"Geri Dönüşüm Sistemleri"

MT MAKİNA LTD. ŞTİ.

PYROLYTIC HANGER & JIG THERMAL CLEANING OVEN

ATF-100

Pyrolytic paint stripping system that cleans powder coatings, varnishes, and organic resins from hangers, jigs, and molds in an oxygen-depleted room without metal deformation.



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Executive Preface

High engineering vision shaping the zero waste goals of the future today.

In industrial painting lines, cleaning paint residue accumulated on hangers and jigs is vital for production quality and operational safety. Chemical or open burning methods cause bending and structural degradation in metals.

MT Makina pyrolytic hanger cleaning systems clean paint by decomposing its chemical structure in an oxygen-depleted and controlled low-temperature (400–450°C) environment. This ensures zero deformation or loss of mechanical strength in your metal hangers. Volatile gases are fully oxidized in an 850°C thermal reactor to produce clean flue gas. We are proud to present our ideal B2B engineering solution to extend jig service life and lower operating costs.



Kurumsal

A technology brand born in Turkey, producing industrial machinery at global standards.

Since its foundation, MT Makina has played a pioneering role in the industrial shredding, destruction, and recycling machinery sector. At our production base in Istanbul, we design global waste management solutions with our expert engineering team and R&D staff. All our production processes comply fully with ISO 9001 Quality Management, ISO 14001 Environmental Management, and CE quality standards. Our machines possess the durability to operate under the most demanding field conditions.

Design & R&D Philosophy

We use 3D parametric modeling, Finite Element Analysis (FEA), and Computational Fluid Dynamics (CFD) software in our designs. Inside-furnace temperature distributions and gas flow rates are simulated in virtual environments to achieve perfect combustion geometry.

Global Export & Service Network

We export our systems to more than 20 countries, primarily in Europe, the Middle East, Russia, and Africa. Our after-sales service teams, together with remote SCADA telemetry monitoring support, ensure continuous plant operation.

Sustainability Commitment & Zero Waste

We focus on environmental protection in all our R&D projects. Our waste incinerators comply fully with emission laws in force by environmental ministries. By converting recovered waste heat into steam or hot water energy, we directly reduce the carbon footprint of the facilities. This approach strengthens circular economy models and permanently minimizes waste disposal costs.

CE	ISO 9001	ISO 14001	TSE-HYB
STANDARDS	QUALITY MNGT	ENVIRONMENT	COMPLIANCE

Pyrolytic Cleaning Principles

Flameless cleaning of paint hangers and jigs from paint layers without damaging the metal.

The hanger cleaning process begins by restricting oxygen levels and locking the temperature within 425–485°C. In this thermal atmosphere, organic layers such as paint, oil, and polymers on hangers and jigs slowly gasify (pyrolyze) without catching fire. This flameless principle protects metal parts from high-temperature shocks, preventing warping.

1. **LOADING** — Feeding wastes into the loading hopper
2. **GASIFICATION** — Thermal decomposition at 850°C
3. **COMPLETE COMBUSTION** — Destruction of gases at 1100°C
4. **FILTRATION** — Washing and neutralisation of harmful gases

PAINT STRIPPING EFFICIENCY & METAL PROTECTION

Pyrolytic cleaning achieves **%100** paint removal efficiency on metal hangers and jigs. Because metals never contact direct flames during cleaning, no chemical corrosion or mechanical deformation occurs, extending hanger lifespan threefold.

Semi-combusted gases released from pyrolysis are drawn into the integrated thermal oxidation chamber (secondary chamber) above the oven. In this chamber, gases are completely oxidized at 850°C - 1100°C in an oxygen-rich environment, converting VOCs into odorless, clean exhaust gas.

ATF-100 General Description

Pyrolytic cleaning of accumulated paint on paint hangers, jigs, and molds without damaging the metal.

