Designation: F 1323 – 98

An American National Standard

AMERICAN SOCIETY FOR TESTING AND MATERIALS
100 Barr Harbor Dr., West Conshohocken, PA 19428
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Standard Specification for Shipboard Incinerators[1]

This standard is issued under the fixed designation F 1323; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

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

1.2 This specification is a companion document to Guide F 1322.

1.3 This specification applies to those incinerator plants with capacities up to 1500 kW per unit.

1.4 Additional information is given in Appendixes Appendix X1-Appendix X5.

1.5 This specification does not apply to systems on special incinerator ships, for example, for burning industrial wastes such as chemicals, manufacturing residues, and so forth.

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

1.7 This specification does not cover emissions requirements.

1.8 *This standard does not purport to address all of the safety concerns 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.* See 4.8.

2. Referenced Documents

2.1 *ASTM Standards:*
F 1322 Guide for Selection of Shipboard Incinerators[2]
2.2 *ANSI Standard:*
B 31.1 Power Piping[3]
ANSI/NFPA No. 70 National Electrical Code[3]
Article 430-7[3]
2.3 *ASME Boiler and Pressure Vessel Code:*
Section I, Power Boilers[4]
Section IX, Welding and Brazing Qualification[4]
2.4 *Underwriter's Laboratory Standards:*
UL 506 Standard for Specialty Transformers[5]
UL 814 Standard for Gas-Tube Signs and Ignition Cables[5]
2.5 *Safety of Life at Sea Convention:*
SOLAS 74 International Convention for the Safety of Life at Sea[3]
2.6 *Other Documents:*
International Convention for the Preventing of Pollution from Ships, 1973, as modified by the Protocol of 1978 (MARPOL 73/78)[6]

NOTE 1—Incinerators designed and manufactured in accordance with alternative standards must show compliance with this specification.

3. Terminology

3.1 *Definitions:*
3.1.1 *cargo-associated waste*—all materials that have become wastes as a result of use on board a ship for cargo stowage and handling. Cargo-associated waste includes but is not limited to dunnage, shoring pallets, lining and packing materials, plywood, paper, cardboard, wire, and steel strapping.
3.1.2 *cargo residues—for the purposes of this specification*, the remnants of any cargo material on board that cannot be placed in proper cargo holds (loading excess and spillage) or which remain in cargo holds and elsewhere after unloading procedures are completed (unloading residual and spillage). However, cargo residues are expected to be in small quantities.
3.1.3 *domestic waste*—all types of food wastes, sewage, and wastes generated in the living spaces on board the ship.
3.1.4 *fishing gear*—any physical device or part thereof or combination of items that may be placed on or in the water with the intended purpose of capturing, or controlling for subsequent capture, living marine or freshwater organisms.
3.1.5 *food wastes*—any spoiled or unspoiled victual substances, such as fruits, vegetables, dairy products, poultry, meat products, food scraps, food particles, and all other materials contaminated by such wastes, generated aboard ship, principally in the galley and dining areas.
3.1.6 *garbage*—all kinds of victual, domestic, and operational waste excluding fresh fish and parts thereof, generated during the normal operation of the ship and liable to be disposed of continuously or periodically. Those substances

[1] This specification is under the jurisdiction of ASTM Committee F-25 on Ships and Marine Technology and is the direct responsibility of Subcommittee F25.06 on Marine Environmental Protection.

Current edition approved April 10, 1998. Published October 1998. Originally published as F 1323 - 90. Last previous edition F 1323 - 90.

[2] *Annual Book of ASTM Standards*, Vol 01.07.

[3] Available from the American National Standards Institute, 11 W. 42nd St., 13th Floor, New York, NY 10036.

[4] Available from the American Society of Mechanical Engineers, 345 E. 47th St., New York, NY 10017.

[5] Available from Underwriter's Laboratories, Inc., 333 Pfingsten Rd., Northbrook, IL 60062.

