

## 1. Generals

The following specification concerns the supply of nr.1 static incinerator model PSV-300 (3 m<sup>3</sup> inner volume), suitable to burn any solid waste, municipal solid waste or special industrial HAZARD WASTE both liquid or gaseous (to communicate) with high PCI (LCV) up to 9.500 Kcal/Kg

The nominal capacities of the furnace are those in the following table:

### NOMINAL CAPACITIES OF FURNACE PS300

		Lower Caloric Value of Waste LCV						
		800	1100	1800	2500	3500	4500	9500
Furnace vol.		Kg/h	Kg/h	Kg/h	Kg/h	Kg/h	Kg/h	Kg/h
3		169	225	250	180	129	120	57

This model of incinerator is available in n.2 configurations, vertical and horizontal post-combustor chamber (PSV / PSO furnaces), allowing different assembling configurations. In the PSV version the P.C. chamber is mounted vertically directly over the furnace body.

The incinerator supply materials and components are all conform to the European CEE EN-UNI norms (UNI / ISO / EN norms) so that the system is certifiable CE.

In any case the system can be furnished conform to different norms where so specified.

The offered furnace is fitted with a dry flue gas cleaning system with dry filtering which permits to have emission levels from the chimney complying with the European Norms 2010/75/CEE even burning toxic waste within the nominal capacity of the furnace.

The emissions concentrations at Stack must be in any case controlled and foreseen through our emission prevision software checked in case there is need to burn special waste with high content of some hazard pollutant.

In case the capacity of the furnace is overridden the emissions could not respect the mentioned European norm 2010/75/CEE.

## **TECHNICAL DATA INCINERATOR PSV-300**

Furnace volume	3 m <sup>3</sup>
Service	batch or continuous with ram loader
Capacity range (with ram loader)	250 Kg/h MSW ,LCV up to 1800Kcal/Kg 57 Kg/h WASTE OILS, LCV 9500 Kcal/Kg 225 Kg/h HSW Chlor gas, LCV 1100Kcal/Kg
Maximum waste PCI	9.500 Kcal/Kg
Loading	Eventual industrial solid wastes can be loaded in continuous through the hydraulic loading machine flanged on the front door.  Liquids are loaded in continuous by means of the special nozzles mounted on the walls of the primary chamber (furnace)
ash discharge	Automatic by means of a screw conveyor
Type of waste	Industrial waste, hazard waste, waste oils
1st chamber working temperature	> 950 °C
Primary burner (start up)	nr.1 startup burner diesel oil BALTUR SPARK 40DSG/W range: 21÷45 Kg/h (236 ÷ 531 KW)
2.nd chamber working temperature	> 1200°C
secondary burners	nr.1 auxiliary burner diesel oil BALTUR SPARK 40DSG/W; range: 21÷45Kg/h (236 ÷ 531 KW)
1 <sup>st</sup> chamber volume	3000 Lt
2 <sup>nd</sup> chamber volume	4200 Lt

residence time	2.5 sec. ref. to 850°C >2.1 sec. at 1200 °C (hazard waste)
Heat up chimney exit temperature	< 600°C
Forced chimney exit temperature	> 180°C
Ash quality	complying with BS3316/87 part 1, par.4 unburned fraction < 3%
Max. limit heat capacity of PSV300	870.000 Kcal/h
Emissions	within 2010/75/CEE
Fue gas flow rate from 2.nd chamber	1500 Nm <sup>3</sup> /h normal 1780 Nm <sup>3</sup> /h max. flow
Diesel consumption at start-up (one hour)	90 Kg/h as diesel
Average diesel consumption in steady state	10 ÷ 20 Kg/h <sup>1</sup>
Installed electric power	40 KW 400V 50/60 Hz
standard chimney height	10 m
Emissions AFS100 plant included	as per table n.1 (CEE norms)
Emissions without depurator	< Ringelmann 1

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<sup>1</sup> Diesel consumption is zero at regime for waste with PCI > 2000 Kcal/Kg

## **2. Description of the standard incinerator**

The incinerator PSV300 is designed for burning in continuous service the design WASTE, being MUNICIPAL SOLID WASTE, HOSPITAL WASTE or INDUSTRIAL HAZARD WASTE but not limited to.

The waste is usually loaded into the furnace in hot condition by means of the hydraulic piston-loader (hydraulic pusher), supplied together with the furnace, flanged on the front head of the furnace, which allows loading waste in hot condition, without risks for the operators (nr.2 operators have normally to work on the loading platform).

In case the piston loader is not included, the furnace is equipped with a front door and the waste is loaded only in batch at the beginning of each working turn.

The combustion is a pyrolytic process and takes place in two stages (primary combustion stage and secondary combustion stage).

The first stage takes place in the first furnace chamber (static) where the waste is loaded.

The normal working temperature of this chamber is not less than 850°C and up to 980°C for normal MSW (municipal solid waste).

The waste is loaded by means of the piston loader if included in the supply (necessary for continuous service).

The primary combustion is adjusted manually by means of the primary combustion air valve, in order to achieve the best combustion conditions in the primary chamber (depending on waste quality).

