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National Fire Protection Association

INTERNATIONAL

Regulations

governing

Marine Fire Hazards

Endorsed by

**American Marine Standards Committee
National Board of Marine Underwriters**

(See Note inside front cover)

1930

**Prepared and Revised by Marine Committee
National Fire Protection Association**

NATIONAL FIRE PROTECTION ASSOCIATION

Executive Office:

60 Batterymarch Street, Boston, Mass.

NOTE:

This pamphlet supersedes the edition of 1926, which, while unchanged in general plan, is extensively revised in the present edition. An additional appendix deals with fire detecting systems on vessels.

The last previous edition of these regulations, issued in 1926, was submitted to and endorsed by the American Marine Standards Committee and the National Board of (Marine) Underwriters. This endorsement applies to the major part of the present text, which is unchanged from the 1926 edition. The new and revised matter in the present pamphlet is being submitted to the American Marine Standards Committee and the National Board of (Marine) Underwriters for similar approval, but action thereon was not completed at the time of printing this pamphlet.

RECEIVED

Regulations Governing
MARINE FIRE HAZARDS
VESSELS

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DEFINITIONS

In these Regulations the following words are used as defined below:

Shall is intended to indicate requirements.

Should is intended to indicate recommendations, or that which is advised but not required.

Approved refers to approval by the Inspection Department and Classification Societies having jurisdiction in the enforcement of the regulations.

FIRE PREVENTION REGULATIONS FOR THE CONSTRUCTION AND MAINTENANCE OF VESSELS.

No provision in these regulations is to be retroactive as regards construction.

CONSTRUCTION.

Article I. Boilers.

1. Lagging. All boilers, including steam domes, shall be thoroughly covered with asbestos or other approved heat-insulating material; such covering to extend down sides below the line of grate bars. However, vertical or donkey boilers need not be covered, provided all woodwork within 18 inches at sides or within 2 feet 6 inches of uptakes or breeching is covered with sheet metal over sheet asbestos.

NOTE: Vessels having boiler houses with steel sides, ends, and roof will not be required to have boilers covered.

2. Floors. All fire-room floors shall be covered with iron plate or at least 2 inches of cement, or other approved material. At least $\frac{1}{4}$ -inch asbestos board or 1-inch plastic asbestos or equivalent shall be laid over all woodwork under a fire-room floor.

3. Foundations. The floor under the grate bars of all externally fired or leg boilers shall be of brick or cement at least 6 inches thick, vented by the insertion of old tubing laid horizontally, or its equivalent, under which shall be at least $\frac{3}{8}$ -inch asbestos board or $1\frac{1}{2}$ -inch plastic asbestos or equivalent covered with sheet metal. The floor under vertical boilers, if laid on a wood deck, shall be of brick or cement or other approved materials, similarly vented, at least $2\frac{1}{2}$ inches thick, extending out in front at least 3 feet; or, if less, shall have a fire-resistive coaming around said floor projecting at least $2\frac{1}{2}$ inches above it, or be covered by a metal pan with projecting edges. On all such floors, under the brick or cement there shall be at least $\frac{1}{4}$ -inch board or 1-inch plastic asbestos or equivalent covered with sheet metal.

4. In Way. Where coal and wood, or stores, or cargo of any description, except oil, are carried or may be carried alongside of boilers, a partition shall be built at least 4 inches clear, to prevent anything being placed next to the boilers; and under no circumstances may anything be placed between such partitions and the boilers. If anything is or may be carried near the back ends of boilers,

similar partitions or bulkheads are to be fitted, but these shall be at least 2 feet distant from boilers, and space between them and boiler kept clear and clean. Under no circumstances may a wood platform, locker or grating be fitted over top of any boiler nearer than 12 inches, and no lines, clothes, or other combustible articles be laid over or alongside of boiler.

5. Ash Guards. A steel coaming at least 12 inches high shall extend from the front of all boilers to side partitions to prevent coal or ashes getting into wings.

6. Drip Pans. Where oil is used for fuel, on leg or externally fired boilers there shall be a drip-pan of heavy iron under the fire boxes to catch all drip. Where wood is used for fuel, a water pan shall be fitted under the grates, and a partition or metal screen erected to prevent cinders or sparks being blown into the woodpiles. In no case may the wood be stacked against the boilers.

7. Casings. The construction of the house or casing over and around the boiler should be of such nature that hot air or gases cannot be pocketed at any high point; but if such exist, suitable vent louvres shall be cut in sides of house or casings to provide a circulation of air.

8. Bulkheads. Screen bulkheads between fire room and engine room should, where possible, extend to the tank top or shell of the vessel in order to form a fire wall between engine room and fire room bilges. Where oil burning equipment is installed, these bulkheads should be made oil-tight to at least two feet above the tank top and bilges to prevent any oil reaching the engine room bilges and tank top.

On shelter or awning deck type of passenger vessels, the spaces above the bulkhead deck shall be fitted with continuous transverse fire-break bulkheads spaced not more than 131 feet apart, mean distance. Steps and recesses and the means for closing all openings in these bulkheads shall be fire-resistive and flame-tight.

NOTE: The regulations accompanying the 1929 International Convention on Safety of Life at Sea provide that "such bulkheads shall be constructed of metal or other fire-resistive material effective to prevent for one hour, under conditions for which the bulkheads are to be fitted in the ship, the spread of fire generating a temperature of 1500° F. at the bulkhead."

Article II. Stacks.

9. In Way. Where a smoke stack passes through a wood deck, the woodwork should be cut away at least 12 inches from the stack and the wood faced with a metal collar over sheet asbestos; but where the construction of the vessel will not permit a space of 12 inches, there shall be an opening at least 4 inches wide around stack; this opening to be completely faced with a metal collar extending at least 6 inches above roof and 6 inches below same, and the carlins and roof on under side around opening, covered with sheet iron extending back radially at least two feet. Sheet asbestos at least $\frac{1}{8}$ inch thick shall be placed under all metal.

10. Umbrellas. The bottom of the flange of the umbrella around stack shall be higher than the top of the flange around the opening in the deck, leaving a clear horizontal space for the escape of the gases, or else a perforated coaming shall be used.

11. Wood Burners. The stacks of all vessels using wood for fuel shall be fitted with spark arresters.

Article III. Steam Pipes.

12. Lagging and Clearances. All main and auxiliary steam pipe lines shall be thoroughly covered with asbestos or other approved material if within six inches of wood-work; and where such steam pipes pass through woodwork, they shall be fitted with a proper metal collar and the wood-work cut away or protected in an efficient manner.

Article IV. Bunkers and Holds for Coal.

13. Vents. Ventilation of all hold, wing, and 'tween-deck bunkers shall be provided for by pipes or trunks leading to outside atmosphere.

14. Temperature Testing. Reserve bunkers and holds shall be provided with sounding trunks so that internal temperature may be read as required.

Article V. Bunkers and Tanks for Oil.

15. General. The storage of oil shall be restricted to cellular double bottom, hold, deep, peak, bunker, settling and other tanks specially constructed for this purpose. These compartments and tanks shall be fitted with approved bulkheads, sub-divisions or swash plates. They shall be so

strengthened as to satisfactorily withstand the stresses brought upon them in a seaway when partially filled; and if separate from the hull shall be properly braced and secured thereto by chocks or clips riveted to both tank and foundation. The scantlings and riveting shall be in accordance with the requirements of the American Bureau of Shipping, or approved equivalent, for vessels and tanks carrying oil in bulk.

16. Location. Fuel tanks should not be located on deck; but if such arrangement is necessary, the installation must be approved.

In order to avoid as far as possible uncontrollable flooding in event of accident, the amount of piping under static head of fuel oil should be reduced to a minimum consistent with the design of the system.

17. On Wooden Vessels. On wooden vessels a lead lining shall be placed under tanks which are separate from the hull. Lining shall be not less than 8 lbs. per square foot, laid over a coaming at least 6 inches high and drained to a sump fitted with independent stripping suction at the lowest point. These tanks shall be not less than 18 inches from boilers at all points except the back, where they shall be at least 24 inches distant.

18. Tests. All oil storage compartments and tanks shall be tested by a head of water in accordance with the requirements of the American Bureau of Shipping or approved equivalent.

19. Painting. All oil tanks, compartments and bunkers shall be thoroughly coated on the outside with a suitable non-flammable and rust-resisting material of a color sufficiently light to readily show oil leaks.

20. Vents. An independent, permanently open, iron vent pipe terminating in a goose neck or approved automatic valve in the open air and above the weather deck shall be provided for every oil tank, compartment or bunker.

The aggregate free area of such vent pipes on tanks that may be filled under pressure shall equal at least the area of the filling pipes.

Vent openings shall be screened (40 x 40 non-corrodible mesh) and such screens shall be accessible for examination and removal.

Vents shall terminate well above the top of the fill pipe;

or, if tight connection to the tank is made in the filling line, at a point one foot above the level of the top of the highest reservoir from which the tanks may be filled and never less than 3 feet, measured horizontally and vertically, from any porthole, window or other similar opening.

21. Fill Pipes. On tankers, fill pipe deck terminals shall be kept closed when not in use; and on other oil burning vessels, they shall be so designed as to make access difficult by unauthorized persons and kept closed when not in use.

22. Manholes and Hatches. Manhole and hatch covers of oil tanks on all vessels shall be designed to fasten securely; and on oil burning cargo or passenger vessels shall be bolted, dogged or locked, and labeled or painted a distinctive color designating them as openings to oil tanks.

23. Drainage. Adequate means shall be provided by wells or gutter-ways and sparring or lining, to prevent any leakage from the fuel oil compartments coming into contact with cargo and to ensure that any such leakage shall have free drainage into the limbers or wells. In machinery spaces, such leakage shall be confined by gutter-ways to bilge cofferdam spaces next to tank bulkheads; and these spaces shall be drained independent of the main bilges by stripping suctions to a suitable pump.

24. Double Bottoms. If double bottoms under holds are used for carrying oil fuels, the ceiling shall be laid on transverse battens, having at least a two-inch air space between the ceiling and tank top and permitting free drainage from tank top into the limbers. The method of venting this space shall be subject to approval.

25. In Way. A clearance between oil tanks and boilers, boiler casings and breechings of not less than 24 inches at the back ends of boilers and 18 inches elsewhere shall be arranged; and all structures giving off heat shall be effectively insulated if within 18 inches of any oil tank or compartment.

26. Cofferdams. The practice of constructing a cofferdam between deep fuel tanks and cargo tanks or storage compartments is recommended for all oil burning steam vessels. Such construction is considered unnecessary on motor vessels using fuel other than gasoline. On steam

vessels burning oil of a flash point lower than 150° F., closed cup, there shall also be a cofferdam between fuel bunker and fire-room compartment. The space enclosed by cofferdams shall be vented in accordance with the provisions of section 20.

Article VI. Oil Burning and Heating Systems.

27. General. It is strongly recommended that systems whereby oil is pumped from tank to the burners be used; but in cases where pumping system is deemed impracticable and the use of gravity feed is desired, special permission shall be obtained for installation, and detailed plans submitted and approved.

Pumps shall be in duplicate, of an approved design, well secured against leaks under a test pressure 50% in excess of the designed pressure of the system carried.

Whether pumps are located inside or outside of the fire room, gear shall be installed for operation from deck of stop valves on each tank and throttle valve on both service and booster pumps. This provision does not apply to fuel pumps on motor vessels.

On steam vessels burning oil of a flash point lower than 150° F., closed cup, the pumps handling such oil shall be located in a compartment separated from the rest of the machinery space by gas-tight bulkheads and accessible therefrom only by a gas-tight door.

The piping and spindles of fire-room controls shall be made gas-tight where they pass through the pump room bulkheads.

This pump room shall be provided with induced ventilation always sufficient to reduce the pressure therein slightly below that in the compartment from which entry is made. The provision of section 20 shall also be observed.

28. Oil Level Indicating Devices. Devices for ascertaining or indicating the oil level in storage and service tanks shall be provided. Use of gauge glasses is prohibited. Sounding pipes and spring loaded trycocks normally closed are approved. Such trycocks should be properly guarded against mechanical damage and drained to a sump. It is recommended that, where practical, a compression chamber connected by air piping to a mercury gauge be installed, with gauge annunciator mounted on a board to indicate and signal audibly when the contents of each tank reach a

predetermined level. Other methods of determining the level of liquid may be used subject to approval.

