Cremation & Incineration Equipment

TECHNICAL SPECIFICATION
FTIII CREMATOR
(UK SPECIFICATION)

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FTIII (S.E)

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INDEX

1.0 INTRODUCTION

The ***FTIII*** Cremator has been specifically designed to cater for the specific needs of the modern-day crematorium facility. The cremators enable the respectful cremation of coffins and human remains whilst complying with the necessary flue gas emission and operational requirements.

This cremator has been specifically designed after many years of experience and research in this very specialised field. In designing the cremator, we have minimised the necessary labour required to operate it, and the simplicity of its design ensures easy operation.

The design of this cremator is very capable of reducing the body to a high quality inert ash in a very efficient manner.

1.1 The Advanced Technical Features of the *FTIII* Cremator

- **Excellent Environmental Performance** - emissions conforming to current European and other World Standards.
- **Robust Solid Hearth** - providing single pass raking for ease of use.
- Excellent Extended Hearth Life.
- **Highest Quality Refractories** - including 63% Alumina in areas of heavy wear. Optionally, long-life refractories can be specified.
- **Robust Construction** - a design capable of numerous cremations per day and cremations times of 75 to 80 minutes fully achievable.
- **One Secondary Combustion Zone Burner** to ensure a secondary zone temperature of 850°C (*), which can be maintained under all conditions of normal operation.
- Easily Removable Factory Finished Decorative Outer Casing.
- **Automatic Control of Air** - for both combustion and flue gas cooling purposes.
- **Advanced Modern PLC Control** features facility to ensure optimum combustion conditions by continuously monitoring throughout each cremation. Remote support available via a modem link.
- **Automatic Control of Suction**.
- **Automatic Temperature Control** of both primary and post combustion zones.
- **Automatic Fail Safe** against over temperature and pressure.
- **Compact Design**, enabling easy installation.

(*) **Minimum of 800°C** in the secondary combustion chamber when operating **with abatement plant**.

2.0 ENVIRONMENTAL PERFORMANCE

The design of this cremator provides a secondary combustion zone that maintains the waste gas temperature greater than 850°C (unabated) or 800°C (abated), for a residence time of greater than 2 seconds during operation. The oxygen content of the waste gases is greater than 6% when averaged over the cremation cycle, and never falls below 3%.

Tests on the ***FTIII*** cremator in conjunction with our mercury abatement filtration system have been proven the equipment to comply and surpass the emission limits set out in PG5/2 (12). Full copies of Independent tests conducted in the UK detailing the emissions into the atmosphere after the filtration process are available on request.

Typical emissions to atmosphere resulting from many hundreds of tests conducted on abated and unabated ***FTIII*** cremators are:

Pollutant	Abated Typical Test Average	Abated Requirement to PG5/2 (2012)	Units	Unabated Typical Test Average	Unabated Requirement to PG5/2 (2012)	Units
Total Particulate Matter	<5	<20	$mg/Nm^3c.$	<90	<120	g/hour
Hydrogen Chloride	<10	<30	$mg/Nm^3c.$	<50	<300	g/hour
Carbon Monoxide	<15	<100	$mg/Nm^3c.$	<20	<150	g/hour
Organic Compounds	<1	<20	$mg/Nm^3c.$	<1	<30	g/hour
Mercury	<20	<50	$\mu g/Nm^3c.$	N/A	N/A	-
Dioxins & Furans	<0.02	<0.1	$ng/Nm^3c.$	<0.6	<1.0	$ng/Nm^3c.$

We always recommend that the operator elects to meet the emissions limit on a mass basis rather than concentration when the cremator is operated unabated. This is because the extremely energy efficient ***FTIII*** cremator has a low fuel gas consumption causing the pollutants to be present in a small volume of flue gas that in turn increases concentrations, but leaves the mass emissions unchanged.

Abated emissions limits must always be on a concentration basis.

A De-NOx system can be specified, and fitted to any ***FTIII*** cremator that reduces the emissions of NOx for superior environmental performance over and above the requirements of PG 5/2(12).

3.0 PROPOSED INSTALLATION

The ***FTIII*** Cremator is a modular design, which allows the user to pick and choose the options available.

