NFPA No
303
File: 300 Series
Marine

Fire Protection of BOATYARDS & MARINAS

MAY
1957

*Price Fifty cents**

NATIONAL FIRE PROTECTION ASSOCIATION
International
60 Batterymarch St., Boston 10, Mass., U.S.A.

2M-5-57-FP

*Discount for quantities.

Printed in U.S.A.

National Fire Protection Association

International

Executive Office: 60 Batterymarch St., Boston 10, Mass.

The National Fire Protection Association was organized in 1896 to promote the science and improve the methods of fire protection and prevention, to obtain and circulate information on these subjects and to secure the cooperation of its members in establishing proper safeguards against loss of life and property by fire. Its membership includes two hundred national and regional societies and associations (list on outside back cover) and seventeen thousand individuals, corporations, and organizations. Anyone interested may become a member; membership information is available on request.

This pamphlet is one of a large number of publications on fire safety issued by the Association including periodicals, books, posters and other publications; a complete list is available without charge on request. All NFPA standards adopted by the Association are published in six volumes of the **National Fire Codes** which are re-issued annually and which are available on an annual subscription basis. The standards, prepared by the technical committees of the National Fire Protection Association and adopted in the annual meetings of the Association, are intended to prescribe reasonable measures for minimizing losses of life and property by fire. All interests concerned have opportunity through the Association to participate in the development of the standards and to secure impartial consideration of matters affecting them.

NFPA standards are purely advisory as far as the Association is concerned, but are widely used by law enforcing authorities in addition to their general use as guides to fire safety.

Definitions

The official NFPA definitions of shall, should and approved are:

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 authority having jurisdiction.

Units of measurements used here are U. S. standard. 1 U. S. gallon = 0.83 Imperial gallons = 3.785 liters.

Approved Equipment

The National Fire Protection Association does not "approve" individual items of fire protection equipment, materials or services. The standards are prepared, as far as practicable, in terms of required performance, avoiding specifications of materials, devices or methods so phrased as to preclude obtaining the desired results by other means. The suitability of devices and materials for installation under these standards is indicated by the listings of nationally recognized testing laboratories, whose findings are customarily used as a guide to approval by agencies applying these standards. Underwriters' Laboratories, Inc., Underwriters' Laboratories of Canada and the Factory Mutual Laboratories test devices and materials for use in accordance with the appropriate standards, and publish lists which are available on request.

Boatyards and Marinas

NFPA No. 303 — 1957

The first standard of NFPA on the subject of marinas was adopted by the Association in 1940 on recommendation of the Committee on Boat Basins & Municipal Marinas of the then NFPA Marine Section. That standard, entitled "Recommended Good Practice Requirements for the Location, Construction, and Operation of Marinas," is superseded by the following recommendations, the scope of which has been enlarged to encompass boat service and storage yards. These recommendations were prepared by the Committee on Motor Craft and Marinas endorsed by the General Committee on Marine Fire Protection and adopted by the Association at its 55th annual meeting, May 11, 1951. Minor amendments were adopted in 1952 and 1957.

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REFERENCES

The following Standards and other publications are referred to herein.

Official Number	*Title*	*Sources**
91	Blower and Exhaust Systems, Standards for	1, 2
—	Building Code Standards for the Installation of Heat Producing Appliances, Heating, Ventilating, and Air Conditioning Equipment	2
20	Centrifugal Fire Pumps, Standards for the Installation and Operation of	1, 2
10	Portable Fire Extinguishers, Standard for the Installation, Maintenance, and Use of	1, 2
30	Flammable Liquids Code	1, 2
306	Gas Hazards on Vessels to be Repaired, Standards for the Control of	1
58	Liquefied Petroleum Gases, Standards on	1, 2
—	Marinas, Recommendations for Design, Construction, and Maintenance of	4
302	Motor Craft, Fire Protection Standards for	1, 3
70	National Electrical Code	1, 2
87	Piers & Wharves, Recommended Good Practice for the Construction and Protection of	1, 2
—	Preventing Cutting and Welding Fires	1
27	Private Fire Brigades, Suggestions for Organization, Drilling and Equipment of	1, 2
33	Spray Finishing Using Flammable Materials, Standards for	1, 2
13	Sprinkler Systems, Standards for the Installation of	1, 2
14	Standpipe and Hose Systems, Standards for the Installation of	1, 2

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Recommendations for Fire Protection of Boatyards and Marinas

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Recommendations for Fire Protection of Boatyards and Marinas

Introduction

The major part of business handled by the boatyards and marinas, for which this pamphlet is specifically prepared, is from services to the pleasure boating public. These recommendations are equally applicable, however, to boatyards handling small commercial craft. Boatyards and marinas are concentration points where the value of boats accommodated frequently exceeds the values of the fixed establishments and equipment. Thus, boatyard and marina managements have a responsibility for the provision of safe facilities for the care and protection of boats being harbored, serviced or stored, in addition to the basic desirability of prudent safeguards for their own property investment.

Boatyards and marinas are subject to many and varying causes of fire with the initial danger usually worsened by conditions favorable to the spread of fire. Accordingly, these recommended practices have been developed around two cardinal principles: the correction or safeguarding of conditions which may cause fire, and the adoption of practices aimed at reducing the chance of any fire from spreading. It should be emphasized that these suggestions are intended as a guide to good fire protection for boatyards and marinas as they exist and expand and for yards and marinas being established.

PART I — FIRE PREVENTION

10. The most effective fight against fire is that carried on to prevent fire. Effective fire prevention requires the consideration of and attention to every potential fire hazard every minute of the day, every day of the year. The magnitude of the fire hazard in any boatyard or marina, irrespective of the physical conditions in the yard or the fire extinguishing equipment provided, depends largely upon operational practices. If managements initiate sound regulations for the conduct of activities, including those of boat owners, and insist on careful adherence to those regulations, the greatest single step in the interest of fire safety to life and property will have been taken.

