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FIRE PROTECTION OF

VESSELS DURING CONSTRUCTION AND REPAIR 1968

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Official NFPA Definitions

Adopted Jan. 23, 1964. Where variances to these definitions are found, efforts to eliminate such conflicts are in process.

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Units of Measurements

Units of measurements used here are U. S. standard. 1 U. S. gallon = 0.83 Imperial gallons = 3.785 liters. One foot = 0.3048 meters. One inch = 25.40 millimeters. One pound per square inch = 0.06805 atmospheres = 2.307 feet of water. One pound = 453.6 grams.

Recommendations for
Fire Protection of Vessels
During Construction, Repair and Lay-Up

NFPA No. 312 — 1968

1968 Edition of No. 312

These Recommendations were prepared by the Sectional Committee on Shipbuilding, Repair and Lay-Up with the concurrence of the Committee on Marine Fire Protection. They were adopted by the Association at its 72nd annual meeting in May, 1968. This edition supersedes that of 1964, of which it is a revision.

Origin and Development of No. 312

The first standard on these subjects was adopted by the NFPA in 1933 on recommendation of its Marine Committee, predecessor of the Marine Section. It was further considered in 1935, 1936, and 1937, and was finally adopted by the Association in 1938 on recommendation of the Marine Section Committee on Builders' Risk, Repair and Lay-Up. Editorial changes were made in 1942.

With the reorganization of NFPA marine activities in 1948, responsibility for these recommendations fell to the Committee on Shipbuilding, Repair and Lay-Up. Their recommendations were adopted by the Association in 1950 (Parts I and II) and 1951 (Part III) and a revised edition was adopted in 1964.

The current edition represents a revision and combination of recommendations to the sections covering construction and repair only.

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SCOPE: This committee, together with the several sectional committees listed below, is organized to encourage the application of fire protection engineering to marine vessels and watercraft of all types and to develop such standards and recommendations as may be appropriate to this objective. The sectional committees are responsible for the initial development and revision of standards and recommendations dealing with their respective subjects and report to the Association through the Committee on Marine Fire Protection.

Fire Protection of Vessels During Construction, Repair and Lay-Up

NFPA No. 312 — 1968

INTRODUCTION

Owing to the quantity and character of combustible materials used in the construction of many vessels, such vessels in course of construction and during repair are readily vulnerable to fire. Long alleyways, unenclosed stairways, hatches and hoistways facilitate the rapid spread of fire throughout the vessel. The location of the shipyard is frequently so isolated that dependence for fire fighting is mainly on the private protection provided. Even where major municipal protection is available, the possible delayed response due either to lateness in the discovery of the fire or the absence of means for quick notification, lack of special equipment in many municipal fire departments for combating shipboard fires, or an unfamiliarity with ship construction due to the transitory nature of the risk may cause material damage or complete destruction before effective means of extinguishment can be brought into action. It is, therefore, obvious that every reasonable means of preventing fire should be provided and supplemented by such means of detection and protection equipment as will permit the prompt discovery, retard the spread and permit extinguishment of any fire before it has passed the incipient stage. To this end, the adoption of the following recommended safeguards is urged, being intended to cover the protection of shipyard installations and vessels under construction and during ship repair and conversion work.

These recommendations are, however, applicable only where they are not in conflict with or superseded by the requirements of regulatory agencies.

1. Construction and Repair

101. Inspection

1011. For ships under construction, a continuing inspection should be made by a responsible person representing the shipyard during the entire construction period to note and initiate action to eliminate fire hazards or to implement work procedures to keep these hazards to a minimum.

1012. Vessels enter repair yards in various conditions, the potential fire hazard of which cannot be determined until an inspection has been made. This should be done by a responsible and qualified employee together with a representative of the owner of the vessel as soon as practicable after vessels enter the yard,

and in any case before work is started. Such inspection should note housekeeping conditions, including location of dunnage and trash; the kind and amount of cargo aboard; and the type, amount and condition of the vessel's fire equipment.