Our hanger cleaning ovens are industrial systems that clean paint residues from electrostatic powder coating lines, molds, and painting jigs in an oxygen-depleted environment (pyrolysis) without damaging the metal or causing warping. The system provides an eco-friendly and cost-effective alternative to chemical acid baths.

Primary Applications

- **Industrial Paint Shops:** Cleaning accumulated powder coating layers on metal painting jigs and hangers.
- **Automotive Supply Industry:** Liquid paint residues on part transport trollies, grates, and painting jigs.
- **Home Appliance Production:** Pyrolytic cleaning of hooks, clamps, and fixtures in assembly and paint lines.
- **Coating & Mold Facilities:** Cleaning organic residues on metal molds and industrial tools.

Key Design Advantages

Pyrolytic ovens turn paint residues into dry ash while preserving the metal structure. Parts exiting the oven are easily cleaned with only a light pressurized water rinse or shaking.

> Due to the precise temperature control and oxygen-free pyrolysis process, warping or deformation of metal hangers is 100% prevented, keeping jig calibration intact.



Detailed Technical Specifications

ATF-100 Capacity, engineering, energy consumption, and physical parameters of the model.

PARAMETER DESCRIPTION	TECHNICAL VALUE / SPECIFICATION
Nominal Incineration Capacity	100 Liters / Batch
Primary Chamber Temperature	400°C - 450°C
Secondary Chamber Temperature	850°C
Primary Burner Thermal Power	180.000 kcal/h
Secondary Burner Thermal Power	200.000 kcal/h
Feeding Door Dimensions	1800 mm x 1800 mm
Primary Chamber Volume	4.5 m³
Electrical Power Requirement	7.5 kW
External Dimensions (W x L x H)	2000 mm x 2400 mm x 2200 mm
Total Empty Weight	~ 4.500 kg
Waste Loading System	Manual Bogie Car on Rails
Ash Discharge System	Manual Sweeping
Flue Gas Treatment System	Direct Flue Gas Burner (Afterburner)
Control Automation	Siemens S7-1200 PLC & HMI

CAPACITY & OPERATING CONDITIONS NOTE

Cleaning capacity depends on paint thickness, paint type, and loading density on hangers. For thick paint layers, pyrolysis duration should be extended, and temperature ramps must be finely adjusted via PLC.

Pyrolysis Chamber & Thermal Control

Pyrolytic gasification process of paint inside the oxygen-depleted cabin.

The pyrolysis chamber is the main sealed cell where painted metal hangers are loaded. This chamber is designed to gasify paint polymers through heat transfer alone, without open combustion (oxygen). Oxygen level inside is constantly monitored and kept close to zero, preventing the paint from igniting and protecting metal parts from high thermal stresses.

Thermal Regime & Modulating Control

The temperature inside the oven is maintained by homogeneous distribution of hot air from the burner via recirculation fans in the cabin. The heating ramp rate is precisely managed by the PLC to preserve the hardness and structural integrity of the steel hangers.



- **Volume:** 4.5 m³ large internal volume optimized for batch cleaning.
- **Heat Recirculation:** Homogeneous temperature distribution via high-flow circulation fans.
- **Precision Sensors:** Dual thermocouple temperature control and safety limit switches.
- **Air Sealing:** Water-cooled silicone profile or heavy-duty braided gaskets.

Afterburner Thermal Reactor (850°C) Chamber

Complete thermal destruction of released pyrolysis gases under high temperatures.

Hydrocarbon gases and volatile organic compounds (VOCs) released during pyrolysis are drawn directly into the afterburner (thermal reactor) chamber under negative draft. For these gases to convert into clean stack exhaust, they are mixed with combustion air and oxidized at a minimum temperature of 850°C in the reactor.

Afterburner Safety & Emission Control

The afterburner chamber is volumetrically sized to guarantee a gas residence time of at least 0.5 seconds. In compliance with EU environmental norms, this duration is sufficient to completely eliminate odor, soot, and visible smoke from the exhaust. The afterburner burner starts operating before the main oven initiates.