11. GENERAL

111. Management and Personnel: It is essential that boatyard and marina owners and managers have a high degree of "fire consciousness." The seriousness with which management plans and follows a fire prevention effort will influence the attitude of all employees and impress the owners of boats using the facilities.

112. Access: Effective fencing of the entire yard area is recommended to prevent easy entry of unauthorized persons. Yard entrances should be limited to the number necessary for efficient operation and such entrances locked or supervised during non-working hours.

113. Cleanliness: A systematic procedure for the maintenance of a clean, neat yard should be adopted and adhered to.

(a) Substantial metal waste cans with covers should be provided as receptacles for such materials as oily or soiled waste, rags, and other discarded combustibles. Oil drums which have been salvaged, cleaned and painted might be used in outside areas as receptacles for rubbish discarded by boat owners or employees. Accumulated rubbish should be disposed of at frequent intervals, preferably daily.

(b) Wood shavings, dust and light wood waste are readily ignited, and should be cleared away daily.

(c) General debris, such as old lumber, empty paint cans, unused boat cradles and discarded boat gear should not be permitted to accumulate near buildings or boats in storage or under repair.

(d) High weeds, grass and brush around yard buildings, in outside storage areas, and in fact, in any part of the yard or closely adjacent to it, constitute a severe potential hazard in dry weather. Undesirable vegetation should be either destroyed by the application of a suitable weed killer or removed by fire-safe methods. Grass should be mowed regularly while green and long cuttings removed.

(e) Congestion in the storage of combustible equipment and supplies should be avoided.

114. Smoking: The hazard due to smoking is great, and it must be handled realistically. Complete prohibition of smoking within the yard is difficult to enforce, and consequently safe smoking areas should be provided. Areas safe for smoking should be designated and so posted by management or the authority having jurisdiction. Smoking should be prohibited in such areas as fueling docks, woodworking shops, sail lofts, paint shops, battery charging and storage rooms. Yard rules should explicitly prohibit smoking in any area during operations involving fuel handling, painting and varnishing, power sanding, etc., or on board boats laid-up or under repair in the yard or lying at yard piers or bulkheads.

(a) "No Smoking" signs should be posted in all areas where smoking is prohibited.

115. Operating Regulations: The enforcement of fire prevention regulations and the maintenance of all fire protection equipment should be a specific responsibility of the yard owner, manager or designated reliable employee. All boatyard managements should comply with local laws, regulations and requirements.

12. SPECIAL HAZARDS

All specially hazardous materials, liquids, stores and operations should be segregated and be given special consideration relative to fire prevention and fire protection.

121. Storage and Handling of Fuels (Gasoline, Light Oils, etc.): The transfer of flammable liquids from one container to another is often accompanied by the liberation of flammable or explosive vapors and the presence of such vapors, diluted in air, normally constitutes the greatest fire hazard.

(a) The fueling station should be so located as to minimize the exposure to all other plant facilities. Floating fueling stations are subject to Tank Vessel Regulations of the United States Coast Guard.

(b) Fuel supply tanks should preferably be buried on shore, but may be above ground, on a pier or on a bulkhead provided they are protected from mechanical injury and are well segregated from working and boat storage areas.

(c) Fuel supply tanks should be installed in accordance with the "Flammable Liquids Ordinance," National Fire Codes Vol. I, including provisions for the protection of tanks from corrosion.

(d) Underground tanks should be securely anchored against flotation.

(e) Boat fueling operations should always be carefully accomplished in accordance with Sec. 732 "Fire Protection Standards for Motor Craft," (NFPA No. 302.) (See paragraph 144.)

(f) Gasoline and light oils stored in drums should be kept in a well marked fire resistive structure separated from other plant facilities. This structure should be well ventilated, particularly at floor level.

(g) Hand carriage of gasoline within the plant area should be restricted to approved safety containers with filling of containers permitted only at the drum. Open buckets or cans should never be used.

(h) Gasoline should never be used as a cleaner in any part of the yard or on board boats. Only soaps, detergents, and approved solvents should be used.

(i) Storage of liquefied petroleum gas cylinders, whether charged or empty, should be isolated in an open shed or an outside area. If outside, they should be suitably shaded from the direct rays of the sun.

122. Storage and Handling of Paints and Spirits: These liquids have high inherent flammability and require careful storage and handling.

(a) A building, preferably of non-combustible or fire resistive construction well separated from other yard working and storage areas, should be provided for the storage and mixing of paints. If this is not feasible, a room within a yard building should be effectively partitioned from the rest of the building for paint storage and mixing.

(b) Only quantities of paint as required should be permitted on the job.

123. Lumber Storage: Flame spread is often rapid in fires involving stored lumber where adequate precautions are not taken. Some basic considerations are:

(a) Main stocks of lumber should be stored in a specifically segregated area of the yard, whether outside or in a separated shed.

(b) Piles should be neatly stacked, and wide aisles maintained between individual piles to permit access and to prevent spread of fire.

(c) Particular care should be taken to maintain a clean ground surface free of debris, long grass, weeds, etc.

124. Wiring and Electrical Equipment: All wiring and electrical equipment should be installed and maintained in accordance with the National Electrical Code and local regulations. Periodic inspection by authorities having jurisdiction is important. Some basic considerations are:

(a) All wiring should be well supported and protected from physical damage.

(b) Circuits should be protected by circuit-breakers or fuses of the correct setting or rating.

(c) All switch and fuse enclosures should be of an approved type and firmly secured to walls or posts.

(d) Electrical equipment including lights, switches, etc., in areas where flammable vapors or dust may be present should be of the explosion-proof type. Such areas include fuel storage, paint mixing, paint shop, spray booth, etc.