1013. With the assistance of a ship's officer, determination should be made of the kinds and amounts of fuel oils or other flammable liquids in all cargo, bunker, deep, settler and double bottom tanks. On all vessels and especially passenger vessels, the location and amount of combustibles such as dry stores, provisions, concentrations of mattresses and other bedding, life preservers, etc., should be determined.

1014. The information obtained should be distributed to the departments responsible for the fire safety of vessels while in the yard, and to the various production departments which are to make repairs to the vessels.

1015. For voyage repairs to be made at the outfitting dock, the inspection may be limited to the actual working area and adjacent compartments. The supplementary information necessary for fire preplanning should be obtained in all instances.

102. Rubbish, Waste Materials, Oil Spills and General Care

1021. Vessels, shipways and outfitting piers should be kept as clean as conditions will permit. All accumulations, and particularly combustible rubbish, refuse and waste materials, should be collected and safely disposed of promptly and at least once each shift as the work progresses. Areas in which hazardous work is to be done should be in clean condition before such work is started.

1022. Furniture and other equipment usually crated or packed in excelsior or similar packing materials should be uncrated or removed from packing in a safe location, preferably well removed from vessels. All packing materials should be disposed of promptly and safely.

1023. Wherever practicable, all oil and other flammable liquids should be removed from vessels while in repair yards, excepting materials stowed/stored in certified spaces, i. e., paint locker, bunker tanks and galley fuel tanks, providing hot work is not required in or adjacent thereto.

1024. Only nonsparking tools should be used in opening piping, pumps, valves, etc. carrying flammable liquids or gases and which have not been certified "gas-free."

1025. Temporary coverings such as tarpaulins which may be used to protect machinery, equipment, combustible stores or

similar materials should either be of non-combustible material or properly flameproofed.

103. Smoking.

1031. Smoking should be prohibited except in locations specifically designated as smoking areas and approved by management or authority having jurisdiction.

104. Storage of Explosives, Flammable Material and Dangerous Cargo.

1041. The storage of explosive, highly flammable (*) — or combustible materials should not be permitted on vessels in course of construction, nor in close proximity to the ways and outfitting berths. This should not be construed to prevent the storage of such quantities as may be necessary for the normal progress of the work, provided such storage is arranged so as not to obstruct fire fighting operations.

1042. Vessels carrying explosives or other dangerous cargo such as flammable gases, hazardous chemicals and flammable liquids (*), but excepting ships' fuel and standard ships' stores (**) should not be permitted to enter a repair yard until such materials have been removed. NFPA Code 306, Control of Gas Hazards on Vessels to be Repaired, outlines the circumstances under which exceptions to this requirement should be exercised with respect to gaseous materials.

1043. EMERGENCY EXCEPTION: Nothing in this document should be construed as prohibiting the immediate drydocking of a vessel whose safety is imperiled, as by being in a sinking condition or by having been seriously damaged. In such cases, all necessary precautionary measures should be taken as soon as practicable.

105. Use of Open Flame or Spark Emitting Devices.

1051. It should be the responsibility of the superintendent directly or through his designated assistants to determine that any hot work requiring the use of riveting, welding, burning, heating or other fire or spark producing operations may proceed with safety. Special attention is called to the danger of hot work in freshly painted areas, in refrigerated spaces, in close proximity to combustible stores or other materials and similar locations. Steps should be taken to assure that all open fires are secured during meal times and that all fires are extinguished at the close of the work period.

*Flammable and inflammable have the same meaning. The term "flammable liquid" in this instance includes all flammable and combustible liquids having a flash point below 200°F. closed cup test.

**Ammunition on armed vessels shall be considered standard ships' stores.

1052. It is particularly important that employees check the opposite sides of the bulkheads or decks on which hot work is to be done, to be certain that there is no combustible materials, painted surfaces, wiring runways, etc. in contact with or in close proximity to such bulkheads or decks, which may be damaged by heat or fire. Where there is any danger of starting fires in the way of hot work, despite the fact that ordinary precautions are employed, a fire watch should be provided to stand by during such operations with portable fire fighting equipment ready to extinguish any incipient fire that may occur.

