ANNEX 3

RESOLUTION MEPC.244(66)
Adopted on 4 April 2014

2014 STANDARD SPECIFICATION FOR SHIPBOARD INCINERATORS

THE MARINE ENVIRONMENT PROTECTION COMMITTEE,

RECALLING Article 38(a) of the Convention on the International Maritime Organization concerning the function of the Marine Environment Protection Committee (the Committee) conferred upon it by international conventions for the prevention and control of marine pollution from ships,

RECALLING ALSO that, at its fortieth session, the Committee adopted, by resolution MEPC.76(40), the *Standard specification for shipboard incinerators*, in respect of regulation 16.6.1 and appendix IV to MARPOL Annex VI,

NOTING that, at its forty-fifth session, the Committee adopted, by resolution MEPC.93(45), *Amendments to the standard specification for shipboard incinerators*,

NOTING ALSO that, at its sixty-fourth session, the Committee decided that incinerators with a capacity greater than 1,500 kW and up to 4,000 kW can be type-approved under the existing standard specification for shipboard incinerators,

BEING AWARE of the need to update the definition section, as well as references to the SOLAS Convention and IEC standards in the *Standard specification for shipboard incinerators*,

HAVING CONSIDERED, at its sixty-sixth session, the *2014 Standard specification for shipboard incinerators*,

1. ADOPTS the *2014 Standard specification for shipboard incinerators*, as set out in the annex to the present resolution;

2. INVITES Administrations to take the annexed Standard specification into account when certifying a shipboard incinerator;

3. INVITES Governments to note that, taking into account regulation 16.5.2 of MARPOL Annex VI, the standard specification for shipboard incinerators does not apply to the design, installation and operation of alternative designs of shipboard thermal waste treatment devices including those which use thermal processes to convert ship generated wastes to gas;

4. REQUESTS the Parties to MARPOL Annex VI and other Member Governments to bring the annexed standard specification to the attention of shipowners, ship operators, shipbuilders, manufacturers of shipboard incinerators and any other interested groups;

5. SUPERSEDES the *Standard specification for shipboard incinerators* adopted by resolution MEPC.76(40), as amended by resolution MEPC.93(45).

ANNEX

2014 STANDARD SPECIFICATION FOR SHIPBOARD INCINERATORS

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1 SCOPE

1.1 The 2014 Standard specification for shipboard incinerators (the Specification) covers the design, manufacture, performance, operation and testing of incinerators intended to incinerate garbage and other shipboard wastes generated during the ship's normal service.

1.2 This Specification applies to those incinerator plants with capacities up to 4,000 kW per unit.

1.3 This Specification does not apply to systems on special incinerator ships, e.g. for burning industrial wastes such as chemicals, manufacturing residues, etc.

1.4 This Specification does not address the electrical supply to the unit, nor the foundation connections and stack connections.

1.5 This Specification provides emission requirements in annex 1, and fire protection requirements in annex 2. Provisions for incinerators integrated with heat recovery units and provisions for flue gas temperature are given in annex 3 and annex 4, respectively.

1.6 This Specification may involve hazardous materials, operations, and equipment. It does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use, including possible port State limitations.

2 DEFINITIONS

For the purpose of the Specification, the following definitions apply:

2.1 *Ship* means a vessel of any type whatsoever operating in the marine environment and includes hydrofoil boats, air-cushioned vehicles, submersibles, floating craft and fixed or floating platforms.

2.2 *Shipboard incinerator* or *incinerator* means a shipboard facility designed for the primary purpose of incineration.

2.3 *Garbage* means all kinds of food wastes, domestic wastes and operational wastes, all plastics, cargo residues, incinerator ashes, cooking oil, fishing gear, and animal carcasses generated during the normal operation of the ship and liable to be disposed of continuously or periodically except those substances which are defined or listed in Annexes to MARPOL. Garbage does not include fresh fish and parts thereof generated as a result of fishing activities undertaken during the voyage, or as a result of aquaculture activities which involve the transport of fish including shellfish for placement in the aquaculture facility and the transport of harvested fish including shellfish from such facilities to shore for processing.