(e) Portable electric tool leads and extension cords should be maintained in top condition and replaced when worn or damaged. Portable equipment should be disconnected when not in use and temporary hangers, such as nails, which might impair wiring insulations should not be used. All portable electric lights should be equipped with substantial lamp guards and should be "explosion-proof" when used in areas having flammable vapor or dust hazards.

(f) Electric motors should be maintained free from oily deposits and dust.

125. Heating: Heating equipment which is defective, improperly installed, or misused is a serious fire hazard. The following recommendations are therefore of particular importance:

(a) Central heating by steam, hot water, or forced air systems of such buildings as required by yard operations is recommended with heat

generating plants located in detached buildings or rooms separated from other areas by fire resistant walls.

(b) All heating equipment should be approved as suitable for uses fitting the particular needs of the yard.

(c) Portable heaters should be so constructed that they are not easily tipped over.

(d) Coal and wood burning stoves, although now in extensive use by boatyards for individual room or shop heating, are not recommended unless each such installation is periodically checked by the local fire authority having jurisdiction and found to possess adequate safeguards. If these stoves are used, the following precautions should be in effect unless the authority having jurisdiction modifies the precautions specifically for each installation:

1. On all sides, a clearance of 36 inches from any combustible material should be maintained unless such material is effectively protected.

2. If flooring under stoves is combustible, it should be protected by a metal pan extending at least 12 inches beyond stoves on all sides and 3 inches deep filled with sand. Stoves should be set upon legs so ash pit bottoms are at least 6 inches above the sand.

3. Stove pipes should be riveted, substantially supported and have a clearance of at least 18 inches from all combustible material. Double metal ventilating thimbles should be used where stove pipes pass through combustible partitions or roofing and these should be at least 12 inches larger in diameter than the pipe. Stove pipes should not pass through concealed spaces.

4. Ready fuel supplies, particularly if scrap wood is used, should be neatly stowed to maintain safe clearance from stoves. Only a limited quantity of fuel should be maintained for ready use.

5. Substantial metal cans should be provided for handling ashes. These cans should not be used as receptacles for combustible waste.

(e) Open flame heating devices should not be used in areas where there is any possibility for flammable vapors or dust to accumulate.

(f) Heating equipment should be installed in accordance with local ordinances, the Building Code Standards of the National Board of Fire Underwriters, for the "Installation of Heat Producing Appliances, Heating, Ventilating, and Air Conditioning Equipment."

(g) An adequate quantity of suitable fire extinguishing equipment should be readily accessible in all areas proximate to heating equipment.

13. BOATYARD HAZARDS

131. Conditions on Individual Boats: Boats are received into yards in various conditions of maintenance and cleanliness. This, coupled with yard operations in repairing, servicing, and storing boats, greatly influences the degree of fire peril that exists within a boatyard.

(a) Unless familiar with conditions on board, the boatyard management should have an inspection made of boats entering the yard for repair, servicing, or storage. This should be accomplished as soon as practicable after arrival of a boat and before commencement of any work aboard. The inspection should determine:

(1.) Presence of combustible vapors in any compartment.

(2.) General maintenance and cleanliness, and location of any combustible materials which require removal or protection for the safe accomplishment of the particular work involved.

(3.) Quantity, type, and apparent condition of fire extinguishing equipment on board.

The resulting information, along with directions covering necessary precautions, should be made known to the employees responsible for accomplishing the servicing work, and if warranted, any basically unsafe conditions and desirable corrections should be discussed with the boat owner.

(b) The following are recommended general precautions for improving on-board conditions relative to the accomplishment of repair work:

1. Smoking in the working area should be prohibited.

2. Loose combustibles in way of any hazardous work should be removed.

3. Unprotected battery terminals should be suitably covered to prevent inadvertent shorting from dropped tools or otherwise. The ungrounded battery lead should be disconnected.

4. Only experienced personnel should be employed in the removal or installation of storage batteries.

5. Protective coverings or shields, used to protect engines, accessories or combustibles, should be of fire resistant materials.

6. Precautions recommended elsewhere herein for specific kinds of work should be followed.

132. Paint Removing and Painting: Paint removing operations, the preparation of surfaces for refinishing and painting, involve marked fire hazards which require the practice of effective precautions. The following are among the more important precautions:

(a) The process of paint removal by burning with a blow torch involves an inherent and obvious hazard and is not recommended, nor is the use of paint removers which contain flammable liquids or solvents.

It is recognized, however, that removal of some coatings necessitates use of these methods, and if used, such methods should be confined to exterior surfaces of boats. Under no circumstances should such methods be used within sheds or in close proximity to other craft. All fuel tank vents should be effectively plugged before burning off is commenced. and plugs removed immediately upon completion of burning operations. Only trained yard personnel should be permitted to handle blow torch paint removing operations.

(b) Recommended methods for removing paint include scraping, machine and hand sanding, wire brushing, and the use of non-flammable removers.

(c) Hand painting in the open involves little hazard as flammable vapors in sufficient density are not likely to accumulate, but painting in boat interiors or in shops requires good ventilation.

(d) No open flame or the operation of spark producing equipment of any kind should be permitted where painting, sanding, scraping or wire brushing work is performed in confined areas, such as boat interiors.

(e) Where flammable vapors might exist, portable electric lamps should be equipped with guards and outer globes as recommended by the National Electrical Code, Article 500.

(f) An adequate supply of fire extinguishing equipment should be quickly available to all areas where painting or refinishing is in process.

NOTE: For additional information see NFPA "Standard for Spray Finishing Using Flammable Materials."