[6] Available from the International Maritime Organization, 4 Albert Embankment, London SE1 7SR, UK.

which are defined or listed in Annexes, other than Annex V, to the International Convention for the Preventing of Pollution From Ships, 1973, as modified by the Protocol of 1978 (MARPOL 73/78) are excluded.

3.1.7 *incinerator*—shipboard facilities for incinerating solid wastes approximating in composition to household waste and liquid wastes arising from the operation of the ship, for example, domestic waste, cargo-associated waste, maintenance waste, operational waste, cargo residues, and fishing gear, and so forth. These facilities may be designed to use or not to use the heat energy produced.

3.1.8 *maintenance waste*—materials collected by the engine department and the deck department while maintaining and operating the ship, such as soot, machinery deposits, scraped paint, deck sweeping, wiping wastes, oily rags, and so forth.

3.1.9 *oily rags*—rags that have been saturated with oil as controlled in Annex I to the Convention. Contaminated rags are rags that have been saturated with a substance defined as a harmful substance in the other Annexes to the Convention.

3.1.10 *operational wastes*—all cargo-associated wastes and maintenance waste (including ash and clinkers) and cargo residues defined as garbage in 3.1.6.

3.1.11 *plastic*—a solid material that contains as an essential ingredient one or more synthetic organic high polymers and is formed (shaped) during either manufacture of the polymer or the fabrication into a finished product by heat or pressure, or both. 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 (vapor-proof barriers, bottles, containers, liners), ship construction (fiberglass 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, rope, and line.

3.1.12 *ship*—a vessel of any type operating in the marine environment and includes hydrofoil boats, air-cushion vehicles, submersibles, floating craft, and fixed or floating platforms.

3.1.13 *waste*—useless, unneeded, or superfluous matter which is to be discarded.

4. Materials and Manufacture

4.1 Metal parts of the incinerator exposed to the combustion process shall be made of materials listed in Section I of the ASME Boiler and Pressure Vessel Code.

4.2 Where welded construction is used, welded joint design details, welding, and nondestructive testing of the combustion chamber shall be in accordance with Section I of the ASME Code. Welders and weld procedures shall be qualified in accordance with Section IX of the ASME Code.

4.3 Piping and piping components associated with incinerators for fuel, sludge, and liquid cargo residues shall comply with ANSI B31.1 for design and material requirements. Fuel oil pressure piping between service pumps and burners shall have a relief valve fitted which will discharge into the suction line or back into the tank. Pressure piping shall be of seamless steel with a thickness of at least Schedule 80. Short lengths of steel, or annealed copper nickel, nickel copper, or copper pipe and tubing may be used at the burners. The use of nonmetallic materials for fuel lines is prohibited. Valves and fittings may be threaded in sizes up to and including 2-in. normal pipe size (NPS) (60-mm outside diameter), but threaded unions are not to be used on pressure lines in sizes 1-in. NPS (33-mm outside diameter) and over.

4.4 All rotating or moving mechanical and exposed electrical parts shall be protected against accidental contact. All electrical devices shall be enclosed in drip-proof or watertight enclosures.

4.5 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 5.1).

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

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

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

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

4.8.2 Where charging is not affected through a charging lock, an interlock shall be installed to prevent the charging door from opening while the incinerator is in operation or while the furnace temperature is above 220°C.

4.9 Incinerators equipped with a feeding sluice shall ensure that the material charged will move from the sluice to the combustion chamber. Examples for accomplishing this are the use of a clear path down or a mechanical pusher.

4.10 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 The incinerator shall be provided with a safe observation port of the combustion chamber 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. An example of a safe observation port is high-temperature glass with a metal closure.

4.12 *Electrical Requirements*:

4.12.1 *General*—Installation requirements shall apply to controls, safety devices, and burners on incinerators.

4.12.1.1 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. This disconnecting means shall be an integral part of the incinerator or adjacent to it (see 6.1).

4.12.1.2 All uninsulated live metal parts and all rotating or moving parts that may cause injury shall be guarded to avoid accidental contact.