The basic cremator will consist:

- ***FTIII*** Cremator (Single end design) with increased primary chamber width to allow larger bariatric coffins to be cremated.
- Dedicated combustion air fan.
- Dedicated draught control system comprising ejector air fan and ejector system.
- Automatic PLC based control system.
- Easy to use Human Machine Interface (HMI) in the form of a standard desktop PC.
- Flue gas monitoring equipment - utilising extractive gas analysis systems, and including O_2, CO analysers and indicative particulate monitor.
- Computer control station, complete with data logging system.
- Remote engineering support - via modem.
- Coanda ejector.
- Industry leading flat *interactive* touch screen Human Machine Interface mounted on the machine.

In addition, the following **options** may be considered (at additional **cost**):

- Remote location of combustion air fan and ejector fan.
- Double end design.
- Automatic coffin loading systems.
- Long-life refractory specification.

Facultatieve Technologies experienced staff are happy to discuss any additional requirements as necessary.

4.0 CREMATOR GENERAL DESCRIPTION

4.1 Principle of Operation

The cremator comprises a primary chamber of generous proportions into which the coffin is inserted and within which the primary combustion takes place. The hearth comprises flat sillimanite tiles. To keep the primary chamber entirely separate from the secondary chamber and avoid bypassing of the flue gases the hearth itself contains no openings, this ensures that all materials are retained for combustion in the primary chamber. The waste gas produced from this phase of the process exits the primary chamber via transfer ports in the chamber sidewall, descending below the solid hearth into the secondary combustion zone in which the gas phase combustion takes place.

The gases enter this zone and are then heated if necessary by the secondary zone burner, and treated by the introduction of additional air. The flue gases make numerous passes within the secondary combustion zone, where the temperature is maintained at the required combustion temperature of 850°C (for unabated operation) such that the two requirements of temperature and oxygen are met to ensure compliance to the environmental requirements. Feedback to the control system from the emissions monitoring equipment ensures close control is always maintained, resulting in low pollutant emissions and excellent fuel economy.

4.2 Primary Combustion Chamber

The primary chamber is equipped with a single burner located in the end wall and two independently controlled sets of air jet comprising: -

- Air jets along the top of the arch.
- Side air along the sidewall of the cremator slightly above the hearth.

4.3 Secondary Combustion Zone

The ***FTIII*** cremator benefits from a generously designed secondary combustion zone, 3.21 m^3 in volume, and is sufficient sized to ensure a flue gas residence time of 2 seconds at all times during operation.

The ***FTIII*** cremator is designed with a secondary combustion zone comprising a series of passes below, and to one side of the primary chamber; one independently operated burner within this zone ensures that the temperature requirements are maintained while adequate supplies of secondary air and the tortuous flue path ensure high levels of turbulence to promote complete combustion.

The post combustion of the flue gases is completed within these high intensity areas, and thus all odours and smoke are eliminated. The design of the post combustion chambers ensures a lengthy, complex passage through the cremator prior to the flue gas exit.

4.4 Combustion System

The primary chamber burner has a maximum rating of 270 kW and this enables normal operating temperature in the range of 850°C to be achieved in the primary chamber.

(The maximum allowable operating temperature is 1100°C to 1150°C).

The secondary combustion zone burner has a maximum rating of 350 kW which will enable temperatures of 850°C (unabated operation) to be achieved in the secondary chamber as required by the Environmental Regulations.

The primary and secondary burners are mounted at the rear of the cremator facilitating easy access for maintenance and repair.

The burners are configured for **fully modulating control**, are ignited automatically and the burner system is protected against flame failure, thereby complying with the gas regulations and BS 5885 Part II.

4.5 Control Valves and Instrumentation

The addition of combustion air to the combustion process is effected by five modulating control valves, controlling individual supplies to each of the burners, primary chamber air supplies and the supply of air to the secondary combustion chamber.

The cremator primary chamber under pressure condition is controlled via a differential pressure transducer controller, controlling the coanda ejector (when operating unabated) draught generation system, and also protecting against system overpressures.

The primary chamber and secondary chamber temperatures are measured via type K thermocouples, temperatures are all displayed on the PC control station.

4.6 Combustion Air System

The cremator installation is supplied with combustion air by a dedicated fan, with a design duty capable of providing the air pressure and flow requirements of the Cremator. For higher operational efficiencies and reduced operational costs the fan is controlled by an inverter this ensures that the minimum of power is used during the cremation process. The fan is located in an integrated enclosure within the cremator's decorative panelling, the enclosure is acoustically lined.

4.7 Induced Draught System
- Cremator Underpressure / Draught Generation

The cremator underpressure is constantly measured and controlled by the addition of a cooling air volume into the hot flue gases via a coanda ejector located shortly after the cremator waste gas outlet.

