"Geri Dönüşüm Sistemleri"

MT MAKİNA LTD. ŞTİ.

MEDICAL WASTE INCINERATION SYSTEM

# YF-20T

Dual-chamber controlled incineration system for hospitals, laboratories, and infectious waste. Safe and environmentally friendly engineering with optional wet scrubbing.



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# Executive Preface

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

Disposal of non-recyclable waste is one of the greatest environmental challenges of modern industrial operations. While landfills threaten soil and water resources, uncontrolled emissions trigger global warming.

As MT Makina, we aim to destroy waste at its source with zero harmful emissions. Our systems are engineered marvels designed for municipalities and industrial facilities with high capacity and zero leakage guarantees. In this catalog, the mechanical, thermal, and automation structures of the system are explained in detail. You can contact our R&D department to select the correct capacity and emission filtration model.



# 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 |

# Thermal Disposal Principles

Infectious and medical waste destruction under controlled high temperature with sterilization guarantee.

Medical and infectious waste poses biological risks due to pathogens, plastic derivatives, and organic components. Thermal disposal is the process of breaking down these hazardous wastes at the molecular level in a high-temperature primary chamber (800–1000°C) into mineral ashes and combustible gases. Thanks to the double-stage combustion structure, pathogenic microorganisms are completely destroyed, providing on-site environmental safety.

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

**MEDICAL WASTE VOLUME REDUCTION & BIOSECURITY**

Medical incineration reduces hazardous waste volume by average **%95** and mass by **%90**. The remaining ash is sterile and completely inert, containing no pathogenic risks. It is the safest method to stop infection spread at the hospital source.

During this thermal process, to ensure complete destruction of acid gases, dioxins, and furans, secondary chamber temperature is locked at minimum 1100°C with a residence time of at least 2.0 seconds. Clean emission profiles are guaranteed via turbulence injection fans and wet scrubber gas cleaning systems.

# YF-20T General Description

Double-chamber disposal solution that eliminates infection risk for hospitals, clinics, and laboratories.

Our medical medical waste incinerators are designed for rapid on-site destruction of pathogenic, pathological, and infectious waste generated in hospitals, laboratories, and clinics. With high combustion temperatures (primary chamber 800–1000°C, secondary chamber 1100–1200°C) and advanced gas scrubbing, they eliminate infection risks without environmental harm.

## Primary Applications

- **Hospitals & Healthcare Facilities:** Disposal of infectious wastes, syringes, dressings, and personal protective equipment.
- **Clinics & Dental Centers:** On-site elimination of infectious waste generated from medical interventions.
- **Laboratories:** Disposal of biological and pathological samples, petri dishes, and chemically contaminated consumables.
- **Quarantine & Veterinary Hubs:** Thermal destruction preventing the spread of infectious waste diseases.

## Key Design Advantages

YF series medical incinerators can be installed in hospital yards or closed utility rooms thanks to their compact design. The system is mounted directly on a flat concrete floor, requiring minimal civil works.

> Through high-integrity door gaskets and negative pressure control, odor and smoke leakage to the surrounding environment is 100% prevented during operation.



# Detailed Technical Specifications

YF-20T Capacity, engineering, energy consumption, and physical parameters of the model.

| PARAMETER DESCRIPTION | TECHNICAL VALUE / SPECIFICATION |
|---|---|
| Nominal Incineration Capacity | 20 kg / h |
| Primary Chamber Temperature | 850°C - 950°C |
| Secondary Chamber Temperature | 1100°C - 1200°C |
| Primary Burner Thermal Power | 100.000 kcal/h |
| Secondary Burner Thermal Power | 120.000 kcal/h |
| Feeding Door Dimensions | 600 mm x 600 mm |
| Primary Chamber Volume | 0.5 m³ |
| Electrical Power Requirement | 4.0 kW |
| External Dimensions (W x L x H) | 1200 mm x 1800 mm x 1800 mm |
| Total Empty Weight | ~ 3.500 kg |
| Waste Loading System | Manual or Hydraulic Ram Feeder |
| Ash Discharge System | Manual Ash Raking |
| Flue Gas Treatment System | Wet Scrubber Tower |
| Control Automation | Siemens S7-1200 PLC & HMI |

**CAPACITY & OPERATING CONDITIONS NOTE**

Stated capacities vary based on waste moisture (10–50%) and calorific value. Dry wastes with high plastic content reach upper limits, while highly humid organic waste requires continuous primary burner support.

# Primary Combustion Chamber & Gasification

Gasification and controlled pyrolysis process of solid wastes.

The primary combustion chamber is the main section where solid waste is directly loaded and the incineration process begins. This chamber is operated under an oxygen-limited (sub-stoichiometric) atmosphere. Thanks to oxygen-restricted combustion, waste does not ignite suddenly; it gasifies slowly (pyrolysis) and undergoes stable thermal decomposition. This method minimizes volatile dust in the flue gas, preventing filter clogging.