29. Heating of Tanks. Where it is necessary to heat oil in storage tanks in order to handle it, the heating shall be done by means of properly installed coils or other approved system using only steam or water. Thermostatic control and thermometer are recommended for all heating devices.

30. Heaters, Other Than Those for Tanks. Heaters shall be of substantial construction, with oil-tight joints. Only steam, water or approved electric device may be used for heating. A $\frac{1}{2}$ -inch relief valve, set at 400 pounds per square inch and discharging to the suction line or tank shall be fitted on the oil side of all heaters to prevent the accumulation of excess pressure when the heater is shut down, due to expansion of the oil caused by leaky steam supply valve or failure to shut off the steam supply.

31. Burners and Air Registers. Drip pans shall be fitted under each burner. Air registers should include provisions for the inspection of burner tips while register is in use. Registers should permit ready adjustments in area of air openings.

Burners shall be fitted in the registers so that they may be either shut off, readily removed, or cleaned independently of each other.

Article VII. Fuel Oil Piping and Fittings.

32. Tank Piping. A piping system for fuel oil storage tanks separate and distinct from other piping in the vessel is recommended; but an interchangeable system providing a method which precludes the possibility of a mixture of ballast water and oil may be used, subject to approval.

33. Type and Material. All piping and fittings comprising the fuel oil system between pumps and burners shall be of the extra heavy type. Seamless drawn pipe is recommended for all pressure lines, but in installations burning oil of a flash point lower than 150° F., closed cup, such piping shall be seamless drawn. No pipe less than $\frac{3}{8}$ inch internal diameter may be used. Unions, if used in place of right and left couplings, shall be of an approved type.

34. Installations. All piping shall be run as directly as possible without sags and so installed that, where possible, pipes pitch toward supply tanks without traps, and provi-

sions shall be made for expansion, contraction, jarring and vibration.

35. Test. Oil piping between pumps and burners shall be tested and proven tight at a pressure of not less than 500 pounds per square inch. All joints and fittings in the pressure piping shall be kept oil-tight under service conditions.

36. Protection. Piping shall be exposed to sight wherever possible, to insure prompt detection of leaks, and shall be protected against mechanical injury in an approved manner.

Pipes extending above the floor, particularly risers to furnaces, shall be effectively cased or jacketed to prevent loosening or breakage.

Fill and vent pipes shall be protected in an approved manner against mechanical injury.

37. Valves. All valves shall be of an approved type. Shut-off valves shall be located as follows: on both sides of any strainers installed in pipe lines; in discharge and suction lines at the pumps; in discharge and suction lines to any tank except double bottom tanks, directly on the outside of the tank or on the inside if required by law; and in branch lines to burners.

A pressure relief valve shall be installed in the discharge line to burners and so arranged as to return surplus oil to the suction line.

38. Strainers. Duplex strainers shall be fitted in the suction of both booster and fuel oil service pumps; provided, however, that if booster pumps are used to deliver oil to the suctions of the service pumps, the strainers need be fitted only in the booster suction. Strainers shall be so designed that one side can be cut out for cleaning while the other is in service.

Article VIII. Lighting.

39. Lamp Rooms. All oil and lamp rooms or lockers constructed of wood shall be completely lined with sheet metal nailed over asbestos at least $\frac{1}{4}$ inch thick, and nailing protected in accordance with N. F. P. A. standard for fire door construction. No openings except doors or covers will be permitted.

40. Oil Lights. All oil lamps shall have metal bodies and, except hand lanterns, shall be kept in brackets well secured or suspended and stayed. They shall be secured in the brackets by an approved device for holding them in place, and shall have metal shields over them. Hand lanterns when suspended shall be secured by clips. It is recommended that solidified fuel, being safer and smokeless, be used in lamps, where possible.

41. Electric Installations. See Appendix B.

Article IX. Galley and Heating.

42. Ranges. The galley range shall be securely fastened to the deck, at least 1 inch air space or approved equivalent insulation being provided between the bottom of range and deck; and, if galley floor is wood, range shall have metal under it extending out in front at least two feet. If range is within 18 inches of a wooden bulkhead, such bulkhead shall be covered with sheet metal over asbestos at least $\frac{1}{4}$ inch thick. All smokepipes or stacks passing through wooden bulkheads or partitions shall be fitted with a proper metal collar and have woodwork cut away. Galley ranges shall have metal hood over them or have the ceiling protected with sheet metal over asbestos at least $\frac{1}{8}$ inch thick. No wooden warming racks over stoves will be permitted.

43. Steam Heat. A central heating plant on vessels is recommended. All heating pipes and radiators shall be kept clear of woodwork. Where radiators are adjacent thereto, a metal shield shall be fitted behind each, with $\frac{1}{4}$ inch air space between shield and woodwork.

44. Stoves. The use of stoves is discouraged; but where used, they shall be securely fastened to the deck, at least 1 inch air space being provided between bottom of stove and deck; and shall have sheet metal on the floor under them extending out on all sides at least 12 inches. If stove is within 18 inches of a wooden bulkhead, such bulkhead shall be protected with sheet metal over asbestos at least $\frac{1}{4}$ inch thick. All smokepipes or stacks passing through wooden bulkheads or partitions shall be fitted with proper metal collars and have woodwork cut away; and all wood-work within 8 inches of smokepipes shall be protected with sheet metal over asbestos at least $\frac{1}{8}$ inch thick.

EXTINGUISHING APPARATUS.

Article I. General.

45. In addition to fire fighting equipment required by rules of U. S. Steamboat Inspection Service, it is recommended that small gear, such as smoke helmets, life lines, slickers and gloves, be provided and kept in approved convenient places.

Article II. Hose and Couplings.

46. Hose shall be of an approved type. All hose couplings and fittings shall be in accordance with National Standard of the N. F. P. A.

Article III. Sprinklers.

47. Features of Design. To improve and encourage the use of sprinkler fire protection aboard ship, it is recommended that the following features be incorporated in any system:

The system and apparatus should be as simple and inexpensive as possible; and, so far as applicable to marine work, should comply in detail with regulations of the N. F. P. A.

The design should be such that it would operate only in case of fire, and not subject the ship or its contents to consequential damage due either to freezing, accidental operation, breakage or to any causes other than fire. To this end, the sprinkler pipes should preferably be empty and under atmospheric pressure; but served by fire pumps of ample capacity. The control should be dual, both manual and automatic; but it is recommended that the automatic feature be attained only through the use of a thermostatic control or other system which would prevent release of water except in the presence of heat.

48. Location. Automatic sprinkler equipment is recommended in cabin, store, crew and passenger spaces; and optionally, in cargo and machinery spaces, owing to the usual impracticability of stowing cargo or arranging machinery to allow proper distribution of a sprinkler equipment.

Article IV. Smothering Devices.

49. Steam Jets. Auxiliary boiler capacity is considered inadequate to supply steam as a smothering agent. On

steam driven vessels, steam jets controlled by master valves in accessible locations are recognized as of limited value for fighting fire in the cargo spaces; but maximum effectiveness of the system is dependent on thermal and stowage conditions seldom obtainable and it should not be relied upon for exclusive protection. The size and number of steam smothering pipes recommended herein are based on a steam pressure of 100 pounds. These sizes are suitable for pressures higher than 100 pounds, but for lower pressures they should be proportionately increased.

(a) Each compartment shall have a branch with steam jets nominally rated to fill it in not more than 15 minutes, neglecting condensation. The outlet or outlets shall be so located in the compartment as to facilitate even distribution of steam.

(b) The main supply pipe from boilers on steam lines shall be of sufficient size to supply 50% of the total volume of all the cargo spaces at one time.

(c) Main supply line, running forward and aft, shall be of equal area at any point to the combined area of the branches taken from same, but at no point need its area be in excess of the main supply from machinery space, or 50% of the area of all branches in the vessel.

(d) The orifice area of the steam jets supplied by any branch pipe shall be at least equal to the cross sectional area of such pipe; that is, the end of the pipe may be left open, or it may be closed and a number of openings made in the pipe, the combined area of which shall be at least equal in area to the open end of the pipe.

(e) Maximum size of branch steam pipe to any cargo compartment shall be one and one-half inches ($1\frac{1}{2}$) nominal diameter.

(f) Cargo spaces requiring more steam than would be supplied by a one and one-half inch ($1\frac{1}{2}$) pipe shall have additional branch pipes and steam jets.

(g) Minimum size of branch pipe to any cargo compartment shall be one inch (1") nominal diameter.

(h) Minimum size of branch pipe to lamp rooms, paint lockers, etc., shall be three-quarters inch ($\frac{3}{4}$) nominal diameter.

Where

L—Length of compartment, in feet.

B—Breadth of compartment, mean, in feet.

H—Depth of compartment, mean, in feet.

D—Diameter of pipe required, in inches.

Then

$$D^2 = \frac{L \times B \times H}{30000}$$

Or in accordance with the following table:

Values of $L \times B \times H$	Connection No. of Inlets	Size of Inlets
30,000	1	1" I.D.
46,000	1	1 1/4" I.D.
67,000	1	1 1/2" I.D.
94,000	2	1 1/4" I.D.
135,000	2	1 1/2" I.D.
203,000	3	1 1/2" I.D.

Size of Main steam pipe

$$D^2 = \frac{\text{Summation of all } (L \times B \times H)}{60000}$$

50. Gas. The use of inert gas, such as carbon dioxide, for extinguishing or preventing fire may be applied to holds, bunkers, and other closed compartments not normally accessible to crew or passengers, and to machinery and boiler compartments if an approved gas alarm signal is installed therein; but, on account of danger to life, the use of gas of this character shall be restricted to such spaces. On motor vessels and those equipped with insufficient boiler capacity to permit effective application of steam smothering, the installation of a gas system, subject to the foregoing restrictions, is recommended.

Tightness of compartments is a direct factor in the effectiveness of any smothering agent, and to that end, care should be taken that 'tweendeck hatches are properly tarpaulined and means for closing other openings provided as far as practicable.

The following are the recommendations of the National Board of Marine Underwriters for carbon dioxide smothering systems in cargo spaces:

1. It is recommended that motor vessels shall be equipped with an approved fire smothering system and should have a detection

EXTINGUISHING APPARATUS

system whereby the compartment in which a fire starts may be determined.

2. The Board of Underwriters approve CO₂ smothering systems consisting of requisite number of suitable I.C.C. cylinders (or equal) containing liquid CO₂ properly installed and piped to all compartments in which cargo may be carried.

3. A. The vessel shall carry at least 50 lbs. of liquid CO₂ for each 900 cu. ft. of cargo space in the largest of such compartments.

B. There shall be carried as a reserve supply such additional cylinders as may be considered necessary by the Board, considering the length of voyage, stowage of cargo, availability of additional cylinders at ports of call and other circumstances.

4. The releasing device shall be of such type that the entire contents of a cylinder can be discharged in less than sixty seconds.

5. All of the cylinders required in Section 3A shall be kept connected to the distribution piping system. The reserve supply provided in Section 3B shall be carried in such a place as to be immediately available.

6. Releasing devices shall be arranged to give an initial discharge of from 25% to 35% of an allowance of 50 lbs. per 900 cu. ft. for any compartment and to permit increments of 5% to 15% being added until fire is extinguished.

7. The number of cylinders to be released for each compartment to meet requirement "6" shall be conspicuously posted on a "Release Chart."

8. Ventilators to cargo compartments shall be equipped with devices for quick and effective closing of aperture in each compartment, such closing devices to be capable of operation from on deck.

9. After a fire is extinguished, the compartment in which it occurred shall be kept closed until a port is reached, neither ventilators nor hatches being opened.

10. When combustible fibres are to be carried in shelter deck spaces, such spaces shall be permanently or temporarily divided by fire-tight steel bulkheads making such shelter deck compartment not longer than the corresponding compartment below, and each such space to be served by a branch of the smothering system.

11. Wooden hatches and tarpaulins shall be placed on all hatches in multiple deck vessels.

12. The Board will also approve steam and other systems for smothering fires which in the opinion of the Board are equivalent to the above.

Article V. Machinery Space Apparatus.

51. **On Coal or Wood Burners.** In addition to regularly prescribed hose and extinguishers in each fire room, steam fire hose, coupled to the injectors, of sufficient length to reach all parts of fire room, should be provided.