The volume of ejector air is constantly modulated by an inverter controlled ejector air fan motor, the speed of the fan (hence the level of draught) is controlled by the cremator's PLC control system.

The pressure sensor / controller also continually monitors any overpressure condition within the cremators primary chamber. On detection of overpressure the combustion air to cremator is automatically turned off such that the combustion rate within the cremator is rapidly reduced. On sustained overpressure, the cremator will go into abort mode until the cause of problem is identified (for example, this could be the failure of the ejector air supply).

This separate ejector fan is located in an integrated enclosure within the cremator's decorative panelling, which is acoustically lined.

4.8 Cremator Process Control – PLC Based

The cremator is supplied with a dedicated **Programmable Logic Controller**, this controller supervises the operation of the cremator the combustion process and automatic process control.

Facultatieve Technologies utilises the Mitsubishi PLC and associated *Melsec* computer software for process control of the cremator.

Data PLC	
Manufacturer	Mitsubishi
Base unit Type	FX 3 U – 80 MT

4.9 Personal Computer Based Control System Including Data Logging

The cremator, is supplied (as standard) with an industrial computer (PC) touch screen monitor (TFT) and the following pre-installed licensed software.

- Microsoft Windows 10 operating system
- Integrated graphics package (Optsoft)
- Remote Access - TeamViewer

The cremator is controlled via the integrated computer system. This PC based control system detailed below provides an industry leading control graphics package, and offers the added benefit of data logging and remote engineering support via an ASDL modem link.

For the above control interface, the PLC design includes a serial data card, which, via a RS 232 connection communicates with the computer system. Allowing the use of our Windows based Optsoft graphics package to operate a **S**upervisory **C**ontrol **A**nd **D**ata **A**cquisition system – known as **SCADA.**

The software control program includes automatic data logging this information is used to automatically generate a report in a format agreed by the UK Environmental Authorities and requires no further manipulation by the operator. The data can be emailed directly to the manager (provided an internet connection is available), also without any intervention from FT.

The control enclosure, including the PLC system is located on the rear of the cremator. Within this enclosure the equipment is situated to minimise the effects of heat, and is adequately ventilated so ensuring trouble free operation.

The PLC based control system is capable of the total control of the cremator and all its functions in order to complete the cremation process once the primary chamber has been charged without the need for operator assistance so simplifying the day to day operation of the cremator.

The PLC control system automatically varies the combustion programme according to coffin type and body weight.

The system monitors many signal inputs from thermocouples throughout the cremator, information from the gas analysers and sends output signals to control the combustion air levels, burner operation, draught control system controlling the cremator at its optimum performance level ensuring cremations times are reduced, fuel efficiently is increased and emission limits are adhered to.

The system also monitors for combustion and component faults, taking appropriate action as required and transmitting the alarms to the operator display as necessary. Should the need arise, provision has also been included for a manual override. Manual control of the cremator is logged by the control system. However, the control system will prevent a dangerous situation from arising from incorrect manual operation.

4.10 Cremator Process Control – Safety Features

The burner flame failure and burner safety systems are housed separately from the burners. They comprise flame failure safety relays connected to a flame rectification type probe, to monitor "start" flame and "main" flame, which automatically shut off gas and air supply valves in the event of flame failure of either the main burner or afterburner, and to prevent burner ignition if the safety circuits are not energised.

Separate gas and air pressure switches are set to shut off the burners if the air supply or gas pressure fall below pre-determined safety levels.

Electrical interlocks prevent the charging door being opened for the introduction of a coffin unless the temperature in the secondary combustion zone exceeds 850°C (unabated operation). For additional safety the charging door will only partially open for ashing out purposes – this feature is only fitted to cremators configured to single end operation.

The cremator is fitted with automatic suction control to maintain a pre-set suction condition within the primary chamber for all normal combustion conditions. This is achieved by either a dedicated ejector fan or system ID fan on filters installations.

4.11 Remote Engineering Support and Email Capability

In order to support the cremator from our technical centre, the standard cremator control system capable of interrogated remotely provided an internet connection with a fixed IP address is available. This enables remote observation of cremator parameters, retrieval and analysis of cremator

emission data. The system also allows the cremator to be interrogated by our expert technicians to resolve operating problems without the initial requirement to attend site to rectify the problem.

Such a modem facility, already in use at many crematoria throughout the UK and Europe, enables offsite maintenance scheduling, installation management, remote monitoring of cremator performance and operator assistance should the need arise.

