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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

1926

Prepared and Revised by Marine Committee,

National Fire Protection Association

NATIONAL FIRE PROTECTION ASSOCIATION

Executive Office:

40 Central Street, Boston, Mass.

NOTE:

These Regulations are a reprint of the edition of 1923, with the following changes and additions:

Minor changes in Sections 19, 20, 28, 31, 37, 43, 50, 53, 72, 73.

Section 80, and Tentative Recommendations omitted.

Appendix B, tentative in the 1923 edition, is now officially adopted.

Appendix C, separately published in tentative form in 1923, has been revised and adopted and is included in this edition.

Appendix D has been added.

Regulations Governing

MARINE FIRE HAZARDS

TABLE OF CONTENTS

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 ¼-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 ⅜-inch asbestos board or 1½-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 2½ 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 2½ 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 ¼-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 any-

thing 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.

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 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 woodwork; and where such steam pipes pass through woodwork, they shall be fitted with a proper metal collar and the woodwork 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 valves 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 reaches 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 approvel electric device may be used for heating. A ½-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 ⅜ 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 provisions 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 ¼ 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 ¼ 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 ⅛ 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 ¼ 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 ¼ 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 woodwork within 8 inches of smokepipes shall be protected with sheet metal over asbestos at least ⅛ inch thick.

APPLIANCES.

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. Steam jets controlled by master valves in accessible location are considered a satisfactory means

of fighting fires in the cargo spaces of a vessel in the present stage of development of extinguishing apparatus. The size and number of steam smothering pipes called for herein are based on a steam pressure of 100 pounds. These sizes are suitable for higher pressure than 100 pounds, but for lower pressure they should be proportionately increased.

(a) Each compartment shall have a branch with steam jets of sufficient size to fill it in not more than fifteen (15) minutes.

(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 on deck, 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, 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 (1½″) nominal diameter.

(f) Cargo spaces requiring more steam than would be supplied by a one and one-half inch (1½″) 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 (¾″) 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×B×H	Connection No. of Inlets	Size of Inlets
30,000	1	1″ I.D.
46,000	1	1¼″ I.D.
67,000	1	1½″ I.D.
94,000	2	1¼″ I.D.
135,000	2	1½″ I.D.
203,000	3	1½″ 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.

Article V. Fire Room 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. In fire rooms with oil burning boilers a sufficient number of 2½-gallon foam-type chemical fire extinguishers shall be provided; and a box of dry sand with a scoop may also be supplied. It is also recommended that an extinguishing system be piped to inaccessible parts of fire room, such as under boilers and floor plates and in bilges. A foam installation is approved for this purpose. Either an automatic or manual system or a combination of both may be used, but control of all manual systems should

be from both inside and outside of the fire and engine room spaces. The type, number and location of extinguishers and layout of pipe lines and nozzles shall be subject to approval.

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.

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 States 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, no open lights or fire, smoking, or electrical apparatus liable to spark shall be permitted within 50 feet of an opening in any oil hose, 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 day time. When carried on at night, no lights 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 leakage 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 inclosed 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.

APPENDIX—A.

Regulations for Freeing Oil Tanks, Bunkers and Compartments of Flammable and Explosive Vapors Previous to Entering for Any Purpose or Making Repairs on Oil Burning or Oil Tank Vessel.

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) Repairs of any kind may be made to any tank, compartment, bunker or other container or space, previously containing explosive or flammable liquids, in any vessel after the air contents of these tanks or containers has been examined by a competent chemist certified as hereinafter provided, and declared free of flammable and explosive vapors, such declaration to be in the form of a gas free certificate furnished in compliance with the following requirements:

(b) At sea or in port where the means of carrying out these requirements are not available and the safety of the vessel necessitates emergency or temporary repairs, such repairs may be made to permit the vessel to proceed to the port of destination.

(c) In cases where a tank or space to be repaired adjoins another tank or space no repairs shall be permitted unless adjacent tanks or spaces are freed of vapor as herein provided.