The furnace can be regulated in oxidizing condition or pyrolytic condition (starved air process).

The primary air is blown into the furnace by means of the electric primary fan V01 through the relevant distribution pipe work mounted under the loading machine and connected to the furnace chamber.

It is possible also to have the automatic primary combustion air regulation system (through a motorized butterfly valve) with extra price.

The furnace chamber is equipped with nr.1 light up burner, mounted at one side of the furnace walls and the standard type is BALTUR SPARK26DSG/W (370W electric motor 3 phase 415V 50Hz); the burner is fitted with its relevant inspection hole (glass Ø50x10 mm tempered).

The burner is fitted with its diesel oil filter and flexible hoses and is fully automatic (block burner).

Start up of the burner is fully automatic from control board; the burner is protected against reverberation by means of a “continuous ventilation” feature (extra price for automatic extraction device).

In the first combustion chamber (primary chamber), in case of starved air process, it is formed a pyrolytic gas, containing CO and H<sub>2</sub> fractions, so to have a residual LCV to increase the post-combustion chamber temperature.

The second combustion stage takes place in the second combustion chamber (Post combustor or P.C.), where the partially unburned gas (pyrolytic gas, coming from the furnace) is mixed with fresh secondary combustion air blown through oriented nozzles and it is burned completely prior being discharged in the atmosphere through the chimney stack.

In the second combustion chamber is mounted the secondary burner standard type BALTUR SPARK35DSGW (370W electric motor – 3 ph. 415V 50Hz), with relevant inspection glass (Ø50x10 mm tempered).

Each burner is fitted with its diesel oil filter and its flexible hoses and valves, and is fully automatic; furthermore the burner is protected against reverberation by means of a “continuous ventilation” feature (extra price for automatic extraction device).

The burner works continuously and is switched on-off (two flame stages) in function of the set-point temperature, which can be adjusted on the instrument located on the front panel of the main control Board.

The oxygen content in the P.C. is adjusted automatically in continuous (automatic system) by means of a motorized butterfly valve MOV02 DN100, controlled continuously (floating valve) by the signal of the oxygen sensor (zircon oxide - immersion type mod. FER 4153); the signal of the oxygen element is firstly linearised and then transmitted (transducer) to the regulating digital instrument mounted in front of the control panel (PID).

In case a continuous flue gas monitoring system (EMISSIONS CONTINUOUS MONITORING BOARD) has been included in the supply according to EEC norms (optional price) the emission data and temperatures are stored in continuous into the data acquisition system (DAQ), equipped with a computer (PC), keyboard and desk printer; the data are stored in the HD permitting continuous inspection of the incineration operations.

All the data can be manipulated in form of tables, diagrams etc.

The combustion efficiency in the post-combustion chamber by means of this automatic control system is maintained very high > 99.99% and the CO from the chimney is always very low and normally less than 50 mg/Nm<sup>3</sup> (40 PPM ).

The auxiliary fuel consumption is optimized through the automatic oxygen adjusting system.

The auxiliary fuel consumption is not significant, at regime conditions, with waste PCI greater than 2000 Kcal/Kg.

In the post combustion chamber the free oxygen percentage is maintained at not less than 6% (usually adjusted to 7÷7.5% ).

The outgoing ash is completely burned and carbonized and free of unburned materials in conformity of EWGA norm and it is discharged in continuous in the ash pit by means of the ash piston working intermittently inside the furnace and finally is elevated onto the ash container by means of the ash conveyor belt (readler, optional price).

The ash is automatically conveyed into a closed tank to be evacuated periodically.

The flue gas coming out from the post-combustion chamber is rapidly cooled down through a heat recuperator (quick cooler) suitable to recuperate up to 75% of the thermal content of the flue gas in form of hot pressurized water or hot air as wanted.

If heat recuperation is not needed the heat in excess is discharged into the atmosphere by means of an air-cooler.

The cooling water circuit includes Nr.1 circulation pump, valves, pipes and fittings.

The cooling water (or air) temperature is regulated automatically.

After having been cooled down, the flue gas is gathered through the gas cleaning system (dry system) and is finally blown through the chimney by the forced draft fan V03.

## **FLUE GAS CLEANING SYSTEM**

The furnace can be equipped with different flue gas cleaning system configurations depending on type and composition of waste (AFS300 dry type wet or dry system).

The configuration for hazard or toxic waste is more or less the following:

- 1) Post combustor
- 2) Flue gas duct valve (armed through compressed air)
- 3) Urea dosing pump with UREA tank (INOX TANK)
- 4) Flue gas quick cooling exchanger (water-flue gas type) or quick flue gas quencher, dry or wet bottom type
- 5) Circulating water air coolers
- 6) Dry reactant 1<sup>st</sup> stage injection system (bicarbonate or lime)
- 7) Cyclonic chamber (reactor – recirculation type)
- 8) Fabric filter (pulse jet type), 1<sup>st</sup> stage
- 9) UREA dosing injection pump DENOX
- 10) DENOX reactor (denitrifying) (optional)
- 11) Dry reactant 2<sup>nd</sup> stage injection system (lime)
- 12) Fabric filter (pulse jet type) 2<sup>nd</sup> stage
- 13) Forced draft ventilator
- 14) Air compressor

Some components of the flue gas cleaning system can be changed or modified accordingly depending on the composition of waste communicated by the client in phase of ordering. The pressurized water-flue gas quick cooling exchanger can be configured in many ways to produce different heat transfer fluids (hot air, hot oil, steam), in case of request (extra price for steam).