> Since the inner surface of the secondary chamber is exposed to highly acidic gas, its refractory lining is built with specialized silica-alumina bricks possessing high corrosion resistance.

SECONDARY CHAMBER REACTION PARAMETERS

- **Minimum Operating Temperature:** 1100°C (1200°C limit for medical and toxic wastes).
- **Gas Residence Time:** Min. 2.0 seconds (EU standard).
- **Secondary Air Flow Rate:** PLC controlled modulated injection.
- **Oxygen Level:** Min. 6% free oxygen guarantee at the flue gas outlet.
- **Thermal Insulation:** Ceramic fiber blanket and calcium silicate backing boards.
- **Automatic Burner Control:** Automatic ignition system when the temperature falls below 850°C.

Ceramic Fiber Insulation & Steel Frame Structure

Lightweight insulation layers eliminating cabin heat loss and a rigid outer frame.

In hanger cleaning ovens, lightweight and thermal shock-resistant ceramic fiber insulation boards are used instead of classic refractory bricks. These boards allow the oven to heat up and cool down very rapidly (low thermal inertia), minimizing energy consumption and shortening cycle times. The steel body is rigid enough to withstand internal pressure fluctuations.

Insulated Wall & Panel Construction

- **Insulation Board:** 1260°C rated ceramic fiber board lining.
- **Backup Layer:** Calcium silicate backup insulation blocks.
- **Frame Insulation:** Outer wall temperature kept under 60°C via mineral wool.

Outer Chassis and Corrosion Protection

Oven cabin walls are formed by mounting 1260°C rated ceramic fiber blankets compressed against the outer steel shell. Door sealing is maintained by water-cooled silicone profiles or heavy-duty fiberglass braided gaskets, preventing 100% of pyrolysis gases from escaping to the exterior.

> The multi-layer insulation structure increases the thermal efficiency of the furnace while reducing fuel consumption by up to 35%.



Burner & Gas Regulation Stations

Modulating automated combustion for cabin heat recirculation and the afterburner reactor.

The cabin indirect heating burner and the afterburner direct reaction burner are equipped with gas regulation trains of high safety standards. The flame intensity of the burners is automatically modulated by the PLC according to temperature fluctuations. This maintains the internal gas balance and keeps fuel consumption minimal.

Flame Safety & Security Interlocks

The gas regulation trains feature double safety solenoid valves, minimum/maximum gas pressure switches, and flame-sensing ionization electrodes as standard. In case of any gas leakage or pressure drop, the system halts gas flow within 1 second and triggers an alarm state.

Fuel Options

Burner systems, depending on customer request and facility infrastructure, suitable for Natural Gas (CNG/LNG), Diesel oil, or LPG fuel types olarak seçilebilir. Ayrıca çift yakıtlı (Dual-Fuel) brülör entegrasyonu da opsiyonel olarak sunulmaktadır.



