Instruction manual

for installation and operation of

Automatic pellet burner

ERATO GP45

http://www.erato.bg

Thank You for buying our product – automatic pellet burner „ERATO GP45”. This manual will help You to use and maintain the unit properly.

ATTENTION!

IN INTEREST OF YOUR PERSONAL SECURITY IT IS NECESSARY TO READ THOROUGHLY AND CAREFULLY THIS INSTRUCTION MANUAL BEFORE PROCEEDING WITH ANY ACTIONS WITH THE BURNER – INSTALLATING, CONNECTING, OPERATING, ETC. IN CASE THAT REQUIREMENTS, DEPICTED IN THIS MANUAL ARE NOT SATISFIED, FAILURE OF THE UNIT COULD BE EXPECTED, OR EVEN FATAL CONSEQUENCES, FOR WHICH ERATO COMPANY DOES NOT TAKE RESPONSIBILITY.

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1. Automatic pellet burner "ERATO GP45" – description and advantages

"ERATO GP45" is automatic pellet burner, which utilizes wood pellets. The burner is designed to be installed on already operating heating boilers or other equipment, thus allowing fuel switch procedure to a renewable energy sources - biomass. The installed burner operates on wood pellets and the thermal energy, resulting from the intensive combustion process is directed to the heat exchange surfaces of a boiler or another thermal consumer.

The burner could utilize following types of fuel

- Wood pellets, having diameter 6 and 8 mm, categorized in the range of: A, AB, B (according to the methodology, developed for pellets properties estimation in ERATO company);
- Pre-dried nuts (cherries for example);
- Fuel mixture – pellets and nuts (for example mixture ratio could be 50% - 50%);
- Other solid biomass based pellets, but these fuels need testing and approval in ERATO company laboratory;

The unit is equipped with

- adjustable operating module, which controls the functions of the unit and is adjustable to the specific needs of a heating system;
- auger, which transports fuel from a bunker to the main unit;
- fresh air supplying fan;
- electric heater, which ignites the fuel;
- combustion chamber, which gives environment for efficient combustion process;
- removable grate of the combustion chamber, allowing easy access and ash cleaning;
- photosensor, which gives information for the status of the combustion process to the control unit and allows dynamic operation of the burner;
- interface panel, equipped with light indicators;
- the control board is equipped with led indicator for indicating the status of adjustable parameters index value;
- a variable potentiometer, which allows easy thermal capacity adjustment;
- a position switch, which certifies that the burner is installed properly and could work safely;

The burner is equipped with

- automatic fuel ignition system;
- automatic fuel transport system – from bunker to the combustion chamber of the main unit;
- safety system, which blocks its operation if the main unit is not installed properly;
- safety system, which blocks its operation in case that at any circumstances the fuel delivery pipe is preheated above certain temperature safety level;
- photosensor, which allows dynamic monitoring of the combustion process status;
- transition system, which modulated the air supply fan operation at ignition process;

Advantages of the burner

- the burner automatically utilizes renewable energy source – biomass, which makes it environmental friendly and does not contributes to the global warming and pollution;
- the burner is installed in order to apply the so called fuel switch process for appliances, utilizing fossil fuels – diesel, natural gas, LPG, coal;
- the burner's design allows easy installation on manual fed boilers – such as those, designed for coal, wood logs. The heating system and the boiler/equipment however need minor redesign and reconstruction in order to allow such fuel switch process;
- the resulting heat energy, based on organized combustion process of renewable energy source - biomass, is less influenced by the global trend of the energy sources and as result the price is competitive, compared to price of the popular energy sources;
- the burner operates automatically and achieves operation comfort, delivered by operating of fossil fuel burners – working with liquid and gaseous fuel, which permits remote control by programmable room thermostat;
- the burner's control unit is equipped with automatic fuel ignition procedure;
- automatic operation of the burner allows variable thermal load adjustment and economic operation of the heating system, which guarantees optimal thermal comfort and reduced fuel consumption;
- simplified installation procedure and initial adjustment, which guarantees faster assembly and unified approach;

- opportunity to utilize biomass, pellet shaped as well as other dried nuts, according the appropriate fuel table;
- high efficiency;
- low pollutant emissions;
- automatic fuel transport from a bunker, built according to the local units arrangement and need of the client (the bunker is not part of the burner equipment delivery);
- simplified maintenance and service;
- minimal operating costs;

2. Automatic pellet burner "ERATO GP 45" technical data

2.1. Thermal and technical data of automatic pellet burner "ERATO GP45", utilizing wood pellets are given in **Table 2.1**;

2.2. Dimensions and technical data of automatic pellet burner "ERATO GP45" are given in **Table 2.2;**

2.3. Recommended solid biomass fuel properties – wood pellets, are given in **Table 2.3;**

2.4. Pellets classification, considering their physical properties (based on fuel proximate analysis) are shown in **Table 2.4;**

Parameter	Dimension	Value
Nominal thermal capacity	*kW*	*45*
Thermal capacity operation range	*kW*	*10 – 45*
Utilized solid fuel	• *Wood pellets;* • *Pre-dried cherry nuts;* • *Other dried nuts;*	
Utilized pellets, complying ERATO classification methodology	*A,AB,B*	
Wood pellets fuel consumption rate at nominal thermal capacity	*kg/h*	*10.6*
Fresh air flow rate, required for effective combustion process and boiler operation	*kg/h*	*75 – 90*
	m^3/h	*70 - 84*
Averaged wood pellets consumption rate (the unit is operating in a popular heating system)	*kg/h*	*7.0*
Air excess ratio	λ	*1.5 – 1.7*
Solid fuel residue	*ash*	*The quantity depends on the ash contents in the raw fuel, as well as operating conditions*

Table 2.1 Thermal and technical data of automatic pellet burner "ERATO GP45", utilizing wood pellets

Parameter		Dimension	Value
Weight	*main module*	*kg*	*22*
	fuel transport auger	*kg*	*14*
Overall dimension of the unit (WxDxH)	*main module*	*mm*	*278 x 610 x 504*
	fuel transport auger	*mm*	*220x1890x110*
Power supply		*-*	*1PEN ; 50Hz; 230V;*
Power consumption rate	*at nominal load*	*0.3*	*A*
	at ignition	*1.5*	*A*
Electrical capacity		*W*	*<100 + 250 (at ignition process)*
Electric protection		*-*	*IP40*

Table 2.2 Dimensions and technical data of automatic pellet burner "ERATO GP45"

Parameter	Dimension	Value
Pellet's characteristic size	*mm*	*6 – 8*
Recommended fuel net calorific value	*MJ/kg*	*>17.2*
	kWh/kg	*>4.7*
Wood pellets category	A, AB, B	
Ash content	*%*	*See Table 2.4.*
Moisture content	*%*	*Max. 8 – 10%*

Table 2.3 Recommended solid biomass fuel properties – wood pellets

Classification of wood pellets, considering their physical properties (based on fuel proximate analysis) – according to fuel evaluation method, developed and applied in ERATO company is show on the following table.

Pellet's category	A^d	DU
A	$A^d \leq 0.6\%$	$DU \geq 97.0\%$
AB	$A^d \leq 0.6\%$	$DU < 97.0\%$
B	$0.6 < A^d \leq 1.0\%$	$DU \geq 97.0\%$
BC	$0.6 < A^d \leq 1.0\%$	$DU < 97.0\%$
C	$1.0\% < A^d \leq 2.0\%$	$DU \geq 97.0\%$
CD	$1.0\% < A^d \leq 2.0\%$	$DU < 97.0\%$
D	$2.0\% < A^d \leq 3.0\%$	$DU \geq 97.0\%$
DE	$2.0\% < A^d \leq 3.0\%$	$DU < 97.0\%$
E	$A^d > 3.0\%$	$DU \geq 97.0\%$
EF	$A^d > 3.0\%$	$DU < 97.0\%$

Table 2.4. Pellets classification, considering their physical properties

where :

A^d – *ash contents, dry basis*, [%];

DU – *mechanical durability*, [%];

3. Description of the construction of automatic pellet burner "ERATO GP45"

3.1. Main properties

The burner consists of the following elements/modules:

- The basis part of the pellet burner is the **main unit**, which consists of:
  - **Combustion chamber,** which forms combustion domain and optimal environment for solid biomass combustion, is designed of high quality stainless steel;
  - **Grate of the combustion chamber,** which could be easily detached and reveals access for ash removal;
  - **Air duct**, which uniformly distributes the airflow and ensures safe cooling of the elements of the burner;
  - **Electric heater**, which heats and ignites the fuel. The heater is positioned in a air cooled tube, which directs the preheated air above the grate in the combustion chamber;
  - **Air supply fan**;
  - **Photosensor,** which monitors the intensity/presence of the combustion process, installed aside of the combustion chamber for easy access and cleaning;
  - **Alarm thermostat,** which stops and blocks burner operation in case of "back fire" process in the fuel delivery pipe;
  - **Control board,** which monitors and controls the operation of the burner and indicates its status;
  - **Transport auger connector**, which realizes power supply to the electric motor of the auger;
  - **Interface panel,** which is equipped with light indicators and thermal capacity control gauge**;**
  - **Transparent window,** though which the operation of the control board could be checked without detaching the cover and any interventions;
- Electrically driven (external for the main unit) **fuel transport auger,** which extracts the solid fuel from the bunker and delivers to the main unit, according to the operating mode of the burner. The transport auger consists of electric motor with internal overheating protection element, attached to it reduction gear, a transport pipe with one end in the fuel

hopper and the other end is side opened and delivers fuel to the main unit though a aperture;

- **Flexible hose**, which is made of specific semitransparent thermal resistant material (in case of combustion process it does not emit toxic substances), which connects the transport auger and the main module;

The main modules of the pellet burner and their arrangement are shown of the following figure.