## Chamber Characteristics & Air Injection

Air injection into the primary chamber is delivered via two separate channels as underfire and overfire air through specialized wear-resistant nozzles located in the base and side walls. The air flow is supplied by a primary air fan with a frequency converter, controlled automatically by the PLC panel based on the temperature curve.



- **Volume:** 4.8 $m^3$ large internal volume allowing high volume waste acceptance at one time.
- **Burner Integration:** Automatic primary burner with flame length adjusted to furnace geometry.
- **Temperature Control:** Continuous furnace temperature monitoring with dual K-Type Thermocouples.
- **Wall Thickness:** A multi-layered refractory wall structure with a total thickness of 300 mm.

# Secondary Combustion Chamber & Turbulence

High-temperature destruction of volatile gases and harmful emissions.

Half-burned hydrocarbon gases, volatile organic compounds (VOCs), and carbon monoxide released as a result of waste gasification in the primary chamber are transferred to the secondary combustion chamber (Post-Combustion Chamber) via gravity and the draft fan. In this chamber, gases undergo thermal oxidation at temperatures of at least 1100°C - 1200°C in an oxygen-rich (super-stoichiometric) environment.

## Turbulent Gas Mixing & EU Compliance Criteria

The chamber geometry and the angle of the secondary air injection nozzles are designed to create a strong vortex (turbulence) in the gases. This turbulence maximizes destruction efficiency by ensuring 100% contact of oxygen molecules with unburned gases. To comply with environmental regulations (EU Directive 2000/76/EC), a minimum gas residence time of 2.0 seconds at 1100°C is guaranteed. This process ensures the complete decomposition of dioxin and furan chains.

> 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.

# Refractory, Ceramic Fiber Insulation & Steel Body Architecture

1450°C resistant internal refractory lining and reinforced external steel construction.

The lifespan and thermal stability of incinerators are directly related to the refractory quality used. In MT Makina furnaces, a multi-layered modern refractory architecture is applied to prevent the transfer of internal temperatures to the outer steel frame and to minimize energy loss. The outer body is reinforced with steel profiles resistant to corrosion and thermal expansion stresses.

## Refractory Layer Structure

- **Fire Face (Inner Layer):** Special refractory concrete casting or fireclay brick with high alumina content (60–85% Al2O3), resistant to 1450°C operating temperature.
- **Intermediate Insulation Layer:** Ceramic fiber blanket and calcium silicate boards with low thermal conductivity, resistant to 1260°C.
- **Chassis Insulation:** Rockwool and insulation mortars ensuring the furnace outer shell temperature remains at maximum 60°C.

## Outer Chassis and Corrosion Protection

The outer body of the furnace is manufactured from ASTM A36 or equivalent structural steel plates. Areas subject to intensive mechanical loads and thermal stresses (door frames and waste inlets) are armored with **Hardox** wear plates. Chassis surfaces are protected with double coats of epoxy primer and high-temperature resistant industrial furnace paint.

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



# Modulating Burner Technology & Gas Control Station

Automatic modulated combustion equipment with high safety and multiple fuel options.

Maintaining the furnace internal temperature at the desired set points (850°C for the primary chamber, 1100°C for the secondary chamber) is achieved through precise control of the burner system. In the MT Makina YF series, industrial burners of proven global standard (Baltur, Riello, or Ecoflam) are used, operating fully integrated with the PLC automation panel.

## Safety and Flame Control

On the burners are photocell (UV detector) sensors that constantly monitor the presence of flame. In case the flame goes out for any reason, safety solenoid valves on the fuel line shut off fuel flow within 1.2 seconds, preventing gas accumulation and explosion risks entirely.

### 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.



# Feeding and Waste Loading Units

Hygienic, odor-free, and top-tier safety loading solutions.

Safe transfer of waste into the incinerator is critical to maintain negative pressure and prevent high temperatures from leaking. MT Makina offers two different waste loading options, both protected by PLC safety interlocks.

