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Ships and marine technology — Shipboard incinerators — Requirements

Navires et technologie maritime — Incinérateurs de bord pour navires — Exigences

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 8, *Ships and marine technology*, Subcommittee SC 2, *Marine environment protection*.

This third edition cancels and replaces the second edition (ISO 13617:2001), which has been technically revised.

The main changes compared to the previous edition are as follows:

— the document was revised for continued consistency with International Maritime Organization provisions for shipboard incinerators, which was updated in 2014;

— several updates were made to the definitions in Clause 3 and to the references of standards cited in Clause 5;

— updates also reflect changes in the regulations of the International Maritime Organization, *International Convention on the Safety of Life at Sea, 2014 (SOLAS)*.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Ships and marine technology — Shipboard incinerators — Requirements

1 Scope

This document covers the design, manufacture, performance, operation, functioning and testing of incinerators intended to incinerate garbage and other shipboard wastes generated during a ship's normal service (i.e. maintenance, operational, domestic and cargo-associated wastes).

This document is applicable to incinerator plants with capabilities up to 4 000 kW per unit.

This document is not applicable to systems on special incinerator ships, e.g. for burning industrial wastes such as chemicals, manufacturing residues, etc.

It does not address the electrical supply to the unit, nor the foundation connections and stack connections.

This document provides emission requirements in Annex A, location requirements in Annex B, and flue gas temperature requirements in Annex D. Recommendations for incinerators integrated with heat recovery units are given in Annex C.

The activities associated with this document can 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 document to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

International Maritime Organization. *International Convention on the Safety of Life at Sea*, 2014 (SOLAS), Chapter II-2, Regulations 3 and 9

International Maritime Organization. *International Convention for the Prevention of Pollution from Ships*, 1973, as modified by the Protocol of 1978 relating thereto (MARPOL)

IEC 60092, *Electrical installations in ships*

IEC 60092-201:1994, *Electrical installations in ships — Part 201: System design — General*

IEC 60092-202:2016, *Electrical installations in ships — Part 202: System design — Protection*

IEC 60092-301:1980, *Electrical installations in ships — Part 301: Equipment — Generators and motors*

IEC 60092-352:2005, *Electrical installations in ships — Part 352: Choice and installation of cables for low-voltage power systems*

IEC 60092-503:2007, *Electrical installations in ships — Part 503: Special features — A.C. supply systems with voltages in the range of 1 kV and up to and including 11 kV*

IEC 60529:1989 (Amd 1:1999, Amd 2:2013), *Degrees of protection provided by enclosures (IP Code)*

ISO/IEC 17025:2017, *General requirements for the competence of testing and calibration laboratories*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
administration
government of the state whose flag the ship is entitled to fly

3.2
cargo residues
remnants of any cargo material which are not covered by the annexes in MARPOL 73/78, except Annex V, 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 conditions 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

Note 1 to entry: Dry bulk cargo residues may include substances that are harmful to the marine environment (HME) with special restrictions for discharges including HME entrained in cargo hold wash water. Port reception facilities for cargo residues considered to be HME may be required at loading or discharge ports handling bulk dry cargoes.

[SOURCE: MARPOL 73/78, Annex V reg. 1.2, modified — The wording "other annexes to the present (IMO) Convention" has been changed to "the annexes in MARPOL 73/78, except Annex V".]

3.3
contaminated rag
rag that has been saturated with any substance defined in MARPOL 73/78 as potentially hazardous or harmful to human health and/or the environment

3.4
food waste
any spoiled or unspoiled food substances

EXAMPLE Fruits, vegetables, dairy products, poultry, meat products, food scraps, food particles and all other materials contaminated by such wastes, generated aboard ship.

3.5
garbage
all kinds of *food waste* (3.4), domestic waste and *operational waste* (3.9), all *plastics* (3.11), *cargo residues* (3.2), *incinerator ashes* (3.7), 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 the annexes in MARPOL 73/78, except Annex V

Note 1 to entry: 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.

[SOURCE: MARPOL 73/78, Annex V reg. 1]

3.6
incinerator
shipboard facility designed for the primary purpose of incineration of waste, such as domestic waste, cargo-associated waste, *maintenance waste* (3.8), *operational waste* (3.9), *cargo residues* (3.2) and fishing gear

Note 1 to entry: These facilities may be designed to use or not use the heat energy produced.

3.7
incinerator ashes
ash and clinkers resulting from shipboard *incinerators* (3.6) used for incineration of *garbage* (3.5)

[SOURCE: MARPOL 73/78, Annex V reg. 1.10]

3.8
maintenance waste
materials collected by the engine department and the deck department while maintaining and operating the ship

EXAMPLE Soot, machinery deposits, scraped paint, deck sweepings, wiping wastes, *oily rags* (3.10), etc.

3.9
operational waste
all solid waste (including slurries) not covered by the annexes in MARPOL 73/78, except Annex V, that are collected on board during normal maintenance or operations of a ship, or used for cargo stowage and handling, including *cargo residues* (3.2)

Note 1 to entry: Operational waste includes, but is not limited to, the following wastes associated with cargo stowage and handling: dunnage, shoring, *incinerator ashes* (3.7), pallets, lining, transit and packing materials, plywood, paper, cardboard, wire, plastic wrapping and steel strapping.

Note 2 to entry: Operational waste also includes cleaning agents and additives contained in external wash water.

Note 3 to entry: Operational waste does not include grey water, bilge water or other similar discharges essential to the operation of a ship.

Note 4 to entry: Wooden material may be defined as quarantine waste in certain countries.