133. Welding, Brazing, Soldering, and Cutting: Considerable fire hazard exists whether welding is accomplished by gas or electric arc methods. Metal cutting by flame is perhaps even more hazardous in that sparks are more numerous and are scattered greater distances from the work. The following recommendations are particularly important:

(a) These operations should be restricted to a shop specifically provided for the purpose or in an open area of the yard. Such a shop should be of non-combustible or fire resistive construction including its flooring, and all combustibles should be kept well away from the shop or area.

(b) Only experienced personnel should be permitted to handle welding, brazing, soldering, and cutting work.

(c) When welding or cutting in or on a boat, the following precautions should be taken:

1. Where practicable, all combustible materials in way of hazardous repair work should be moved to a safe location aboard or ashore. Temporary protective coverings, such as tarpaulins, should be used to protect combustible materials which cannot be moved. and these coverings should be of either non-combustible material or be properly flame-proofed.

2. The area should be absolutely free of combustible vapor, and flammable liquids.

3. All openings such as hatches, ports, tank openings, etc., through which sparks might pass, should be protected.

4. Non-combustible tarpaulins, properly flame-proofed tarpaulins or metal shields should be set around the work in process to restrict the travel of sparks.

5. Careful check should be made of conditions on the opposite side of decks or bulkheads for the possibility of damage by heat or fire before welding or cutting is commenced on them.

(d) Neither welding nor cutting processes should be attempted on a fuel tank unless one of the following provisions has been complied with:

1. The tank is completely freed of flammable vapor and maintained in that condition by flushing with hot water solution and tri-sodium phosphate or similar alkali, followed by steaming, and a certificate obtained from a Certificated Gas Chemist,* or in accordance with the NFPA "Standards for the Control of Gas Hazards on Vessels to be Repaired." (NFPA No. 306.)

2. The tank has been inerted by carbon-dioxide (CO_2), nitrogen (N_2), or filled with water. If either of the first two methods is used, the maintenance of an inert atmosphere must be periodically checked with a CO_2 gas analyzer or equivalent.

(e) All welding and cutting equipment should be maintained in the best possible condition. Oxy-acetylene hose should be neatly coiled and stored in a cool location, free from grease, oil, etc. Spare gas cylinders should be limited to five or less and be kept in a well ventilated locker. Electric welding equipment should conform to the provisions of Paragraph 124 of the National Electrical Code.

(f) Wherever welding or cutting operations are in process, adequate fire extinguishing equipment should be at hand.

NOTE: For additional information, see NFPA pamphlet "Preventing Cutting and Welding Fires."

134. Woodworking: Improper arrangement of equipment and machinery in congested areas causes accumulations of sawdust, shavings, and wood waste which constitute hazards frequently neglected in boatyards. The following safety precautions are recommended:

(a) Good housekeeping is essential. Waste and refuse should be removed daily.

(b) Care should be taken to prevent the accumulation of dust anywhere. Damp sawdust conducts electricity and should be removed from

* The holder of a valid certificate issued by the American Bureau of Shipping establishing him as a person qualified to determine whether repairs and alterations which may involve gas hazards, can be undertaken with safety.

electrical equipment, switches, etc. Dry dust is easily ignited and is a potential flash fire hazard.

(c) Installation of blowers for automatic conduction of sawdust and shavings from saws and planers is strongly recommended. The NFPA "Standards for Blower and Exhaust Systems" (NFPA No. 91), should be consulted on this subject.

(d) Machines should never be left unattended while in operation.

(e) The area provided to accommodate boats undergoing repair should be large enough to permit free access all around and under them. A check should be made of any boat in this area to make certain it is free of explosive vapors or other hazards.

(f) All volatile liquids required should be kept to a minimum and handled in safety cans.

(g) A liberal supply of appropriate first aid fire extinguishing equipment should be distributed so that units are handy from any point of shops or repair areas.

135. Machine Work: Sparks from work in process combined with combustible accumulations in metal dusts, cuttings, borings, etc., are hazards.

(a) It is recommended that the boatyard machine shop be housed in a separate noncombustible or fire resistive building.

(b) If the machine shop is located in a building housing other shops, *e.g.*, woodworking, it should be effectively partitioned, preferably by a fire wall. It is important that dust or shavings from such shops as the woodworking be prevented from drifting into the machine shop.

(c) The continuous maintenance of cleanliness, and of machines and motors in good repair is essential.

(d) All flammable liquids required should be kept to a minimum and handled in approved safety cans.

(e) Engine test stands should be segregated from other shop activities. Such stands should be located in a separate building or in a cut off area near an exterior wall to permit a short, direct exhaust system and external location of fuel supplies. The exhaust piping and silencing equipment should be suitably lagged with a clearance of at least 30 inches maintained from all woodwork, and the system should include suitable provisions against the emission of sparks.

1. Fuel supply tanks for diesel oil or gasoline should be located outside of buildings and well separated from engine exhaust discharge. Fuel feed lines from tanks to bed should be installed in accordance with good practice and be equipped with stop valves at tank and at stand. Extreme care should be taken to be certain the fuel systems are always grounded. Use of approved flexible fuel line connectors

at engine bed end of fuel feed lines is recommended. Gravity flow of fuel from exterior tanks to test stands is not recommended.

2. The engine test stand equipment should include a permanent engine cooling system which can be adjusted to meet the requirements of various engine types.

(f) Liberal provisions of fire extinguishing equipment for Class B and C fires is recommended. (See Part II.)

136. Battery Service and Storage: Hydrogen gas liberated from storage batteries constitutes both a fire and an explosion hazard. The following precautions are therefore recommended:

(a) The battery room should either be a separate noncombustible or fire resistive structure or an area segregated from all others by fire walls and entered only by an approved fire door which should be normally closed.

1. Ventilation of the battery room is vital. Air inlets at, or below, the level of the battery racks with adequate exhausts at ceiling, are required. A vent stack equipped with natural draft exhaust head to aid in providing an upward draft is desirable.