Loading Bogie Car & Jig Placement Systems

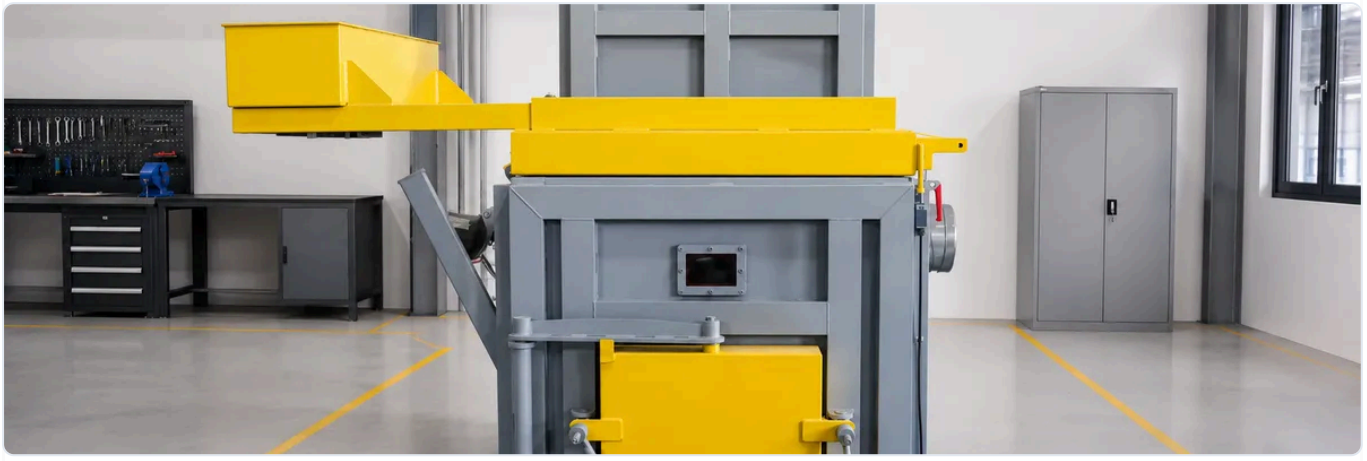
Rail mechanism ensuring easy and rigid placement of fixtures inside the oven.

In hanger cleaning ovens, a heavy-duty loading bogie car traveling on rails extending in front of the oven is used instead of a waste hopper. The operator places the painted hangers and molds onto the bogie car outside. The car is then driven on rails into the oven cabin via manual or motorized drive.

Bogie Car Load Capacity

Since the bogie car is continuously exposed to 450°C, it is manufactured from structural steel profiles welded to withstand thermal stresses. Wheel bearings are high-temperature graphite-lubricated type. The car front door is designed integrated with the oven door, sealing the cabin inlet in a single action.

GÜVENLİK KİLİDİ: Primer brülör çalışırken kapak açılmaz.



Carbon Ash Cleaning & Routine Sweeping Methods

Dust-free cleaning of carbon ash remaining at the bogie base after the pyrolysis cycle.

Following the gasification of paint polymers in an oxygen-depleted environment, only a dry carbon ash (soot) composed of inorganic pigments remains on the hangers and the oven floor. Once parts exit the oven, this soot is washed away via a light pressurized water rinse or mechanical shaking. The oven interior should be swept periodically.

Carbon Soot Sweeping

After the hanger cleaning process is complete, carbon soot accumulating on the oven floor is swept and cleaned manually. These ashes are inert and harmless.

Compressed Air & Shaking

Powdery paint ash remaining on the hot hangers exiting the oven is completely removed from the surfaces via compressed air blow or light mechanical shaking.

CLEANING & MAINTENANCE STANDARDS

- **Periodic Sweeping:** Sweeping the oven floor after every 5 cycles.
- **Double Seal Check:** Odor leak tightness inspection of oven door gaskets.
- **Thermal Efficiency:** High-density ceramic fiber insulation preventing heat loss.
- **Low Waste Volume:** Up to 98% reduction in paint volume.
- **Harmless Ash Structure:** Completely inerted paint pigment residues.

Direct Flue Gas Treatment (Afterburner) System

Combusting pyrolysis gases in the afterburner chamber at 850°C before release to the environment.

In hanger cleaning ovens, a high-temperature afterburner system is used instead of a wet scrubber to destroy pyrolysis gases directly. The afterburner chamber converts all volatile hydrocarbons into carbon dioxide (CO_2) and water vapor (H_2O), ensuring odorless and smokeless stack emissions.

Carbon Oxidation

In the high-temperature thermal reactor, gases are mixed with oxygen to convert all unburned carbon-hydrogen bonds into carbon dioxide.

Odorless & Smokeless Exhaust

Exhaust gases exiting the stack after the thermal reactor are completely colorless, odorless, and 100% compliant with environmental regulations (EU standards).