2.4 *Waste* means useless, unneeded or superfluous matter which is to be discarded.

2.5 *Food wastes* means any spoiled or unspoiled food substances and includes fruits, vegetables, dairy products, poultry, meat products and food scraps generated aboard ship.

2.6 *Plastic* means a solid material which contains as an essential ingredient one or more high molecular mass polymers and which is formed (shaped) during either manufacture of the polymer or the fabrication into a finished product by heat and/or pressure. Plastics have

material properties ranging from hard and brittle to soft and elastic. For the purposes of this specification, plastic means all garbage that consists of or includes plastic in any form, including synthetic ropes, synthetic fishing nets, plastic garbage bags and incinerator ashes from plastic products.

2.7 *Domestic wastes* means all types of wastes not covered by Annexes to MARPOL that are generated in the accommodation spaces on board the ship. Domestic wastes does not include grey water.

2.8 *Operational wastes* means all solid wastes (including slurries) not covered by Annexes to MARPOL that are collected on board during normal maintenance or operations of a ship, or used for cargo stowage and handling. Operational wastes also includes cleaning agents and additives contained in cargo hold and external wash water. Operational wastes does not include grey water, bilge water or other similar discharges essential to the operation of a ship, taking into account the guidelines developed by the Organization.

2.9 *Oil residue (sludge)* means the residual waste oil products generated during the normal operation of a ship such as those resulting from the purification of fuel or lubricating oil for main or auxiliary machinery, separated waste oil from oil filtering equipment, waste oil collected in drip trays, and waste hydraulic and lubricating oils.

2.10 *Oily rags* means rags which have been saturated with oil as controlled in Annex I to MARPOL. Contaminated rags are rags which have been saturated with a substance defined as a harmful substance in Annexes to MARPOL.

2.11 *Cargo residues* means the remnants of any cargo which are not covered by Annexes to MARPOL and which remain on the deck or in holds following loading or unloading, including loading and unloading excess or spillage, whether in wet or dry condition or entrained in wash water but does not include cargo dust remaining on the deck after sweeping or dust on the external surfaces of the ship.

2.12 *Fishing gear* means any physical device or part thereof or combination of items that may be placed on or in the water or on the sea-bed with the intended purpose of capturing or controlling for subsequent capture or harvesting, marine or fresh water organisms.

3 MATERIALS AND MANUFACTURE

3.1 The materials used in the individual parts of the incinerator are to be suitable for the intended application with respect to heat resistance, mechanical properties, oxidation, corrosion, etc. as in other auxiliary marine equipment.

3.2 Piping for fuel and oil residue (sludge) should be seamless steel of adequate strength and to the satisfaction of the Administration. Short lengths of steel, or annealed copper nickel, nickel copper, or copper pipe and tubing may be used at the burners. The use of non-metallic materials for fuel lines is prohibited. Valves and fittings may be threaded in sizes up to and including 60 mm O.D. (outside diameter), but threaded unions are not to be used on pressure lines in sizes 33 mm O.D. and over.

3.3 All rotating or moving mechanical and exposed electrical parts should be protected against accidental contact.

3.4 Incinerator walls are to be protected with insulated fire bricks/refractory and a cooling system. Outside surface temperature of the incinerator casing being touched during normal operations should not exceed 20°C above ambient temperature.

3.5 Refractory should be resistant to thermal shocks and resistant to normal ship's vibration. The refractory design temperature should be equal to the combustion chamber design temperature plus 20% (see paragraph 4.1).

3.6 Incinerating systems should be designed such that corrosion will be minimized on the inside of the systems.

3.7 In systems equipped for incinerating liquid wastes, safe ignition and maintenance of combustion should be ensured, e.g. by a supplementary burner using gas oil/diesel oil or equivalent.

3.8 The combustion chamber(s) should be designed for easy maintenance of all internal parts including the refractory and insulation.

3.9 The combustion process should take place under negative pressure which means that the pressure in the furnace under all circumstances should be lower than the ambient pressure in the room where the incinerator is installed. A flue gas fan may be fitted to secure negative pressure.