(b) All electrical equipment and wiring should meet the requirements of the National Electrical Code for use in Class I hazardous locations.

(c) Battery chargers used should have separate control switches. A master switch should control all chargers.

(d) Charging equipment must be well secured, protected from physical damage and so located as to permit good ventilation all around it.

(e) Racks for storing and charging use should be substantial, suitably insulated, reasonably open and permit the setting of batteries so that no pockets, in which gases might accumulate, can be formed.

(f) Use of battery clips equipped with rubber cuffs to prevent short circuits is recommended as well as insulated tools.

(g) All battery servicing work should be accomplished by experienced personnel only. The following specific precautions should be followed:

1. Smoking should be strictly prohibited in battery room.

2. No open flame or spark producing work should be undertaken in the battery room.

3. No volatile liquids should be stored or used in the room.

4. Cell caps should be kept tight while connecting or disconnecting batteries.

5. Battery tongs or other appropriate carrying devices should be used when removing or lifting batteries.

6. Leads should never be connected or disconnected if power is being supplied to or released by batteries.

(h) Suitable first aid fire extinguishing equipment, preferably automatic, should be provided in battery rooms.

137. Servicing Liquefied Petroleum Gas Systems: The same extreme care that is necessary to safe operations involving gasoline is also essential with respect to liquefied petroleum gas.

(a) Changing of cylinders should be performed in accordance with Paragraph 742 (c) of NFPA "Fire Protection Standards for Motor Craft."

(b) Checks for leaks in liquefied petroleum gas systems must never be made with flame. Use of soap suds is recommended.

NOTE: For further information, see NFPA "Standards on Liquefied Petroleum Gases."

138. Boat Storage: Fire prevention, relative to boats in storage, should be considered as consisting of two basic parts; namely, that relative to conditions within boats and that relative to the storage facilities.

(a) It is imperative that hazardous conditions within boats be detected and corrected.

1. All loose combustibles should be removed and stored in suitable lockers or segregated areas as desirable.

2. Liquefied petroleum gas cylinders, alcohol or kerosene from galley fuel tanks and any reserve fuel supplies for the galley should be removed.

3. Batteries should be removed.

4. If fuel is removed from tanks, fuel lines, and accessories, this operation must be conducted with due regard to the hazards involved. If facilities or personnel are not adequate for the safe handling of this work, it should not be undertaken. In any event, stop valves at tanks should be tightly closed.

5. Managements should see that extreme care is taken to check tanks and fuel systems for leaks.

6. Good ventilation should be provided for hulls, especially bilges.

(b) Boats in storage should be placed in such a manner as to provide good access to each. Subject to control by the physical features of sheds, wet basins or outside areas, the grouping of boats is recommended with minimum open spaces of 3 feet between boats at deck and passages wide enough to permit movement of fire equipment between groups.

1. Smoking should be prohibited in storage sheds and within boats.

2. Covers placed over boats stored in the open should be properly flame-proofed. Sheet metal, canvas treated with fire retardant or wood similarly treated is recommended. The use of untreated canvas for this purpose is hazardous practice.

3. Suitable lockers or facilities should be provided for boat gear, with care exercised to see that no items subject to spontaneous ignition are included, such as oil skin clothing, etc.

4. Ground, floor surfaces, and boat cradles should be kept free of combustible rubbish.

5. No flammable liquids or materials should be stored in boat storage areas.

6. Shore electrical power should be disconnected whenever boats are unattended.

(c) Printed yard regulations, boat storage agreements, etc., should include specific references to the permissible activities of boat owners, boat crews, or independently hired outside contractors within the yard. Items recommended for inclusion in yard regulations follow:

(1.) Designation of areas of yard where smoking is permissible and strict prohibition of smoking aboard boats in storage or in storage sheds.

(2.) Prohibition of the use of portable open flame heaters on board stored boats.

(3.) Restriction of paint removing work by other than yard personnel to non-hazardous methods.

(4.) Restriction on work performed by other than yard personnel to daylight hours, preferably the regular yard operating hours or such times as yard personnel is present.

(5.) Prohibition on the use of flammable liquids for cleaning.

(6.) Prohibition against living aboard boats in dry storage.

(7.) Specific request for cooperation in the maintenance of general cleanliness throughout the yard.

14. MARINAS

Facilities for the berthing or mooring of small craft in commission but not in use are known as marinas, and while many of the foregoing recommendations for boatyards are applicable to marinas, the following have specific reference to such berthing and mooring facilities.

NOTE: The National Assn. of Engine & Boat Manufacturers has published "Recommendations for Design, Construction and Maintenance of Marinas," which deals with features beyond the scope of this pamphlet.

141. Location: The following factors are considered important relative to the area in which marina facilities are located.

(a) The area should be sufficiently extensive to contain the number of piers of proper design and layout to efficiently accommodate the total estimated number of boats to be berthed with enough clear space remaining for turning, entrance and exit operations.

(b) The area should be under the protection of a municipal fire department with convenient land access by an improved road and good access on the water side to fire boats, workboats, tugs or other craft which might be of assistance in an emergency.

142. Design: The marina should be so designed as to avoid congestion. This requires an entrance and an exit remote from each other, plus enough

space between main piers and sufficient width of roadstead for convenient maneuvering. If a separate entrance and exit is not feasible, the single opening should be so located as to be as accessible as possible from all points within the marina and large enough for two lines of boats moving rapidly during emergencies. It is recommended that the space between main piers be not less than twice the over-all length of the largest boat to be berthed. The design should specifically provide:

(a) Access to all parts for the operation of fire fighting apparatus.

(b) Access to each boat for emergency removal without the necessity of moving any other boat.

(c) Adequate means of illumination. This may best be accomplished by a system of electric flood lights providing at least ¼ foot-candle of light on all piers and walks. Where lights must of necessity be placed on piers, the transformers and meters should be located on the land end.

