

**CONCISE DESCRIPTION AND SPECIFICATIONS  
OF ROTARY PYROLYTIC  
GASIFICATION/INCINERATION KILN**

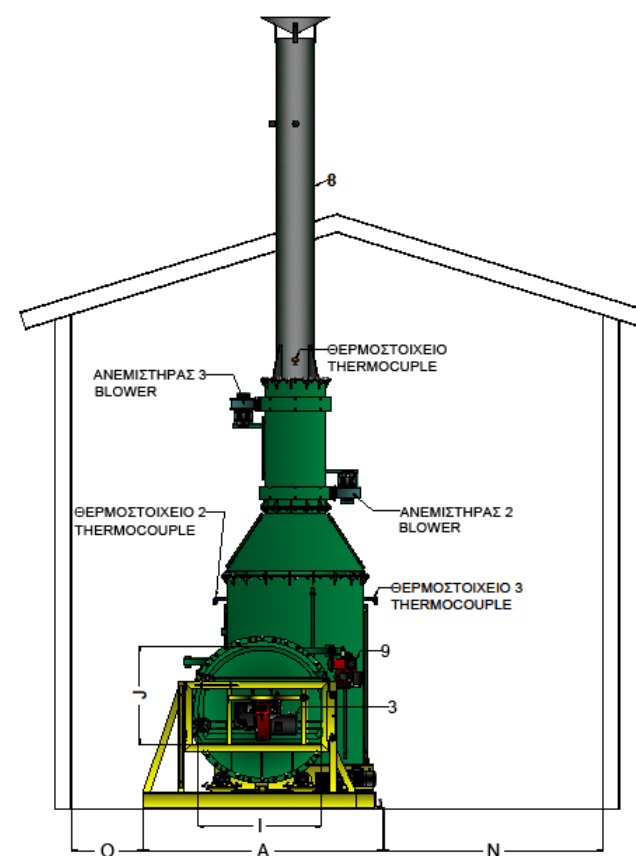
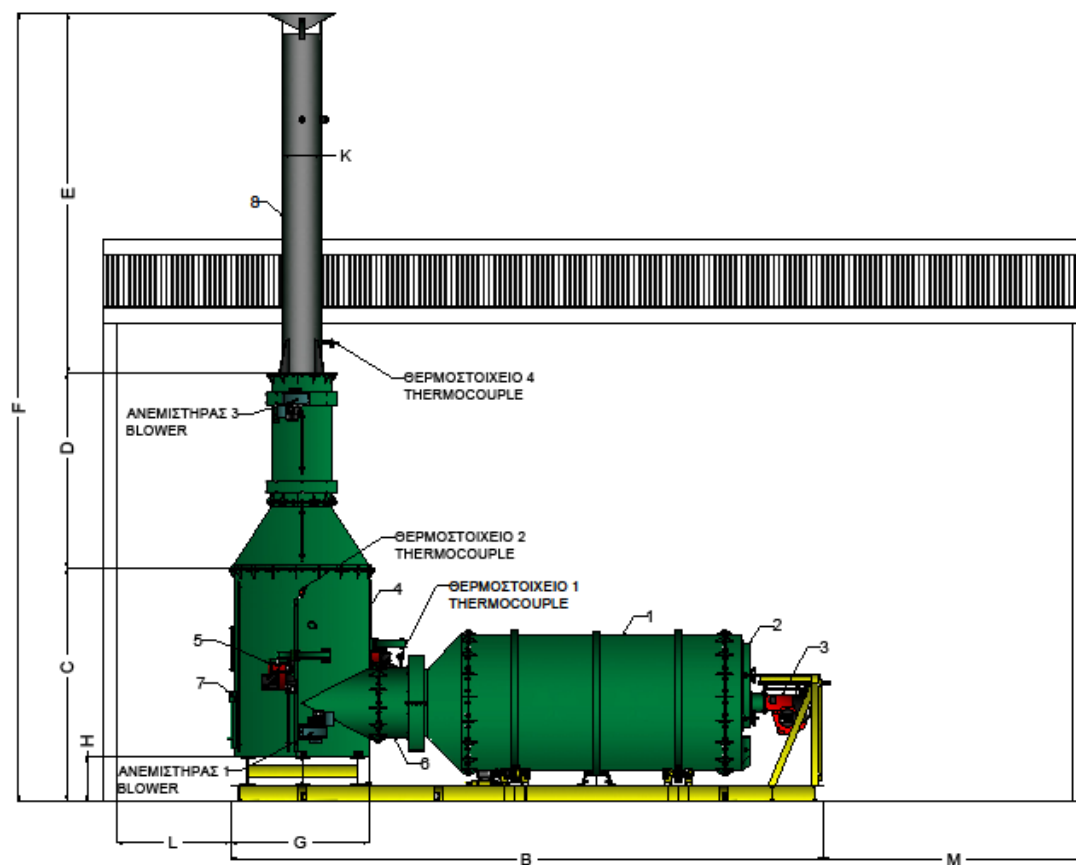