3.10 The incinerating furnace may be charged with solid waste either by hand or automatically. In every case, fire dangers should be avoided and charging should be possible without danger to the operating personnel.

.1 For instance, where charging is carried out by hand, a charging lock may be provided which ensures that the charging space is isolated from the fire box as long as the filling hatch is open.

.2 Where charging is not effected through a charging lock, an interlock should be installed to prevent the charging door from opening while the incinerator is in operation with burning of garbage in progress or while the furnace temperature is above 220°C.

3.11 Incinerators equipped with a feeding sluice or system should ensure that the material charged will move to the combustion chamber. Such system should be designed such that both operator and environment are protected from hazardous exposure.

3.12 Interlocks should be installed to prevent ash removal doors from opening while burning is in progress or while the furnace temperature is above 220°C.

3.13 The incinerator should be provided with a safe observation port of the combustion chamber in order to provide visual control of the burning process and waste accumulation in the combustion chamber. Neither heat, flame, nor particles should be able to pass through the observation port. An example of a safe observation port is high-temperature glass with a metal closure.

3.14 Electrical requirements[1]

3.14.1 Electrical installation requirements should apply to all electrical equipment, including controls, safety devices, cables, and burners and incinerators.

[1] International Electrotechnical Commission (IEC) Standards, particularly IEC Publication 60092 – Electrical Installations in Ships, are applicable for this equipment.

3.14.1.1 A disconnecting means capable of being locked in the open position should be installed at an accessible location at the incinerator so that the incinerator can be disconnected from all sources of potential. This disconnecting means should be an integral part of the incinerator or adjacent to it (see paragraph 5.1).

3.14.1.2 All uninsulated live metal parts should be guarded to avoid accidental contact.

3.14.1.3 The electrical equipment should be so arranged so that failure of this equipment will cause the fuel supply to be shut off.

3.14.1.4 All electrical contacts of every safety device installed in the control circuit should be electrically connected in series. However, special consideration should be given to arrangements when certain devices are wired in parallel.

3.14.1.5 All electrical components and devices should have a voltage rating commensurate with the supply voltage of the control system.

3.14.1.6 All electrical devices and electric equipment exposed to the weather should meet the requirements of international standards acceptable to the Organization.[2]

3.14.1.7 All electrical and mechanical control devices should be of a type tested and accepted by a nationally recognized testing agency, according to international standards.

3.14.1.8 The design of the control circuits should be such that limit and primary safety controls should directly open a circuit that functions to interrupt the supply of fuel to combustion units.

3.14.2 Overcurrent protection

3.14.2.1 Conductors for interconnecting wiring that is smaller than the supply conductors should be provided with overcurrent protection based on the size of the smallest interconnecting conductors external to any control box, in accordance with the requirements of international standards acceptable to the Organization.[3]

3.14.2.2 Overcurrent protection for interconnecting wiring should be located at the point where the smaller conductors connect to the larger conductors. However, overall overcurrent protection is acceptable if it is sized on the basis of the smallest conductors of the interconnecting wiring, or in accordance with the requirements of international standards acceptable to the Organization.[4]

3.14.2.3 Overcurrent protection devices should be accessible and their function should be identified.

3.14.3 Motors

3.14.3.1 All electric motors should have enclosures corresponding to the environment where they are located, at least IP 44, in accordance with the requirements of international standards acceptable to the Organization.[5]

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2 Refer to IEC Publication 60092-201, table V (1994-08 edition).

3 Refer to IEC Publication 60092-202 (1994-03 edition with amendment).

4 Refer to IEC Publication 60092-202 (1994-03 edition with amendment).

5 Refer to IEC Publication 60529 (2013-08 edition with amendment).

3.14.3.2 Motors should be provided with a corrosion-resistant nameplate specifying information in accordance with the requirements of international standards acceptable to the Organization.[6]

3.14.3.3 Motors should be provided with running protection by means of integral thermal protection, by overcurrent devices, or a combination of both in accordance with manufacturer's instruction that should meet the requirements of international standards acceptable to the Organization.[7]

3.14.3.4 Motors should be rated for continuous duty and should be designed for an ambient temperature of 45°C or higher.

3.14.3.5 All motors should be provided with terminal leads or terminal screws in terminal boxes integral with, or secured to, the motor frames.

