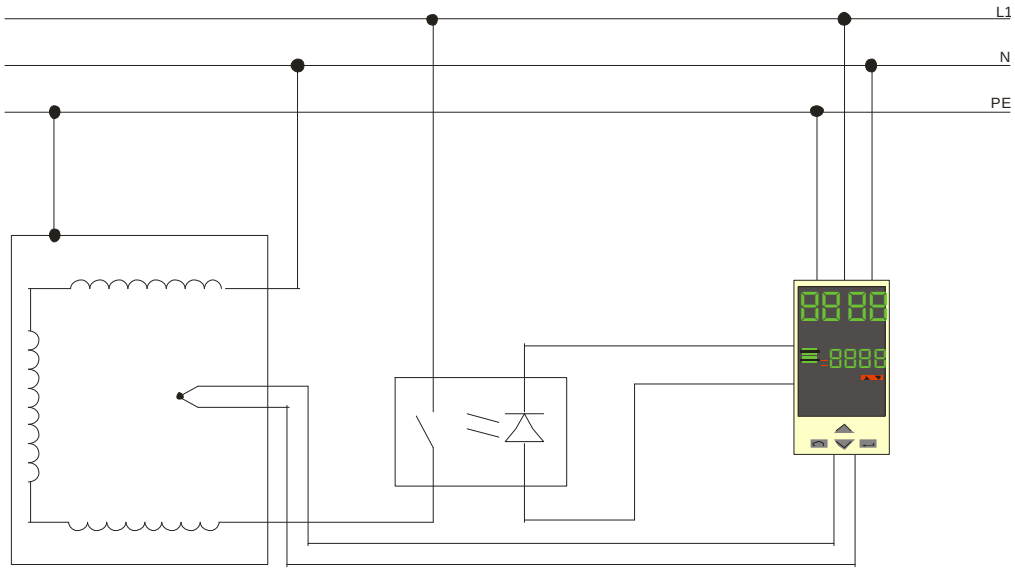


Fig.2. Electric connection diagram.

6. First launching

If it is the first launching of the furnace it is advisable to dry the heating chamber. To perform this action a short programme should be set on the program selector (the first section). It covers heating with the maximum temperature increase up to 700 °C. After the temperature is reached, the furnace can be turned off. This function should be initiated only in the target operating area of the furnace, with the activated travelator. During the first heating the insulating mats of the furnace will change their colour, which indicates that the drying process proceeds in a correct way.

7. Temperature program selector

Temperature program selector, which is also called a driver, is a unit of two cooperating modules – a temperature adjuster and an electronic clock. The main feature which distinguishes it from an ordinary temperature adjuster is a function of temperature increase control in a specific time.

Distinctive features

Amount of programmes	2
Amount of sections in the programme	16
Maximum temperature in a section	800 [^{o}C]
Maximum temperature increase	10 [^{o}C/min]
Maximum time of one section	1000 [min]
Maximum delay of the programme running	9999 [h]
Kind of adjustment	PID
Adjustment with the priority	temperature

Glossary

program selector - (driver) – temperature adjuster with the control of temperature increase, its holding and decrease in the furnace;

temperature increase – monitored temperature increase (heating) in the furnace chamber, its value is defined with the use of the unit: [^{o}C/min], it is illustrated with the rising line;

cooling – a kind of temperature increase, but in the opposite direction, its value is defined with the unit: ^{o}C/min, it is illustrated with the falling line;

temperature holding – holding the fixed temperature which has been reached in the previous section, it is defined with the time unit: [min], it is illustrated with a straight line;

programme – a list of subsequent sections which constitute the instructions concerning the way of heating, set by the founder in the program selector;

section – a part of programme describing the performance of the program selector in a given time;

delay – a function of the program selector which enables initiating the previously saved programme with the time delay;

temperature priority – a function of the program selector which operates in the background of each section, which is aimed at stopping the count of time in the section when the furnace chamber is under-heated in the ±5 ^{o}C band;

restoring of power supply – a function of the program selector that enables the continuation of the burn out process after the power supply is restored in the situation when power supply was cut off;