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## TECHNICAL DESCRIPTION

### VIEWS OF ROTARY KILN



**TECHNICAL CHARACTERISTICS OF ROTARY KILNS TYPE “PyroRot”**

Dimensions in mm

MODEL	A	B	C	D	E	F	G	H	I	J	K	L(min)	M(min)	N(min)	O(min)
PyroRot 50	2050	4400	2110	1110	3300	7120	1400	340	450	470	330	1000	2000	1000	500
PyroRot 60	2100	4600	2160	1130	3500	7145	1550	355	500	586	350	1000	2000	1000	500
PyroRot 85	2400	4950	2370	1400	3500	7940	1800	470	700	800	400	1000	2000	1000	500
PyroRot 110	2500	5800	2530	1500	4000	8590	1900	720	750	850	450	1000	2300	1000	600
PyroRot 140	2500	6300	2570	1500	4000	9050	1900	760	750	850	450	1000	2300	1000	600
PyroRot 143	2500	6300	2570	3000	4000	9570	1900	760	850	850	450	1000	2300	1000	600
PyroRot 165	2850	6900	2790	1500	4500	9440	2000	910	850	950	500	1000	2400	1200	1000
PyroRot 220	3000	8000	3080	1600	4500	10230	2000	950	850	950	500	1000	2400	1200	1000
PyroRot 270	3400	8400	3180	1700	5000	10930	2200	1150	950	1050	550	1200	2600	1500	1200
PyroRot 320	3600	9000	3580	1700	5000	11450	2200	1180	950	1050	600	1200	2600	1500	1200
PyroRot 440	4100	10300	3720	1800	5500	12400	2500	1380	1000	1200	650	1200	2800	1500	1200
PyroRot 540	4300	11100	4510	1800	6000	13720	2500	1410	1000	1300	700	1200	2800	1500	1200
PyroRot 840	4500	13305	6215	2350	6500	15000	2600	1410	1000	1300	750	1200	2800	1500	1200
PyroRot 1000	4700	13900	6480	2550	6700	15800	2800	1500	1280	1380	800	1200	2800	1500	1200
MODEL TYPE PyroRot		<b>50</b>	<b>60</b>	<b>85</b>	<b>110</b>	<b>140</b>	<b>143</b>	<b>165</b>	<b>220</b>	<b>270</b>	<b>320</b>	<b>440</b>	<b>540</b>	<b>840</b>	<b>1000</b>
CAPACITY (A)	Kg/h	~90	~100	~150	~200	~235	~250	~270	~380	~450	~660	~900	~1.150	~1.500	~1.800
MAXIMUM LOAD	Lit	500	600	850	1.100	1.400	1.430	1.650	2.200	2.700	3.200	4.400	5.400	8.400	10.000
TOTAL ELEC.POWER	KW <sub>e</sub>	2.7	2.8	3.0	4.0	4.5	5.0	5.0	6.0	7.0	8.0	9.0	10.0	11	15
TOTAL THERMAL POWER	KW <sub>th</sub>	590	590	590	850	1.000	1.000	1.000	1.200	1.200	1.400	1.400	1.700	2.400	3.100
TOTAL WEIGHT (~)	Kg	6.500	6.860	8.120	9.100	10.200	10.200	11.300	12.400	14.400	17.000	18.600	25.600	31.000	38.800