52. **On Oil Burners and Motor Vessels.** In fire rooms of oil burners and in machinery spaces of motor vessels, a sufficient number of hand chemical fire extinguishers, rated Class B in National Fire Protection Association First Aid Fire Appliance Rules shall be provided; and a box of dry sand with a scoop shall also be supplied. It is recommended that an extinguishing system be installed to protect inaces-

sible parts of the machinery space; such as under boilers and under floor plates and in bilges of firerooms and motor rooms. A foam or carbon dioxide snuffing installation is approved for this purpose. Controls shall be manual and operated from outside of the spaces served. Additional inside control is optional, but if provided shall be manual. The type, number and location of extinguishers and the capacity and layout of extinguishing systems shall be subject to approval and as far as practicable in accordance with National Fire Protection Association Regulations on the subject.

Article VI. Extinguishers.

53. General. Hand chemical extinguishers should be distributed through all parts of the vessel accessible to crew or passengers, and the selection and distribution governed by the regulations of the N. F. P. A. on First Aid Fire Appliances. All extinguishers shall be of types approved by the U. S. Steamboat Inspection Service and on the List of Inspected Fire Protection Appliances issued by the Underwriters' Laboratories.

Article VII. Detection and Alarm.

54. General. It is recommended that on passenger and cargo vessels, except tankers, pipes for detection of smoke or fumes be led from holds, bunkers and inaccessible parts liable to fires, to the bridge, engine room or other points where they may be readily observed; and that vessel be equipped throughout with a fire alarm system approved as to type and installation. See Appendix F.

OPERATION.

Article I. General Requirements.

55. In addition to the U. S. Government Rules as to operation, quarters, stowage and packing of hazardous cargoes, etc., the following are recommended or required as noted.

Article II. Drills and Quarters.

56. It is recommended that certain members of the crew be designated as fire wardens and trained to special duties, such as use of smoke helmets and extinguishing apparatus, life saving, etc.; and that some form of compensation or privilege be accorded the men so designated.

Article III. Care of Coal Bunkers.

57. Care shall be taken that all vents are clear when bunkering is completed. In case of vessels having wooden bunkers using soft coal for fuel, same shall be thoroughly cleaned out at least once every sixty days while vessel is in commission. The coal bunkers of all vessels shall be cleaned on going out of commission or being laid up for over sixty days, making sure that all coal dust and rubbish are removed. Special care shall be taken in cleaning shelf pieces.

Article IV. Painting.

58. Care shall be taken to ventilate, so far as possible, all confined spaces where paint containing flammable ingredients is being used or stored, and naked lights in such spaces are prohibited. Paint lockers shall not be located in close proximity to boilers or stacks.

Article V. Fuel Oil Requirements.

59. **Flash Point.** These regulations are intended to apply generally to those oil burning equipments using only liquids having a flash point above 150° F., closed cup tester; however, the necessity, under certain conditions, of burning fuel oil of lower flash than this point is recognized and additional requirements for the use of such oils are noted in sections 26, 27, 33 and 78 of these regulations. No untopped oil shall be used for fuel except in accordance with these additional precautions.

60. **Flash Test.** In determining the flash point, either Elliott, Abel, Abel-Pensky or Tag closed testers shall be used, but the Tag closed testers (Standardized by the United Stats Bureau of Standards) shall be authoritative in case of dispute. All tests shall be made in accordance with the methods of tests as adopted by the American Society for Testing Materials.

Article VI. Loading and Bunkering of Oil.

61. **Preliminary.** Before commencing to load oil, all signal bells, gongs, etc., shall be tested to insure working condition.

62. **Oil Hose.** Hose used for filling or discharging shall be of the flexible metallic type equipped with oil tight flanged joints or some other approved coupling device for

the purpose of preventing rupture of connections. The inner metallic lining of such hose shall be effectively grounded against possible charge of induced electricity.

63. Hatches and Manholes. No double bottom, deep, peak or independent tank manhole or hatch opening shall be used for fuel oil filling purposes, except on tankers where trunk hatches extend to weather deck and proper warnings are posted while operation is under way.

Hatches on tanks shall be kept closed during loading or discharging except when in use for such purposes. Tugs or other steam vessels shall not be allowed alongside when oil tank hatches are open.

64. In Way. While oil is being received or discharged, open lights or fire, smoking or electrical apparatus liable to spark shall be kept remote from oil hose and openings in any tank or compartment containing a tank or vents.

65. Galley. If practicable, galley fires in tankers shall be extinguished during loading or discharging; otherwise, openings to the galley shall remain tightly closed.

66. Lights. Loading or discharging should, as far as possible, be carried on in the daytime. When carried on at night, no light shall be permitted on the deck. Flood lighting or lights in clusters suspended in the rigging well above the deck are approved. Wires shall not lie on or drag across the deck. The use of portable connected electric lights on deck of tankers or in tanks or pump rooms of any oil burning or oil carrying vessels is prohibited.

Article VII. Tank Cleaning and Disposal.

67. Dry Dock. When vessels containing fuel oil of any kind are in dry dock, care shall be taken that no oil drains on to the dock. Should it be necessary to remove oil from tanks, precautions shall be taken to prevent any oil escaping to form an accumulation of vapor or oil on or around the dock. Should any oil so escape, it shall be skimmed and disposed of ashore.

68. In Port. Tankers or other vessels carrying water for ballast in fuel oil compartments or double bottom shall not discharge such water ballast into rivers or harbors or adjacent to ships or docks.

69. Tank Freeing. Tanks, valves and pipe lines throughout the vessel shall be freed of vapor in accordance with the regulations of Appendix A before repairs in way are undertaken.

Article VIII. Precautions on Oil Burning and Tank Vessels.

70. Inspection. The inside of oil compartments and tanks should be inspected at least annually; and bulkheads separating such compartments from others should be examined for leaks during inspection and whenever oil is taken aboard.

71. Tank Readings. Gauge valves or crocks fitted to the storage or settling tanks shall be kept closed, except when a reading is to be made; and shall be closed immediately upon completion of the reading.

72. Dampers. Areas of dampers in stacks or up-takes of oil-burning boilers shall not exceed two-thirds of the cross-sectional area of such stacks or up-takes, in order to prevent dangerous accumulations of vapor in the furnace or breechings, with consequent blowing back into the fire room.

73. Tests. Whenever that part of the oil system subject to pressure has not been in use for a week, or after joints in same have been remade, it should be tested cold under a pressure at least equal to the working pressure; and a careful inspection made for leaks before fires are lighted. All fuel oil fittings should at all times be kept in working order; and the oil slots, drafts, and valves should be frequently tried when not in use to insure such condition.

74. Vents. Frequent inspection shall be made to insure that wire gauze screens in vents are clean and intact.

Article IX. Furnaces and Fires on Oil Burning and Tank Vessels.

75. Re-Lighting. In the event of oil accumulating in the furnace, such as might be caused by sudden extinguishing of the burners, the vapor must be blown out and drip oil removed before burners are again lighted.

76. Fire Room. Oil shall not be permitted to accumulate in the oil boxes, openings of furnaces, bilges, or on the floor plates; and no lighted material shall be allowed access to the bilges. After fires are out, bottoms of furnaces shall be examined and any oil remaining removed. In case of leak-

age of oil system in fire room, immediate action shall be taken to shut off the oil supply.

77. Galley. On tankers, when coal burning fires are lighted, the use of waste, chips, oil, etc., shall be prohibited, and only a limited amount of wood covered with coal shall be used. Every precaution shall be taken to prevent sparks or flame from blowing out the smokepipe.

78. Low Flash Oil. When oil of a flash point lower than 150° F., closed cup, is used, attention is called to the extra hazard incurred by permitting any such oil to escape and gas therefrom to form an explosive mixture with the in-closed atmosphere of fire room or compartment. Full information should be supplied to the Chief Engineer as to characteristics of oil to be shipped; and rules for handling, heating and burning of such oil should be laid down by him according to his best judgment and experience, and no deviation therefrom on the part of engineering subordinates allowed. This general regulation is promulgated pending the results of further investigation of low flash oil hazards.

79. Matches. The use aboard tankers or oil burning ships of other than strike-on-box matches is prohibited.

A P P E N D I X — A.

Regulations for Freeing Oil Tanks, Bunkers and Compartments of Dangerous Concentration of Flammable, Explosive or Toxic Gases Previous to Entering for Any Purpose or Making Repairs on Oil Burning or Oil Tank Vessels.

1. For the purpose of these regulations, an "explosive and flammable liquid" is defined as one which, when vaporized and mixed with air in proper proportion, is flammable or explosive.

2. (a) Before vessel shall enter a dry dock, shipbuilding or ship repair plant, or other establishment for the purpose of undergoing construction work or repairs and/or alterations of any kind, due diligence shall be used by the owner and/or operator to gas-free the compartments and pipe lines of such vessel subject to gas accumulation, with the exception of bunker tanks containing fuel. Before any repairs and/or alterations are undertaken on the vessel at the dry dock, shipbuilding or ship repair plant, a certificate prepared by a certified chemist approved by the American Bureau of Shipping, certifying that the compartments are then free from dangerous concentration of flammable explosive or toxic gases shall be obtained by the shipyard officials and copies furnished to the master and representatives of the owners. The only exception to the above shall be where a vessel has to dry-dock for examination and/or bottom painting, or enter a repair yard for repairs confined solely to work on the rudder, propeller, tailshaft, or other parts remote from the cargo compartments; and in this case the cargo compartments shall be sealed during the entire time the vessel is in the repair yard. Provided, however, that in case repairs and/or alterations to the bunker tanks of such vessels are to be made, then similar precautionary measures are to be taken and a like chemist's certificate shall be provided.

(b) Nothing contained herein, however, shall prohibit the cleaning and gas-freeing of vessels at a place especially set apart for such purpose by a dry dock, shipbuilding or ship repair plant.

(c) Nothing in the above shall be construed to prohibit the immediate dry-docking of a vessel in a sinking condition, or having a seriously damaged bottom, making it impractical to clean and gas-free her tanks in advance.

(d) On vessels elsewhere in port than as specified in paragraph (a), no repairs requiring use of fire or spark producing tools or equipment shall be made in and/or around tanks, pump rooms or upon pumps, cargo lines, heater coils or smothering lines, or in any spaces subject to gas emission or accumulation; until such tanks and such spaces shall have been freed of sediment and dangerous concentrations of flammable, explosive or toxic gases and passed as such by a certified chemist. Where fire or open flame equipment is used, the adjacent tanks and/or spaces shall be filled with water or gas-freed as noted heretofore and passed as such by a certified chemist.

(e) Where repairs are necessary in and/or around cargo tanks or spaces subject to gas accumulation, which will not require the use of fire or spark producing equipment, the compartment in question shall be cleaned thoroughly and freed of dangerous concentrations of flammable, explosive or toxic gases before proceeding with any such repairs.

(f) Overhaul of pumps and pipe lines at sea and emergency repairs, necessary to permit the vessel to go forward, either at sea or in a port where facilities for obtaining chemist's certificate are lacking may be executed without such certificate provided, however, all other provisions of paragraphs 2 (d) and 2 (e) are complied with.

3. (a) The process of freeing such containers of vapor shall be by the steaming method or any other effective method as insured in each case by the chemist's examination of the air content.

(b) It is recommended that an approved gas detector be provided at all repair yards or other places where repairs are executed in order to facilitate frequent determination of gas concentration. Such detector should be used only by persons designated by and under the general supervision of the certified chemist.

4. (a) If steaming method is used, the procedure shall be as follows:

Tanks shall be closed and live steam blown into the tanks, compartments or space to be cleaned, for a period of time to be governed by the condition or nature of the oil carried.

Regardless of method used for freeing tanks of vapor, all pipes leading to or from such tanks, compartments or spaces shall be thoroughly washed out and cleansed, and all pipes

connecting to other tanks containing oil shall be effectively blanked off. Vent pipes shall be proven and left open.

Inasmuch as the time for steaming will be determined by the foregoing, no definite rule is laid down to cover all contingencies, but the following table is recommended as covering average conditions:

Where

L—Length of compartment in feet.

B—Breadth of compartment in feet.

H—Depth of compartment in feet.

The time of steaming is arrived at by taking the number of hours given in the table under the actual size of steam connection corresponding to the value given for $L \times B \times H$, or the volume in cubic feet of the compartment to be steamed.

Size of steam connection at 100
pounds pressure

Value of $L \times B \times H$	1 in.	$1\frac{1}{4}$ in.	$1\frac{1}{2}$ in.
	Hours Steaming	Hours Steaming	Hours Steaming
Not exceeding			
30,000	20	14	10
40,000	26	18	13
50,000	32	22	16
60,000	38	26	19
70,000	44	30	22

The above calculations are based on a steam pressure of 100 lbs. per square inch.