[SOURCE: MARPOL 73/78, Annex V reg. 1.12]

3.10
oily rag
rag which has been saturated with oil as controlled in Annex I to MARPOL 73/78

3.11
plastic
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

Note 1 to entry: Plastics have material properties ranging from hard and brittle to soft and elastic. Plastics are used for a variety of marine purposes including, but not limited to, packaging (vapour-proof barriers, bottles, containers, liners), ship construction (fibreglass and laminated structures, siding, piping, insulation, flooring, carpets, fabrics, paints and finishes, adhesives, electrical and electronic components), disposable eating utensils and cups, bags, sheeting, floats, fishing nets, strapping bands, synthetic rope and line, and *incinerator ashes* (3.7) from plastic products.

3.12
ship
ship of any type operating in the marine environment and including hydrofoil boats, air-cushioned vehicles, submersibles, floating craft and fixed or floating platforms

3.13
sludge oil
sludge from the fuel oil lubricating oil separators, waste lubricating oil from main or auxiliary machinery, or waste oil from bilge water separators, oil filtering equipment or drip-trays, etc.

3.14
waste
useless, unneeded or superfluous matter, which is to be discarded

4 General design requirements

4.1 Piping

Piping for fuel and sludge oil shall be constructed of 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. Non-metallic materials shall not be used for fuel lines. Valves and fittings may be threaded in sizes up to and including 60 mm outer diameter, but threaded unions shall not be used on pressure lines in sizes 33 mm outer diameter and over.

4.2 Rotating parts

All rotating or moving mechanical and exposed electrical parts shall be protected by guards or shields against accidental contact by personnel in the vicinity of the incinerator.

4.3 Insulation and cooling

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

The refractory shall be resistant to thermal shocks and resistant to normal ship's vibration. The refractory design temperature shall be equal to the combustion chamber design temperature plus 20 % (see 4.12).

The outside surface of the combustion chamber(s) shall be shielded from contact such that personnel are not exposed to extreme heat of more than 20 °C above the ambient temperature, or direct contact with surface temperatures exceeding 60 °C.

EXAMPLE 1 Double jacketing with an air space between jackets.

EXAMPLE 2 Expanded metal jacketing.

4.4 Corrosion

Incinerating systems shall be designed such that corrosion is minimized on the inside of the systems.

4.5 Liquid waste incineration

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

4.6 Combustion chamber

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

4.7 Combustion pressure

The pressure in the furnace under all circumstances shall be lower than the ambient pressure in the space where the incinerator is installed to ensure that the combustion process takes place under negative pressure. A flue gas fan may be fitted to provide negative pressure.

4.8 Charging solid waste

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

EXAMPLE 1 Where charging is carried out by hand, a charging lock can be provided which ensures that the charging space is isolated from the fire box as long as the filling hatch is open.

EXAMPLE 2 Where charging is not effected through a charging lock, an interlock is 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.

4.9 Feeding system

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

4.10 Ash removal

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

4.11 Observation port

The incinerator shall 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 shall be able to pass through the observation port.

EXAMPLE An example of a safe observation port is high-temperature glass with a metal closure.

4.12 Design temperature values

The incinerator system shall be designed and constructed for operation under the following conditions:

— maximum flue-gas-outlet temperature of the combustion chamber: 1 200 °C;

— minimum flue-gas-outlet temperature of the combustion chamber: 850 °C;

— pre-heat temperature of the combustion chamber: 650 °C.

Preheating is not required in batch-loaded incinerators. However, in batch-loaded incinerators without preheating, the incinerator shall be so designed that the temperature in the actual combustion space reaches 600 °C within 5 min after starting.

4.13 Pre-purging and post-purging

Incinerator controls shall include the following purge cycles.

— Pre-purge, before ignition: at least four air charges in the chamber(s) and stack, but not less than 15 s.

— Time between restarts: at least four air charges in the chamber(s) and stack, but not less than 15 s.

— Post-purge, after the shut-off of the fuel oil: not less than 15 s after the closing of the fuel-oil valve.

4.14 Mass fraction of oxygen in the discharge gases

Incinerators shall be designed so that the incineration produces a minimum of 60 g/kg of oxygen (measured in dry flue gas) in the discharge gases.

4.15 Warning plate(s)

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

4.16 Instruction plate(s)

The incinerator shall have (an) instruction plate(s) attached in a prominent location on the unit that clearly explain(s) the procedures for the following operations:

— cleaning ashes and slag from the combustion chamber(s) and cleaning of combustion air openings before starting the incinerator (where applicable);

— operating procedures and instructions, including proper start-up procedures, normal shut-down procedures, emergency shut-down procedures and procedures for loading garbage (where applicable).

4.17 Flue gas cooling

To avoid building-up of dioxins, the flue gas shall be shock-cooled to a maximum of 350 °C within 2,5 m from the flue gas outlet of the combustion chamber.

5 Electrical requirements

5.1 General requirements

Incinerator electrical components and installations, including controls, safety devices, cables and burners, shall comply with IEC 60092.

5.2 Disconnects

A disconnecting means, capable of being locked in the open position shall be installed at an accessible location at the incinerator so that the incinerator can be disconnected from all sources of potential risks. This means of disconnecting shall be an integral part of the incinerator or adjacent to it (see 7.1).

5.3 Live parts

All uninsulated live metal parts shall be guarded to avoid accidental contacts.

5.4 Failure design

The electrical equipment shall be arranged so that a failure of this equipment causes the fuel supply to be shut off.

5.5 Control-circuit connections

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

5.6 Component voltage ratings

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