- NOTE:**
- Besides the listed models, we manufacture custom made models, according to customer's need
  - The above mentioned dimensions are approximate end referred to batch processing kilns. For continuous processing, please contact us.
  - We offer, as an option, automatic loading systems, thermal recuperation or heat-exchanging systems and gas cleaning and reforming systems.

**CONCISE DESCRIPTION OF ROTARY PYROLITIC / GASIFICATION / INCINERATION KILN**

- ✓ The feedstock is loaded into the pyrolysis/gasification chamber “1” from the door “2”, which opens either left or right, according to the client’s requirements, or in continuous processing models, has a proper opening for the automatic feeding system to be attached on.
- ✓ After the waste is loaded, the burners “5” and “9”, of the secondary combustion chamber “4”, are turned on. When the temperature of the secondary combustion chamber “4” reaches the preset value – preheated temperature, the main burner “3” turns on and the operation of the selected program starts.
- ✓ The flue gas of the pyrolysis chamber “1” flows towards the secondary combustion chamber “4”, through the pipeline “6”, in which they burn again – secondary combustion – at higher temperature, up to **1200° C**. The duration of the flue gas remain in the secondary combustion chamber is approximately **5 sec** – the national and European Union legislations demand secondary combustion duration longer than 2 sec. In case of gasification procedure for producing syngas, the flue gases are not burned and the flow for the appropriate treatment.
- ✓ The temperatures of the chambers are detected by the thermocouples installed in the chambers and transmit the data to the input of PLC, installed in the electrical panel, which controls the overall operation of the kiln – e.g. start or stop burners, rotating combustion chamber, fan control, etc.
- ✓ In the case of the incineration procedure, the flue gases, at the upper part of the secondary combustion chamber, are rapidly cooled - in a controllable way, with the inflow of ambient temperature air, through the fans and are driven, without odor and residues, to the environment, through the chimney “8”. In case of MW (Medical wastes) or MSW (Municipal Solid Wastes) they are driven to the heat exchanger(s) and to anti-pollution system and then to the environment, in order to meet all the EU and National Restrictions, imposed for the flue gases.
- ✓ The remaining ash is removed from the door “2”, of the combustion chamber, where the burner “3” is placed, and the residues of the flue gases are removed from the door “7”, of the secondary combustion chamber. In case of the optional automatic ash removal system, or the continuous processing kiln, the remaining ash is removed automatically, during operation, through the bottom of the secondary chamber.
- ✓ **THE DIMENSIONS OF THE COMBUSTION CHAMBER’S DOOR “I”, “J” ARE NET AND MAY VARY ACCORDING TO CLIENT’S REQUIREMENTS.**
- ✓ **ACCORDING TO THE METHOD USED TO LOAD THE KILN, A PROPER LAYOUT OF THE AREA IN FRONT OF THE PYROLYSIS/GASIFICATION CHAMBER IS SUGGESTED e.g. A SPECIFIC ROUTE CONSTRUCTION FOR A FORKLIFT or A STEADY STEEL CONSTRUCTION FOR WASTE DRIVEWAY or A PUMP SYSTEM FOR LOADING SHREDDED WASTE OR LIQUIDS.**
- ✓ **THE CHIMNEYS’ (STACKS’) HEIGHT MAY BE ALTERED, WITH MINIMUM HEIGHT THE ONE LISTED IN THE TABLE.**

## ROTARY KILNS Type “PyroRot”

### FOR SOLID AND LIQUID WASTE

#### GENERAL

The pyrolytic gasifier / incineration kilns “**PyroRot**” are **liquid proof** and have been designed for the pyrolysis, gasification or combustion of all kind of wastes, and mainly of **liquid wastes**, e.g. Urban wastes, Medical wastes, animal wastes, blood from slaughterhouses and wastes with high humidity level.