(d) Location of marine railways or hoists so that they are adjacent to open water and not partially obstructed by moored or moving boats. These facilities may be vital in an emergency.

(e) Safe location of fuel storage and handling facilities. Where tide and weather exposure conditions permit, all fuel handling operations should be outside the berthing area.

1. Outside fueling stations, whether stationary or floating, should be so located as to minimize exposure to mooring piers and other property in case of fire or other emergency at the station.

2. Inside fueling stations should be located near an exit opening or other location where, in case of fire on board a boat alongside, the boat may be quickly removed from the marina without endangering other boats at their berths.

3. Fuel storage tanks buried on shore and anchored against flotation are preferable, but where this is not feasible they may be above ground, or on a pier or bulkhead provided they are protected against physical damage due to possible settlement of the pier or bulkhead structure, impacts due to collision, or weather and tidal conditions. No boat berths should be located within 75 feet of tanks above grade or mean high water, except when tanks are surrounded by a dike.

4. Outside berths and connections should be provided for tank barges or fuel supply boats for use when filling fuel storage tanks.

5. Fuel transfer pumps for land tanks should be located on shore in a well ventilated, fire resistive pump house with concrete floor, heavily reinforced walls and relatively light roof construction. Both suction piping to supply connection and delivery piping to fueling station should be run below deck of pier or protected against mechanical injury. Delivery line from a shore tank should be run from the top of the tank (thereby requiring use of a pump) and designed or equipped to prevent syphoning. In such systems a failure in the delivery line cannot drain the supply tanks with resultant loss and serious fire

hazard. Where, of necessity, a supply tank is on pier or bulkhead, the pump house may be located adjacent to the tank, but it should be constructed and equipped similarly to a pump house on shore and similar precautions against failure and syphoning should be taken in the layout of both suction and delivery lines.

(f) A minimum width of 2 feet of catwalks not exceeding 50 feet in length and where this length is exceeded, the width should not be less than 4 feet to permit easy transfer of wheeled fire fighting equipment.

(g) As a means of reducing the possibility of spread of fire from one pier to another by oil on the surface of the water, consideration should be given to provision of suitable fire breaks. Their number would depend upon the extent of the marina and the number of mooring piers. They may take the form of aprons extending the length of the pier and extending vertically from the pier deck to a point below extreme low water. Additionally, the provision of fire breaks at intervals not exceeding 75 feet, is recommended to prevent the spread of fire along the undersides of piers.

143. Construction: The variety of fire perils to which active marinas are exposed make it desirable to use as much fire resistive construction as feasible, and it is recommended that applicable provisions of the NFPA "Recommended Good Practice for the Construction and Protection of Piers and Wharves" be followed.

(a) Bulkheads and main mooring piers should preferably be of concrete or masonry construction. Where wood construction is employed, adequate separation of main mooring piers is of added importance in order to reduce the fire exposure hazard.

(b) Except for service piers, ordinary catwalk construction is permissible for mooring piers but compliance with Paragraph 142 (f) is recommended.

(e) Electrical circuits installed on piers should be safeguarded against the effects of vibration and the corrosive action of salt water and salt air.

1. All service outlets and fittings should be of marine type with installation in accordance with the National Electrical Code.

2. Electrical equipment used or installed in such places as the fuel transfer pump house, should comply with requirements of that code relative to Class I Hazardous Locations. The National Electrical Code defines such locations as places in which flammable gases or vapors are or may be present.

3. Electrical equipment used to power marina facilities, such as hoists or railways, should be installed so as to be above even abnormally high water.

144. Operational Hazards: Specific attention is called to Section 11 which is equally applicable to marina facilities and pertinent parts of Section 12.

(a) No tank barge or other supply boat should be permitted within the marina.

(b) All boat fueling operations should be carefully accomplished in accordance with Section 732, "Fire Protection Standards for Motor Craft," (NFPA No. 302) as quoted below:

> "732. Utmost care shall be exercised during fueling operations.
>
> (a) Fueling should never be undertaken at night except under well lighted conditions.
>
> (b) During fueling operations, smoking shall be forbidden on board or anywhere nearby.
>
> (c) Before opening tanks the following precautions shall be observed:
>
> 1. All engines, motors, fans shall be shut down.
> 2. Galley stoves shall be extinguished. (Coal fires shall be banked.)
> 3. All ports, windows, doors and hatches shall be closed.
> 4. Quantity of fuel to be taken aboard shall be determined in advance of fueling operations.
>
> (d) The fuel delivery nozzle shall be put in contact with the fill pipe before the flow of fuel is commenced and this contact shall be continuously maintained until the flow has stopped. There is a serious hazard from static discharge unless this rule is observed.
>
> (e) Tanks shall not be completely filled. Allow a minimum of 2 per cent of tank space for expansion. This space allowance should be 6 per cent if the fuel being taken aboard is 32° F. or below in temperature.
>
> (f) After fuel flow has stopped:
>
> 1. Fill cap shall be tightly secured.
> 2. Any spillage whatsoever shall be wiped up completely.
> 3. Entire boat shall be opened and allowed to ventilate for at least five minutes before starting any engines or lighting galley fires."

(c) Every fuel delivery nozzle should be equipped with a self-closing control valve, which will shut off the flow of fuel when the operator's hand is removed from the nozzle.

(d) Fueling from cans should be prohibited at berths, but may be permitted at the fueling station.

(e) The use of approved portable filling buggies at fueling stations is permissible.

PART II — FIRE PROTECTION

20. Despite the most careful vigilance and effort, fire has many opportunities to strike active boatyards and marinas. Woodworking, paint removing and spraying, welding and cutting, handling gasoline and other highly flammable liquids, etc., are all continuing operations, and all are extra hazardous. Further, boatyards and marinas are frequently in locations quite isolated from public protection. Hence, the selection, location and maintenance of the proper type of fire fighting equipment is essential.