8.1. Program selector operation

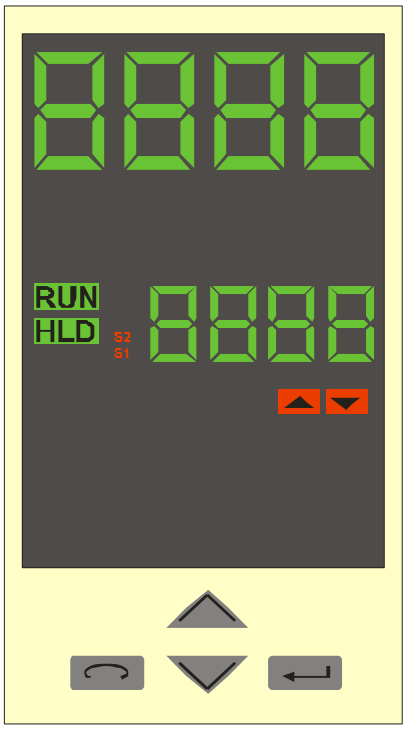


Fig. 3. Front board of the program selector

Driver description:

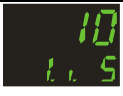
8.8.8.8.	The top, big display shows the current temperature while the process is in operation. During programming the work parameters the top display shows the value of the section (temperature increase or the time of the section).
8.8.8.8.	The bottom, small display shows the current programme and the section. During working parameters programming the bottom display shows the current position of programmed section and the programme.
RUN HLD	RUN – programme in progress HLD – termination of the time counting (temperature priority)
S2 S1	S2 – programme no. 2 S1 – programme no. 1
	Heating signalling
	Confirmation of chosen functions and options
	Increasing the value / running the programme no. 1
	Decreasing the value / running the programme no. 2
	Getting around the menu

Signs available:

	Temperature detector failure
	Termination of the current programme
	Entering the programme no. 1 box
	Entering the progamme no. 2 box
	The box of service configuration – unavailable for the user
	The box of the programme no. 1 delay – up to 1,1 min
	The box of the programme no. 2 delay – up to 1,1 min
	The demonstration box of the second programme, fourth section, temperature 302°C. The indicator light is the signal of furnace heating.
	The demonstration box of the second programme, third section. The HLD indicator light is the signal of time counting termination while waiting for the proper temperature.

8.2. Entering the programme

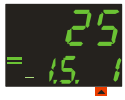
If the machine is launched for the first time, it is demanded to enter the working programme suitable to the casting mass and the cast alloy. The temperature-time description, which is further called a casting programme, is available at the manufacturer's of the casting mass.
The table below shows the procedure of entering the demonstration casting programme shown in Fig.4 'step by step'.

	sign	description	value	range
main switch		Turn on the power supply with the knob at the front of the temperature driver and wait a moment till the box below appears.		
main box		This screen shows the current temperature in the furnace chamber. press		
programme stop		This screen enables the termination of the current programme. In this case it is advisable to go further… press		
programme selection		With the use of the keys: ▲ and ▼ one of the available programmes should be chosen. choose Pr91 and press	1 [program]	1÷2
section 1		Programming starts with the temperature increase in section 1. choose 1 and press	1 [°C/min]	0÷10
		When the increase in a section amounts more than 0 the proper furnace temperature should be set. choose 150 and press	150 [°C]	0-800
section 2		0 increase value will cause holding the temperature set in the previous section. choose 0 and press	0 [°C/min]	0÷10
		The value describing the temperature from the previous section holding time. choose 60 and press	60 [min]	0÷1000
section 3		Temperature increase in section 3 (analogous to section 1). choose 2 and press	2 [°C/min]	0÷10
		Temperature verge of section no. 3 (analogous to section 1). choose 300 and press	300 [°C]	0-800
section 4		Holding the temperature from the previous section (analogous to section 2). choose 0 and press	0 [°C/min]	0÷10
		The value describing the temperature from the previous section holding time (analogous to section 2). choose 60 and press	60 [min]	0÷1000
section 5		Temperature increase in section 5. choose 10 and press	10 [°C/min]	0÷10

