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Marine

Standards for the
CONTROL OF GAS HAZARDS
on
VESSELS TO BE REPAIRED

May

1960

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NATIONAL FIRE PROTECTION ASSOCIATION
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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 nearly eighteen thousand individuals, corporations, and organizations. Anyone interested may become a member; membership information is available on request.

This is one of a large number of publications on fire safety issued by the Association; a complete list is available without charge on request. All NFPA standards adopted by the Association are published in the **National Fire Codes** which are re-issued annually. The standards, prepared by the technical committees of the NFPA 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. Complete information on Committees will be found in the NFPA Year Book.

Official NFPA Definitions

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. One foot = 0.3048 meters. One inch = 24.50 millimeters. One pound per square inch = 0.06805 atmospheres = 2.307 feet of water.

Approved Equipment

The National Fire Protection Association does not "approve" individual items of fire protection equipment, materials or services. 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, the Factory Mutual Laboratories and the American Gas Association (gas devices) test devices and materials for use in accordance with the appropriate standards, and publish lists which are available on request.

Control of Gas Hazards on Vessels to Be Repaired.

NFPA No. 306 — 1960

Foreword.

The original standards on this subject were developed by the NFPA Committee on Marine Fire Hazards in 1922 in cooperation with the NFPA Committee on Flammable Liquids. They were adopted by the Association and published as "Appendix A" of the "Regulations Governing Marine Fire Hazards." Further editions with minor changes were published in 1923, 1926 and 1930. In 1947 a completely revised standard was prepared by a joint committee of the American Bureau of Shipping and the National Fire Protection Association. The revised standard was adopted in 1948 by the NFPA and published as "Regulations Governing the Control of Gas Hazards on Vessels to Be Repaired." Amendments were adopted in 1949, 1950, and 1951. The present revised text, which supersedes earlier editions, was also prepared by the joint committee mentioned above. It has been endorsed by the NFPA Committee on Marine Fire Protection and was adopted by the Association at its 64th annual meeting, May 16–20, 1960.

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Standards for Certifying Cargo Tanks, Fuel Tanks and Other Compartments

Before Making Repairs on Vessels Carrying or Burning Combustible or Flammable Liquids or Carrying Flammable Compressed Gases.

SECTION 1.

110. Scope. These standards describe the conditions required before making repairs on any vessel carrying or burning combustible or flammable liquids, or carrying flammable compressed gases. They are applicable to both cold work and to repairs involving riveting, welding, burning or like fire producing operations on vessels while in ports in the continental United States, both within and outside ship repair yards. They are applicable specifically to those spaces in such vessels which are subject to concentrations of combustible or flammable liquids or gases as hereinafter described.

111. Tank Vessels Entering a Repair Yard. Tank vessels shall not be allowed to enter a repair yard, except as provided in Section 4 of these standards, unless cleaned or cleaned and inerted in accordance with the provisions in Section 3, paragraphs 320- or 330- respectively, and so certified by a Certificated Gas Chemist. Repairs or alterations shall not be undertaken until a Gas Chemist's Certificate is obtained.

112. Tank Vessels Not Entering a Repair Yard. Repairs or alterations shall not be made, unless the compartments or spaces involved and the adjacent compartments or spaces have been cleaned, in accordance with the provisions in Section 3, paragraphs 340- or unless the compartment or spaces involved have been cleaned and the adjacent compartments or spaces have been inerted in accordance with paragraphs 350- and so certified by a Certificated Gas Chemist. Repairs or alterations shall not be undertaken until a Gas Chemist's Certificate is obtained.

113. Vessels Other Than Tank Vessels Anywhere. On any vessels which have carried flammable or combustible liquid in bulk as fuel or cargo, whether in a repair yard or elsewhere, no repairs involving hot work shall be made in and on the external boundaries (shell, tank top or deck) of cargo tanks, fuel tanks, oil pipe lines and heating coils, unless such compartments

and pipe lines, deemed necessary by the Certificated Gas Chemist, have been cleaned or inerted to meet the appropriate designation requirements of Section 2, paragraphs 220- except that the application of 224(b) may be used only in the case of repairs not involving the tank top or decks of tank boundaries. In such cases paragraph 224(b) may be modified by partially flooding with water provided that any hot work is performed at least three feet below the water level; provided further that the gas content of the atmosphere above water does not exceed one half of one per cent by volume in air. In no case shall internal hot work be permitted within any compartment or space unless the compartment in which the work is to be performed is in such a condition as will meet the requirements of Section 2, paragraph 221. Repairs or alterations shall not be undertaken until a Gas Chemist's Certificate is obtained.