3.14.4 Ignition system

3.14.4.1 When automatic electric ignition is provided, it should be accomplished by means of either a high-voltage electric spark, a high-energy electric spark, or a glow coil.

3.14.4.2 Ignition transformers should have an enclosure corresponding to the environment where they are located, at least IP 44 in accordance with the requirements of international standards acceptable to the Organization.[8]

3.14.4.3 Ignition cable should meet the requirements of international standards acceptable to the Organization.[9]

3.14.5 Wiring

All wiring for incinerators should be rated and selected in accordance with the requirements of international standards acceptable to the Organization.[10]

3.14.6 Bonding and grounding

3.14.6.1 Means should be provided for grounding the major metallic frame or assembly of the incinerators.

3.14.6.2 Non-current carrying enclosures, frames and similar parts of all electrical components and devices should be bonded to the main frame or assembly of the incinerator. Electrical components that are bonded by their installation do not require a separate bonding conductor.

3.14.6.3 When an insulated conductor is used to bond electrical components and devices, it should show a continuous green colour, with or without a yellow stripe.

6 Refer to IEC Publication 60092-301 (1980-01 edition with amendment).
7 Refer to IEC Publication 60092-202 (1994-03 edition with amendment).
8 Refer to IEC publication 60529 (2013-08 edition with amendment).
9 Refer to IEC Publication 60092-503 (2007-06 edition with amendment).
10 Refer to IEC Publication 60092-352 (2005-09 edition with amendment).

4 OPERATING REQUIREMENTS

4.1 The incinerator system should be designed and constructed for operation with the following conditions:

Maximum combustion chamber flue gas outlet temperature	1,200°C
Minimum combustion chamber flue gas outlet temperature	850°C
Preheat temperature of combustion chamber	650°C

4.2 For batch loaded incinerators, there are no preheating requirements. However, the incinerator should be designed that the temperature in the actual combustion space should reach 600°C within 5 minutes after start.

Prepurge, before ignition:	at least 4 air changes in the chamber(s) and stack, but not less than 15 s.
Time between restarts:	at least 4 air changes in the chamber(s) and stack, but not less than 15 s.
Postpurge, after shut-off fuel oil:	not less than 15 s after the closing of the fuel oil valve.
Incinerator discharge gases:	Minimum 6% O_2 (measured in dry flue gas).

4.3 Outside surface of combustion chamber(s) should be shielded from contact such that people in normal work situations will not be exposed to extreme heat (20°C above ambient temperature) or direct contact of surface temperatures exceeding 60°C. Examples for alternatives to accomplish this are a double jacket with an air flow in between or an expanded metal jacket.

4.4 Incinerating systems are to be operated with underpressure (negative pressure) in the combustion chamber such that no gases or smoke can leak out to the surrounding areas.

4.5 The incinerator should have warning plates attached in a prominent location on the unit, warning against unauthorized opening of doors to combustion chamber(s) during operation and against overloading the incinerator with garbage.

4.6 The incinerator should have instruction plate(s) attached in a prominent location on the unit that clearly addresses the following:

4.6.1 Cleaning ashes and slag from the combustion chamber(s) and cleaning of combustion air openings before starting the incinerator (where applicable).

4.6.2 Operating procedures and instructions. These should include proper start-up procedures, normal shut-down procedures, emergency shut-down procedures, and procedures for loading garbage (where applicable).

4.7 To avoid building up of dioxins, the flue gas should be shock-cooled to a maximum 350°C within 2.5 m from the combustion chamber flue gas outlet.

5 OPERATING CONTROLS

5.1 The entire unit should be capable of being disconnected from all sources of electricity by means of one disconnect switch located near the incinerator (see paragraph 3.14.1.1).

5.2 There should be an emergency stop switch located outside the compartment which stops all power to the equipment. The emergency stop switch should also be able to stop all power to the fuel pumps. If the incinerator is equipped with a flue gas fan, the fan should be capable of being restarted independently of the other equipment on the incinerator.