		Temperature verge in section 5. choose 730 and press ↵	730 [°C]	0-800
section 6		Holding the temperature from the previous section. choose 0 and press ↵	0 [°C/min]	0÷10
		The value describing the temperature from the previous section holding time. choose 240 and press ↵	240 [min]	0÷1000
section 7		The section in which the furnace chamber is cooled down. choose 10 and press ↵	10 [°C/min]	0÷10
		The cooling verge of **the casting temperature**. choose 630 and press ↵	630 [°C]	0-800
section 8		Holding the temperature from the previous section. choose 0 and press ↵	0 [°C/min]	0÷10
		The time of sustaining **the casting temperature,** which enables making the cast. choose 360 and press ↵	360 [min]	0÷1000
section 9		Setting the 0 values in both boxes indicates the end of the programme.	0 [°C/min]	0÷10
		choose 0 and press ↵	360 [min]	0÷1000
		In order to come back to the main box, which enables to start the programme, press the ⬭ key twice.		
Programme no. 1 has been saved.				

8.3. Launching the programme without a delay

In order to start the previously entered programme immediately, one has to follow the undermentioned instruction.

	sign	description
main switch		Turn on the power supply with the knob at the front of the temperature driver and wait a moment till the box below appears.
main box		This screen shows the current temperature in the furnace chamber. The temperature must not be higher than 150 °C. to start programme no. **1** press the following key ▲ to start programme no. **2** press the following key ▼
programme no. 1		The programme is immediately started and it is carried out from the first section. *the analogous situation concerns programme no. 2

8.4. Launching the programme with a delay

In order to start the programme with a time delay one should follow the undermentioned instruction.

	sign	description
main switch		Turn on the power supply with the knob at the front of the temperature driver and wait a moment till the box below appears.
main box		This screen shows the current temperature in the furnace chamber. The temperature must not be higher than 150 °C. to delay the start of programme no. **1** press and hold the following key ▲ to delay the start of programme no. **2** press and hold the following key ▼
launch delay		With the keys ▲ and ▼ set the delay time counting in hours and confirm it with the following key: ↵. *the analogous situation concerns programme no. 2
programme no. 1		While the delay function is in operation this state is indicated with the flashing sign S1 or S2. After this time the driver starts completing the default programme. *the analogous situation concerns programme no. 2