In steaming tanks the last one-fifth of the steaming period should be carried out with the manhole plates or tank lids opened to the atmosphere.

(b) Upon completion of the operation above noted, the tank or space so treated shall have all manhole plates and covers or other openings removed and thoroughly ventilated by means of wind sails, forced or induced draft.

(c) Following this or any other process, specimens of air shall be taken by a competent chemist whose ability and reliability shall be certified by the American Bureau of Shipping. These samples shall be analyzed or tested by him, and if the tank or space from which samples have been taken still contain dangerous concentration of flammable, explosive or toxic gases, such further steaming and/or ventilating shall be carried out as recommended by the chemist. After such steaming and/or ventilating, further

samples shall be taken by him and analyzed or tested; this process to continue until the tank is certified by the chemist to be free of all dangerous concentration of flammable, explosive or toxic gases.

5. (a) The tests herein prescribed and required shall be made as provided by a competent chemist, whose ability and reliability shall be certified by the American Bureau of Shipping. The gas-free certificate shall indicate that the tank or space in question has been entered by the chemist, thoroughly examined and found to be free of sediment and dangerous concentration of flammable, explosive or toxic gases.

(b) When sediment and oil shall have been removed as per certificate, but the chemist considers dangerous regeneration of gas possible from unreachable oil remaining in crevices or under scale, he shall note on the certificates, when delivering them to the interested parties, the necessity of further testing of such tanks while undergoing repairs; and such tests as are recommended, shall be made before proceeding to completion of repairs covered by these certificates.

6. While repairs or cleaning operations (but not air samplings) are under way, a current of air under forced or induced draft shall be continuously circulated through the tank or other space.

NOTE: Ventilation may be accomplished by wind sails, draft forced or indirect by a blower, pump or fan. It is recommended that compressor or other air unit have a minimum capacity of not less than 400 cubic feet of free air per minute—and that motor and fan shall be of a type safe for use in hazardous atmospheres.

7. (a) Open lights or fire shall be kept remote from an opening in any tank or space not conditioned for repair as previously outlined. Lights carried into such tanks shall be electric, of a type approved by the Bureau of Mines for use in gaseous mines. Approved electric hand flash lights may be used as accessories.

If possible, all repairs should be made during daylight. Portable connected electric lamps are prohibited except when cables are protected by metal conduit and approved lamps securely attached thereto. Approved self-contained electric battery lamps may be used.

FREEING OIL TANKS OF FLAMMABLE VAPORS

(b) No repairs of any kind shall be made until the foreman is provided with a permit signed by an authorized official. This permit shall not be issued until tank or other container has been freed of vapors as previously outlined, and shall be carried by the foreman in charge and shown upon request to anyone in authority.

NOTE: It is recommended that a permit form similar to the following be used for this purpose:

Date: _____

Fire Permit No.

Permission is hereby granted to.....

(Foreman) to make repairs, including repairs necessitating the use of fire on.....

as follows:

Subject to the following conditions:

Fire to be kept as low as possible. All precautions to be taken to prevent sparks from flying. When finished using for the day, fire must be extinguished and coals thoroughly wet.

.....
Authorized Official.

8. Should any emergency require the entering of a tank, bunker or other space before it is thoroughly free of vapors, the person or persons so entering shall be protected by an air hole mask or a gas mask approved for such purpose by the Underwriters' Laboratories in accordance with tests prescribed by the U. S. Bureau of Mines. A rope shall be attached to the body of each man at work in the tank and each rope held by two strong men outside the tank. Persons at work within the tanks shall be under constant attendance, so that upon any indication of trouble they may be withdrawn.

Oxygen breathing apparatus may be worn for a period of not more than 20 minutes, after which it shall be aired for not less than 6 hours before further use. Wearers of respiratory apparatus shall be instructed and trained in their use before being permitted to enter a dangerous atmosphere.

A P P E N D I X — B.

ELECTRICAL INSTALLATIONS.

All electrical apparatus and wiring, including fixtures, fittings, etc., shall be installed in accordance with the current Marine Rules of the American Institute of Electrical Engineers, in so far as said Rules relate to fire and accident hazards.

Herewith are given salient paragraphs taken from the Rules above referred to, as illustrating the general nature of the requirements; but the quotation of these paragraphs is not intended to exclude any other paragraph of the aforesaid Rules having application to fire and marine hazards.

Numbers in brackets at headings of paragraphs are the section numbers in "Recommended Practice for Electrical Installations on Shipboard" (Marine Rules) prepared by the Marine Committee of the American Institute of Electrical Engineers.

When the American Standard for Electrical Installation on Shipboard, now in course of preparation by a Sectional Committee of the American Engineering Standards Committee, is finally adopted, extracts from this will be recommended to supersede the present text of Appendix B.

Generating Sets.

1. (42.) Name Plates. A suitable name plate should be supplied and mounted in a conspicuous place, indicating:

Maker's name,
Serial number,
Capacity in kilowatts, volts and amperes.
Normal speed,
Type,
Steam and exhaust pressures.

2. (45.) High Voltage Test. The dielectric strength of the insulation of the sets should be tested by a continuous application of alternating e.m.f. of 1500 volts for one minute between all circuits and ground; between shunt winding and other windings; between brush rings of opposite polarity; and between armature windings of generators, if provided with two commutators.

3. (49.) Installation and Location. Switchboards should be installed in the same compartment with generating sets, in a dry place, away from the vicinity of steam, water and oil pipes. The switchboard should be so located as to be

accessible from all sides, should be at least 4 inches from the deck, and 18 inches from all bulkheads. In front of the switchboards should be provided a hard wood horizontal hand rail. No other wood should be provided in the construction or protection of the switchboard. Current carrying parts should be at least 12 inches from the deck whenever possible.

4. (50.) Construction.

(a) **PANELS.** Material should be non-combustible, non-absorbent, insulating material, free from metallic veins, spots, etc., and should be of slate, impregnated ebony, asbestos lumber, or similar material. No single panel larger than 36 inches by 84 inches should be used, and if of slate it should be at least $1\frac{1}{2}$ inches thick. Each panel should have a bevel on the front edge. Small panels are preferable.

(b). **FRAMEWORK.** The supporting framework of panel should consist of angle iron or pipe standards and cross bar of liberal dimensions to provide support and securing of the panels. It is recommended that $\frac{1}{8}$ inch rubber cushioning washers be used behind each mounting bolt.

Switchboards.

5. (51.) Equipment.

(a) **GENERATOR SWITCHBOARD.** The following should be supplied for a two-wire system.

- 1—Voltmeter for one or more generators.
- 1—Ammeter for each generator.
- 2—Ground detector lamps for one or more generators.
- 1—Ground detector switch for one or more generators.
 - Multiple pole, independent arm or single-pole circuit breakers for each potential wire of each generator.
- 1—Selective voltmeter switch for two generators; when more than two generators are installed, one switch for each generator.
- 1—Illuminating lamp for each generator.

For small installations where only two generators are required and the circuits are not in excess of 100 amperes, when only independent operation of generating sets is desired, the equalizing switch may be omitted, and the circuits provided with double-pole, double-throw knife switches, properly protected with enclosed fuses.

(b) **DISTRIBUTION SWITCHBOARD.** The following should be supplied:

Each feeder circuit for power, lighting or heating, carrying current in excess of 100 amperes, should be protected by multiple-pole independent arm or single-pole circuit breakers. For circuits of 100 amperes or less a multiple-pole switch with enclosed fuses may be used. All fuses other than instrument fuses should be mounted on front of switchboard. Searchlight circuit should be provided with two single-pole or a double-pole independent arm circuit breaker and an ammeter.

6. (52.) Generator protection should be single-pole circuit breakers in each potential wire or a multiple-pole independent arm circuit-breaker which should open in case of overload as predetermined and should be provided with approved overload time-limit device. Fuses are not recommended for generator protection.

Cables.

7. (83.) **Leaded and Armored Cable.** In engine and fire rooms and adjoining spaces, bunkers, cargo spaces, refrigerator spaces, pump rooms, deck machinery spaces, outside work and in all deck houses and spaces not occupied as living quarters, conductors should be leaded and armored.

8. (84.) **Armored Cable.** For all spaces other than the above, including living quarters of officers and crews, and passenger accommodations, conductors may be armored only. In lighting fixtures the armor may be omitted and in fixtures of multiple of lamps, 2800-cir. mils stranded rubber and cotton braid insulated wire may be used for the individual lamps and spliced.

9. (85.) **Interior Communication Cable.** For interior communication circuits of less than 25 volts, single conductor of at least 2800-cir. mils may be used. For interior communication apparatus, such as telegraphs, and control circuits, such as telemotors, requiring two or more wires, interior communication cable should be used.

10. (86.) **Portable Conductor Armored.** Conductors for portable cargo fixtures, watertight and non-watertight portables, signaling lights and all portable or semi-portable fixtures outside living quarters should be two-conductor portable armored. Portable conductor for running lights should be three-conductor portable armored.

11. (87.) Portable Conductor Braided. Conductors for portable or semi-portable apparatus, such as desk lights, flat irons and curling irons used in living quarters, should be two-conductor portable braided.

12. (99.) Metallic Circuits. All circuits should be complete metallic and no ground return should be employed except for aerial or submarine transmission.

13. (158.) Protecting Cases. All controlling appliances except those installed on the main switch or distribution boards should be protected by enclosing cases provided with hasps and locks. Enclosing cases should be either non-watertight or drip-proof, designed to give mechanical protection and to prevent unauthorized manipulation; or of the watertight type.

Power Control.

14. (163.) Enclosures as Part of Control. Controllers for deck machinery when exposed to the weather should be of watertight construction with auxiliary panels containing protective devices and resistors similarly constructed or enclosed in a steel housing. The auxiliary panel, if separate, may be installed below decks, and may be of non-watertight construction. Arrangements, however, may be made for ventilating resistors while such auxiliaries as capstans, windlasses and deck winches are in operation.

15. (175.) Installation and Location. Controlling appliances should be in all cases installed convenient for operation as close to the motors as possible, and so located that free access may be had to all parts of the control.

Controlling appliances should be located as far as practicable in dry places, away from steam or water pipes, and in position least liable to mechanical injury.

In locating controllers, thought should be given particularly to the fact that, if put in out of the way places, they will probably be subjected to poor inspection, and the question of inspection should be one of the first considerations.

No wood or flammable material should be used in connection with the installation of controlling appliances.

If the controller does not completely break the motor circuit, a switch connecting all leads should be installed between the feeder and controller.

Controllers for deck auxiliaries when installed below decks, such as windlasses, may be of the non-watertight

construction. Controllers for engine room auxiliaries may be of the non-watertight construction, unless exposed to dripping moistures, etc. Controllers should not be located in places exposed to flammable gases, as on tank ships.

The engine room auxiliaries when equipped with automatic starters may have the starters installed adjacent to main switchboard, provided there is a starting and stopping button installed at the auxiliary.

Batteries.

16. (207.) Auxiliary batteries may be used for the purpose of maintaining emergency lights or other source of power where desired, at times when the regular lighting or power circuits of the ship are inoperative.

17. (208.) The location of the battery should be carefully considered at time of installation, and should be such as to protect the battery from damage in case of accident, so far as this is possible. Batteries used for emergency lighting, or to operate radio-motor-generator sets, should be located as high as possible and never below the main deck level. In selecting the location, exposure to extreme heat or cold, vibration, steam or salt water, is to be avoided.

18. (209.) **Size and Capacity.** When used for lighting, the battery should be of a size sufficient to maintain the emergency lights for at least six hours. When used for radio power, it should be of sufficient capacity to furnish all power required for operating the radio equipment for a period not less than six hours. The current and voltage required for such service should be specified by the manufacturers of the radio equipment. Where a common battery is used, for emergency lights and radio, the battery should have capacity to carry the combined loads for not less than six hours. When used for signal or intercommunication apparatus, the battery should be of sufficient capacity to maintain the systems to which it is connected in proper operating condition for not less than six hours.

19. (224.) **General.** Every vessel equipped with an electric lighting plant should be provided with means for emergency lighting in case of failure of the electrical plant, the capacity of which must be equal to the emergency lighting requirements for six hours.

A P P E N D I X — C.
Recommendations for the Stowage of
HAZARDOUS COMMODITIES.