Induced Draft Fan (IDF) & Pressure Balance

Frequency-controlled exhaust fan guiding oven gas flow and negative draft control.

Regular draft of pyrolysis gases from the cabin into the afterburner chamber is maintained by a high-temperature resistant induced draft fan (IDF) mounted at the stack outlet. The fan speed is automatically regulated by the PLC based on input from the cabin pressure sensor, keeping the cabin under slight vacuum (-10 Pa).

Induced Draft Fan Operation

While pyrolysis gases are drawn into the afterburner chamber, the induced draft fan controls the gas flow rate. The negative draft balance inside the chamber is constantly maintained.

- **Temperature Resistance:** Specialized fan impeller and bearing structure resistant to stack gas up to 350°C.
- **Frequency Control:** Automatic speed control via inverter based on pressure transmitter data.
- **Sealing:** Mechanical sealing elements preventing odor and smoke bypass at the shaft output.



PLC Control Panel and SCADA Integration

Safe management of the entire facility from a single screen, data logging, and remote telemetry support.

The ATF-100 incineration plant features fully automatic operation. Combustion air flow rates, burner modulation, kiln pressure, dosing rates, and safety interlocks are managed by Siemens or Schneider PLC. The operator controls the system via a color HMI touch screen.

Smart Sensor Integration

Pressure transmitters, thermocouples, pH probes, and flowmeters installed on the plant transmit real-time data to the PLC panel. The system processes these data to optimize combustion stability and minimize fuel consumption.

SCADA and Remote Service

Thanks to the built-in internet modem, MT Makina engineers can monitor operation data remotely, update parameters, and analyze faults, solving service needs without requiring on-site intervention.

HMI SCREEN PARAMETERS

- **Chamber 1 Temp:** 850°C - 950°C (Grafiksel Takip)
- **Chamber 2 Temp:** 1100°C (Emisyon Emniyet Kilidi)
- **Draft Pressure:** -15 Pa (Hafif Vakum Kontrolü)
- **pH level:** 7.2 (Otomatik Dozajlama Aktif)
- **System Status:** RUNNING - LIVE TELEMETRY

> The system logs all emission and operating temperature data for 1 year (compatible with USB export).



Environmental Emission Standards & Compliance

Comparison of facility emission values with European Union norms and legal limits.

ATF-100 is equipped with gas cleaning technologies capable of complying with the strictest environmental laws. The combination of 1100°C temperature and a minimum of 2 seconds residence time in the secondary combustion chamber with gas scrubbing systems reduces pollutants in the stack gas to far below legal limits.

POLLUTANT AGENT	EU LIMIT (2010/75/EU)	MEASURED VALUES
Total Particulate Matter (PM)	10 mg/m³	< 6.5 mg/m³
Carbon Monoxide (CO)	50 mg/m³	< 15.0 mg/m³
Sulfur Dioxide (SO_2)	50 mg/m³	< 8.0 mg/m³
Nitrogen Oxides (NOx)	200 mg/m³	< 120.0 mg/m³
Hydrochloric Acid (HCl)	10 mg/m³	< 2.5 mg/m³
Dioxins and Furans	0.1 ng-TEQ/m³	< 0.04 ng-TEQ/m³

CONTINUOUS EMISSION MONITORING (CEMS)

Through stack-mounted continuous emission monitors (CEMS), parameters like CO, O_2, dust, SO_2, and temperature are logged in real-time. The system supports direct remote data telemetry to national environmental databases.

Installation Site, Concrete Foundation & Assembly

Tesisin kurulacağı beton zemin kaide gereksinimleri ve altyapı bağlantıları.

Since the waste incinerator is a heavy-duty system with thermal expansion characteristics, the installation floor and infrastructure must meet specific standards. Concrete foundation plans and utility connection drawings are delivered by MT Makina engineers to the client before shipment.