201. Classification of Fires: For all practical purposes there are three general classes of fires, and boatyards are exposed to all three.

Class A fires, defined as fires in ordinary combustible materials such as wood, cloth and paper where the "quenching-cooling" effect of quantities of water or solutions containing large percentages of water is most effective in reducing the temperature of the burning material below the ignition temperature and is, therefore, of first importance.

Class B fires, defined as fires in flammable petroleum products or other flammable liquids, greases, etc. where the "blanketing-smothering" effect of oxygen-excluding media is most effective.

Class C fires, defined as fires involving electrical equipment where the electrical nonconductivity of the extinguishing media is of first importance.

21. PRIVATE PROTECTION

Immediate transmission of an alarm to the municipal fire department upon the first discovery of a fire should be a basic rule. Then make the most prompt and effective use of the equipment at hand.

211. Analysis of Hazards: The means and methods desirable for adequate first aid fire protection will vary considerably for individual yards and marinas. Factors which should influence the type and extinguishing power of fire fighting equipment selected include:

(1) life and property values at risk
(2) class, rapidity of spread, and intensity of fire anticipated
(3) accessibility of area to be protected
(4) temperature to which fire equipment may be exposed
(5) time interval between transmission of alarm and arrival of public fire department assistance.

212. Division of Plant into Fire Protection Areas: Due to the extreme variation of hazards present in the course of operations, it is recommended that a layout plan be prepared and maintained. This plan should be used to determine the fire protection required by the various separated working areas. The plan should be descriptive of the premises including:

(1) area, type of construction, usage, sub-division and spacing of all buildings
(2) yard entries, internal roadways, and passages

(3) outside boat storage areas
(4) marine railways and lifts
(5) docks and piers
(6) fueling facilities including fuel storage
(7) adjacent premises and their occupancies

(a) Consideration of the extent of the fire hazard existing in adjacent premises is extremely vital in measuring the degree of yard exposure to fire originating within those premises.

(b) When the fire protection provisions required are determined, they should be incorporated in the completed lay-out plan, which can then be effectively used to educate and familiarize employees with the location and use of the equipment.

213. Fixed Fire Extinguishing Equipment: Both automatic and hand operated devices of approved types are available which, when properly installed, maintained and handled, will provide means for controlling and extinguishing incipient fires. Among these are the following:

(a) AUTOMATIC SPRINKLERS: These are considered the most important of all fire protective devices when correctly installed, with an abundant and constant water supply at proper pressure, and maintained so as to be operative at all times. Sprinkler systems have been found very reliable and satisfactory for use in practically all types of structures and under nearly all conditions of fire hazards. Wet or dry pipe systems are available and, where subject to temperatures below freezing even for short periods, the dry pipe system is essential. Installation of sprinkler systems should be entrusted to reliable, specialized contractors only, and should be in accordance with the NFPA "Standards for the Installation of Sprinkler Systems." Regular inspection and maintenance of systems at reasonable intervals is necessary.

(b) STANDPIPE AND HOSE SYSTEMS: These systems provide a quick means of applying an effective quenching stream on incipient fires and also can be used to control more advanced fires or to prevent their spread.

1. For average boatyard structures, standpipes should not be less than 2 inches in diameter, and should be placed so as to require hose lengths of about 100 feet with which to reach the area under protection with serviceable water streams. Approved unlined linen hose is recommended for heated or dry locations, but where conditions are moist, approved single-jacket cotton-rubber-lined hose having jacket treated to prevent mildew should be used. Hose should be 1½-inch diameter with ⅜-inch nozzles.

2. A systematic and regular check of all parts of a standpipe system is essential. A capable yard employee should be entrusted with this work and held responsible for the maintenance of the system in an instantly operative condition.

NOTE: For details relative to standpipe and hose systems see NFPA "Standards for the Installation of Standpipe and Hose Systems."

(c) UNDERGROUND FIRE LINES WITH HYDRANTS: In yards encompassing considerable area, and having marina facilities, underground fire

line systems with hydrants are highly recommended. Such systems should be connected to the public water supply if available, and this connection should be independent of other public water service lines in the yard. If a public water supply connection is not available or feasible, an underground fire line should be supplied by an approved fire pump of not less than 500-gpm capacity, depending upon the extent of the yard or marina. Fire pumps should take suction from a fresh water supply but, if necessary, salt water may be used. It should be noted that ordinary trade pumps, while efficient for general service, are seldom reliable under the stress of fire demands and are not approved for such purpose.

1. In laying out a yard system, the piping should be run to serve all buildings, piers, repair docks, outside boat storage areas, and areas used to store combustibles such as lumber. Hydrants should be so located as to keep hose lines as short as practicable, preferably not over 250 feet. The guiding requirement should be the ability to apply two effective streams to every exterior part of the yard serviced by the hose normally attached to the hydrant. Hydrants should be located in relation to buildings so as to be accessible and usable under any anticipated conditions of fire.

2. Underground piping must be laid with due regard to climatic and seasonal conditions. During the winter season the system may require complete draining with water supply instantly available through control of a main valve located in a heated area, which may also house the pump if the system is privately charged. Such an area must be accessible and useful under any fire conditions within the yard. Underground piping should not be less than 6 inches in diameter and hydrants should conform with the National Standard.

3. Approved 1½-inch hose in 75-foot lengths should be provided and properly housed in hose houses equipped with play pipes, ordinary nozzles and fog nozzles, hydrant wrenches and spanners. Such equipment should be located at strategic points, for instance where piers exceed 250 feet, each should be provided with a 2-inch water line extending the length of the pier and be equipped with 1½-inch hose connections at 75-foot intervals. At shore ends these water lines should be equipped with 2½-inch hose adapters to permit connection to a fire hydrant outlet of the same size. The pier water lines should be normally dry where freezing temperatures occur.

