**SHIP INCINERATOR**

**Working principle of Incinerator**

The Incinerator is designed with the primary combustion chamber for burning sludge oil or solid waste, and a secondary combustion chamber for burning out and uncombusted exhaust gases.

The primary combustion chamber is equipped with a primary burner.

Diesel oil is supplied to this burner for initial ignition. After this, the sludge oil is supplied to the main burner until it ignites.

The primary burner is then switched off either automatically or manually. Atomizing air is provided to the sludge burner for efficient combustion.

A pressure regulating valve is provided on the sludge return line to adjust the quantity of sludge entering the conversion space.

The heat from the primary burner will dry out and start burning the solid waste and or ignite the sludge oil.

The very large, transmission area in the primary combustion chamber optimizes the drying and burning of the solid waste.

In the secondary combustion chamber, the gases from the primary combustion chamber will burn out.

A wall made of ceramic heavy duty refractory lining separates the primary and the secondary combustion chamber.

In the case of solid garbage or waste, the waste is fed into the incinerator through the feeding door.

Note that the primary burner cannot be ignited, if this door is open, the rest of the combustion process is the same.

Food wastes are any spoiled or unspoiled victual substances, such as fruits, vegetables, dairy products, poultry, meat products, food scraps, food particles and other materials generated abroad ships, principally in the galley and dining room.

Plastic waste means solid materials which contain as an essential ingredient one or more synthetic organic high polymers, and which is formed during either manufacture of the polymer or the fabrication into a finished product by heat and/or pressure.

**Shipboard incineration – Regulations**

(1) Except as provided in paragraph (5), shipboard incineration shall be allowed only in a shipboard incinerator.

(2) (a) Except as provided in sub-paragraph (b) of this paragraph, each incinerator installed on board a ship on or after 1 January 2000 shall meet the requirements contained in appendix IV to Annex VI- Regulations for the Prevention of Air Pollution from Ships. Each incinerator shall be approved by the Administration taking into account the standard specifications for shipboard incinerators developed by the Organization (Refer to resolution MEPC.76(40), Standard specification for shipboard incinerators, and resolution MEPC.93(45), Amendments to the standard specification for shipboard incinerators).

(b) The Administration may allow exclusion from the application of sub-paragraph (a) of this paragraph to any incinerator which is installed on board a ship before the date of entry into force of the Protocol of 1997, provided that the ship is solely engaged in voyages within waters subject to the sovereignty or jurisdiction of the State the flag of which the ship is entitled to fly.

(3) Nothing in this regulation affects the prohibition in, or other requirements of, the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, 1972, as amended, and the 1996 Protocol thereto.

(4) Shipboard incineration of the following substances shall be prohibited:

(a) Annex I, II and III cargo residues of the present Convention and related contaminated packing materials;

(b) polychlorinated biphenyls (PCBs);

(c) garbage, as defined in Annex V of the present Convention, containing more than traces of heavy metals; and

(d) refined petroleum products containing halogen compounds.

(5) Shipboard incineration of sewage sludge and sludge oil generated during the normal operation of a ship may also take place in the main or auxiliary power plant or boilers, but in those cases, shall not take place inside ports, harbours and estuaries.

(6) Shipboard incineration of polyvinyl chlorides (PVCs) shall be prohibited, except in shipboard incinerators for which IMO Type Approval Certificates have been issued.

(7) All ships with incinerators subject to this regulation shall possess a manufacturer's operating manual which shall specify how to operate the incinerator within the limits described in paragraph (2) of appendix IV to this Annex.

(8) Personnel responsible for operation of any incinerator shall be trained and capable of implementing the guidance provided in the manufacturer's operating manual.

(9) Monitoring of combustion flue gas outlet temperature shall be required at all times and waste shall not be fed into a continuous-feed shipboard incinerator when the temperature is below the minimum allowed temperature of 850 degrees Centigrade. For batch-loaded shipboard incinerators, the unit shall be designed so that the temperature in the combustion chamber shall reach 600 degrees Centigrade within five minutes after start-up.

(10) Nothing in this regulation precludes the development, installation and operation of alternative design shipboard thermal waste treatment devices that meet or exceed the requirements of this regulation.

**Safety Requirements**

* Outside surface temperature of the incinerator casing should not exceed 20ºC above the ambient temperature, i.e. maximum 60ºC. In order to fullfil this condition, incinerator walls are to be protected with an adequate insulation layer or with a cooling system like double jacket with air flow in between.
* In order to prevent possible hazardous events (explosions), the burner management system has to assure a sufficient pre-purge of combustion chamber before the ignition. This condition should be accomplished with least four air changes in the chamber including the stack, but not less than for 15 seconds. This are to be respected between restarts, too. Alike, a sufficient post-purge after shut-off fuel oil should be done in the period longer than 15 seconds after the closing of the fuel oil valve.
* The negative pressure in the combustion chamber should be provided with the adequate draft to prevent leakage of hot gases into the operating ambient. This is to be achieved by the exhaust fan with a sufficient capacity.
* In order to avoid building-up of dioxins, the flue gas should be shock-cooled to maximum 350ºC near to the combustion chamber outlet. This can be achieved by suction of ambient air into the flue gas duct, what requires an adequate capacity of the exhaust flue gas fan.

**Safety Devices**

* 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.
* Two control solenoid valves on the main supplement fuel and liquid waste line to each burner should be provided in series to assure safe closing in cases of shut-down event.
* 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.
* 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 pre-set temperature.
* A negative pressure switch should be provided to monitor the draft and the negative pressure in the combustion chamber, which should activate before the negative pressure rises to atmospheric pressure.