A comprehensive treatment of the subject of hazardous cargoes and their packing and stowage is beyond the scope of these Regulations; but the following condensed tabulation may be used as a guide pending promulgation by the Interstate Commerce Commission of rules covering marine transportation, under authority of Act of Congress, March, 1921, and their probable enactment into law.

Key.

- A—On deck, in the open. Requires stowage on the open weather deck of a vessel, but the goods may be covered by tarpaulins or awnings to protect them from the elements.
- B—On deck, under cover. Requires stowage on the weather deck of a vessel, but the goods may be stowed in covered erections on such weather deck, such as lockers, forecastle, bridge and poop, having openings in the sides or ends, but no connections such as hatches, companionways or manholes to any cargo carrying compartment below deck.
- C—Under deck, away from heat.
- D—'Tween decks, readily accessible.
- E—Under deck in a separate compartment and with commodities having like characteristics or upon request with certain other commodities when approved by the inspection department having jurisdiction.

NOTE: References under Stowage to "Explosive Restrictions," "Magazine," "Cotton Regulations" and "Special" are to the rules of the Board of Underwriters (Marine) of New York on these subjects.

For the purposes of this Table flammable and combustible liquids are defined as follows: Flammable (or inflammable) liquids are those having flash points of 80° F. or below (Tag, open cup test) and bear I. C. C. Red Label. Combustible liquids are those having flash points 81° to 150° F. and bear no I. C. C. label.

Commodity	Properties	Stowage
Acetate, Amyl	See Amyl Acetate	
Acetic Acid over 80%	Corrosive liquid	B. or E.
Acetic Anhydride	Corrosive liquid	B.
Acetone	Flammable liquid	B. or E. Cool
Acetone Oil	Flammable liquid	B. or E. Cool

APPENDIX C

Commodity	Properties	Stowage
Acetyl Chloride	Corrosive and flammable liquid	A.
Acetylene	Compressed flammable gas	B. Cool
Acids	(See under name of acid)	
Acids, Nitric and Sulfuric Mixed or Nitrating Acid or Mixed Acid	Corrosive liquid	A.
Air, Compressed	Compressed gas	C.
Alcohol	Flammable liquid	B. or E.
Alcohol, Amyl	(See Amyl Alcohol)	
Alcohol, Denatured	Flammable liquid	B. or E.
Alcohol, Wood	Flammable liquid	B. or E.
Ammonia, Anhydrous	Liquefied gas, non-flammable	B. Cool
Ammonia Aqua	Strong smelling liquid, non-combustible	No fire hazard
Ammonium Nitrate	Oxidizing material	B. or D. Separate compartment from chlorates or sodium nitrite
Ammonium Perchlorate	Oxidizing material	B. or E.
Ammonium Picrate	High explosive	Magazine
Ammunition for cannon	Explosive	Explosive restrictions —Magazine
Ammunition for small arms		No restrictions
Amyl Acetate (Banana Oil)	Flammable liquid, strong odor	B. or E.
Amyl Alcohol	Combustible liquid, strong odor	B. or E.
Aniline Oil	Poisonous and bad smelling liquid	A.
Aniline Salt	Dry, solid	No fire hazard
Asphalt	Solid or semi-solid	No restrictions
Asphalt Paint or Varnish	Flammable liquid	A. or E.
Argon	Combustible liquid	C. or D.
Argon	Non-combustible compressed gas	C.
Arsenic Trioxide	Poisonous solid	Away from foods
Arsenic Acid	Poisonous liquid	Away from foods
Arsenious Acid	Poisonous solid	Away from foods
Banana Oil	(See Amyl Acetate)	
Barium Chlorate	Oxidizing material	B. or D. Separate compartment from ammonia compounds or acids

STOWAGE OF HAZARDOUS COMMODITIES

Commodity	Properties	Stowage
Barium Nitrate	Oxidizing material	Dry
Barium Peroxide (binoxide, dioxide)	Oxidizing material	B. or D.
Barrels , empty coal oil		A. or E. Prohibited unless tightly closed
Barrels , empty gaso-line		Prohibited
Batteries , wet	Corrosive Liquid contained	C. or D.
Batting Dross	Flammable solid	B. Cool
Benzine	Flammable liquid	B. or E.
Benzol (or Benzene)	Flammable liquid	B. or E.
Benzol, Trinitro	(See Tri-nitro Benzol)	
Benzoyl Chloride	Corrosive liquid, irritant, fuming	A. or B.
Benzyl Chloride	Corrosive liquid, irritant, fuming	A. or B.
Beta Naphthol	Solid, bad smell	Away from foods
Bi-Nitro toluol (or -ene)	Combustible solid or liquid. Odor contaminating to certain foods and liable to explode in ambient fire.	B. or in a hold with no other commodities susceptible to fires.
Bisulphide of Carbon	(See Carbon Bisulphide)	
Black Powder	Explosive	Magazine
Blasting Caps	Explosive	Magazine, away from other explosives
Blau Gas	Compressed flammable gas	B. Cool
Bleaching Powder (Chloride of Lime)	White powder, strong odor of chloride	E. Away from textiles and foods; cool; dry; special
Blood , dried	Brown solid, bad odor	Away from foods; dry
Brewers Grains	Dried brewers waste	Dry
Bromine	Corrosive and bad smelling liquid	A. Cool
Bronzing Liquid	Flammable liquid	B. or E.
Butane	Compressed flammable gas	B. Cool
Calcium Arsenate	Poisonous solid	Away from foods
Calcium Carbide	Solid material; produces acetylene gas if wet	D. Dry—Special
Calcium Cyanamide , (hydrated)	Non-hazardous, gives off ammonia gas if wet	Dry

APPENDIX C

Commodity	Properties	Stowage
Calcium Cyanamide (not hydrated)		Prohibited
Calcium Oxide , or Quicklime or Un- slaked Lime	Solid; gives off great heat if wet	B. Dry
Calcium Phosphide	Flammable solid; ignites in contact with water	B. Dry
Camphor	Combustible solid; strong odor;	Away from foodstuffs
Carbolic Acid (Phenol)	Poisonous liquid; offensive odor	A. or E.
Carbon Bisulphide	Flammable liquid; very offensive odor	A. Cool
Carbon Black (lamp black)	Finely divided black solid	No restrictions
Carbon Dioxide	See Carbonic Acid	
Carbon Oil (Pintsch gas drips)	Flammable liquid	B. or E.
Carbon Papers	Non-hazardous	No restrictions
Carbon Tetrachloride	Non-combustible liquid, strong odor	No restrictions
Carbonic Acid	Non-combustible gas	B. C. or D. Cool
Carbonyl Chloride	(See Phosgene)	
Celluloid (Xylonite), Fiberloid, Viscoloid, Pyroxylin Plastic)	Flammable solid	C. Cool
Celluloid Scrap or Pyralin Scrap	Flammable solid	A. Cool
Cement, Asphalt	Flammable liquid Combustible liquid	A. Cool C. or D.
Cement, Leather	Flammable liquid Combustible liquid	A. Cool C. or D.
Cement, Linoleum	Flammable liquid Combustible liquid	A. Cool C. or D.
Cement, Liquid	Flammable liquid Combustible liquid	A. Cool C. or D.
Cement, Naphtha	Flammable liquid	A. Cool
Cement, Roofing	Flammable liquid Combustible liquid	A. B. or E. C. or D.
Cement, Rubber	Flammable liquid Combustible liquid	A. Cool C. or D.
Cement, Waterproof	Flammable liquid Combustible liquid	A. Cool C. or D.
Charcoal, Animal (bone black)	Harmless	No restrictions
Charcoal, wood lump , crushed, ground, granulated or pul- verized	Liable to spontaneous ignition	C. Dry

STOWAGE OF HAZARDOUS COMMODITIES

Commodity	Properties	Stowage
Charcoal, screenings, ground or pulverized	Very liable to spontaneous ignition	C. Dry
Charcoal tablets in bottles	Non-hazardous	No restrictions
Chloride of Lime	(See Bleaching Powder)	
Chloride of Phosphorus	Fuming corrosive liquid	A. Dry
Chloride of Silicon	Fuming corrosive liquid	A.
Chloride of Sulphur	Fuming corrosive liquid	A.
Chloride of Tin, (Anhydrous Stannic Chloride or Tetrachloride)	Fuming corrosive liquid	A.
Chlorine Gas	Liquefied incombustible gas; poisonous and offensive	B. Cool
Chloroform	Non-combustible liquid anesthetic	A.
Chloropicrin	Deadly poisonous gas	Prohibited
Chlorosulphonic Acid	Corrosive liquid; strong odor	A.
Chromic Acid (anhydrous)	Oxidizing material	B.
Cleaning Fluids	Flammable liquid Combustible liquid	A. or B. C. or D.
Coal, pulverized (foundry facings)	Flammable solid (liable to spontaneous ignition)	B.
Coal Gas	Flammable gas	B. Cool
Coal Tar	Combustible liquid	E.
Coal Tar Distillate or Naphtha	Flammable liquid	B. or E.
Coal Tar (light oil)	Flammable liquid	B. or E.
Cobalt Resinate (precipitated)	Flammable solid	B.
Collodion	Flammable liquid	B. Cool
Collodion Cotton	See Nitro-Cellulose	
Cologne Spirits	Flammable liquid	B. or E.
Columbian Spirits	(See wood alcohol)	
Cotton, baled	Readily combustible	Cotton Regulations
Cotton Batting Dross	Readily combustible solid	B. Cool
Cotton, burnt	Flammable solid; liable to ignite spontaneously	A.

APPENDIX C

Commodity	Properties	Stowage
Cotton Waste , oily with mineral oil	Combustible solid	Cotton Regulations, Special
Cotton Waste , oily with animal or vegetable oil or wet cotton waste	Combustible solid, liable to spontaneous ignition	Cotton Regulations, Special
Creosote	Combustible liquid; offensive odor	Away from foods
Creosote Oil	Combustible liquid; offensive odor	Away from foods
Cresylic Acid	See Carbolic Acid	
Crude Oil (Petroleum)	Flammable liquid	B. or E.
Cyanide of Potassium	(See Potassium Cyanide)	
Cyanide of Sodium	(See Sodium Cyanide)	
Dental Gas (Nitrous Oxide)	Non-combustible gas (Asphyxiating)	B. Cool
Disinfectants	Offensive odor, generally poisonous	Away from foods
Dimethyl Sulphate	Corrosive liquid	A.
Dimethyl-Sulphide	Corrosive liquid, poisonous	A.
Di-Nitro-toluol (or -ene)	See Bi-Nitro-toluol	
Distillate	Flammable liquid	B. or E.
Driers, liquid	Flammable liquid	B. or E.
Dross, Rosin or Bating	Flammable solid	B. Cool
Drums, empty (previously containing flammable liquids)	Generally still contain some liquid	A. or E. Prohibited unless tightly closed
Dynamite	See High Explosives	
Electrolyte	Corrosive liquid	A.
Eradicators , paint or grease, liquid	Flammable liquids	A.
Ethane	Compressed flammable gas	B. Cool
Ether	Flammable liquid	A. Cool
Ethyl Acetate	Flammable liquid	B. or E.
Ethyl Chloride	Flammable liquid	A. Cool
Ethyl Methyl Ketone	Flammable liquid	B. or E.
Ethylene	Compressed flammable gas	B. Cool
Ethylene Chlorhydrin, 36-40%	No restrictions	
Ethylene Chlorhydrin, 98%	Combustible liquid	C. or D.