4. Where marina facilities are extensive, turret nozzles located on shore, preferably of the spray type, are suggested as an effective supplementary means for controlling and preventing the spread of fire.

NOTE: For further information on fire pumps see NFPA "Standards for the Installation and Operation of Centrifugal Fire Pumps."

214. Portable Fire Extinguishing Equipment: This is frequently referred to as first aid fire-fighting equipment because its successful use depends upon prompt application to incipient fires. It is essential that boatyards be well armed with the proper first aid fire-fighting equipment. Only extinguishers listed by Underwriters' Laboratories or approved by

the Factory Mutual Laboratories or other recognized testing agency should be used. It is equally essential that that equipment be maintained in operative condition, and that employees know how to use it effectively.

NOTE: For further information on extinguishers see NFPA "Standards for Installation, Maintenance and Use of Portable Fire Extinguishers."

(a) CLASSIFICATION OF FIRE EXTINGUISHERS: Based upon the preceding classification of fires and also upon fire extinguishment potentials as determined by physical testing of fire extinguishers by Underwriters' Laboratories, Inc., classifications have been established for first aid fire extinguishing appliances. This classification consists of a **numeral** and a **letter.** It appears on the label affixed to the appliances labeled by Underwriters' Laboratories, Inc., and Underwriters' Laboratories of Canada. This **numeral** and **letter** connote the following:

(1) In the case of Class "A" appliances, the **numeral** is indicative of the approximate relative fire extinguishing potential of various size Class "A" fire appliances, *i.e.*, a 4-A appliance can be expected to extinguish approximately twice as much fire as a 2-A appliance.

(2) In the case of Class "B" appliances, the **numeral** is also indicative of the approximate relative fire extinguishing potential of various size Class "B" fire appliances and, in addition, the **numeral** is an approximate indication of the square foot area of deep-layer flammable liquid fire which an average operator can extinguish, *i.e.*, a 10-B unit can be expected to extinguish 10 square feet of deep layer flammable liquid fire when used by an average operator.

(3) In the case of Class "C" appliances, no **numeral** is used since Class "C" fires are essentially either Class "A" or "B" fires involving energized electrical wiring and equipment. The size of the Class "C" appliance installed should be commensurate with the size and extent of the area involving the electrical hazard or containing equipment being protected, considering that it must be covered or blanketed by the Class "C" extinguishing media for effective fire extinguishment.

(4) The **letter** refers to the class of fire (see Paragraph 201 preceding) on which the use of the particular appliance is approved for most effective fire extinguishment.

EXAMPLES:

Foam extinguisher rated 2-A,4-B. This appliance should extinguish approximately twice as much Class "A" fire as a 1-A appliance, and four times as much Class "B" fire as a 1-B appliance. Also, the extinguisher should extinguish a fire in a deep-layer flammable liquid, such as a dip tank having a surface area of 4 square feet, when used by an average operator.

Dry chemical extinguisher, rated 6-B,C. This appliance should extinguish approximately six times as much Class "B" fire as a 1-B unit and should successfully extinguish a deep-layer flammable liquid fire of 6 square feet area when used by an average operator. It also is safe to use on fires involving electrical equipment.

(b) FIRE EXTINGUISHERS: Table II lists the various types of commercially produced first-aid appliances by the extinguishing agent utilized and by suitability for particular classes of fire.

TABLE I

Conversion Table for Classification of Fire Extinguishers

The method of classifying extinguishers used in the 1955 and earlier Editions of NFPA No. 10 differs from the presently described method. The object of this Appendix is to indicate an *approximate* conversion from the old to the new method of classifying portable fire extinguishers. Since an accurate reclassification of extinguishers already in service and labeled under the old system of classification cannot be determined except by actual fire tests, only *approximate* conversion classifications can be given.

CLASSIFICATION OF FIRE EXTINGUISHERS.

	Extinguisher Type and Size	Classifications Under Old Method	Approximate Classifications Under Present Method
Chemical Solution (soda-acid)	1¼, 1½-gallon	A-2	1-A
	2½-gallon	A-1	2-A
	17-gallon	A	10-A
	33-gallon	A	20-A
Water	1½, 1¾-gallon (pump or pressure)	A-2	1-A
	2½-gallon (pump or pressure)	A-1	2-A
	4-gallon (pump or pressure)	A-1	3-A
	5-gallon (pump or pressure)	A-1	4-A
	17-gallon (pressure)	A	10-A
	33-gallon (pressure)	A	20-A
	6 10-quart pails and 25-gallon cask (minimum)	A-1	2-A
Loaded Stream	1-gallon	A-2,B-4	1-A
	1¾-gallon	A-1,B-2	2-A,½-B
	2½-gallon	A-1,B-2	2-A,½-B
	33-gallon	A	20-A
Foam	1¼-gallon	A-2,B-2	1-A,2-B
	1½-gallon	A-2,B-2	1-A,2-B
	2½-gallon	A-1,B-1	2-A,4-B
	5-gallon	A-1,B-1	4-A,6-B
	10-gallon	A,B	6-A,8-B
	17-gallon	A,B	10-A,10-B
	33-gallon	A,B	20-A,20-B
Vaporizing Liquid (carbon tetrachloride base)	1, 1¼, 1½-quart (pump)	B-2,C-2	½-B,C
	1, 1½, 2, 2½-quart (pressure)	B-2,C-2	½-B,C
	1-gallon (pressure)	B-2,C-1	1-B,C
	3½-gallon (pressure)	B-2,C-1	1-B,C
Vaporizing Liquid (chlorobromomethane)	1 and 1½-quart (pressure)	B-2,C-1	1-B,C
	1-gallon (pressure)	B-2,C-1	2-B,C