4.12.1.3 The electrical equipment shall be so arranged so

that failure of this equipment will cause the fuel supply to be shut off.

4.12.1.4 The power supply to the electrical control system shall be from a two-wire branch circuit that has a grounded conductor; otherwise, an isolation transformer with a two-wire secondary shall be provided. When an isolation transformer is provided, one side of the secondary winding shall be grounded.

4.12.1.5 One side of all coils shall be electrically located in the grounded side of the circuit. All switches, contacts, and overcurrent devices shall be electrically located in the ungrounded or "hot" side of the circuit. All electrical contacts of every safety device installed in the same control circuit shall be electrically connected in series. However, special consideration shall be given to arrangements when certain devices are wired in parallel.

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

4.12.1.7 All electrical devices shall be at least NEMA Type 2 (Driptight). Electric equipment exposed to the weather shall be at least NEMA Type 4.

4.12.1.8 All electrical and mechanical control devices shall be of a type tested and accepted by a nationally recognized testing agency.

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

4.12.2 *Overcurrent Protection*:

4.12.2.1 Conductors for interconnecting wiring that is smaller than the supply conductors shall be provided with overcurrent protection based on the size of the smallest interconnecting conductors external to any control box.

4.12.2.2 Overcurrent protection for interconnecting wiring shall 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.

4.12.2.3 Overcurrent protection devices shall be accessible and their function shall be identified.

4.12.3 *Motors*:

4.12.3.1 Motors exposed to dripping or spraying oil or water shall be of drip-proof construction. All motors shall be fully guarded as installed.

4.12.3.2 Motors shall be provided with a corrosion-resistant nameplate specifying information in accordance with NEC, Article 430-7.

4.12.3.3 Motors shall be provided with running protection by means of integral thermal protection, by overcurrent devices, or a combination of both in accordance with manufacturer's instructions that shall be based on the requirements of National Electrical Code, NFPA No. 70.

4.12.3.4 Motors shall be rated for continuous duty and shall be designed for an ambient temperature of 122°F (50°C) or higher.

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

4.12.4 *Ignition System*:

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

4.12.4.2 Ignition transformers shall conform to requirements of the UL Standard 506.

4.12.4.3 Ignition cable shall conform to requirements of the UL Standard 814.

4.12.5 *Wiring*:

4.12.5.1 All wiring for incinerators shall be rated for the maximum operating temperature to which it may be exposed. Such wiring shall be in accordance with National Electrical Code, NFPA No. 70. All wiring between components shall have copper conductors not less than size No. 18 AWG and constructed in accordance with the National Electrical Code, NFPA No. 70.

4.12.5.2 All electrical wiring shall have a voltage rating commensurate with the voltage of the power supply.

4.12.5.3 Conductors shall be protected from physical damage where appropriate.

4.12.5.4 Conductors shall be sized on the basis of the rated current of the load they supply.

4.12.6 *Bonding and Grounding*:

4.12.6.1 Means shall be provided for grounding the major metallic frame or assembly of the incinerators.

4.12.6.2 Noncurrent carrying enclosures, frames, and similar parts of all electrical components and devices shall be bonded to the main frame or assembly of the boiler. Electrical components that are bonded by their installation do not require a separate bonding conductor.

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

5. Operating Requirements

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

Maximum combustion chamber temperature	2190°F (1200°C)
Minimum combustion chamber temperature	1560°F (850°C)
Preheat temperature of combustion chamber	1200°F (650°C)

For batch loaded incinerators, there are no preheating requirements. However, the incinerator shall be so designed that the temperature in the actual combustion space shall reach 1110°F (600°C) within 5 min after start.

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

5.2 Outside surface of combustion chamber(s) shall be shielded from contact such that people would not be exposed to extreme heat (maximum 68°F (20°C) above ambient temperature) or direct contact of surface temperatures exceeding 140°F (60°C). Examples for alternatives to accomplish this are a double jacket with an air flow in between or an expanded metal jacket.

5.3 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.

5.4 The incinerator shall have warning plates attached in a