1052.1. On refrigerated ships it may be necessary to remove combustible insulation for a safe distance from the location where welding or burning is to be done, and special care must be taken to prevent sparks or hot slag from entering exposed insulated spaces. Equipment and materials in way of hot work which cannot be moved should be protected as prescribed in 1025. Doorways, hatch and tank openings, portholes, etc., should be protected where there is a danger of sparks or hot slag dropping or ricocheting into such openings and igniting combustible materials. Hot work should not be done on vessels where there is a danger of sparks or hot slag falling into oil slicks on the waters beneath.

1052.2. Where hot work processes cannot be properly safeguarded in making necessary repairs, such repairs should be accomplished by safer means, such as by drilling, sawing, bolting or other appropriate means.

1053. Riveting furnaces should be located with due regard for the safety of any combustible materials nearby. All fires in rivet heating furnaces or pots should be extinguished at the close of each shift. Attention is called to the need for adequate ventilation in confined spaces where riveting furnaces are used.

1054. Before any hot work involving riveting, welding, burning, heating or other fire or spark producing operations are started in or on any fuel spaces or other areas which contain or have contained flammable or combustible liquids or vapors, certification should be obtained in accordance with the Standard for the Control of Gas Hazards on Vessels to be Repaired (NFPA No. 306). Attention is called to the hazards of fuel in the tanks of motor driven life boats.

1055. Equipment such as blow torches, cutting and welding apparatus should be so stored at the close of each day's work as to prevent tampering by unauthorized persons. Oxygen, acetylene and other flammable gas lines should be disconnected at the source of supply at the end of each working shift, and the discharge end of

the hose removed from below decks or enclosed spaces. During lunch periods, torches should be removed to open air spaces or the lines disconnected.

1055.1. Only oxygen, acetylene or other flammable gas hose in good repair should be used. Where gases are supplied from portable cylinders, the latter should not be placed below the main deck, in confined spaces or under overhanging decks. Portable outlet headers from piped systems should comply with the provisions of NFPA No. 51, Standard for the Installation and Operation of Oxygen-Fuel Gas Systems for Welding and Cutting.

1056. Electric welding cables should be inspected frequently and cables with damaged insulation should be reinsulated or replaced. Cables should be triced up off steel decks, bulkheads, etc. wherever possible to reduce the possibility of short-circuiting or grounding. When not in use, electrodes should be removed from holders and the holders so placed that they will not cause arcing or electrical short circuits.

1057. Vessels in dry dock should be suitably grounded.

1058. Heating for the personal comfort of employees or for other reasons should be done by means of steam, hot water or electricity, using the vessel's heating facilities as far as practicable. Where salamanders must be used they should be mounted on 4-inch legs and be of the coal or coke burning type, and should be permitted only where someone is constantly in attendance. They should be located a safe distance from combustible materials and so arranged as to avoid any danger of upset. Under no conditions should compressed air or oxygen be discharged into salamanders to increase the rate of burning. Attention is called to the need for adequate ventilation in confined spaces where salamanders are used.

1059. It is recommended that temporary, appropriately worded danger markings or warning signs be posted throughout vessels in course of construction or under repair wherever required. Sample wordings of such signs are: Smoking Prohibited; Danger, Fuel Oil; Paint Storage, Positively No Hot Work; Cork Insulation, No Welding or Burning; Carbon Dioxide, Do Not Enter.

106. Temporary Electrical Installations.

1061. Electrical wiring and equipment of a temporary nature on vessels under construction should be substantially installed in such manner as to be safe from physical damage, and should be inspected frequently. Defects in wiring, fixtures or equipment of a

type liable to create dangerous conditions should be promptly remedied. Portable equipment should be provided with overcurrent protection such as fuses or circuit breakers and should be disconnected when not in use. Except where lights are required for inspection purposes, electric current to the vessels' lighting system should be cut off when no work is being done. All electric lines should be kept triced up off the decks wherever possible.

1062. On vessels in repair yards, the vessel's lighting system should be used insofar as practical, except as prohibited in 1071, supplied either by self-generated power or from shore to ship connections.