3. 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.

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×B×H, or the volume in cubic feet of the compartment to be steamed.

	Size of steam connection at 100 pounds pressure		
Value of L×B×H Not exceeding	1 in. Hours Steaming	1¼ in. Hours Steaming	1½ in. Hours Steaming
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 abliity 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 explosive or flammable 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 explosive or flammable gases.

5. (a) In cases where a vessel in which the last cargo carried was oil of flash point below 150° F., closed cup, is to undergo repairs at a shipyard, or alongside of a wharf, all of the vessel's compartments or tanks having contained such oil, with the exception of the bunker tanks, shall have been steamed and ventilated for at least twenty-four hours, or otherwise effectively freed of vapor prior to delivery to repair yard; and all tanks in which any repairs are to be made, and tanks adjacent to same, shall have been proven free from explosive and flammable gases as provided in paragraph 4 (c). The balance of the tanks shall be sealed tight.

The only exception to this rule shall be where the repairs to be made are confined exclusively to the engine and fire room spaces or/and to quarters, or where vessel is placed on dry dock merely for the purpose of cleaning and painting under water body and overhauling sea valves, in which case it will only be deemed necessary that all tank lids and/or covers shall be sealed tight.

(b) Repairs may be made to equipment in pump room without freeing from gas any space on the vessel other than pump room space.

(c) No repairs necessitating the use of fire or of tools liable to cause sparks by contact with metal may be made to the decks of a vessel, except by special permission of the certified chemist, without first freeing adjacent tanks from explosive or flammable gases.

6. (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.

(b) Where oil or sediment liable to regenerate explosive or flammable gases has not been entirely removed from the tank in which repairs are to be made, the above mentioned certified chemist shall, when delivering to the interested parties the gas free certificate required by these regulations, advise them as to the necessity, if any, of further testing of said tanks while undergoing repairs, and such tests shall be made before proceeding with repairs in the tanks.

7. 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.

8. (a) No open light or fire shall be permitted within 50 feet of 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. Electric hand flash lights may be used as accessories.

NOTE: If possible, all repairs should be made during daylight. Portable connected electric lamps are prohibited. Self-contained electric battery lamps may be used.

(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.

.....

9. 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 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.

APPENDIX—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 1½ 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 ⅛ 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 then 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 consideration.

No wood or inflammable 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 inflammable 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 the 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.

APPENDIX—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 other certain 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	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

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 Sulphuric 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 D.
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 Combustible liquid	A. or E. 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

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 gasoline		Prohibited
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)	
Beta Naphthol	Solid, bad smell	Away from foods
Bi-Nitro Toluol liquid and solid	Strong contaminating smell	Away from foods
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 chlorine	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.
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
Calcium Cyanamide (not hydrated)		Prohibited
Calcium Oxide, or Quicklime or Unslacked 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.

Commodity	Properties	Stowage
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 pulverized	Liable to spontaneous ignition	C. Dry
Charcoal, screenings, ground or puverized	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.

Commodity	Properties	Stowage
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
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	Flamable solid; liable to ignite spontaneously	A.
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
Crude Oil (Petroleum)	Flammable liquid	B. or E.

Commodity	Properties	Stowage
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.
Distillate	Flammable liquid	B. or E.
Driers, liquid	Flammable liquid	B. or E.
Dross, Rosin or Batting	Flammable solid	B. Cool
Drums, *empty (previously containing* flammable liquids)	*Generally still contain* some liquid	A. *or* E. *Prohibited* unless tightly closed
Electrolyte	Corrosive liquid	A.
Eradicators, paint or grease, liquid	Flammable liquids	A.
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
Explosives, High	Explosive	Explosive restrictions
Extracts, liquid (flavoring)	Flammable liquid Combustible liquid	B. or E. C. or D.
Fiber	Readily combustible	Cotton Regulations
Films, Moving Picture (nitro-cellulose)	Flammable solid	C. Cool
Ferro-Silicon	Solid material; may give off poisonous gas	B.
Filter Press Cloth (new)	Non-hazardous	No restrictions
Filter Press Cloth (used or oily)	Flammable	C. or D.
Firecrackers	Fireworks	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.