STOWAGE OF HAZARDOUS COMMODITIES

Commodity	Properties	Stowage
Ethylene Dichloride	Flammable liquid	B. or E.
Ethylene Glycol	Combustible liquid	C. or D.
Monobutyl Ether (Butyl Cellosolve)	Combustible liquid	C. or D.
Ethylene Glycol Monoethyl Ether (Cellosolve)	Combustible liquid	C. or D.
Ethylene Glycol Monoethyl Ether Acetate (Cellosolve Acetate)	Combustible liquid	C. or D.
Ethylene Glycol	Combustible liquid	C. or D.
Monomethyl Ether (Methyl Cellosolve)	Combustible liquid	C. or D.
Ethylene Oxide	Flammable Gas	B. Cool
Explosives, High	Explosive	Explosive restrictions
Extracts, liquid (flavoring)	Flammable liquid	B. or E.
Fiber	Combustible liquid	C. or D.
Films, Moving Picture (nitro-cellulose)	Readily combustible	Cotton Regulations
Ferro-Silicon	Flammable solid	C. Cool
Filter Press Cloth (new)	Solid material; may give off poisonous gas	B.
Filter Press Cloth (used or oily)	Non-hazardous	No restrictions
Firecrackers	Flammable	C. or D.
Fireworks	Fireworks	B. C. or D.
Fish Scrap or Meal	Offensive odor; may ignite spontaneously if damp	B. Dry or C., Special
Formaldehyde	Offensive odor; poisonous	B. Special
Formic Acid	Corrosive liquid	A.
Fulminate of Mercury, wet	Explosive	Magazine
Fulminate of Mercury, dry	Explosive	Prohibited
Fulminate of Silver	Explosive	Prohibited
Fuses, safety	Explosive	C. Dry
Fuses, detonating	Explosive	Magazine, separate hold from other explosives
Fusel Oil	Combustible liquid; offensive odor	A. or E. Away from foods
Gases	(See under name of gas)	

APPENDIX C

Commodity	Properties	Stowage
Gases, Lachrymatory	Poison	Prohibited
Gas Drips (Hydrocarbon)	Flammable liquid	B. or E. Cool
Gas Oil	Combustible oil	A. or E.
Gasoline	Flammable liquid	B. or E.
Grass, dried	Combustible	D.
Gun Cotton, dry	Explosive	Prohibited
Gun Cotton, wet 20% water in lined cases	Flammable	D., Special
Gun Powder (Black Powder)	Explosive	Magazine
Hay, baled	Combustible	Cotton Regulations
Hay, loose	Combustible	Prohibited
Helium	Compressed non-combustible	B. Cool
Hemp, baled	Combustible fiber	Cotton Regulations Dry
Hemp, loose	Combustible	Prohibited
Hydriodic Acid	Corrosive liquid	A.
Hydrobromic Acid	Corrosive liquid	A.
Hydrocarbon Gas	Compressed flammable gas	B. Cool
Hydrocarbon Gas Drips	Flammable liquid	B. or E. Cool
Hydrochloric Acid (Muriatic)	Corrosive liquid	A.
Hydrocyanic Acid	Poisonous gas	Deadly poison— B. Cool; Special
Hydrofluoric Acid	Corrosive liquid	A.
Hydrofluosilic Acid	Corrosive liquid	A.
Hydrogen Gas, compressed	Flammable gas	B. Cool
Hydrogen dioxide or peroxide	Non-combustible liquid	B. Cool; away from Textiles
Insecticide, liquid	Flammable liquid; poisonous	A.
Insulation Tape (varnished cloth)	Combustible liquid	C. or D. Special
Iron Mass, or Iron Sponge (in bags)	May ignite spontaneously	A. or B. Cool
Iron Mass, spent	May heat spontaneously if improperly prepared	D.
Iron Sponge, spent	Liable to spontaneous ignition	Prohibited
Iron Oxide, spent	Liable to spontaneous ignition	Prohibited

STOWAGE OF HAZARDOUS COMMODITIES

Commodity	Properties	Stowage
Isobutane	Compressed flammable gas	B. Cool
Isopropanol (Isopropyl Alcohol)	Flammable liquid	B. or E.
Jute	Baled fiber	Cotton Regulations
Kerosene	Combustible liquid	A. or E.
Ketone, Methyl or Ethyl	Flammable liquid	A. or D.
Lacquer	Flammable liquid	B. or E., Special
Lamp Black	(See Carbon Black)	
Lead Nitrate	Oxidizing material	D.
Lead Picrate	High explosive	Prohibited
Leather Cement	Flammable liquid	A.
	Combustible liquid	C. or D.
Leather Dressing	Flammable liquid	A.
	Combustible liquid	C. or D.
Ligroin	Flammable liquid	A.
Lime, unslaked	Solid, gives off great heat if wet	B. Dry
Liquefied Petroleum Gas	Compressed flammable gas	B. Cool
Magnesium (powder, metallic or ribbon)	Flammable solid	D.
Magnesium Peroxide	Oxidizing material	B. or D.
Matches (safety or strike-on-box matches)	Flammable solid	B. or D. or E., Special
Matches , Strike anywhere	Flammable solid; liable to accidental ignition	B. or D. or E., Special
Metal Polish	Flammable liquid	A. or B.
	Combustible liquid	C. or D.
Methane	Flammable gas	B. Cool
Methyl Acetate	Flammable liquid	B. or E.
Methyl Alcohol	Flammable liquid	B. or E.
Methyl Chloride	Compressed flammable gas	B. Cool
Methyl Ethyl Ketone	(See Ethyl Methyl Ketone)	
Methyl Sulphide	(See Di-methyl Sulphide)	
Military and Naval Explosives and Devices Containing Explosives		Magazine
Mirbane Oil (Mono-Nitro-Benzol)	Combustible liquid offensive odor	A.

APPENDIX C

Commodity	Properties	Stowage
Mono-Chlor-Benzol	Flammable liquid	A., B. or E.
Mono-Nitro-Benzol	(See Mirbane Oil)	
Moss, Baled	Combustible	Cotton Regulations
Motor Fuel	Flammable liquid	B. or E.
Mustard Gas	Poisonous Gas	Prohibited
Moving Picture Film (Nitro-cellulose)	Flammable solid	C. Cool
Muriatic Acid	(See Hydrochloric Acid)	A.
Naphtha	Flammable liquid	B. or E.
Naphtha Distillate	Flammable liquid	B. or E.
Naphtha, Coal Tar	Flammable liquid	B. or E.
Naphtha Soap	May give off slight amount of flammable vapor	Ventilated
Naphtha, Wood	(See Methyl Alcohol)	
Naphthalene	Combustible solid; strong odor	Away from foods
Nitrate of Soda	(See Sodium Nitrate)	
Nitrate of Barium, Lead or Strontium	Oxidizing material	Dry
Nitre Cake	Hygroscopic material containing free acid	B. or E.
Nitric Acid	Corrosive liquid	A.
Nitro Benzol	Combustible liquid; strong odor	A.
Nitrocellulose, dry	High explosive	Prohibited
Nitrocellulose, wet with 20% water, lined cases	Flammable solid	D. Special
Nitrocellulose, wet with solvent, at least 30%	Flammable; may give off flammable vapor	B. Special
Nitrogen	Compressed non-combustible gas	B. Cool or C.
Nitro Guanidine, wet	Flammable solid	C. or D.
Nitro-Starch, dry	High explosive	Prohibited
Nitro-Starch, wet with 20% water, lined cases	Flammable solid	D. Special
Nitroglycerine	High explosive	Prohibited
Nitrous Oxide	Compressed non-combustible gas	B. Cool
Oiled Clothing	May ignite spontaneously if improperly prepared	D.
Oil, animal or vegetable in wooden barrels	May cause spontaneous ignition if mixed with fiber or textiles	

STOWAGE OF HAZARDOUS COMMODITIES

Commodity	Properties	Stowage
Oil, Naphtha	Flammable liquid	B. or E.
Oil, Pine Tar	Combustible liquid	Away from foods B., D. or E.
Oil of Vitriol or Sulphuric Acid	Corrosive liquid	A.
Oxygen, compressed	Non-combustible gas	B. Cool
Oxylithe (Sodium Peroxide)	Oxidizing material	B.
Oxone (fused Sodium Peroxide)	Oxidizing material	C. Dry
Paints, Aluminum, Bronze or Gold	Flammable liquid	B. or E.
Paints, Mixed	Flammable liquid Combustible liquid	A. or E. C. or D.
Paint or Varnish Remover	Flammable liquid	A. or E.
Paper Stock or Waste, baled	Combustible solid	Cotton Regulations
Pentane	Flammable liquid	A. Cool
Perchloric Acid	Corrosive	A.
Percussion Caps	Explosive	D.
Petroleum Crude (crude oil)	Flammable liquid	B. or E.
Petroleum Distillate	Flammable liquid	B. or E.
Petroleum Ether	Flammable liquid	B. Cool
Petroleum Gas (liquefied)	Flammable liquid	B. or E. Cool
Petroleum Oil	Combustible liquid	A. or E.
Phenol	(See Carbolic Acid)	
Phosgene	Poisonous gas	Prohibited
Phosphorus, Amorphous or Red	Flammable solid	A.
Phosphorus, White or Yellow	Flammable solid; spontaneous ignition if exposed to air	A.
Phosphorus Chloride	Fuming corrosive liquid	A. Dry
Phosphoric Anhydride	Flammable solid	B. Dry
Phosphorus Sesquisulphide	Combustible solid	D.
Phosphorus Trichloride	Corrosive liquid	A.
Phosphorus Pentachloride	Flammable solid	B.
Phosphorus Oxychloride	Corrosive liquid	A.
Picric Acid, dry	High explosive	Magazine
Picric Acid, wet with 20% water	High explosive	Magazine

APPENDIX C

Commodity	Properties	Stowage
Picrate of Ammonia	High explosive	Magazine
Pintsch Gas	Compressed flammable gas (See Carbon Oil)	B. Cool
Pintsch Gas Drips		
Poison Gas	Poisonous vapor or fumes	Prohibited
Polishing liquids	Flammable liquid Combustible liquid	A. or B. C. or D.
Potassium Bromate	Oxidizing material	B. or D. Away from acids and ammonia compounds
Potassium Chlorate	Oxidizing material	B. or D. Away from acids and ammonia compounds
Potassium Cyanide	Poisonous solid	C. or D.
Potassium Nitrate	Oxidizing material	B., D. or E. Away from acids
Potassium Pechlorate	Oxidizing material	B. or D. Away from acids
Potassium, Metallic	Flammable solid	B. or D. Dry
Potassium Permanaganate	Oxidizing material	B.
Potassium Sulphide (fused, chipped or concentrated)	Flammable solid	B. Dry
Potassium Sulphide (crystal)	Non-hazardous	Away from foods
Powder, black	Explosive	Magazine, Special
Powder, smokeless, cannon	Explosive	C.
Powder, smokeless, for small arms	Explosive	Magazine
Powder, Flash	Common fireworks	B. C. or D. Cool
Primers, Small Arms	Explosive	D.
Primers, Cannon	Explosive	D.
Propane	Compressed flammable gas	B. Cool
Propylene	Compressed flammable gas	B. Cool
Pyroxylin Plastic	(See Celluloid)	
Pyroxylin Plastic, Scrap	Flammable solid	A. Cool
Pyralin (finished celluloid sheet)	Flammable solid (See Celluloid)	C. Cool
Pyridine	Flammable liquid offensive odor	B. Cool
Quicklime	Solid; gives off great heat if wet	B. Dry

STOWAGE OF HAZARDOUS COMMODITIES

Commodity	Properties	Stowage
Rags , wet or oily	Liable to spontaneous ignition	A. Special
Rags , not wet or oily	Combustible solid	Cotton Regulations
Railway Fuses	Common fireworks	B. C. or D. Cool
Railway Torpedoes	Special fireworks	B. Cool
Roofing Cement	Flammable liquid	A. B. or E.
	Combustible liquid	C. or D.
Rosin Dross	Flammable solid	B. Cool
Rubber Cement	Flammable liquid	A. Cool
	Combustible liquid	C. or D.
Rubber Scrap (not ground nor buffed)	Not dangerous	C.
Rubber Scrap (ground or buffed)	Flammable solid	B. Cool
Rubber (reclaimed or shoddy)	May be flammable solid	B. Cool
Safety fuses		Dry
Saltpetre , in bags	Oxidizing material	Dry
Saltpetre , in boxes or kegs	Oxidizing material	Dry
Sheep dip (not containing flammable ingredients)	Poisonous	Away from foods
Shellac , liquid	Flammable liquid	B. or E.
Shoe Cement	Flammable liquid	A. Cool
Sisal (Baled Fiber)	Combustible fiber	Cotton Regulations
Smokeless Powder	(See Power, Smokeless)	
Soap , Naphtha	(See Naphtha Soap)	
Sodium Chlorate	Oxidizing material	B. or D. Away from acids and ammonia compounds
Sodium Cyanide	Poisonous solid	A. or B.
Sodium , Metallic	Flammable solid; fire or explosion in contact with water; liable to ignition	B. or D. Dry
Sodium Nitrate	Oxidizing material	Dry
Sodium Nitrite	Oxidizing material	B. or D. Separate compartments from Ammonium Nitrate
Sodium Peroxide	Oxidizing material	B. Dry; isolated
Sodium Sulphide (fused, chipped or concentrated)	Flammable solid	B. Dry
Sodium Sulphide (crystal)	Non-hazardous, offensive odor	Away from foods
Solvents	Combustible liquids	B. or E.