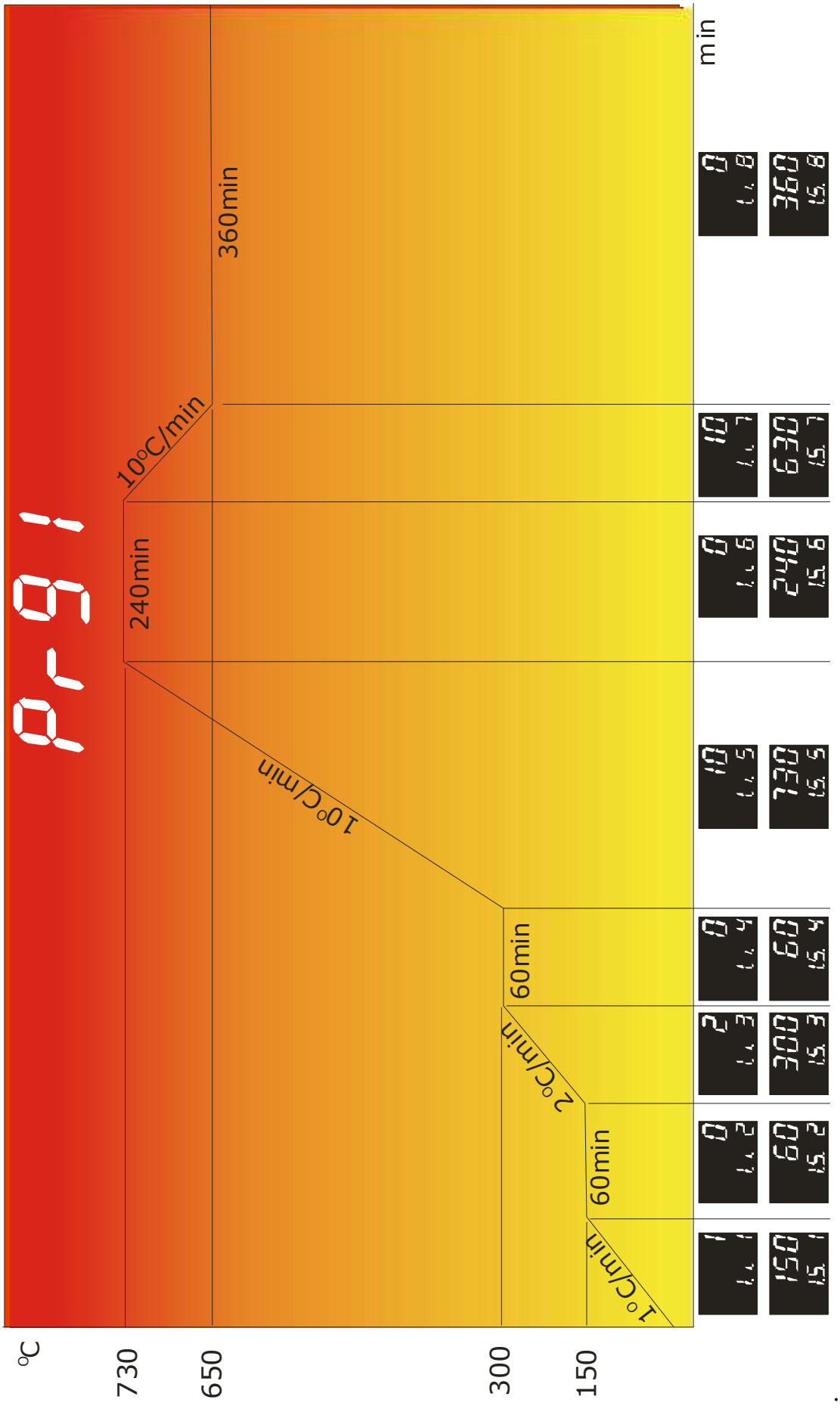
8.5. Stopping the current programme

In order to stop the current programme one should follow the undermentioned procedure.

	sign	description
programme no. 1		While the programme is in operation press the following key: ⬭ *the analogous situation concerns programme no. 2
programme stop		Press the ▲ key till the sign YES appears, then press the following key: ↵.
main box		The current programme will be stopped, the program selector will return to the main box and it will show the current temperature in the furnace chamber. WARNING: Another launching will be possible only after the temperature is lower than 150 °C.

9. Demonstration annealing programme

The following drawing shows the popular tray annealing programme which consists of the sections responsible for drying, annealing and casting the tray.
The boxes ascribed to separate sections can be helpful while programming the programme.


°C
730
650
300
150
min
360min
240min
60min
60min
10°C/min
10°C/min
2°C/min
1°C/min

10. Warehousing and transport

- each furnace is equipped with the present Operation and Maintenance Manual which confirms its origin by the serial number given by the manufacturer;
- during transport or warehousing the furnace should be wrapped in foil and protected from humidity or damage;
- during the time of transportation the furnace should be wrapped in a factory cardboard container which assures a proper protection – transport on the pallet is advisable.