Commodity	Properties	Stowage
Fulminate of Mercury, wet	Explosive	Magazine
Fulminate of Mercury, dry	Explosive	Prohibited
Fulminate of Silver	Explosive	Prohibited
Fuses, safety		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)	
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 gas	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	Prohibited
Hydrofluoric Acid	Corrosive liquid	A.
Hydrofluosilicic Acid	Corrosive liquid	A.
Hydrogen Gas, compressed	Flammable gas	B. Cool
Hydrogen dioxide or peroxide	Non-combustible liquid	B. Cool; away from Textiles

Commodity	Properties	Stowage
Insecticide, liquid	Flammable liquid; poisonous	A.
	Combustible liquid	C. or D., Special
Insulation Tape (varnished cloth)	May ignite spontaneously	A. or B. Cool
Iron Mass, or Iron Sponge (in bags)	May heat spontaneously if improperly prepared	D.
Iron Mass, spent	Liable to spontaneous ignition	Prohibited
Iron Sponge, spent	Liable to spontaneous ignition	Prohibited
Iron Oxide, spent	Liable to spontaneous ignition	Prohibited
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.
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.
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)	

Commodity	Properties	Stowage
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.
Mono-Chlor-Benzol	Flammable liquid	A. or B.
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-Starch, dry	High explosive	Prohibited
Nitro-Starch, wet with 20% water, lined cases	Flammable solid	D. Special

Commodity	Properties	Stowage
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	
Oil, Naphtha	Flammable liquid	B. or E.
Oil, Pine Tar	Combustible liquid	Away from foods
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
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.

Commodity	*Properties*	*Stowage*
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
Picrate of Ammonia	High explosive	Magazine
Pintsch Gas	Compressed flammable gas	B. Cool
Pintsch Gas Drips	(See Carbon Oil)	
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	A. or B.
Potassium Nitrate	Oxidizing material	B. or D. Away from acids
Potassium Perchlorate	Oxidizing material	B. or D. Away from acids
Potassium, Metallic	Flammable solid	B.
Potassium Permanganate	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
Pyroxylin Plastic	(See Celluloid)	
Pyroxylin Plastic, Scrap	Flammable solid	A. Cool

Commodity	Properties	Stowage
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
Rags, wet or oily	Liable to spontaneous ignition	A. Special
Rags, not wet or oily	Combustible solid	Cotton Regulations
Railway Fusees	Common fireworks	B. C. or D. Cool
Railway Torpedoes	Special fireworks	B. Cool
Roofing Cement	Flammable liquid Combustible liquid	A. B. or E. C. or D.
Rosin Dross	Flammable solid	B. Cool
Rubber Cement	Flammable liquid Combustible liquid	A. Cool C. or D.
Rubber Scrap (not ground or 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 Powder, 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	B. 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

Commodity	Properties	Stowage
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.
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	Combustible liquid	A. or E.
Thermit	Combustible solid	No restrictions
Thermit Ignition Powder	Flammable solid	D.
Tin Chloride	(See Chloride of Tin)	
Tin Tetrachloride (Bichloride Anhydrous)	Corrosive liquid	A.
Toluene (Toluol)	Flammable liquid	B. or E.
Toluene, Mono-nitro	Combustible liquid	B. or E.
Toluene, Di-nitro	Combustible solid; liable to explode in fire	B.
Toluene or Toluol, Tri-nitro	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.