Facultatieve Technologies offer an email facility built into the cremator SCADA System. This can be used to send selected reports to up to 4 different email addresses. For security and management reasons the email account needs to set up and managed by the operator. We will assist with this during the commissioning phase or during a service if applicable. In order for us to set this up for the operator we need the following email server settings.

- Email client (default installed is Mozilla Thunderbird)
- Email address
- Password
- Username
- Encryption type
- Password authentication type
- Server type – POP/IMAP
- Incoming port
- Outgoing port
- Incoming server address
- Outgoing server address
- Confirmation all firewall/router settings allow the above account

In addition to this we will need the following information
Recipient Address 1 to 4 and required reports per recipient. Reports available are, Cremation, Daily, Weekly, Monthly.

This information will be gathered via a tablet form, and we will ask you to confirm that the details given are issued by yourselves. You may need to involve your IT support in this process. As stated above the default client installed is Mozilla Thunderbird, we install this on our PC's as standard as we have found it reliable. If you choose to use a different email client, then this will need to be installed by the operator.

4.12 Flue Gas Monitoring

The cremator is supplied as standard with an extractive flue gas analysis system based the Fuji Electric Zr Oxide O_2 analyser.

Technical Data	
Analyzer Model	Type ZRM

Detector Model	Type ZFK 2

The above fast response oxygen probe is utilised for control purposes. For the purposes of regulation data/logging and monitoring a further combined oxygen and carbon monoxide analyser is utilised – utilising Infra-red techniques for Carbon monoxide detection.

Additionally, a flue gas particulate monitor such as the PCME Leak Alert 65 (Single Output) monitor is also provided.

These flue gas analysers are located to allow the analyser readings to be on display to the operating staff at the most convenient points within the crematory, and are repeated on the PC control station.

The standard configuration provides for the continuous monitoring of:

- Oxygen
- Carbon monoxide
- Primary chamber temperature
- Secondary combustion chamber inlet / outlet temperature
- Flue gas temperature
- Flue gas particulate level

Facultatieve Technologies qualified staff, are happy to discuss any additional requirements as necessary.

4.13 Cremator Loader – Optional Extra Cost Item

Facultatieve Technologies can offer numerous coffin loading systems, varying from simple manual transfer trolleys to fully automatic powered static loaders integrated into the design of the cremator, as well as powered mobile coffin charging trolleys.

5.0 CREMATOR CONSTRUCTION DESCRIPTION

5.1 Casing and Framework

The casing and framework of the cremator is fabricated of steel plate and sectional steel construction, the whole braced for rigidity, so as to properly support the refractory and insulating materials with which the casing is lined.

The overall external dimensions of the cremator are:

	Single end	Double end
Length (m)	**3.86**	3.73
Width (m)	**2.15**	2.15
Height (m)	**2.45**	2.45
Height over door gear (m)	**3.30**	3.30
Weight (kg)	**13,500**	13,500

The cremator size is generally as detailed by the ***FTIII*** brochure.

5.2 Cremator Charging Door

The refractory lined charge door is situated at the front of the cremator is counterbalanced and suspended on precision roller chains for ease of operation. Operation is by means of a single-phase electric motor controlled by adjacent push buttons, interlocked to prevent charging unless the secondary combustion chamber temperature is above 850°C (unabated operation). The door opens to the full dimensions of the primary chamber thus allowing for the introduction of very large coffins.

The dimensions of the charging aperture are:

	***FTIII* Cremator**	
	Single end	Double end
Width (mm)	**1100**	1100
Height (mm)	**750**	750

The **recommended maximum** size of coffin which can be inserted into the machine is:

	***FTIII* Cremator**	
	Single end	Double end
Length (mm)	**2350**	2350
Width (mm)	**1050**	1050
Height (mm)	**700**	700

With reference to coffins longer than 2.15m (7'0"), please refer to FTL O and M manual for the special loading instructions or contact FTL when using any of FTL auto loading systems.

5.3 Ash Removal

5.3.1 Single Ended Cremator

Access for raking on single ended units is through the charging door. At the end of the cremation, the door is opened to a safe, partially open position, which protects the operator from the radiated heat. The door is operated by a pushbutton and door height is controlled by the PLC control system.

5.3.2 Double Ended Cremator

Access for raking on double ended units is through a dedicated rear ash door. At the end of the cremation the door is opened by pushbutton operation to its fully open position so giving the operator easy access to the calcined remains. This door is designed constructed and installed in a similar manner to the charging door. In the open position the aperture is 230mm high x 350mm wide.