5.3 The control equipment should be so designed that any failure of the following equipment will prevent continued operations and cause the fuel supply to be cut off.

5.3.1 Safety thermostat/draft failure

5.3.1.1 A flue gas temperature controller, with a sensor placed in the flue gas duct, should be provided that will shut down the burner if the flue gas temperature exceeds the temperature set by the manufacturer for the specific design.

5.3.1.2 A combustion temperature controller, with a sensor placed in the combustion chamber, should be provided that will shut down the burner if the combustion chamber temperature exceeds the maximum temperature.

5.3.1.3 A negative pressure switch should be provided to monitor the draft and the negative pressure in the combustion chamber. The purpose of this negative pressure switch is to ensure that there is sufficient draft/negative pressure in the incinerator during operations. The circuit to the program relay for the burner will be opened and an alarm activated before the negative pressure rises to atmospheric pressure.

5.3.2 *Flame failure/fuel oil pressure*

5.3.2.1 The incinerator should have a flame safeguard control consisting of a flame sensing element and associated equipment for shut down of the unit in the event of ignition failure and flame failure during the firing cycle. The flame safeguard control should be so designed that the failure of any component will cause a safety shut down.

5.3.2.2 The flame safeguard control should be capable of closing the fuel valves in not more than 4 s after a flame failure.

5.3.2.3 The flame safeguard control should provide a trial-for-ignition period of not more than 10 s during which fuel may be supplied to establish flame. If flame is not established within 10 s, the fuel supply to the burners should be immediately shut off automatically.

5.3.2.4 Whenever the flame safeguard control has operated because of failure of ignition, flame failure, or failure of any component, only one automatic restart may be provided. If this is not successful then manual reset of the flame safeguard control should be required for restart.

5.3.2.5 Flame safeguard controls of the thermostatic type, such as stack switches and pyrostats operated by means of an open bimetallic helix, are prohibited.

5.3.2.6 If fuel oil pressure drops below that set by the manufacturer, a failure and lock out of the program relay should result. This also applies to an oil residue (sludge) burner (applies where pressure is important for the combustion process or a pump is not an integral part of the burner).

5.3.3 *Loss of power*

If there is a loss of power to the incinerator control/alarm panel (not remote alarm panel), the system should shut down.

5.4 Fuel supply

Two fuel control solenoid valves should be provided in series in the fuel supply line to each burner. On multiple burner units, a valve on the main fuel supply line and a valve at each burner will satisfy this requirement. The valves should be connected electrically in parallel so that both operate simultaneously.

5.5 Alarms

5.5.1 An outlet for an audible alarm should be provided for connection to a local alarm system or a central alarm system. When a failure occurs, a visible indicator should show what caused the failure (The indicator may cover more than one fault condition.).

5.5.2 The visible indicators should be designed so that, where failure is a safety related shutdown, manual reset is required.

5.6 After shutdown of the oil burner, provision should be made for the fire box to cool sufficiently (as an example, of how this may be accomplished, the exhaust fan or ejector could be designed to continue to operate. This would not apply in the case of an emergency manual trip).

6 OTHER REQUIREMENTS

6.1 Documentation

A complete instruction and maintenance manual with drawings, electric diagrams, spare parts list, etc. should be furnished with each incinerator.

6.2 Installation

All devices and components should, as fitted in the ship, be designed to operate when the ship is upright and when inclined at any angle of list up to and including 15° either way under static conditions and 22.5° under dynamic conditions (rolling) either way and simultaneously inclined dynamically (pitching) 7.5° by bow or stern.

6.3 Incinerator

6.3.1 Incinerators are to be fitted with an energy source with sufficient energy to ensure a safe ignition and complete combustion. The combustion is to take place at sufficient negative pressure in the combustion chamber(s) to ensure no gases or smoke leaking out to the surrounding areas (see paragraph 5.3.1.3).

6.3.2 A driptray is to be fitted under each burner and under any pumps, strainers, etc. that require occasional examination.