Commodity	Properties	Stowage
Turpentine substitute	Combustible liquid	B. or E.
Type Cleaning Compounds	Flammable liquid	A. or B.
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*	D.
Varnish Remover	(See Paint Remover)	
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)	Liable to spontaneous ignition	A.
Wood Flour	Combustible	No restrictions
Wood Alcohol	Flammable liquid	B. or E.
Wool, oily or greasy	Combustible solid	Special
Xylol or Xylene	Combustible liquid	B. or E.
Zinc Dust	Slightly combustible; liable to spontaneous ignition if wet	Dry

APPENDIX—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 AND ENGINES USING GASOLINE FOR STARTING.

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 steel of thickness not less than No. 14 gage (U. S. Standard) or of copper of thickness not less than No. 18 gage (U. S. Standard). Steel tanks shall be galvanized on the outside after completion or kept well coated to prevent corrosion. Tinning the inside of fuel tanks is a recommended practice.

(d) Seams of tanks may be welded, brazed or riveted; but if riveted shall be brazed or welded after riveting. Outside rivet heads and/or points shall be brazed or welded. Soldering in lieu of welding or brazing is not recommended.

(e) Diaphragms in tanks shall be well fastened. Flanges shall be bent to an inside radius of not more than twice the thickness of plating, and the riveting, welding or brazing shall be as close to the throat of the flange as practicable.

(f) Tanks shall be designed to withstand four times the maximum working pressure. All tanks shall be tested hydrostatically to twice the maximum working pressure without showing leakage or permanent deformation. The minimum test pressure shall be 4 pounds gage.

If fuel tanks have flat heads or are not cylindrical they shall be fitted with diaphragms to break the wash of con-

tents and shall be properly braced on flat surfaces by diaphragms or other stays to prevent bulging and panting.

For pressure fuel tanks a circular section is recommended.

(g) Drains in the bottom of fuel tanks are not recommended; but where fitted, plugs or pipes shall be threaded into spot faces 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 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) Permanently open vents on gravity tanks and relief valves on pressure tanks are required. Vents and reliefs shall be carried to the outside air. Vent orifices over ⅛ inch iron pipe size shall be screened with 40 x 40 non-corrodible mesh.

(k) Gage 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.

2. Fuel Piping:

(a) All fuel piping shall be seamless drawn annealed copper tubing.

(b) Fittings and connections shall be of the solderless type and in accordance with the Society of Automotive Engineers Standard Practice Code, published in the S. A. E. handbook. All valves and cocks shall be of brass.

(c) It is recommended that piping be run in sight if practicable, protected from mechanical injury and secured against vibration.

(d) A strainer of approved type shall be fitted in the engine compartment with shut-off valves on each side of strainer.

(e) Filling pipes to tanks shall be so arranged that fumes and possible overflow cannot get into the hull. A pipe or trunk made tight at tank and deck filling plate is recommended for this purpose.

3. Carburetor:

(a) A fixed open drip pan shall be provided beneath the carburetor, of sufficient size to catch any possible leakage or drip therefrom.

(b) Air intakes shall be so directed that back firing cannot blow down into bilge or carburetor pan. It is recommended that gas tight air intakes be carried up even with the top of the motor and screened.

(c) If an air heater is used it shall be installed well above the bilge.

4. Motor and Exhaust:

(a) The exhaust manifold on motors should be water jacketed; 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.

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 ⅛ inch asbestos board covered with sheet metal. A dead air space of ¼ 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.

(c) 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:

(a) Particular attention shall be paid to securing proper drainage to the pump well so that bilges can be flushed and cleaned.

Means should be provided for ventilating the bilge thoroughly.

NOTE: This can best be accomplished by an adequate system of mechanical ventilation. Where such a system is not feasible, means for natural ventilation from end to end of compartment should be provided with a view to scavenging the bilges and not merely the upper atmosphere of the enclosed spaces.

6. Operation:

NOTE: Attention is called to the hazard involved in the handling of gasoline. An atmospheric saturation as low as 1¼ 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 bottoms. A recently emptied gasoline tank is in its most dangerous condition. The following precautions are recommended therefore in order to reduce the fire 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.