In both of the above designs the ash then may be raked (using an ash rake) and removed directly via the integral ash chute, into a refractory sump positioned below the ash out door. Whilst within this refractory lined ash box, the ashes can be cooled automatically by a flow of cold air. The cooled ashes can then be dropped into the attached stainless ash box, by manually opening a slide valve. The ashes can then be removed from the cremator and transported elsewhere for further processing if so desired.

5.4 Access for Maintenance

The need for access for maintenance has been carefully considered in the cremator design, and facilities have been provided for the cleaning out of accumulations of ash in any of the chambers and flue passages, access ports being provided for this purpose.

5.5 External Finish

Externally, the cremator casing is clad with pre-finished painted panels before leaving our production facility. Consequently, no additional finishing of these items is required and they are a distinctive feature of the cremator.

As well as giving the cremator a pleasing appearance, the panels ensure operator safety, by preventing any hot surfaces from being touched. The cladding panels ensure a gap of air between the internal cremator casing, and the external surfaces. This greatly reduces the external surface temperatures to levels only slightly above the room ambient temperature.

The charging door at the front of the cremator is faced with stainless steel surrounded by a stainless steel bezel. The rear ashing out door on double ended units is also finished in stainless steel.

5.6 Refractory Materials – *FTIII* Cremator

5.6.1 Standard Refractory Lining

Refractories are of high quality, comprising fire-brick, backed by calcium silicate and microporous insulating materials.

Location of refractory in cremator	Quality of refractory (Alumina content)	Thermal conductivity (W/m °C)	Bulk density (g/cm^3)	Maximum operating temperature (°C)
Used in areas of high turbulence.	63%	2.0	2.25	1600
Used in cremator sidewalls.	42%	1.9	2.25	1400
Used in cremator hearth.	65%	1.62	2.45	1600
Castable refractories used for burner quarls, lintels and outlet port.	50%	N/A	2.37	1600
Ash chute	50%	N/A	2.37	1400

*As an optional extra cost item, the cremator can be supplied with a **Longer Life** refractory lining at addition cost. (see section 5.7)*

5.6.2 High Quality Insulation

The quality and thickness of the insulation materials used in the construction of the cremator are such that the exterior casing is kept at a safe temperature for the operators at all times.

Type and location of insulation	Insulation thickness (mm)	Thermal conductivity (W/m °C)	Bulk density (g/cm^3)	Maximum operating temperature (°C)
Calcium Silicate Insulation used in the areas around and between the refractories and the steel casing.	75	0.10	0.2	1050
High grade microporous insulation included within the insulation layers between the steel casing and the internal refractory.	25	0.3	0.3 to 0.35	950

5.7 Longer Life Refractory Materials – *FTIII* Cremator – Optional Extra Cost Item

5.7.1 Longer Life Refractory Lining

Refractories are of high quality, comprising cast blocks, backed by calcium silicate and microporous insulating materials.

Location of refractory in cremator	Quality of refractory (Alumina content)	Thermal conductivity (W/m °C)	Bulk density (g/cm^3)	Maximum operating temperature (°C)
Used in areas of high turbulence – CAST	45.7	2.0	2.25	1600
Used in cremator sidewalls – CAST	45.7	1.9	2.25	1400
Used in cremator hearth	60% Si C	4.8	2.44	1600
Castable refractories used for burner quarls and outlet ports	50%	N/A	2.37	1600
Ash chute	50%	N/A	2.37	1400

5.7.2 High Quality Insulation

The quality and thickness of the insulation materials used in the construction of the cremator are such that the exterior casing is kept at a safe temperature for the operators at all times.

Type and location of insulation	Insulation thickness (mm)	Thermal conductivity (W/m °C)	Bulk density (g/cm^3)	Maximum operating temperature (°C)
Calcium Silicate Insulation used in the areas around and between the refractories and the steel casing.	75	0.10	0.2	1050
High grade microporous insulation included within the insulation layers between the steel casing and the internal refractory.	25	0.3	0.3 to 0.35	950

6.0 TECHNICAL SPECIFICATION – *FTIII* CREMATOR

6.1 Cremator Primary Chamber Internal Dimensions

	FTIII Cremator	
	Single end	Double end
Length (mm)	**2500**	2500
Width (mm)	**1100**	1100
Height (mm)	**830**	830

6.2 Secondary Combustion Chamber

The secondary combustion chamber is specifically designed to ensure a **flue gas residence time of 2 seconds** at a flue gas temperature of 800 - 850°C and oxygen content of 6%.