7 TESTS

7.1 Prototype tests

An operating test for the prototype of each design should be conducted, with a test report completed indicating results of all tests. The tests should be conducted to ensure that all of the control components have been properly installed and that all parts of the incinerator, including controls and safety devices, are in satisfactory operating condition. Tests should include those described in paragraph 7.3 below.

7.2 Factory tests

For each unit, if preassembled, an operating test should be conducted to ensure that all of the control components have been properly installed and that all parts of the incinerator, including controls and safety devices, are in satisfactory operating condition. Tests should include those described in paragraph 7.3 below.

7.3 Installation tests

An operating test after installation should be conducted to ensure that all of the control components have been properly installed and that all parts of the incinerator, including controls and safety devices, are in satisfactory operating condition. The requirements for prepurge and time between restarts referred to in paragraph 4.2 should be verified at the time of the installation test.

7.3.1 Flame safeguard. The operation of the flame safeguard system should be verified by causing flame and ignition failures. Operation of the audible alarm (where applicable) and visible indicator should be verified. The shutdown times should be verified.

7.3.2 Limit controls. Shutdown due to the operation of the limit controls should be verified.

7.3.2.1 Oil pressure limit control. The lowering of the fuel oil pressure below the value required for safe combustion should initiate a safety shutdown.

7.3.2.2 Other interlocks. Other interlocks provided should be tested for proper operation as specified by the unit manufacturer.

7.3.3 Combustion controls. The combustion controls should be stable and operate smoothly.

7.3.4 Programming controls. Programming controls should be verified as controlling and cycling the unit in the intended manner. Proper prepurge, ignition, postpurge, and modulation should be verified. A stopwatch should be used for verifying intervals of time.

7.3.5 Fuel supply controls. The satisfactory operation of the two fuel control solenoid valves for all conditions of operation and shutdown should be verified.

7.3.6. Low voltage test. A low voltage test should be conducted on the incinerator unit to satisfactorily demonstrate that the fuel supply to the burners will be automatically shut off before an incinerator malfunction results from the reduced voltage.

7.3.7 Switches. All switches should be tested to verify proper operation.

8 CERTIFICATION

Manufacturer's certification that an incinerator has been constructed in accordance with this standard should be provided (by letter, certificate, or in the instruction manual).

9 MARKING

Each incinerator should be permanently marked, indicating:

.1 manufacturer's name or trademark

.2 style, type, model or other manufacturer's designation for the incinerator.

.3 capacity – to be indicated by net designed heat release of the incinerator in heat units per timed period; for example, British Thermal Units per hour, megajoules per hour, kilocalories per hour.

10 QUALITY ASSURANCE

Incinerators should be designed, manufactured and tested in a manner that ensures they meet the requirements of this Specification.

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ANNEX 1

EMISSION STANDARD FOR SHIPBOARD INCINERATORS WITH CAPACITIES OF UP TO 4,000 kW

Minimum information to be provided

1 An IMO type approval certificate should be required for each shipboard incinerator. In order to obtain such certificate, the incinerator should be designed and built to an IMO approved standard. Each model should go through a specified type approval test operation at the factory or an approved test facility, and under the responsibility of the Administration.

2 Type approval tests should include measuring of the following parameters:

Max capacity	:	kW or kcal/h kg/h of specified waste kg/h per burner
Pilot fuel consumption	:	kg/h per burner
O_2 average in combustion chamber/zone	:	%
CO average in flue gas	:	mg/MJ
Soot number average	:	Bacharach or ringelman Scale
Combustion chamber flue gas outlet temperature average	:	°C
Amount of unburned components in ashes	:	% by weight

3 **Duration of test operation**

For oil residue (sludge) burning	:	6-8 hours
For solid waste burning	:	6-8 hours

4 **Fuel/waste specification for type approval test (% by weight)**

Oil residue (sludge) consisting of:	75% oil residue (sludge) from heavy fuel oil 5% waste lubricating oil 20% emulsified water
Solid waste (class 2) consisting of:	50% Food Waste 50% rubbish Containing Approx. 30% paper, " 40% cardboard, " 10% rags, " 20% plastic The mixture will have up to 50% moisture and 7% incombustible solids.