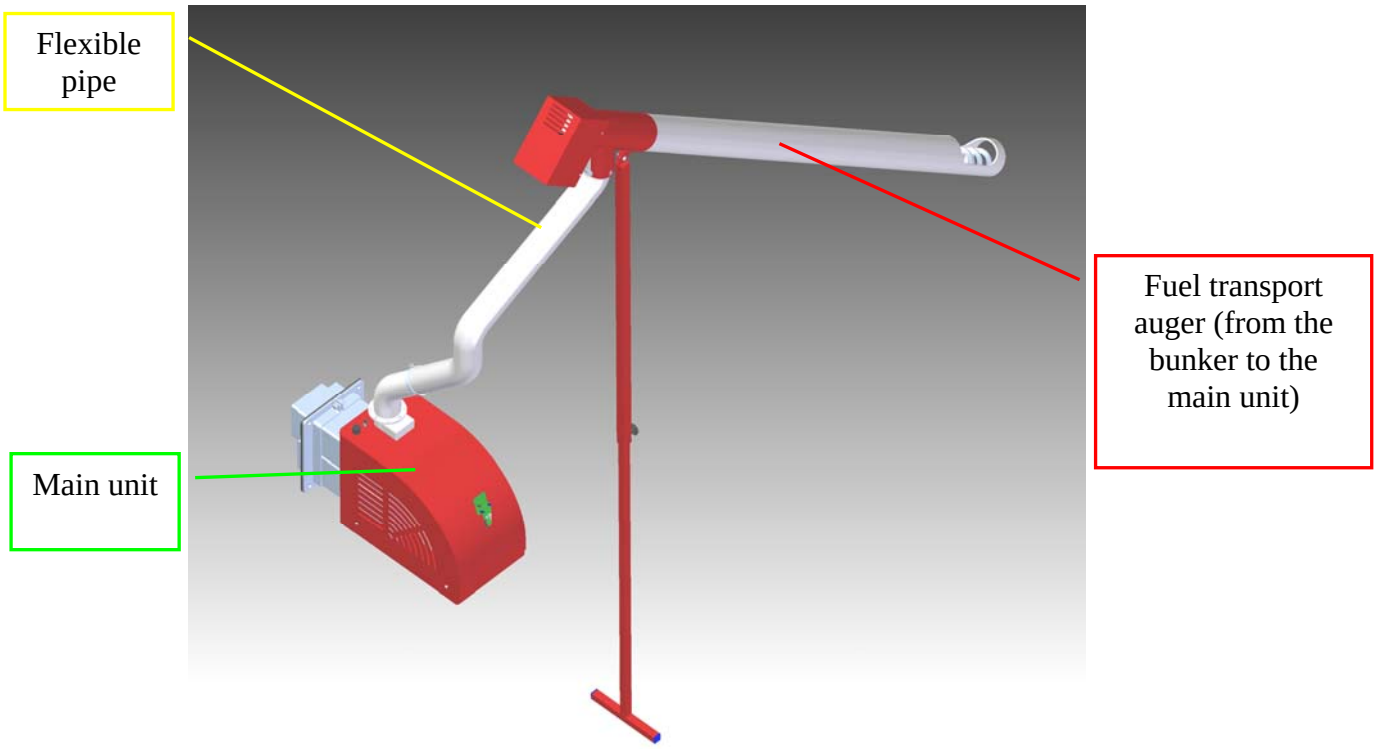

Figure 3.1 Arrangement of the modules of the pellet burner *(top view)*;

Elements and modules of the main unit are shown on figure 3.2 and figure 3.3.

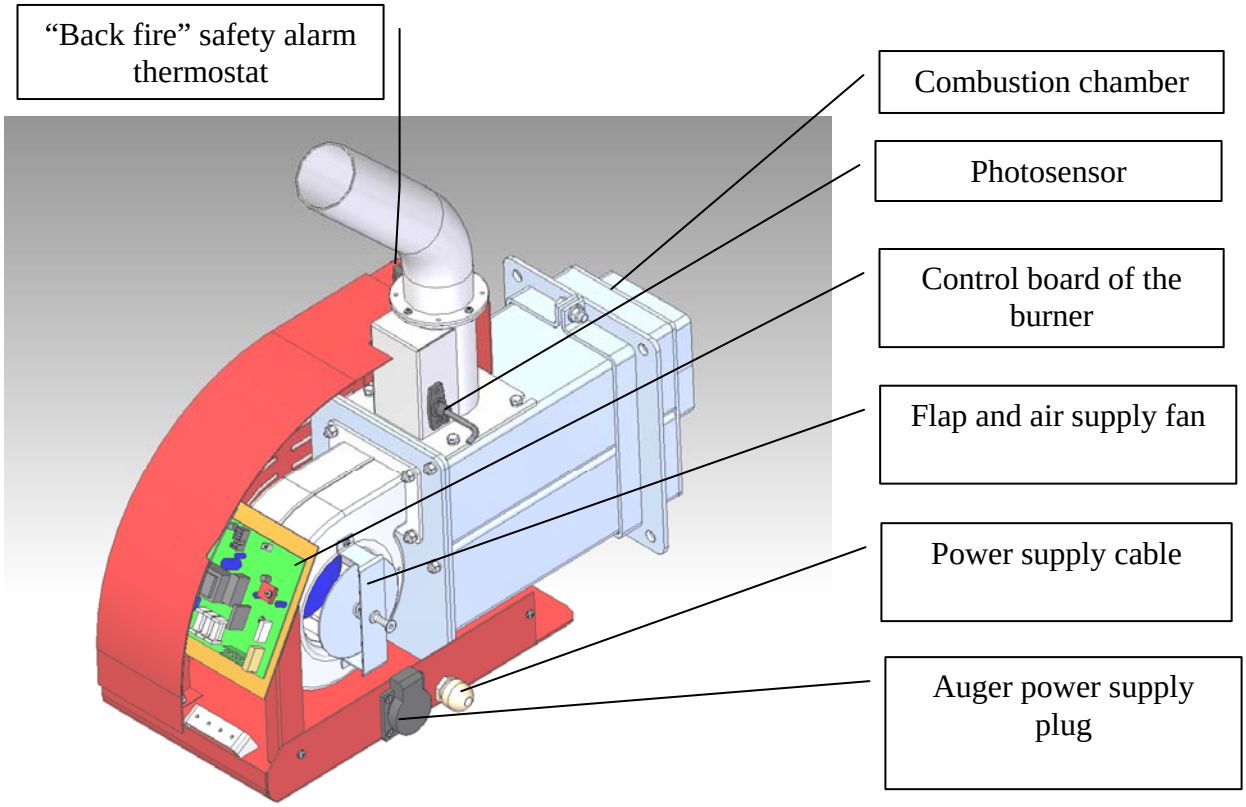

Figure 3.2 Section view of the elements of the main unit of the burner;

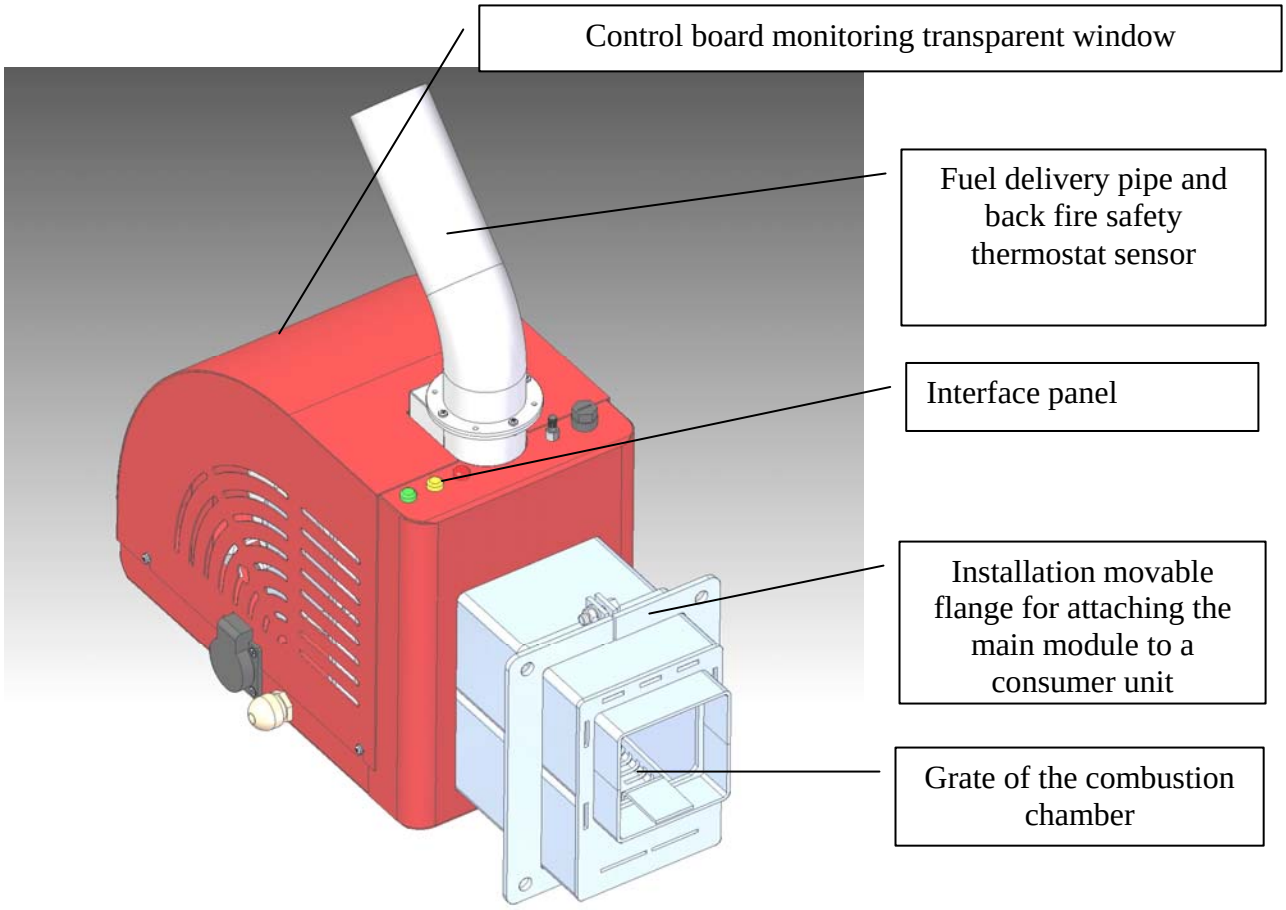

Figure 3.3 Side view of the main unit of the burner;

3.2. Specific design measures in order to increase the safety operation of the burner

- The ignition and the combustion process is monitored by microprocessor control board;
- The ignition process is monitored and in case that the fuel is not ignited for some reason, after certain number of ignition trials, the operation of the burner is stopped and alarm mode is indicated;
- In case that fuel is consumed from the hopper, than after the defined number of ignition trials the burner will go out in stop mode and alarm is indicated as well;
- The flexible hose, which connects the fuel transport auger with the main unit, is transparent and is made of specific heat resistant material;
- Information stickers are applied, indicating certain precautions measures and correct operation of the unit;
- The burner is equipped with safety elements, which are involved in back fire protection system:
    - Free falling duct, which practically interrupts the fuel flow between the transport auger and the main module. This ducts is approximately 250mm long. Beside that, the fuel auger is connected to the main unit by a flexible hose, which does not contain fuel. The grate of the burner is however charged with controlled amount of fuel, which is utilized at controlled combustion process and possibility of back fire is strongly reduced;
    - Sensor of back fire alarm thermostat, which is positioned on the fuel delivery pipe of the main unit (under the cover), activates at surface temperature levels above 90 – 95^{o}C. In case of alarm thermostat activation, the main unit and the fuel transport auger are stopped and switched to alarm mode. This mode is indicated by active “ALARM” light of the interface panel on the main unit. The alarm mode is not automatically deactivated (even if the fuel delivery pipe is cooled down) and need manual resetting – the protective cap of the alarm thermostat should be unscrewed, the internal button should be pressed until it clicks into its nominal position and than the cap should be screwed back. The cause of the alarm situation should be clarified and precaution measures should be taken before restarting the burner (performed by switching OFF and back ON the main power supply).