Technical Data	
Secondary combustion chamber volume	3.21 m^3
Residence time in secondary combustion chamber	> 2 seconds

6.3 Burners

The following table specifies the maximum and the minimum power of the burners:

	Max fire	**Min fire**
Primary chamber burner (kW)	270	60
Secondary chamber burner (kW)	350	150

Several data of the burners are specified in the following table:

Data	
Burner fuel	Natural gas or LPG *(Diesel burners can be supplied as an option at extra cost).*
Burner control mode	Continuous modulation of burner output, burners are low NOx design.
Burner controls	- Manufacturer: Kromschroeder - Model: BCU 370 - Flame detector: Ionisation probe
Primary chamber burner gas valve	Control valve gas safety, at 240 V.
Secondary chamber burner gas valve	Control valve gas safety, at 240 V.

6.4 Utility / Fuel Consumption

Technical Data	
Natural gas consumption of the cremator per cremation (based on 5 cremations/day, 5 days/week including preheat)	20 - 25 m^3
Natural gas consumption of the cremator per cremation (based on <10 cremations/day, 6 days/week including preheat)	**<5 m^3**
Typical **electrical** consumption per hour under normal running conditions	8.75 kW

Natural Gas net $CV_{nat\ gas}$> 34.82 MJ/m^3.
Energy consumption details based on verifiable, measured data at working Crematoria.

6.5 Cremation Capacity

This design of cremator is robust, and will perform typically around **6 - 7 cremations per normal working day**, however, it is fully capable of operating for extended periods beyond "normal working hours", as required. Operating for longer working days, numerous examples of the ***FTIII*** in operation in Germany and Italy, regularly perform in excess of 12 cremations per day, 7 days a week.

6.6 Air Requirements

The following table specifies the maximum and the minimum flow of combustion air in the two chambers:

	Modulating flow	
	Max flow (Nm^3/h)	Min flow (Nm^3/h)
Combustion air to primary chamber	500	0
Secondary chamber air	900	0

The following table specifies the different characteristics of the combustion and ejector air fan:

	Flow (m^3N/h)	**Pressure** (Pa)	**Motor** (kW)	**Manufacturer**	**Model**
Combustion Air Fan	1500 (Design)	7600	7.5	Fans and Blowers Ltd	QP 6115
Ejector Air Fan	500 (Min) 2500 (Max)	7600	7.5	Fans and Blowers Ltd	QP 6115

Air fan frequency inverter variable speed controller is described in the following table:

Technical Data	
Manufacturer	Danfoss
Model	HVAC 6000 Series with built RFI filter

6.7 Cremator Process Data

	Temperatures (°C)		Pressure (Pa)	
	Max	Min	Max	Min
Primary chamber	1050	750	-10 mm	-70 mm
Secondary chamber	1150	850 (Design)	N/A	

Note: Primary chamber temperature and pressure varies with progress of cremation.

6.8 Flue Gas Conditions

The gas sample for combustion control of flue gases is made in the exit duct of the cremator.

	Condition when unabated	
Flue gas temperature	850	°C
Flue gas volume exit of secondary combustion chamber (Typical)	1270	Nm^3/ h
Content of carbon monoxide Typical content over the cremation	<15 (Using natural gas fuel)	mg/Nm^3
Flue gas particulate content (Typically)	<80 <120	mg/Nm^3 g/h

All above figures are given at reference conditions of 273K, 1013 mbar,11% oxygen & dry gas and is on the basis of unabated operation.

6.9 Cremator Heat Loss

Although fabricated from the highest quality refractories and insulating materials, the cremator will lose heat to its surrounding environment. This heat loss is via convection, from all its surfaces, and is calculated as **11** kW at maximum.

6.10 Cremator Control / Instruments

Each of the below probes is connected to an indicator mounted on the control panel for visual indication of all process values.

Thermocouples		
Primary chamber	No 1	Type K - Ni / Cr Element
Secondary chamber inlet	No 1	Type K - Ni / Cr Element
Secondary chamber outlet	No 1	Type K - Ni / Cr Element
Chimney	No 1	Type K - Ni / Cr Element

In the following table are specified the tool used for pressure control and the engine used for the valves of the oven:

	Manufacturer	Type
Primary chamber pressure controller	Mecatrone	MFP
Cremator air valve motors	Kromschroeder	ICW – 20