1063. Where temporary portable electric lights must be used, they should be made up with substantial rubber covered wire. Where temporary artificial lighting is needed in hazardous areas, only explosion-proof lighting fixtures should be used.

1064. Temporary electrical wiring should be installed in a safe manner and should be properly fused. Such wiring and lamps should not be placed in direct contact with combustible materials. Makeshift hangers such as nails which might damage wiring insulations should not be used. Substantial wire guards should be installed on all lights subject to physical damage.

107. Application of Paints and Other Flammable Compounds.

1071. No welding, burning or other open flames or spark-producing machines or operations such as chipping, grinding, etc. should be permitted in close proximity to the application of flammable paints or other flammable compounds. Adequate ventilation should be provided in such areas as deemed necessary to maintain the atmosphere at not more than 10 percent of the lower explosive limit or below the lower limit of toxicity for that particular material as determined by a Certificated Chemist or Competent Person. In all instances, precautions and application instructions of the manufacturer should be obtained and observed. Where artificial lighting is needed in hazardous areas, only approved explosion-proof lights should be used.

108. Protection to Door Openings.

1081. As construction advances, so far as practicable, all door openings should be provided with their permanent doors.

1082. In order to minimize the spread of fire, it is essential that all doors, including draft stop doors, fire screen doors and watertight bulkhead doors, be kept closed when work is not in progress. So far as practicable, care should be taken that the closing of these openings is not obstructed or prevented by hose or pipe

lines, electrical connections or other lines. Provisions for disconnecting such lines should not be considered as a satisfactory alternative. All other openings through bulkheads such as vent ducts should be kept closed off during the course of construction, wherever practicable.

1083. Where doors to quarters are kept locked to prevent theft or unauthorized entry, the keys should be made available to the watchman and fire brigade, or should be located at a designated place aboard where they can be obtained without delay in emergencies by such personnel.

109. Staging and Miscellaneous Structures.

1091. Staging other than steel or fire-retardant treated wood should be removed as soon as its purpose has been served. It is recommended that combustible staging materials be treated with an approved flame-retardant compound to resist ignition from sparks and to retard the spread of fire. Periodic testing to assure flame-proof quality is recommended. Small buildings on or under shipways should be restricted to those absolutely necessary and should be of non-combustible construction.

110. Watch Service.

1101. During the outfitting of new vessels and on inactive vessels, with few or no crew members aboard, berthed at repair yards in the conduct of all major conversion and repair operations a competent watchman should be on duty aboard the vessel at all times. It is recommended that there be installed on the vessel an approved watchman supervisory system of watch boxes connected to a central office where watchman's signals will be received.

1102. Where watch systems such as described in 1101 are not feasible or are not deemed necessary, an approved watchman's portable clock system should be provided during the outfitting, repair and conversion period.

1103. Such watch service may also be necessary on the shipways during earlier stages of construction depending upon the degree of completion of vessels, combustibility of ways, stocks and staging, and the obstruction or congestion caused by the proximity of adjacent ways.

1104. Before going on duty, watchmen should be informed of locations where riveting, welding, burning or other hot work has been carried on in the vicinity of combustible material during the previous work period. They should also be advised of the locations of freshly painted areas, tanks containing oil or other hazardous

conditions. All such locations should be inspected during the progress of the work and as soon as practicable after work has been stopped. The regular watch force should be assisted by other competent persons when necessary in order to complete the inspection within a reasonable period. The watchmen should be required to give further special attention to these locations during their rounds so as to ensure against the spread of any previously undetected fires.

1105. Watchmen should be familiar with the location of all items of fire equipment on vessels, should inspect them during their daily tours of inspection, and should have a knowledge of their use.

1106. Careful selection of watchmen is emphasized. Alertness, quick reaction, perfect hearing and sense of smell, good eyesight, bodily agility and good health are indispensible requirements for a competent watchman.