4. Installation of automatic pellet burner

Requirements and recommendations.

4.1. Some basic requirements for correct installation of automatic pellet burner "ERATO GP45" are

- The burner should be positioned in order to guarantee comfort maintenance and easy access for cleaning procedures;
- The main unit of the burner should be installed on a unit (a boiler, heat consumer, etc.), which has the appropriate thermal capacity, at least equal that of the burner and should provide easy access for burner's grate cleaning and ash removal;
- It is strongly forbidden to install the burner in dwellings, including corridors;
- The installation process of the burner, its attachment and connection of the power supply and control should be performed by authorized personal only;
- Installation and maintenance of the burner is performed by specialized trained personal of authorized companies;
- Connection of the burner to the power supply and the control board should be performed by authorized technician only;
- Before starting the burner, the heat consumer unit (at which the burner is attached) should be thoroughly checked in order to guarantee safe operation of the system;
- The maintenance of the burner should be performed by adult person, who is familiar with the safety procedures and the user manual of the appliance;

4.2. Installation of the burner

The installation process of the burner should be based on authorized project, which is governs the requirements of acting norms and recommendations.

- In case that the heat consumer unit is solid fuel hot water boiler, that the requirements are depicted in norm EN 303-5/2000 - „*Heating boilers. Part 5 : Heating boilers for solid fuels, hand and automatically fired, nominal heat output of up to 300 kW. Terminology, requirements, testing and marking*";

- In case that the heat consumer is not hot water boiler, than appropriate norm and requirements should be governed at preparing the installation project;
- Fire safety requirements;
- To the power supply - EN 60335-1/1997 - "*Household and similar electrical appliances – safety. Part 1. General requirements*";

4.3. Overall and attachment dimensions of the burner's main unit

The installation process of the burner should consider the requirements, described above, as well the dimensions of the unit, shown on the following figures.

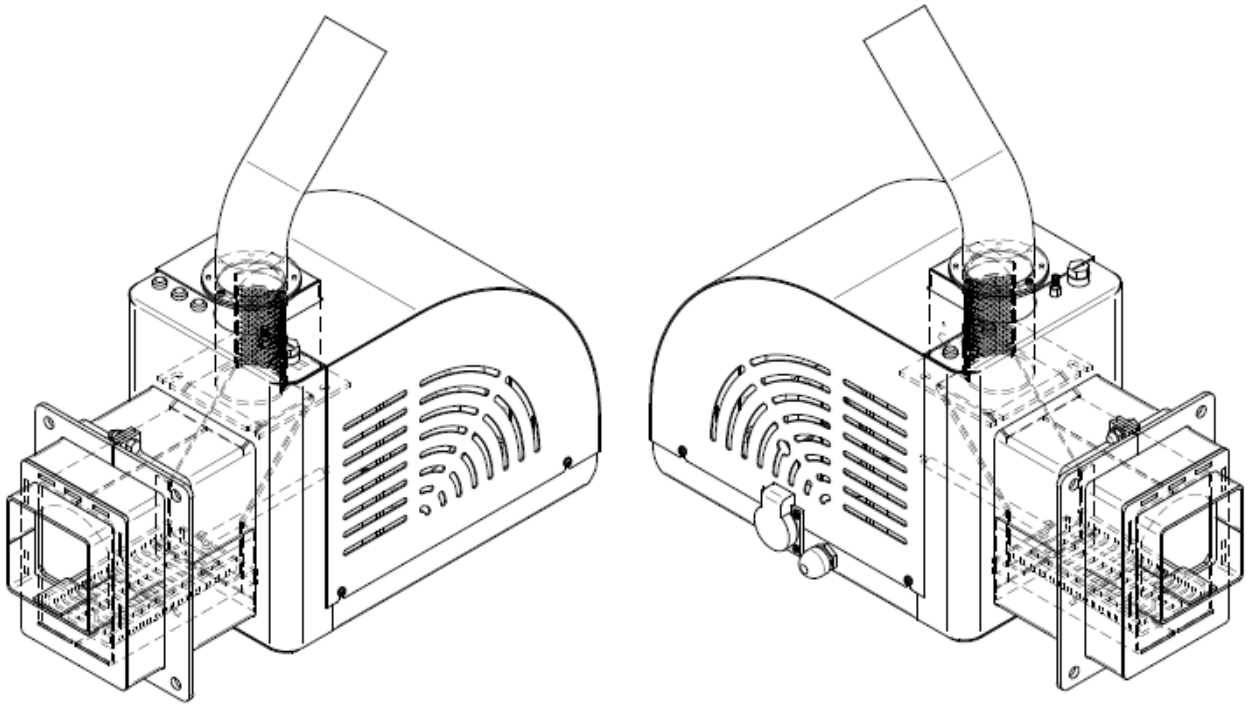

Figure 4.1. Isometric view of the main unit of the burner **–** *side view*;

Figures 4.2, 4.3. and 4.4. show the overall and detailed dimensions of the main unit of the burner, which should be considered at preparing a project and installation of the appliance.

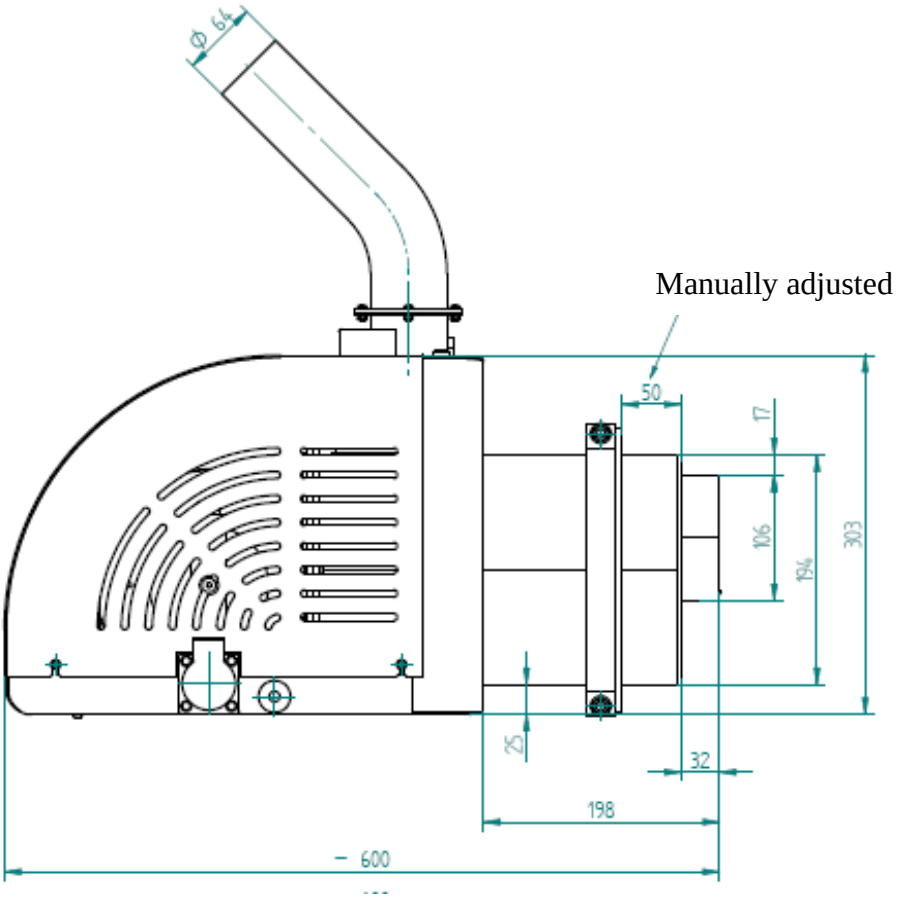

Figure 4.2. Overall and characteristic dimensions of the main unit – *side view*;

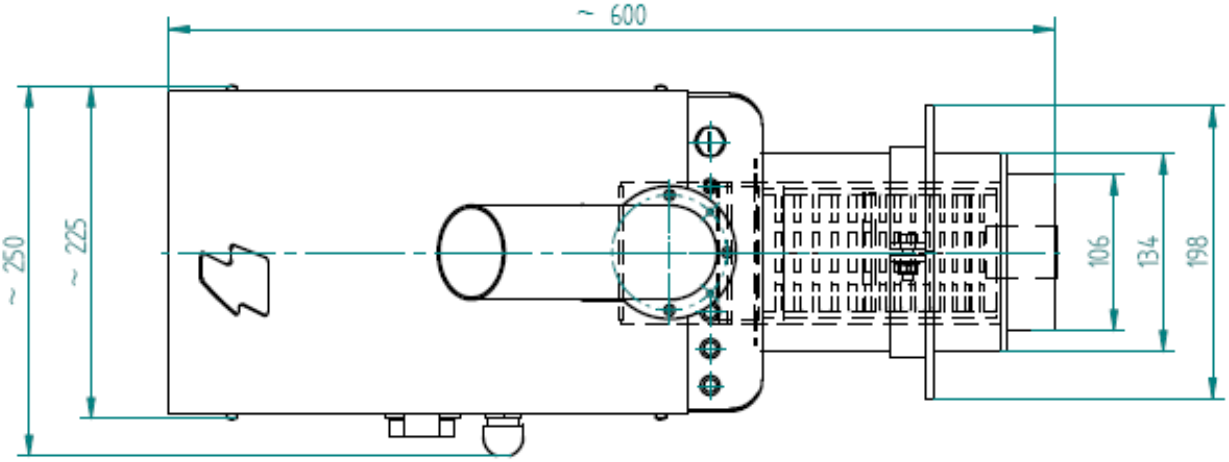

Figure 4.3. Overall and characteristic dimensions of the main unit – *top view*;