Classes of waste

Reference: Waste classification from Incinerator Institute of America (information for type approval tests only).

Class 2 Refuse, consisting of approximately even mixture of rubbish and garbage by weight. This type waste is common to passenger ships occupancy, consisting of up to 50% moisture, 7% incombustible solids and has a heating value of about 10,000 kJ/kg as fired.

Calorific values	**kJ/Kg**	**kcal/kg**
Vegetable and putrescibles	5,700	1,360
Paper	14,300	3,415
Rag	15,500	3,700
Plastics	36,000	8,600
Oil sludge	36,000	8,600
Sewage sludge	3,000	716

Densities	**kg/m^3**
Paper (loose)	50
Refuse (75% wet)	720
Dry rubbish	110
Scrap wood	190
Wood sawdust	220

Density of loose general waste generated on board ship will be about 130 kg/m^3.

5 **Required emission standards to be verified by type approval test**

O_2 in combustion chamber	6 – 12%
CO in flue gas maximum average	200 mg/MJ
Soot number maximum average	BACHARACH 3 or RINGELMAN 1 (A higher soot number is acceptable only during very short periods such as starting up.)
Unburned components in ash residues	Max 10% by Weight
Combustion chamber flue gas outlet temperature range	850 – 1200 °C

Flue gas outlet temperature and O_2 content should be measured during the combustion period, and not during the preheating or cooling periods. For a batch loaded incinerator, it is acceptable to carry out the type approval test by means of a single batch.

A high temperature in the actual combustion chamber/zone is an absolute requirement in order to obtain a complete and smoke free incineration, including that of plastic and other synthetic materials while minimizing dioxins, VOC (Volatile Organic Compounds), and emissions.

6 Fuel related emission

6.1 Even with good incineration technology the emission from an incinerator will depend on the type of material being incinerated. If for instance a vessel has bunkered a fuel with high sulphur content, then oil residue (sludge) from separators which is burned in the incinerator will lead to emission of SO_X. But again, the SO_X emission from the incinerator would only amount to less than one per cent of the SO_X discharged with the exhaust from main and auxiliary engines.

6.2 Principal organic constituents (POC) cannot be measured on a continuous basis. Specifically, there are no instruments with provision for continuous time telemetry that measures POC, HCl, or waste destruction efficiency, to date. These measurements can only be made using grab sample approaches where the sample is returned to a laboratory for analysis. In the case of organic constituents (undestroyed wastes), the laboratory work requires considerable time to complete. Thus, continuous emission control can only be assured by secondary measurements.

6.3 Onboard operation/emission control

6.3.1 For a shipboard incinerator with IMO type approval, emission control/monitoring should be limited to the following:

.1 control/monitor O_2 content in combustion chamber (spot checks only; an O_2 content analyser is not required to be kept on board).

.2 control/monitor temperature in combustion chamber flue gas outlet.

6.3.2 By continuous (auto) control of the incineration process, ensure that the above-mentioned two parameters are kept within the prescribed limits. This mode of operation will ensure that particulates and ash residue contain only traces of organic constituents.

7 Passenger/cruise ships with incinerator installations having a total capacity of more than 1,500 kW

7.1 On board this type of vessel, the following conditions will probably exist:

.1 Generation of huge amounts of burnable waste with a high content of plastic and synthetic materials.

.2 Incinerating plant with a high capacity operating continuously over long periods.

.3 This type of vessel will often be operating in very sensitive coastal areas.

7.2 In view of the fuel related emission from a plant with such a high capacity, installation of a flue gas sea water scrubber should be considered. This installation can perform an efficient after-cleaning of the flue gases, thus minimizing the content of:

HCl
SO_X
particulate matter.