APPENDIX C

Commodity	Properties	Stowage
Strontium Nitrate	Oxidizing material	Dry
Sulphur	Combustible solid	No restrictions
Sulphur Chloride	Fuming corrosive liquid	A.
Sulphur Dioxide	Compressed non-combustible gas (suffocating odor)	B. Cool
Sulphuric Acid	Corrosive liquid	A.
Sweepings (cotton mill, not containing animal or vegetable oil)	Combustible	Cotton Regulations
Tankage , leather, hair, rough ammoniates	Combustible if improperly dried, liable to spontaneous ignition	B. or E. Dry
Tankage , garbage or slaughter house	Combustible if improperly dried, liable to spontaneous ignition	B. or E. Dry
Tar	Combustible liquid	A. or E.
Tar Oil	Odorous combustible liquid	B., D. or E.
Thermit	Combustible solid	No restrictions
Thermit Ignition Powder	Flammable solid	D.
Thorium Nitrate	Oxidizing material	Dry
Tin Chloride	(See Chloride of Tin)	
Tin Tetrachloride (Bichloride Anhydrous)	Corrosive liquid	A.
Titanium Tetra-chloride	Fuming corrosive liquid	A.
Toluol (or -ene) Di or Bi-nitro	(See Bi-Nitro-toluol)	
Toluol (or -ene) Mononitro		B. or D.
Toluol (or -ene) Trinitro	High explosive	Magazine
Torpedoes, Toy	Special fireworks	B. Cool
Tow	Combustible fiber	Cotton and Hemp Regulations
Tri-nitro Benzol	High explosive	Magazine
Tri-nitro Phenol	High explosive	Magazine
Turpentine	Combustible liquid	B. or E.
Turpentine substitute	Combustible liquid	B. or E.
Type Cleaning Compounds	Flammable liquid	A. or B.

STOWAGE OF HAZARDOUS COMMODITIES

Commodity	Properties	Stowage
Varnish	Flammable liquid Combustible liquid	A. or E. C. or D.
Valeric Acid	Bad odor	Away from foods
Varnished Cloth or Paper	Combustible; may ignite spontaneously (See Paint Remover)	D.
Varnish Remover		
Vinyl Chloride	Compressed flammable gas	B. Cool
Vinyl Acetate	Flammable liquid	B. or E.
Vulcanizing Compounds	Flammable or corrosive liquid	A. or B.
Waste (if not wet or oily with animal or vegetable oil)	Combustible	Cotton Regulations
Waste (if wet or oily with animal or vegetable oil)	Liabile to spontaneous ignition	A.
Water Gas Tar	Odorous Combustible liquid	D. or E.
Wood Flour	Combustible	No restrictions
Wood Alcohol	Flammable liquid	B. or E.
Wool, natural	No restrictions	
Wool, oily or greasy	Combustible solid	Special
Xylol or Xylene	Combustible liquid	B. or E.
Zinc Dust	Slightly combustible; liabile to spontaneous ignition if wet	Dry

A P P E N D I X — D.

INTERNAL COMBUSTION ENGINES.

The provisions of Appendix D supplement and supersede the provisions of the Main Rules in their application to motor driven vessels. Where no specific ruling is provided in Appendix D, provisions of the Main Rules shall apply.

GASOLINE ENGINES.

1. Location, Material and Construction of Fuel Tanks:

(a) It is recommended that fuel tanks be located in water-tight compartments separate from but adjacent to the engine room, mounted in a pan or on a metal lined water-tight flat, above the load line, with overboard drains. Where this arrangement is not practicable, fuel tanks may be located to suit the design of the vessel, but preferably outside of the engine compartment and so that excessive lengths of feed piping will be avoided. All tanks shall be substantially secured in position to prevent movement and installed to afford as ready external examination and access as possible.

(b) Portable tanks below decks shall not be permitted.

(c) Fuel tanks shall be constructed of copper of thickness not less than No. 18 gauge (U. S. Std.) or of iron or steel of thickness not less than No. 14 gauge (U. S. Std.), except that on light runabouts where cylindrical iron or steel tanks are used, those not exceeding 35 gallons capacity shall be of not less than 18 gauge (U. S. Std.) and those of 35 to 70 gallons capacity, of not less than 16 gauge (U. S. Std.). Copper is preferable for all gasoline tanks. Ferrous metal should be used only for cylindrical tanks. Non-corrosive alloys may be used subject to approval. Steel or iron tanks shall be galvanized both inside and outside after completion or kept well coated to prevent corrosion. Tinning inside of fuel tanks is a recommended practice.

(d) Seams of copper tanks shall be rolled, riveted and soldered or rolled and brazed. All outside rivet points and heads shall be soldered or brazed.

Seams of ferrous metal tanks shall be welded or riveted and welded.

All outside rivet points and heads shall be welded.

(e) If fuel tanks have flat heads or are not cylindrical, they shall be fitted with diaphragms, of same character of material as tanks, to break the wash of contents; and shall be properly braced on flat surfaces by diaphragms or other

stays to prevent bulging and panting. Diaphragms in tanks shall be well fastened by angles or flanges. Flanges shall be bent to an inside radius of not more than twice the thickness of the flanged sheet and the riveting, welding or brazing shall be as close to the throat of the flange as practicable.

For pressure fuel tanks, the cylindrical type is recommended.

(f) Tanks shall be designed with a factor of safety not less than 4. Gravity tanks shall be tested by static head above tank top of 10 feet of water, without showing leakage or permanent deformation. Pressure tanks shall be tested to twice the designed working pressure or that required for gravity tanks, whichever is the greater, without leakage or permanent deformation.

(g) Outlets on gas feed line for drawing loose gasoline for any purpose whatever are prohibited in the engine compartment. Drains in the bottom of fuel tanks are not recommended, but where fitted shall be closed by plugs or plugged pipes threaded into spot faces, riveted and soldered, welded or brazed to the tank.

(h) It is recommended that all outlets pass through the top of the tank. In cases where outlets pass through side or bottom, connections shall be threaded into spot faces, riveted and soldered, welded or brazed to the tank. It is recommended that where practicable such connections be made up with a lock nut and copper washer inside.

(i) Shut-off valves or cocks of approved type, such as those having ground seats or plugs, shall be placed in the supply line from tank. One valve shall be placed as close to the tank as practicable, another as close to the carburetor as practicable. If shut-offs are of the cock type they shall be spring seated and provided with stops to indicate the open and closed positions.

Shut-off handles shall be readily accessible. Where the installation permits, a device shall be provided for closing the shut-off at the tank from outside the tank compartment, preferably from on deck. It is recommended that a heat actuated device be installed so as to automatically shut off fuel supply near the tank in event of fire.

Tanks large enough to permit the entrance of workmen shall be fitted with an internal gate valve shut-off with a control rod leading to an accessible place on the open deck.

(j) Vents or reliefs leading outboard shall be provided on all gasoline tanks; sizes to be as follows:

0 to 100 gals.— $\frac{3}{8}$ in. I. P. S.
101 to 150 gals.— $\frac{1}{2}$ in. I. P. S.
151 to 300 gals.— $\frac{3}{4}$ in. I. P. S.
301 to 500 gals.— 1 in. I. P. S.

Two vents or reliefs having a combined area equivalent to that specified above may be used in place of a single vent or relief.

(k) Gauge glasses and try cocks shall not be used. Other methods of indicating the level of the liquid may be used, provided, however, that they are so arranged as not to expose the liquid or vapor.

(m) Auxiliary gasoline tanks shall be of a type permitting the same fill pipe and vent arrangement as required on main tanks in order to avoid handling of loose gasoline under deck. On existing installations, where tanks are mounted, or on integral with auxiliary power units, and it is impracticable to alter in compliance with the above, gasoline supply for such tanks shall be kept only in approved safety cans filled at a station, and particular care against spilling shall be exercised in the operation of filling the auxiliary tanks therefrom.

2. Fuel Piping.

(a) All fuel piping shall be seamless drawn annealed copper tubing or I. P. S. copper pipe.

(b) Fittings and connections for tube shall be at least equal to the solderless type of the S. A. E. Standard Practice Code* and for pipe, with the exception of ground unions, shall be standard pipe threaded and soldered.

All valves, cocks and pipe or tube fittings shall be of non-ferrous composition.

(c) Piping shall be run in sight whenever practicable, protected from mechanical injury and effectively secured against vibration by neat fitting clips.

(d) A strainer of approved type with bolted or dogged bonnet shall be fitted in the feed line within the engine compartment and supported to take its weight off the line. A shut-off shall be fitted on each side of strainer to permit opening and cleaning.

*Published in the handbook of the Society of Automotive Engineers.

(e) Filling pipes and sounding holes shall be so arranged that vapors or possible overflow when filling can not escape to the inside of the boat and will run overboard. A pipe made tight to tank and to filling plate on deck outside of cockpit and coamings meets this requirement.

Filling pipes shall extend nearly to the bottom of the tank, and a strainer of non-corrodible wire mesh fitted in the throat of the fill is recommended.

To minimize vibration and strains at the tank top, filling pipes may be offset or connected to a diaphragm plate fitted on the tank.

3. Carburetor.

(a) All carburetors shall have integral therewith or properly secured thereto an approved drip collector. This shall be drained by a device for effectively returning drip to engine intake or discharging it overboard.

(b) Air intakes shall be so directed that backfire can not blow down into the bilge and shall be fitted with an approved backfire flame arrester.

4. Motor and Exhaust.

(a) The exhaust manifold should be water jacketed and cooled by discharge from a pump which operates whenever the engine is running; if not, woodwork within nine inches shall be protected by $\frac{1}{8}$ -inch asbestos board covered with sheet metal. A dead air space of $\frac{1}{4}$ inch shall be left between the protecting asbestos and the wood, and a clearance of not less than 2 inches maintained between the manifold and the surface of such protection.

(b) Where the exhaust pipe is overhead or where a low level exhaust is not cooled by the entire discharge of circulating water, it is recommended that a length of not less than twelve diameters of such exhaust pipe adjacent to the manifold be water jacketed and cooled in same manner as manifold.

Where the first twelve diameters of exhaust is neither jacketed nor cooled by entire discharge of circulating water, woodwork within 6 inches of any part of the exhaust shall be protected by $\frac{1}{8}$ -inch asbestos board covered with sheet metal. A dead air space of $\frac{1}{4}$ inch shall be left between the protecting asbestos and the wood and a clearance of not less than one-half its diameter shall be maintained between the pipe and the surface of such protection.

(e) Exhaust piping shall be led to the point of escape with a minimum number of bends or elbows. Ninety degree elbows or bends of less than five diameters radius are not recommended.

5. Bilge.

Frequent flushing and cleaning of bilges is recommended. Drain outlets should be fitted in the bottom of the hull and particular attention paid to securing complete drainage thereto and to the bilge pump suction in order to facilitate this operation, either hauled out or afloat.

6. Ventilation.

Any compartment or space in which a motor is located, particularly the lower portion and bilges, shall be provided with ventilation effective to remove all accumulation of flammable or explosive vapor. Tank compartments should be similarly ventilated when practicable.

To meet this requirement, the following is recommended:—Where motors and/or tanks are in compartments; permanently open and adequate inlet and outlet ventilating ducts extending to the bilges should be installed; two inlets leading to the wings at one end of the compartment and two outlets from the wings at the opposite end.

Where motors and/or tanks are not in compartments; at least one such duct should be installed in the fore part of the boat and one in the after part. Inlet ducts should be provided with cowls or equivalent fittings.

Where feasible, it is also recommended that:—

Outlet ducts be fitted with wind-actuated self-trimming or rotary exhauster heads; or that power or hand operated blowers be fitted in each inlet duct or exhauster in each outlet duct. If power exhausters are used, motors shall be of approved explosion proof type installed outside of the ducts.

7. Operation.

Attention is called to the hazard involved in the handling of gasoline. An atmospheric concentration as low as $1\frac{1}{4}$ per cent is practically odorless, but is sufficient to create a mixture which may be exploded by a slight spark. Such explosive vapor may travel a considerable distance from the point of leakage.