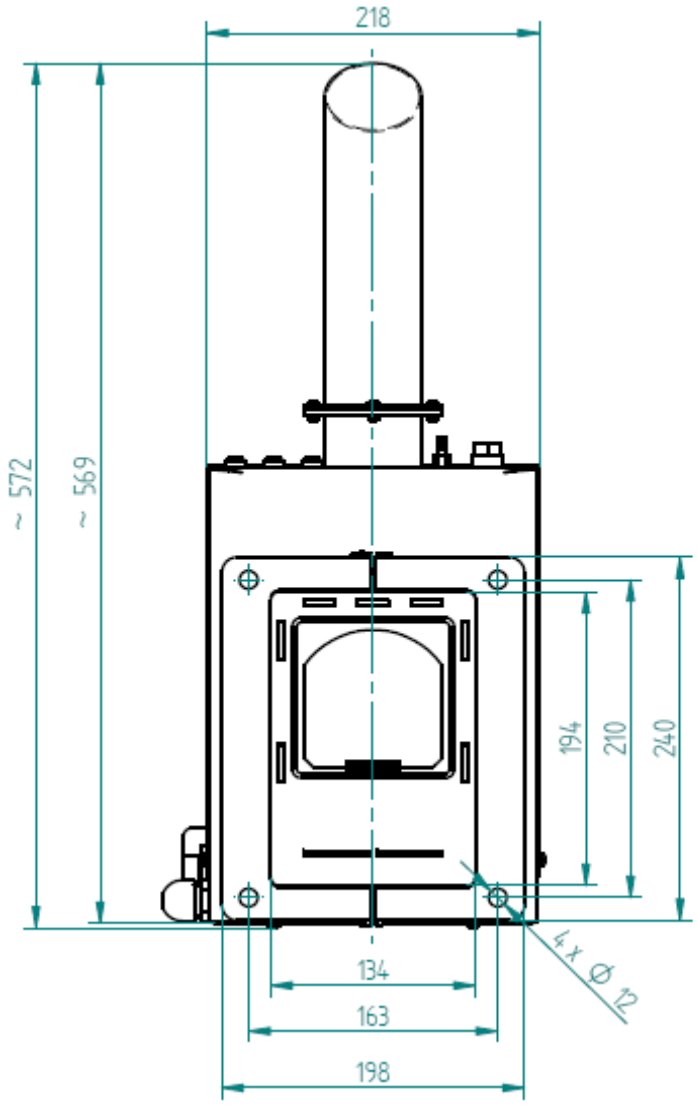

Figure 4.4. Overall and characteristic dimensions of the main unit – *front view*;

4.4. Arrangement and installation of the pellet burner's modules

- **The main unit** of the burner should be installed in horizontal position on a heat energy consumer appliance. According to the type of the appliance, an expert should prepare technical evaluation of the project for installation of the burner, as well as local arrangement of the units in order to ensure efficient and reliable system operation and easy access for cleaning and maintenance purposes. The main unit of the burner should be attached to the heat energy consumer appliance. The insulation gasket should be placed between the main unit's movable flange and the heat energy consumer. *It is forbidden to start the burner in any ways if the main unit is not installed on the heat consumer and special precautions have been taken in order the pellet burner to operate safely*;

- **Fuel transport auger** is positioned in a close region of the burner, in order to allow its easy connection with fuel delivery pipe of the main unit by the applied transparent flexible hose. The auger should be positioned at 45^{o} – the angle between the axis of the auger and the horizontal plane, in order to provide optimal operating conditions for the electric motor and efficient combustion process in the combustion chamber of the main unit. The lower section of the auger should be positioned in the fuel bunker and appropriate measures should be taken in order to prevent fuel discharge through gaps between the auger's pipe and the wall of the bunker. Additionally the lower section of the transport auger should be positioned in the lowest part of the hoper in order to ensure reliable fuel charging of the auger's pipe entrance. The final position of the transport auger should be fixed by adjustment of the length/height of the auger's movable support element. The fuel transport auger and the hoper should properly be arranged in order to ensure safe operation of the units and easy access and maintenance. The installation of the flexible hose should be considered as well – it could be bended and eventually its length could be decreased if necessary;

  ATTENTION: any change of the position (i.e. angle between the auger's axis and the horizontal plane) practically influences/changes the fuel flow rate and the thermal capacity of the burner as follows:

  - ***decrease*** *of the angle between the axis of the transport auger and horizontal plane leads to* ***increased*** *fuel flow rate and respectively higher thermal capacity of the burner;*
  - ***increase*** *of the angle between the axis of the transport auger and horizontal plane leads to* ***decreased*** *fuel flow rate and respectively lower thermal capacity of the burner;*

- **Flexible hose** should be installed – it connects the exit pipe of the fuel transport auger and the fuel delivery pipe of the main unit. The flexible hose should be straight (no visible hose slacking is allowed as such regions could accumulate dust and small fuel particles) and finally its ends should be tightened to the pipes by applied adjustable braces.

5. Initial steps and starting of automatic pellet burner "ERATO GP45"

Attention : The burner should be installed, adjusted and verified ONLY by trained staff of an authorized company.

5.1. Basic fuel requirements

- The fuel should be dry. The unit producer recommends that the fuel should be stored in dry and well ventilated rooms;
- It is strongly forbidden to store the fuel in close region of the unit, on which the pellet burner is installed, the minimal safety distance between the fuel and the appliance is 400 mm;
- The burner producer recommends an optimal distance between the unit, on which the pellet burner is installed, and the fuel bunker to be at least 1000mm. It is recommended to store the fuel in room, next to that, where the system is installed;
- At the installation procedure of the burner, as well as the fuel storage one, fire prevention recommendation should be considered. It is also recommended to install a fire-extinguisher in a safe and easy accessible place;

5.2. Staring automatic pellet burner "ERATO GP45"

Basic requirements:

- Any maintenance procedures should be performed in accordance with the described in this manual;
- Any intervention in the working process of the unit, which could lead to unit's failure and/or dangerous and health threatening situations, are strongly prohibited;
- The unit should be checked by the maintenance staff or any trained personal/end user regularly;
- The end-user should not perform any interventions, repairs, etc. of the unit. In case that warning and failures arise, check the failures table (applied at the end of this manual) and call the service support if the case is not described there;
- Any adjustments of thermal capacity higher than the nominal thermal load of the unit is not allowed;
- The ash residue should be collected in fireproof containers and cooled down to ambient temperature. The cooled ash should be disposed in appropriate waste containers. Please take into account that the mineral ash, result of

wood biomass pellets could be considered/utilized as soil fertilizer and dispersed for agricultural purposes for example;

5.2.1. Interface control board of automatic pellet burner "ERATO GP45"

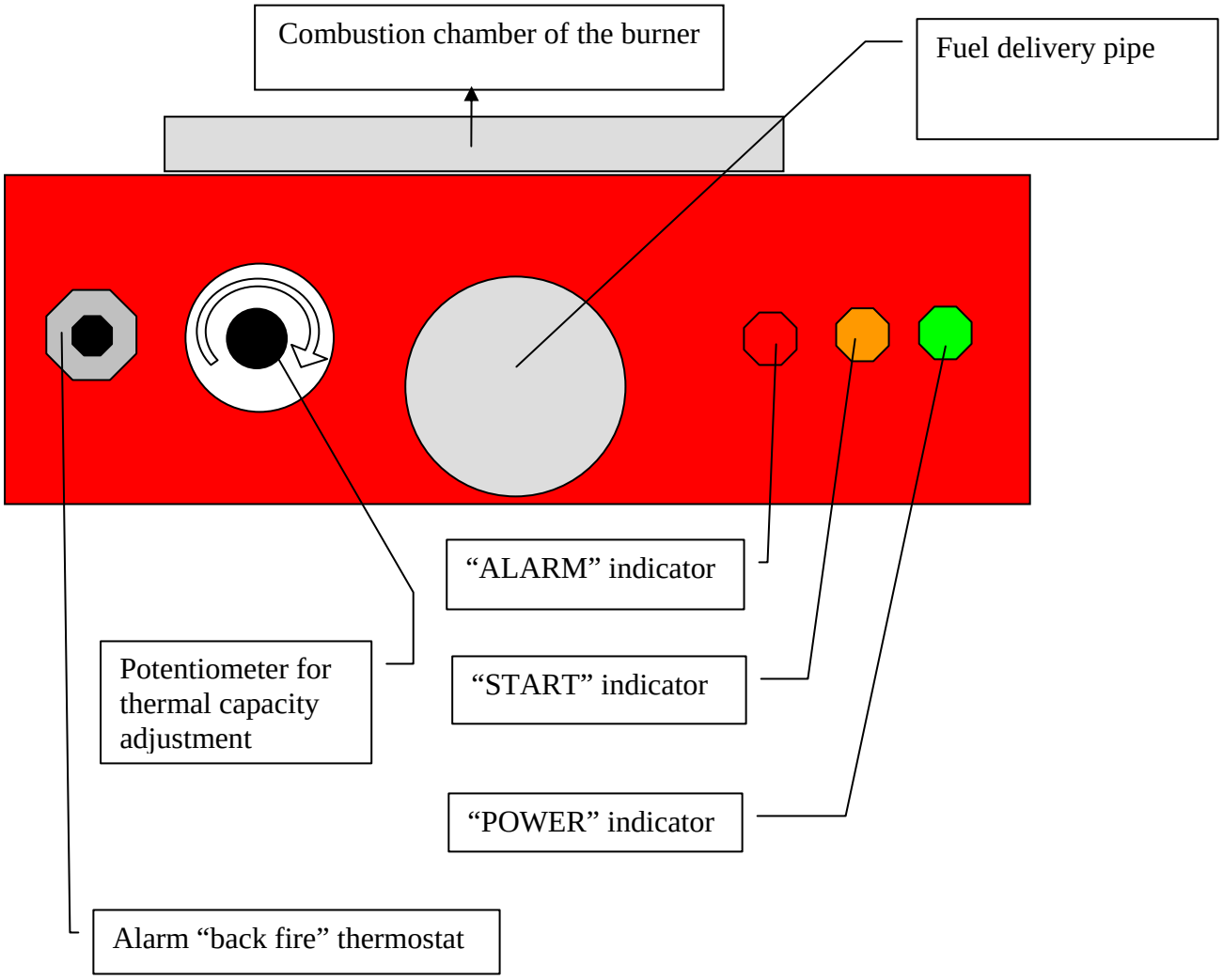

Figure 5.1. Interface board, equipped with indicator lamps, control and safety elements of automatic pellet burner "ERATO GP45".