The stirring of the wastes inside the kiln, is achieved by the rotating of the horizontal chamber, which leads, firstly to the drying and secondly to the removal of the upper burned layer of the wastes, resulting in an easy and full pyrolysis /gasification or combustion of them.

The chambers are manufactured from construction steel plates, of 5mm thickness, with proper reinforcements.

The inner surfaces of the chambers are covered with special mixtures of refractory and insulating materials, which can withstand high temperatures and are part of the know-how of our company, after a decade of research.

The construction is of pedestal type and can be transported and installed easily.

The cylindrical shape of the kiln, ensures a long life of the refractory materials even at high and continuous temperatures

The advantages of these kilns are the following:

- They can pyrolyse, gasify or incinerate quickly and effectively, all kind of wastes, with maximum liquid up to 100% - that is pure liquids – e.g. liquid waste, blood etc.
- The capability to adjust the gasification/incineration process, by adjusting all the parameters in the process, through a friendly User’s Interface, installed on a touch panel – a propriety of our company.

In the case of incineration, in the chimney, at the exit of the flue gases, there is a quick controllable cooling system, for reducing their temperature, before releasing them to the environment, for avoiding liquefaction and creation of harmful compounds.

All the gasification/incineration programs, are automatically controlled through PLC, which is located into the electrical control board. That ensures full gasification/incineration and at the same time, protection of the environment.

#### USE

The rotary gasification/incineration kilns of “PyroRot” type are being used at **hospitals, Urban Waste stations, slaughterhouses, rural industries, food industries etc., or for Waste Treatment purposes.**

These – before mentioned- kilns can treat from **100-1800kg/h**, with maximum liquid up to **100%**. We can provide even bigger systems, upon customer’s request.

#### COMBINED HEAT AND POWER (CHP)

The pyrolytic gasification/incineration kilns of “PyroRot” type, have high efficiency in heat recovery, due to high temperature of the flue gases.

Depending on the quality and the quantity of the waste, we can provide the most suitable heat recovery system with the form of hot water, steam or superheated oil or Power generation system, based on Syngas production or direct electrical generation from flue gases thermal power.

## **ROTARY PYROLYTIC/GASIFICATION/INCINERATION KILN "PyroRot"**

### **TECHNICAL DESCRIPTION**

- The before mentioned **PyroRot** models are rotary pyrolytic gasification/incineration kilns, with capacity from **100kg** to **1800kg** of liquid and solid waste per hour – see value "A" in the above provided table – as well as whole animal carcasses. The numbers in the above table are referred to the standard models of our company. Besides them, our company can manufacture other customized gasification/incineration kilns, with different dimensional characteristics, according to the customer requirements.
- The kilns are manufactured with construction steel plates and I-beams and are extremely robust as shown in the sketches. The dimensions and the shape of the kiln can also be seen in the sketches – either batch or continuous processing.
- In the case of incineration, it has two chambers and creates conditions for an efficient and proper pyrolysis of the pathogenic – infectious and toxic waste. In the first chamber, takes place the controlled pyrolysis at temperatures up to **1000°C**. Thence the flue gases are re-burned in the second chamber – afterburner chamber – with an excess of fresh air, which is furnished through air fans, at temperatures up to **1200°C**, and with this pyrolytic afterburner, better flue gas emission results are achieved.
- As shown in the form, each chamber has its burner or burners and fresh air fans. At the chimney, during the exiting of the flue gases, there is a system that cools them, so that they are emitted into the environment in lower temperatures and thus avoiding condensation and the formation of harmful compounds.
- The first cylindrical chamber, rotates periodically or continuously, controlled by the PLC program of the electrical panel.
- The inner surface is constructed from special mixtures of refractory and insulating materials, of approximately **200 mm** thickness, which withstand high temperatures and they are know-how of our company, a result of a decade research.