Gasoline vapors are heavier than air and do not readily escape from low lying pockets such as bilges or tank bot-

toms. A recently emptied gasoline tank is in its most dangerous condition. The following precautions are recommended therefore in order to reduce the fire and/or explosion hazard:

- (a) All gasoline connections shall be tight.
- (b) Care shall be taken not to expose gasoline in closed spaces through spilling, drawing off, storage, or use in cleaning, no matter how small the quantity.
- (c) Ventilation as adequate as possible shall be insured by attention to all arrangements therefor both before starting and while running.
- (d) Naked lights, however small, shall not be carried into compartments where gasoline vapor may be present.
- (e) The engine compartment shall be kept clean and free from flammable rubbish.
- (f) A continuous metallic connection shall be maintained during filling operations.

NOTE: There is a serious hazard from static discharge unless the above rule is complied with.

GENERAL REQUIREMENTS FOR FIRE PROTECTION ON MOTOR CRAFT.

8. Hull Arrangement.

From standpoint of fire hazard, it is highly desirable that bilges of machinery and fuel tank spaces should be separated from bilges of accommodation spaces by bulkheads as tight as practicable, i.e. of double diagonal wood, steel plate or equivalent construction.

9. Galley Arrangement. (Applies also to sailing and steam craft.)

- (a) For the reason that galley stoves are liable to promiscuous, unskilled or ignorant operation more than any other piece of boats' gear involving fire risk; it is important that such equipment should be selected and installed with a view to minimizing both the personal and physical hazards.
- (b) Cooking or heating stoves should not be located in the same compartment with machinery or gasoline tanks; but when such arrangement is unavoidable, stoves shall be placed as remote as possible from carburetors and tank connections.

(c) Woodwork within 12 inches of bottom and sides and 24 inches over top of stoves shall be protected with $\frac{1}{8}$ inch asbestos board covered with sheet metal and a dead air space of $\frac{1}{4}$ inch left between the protecting asbestos and the woodwork.

(d) Fixed stoves shall be permanently secured in place. Portable stoves shall be rigidly secured in place when in use.

10. Galley Stoves. (Applies also to sailing and steam craft.)

(a) **COAL, CHARCOAL OR WOOD:**—Such stove installations are covered in Secs. 42-44, page 11, Regulations on Marine Fire Hazards.

(b) **ALCOHOL, SOLID AND FLUID:**—Containers of solidified alcohol shall be properly secured on a fixed base to prevent sliding or overturning in a sudden roll of vessel.

For fluid burners where wet priming is used, a catch pan not less than $\frac{3}{4}$ inch deep shall be secured inside the frame of the stove or metal protection thereunder flanged up $\frac{3}{4}$ inch to form a pan.

Gasoline shall not be used for priming.

Either pressure or gravity feed is permissible, but where gravity or siphon is used an easily accessible shut-off valve shall be fitted in feed line at tank.

Tanks may be detached or on frame of stove, but in all cases shall be arranged so that a flare up at stove would not prevent easy access to shut-off or release.

(c) **FUEL OIL OR KEROSENE:**—Where wet priming is used, a catch pan not less than $\frac{3}{4}$ inch deep shall be secured inside the frame of the stove, or metal protection thereunder flanged up $\frac{3}{4}$ inch to form a pan.

Gasoline shall not be used for priming.

Either pressure or gravity jet feed is permissible. Bubble feed or any system which may be affected by list or roll of the vessel shall not be used. On gravity or siphon tanks, an easily accessible shut-off valve shall be fitted in feed line at tank.

Tanks of not over one gallon capacity may be mounted on the frame of the stove. Tanks of over one gallon capacity shall be detached, securely mounted outside, or inside with outside fill connection. Inside tanks shall be arranged so that a flare up at the stove would not prevent easy access to shut-off.

Burners shall not be primed when hot and burner tips shall be kept clear to avoid choke, extinguishment and consequent flooding.

(d) **GASOLINE:**—Only dry primed burners shall be used.

A catch pan not less than $\frac{3}{4}$ inch deep shall be secured inside the frame of the stove, or metal protection thereunder flanged up $\frac{3}{4}$ inch to form a pan.

Either pressure or gravity jet feed is permissible. Bubble feed or any system which may be affected by list or roll of vessel shall not be used.

Tanks attached to frame of the stove shall not be used. Tanks shall be detached, securely mounted outside, or inside with outside fill and vent connection. A shut-off valve shall be fitted in the feed line at the tank and shall be arranged so that a flare up at the stove would not prevent easy access to the shut-off or release or subject the tank to undue heat. Feed and transfer lines shall be seamless copper tubing properly secured by neat fitting clips and with S. A. E. solderless connections or equivalent.

Burner tips shall be kept clear to avoid choking and an approved anti-flooding device shall be installed in the feed line. Particular care must be taken against snuffing a flame from a boil-over or any other cause and frequent attention must be given to insure continued tightness of joints and glands. Testing for leaks must be done with soapsuds and not with flame.

Tanks should fill from the power tanks by a transfer piping system or be large enough to carry a trip supply, run in at a station the same as the power gasoline. The practice of drawing off gasoline from power tanks or of carrying a spare supply is strongly condemned; but where an existing design necessitates such practice, spare gasoline shall be carried only in an approved safety can.

(e) **LIQUEFIED AND COMPRESSED GAS:**—

Only dry primed burners shall be used.

Drums and cylinders shall be I.C.C. standard approved for the contained product and shall be filled according to I.C.C. regulations.

Gas stored at a pressure of over 20 lbs. at 100° F. in accordance with the specifications of the Bureau of Explosives, shall have a suitable reducing device at outlet of drum or cylinder, so that dangerous pressure at the burners may be avoided.

Gas storage cylinders and drums shall be substantially secured and located so that escaped vapor from leakage or any other cause cannot reach the bilges, machinery space or accommodations.

Tanks shall be located on deck wherever possible and may be placed below deck only when the possibilities of all on-deck locations have been exhausted. The following on-deck locations are recommended:

- (1) In a box on the cabin top, or on deck. (Between boats is a convenient place.)
- (2) In a box in the cockpit or on bridge deck or in a cockpit or bridge deck transom locker, provided such locker is vapor-tight to compartment below.
- (3) In a dummy stack, provided such stack is vapor-tight to compartment below.
- (4) In built-in vapor-tight locker opening only to outside air, in any part of cabins.

On vessels where none of the above locations are or can be made available, the tanks may be installed below deck; but such location is recommended only as a secondary resort.

The following under-deck locations are recommended as the best available in lieu of on-deck installation.

- (1) In forward or after peak space, separated from rest of boat by vapor-tight bulkhead, reached through a deck manhole and adequately protected from injury due to movable gear in peak.
- (2) Under deck in vapor-tight galley cabinet reached through a deck manhole or hatch.
- (3) Under cockpit floor or bridge deck in a vapor-tight under-deck cabinet reached through a manhole or hatch.

NOTE: When arrangement of vessel does not permit compliance with the above, each installation shall be subject to specific approval.

Each cylinder or drum shall have an independent shut-off.

For gas delivered to the stove in liquid form, feed lines shall be of seamless copper tube not greater than 3/32 inch inside diameter with wall not less than 3/64 inch thick and connected by approved compression fittings. For gas delivered in gaseous form, screwed brass or copper pipe and fittings may be used.

Lines shall, as far as possible, be exposed to sight, but protected from mechanical injury and substantially secured against vibration by neat fitting clips.

Particular care must be taken against snuffing a flame from boil-over or any other cause, and frequent attention must be given to insure continued tightness of joints and glands. Testing for leaks must be done with soapsuds and not with flame.

(f) **GENERAL:**—Vapors from all of the above fuels are heavier than air, regardless of their varying rates of evaporation. Such vapors will sink to the bottom of enclosed compartments into which they are released and are not easily dispelled by overhead ventilation. An explosive or flammable mixture results from certain degrees of atmospheric concentration by each of these vapors. Safety requires absolute prevention of vapor escape to any compartment in which flame may be present.

When fuel containers are to be changed; close valves, burn out the line by lighting stove, break connections at pipe unions and change manifolds on deck or elsewhere in open air.

11. Electrical Equipment.

Low voltage installations do not warrant admission of substandard material and workmanship in motor craft where the possible presence of flammable or explosive vapors renders a spark or incandescence from a physical failure liable to entail serious consequences.

(a) Electrical installations operating at potential of over 32 volts shall be in accordance with Appendix B (A.I.E.E. Marine Rules). Those carrying 32 volts or lower shall conform to following:

(b) Generators and switchboards shall be placed in dry and adequately ventilated locations, as high above the bilges as practicable.

(c) All acid battery sets should preferably be located in a box or locker on the weather deck; but sets of sixteen cells or less may be placed under deck if located so that gas generated in charging can be easily dissipated by natural or induced ventilation. Acid batteries should be set in lead pans. Alkaline batteries should be insulated from possible metal contact and short circuit.

Battery sets, acid or alkaline, should be secured against shifting with roll of the vessel and should be easily accessible for observation of terminals, testing and replenishment. Preferably, batteries should not be located in the same compartment with a gasoline tank or engine; but where location elsewhere is impracticable, sets shall be effectively screened off by a cage or similar structure in order to minimize danger of accidental spark through dropping of a metal object across terminals.

(d) Ignition wiring as supplied by engine makers is generally acceptable. Service wiring shall be not smaller than 14 gauge B. & S.

Single conductor shall be National Electrical Code standard rubber insulated.

Twin conductor shall be National Electrical Code standard rubber insulated and lead sheathed.

Armored conductor with substandard insulation is not approved.

Rubber covered wire may be run in wooden or metal raceways, or on fitted insulating blocks where not exposed to oil or mechanical injury, or in conduits or non-metallic flexible tubing in exposed locations such as machinery spaces. However, extended use of conduit is not recommended on account of liability of moisture to accumulate therein unless the conduit system will drain any moisture collecting within it or the contained conductors are lead covered.

Wiring joints shall be made up mechanically and electrically sound and soldered and taped.

Battery terminals where soldered lugs are not used shall be frequently examined to insure proper contacts.

Accessories such as switches, sockets, etc., shall be standard types for current to be carried.

Circuits shall be protected by National Electrical Code fuses of suitable capacity for wire used.

A manual master cut-out switch shall be installed as close to the battery as practicable.

12. Fire Extinguishing Equipment.

(a) Portable hand fire extinguishing equipment shall be provided, and fixed extinguishing systems for protection of machinery spaces and galleys are recommended.

(b) Hand extinguishers and manual controls for systems shall be placed so that they may be readily reached from

outside the compartment which they are intended to serve; but neither free carbon dioxide nor carbon tetrachloride should be discharged into closed compartments occupied by persons, particularly sleeping quarters, as their smothering and/or strangulating effects may prove dangerous to life.

(c) Selection and distribution of hand extinguishers shall be governed by regulations of the National Fire Protection Association on First Aid Fire Appliances and all extinguishers and systems shall be on the List of Inspected Fire Protection Appliances issued by Underwriters' Laboratories and approved by U. S. Steamboat Inspection Service.

NOTE: A condensed classification of extinguisher types is quoted below from approved listings of U. S. Steamboat Inspection Service.

FIRE EXTINGUISHERS.

Soda-Acid.

Effect: Primarily quenching and cooling.

Freezing: Requires protection below 32° F.

Dielectric: Low.

Uses: For wood, paper, and fabric fires.

Limitations: Least effective on flammable liquid fires. Dangerous in electrical apparatus.

By-effects: Acid detrimental to fabrics, etc.

Antifreeze.

Chemicals treated to resist freezing.

Otherwise generally same as soda-acid.

Under this classification are calcium-chloride and "loaded stream" types.

Carbon-Tetrachloride.

Effect: Becomes fire-smothering gas at 140° F.

Freezing: Nonfreezing above—50° F.

Dielectric: High. Safe at 5,000 volts.

Uses: For fires in electrical apparatus and in confined fires in flammable liquids where burning surface is accessible to stream.

Limitations: Ineffective unless vaporized by heat, and smothering gas quickly dissipates in atmosphere.

By-effects: Gas strangulating, but not toxic. Harmless to fabrics, etc.

Foam (Or Froth).

Effect: Smothering by inert gas in foam blanket.

Freezing: Solutions require protection below 32° F. Dry powders unaffected by atmospheric temperatures.

Dielectric: Low.

Uses: For fires in combustible materials and flammable liquids where burning surface is accessible to stream or flow.

Limitations: Dangerous on fires in electrical apparatus.

By-effects: Harmless.

Carbon-Dioxide (Direct).

Effect: Smothering and cooling by inert gas applied direct on flames or into burning compartment.