Interface board devices description:

- **Alarm "back fire" thermostat** – *it stops the operation process of the burner and rises alarm signal in case that so called "back fire" arise in the fuel delivery pipe or hot flue gases are flowing through this pipe due to some emergency reasons*;
- **"POWER" indicator** – *shows presence of power supply to the main unit*;

- **"START" indicator** – *shows presence of* ***operation*** *signal, supplied by external control module*;
- **"ALARM" indicator** – *shows* ***alarm status*** *of burner's operation (the alarm back-fire thermostat is activated);*
- **Thermal capacity adjustment potentiometer**– *sets the operating thermal capacity (i.e. the fuel flow rate) of the burner*;

5.2.2. Automatic pellet burner power supply

- The burner should be connected to the power supply of the unit, at which it is attached and the appropriate safety rules should be satisfied. Use the attached to the main unit power supply cable and connect it to the control and power supply box of the heat consumer. If the heat consumer is a hot water boiler, than the control device is practically the operating thermostat of the boiler. Description of the power supply cable is as follows:
  - **black** – (single phase 220-230V AC, 50/60 Hz) – this wire should be connected to appropriate connection point of the heat energy consumer and has power supply through the main switch of the appliance of 220V. ATTENTION: the power supply should be serially connected through alarm thermostat or any other safety device in case of emergency situations, thus the power supply of the burner should be totally switched off in case of emergency;
  - **brown** – (single phase 220-230V AC, 50/60 Hz) – this wire should be connected to the control module of the heat energy consumer. In most cases this is the operating thermostat of a hot water boiler. When this module interrupts the control signal (phase line), then this signal stops the operation of the burner and the control board performs predefined algorithm for combustion process interruption and cooling down the combustion chamber of the burner;
  - **blue** – "zero" – this wire should be connected to the ***zero line*** of the main power supply;
  - **green-yellow**– (so called "protective earth") – this wire should be reliably earthed;
- The lower section of the fuel transport auger is positioned in the bunker, appropriately positioned and charged with fuel;

5.2.3. Switching on the burner

Switching the burner on is performed by supply electrical power through the power supply box of the heat energy consumer, where the burner is

installed. If the burner has been in operation mode (or in so called "hot start mode"), then if the power supply is restored, it starts/continues its operation automatically.

ATTENTION : *During the operation of burner and the heat consumer unit, when there are certain incompact sections, there could be smoke leakages, eventually through the flexible hose, which connects the fuel transport auger and the main unit of the burner. It is strongly recommended to make appropriate steps for stopping these leakages. Air flow rate adjustment is (adjust the position of the flap of the air fan) also recommended in order to decrease the pressure in the combustion chamber. Same process could be observed at transition periods (autumn and spring) and especially in summer, when the ambient temperature is relative higher that the operating temperature of the unit, as well as the chimney's draught is decreased.*

Comment :

- *At the period of fuel ignition an electric heater, positioned in a preheated air directing pipe is activated. The heater and the surrounding air are heated to high temperature levels and certain precautions should be taken in order not to touch and get skin burned in case of combustion chamber manual manipulation. In case that manual operation is required (for example for ash cleaning or fuel management)- self protective measures and appropriate instruments should be used.*
- *During the start-up operation of the burner, the fuel transport auger should be charged (filled) with fuel – this is long lasting, time consuming period. In such case it is recommended to plug the auger power supply cord into a common power supply wall-plug and do the auger charge until fuel starts to drop from its outlet. After this charge operation the auger's plug should be connected to the operating plug of the main unit.*

  ATTENTION: *the control board of the burner monitors the presence and adequate operation of the transport auger and if the auger is not plugged in the main unit of the burner, then the control board goes in alarm mode and the burner will not function. In order to go in nominal operation mode it is necessary to plug the auger power supply in the contact point on the main module and restart the burner – switch off and back on the power supply.*

  Explanation : *if the auger's power supply cable has been disconnected from the main unit of the burner (this situation is considered as alarm mode of the control board of the burner) – i.e. the electric motor is malfunctioning or wiring problems) and the burner has been switched on, then the control board indicates this mode by simultaneous lighting the*

yellow *and* ***green*** *LEDs (light emitting diodes), positioned on its surface (observed though the transparent windows of the main unit). The reset process should be performed : the auger should be correctly plugged in the operating connect point on the main unit, the power should be switched off and back on.*

- *The burner operates by predefined working algorithm, programmed in the inerasable memory chip on the control board. Optimal values of the parameters are defined by default at production and in principal no change is required in order to run the unit;*

5.2.4. Burner's operating algorithm

The burner starts its nominal operation if the following conditions are fulfilled:

- The main unit of the burner is installed at the heat energy consumer appliance;
- Available power supply;
- Start signal is available (the "START" indicator is lit);
- No alarm signals are available;
- The fuel transport auger is charged and filled with fuel and bunker is charged with fuel as well;

If the above described conditions are satisfied, then the control board performs operations as follows:

- The fuel transport auger is activated, the electric heater is activated and air fan are running simultaneously;
- After a factory set (predefined) period of time has ran out, (during this period the so called "initial fuel" mass has been charged to the combustion chamber), the electric motor of the fuel transport auger will be stoped (the ignition heater is active however);
- After certain period of time the photosensor of the burner should recognize stable combustion process by the emitted visible light and the electrical ignition element will be switched off. This is followed by graduate increment of the thermal capacity (i.e. the fuel flow rate) of the burner and after certain period of time the nominal thermal capacity will be reached. In case that the photosensor does not sense intensive light, i.e. there is no combustion process, or it is rather lean, than the control board of the burner will initiate new attempt to start the burner, the

above described cycle will be repeated. The total number of ignition start trials is however limited. In case that this limit has been passed, then burner will go into alarm mode and will not function until manual assistance is performed (for example bunker's charge with fuel, solving a problem, etc.) and the burner is restarted;

- In case that the fuel has been ignited, the burner goes into nominal operation mode, which is performed by periodic fuel transport to the combustion chamber of the burner, followed by a certain interval, utilized for fuel combustion. The periods for fuel charge and combustion are connected and only the charge period is changed by the position of thermal capacity potentiometer position.

  ATTENTION : *The thermal capacity potentiometer should not be in any case positioned at the maximal value (i.e. in the red zone of the scale) as this will result in set-point of thermal capacity of the burner, exceeding its nominal load. The air flow rate, supplied by the air fan, however could be manually adjusted by the specialized position screw. This manipulation should be performed by authorized technician only, directed by inflow flue gas measurement (flue gas temperature, pollution emissions, air excess ratio, chimney's draught, etc.), which give detailed overview of the combustion process;*

- When the set-point has been reached, defined by the external control unit, the control signal will be set off and the START signal will go off for nominal operation of the burner. The air supply fan will continue to run for a certain (factory preset) period of time and the remaining fuel will be incinerated and the remaining ash will be blown away by the air flow;
- When a new START signal has been sent to the burner, the above described algorithm will be performed in a so called operation cycle;
- In case that the START signal goes off (for any reason – room thermostat for example, etc.) the burner will go into stand-by mode, following the algorithm, described above;
- In case that in stand-by mode the burner receives a START signal, the control board will perform the above described algorithm in order to initiate ignition and continue into nominal thermal capacity mode;
- In case the first fuel dose is not ignited due to any reason, the control board of the unit will automatically start new ignition procedure. The total number of ignition trials is limited to 2 (factory preset value);

- In case that during nominal operation the photosensor does not recognize active combustion process, the initial fuel ignition procedure is started automatically;
- In case the total number of ignition trials has been exceeded, for example when the fuel in the bunker has been consumed, the burner will go into alarm mode and the **green** LED will light, indicating that manual assistance and restart of the unit is required as well. After the reason for alarm mode has been clarified and overcome, the burner should be restarted by switching it off and back on from the main power supply. One can use the power supply of the main unit, which supplies electrical power to the burner, however;
- In case that the power supply has been interrupted, at its renewal the burner will continue its operation automatically;

5.2.5. Operating control parameters of the burner

The control board of the burner has factory preset operating parameters values, which in common case are satisfying the requirements of a system and does not require any intervention and variation. The optimal operating conditions, however are achieved by adjustment of the thermal capacity (by adjustment of the thermal capacity potentiometer) and adjustment of the air flow rate control flap.

The control board is equipped with various LEDs (with different colors), which indicate the operating mode of the unit and its adjustment indexes values. The adjustment of the operating parameters of the burner should be performed by a trained authorized technician.

- **Description of LED indication (positioned on the control board of the unit):**

  Green and yellow LEDs are blinking in series mode – they are indicating *operating information* for the status of the burner. This information could be utilized in order to analyze the operating mode of the unit. For example the number of blinking signals of the **green** LED, indicates the index of the potentiometer number (P1 … P5), which are positioned on the control board. The number of the following **yellow** LED blinking signals indicate the value of the position of the appropriate potentiometer. The correspondence between the number **yellow** LED blinking and parameter's value are given in Table 5.1. The **red** LED is active when the photosensor senses presence of the combustion process.

EXPLANATION : *the emitted light from the above mentioned LEDs could be monitored through the transparent window, positioned above the control board of the burner, installed on its top cover.*

Table 5.1. gives detailed information about the number of LED blinking signals and the corresponding values of the operating parameters of the burner's control board:

Symbols:

P1 – potentiometer, which defines the operating period for transporting initial fuel doze to the combustion chamber of the burner;

P2 – potentiometer, which defines operating period for supplying fuel at nominal load;

P3 – potentiometer, which defines operating period for running the air fan after a STOP signal (at absence of START signal) has been received by the burner;

P4 – potentiometer, which defines operating period for ignition of the initial fuel doze;

P5 – potentiometer, which defines operating value of the photosensor sensitivity;

EXPLANATION : A common criteria for the quality of a combustion process is its natural color. In case that this color is rather dark yellow and smoke eddies are observed, this indicates that the fuel flow rate exceeds the optimal one for the current air flow rate and should be decreased by setting the potentiometer on the interface board to a lower position. The air flow control flap could be opened as well. The objective of the adjustment is to achieve stable intensive and turbulent combustion process and minimal char/unburned residue. *In practice however, the factory preset values of the operating parameters do not require any adjustment, even when the fuel has been changed.*

Number of LED blinking	Potentiometer number				
	P1	**P2**	**P3**	**P4**	**P5**
[-]	Operating period [seconds]				Index
0	30	3	30	45	0
1	45	4	60	90	1
2	60	5	90	135	2
3	75	6	120	180	3
4	90	7	150	225	4
5	105*	8	180	270	5
6	120	9	210	315	6
7	135	10	240	360	7*
8	150	11	270	405	8
9	165	12	300*	450*	9

Table 5.1. Description of the operating parameters of the burner's control board.