111. Fire Alarm Service.

1111. At yards where private fire alarm systems are provided, temporary private fire alarm boxes, plainly marked so as to be easily located, should be installed on or near vessels under construction or repair. Where private fire alarm or central station supervised watchman's service is not provided, telephones should be made available at convenient locations on or near vessels and connected to a central office where someone is constantly on duty, who is charged with the responsibility of and provided with suitable means for promptly summoning public or private fire fighting facilities.

1112. Provision should be made for the establishment, marking and maintenance of proper fire lanes at the ways and outfitting and repair piers.

1113. Ways, hull and pier numbers should be prominently displayed. Yard layout diagrams should be provided for public fire fighting facilities whenever the yard is primarily dependent upon these facilties for fire protection.

112. Fire Protection Equipment.

1121. Water for fire extinguishing purposes should be available to all parts of vessels in course of construction and under repair. 1-½ inch and 2-½ inch lines of adequate length connected to shore hydrants or hose connections should lead to points on vessels convenient for use in an emergency. Adequate supplies of spare hose and nozzles should be readily available. Due regard should be had for the capacity of existing shore hydrants to assure that an adequate water supply is available when all outlets are in use.

1122. During the construction of large vessels, it is recommended that temporary pipe risers with hose connections be in-

stalled at the shipways and that a supply of hose be available at such connections on the various decks of vessels under construction. These risers should be installed in the ratio of one for each 200 feet of length of the vessel.

1123. While vessels are at piers or in dry dock, it is recommended that temporary hose lines supplied by shore connections be placed aboard vessels connected and ready for use, in the ratio of at least one hose line for each 200 feet of length of vessel. Where this may be deemed unnecessary due to the size and type of vessel involved, hose lines should be provided at the piers or dry docks. These lines should be nominal 1-½ inch or 2-½ inch in size, or a combination of both sizes and of sufficient length so that any part of the vessel may be reached by at least one line.

1124. On vessels under repair, it is recommended that the vessel's fire system piping be connected to water supplies from the yard by means of temporary shore to ship connections. Caution should be used in turning on these water supplies at shore connections until it is determined that the vessel's fire system is intact and will not result in flooding any portion of the vessel.

1125. Where automatic sprinklers are installed as part of a vessel's permanent fire equipment, they should be progressively placed in service as they are installed.

1126. There should be provided at convenient locations throughout vessels approved portable fire fighting and extinguishing appliances such as hand extinguishers in suitable numbers for Class A, B and C fires (*) and emergency breathing apparatus. Hose lines (¾ inch size) supplied from shore connections provide very satisfactory first aid protection for Class A fires. The location of such equipment should be suitably designated and the proper use thereof. Location of equipment may be done effectively by red lights, continuously lighted when electric current is in service on vessels.

1127. Equipment should be available for extinguishing large Class B and Class C fires which cannot be controlled by the limited capacity of portable hand extinguishers.

NOTE: Classification of Fires: For all practical purposes there are three general classes of fires:

CLASS A FIRES, defined as fires in ordinary combustible materials

*More detailed information on portable fire extinguishers may be found in the Standard for the Installation of Portable Fire Extinguishers (NFPA No. 10), and Maintenance and Use of Portable Fire Extinguishers (NFPA No. 10A). Published by the National Fire Protection Association.

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 energized electrical equipment where the electrical nonconductivity of the extinguishing media is of first importance.

113. Fire Brigade.

1131. Except where a private fire department with paid members is separately employed, designated employees should form the nucleus of a fire brigade, and should be thoroughly drilled in the use of extinguishing equipment provided, including the laying of hose lines, the handling of hose streams and special extinguishing equipment, and the use of self-contained breathing apparatus. Drills should be held at least once a month. For further details, refer to NFPA No. 27, Private Fire Brigades.

114. Mooring at Piers, Stability Fire Fighting.

1141. When vessels are at outfitting piers it is recommended that all openings below weather decks not in use for access or ventilation be kept closed as far as practicable.

1142. On all vessels afloat, all practicable and reasonable measures should be taken to insure maximum stability. After an outbreak of fire, at the first indication of lack of stability, the discharge of fire streams should be reduced to the minimum necessary to prevent the spread of fire. Effective means to prevent overturning of the vessel should be taken as soon as the extent of the fire indicates there will be danger of lack of stability.