The recuperated hot fluid (or hot air which is) can be sent to an ORC turbine (E-RATIONAL1000 or TRIOGEN) to generate electric energy (possibility 30 to 40 KW el. in continuous working), with extra cost added to the standard supply price.

The cyclonic chamber has the function to mix the dry reagent (powder) and let it react with the acid fumes.

Then the fabric filter separates the reacted dust down to its bottom hopper.

From the bottom hopper the exhausted dust is extracted by means of a motorized stellar valve and a cochlea into a metal container which must be emptied periodically.

The dust tank is studied to not have any leakage of dust in the surrounding area.

After being deputed the flue gas is aspirated by the forced draft ventilator (V03) and is blown through the forced draft chimney into the atmosphere.

## **CHIMNEY**

The plant is fitted with nr.2 separated chimney ducts as described in the following.

- N.1 heat up chimney internally lined with refractory used during the heat-up phase and shut-down procedures.  
This chimney is fitted with a gate-valve to close the heat up chimney when the flue gas cleaning plant gets working.  
This gate valve is automatically operated by means of compressed air.
- N.1 forced flue gas duct (forced chimney) always in service when the gas cleaning plant is working (regime conditions).  
This chimney is a vertical metal duct 9 m height and is externally insulated by means of a 50 mm thick mineral wool layer, in order to avoid excessive cooling down of the flue gas exiting into the atmosphere; the exit temperature is maintained always > 180°C and the stack plume (due to moist) is not visible (transparent).

The height of the forced draft chimney is 10 m above soil and the support structure is designed in conformity of the local meteo data.

### **3.MATERIALS SPECIFICATION**

It is intended that all materials are conform to ISO NORMS - metric system unless other norms can be accomplished where required.

Structures are made of	Italian steel S235 EN 10025 (ex Fe360B UNI7070) Equivalent to ASTM A53 Gr. B, DIN St37
Coatings cycles are	Shotblasting Gr.Sa 2 1/2 Alum. coating for H.T. (two layers)(air less sprayed)
bolts are	UNI5737.68 steel Gr.8.8 (high strength), galvanized
All refractory linings are Two layers Composition of layers:	Special HIGH ALLUMINA CHAMOTTE cast in factory 80 ÷120 mm insulating layer 100 ÷120 mm high allumina hot layer
All electric motors	Italian primary suppliers only
Electric ancillaries	SIEMENS or OMRON
PLC	SIEMENS or OMRON
Thermocouples (nr.2)	INCONEL 625 sleeve - tested with certificate
Instruments	Italian primary manufacturer, certified (CSA)
Oxygen sensor	Italian primary manufacturer ceramic sensor (ZrO2)(FER)
Burners	BALTUR or RIELLO or JOHANNES
Static calculations	According to EURO CODES



#### **4. CONTROL PANEL**

The main control panel is to be mounted inside a conditioned room (control room) not included (civil works).

The panel is a 40KW double door cabinet, enclosure IP55 – main supply 400V 3 ph. 50Hz / 60Hz, as specified in the order.

All functions are recorded on the PLC, programmed by our technicians through the keyboard, not accessible by the unauthorized persons.

On the front panel there are mounted the regulating instruments, digital type, with luminous led indicators, so that the operator can easily control the system by the instruments panels. The data acquisition system (DAQ) stores in continuous on magnetic archive (HD) all the emission data as well oxygen percentage and the temperatures.

Further on the frontal panel are mounted all the push-buttons, circuit breakers and signaling lamps to safely control the working procedures also manually (AUTO-MANUAL WORKING).

In AUTO working, to start the furnace, the operator only needs to push the “START” push button and wait until the green light “LOAD” is switched on.

It takes about one hour before the secondary chamber has reached the regime temperature, after burners light up.

##### Working with piston loader

The furnace can be loaded also with industrial solid waste in continuous and in this case No.2 operators must charge the waste by means of the piston loader when the relevant signaling green lamp “LOAD” is "on", in hot condition.

When they want to interrupt the work (at the end of a working turn) it is sufficient to push the “COOL DOWN” push button on the front panel and the furnace automatically finishes the last cycle and immediately starts the cool down procedure up to a safe temperature of 200°C.

At the end of the operations the horn advises the chief operator to switch off the main circuit breaker of the electric board.

The cool down procedure to ambient temperature takes about one hour.

The system is equipped with an alarm horn and an intermittent yellow light (rotating alarm, ROTALARM), to signal to the operator when a controlling parameter overrides its alarm limit or to warn the operator to stop the plant at end of working.



PSV FLUE GAS CLEANING SYSTEM WORKING