* The values, indicated with this symbol show the default (factory preset) values of the operating parameters, which in most cases will guarantee reliable and effective operation of the burner;

The producer reserves the right to change the specification and/or the default values of the operating parameters of the unit without prior notice;

NOTES:

- The default values of the operating parameters of the burner are derived at the following conditions:
    - The fuel is wood pellets, with diameter d=6 mm, **A** category (see table of wood pellets categories);

- The axial inclination of the fuel transport auger (the angle between the auger axis and horizontal plane) is 45^{o};

- The ash content (mineral, incombustible content in the fuel) does not influence significantly the gross calorific value of the fuel, but requires specialized design of the burner in order to achieve optimal and efficient combustion process. Following this, one should test the applicability of a fuel for combustion process in the current design of the burner and if positive result is achieved to be massively utilized as fuel material. However, many aspects of the unit operation should be considered;
- The producer preserves its right to change any value of the operating parameters of the burner, without a without prior notice;
- Table 5.1. contains values of the operating parameters if the control board and the default values are indicated;
- The above shown values of operating parameter P2 define the thermal capacity of the burner;
- Adjustment of the burner's thermal capacity could be achieved by detecting the fuel flow rate at nominal operating mode – the amount of fuel transported by the auger for certain period of time at nominal operating mode, considering the gross calorific value of the fuel and the overall efficiency of the system : burner-heat energy consumer unit.
- An approach to determine the fuel flow rate is as follows :
    - The flexible hose, which connects the fuel transport auger and the main unit of the burner should be disconnected at the main unit's side and is directed to a fuel container (for example a plastic bag or somewhat appropriate) and the transported fuel will be accumulated in this container;
    - Switch ON the burner and set START signal (by the control unit of the energy consumer) ON as well;
    - Unplug the photosensor by drawing until it is out of the sensor's handler and the control board of the burner will analyze this mode as nominal operation one (i.e. presence of combustion process);
    - In this mode the control board will power the transport auger's electric motor and fuel will be transported regularly. The fuel, which goes off the exhaust side of the flexible hose should be collected with no scattering in a container for a measured period of time. For example : the measuring period is 15 minutes (which is ¼ of an hour) and the container's accumulated fuel mass is 1.0 kg. The calculation shows that the fuel flow rate is 4 kg/h (practically the fuel flow rate is determined by dividing the accumulated fuel

mass on the period of time, during which the fuel is transported and accumulated).

Here is a sample for application of such an approach:

- ***Determine the fuel flow rate*** *(for an hour or less, for example a shorter period of time– 15 minutes=1/4 hour)- m_{fuel}=7.68 kg/h. Calculate the instant fuel flow rate (m'_{fuel}), (divide fuel flow rate per hour on 3600 , where 1 hour = 3600 seconds) and achieve m'_{fuel} = 0.002133 kg/s;*

- ***Determine/consider the gross calorific value of the fuel****– for example wood pellets have calorific value $H_{pellets}$ = 17.2 MJ/kg = 17200 kJ/kg. In case other dimension of the calorific value is more convenient to apply, for example – kWh/kg, then the calculation is as follows : wood pellets have gross calorific value of 4.77 kWh/kg (which is equal to 17.2 MJ/kg);*

- ***Determine/consider the net efficiency of the system : pellet burner-heat consumer unit*** *at nominal thermal capacity mode – η_{system}=89%=0.89. If the net efficiency is not know a priory, a good initial guess is η_{system}=85%=0.85.*

- ***Calculate the thermal capacity of the heat consumer unit -*** $P_{heat\_consumer} = \eta_{system} * H_{fuel} * m'_{fuel} = 0.89 * 17200 * 0.002133 = 32.652\,kW$ *if the calorific value of the fuel is applied in dimension – MJ/kg. In case that the calorific value of the fuel is applied in other dimension, for example kWh/kg, then the calculation is as follows* $P_{heat\_consumer} = \eta_{system} * H_{fuel} * m_{fuel} = 0.89 * 4.77 * 7.68 = 32.6\ kW;$

- *The same algorithm should be followed for calculating thermal capacity of the heat consumer in case that the fuel calorific value differs that cited above or the required thermal capacity of the unit is lower that the nominal one;*

The producer reserves the right to change the factory defined values of operating parameters of the burner without prior notice;

5.2.6. Adjustment process of the burner, according to the heat demand of a consumer

It is recommended to make appropriate adjustments of operating parameters of the burner in order to obtain high efficiency and reliable

performance of the unit, considering the thermal load. This is achieved by appropriate adjustment of the position of the thermal capacity potentiometer.

It is **highly recommended** to adjust the initial quantity (so called initial doze) of the fuel in order to ensure efficient and safe ignition process and reliable operation of the pellet burner.

It is highly recommended to perform adjustment of and the air flow rate by adjusting the position of the air control flap in order to achieve optimal combustion process, i.e. low pollutant concentrations (pollutants are CO, unburned hydrocarbons, NOx) in the flue gases and low air excess ratio. The adjustment process should be performed by a trained technician by using gas-analyzer measuring equipment.

5.2.7. Nominal thermal load of the burner

After the pellet burner has been started successfully (the fuel in the combustion chamber is ignited) and the heat consumer unit, which demands heat energy is heated up and tempered, one could assume that the system burner-heat consumer unit are in steady state mode and thermally tempered. The adjustment process should be performed in such steady conditions, followed by appropriate air control flap adjustment. In this mode an installer should perform so called "warm test" of the system, following the active norms and requirements.

Note : It is not recommended to operate the burner at thermal load lower than minimal thermal capacity, indicated in its technical information, as such conditions are characterized with decreased efficiency. If the unit should operate at thermal capacity, lower than nominal operation mode, one should perform local adjustment of the operating parameters of the burner – both the thermal capacity and the air flow rate, in order to ensure high efficiency and high reliability of the system;

ATTENTION : *Air flow rate considerably influence the operating mode of the burner and the overall system performance and efficiency – if the air flow rate is less than required, than the fuel is partially unburned due to low mixing intensity and decreased combustion efficiency. In case that the air flow rate exceeds the optimal air flow rate (for the operating thermal capacity of the burner) the result will be also a sensible decrease of the combustion efficiency due to intensive cooling of the combustion process and respectively increased amount of unburned fuel as well. The above mentioned characteristics should be carefully considered and appropriate adjustment of the combustion process properties should be set-up, utilizing gas-analyzer in order to achieve high efficiency and economic performance of the system.*

5.3. Adjustment of the thermal capacity of the burner

Adjustment of the thermal capacity of the burner is performed by simultaneous adjustment of the position of the thermal capacity potentiometer (i.e. the fuel flow rate) and the air flow rate, controlled by the flap of the burner's air fan.

Information about the thermal capacity of the burner at different values of the thermal capacity parameter P2 is shown in the following table.

P2 Number of LED blinking	Thermal capacity of the unit [kW]
1	10.0
2	15.0
3	20.0
4	27.0
5	33.0
6	38.0
7	41.0
8	43.0
9	45.0

Table 5.2. Thermal capacity of a system : pellet burner – heat consumer unit, according to the value of thermal capacity parameter P2;

EXPLANATION: *The above table gives information about the thermal capacity of a system : pellet burner – heat consumer unit, assuming that the effective efficiency is* $\eta = 0.89$;

ATTENTION : *In case of change of the fuel type (for example changing the pellets category) an appropriate adjustment of the operating parameters requirement could arise in order to achieve thermal capacity and high efficiency of the system.*

5.3.1. Decreasing thermal capacity of the burner

Thermal capacity of the burner is decreased by turning the position of the potentiometer, positioned on the interface panel of the burner, in direction to lower set-point – turn the potentiometer in direction anticlockwise, which will result in decreased fuel consumption rate;

5.3.2. Increasing thermal capacity of the burner

Thermal capacity of the burner is increased by turning the position of the potentiometer, positioned on the interface panel of the burner, in direction

to upper set-point – turn the potentiometer in direction clockwise, which will result in increased fuel consumption rate;

Explanation : *In case of changing the thermal capacity of the burner it is recommended to adjust the air flow rate as well, by adjusting the position of air flow control flap. In principal a decrease of the thermal capacity will require lower air flow rate and vice versa. Decreasing the air flow rate is performed by closing the air flow control flap, respectively – the increase of the air flow rate is realized by opening that flap. However, in practice a thermal capacity variation of around 20% is considered in the operating range and air flow control flap adjustment is not required;*

ATTENTION: *precise adjustment of operating parameters, which define the thermal capacity and overall performance of the burner, should be done by a trained technician, eventually customer. It is recommended to perform such a adjustment procedure by utilizing data, derived by inflow flue gas measurement of gas-analyzer;*

5.4. Stopping the pellet burner

Stopping the operation of the burner should be performed by turning OFF the "START" signal from the control module of the heat consumer unit. Respectively, the starting process should be invoked by turning ON the "START" signal of that control module. In case that the heat consumer is a hot water boiler this "START" signal is actually the status of the operating thermostat of the boiler. In case that the burner will not operate for a relatively long period of time, it is recommended to shut down the central power supply of the unit and clean the ash deposited in the combustion chamber, beneath it, as well as other surfaces of the combustion chamber, the photosensor should be checked/cleaned as well.

ATTENTION : *In case that the burner will not operate for a long period of time, then thorough ash deposit cleaning procedure should be performed. The ash layer acts corrosively on the carbon steel surfaces, which will lead to a decrease of the lifetime of the burner's main module. It is obligatory to perform service procedures and preventive observations of the unit by trained service personal only as well as thorough cleaning at the end of the heating season. Completing these requirements will ensure long exploitation duration of the burner and its high efficiency and reliability.*

5.5. Turning the burner OFF

The pellet burner is turned off by changing the "START" signal status into OFF, supplied by the control module of the heat consumer unit. During the

working process in OFF state, the control module of the burner performs so called “controlled turning off procedure” in which the air fan is working (and the burner is cooling down) and operating parameters are simultaneously monitored, in case of emergency appropriate actions will be taken. After the burner has been cooled down to ambient temperature, it should be switched off by turning off the main power supply of the heat consumer unit. It is recommended to clean the deposited ash thoroughly both of the burner as well as heat consumer surfaces.