- All the operation cycles are controlled by the PLC of the electrical panel, and this automatically ensures complete pyrolysis or gasification/incineration, while protecting the environment. On the panel, are all the instruments for the automatic operation of the kiln (thermocouples, thermostats, automation, safety relay, drum-type or inkjet recording temperatures device, etc.).
- The loading of the kiln takes place through the front door, as shown in the form and from the same door, the ashes are being removed after the end of the process. As mentioned before, optionally, we can provide automatic systems for loading and unloading. In case of continuous operating kiln, the automatic ash removal system is standard.
- For batch processing kiln, no special loading system is required, but the loading is held manually or by mechanical means. In case of heavy whole animals, a simple system with a winch or forklift should be studied, depending on how the animal's corpses are handled. We can provide such a solution if it is necessary.
- The chimney is made of special heat resistant steel of 3 or 5 mm thickness, is vertical and reaches a height of up to 15 meters above the ground.
- At the beginning of the pyrolysis/gasification/incineration programs, the first chamber is static and then it starts to rotate periodically and finally rotates continuously for the complete pyrolysis/gasification/incineration of the feedstock-waste.
- For batch processing, when the pyrolysis/gasification/incineration program is completed, the kiln stops and automatically starts the cooling program to the preset values. Upon completion of all the procedures, the kiln stops at the loading or unloading position – user's choice.

**We declare that:**

1. We provide a one-year guarantee of proper operation.
2. All the equipment in use has 2 years guaranteed.
3. We can undertake the maintenance of the incineration kiln.
4. We have parts for 10 years.

**WARRANTY QUALITY OF EMITTED EXHAUSTS**

The allowable emitting limits for incineration kilns and the incineration of wastes, are defined by the EU Directives 94/667/EEC, 2000/76/EC and JMD 7089/2007 (GG 287 B / 2-3-2007)

From the measurements report of our incineration in 8/10/93, from the Laboratory of Thermal Power and facilities of the N.T.U.A. (National Technical University of Athens), comes that we are within the allowable limits.

So we have:

- Solids in suspension 16.6 - 72.6 mg/Nm<sup>3</sup> of average 50 mg/Nm<sup>3</sup>.
- Flue gases visibility 0-1 Ringelmann  
(1 bacarah = 0,6 Ringelmann).
- CO = 0,00033 % max. (1 PPM CO = 1, 25 mg/Nm<sup>3</sup>)

**Please note that our company, upon request of the customer, may assign an independent and certified company, for conducting measurements of the flue gases.**

**QUANTITATIVE RESULTS**

- 3% up to 5% of the initial waste volume (max).
- 10% of the initial weight (glass, metals, china) (max).
- 3% of the initial weight of non-combustible mineral (max).

## **TECHNICAL DESCRIPTION of WORKS**

This technical description refers to the works to be completed by our company, for the supply and installation of the rotating pyrolytic gasification/incineration kiln.

The works to be completed are the following:

1. Construction of a platform for the kiln to be mounted – optional and after agreement, if needed.
2. Installation of the rotating pyrolytic incineration kiln.
3. Manufacture and installation of a steel shelter, for the protection of the incineration kiln - optional and after agreement, if needed.
4. Install of plastic oil storage tank - optional and after agreement, if needed.
5. Operation tests – system delivery.

In more details, the works to be performed are as follows:

### **1. CONSTRUCTION OF A BASE INSTALLATION PLATFORM FOR THE ROTARY KILN**

At the place where the kiln is to be installed, the EMPLOYER constructs a platform of approximately 20 cm of reinforced concrete, with structural grid – double reinforcement on the bottom and the surface of the platform.

On the platform will be anchored the base of the kiln and the steel construction.

### **2. INSTALLATION OF THE ROTARY KILN**

- 2.1 The incineration kiln is mounted on its base, all its parts are assembled and it's adjusted so that all parts are coplanar. Pilot rotations are taking place, after connecting the electrical panel of the incineration kiln to the power supply, to ensure a smooth operation. Note that, the power supply is in the responsibility of the EMPLOYER and is agreed with our company.
- 2.2 Check of all mechanical, electrical and electronic parts takes place, before released for full operation.