Foundation & Concrete Specification

The installation ground must be a reinforced concrete raft foundation of minimum **C25/30** class. Concrete thickness must be minimum 250 mm and designed with double-layer steel mesh reinforcement. The furnace foundation being perfectly level is critical for tension-free installation of piping and mechanical connections.

Installation Period

The on-site installation period, including modular parts assembly, piping, and electrical wiring, is on average **5–7 business days**. Upon completion, cold tests and hot commissioning (waste burning test) are performed under the guidance of an MT Makina supervisor.

INFRASTRUCTURE REQUIREMENTS

- **Electrical Power:** 380 V / 50 Hz, 32 A three-phase power line.
- **Fuel Line:** Diesel tank or min. 300 mbar gas connection line depending on burner type.
- **Water Connection:** Mains water at continuous 2–4 bar pressure for the scrubber (Softened water is recommended).
- **Compressed Air:** Min. 6 bar dry air for pneumatic loading door and filter cleaning.

COMMISSIONING AND ACCEPTANCE PROCESS PROTOCOL

1. Mechanical & Electrical Controls (Cold Tests):
After system installation, all motor rotation directions, fan flow rates, PLC signalings, burner ignition sequence, and air tightness gaskets are tested. Basic safety training is delivered to operators at this stage.

2. Incineration Test & Emission Measurement (Hot Tests):
The system is gradually heated to reach the operating temperature (1100°C). Capacity is verified by performing real waste loading. During commissioning, emission values are checked and reported with flue gas analyzers.

Periodic Maintenance & Operation Schedule

Routines and inspections required to maximize system lifespan and thermal efficiency.

Not neglecting periodic maintenance in industrial incineration plants is essential for the health of mechanical components and refractory structures operating under high temperatures. A detailed maintenance schedule is delivered to operators with the system.

MAINTENANCE PERIOD	INSPECTIONS AND OPERATIONAL STEPS
Daily Inspections	Clearing the ash drawer, burner photocell cleaning, inspection of air nozzles, checking scrubbing pH levels.
Weekly Inspections	Fuel filter cleaning, fan belt tension checks, pneumatic door piston seals, soot accumulation checks in exhaust ducts.
Monthly Inspections	Refractory wall wear check, thermocouple sensor calibrations, cleaning the scrubber pump impeller.
Yearly Maintenance	Local replacement of worn refractory, electrical panel terminal checks, ID fan bearing replacements, chimney sweeping.

ORIGINAL SPARE PARTS GUARANTEE

All critical refractory castables, thermocouple sensors, burner nozzles, and filter bags are stocked at MT Makina. Thanks to our rapid parts dispatch, downtime is kept to a minimum.

Occupational Health, Safety (OHS) & Protective Gear

Operator safety and high-temperature protection systems in plant operation.

Waste incineration systems contain high temperatures, high-voltage electricity, fuel lines, and moving hydraulic or pneumatic components. Therefore, strict adherence to OHS rules during plant operation is mandatory to prevent accidents and injuries. All electrical safety lock mechanisms are active for system safety.

Mechanical & Electrical Interlocks

Waste loading doors are locked with limit switches and solenoid bolts to prevent manual opening when the internal temperature is not below limits or when the draft fan is off. The system warns with audible and visual alarms in case of critical failures on the HMI panel.

Emergency Scenarios

In case of power failure or overheating, burner fuel solenoid valves close instantly via spring-return safety valves. In addition, **Emergency Stop Buttons** are located at easily accessible points throughout the facility.

REQUIRED PROTECTIVE EQUIPMENT

- **High-Heat Gloves:** Use of sleeved aluminized gloves is mandatory during waste feeding and ash cleaning.
- **Heat-Protective Visor:** Visor with gold-coated shield protecting the face from high radiation heat.
- **Dust Mask:** Use of FFP3 class dust/ash mask is mandatory during ash removal.
- **Safety Shoes:** Steel-toed, puncture-resistant, antistatic protective boots.

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