- **Emergency burner stop**

  In operating process of the burner emergency situations could arise and the unit will go into alarm/failure mode. Such situations are detected by the process control board and it will go into automatic protective mode in order to be protected as well as the heat consumer unit. These modes are operated by appropriate preventive measures, automatic taken by the control board of the main module and the “ALARM” indicator light will be activated and/or the LEDs of the control board will indicate the situation and eventually will identify it. Please check the status of the LEDs and refer this manual before taking any actions. After the cause of the alarm situation is clarified, take adequate actions for bringing back the burner into normal operating conditions and restart it by switching off the power supply OFF the main module and back into ON.

ATTENTION :

- *in case of emergency situation – heat consumer overheating, the emergency thermostat (which is not part of the burner’s equipment and is installed on the control module of the unit) is activated. In this case the system (burner-heat consumer) should be cooled down and the reason for such emergency situation should be investigated and preventive measures should be performed. The emergency thermostat should be manually reset by unscrewing its preventive cap and its stem should be pressed until the thermostat switches back on (a “click” sound is heard in this process), then screw back its cap. After the system (burner-heat consumer) boiler is checked and the cause for overheating is determined and repaired, restart the burner by turning off its power supply and then back on in order to run the burner in normal mode*;
- *in case of alarm mode – fuel delivery pipe overheating, the alarm thermostat of the burner’s main module is activated and “ALARM” indicator light is active as well. This alarm thermostat senses the temperature on the surface of fuel pipe and prevents so called “back fire” process. After the unit is cooled down and the reason for such kind of emergency situation are clarified and special preventive measures have*

been taken, then the burner should be activated into nominal operating mode. This is done by manually reset the alarm thermostat (unscrew the protective cap, press down the button until "click" is heard and screw the protective cap back) and the restart the burner. In some situations this alarm thermostat could be damaged and will need renewal, in such situation please refer to service assistance;

5.6. Showing and teaching the end user about the maintenance and adjustment procedures of the burner

It is necessary to show and teach the end user the maintenance procedures for operating the burner efficiently and keep its reliability in high degree order. Also the installer should demonstrate and teach the end user how to adjust the thermal capacity of the burner, according to the estimated heat consumption and initial fuel transport auger charging:

- **combustion chamber cleaning** – it is recommended (at least once per day or a longer period is appropriate) to stop the burner (turn off the "START" signal of the burner), wait until the char has been incinerated and the burner cooled down. After the combustion chamber has been cooled down, remove the grate and clean the ash residue thoroughly. Use protective gloves and appropriate instruments if necessary;
- **cleaning procedure of the flexible hose, connecting the fuel transport auger and the main unit of the burner**– it is recommended to clean periodically this hose, as during the fuel transport fine particles are deposited on the internal surface of the hose, which eventually could impede the fuel transport though it. Furthermore, the deposited layer of fine fuel particles could be ignited in case that hot flue gases are exhausted though this hose in case of emergency;

ATTENTION : *regular cleaning of burner will ensure long-life reliable exploitation period, economic and efficient performance of the unit;*

5.7. Safety and unexpected risks

Risks could arise at the exploitation of the burner:

The automatic pellet burner "ERATO GP45" is designed according to the safety requirements of the operating European standards and norms. However safety and unexpected risks could arise in situations like following:

- *The pellet burner is operating incorrectly/abnormally;*
- *The unit is installed by unauthorized/unqualified personal;*

- *The safety instructions, described in this manual are not followed and fulfilled;*

Unexpected risks:

The unit is designed and produced according to the requirements of the operating EU safety norms. However, in spite of that possible risks are considered as a result of the operating process of the pellet burner, it is possible to arise risks as follows:

- ***Cauterization risks**, caused by high temperatures, as a result of the combustion process in the combustion chamber, at manual cleaning processes of the surfaces of the burner (i.e. its combustion chamber), or ash residue cleaning, or any unburned fuel material, smoldering in the grate of the combustion chamber;*

- ***Electrical shock risks** at indirect contact. The burner is connected to the power supply and its operating modules are separated in a section of its main module, equipped with required protective and short-circuit preventive elements. It is obligatory to perform burner ground connection by authorized personal/technician. It is forbidden to remove the cover of the main unit of the burner, as well as the protective cover of the electric motor of the fuel transport auger, by unauthorized person.*

- ***Fingers injuring risks** at operating mode or at maintenance and cleaning process of the burner. It is recommended to use appropriate individual resources for self-protection;*

- ***Suffocation risks** due to flue gas uncontrolled emissions, in case when the chimney draught is insufficient, in case that the flue gas duct (of the heat consumer unit) is clogged, or in case that the flue gas duct is not fully tightened and gas leaks are possible;*

5.8. Operation faults and repairing procedures

No	Operation fault	Cause	Method of repairing
1.	In case that the burner is installed on a hot water boiler and there is low temperatures in the heat energy supplied rooms	Insufficient heat capacity	Adjustment of operating parameters is required – *this should be performed by authorized technician*
		Low set-point temperature of the boiler's operating thermostat	It is necessary to increase the set-point of the boiler's operating thermostat (up to 90^{o}C)
		Low set-point temperature of the remote room thermostat (if connected)	It is necessary to increase the set-point of the room thermostat
2.	In case that the burner is installed on a hot water boiler and there is high temperatures in the heat energy supplied rooms	High set-point temperature of the boiler's operating thermostat	It is necessary to decrease the set-point of the boiler's operating thermostat (*it is recommended to keep it above $60^{o}C$*)
		High set-point temperature of the remote room thermostat (if connected)	It is necessary to decrease the set-point of the room thermostat
3.	The burner is active, but no combustion process	"START" signal is not available	It is necessary to check the status of the "START" signal of burner : check control module of the heat consumer unit
4.	Difficult fuel ignition	Low quality fuel	It is necessary to replace the fuel, most probably due to its high moisture content, which could be above the required value for nominal operation of the burner
5.	Heat consumer unit emergency overheating	Absence of heat consumption or incorrect adjustment of the parameters of the burner or imbalanced operation of the system : burner-heat consumer	It is necessary to check the correct operation process of the system : burner-heat consumer unit and eventually appropriate adjustment of the operating parameters of the burner– *this should be performed by authorized technician only*. After

			the system is cooled down to ambient temperature and the reason for overheating is serviced out/resolved, the protective cap of the emergency overheating thermostat (if activated) should be unscrewed, its rod should be pressed until the thermostat is reset and its cap should be screwed back. Then restart the burner (switch off the power supply and back on)
6.	No fuel ignition	Absence of fuel in the hopper	The fuel hopper should be charged. Then manually charge the fuel transport auger until new fuel comes out of the exit side of the auger and back plug its cable onto the burner's main unit.
		Absence of fuel in the burner's combustion chamber	It is possible by manually restarting to achieve nominal operation process of the burner. If this approach results in stable ignition, then it is necessary to increase the transported initial fuel mass - *the adjustment should be performed by authorized technician*;
		Fuel is present in the burner's grate, but it's not ignited or it is fully incinerated and the combustion process has extinguished, i.e. not present;	In case that the electric heater is out of order or not operating, then it should be replaced (or checked for proper functioning). In case that the electric heater is working, then it is necessary to adjust the operating parameters and/or the air flow rate - *the adjustment should be performed by authorized technician*;
		Abnormal operation or malfunctioning of the photosensor	The photosensor should be checked, cleared if necessary adjusted or replaced in case it is out of order;

7.	The burner is not running or it stops	No power supply	Check the status of "POWER" indicator, positioned on the interface panel of the burner. Check the connection and electricity parameters of the burner's main unit and the heat consumer power supply – the parameters should be as follows 220 V, 50 Hz – *it should be performed by authorized technician only;* Check the correctness of the power supply connection, according to the applied electrical scheme – *it should be performed by authorized technician only;* Check for tightness of electrical joints of the control board – *it should be performed by authorized technician only;*
		Absence of "START" signal to the burner's main unit	Check the status of "START" indicator – it should be lit. Check the wiring and connection of the burner's main unit and the power supply box of the heat consumer's power supply - – *it should be performed by authorized technician only;* Check for tightness of electrical joints of the control board – *it should be performed by authorized technician only;* Check the operation and functioning of the control module, which gives operating signal to the burner – check the parameters of the power supply – it should be as follows : 220 V, 50 Hz – *it should be performed by authorized technician only;*

		The "ALARM" indicator is lit – the alarm thermostat has been activated due to overheating of the main module's fuel delivery pipe	After the main unit is cooled down to ambient temperature, the reason for this emergency situation should be clarified and necessary steps should be taken in order to sustain operating conditions for the burner. The alarm thermostat should be reset by manual unscrewing its protective cap, push its button until a "click" sound is heard and the cap should be screwed back;
		The burner does not run and a "START" signal is present (the "START" indicator is active	Check if the control board is in alarm mode – see following table with operating and alarm indication
		Safety fuses are broken due to emergency short circuit	*This check-up operation should be performed by authorized technician only : check each fuse status and replace if necessary with appropriate one (**Attention**: safety fuses F3 and F4 are fast reacting);*
8.	The flame looks "opaque" and smoke is observed at the exit of the chimney	Low quality fuel	Fuel replacement is recommended, most probably the moisture content is higher than required for nominal operation of the burner – see the requirements in the fuel properties table;
		Inappropriate operating parameters adjustment	It is necessary to perform operating parameters adjustment and achieve efficient combustion process – *this operation should be performed by trained authorized personal only*;
9.	The ignition process of the fuel is successful, but the unit could not reach stable	Incorrect photosensor positioning	Change (i.e. slightly rotate or even axially move) the position of the photosensor
		The external surface of the photosensor is dirty	Clean the transparent section of the photosensor by careful cleaning – do not use solvents