1143. In locations where carbon dioxide gas is readily available in adequate quantities, this medium of extinguishment should preferably be employed in order that the vessel's stability be not endangered.

1144. On vessels under repair, the vessel's pumping facilities should be in condition and ready to free the bilges of water whenever it tends to accumulate, in which connection it is important that all scuppers leading from all main decks below main deck to the bilge be maintained free and open.

1145. When more than one vessel is berthed at the same pier or in the same wet basin, provision should be made for the withdrawal of any vessel in the event that fire makes such withdrawal necessary.

2. Lay-Up

200. The following recommendations are intended for application with respect to vessels laid up for indefinite periods without personnel resident aboard.

201. Lay-Up Berth.

2011. Where the lay-up berth is contiguous to a wharf, pier, or other land-connected structure, it should be free from exposure to potential fire and explosion hazards, easy of access for fire fighting equipment, and within convenient proximity of adequate fire fighting facilities and water supply therefor. It should have sufficient depth of water at all stages of the tide to permit removal of the vessel in the event of fire.

2012. The wharf or pier should be in good repair and provided with adequate means for the safe mooring of vessels. Piers and wharves constructed and protected in accordance with the standards of the National Fire Protection Association* are recommended for vessel lay-up.

2013. A fire alarm box, telephone, or other reliable means of communication should be conveniently available and readily accessible.

2014. Vessels laid up in such numbers as to constitute a fleet should be separated in small groups to reduce the danger of fire-spread. The degree of separation of vessels or groups thereof should be determined by the size of the vessels, the character of their construction as to combustible materials, and the prevailing winds at the site of lay-up.

2015. Mooring of vessels, whether singly or in groups, should be effected in such manner as to facilitate their quick removal in the event of fire.

2016. Where vessels are to be laid up some distance from shore facilities, *e.g.,* at anchor, the site should be chosen with due regard to the availability of adequate fire fighting forces and equipment, and arrangements should be made in advance for obtaining prompt response of such facilities in case of need.

202. Ground Tackle.

2021. A vessel in lay-up should have both anchors available for use.

2022. The windlass should be in operating condition. If power for operation of the windlass by the vessel's machinery is precluded

*See Standard for the Construction and Protection of Piers and Wharves (NFPA No. 87) published by the National Fire Protection Association.

or impracticable, temporary or emergency sources of power should be made available.

2023. Vessels laid up at an anchorage should maintain a readily accessible means of parting or slipping the chain.

203. General Care and Cleanliness.

2031. Vessels in lay-up should be kept thoroughly clean throughout. All accumulations, particularly combustible rubbish, refuse and waste materials should be collected promptly and disposed of safely.

2032. All mattresses, blankets, carpets, and similar combustible equipment should be removed from the vessel. Where removal is impracticable, such equipment, under any circumstances, should not be stored on board in unventilated compartments.

2033. Protective coverings such as tarpaulins, which may be used to protect machinery and equipment, should be either of noncombustible material or properly flameproofed.

2034. Smoking should be prohibited on vessels in lay-up except at locations specifically designated and approved as smoking areas by management or the authority having jurisdiction and so posted.

2035. Tankers should be certified in accordance with the Standard for the Control of Gas Hazards on Vessels to be Repaired (NFPA No. 306) immediately prior to being laid up.

2036. In the event that any repairs may be effected to vessels while in lay-up for purposes of emergency, preservation or reactivation, such repairs should be made in accordance with the recommendations of par. 1144, insofar as those recommendations apply.

204. Ventilation—Closure of Openings.

2041. Holds and bilges should be well ventilated. The bilge limbers should be left off to permit ready inspection of the bilges.

2042. All double bottom, deep, peak, and settling tanks used for fuel oil should have their manhole cover plates secured in oil-tight condition, and all traces of unconfined oil should be removed.

2043. All fuel tank vents should be fitted with spark arresters and left open.

2044. All draft stops or dampers in the ducts of mechanical ventilating systems should be secured in the closed position.