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ANNEX 2

FIRE PROTECTION REQUIREMENTS FOR INCINERATORS AND WASTE STOWAGE SPACES

For the purpose of construction, arrangement and insulation, incinerator spaces and waste stowage spaces should be treated as category A machinery spaces (SOLAS II-2/3.31) and service spaces (SOLAS II-2/3.45), respectively. To minimize the fire hazards these spaces represent, the following SOLAS requirements in chapter II-2 should be applied:

1 For passenger ships carrying more than 36 passengers:

.1 regulation 9.2.2.3.2.2(12) should apply to incinerator and combined incinerator/waste storage spaces, and the flue uptakes from such spaces; and

.2 regulation 9.2.2.3.2.2(13) should apply to waste storage spaces and garbage chutes connected thereto.

2 For all other ships including passenger ships carrying not more than 36 passengers:

.1 regulation 9.2.3.3.2.2(6) should apply to incinerator and combined incinerator/waste spaces, and the flue uptakes from such spaces; and

.2 regulation 9.2.3.3.2.2(9) should apply to waste storage spaces and garbage chutes connected thereto.

3 Incinerators and waste stowage spaces located on weather decks (SOLAS II-2/3.50) need not meet the above requirements but should be located:

.1 as far aft on the vessel as possible;

.2 not less than 3 m from entrances, air inlets and openings to accommodations, service spaces and control stations;

.3 not less than 5 m measured horizontally from the nearest hazardous area, or vent outlet from a hazardous area; and

.4 not less than 2 m should separate the incinerator and the waste material storage area, unless physically separated by a structural fire barrier;

4 A fixed fire detection and fire-extinguishing system should be installed in enclosed spaces containing incinerators, in combined incinerator/waste storage spaces, and in any waste storage space in accordance with the following table:

	Automatic sprinkler system	Fixed fire-extinguishing system	Fixed fire detection system
Combined incinerator and waste storage space	X		
Incinerator space		X	X
Waste storage space	X		

5 Where an incinerator or waste storage space is located on weather decks it should be accessible with two means of fire extinguishment; either fire hoses, semi-portable fire extinguishers, fire monitors or combination of any two of these extinguishing devices. A fixed fire-extinguishing system is acceptable as one means of extinguishment.

6 Flue uptake piping/ducting should be led independently to an appropriate terminus via a continuous funnel or trunk.

* * *

ANNEX 3

INCINERATORS INTEGRATED WITH HEAT RECOVERY UNITS

1 The flue gas system, for incinerators where the flue gas is led through a heat recovery device, should be designed so that the incinerator can continue operation with the economizer coils dry. This may be accomplished with bypass dampers if needed.

2 The incinerator unit should be equipped with a visual and an audible alarm in case of loss of feed-water.

3 The gas-side of the heat recovery device should have equipment for proper cleaning. Sufficient access should be provided for adequate inspection of external heating surfaces.

* * *

ANNEX 4

FLUE GAS TEMPERATURE

When deciding upon the type of incinerator, consideration should be given as to what the flue gas temperature will be. The flue gas temperature can be a determining factor in the selection of materials for fabricating the stack. Special high temperature material may be required for use in fabricating the stack when the flue gas temperatures exceed 430°C.

* * *

ANNEX 5

FORM OF IMO TYPE APPROVAL CERTIFICATE FOR SHIPBOARD INCINERATORS WITH CAPACITIES OF UP TO 4,000 KW

CERTIFICATE OF SHIPBOARD INCINERATOR

NAME OF ADMINISTRATION

BADGE
OR
CYPHER

This is to certify that the shipboard incinerator listed has been examined and tested in accordance with the *Standard for Shipboard Incinerators for disposing of ship-generated waste*, as amended by resolution MEPC.244(66), and as required by regulation 16.6.1 of MARPOL Annex VI.

Incinerator manufactured by .....
Style, type or model for the incinerator*.....

Max. capacity	.....	kW or kcal/h
	.....	kg/h of specified waste
	.....	kg/h per burner
O_2 Average In combustion chamber/zone	.....	%
CO Average in flue gas	.....	mg/MJ
Soot number average	.....	Bacharach or ringelman scale
Combustion chamber flue gas outlet temperature average	.....	°C
Amount of unburned components in ashes	.....	% by weight

A copy of this certificate should be carried on board a vessel fitted with this equipment at all times.

Signed .....
Official stamp Administration of .....
.....
Dated this ..... day of.....

* Delete as appropriate

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