### 1. Manual Pneumatic Loading Door

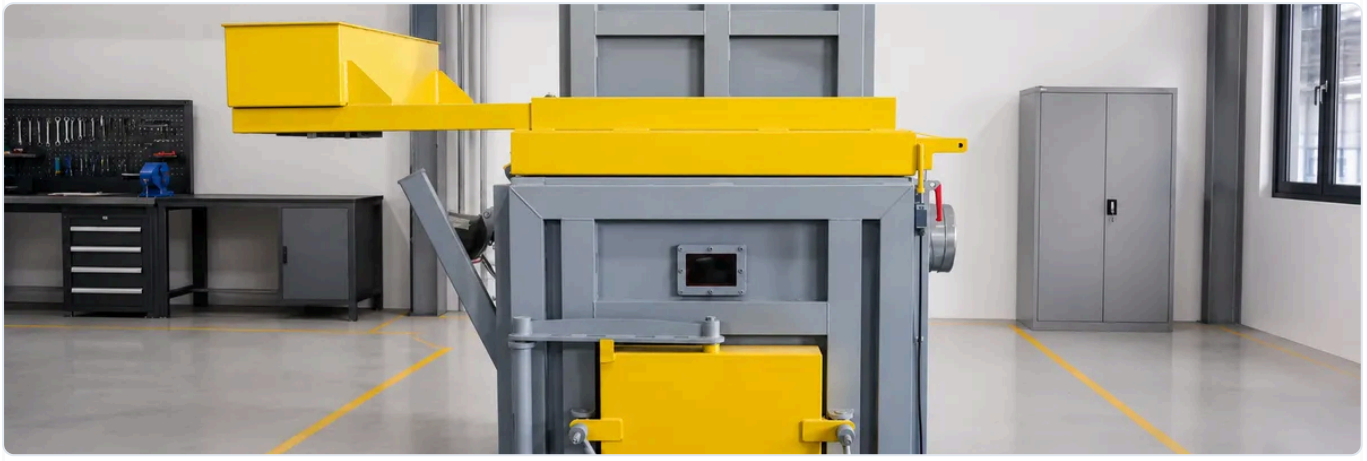
A sliding cover design at the top of the kiln, operated by pneumatic or hydraulic cylinders. The hatch opens automatically when the operator presses the button and closes quickly after waste is loaded.

**SAFETY INTERLOCK: The hatch will not open while the primary burner is operating.**

### 2. Automatic Hydraulic Ram Feeder

An automatic system where waste is poured into a loading hopper and a hydraulic piston ram pushes the waste into the kiln. Ideal for continuous operations.

**DOUBLE GUILLOTINE VALVE: Completely prevents backfiring of flames from the kiln.**



# Ash Grate Design & Wet Ash Discharge Unit

Regular and clean discharge of mineral ash resulting from combustion.

After the complete combustion of waste, ashes accumulating at the hearth base must be removed from the system. In MT Makina models, a high-alloy, heat-resistant cast grate structure is used. The ash chamber beneath the furnace is isolated so that ash can be cleaned easily without spreading dust.

## Cast Grate & Manual Discharge

Solid waste burns on the grate at the base. Combustion air passes through these grate openings, feeding from beneath the waste and supporting complete combustion. At the end of combustion, ashes filter through the grate and fall into the ash drawer. Ash doors are gasketed and locked to prevent dust propagation.

### Automatic Wet Ash Discharge (Optional)

For continuous operating plants, a water-bath (wet-ash) screw conveyor system can be installed at the base of the ash chamber. Ashes fall into water, cooling instantly, and are transferred dust-free by a screw conveyor to bags or waste containers after wetting.

### ASH MANAGEMENT & DISCHARGE STANDARDS

- **Grate Material:** Chrome-nickel alloy cast grate with 1200°C thermal resistance.
- **Manual Raking Interface:** Heavy-duty, double-sealed ash removal door.
- **Sealing:** Silicone-gasketed doors preventing air infiltration under negative pressure.
- **Ash Reduction Rate:** Disposal efficiency of 95% by volume and 90% by weight.
- **Ash Characterization:** Inert (harmless) mineral ash structure thanks to complete combustion.
- **Environmental Protection:** Integration of a dust collection hood preventing dust dispersion during dry discharge.

# Flue Gas Cleaning – Wet Scrubber

Washing flue gas emissions with water curtain and chemical solutions.

Flue gas from the secondary chamber must be cleaned of dust, acid gases (SOx, NOx, HCl), and heavy metals. MT Makina wet scrubber washes gases under a water curtain and neutralizes them via chemical dosing.

### Acid Neutralization and Dosing

The pH level of washing water is continuously balanced using automatic pH control and chemical (NaOH) dosing pumps. Acidic gases like SO2 and HCl are turned into salts and precipitated.

### Demister and PP Tower

A stainless steel demister at the tower outlet captures water droplets carried by gases. To resist acid corrosion, the scrubber body and tower are made of Polypropylene (PP) reinforced with a steel cage.



# Dry Filtration and Cyclone Separators

Separation of fly ash and coarse dust through mechanical centrifugal force.

Removing coarse ash and fly soot before the gas enters the wet scrubber is crucial to prevent clogging and extend system life. For this purpose, gases pass through high-temperature resistant dry Cyclone Dust Separators.

## Multicyclone Operating Principle

Gases enter the cyclone chamber tangentially at high velocity. The geometry creates a strong vortex. Due to centrifugal force, solid soot and dust particles heavier than the gas strike the walls, lose kinetic energy, and drop into the dust hopper at the bottom.



- **Temperature Resistance:** Steel body design capable of operating up to 400°C.
- **Zero Energy Consumption:** Operates purely on mechanical principles without electricity.
- **Easy Cleaning:** Easy Cleaning: A sealed, easily detachable dust collector bucket at the bottom.

# PLC Control Panel and SCADA Integration

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

The YF-20T 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.

YF-20T 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 Guide

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 Equipment

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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