### **3. MANUFACTURE OF STEEL SHELTER, FOR THE PROTECTION OF THE KILN**

For the protection of the incineration kiln from the rain water, a steel shelter is manufactured, covered with trapezoidal metal plate, or whatever seems appropriate for the customer. The roof covers, at least, the main part of the incineration kiln, the control – operation panel and the burners.

The anchoring of the steel shelter to the platform is made through anchors or metal bits.

#### 4. **INSTALLATION OF FUEL SUPPLY**

If needed, and for the purposes of the operation of the kiln, a plastic container of hard polyethylene–horizontal or vertical type (depending on the area that'll be indicated) - is installed by the CLIENT.

The installation includes construction of a platform by the CLIENT, according to the instructions of the manufacturer.

After installation of the tank, all the necessary connections to the kiln – burners system are made.

The installation of the tank is avoided if the use of natural gas or LPG is possible. In this case, the CLIENT shall provide to the mounting and operation location, of the kiln, the fuel gas supply pipe, according to our company's instructions.

#### 5. **OPERATIONAL TESTS – SYSTEM COMMISSIONING**

The final phase of work includes the settings of the burners, operation times of the kiln's various stages, regulation and control of operating temperatures – under the requirements of current legislation – and finally the general system control.

All these tests are conducted with and without load and under the most unfavorable and severe conditions.

Training of an operator – of our customer preference – to operate and maintain the system.

October 2019

For **ASTE Technologies**

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**EXAMPLES AND GUIDELINES FOR CHOOSING THE APROPRIATE INCINERATION KILN**

**A. SLAUGHTERHOUSE WASTES per LIVE-STOCK**

- |                        |                             |
|------------------------|-----------------------------|
| 1. <b>Cattle waste</b> | ~ <b>25%</b> of live weight |
| 2. <b>Sheep waste</b>  | ~ <b>35%</b> of live weight |
| 3. <b>Pig waste</b>    | ~ <b>15%</b> of live weight |

Notes:

1. The above-mentioned volumes of pyrolysis incineration kilns are effective ones.  
For estimating the weight of slaughterhouse wastes to be incinerated per full cycle operation, we calculate as follows:
  - 1.1 For **solid slaughterhouse waste**, we multiply the volume by **0.8**  
E.g. For 5400 lit, we can load  $5400 \times 0.8 = 4320$  kg of solid wastes
  - 1.2 For **liquid slaughterhouse waste**, we multiply the volume by **0.95**  
E.g. For 5400 lit, we can load  $5400 \times 0.95 = 5130$  kg of liquid wastes
  - 1.3 For **mixed (solid and liquid) slaughterhouse waste**, we multiply the volume by **0.85**  
E.g. For 5400 lit, we can load  $5400 \times 0.85 = 4590$  kg of mixed wastes
2. The **operation cycle** for **solid and mixed wastes** is approximately **4h and 15 min**  
The **operation cycle** for **liquid wastes** is approximately **2h and 30 min**
3. A mean indicative operational cost, is **0.073 euros/kg of waste**  
(The burner fuel is LPG, with a cost of 0.93 euros per kg)

**B. MEDICAL WASTE (toxic and infectious)**

1. For **shredded waste**, we multiply the volume by, approximately, **0.9**  
E.g. For 5400 lit, we can load  $5400 \times 0.9 = 4860$  kg of shredded wastes
2. For **packed waste**, we multiply the volume by, approximately, **0.75**  
E.g. For 5400 lit, we can load  $5400 \times 0.75 = 4050$  kg of packed wastes

The **operation cycle** for **medical wastes** is approximately **1h and 25 min**

A mean indicative operational cost, is **0.035 euros/kg of waste**  
(The burner fuel is LPG, with a cost of 0.93 euros per kg)

**C. MUNICIPAL SOLID WASTE**

For MSW, please contact us.