	operating mode	The photosensor is gone – its working surface is damaged and overheating zones are observed	It is necessary to replace the photosensor – *it should be performed by authorized technician only*
10.	The operation of the burner is not stable	Photosensor malfunctioning	Check the condition and functionality of the photosensor
		The operating parameters of the control board have been changed	Check the position of the heat capacity potentiometer
			Check the operating parameters of the burner's control board – *it should be performed by authorized technician only;*
		The position of air flow control flap has been changed	Adjust the combustion process – check both the operating parameters as well as position of the air flow rate control flap – *it should be performed by authorized technician only;*
11.	Presence of unburned fuel in the ash tray of the heat consumer unit	Ineffective fuel combustion process	It is necessary to perform adjustment of the operating parameters and the air flow rate – *it should be performed by trained authorized technician*;
12.	Ash slagging and deposition is observed in the region of the combustion chamber of the burner (especially on the grate)	The fuels' ash content is higher than recommended	It is necessary to replace the fuel with appropriate one – see the table with properties of the recommended fuel
		The burner is operating at thermal capacity higher than the nominal one	Decrease the thermal capacity of the burner by changing the set-point of the heat capacity potentiometer
13.	Alarm mode of the burner's control board	Alarm mode of the operating conditions of the burner	Check LED indications, depicted in the following table. Get help by authorizer technician if necessary
14.	The burner has stopped and after a manual restart it works properly	The photosensor is malfunctioning and the gives improper signal to the control board	Check the quantity of the fuel at nominal mode, delivered on the burner's grate: • In case that this quantity is less than required, than increase the thermal

			capacity of the burner or decrease the air flow rate by repositioning the control flap of the air fan; • In case that this quantity is higher than required, than decrease the thermal capacity of the unit or increase the air flow rate by repositioning the control flap of the air fan;
15.	High temperature of the flue gases (if flue gas thermometer is mounted)	The heat exchanging surfaces of the heat consumer are deposited with ash, presenting heat resistive layer, thus decreasing the heat exchanging intensity	It is necessary to clean thoroughly the heat consumer surfaces in order to decrease ash layer heat resistance;
16.	Flue gases are emitted out of the heat consumer unit after certain period of exploitation	The flue gas duct is clogged or even blocked by fly ash deposits	It is necessary to clean thoroughly the heat consumer's flue gas duct as well as chimney*;*
17.	Other failures, not described above		It is necessary to consult authorized technician and eventually service maintenance should be performed

Table 5.3. Automatic pellet burner faults and repair procedures**.**

No	Indication status	Meaning	Method of repairing
1.	**Yellow** LED is permanently active	The number of ignition trials has been reached and now fuel ignition has been achieved	Check the causes for lack of fuel ignition – *see Table 5.3*
2.	Fast blinking **yellow** LED	The combustion process intensity is exceeding nominal levels or the photosensor has been short circuited	Check the potentiometer, which controls the adjustment of the sensitivity of the photosensor - *this operation should be performed by authorizer technician only*
3.	**Green** LED is permanently active	The operating signal of the photosensor for the combustion process has been lost during nominal operation mode	Check the status of the photosensor, ask for help of a service if necessary;
		Unsuccessful fuel ignition	Check the reasons – see Table 5.3.
4.	Fast blinking **red** LED	The rotation sensor is not properly connected or the air fan is not working	*Service assistance by authorized technician is required*
5.	The **yellow** and **green** LEDs are permanently active	The fuel transport auger's electric motor is disconnected or malfunctioning	Check if the power supply cable of the fuel transport auger has been disconnected from the burner's main unit. Check the status and functioning of the auger itself;
		The operating relay on the control board is malfunctioning	*Service assistance by authorized technician is required*

Table 5.4. Detailed description of control board's alarm mode indications.

5.9. Automatic pellet burner “ERATO GP45” warranty form completion.

The applied WARRANTY FORM should be completed, by filling the required information in the appropriate fields. The assigned field for signatures and stamp should be completed as well in order to <u>VALIDATE</u> the WARRANY FORM of the unit.

5.10. Actions, after the burner is not in exploitation anymore.

When the lifetime period of the unit has been completed, then it should be treated properly in order to preserve environment contamination. The unit should be dismounted and disassembled by environmentally safe methods. This requirement is most commonly completed by appropriate components recycling, considering separate waste disposal and utilization methods.

6. Electrical scheme of automatic pellet burner “ERATO GP45”

Figure 6.1 shows the principal electrical scheme of automatic pellet burner “ERATO GP45”.

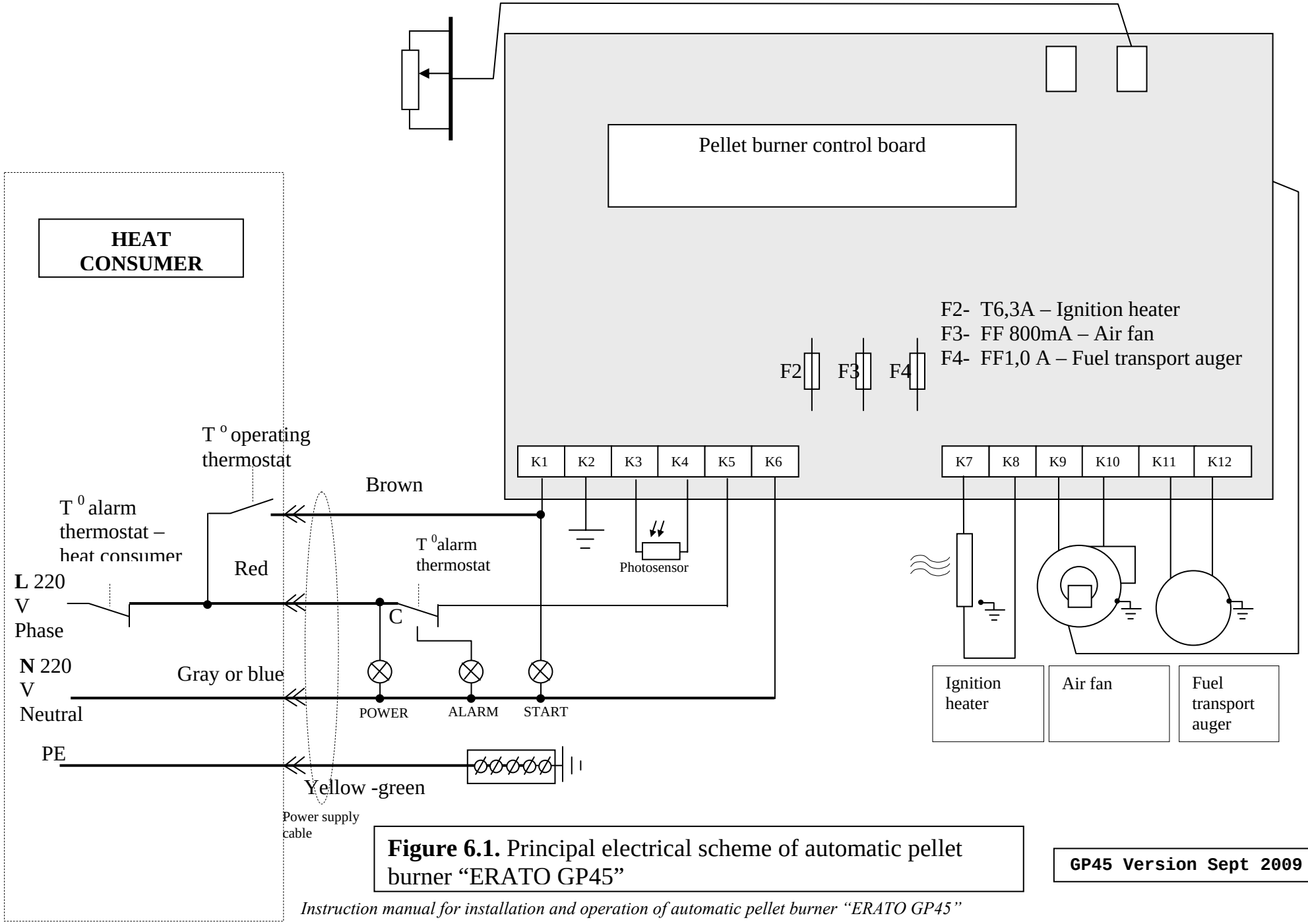

Figure 6.1. Principal electrical scheme of automatic pellet burner "ERATO GP45"

GP45 Version Sept 2009

QUALITY CERTIFICATE

Product	**Automatic pellet burner "ERATO GP45"**
Serial number	
Date of production	
Operation test check	
Technical control	

“ZMM-ERATO” LTD - Haskovo

WARRANTY FORM

Product:	**Automatic pellet burner “ERATO GP45”**
Serial number	
Date of purchase	
Vendor company	
Buyer	(signature)
Seller	(signature)
Initial operation date	(date)
Service company/technician	(signature and stamp)

WARRANTY CONDITIONS

The producer guarantees correct and reliable operation of the unit ONLY when installation and maintenance requirements are completed.

The warranty period of the pellet burner starts from date, when the warranty form is filled and stamped by the authorized organization.

The warranty period of the pellet burner starts from date when it is started for very first time, but no longer than 18 months of the day of delivery.

The warranty period of the automatic pellet burner "ERATO GP45" is **24** (twenty four) months.

THE WARRANTY OF THE AUTOMATIC PELLET BURNER IS NOT VALID in case one of the following is fulfilled:

- Unit damages, caused by incorrect handling, transport and/or loading/unloading, which are not organized by the producer;
- Failures, caused by natural disasters (Earth quakes, fires, floods, etc.);
- Unsatisfied installation, maintenance and service requirements, which are described in this manual;
- Repairing of any failure of the unit, performed by unauthorized technicians or the end user;
- Any changes in the design of the burner;
- Incorrect installation and/or improper functioning due to operator/client influence;
- Failures, caused by factors, for which the producer could not be blamed and/or has no control over them;
- Any malfunctions or damages, which are not caused by the operation of the pellet burner itself, but result in unit damages and its functionality;

Every warranty service operation should be noticed in its warranty service procedures list.

The warranty period of the unit is interrupted by the period, during which the unit is warranty serviced by authorized technicians (the period between failure notification and its repairing).

The warranty of the unit is valid when the original invoice document and the original warranty form are presented only.

WARRANTY SERVICE PROCEDURES LIST

Entry date of unit in the service company	Description of the failure	Date of delivery back to the end user	Signature of the technician, which repaired the unit

CONFORMITY DECLARATION

We, "ZMM-HASKOVO AD"

"Saedinenie" 67 Bulvd.

6300, Haskovo, Bulgaria

declare our own responsibility that the unit:

automatic pellet burner **"ERATO GP45"**

for which the current DECLARATION states, is in compliance and conformity with basic safety and health requirements according to :

Annex I of the EEC Directive 98/37 (Directive on Machines).

Generated in Haskovo	Executive director
Date : 18.08.2009	"ZMM-HASKOVO AD"
	M.Sc. Peter Andreev