114. Vessels Carrying Flammable Compressed Gas. On any vessels which have carried flammable compressed gas in bulk, no repairs or alterations involving hot work shall be made unless the applicable provisions of paragraphs 111 and 112 are complied with; provided, however, individual pressure tanks, inerted in accordance with paragraph 225, are considered in a safe condition for such work not directly involving these tanks or their pipe lines or the spaces in which these tanks are located.

120. Emergency Exception. Nothing in these standards shall be construed as prohibiting the immediate dry-docking of a vessel whose safety is imperiled, as by being in a sinking condition or by having been seriously damaged, making it impracticable to clean and gas-free in advance. In such cases however all necessary precautionary measures should be taken as soon as practicable to provide safe conditions satisfactory to the Certificated Gas Chemist.

130. Governmental Regulations. Attention of owners, repairers and chemists is directed to the general regulations of the government covering repairs to vessels. Nothing in these standards shall be construed as superseding existing requirements of any governmental or local authority.

The "Rules and Regulations for Tank Vessels" and other rules and regulations for vessel inspection of the United States Coast Guard prescribe an inspection prior to making repairs involving riveting, welding, burning or like fire producing operations. These regulations provide, under the conditions stated therein, for inspection by a gas chemist certificated by the American Bureau of Shipping or alternately another person. For particulars, these regulations should be consulted.

SECTION 2.

210. Standard Definitions.

For the purpose of these standards the following definitions are to be recognized:

211. CERTIFICATED GAS CHEMIST: The holder of a valid certificate issued by the American Bureau of Shipping in accordance with its "Rules for Certification of Chemists" establishing him as a person qualified to determine whether repairs and alterations to vessels, which may involve gas hazards, can be undertaken with safety.

212. GAS CHEMIST'S CERTIFICATE: A written statement prepared and issued by a Certificated Gas Chemist in form and manner prescribed by the American Bureau of Shipping. (See page 306–15.)

213. FLAMMABLE AND COMBUSTIBLE LIQUIDS:

a. FLAMMABLE LIQUID*: For the purpose of these requirements, a flammable liquid is any liquid which gives off flammable vapors (as determined by flash point from an open cup tester, as used for test of burning oils) at or below a temperature of 80°F.

b. COMBUSTIBLE LIQUID: For the purpose of these requirements a combustible liquid is any liquid having a flash point above 80°F. (as determined by means of an open-cup tester as used for test of burning oils).

c. EQUIVALENT FLASH POINTS:

Open Cup Tester °F.	*"Tag" Closed Cup Tester* (A.S.T.M.) °F.	*Pensky-Martens Closed Tester* °F.
80	75	—
150	—	140

d. FLAMMABLE COMPRESSED GAS: For the purpose of these requirements, flammable compressed gas is defined as any flammable gas which has been compressed and liquefied for the purpose of transportation and has a Reid vapor pressure exceeding 40 pounds.

*Note: "Flammable" and "Inflammable" have the same meaning.

214. TANKER DESIGNATIONS:

a. TANK VESSEL: A tank vessel is any vessel especially constructed or converted to carry liquid bulk cargo in tanks.

b. TANK SHIP: A tank ship is any tank vessel propelled by power or sail.

c. TANK BARGE: A tank barge is any tank vessel not equipped with means of self-propulsion.

215. REPAIR CLASSIFICATIONS:

a. HOT WORK: Any repair or alteration involving riveting, welding, burning or similar fire-producing operations. Grinding, drilling or similar spark-producing operations shall be considered hot work except when in the judgment of the Certificated Gas Chemist, circumstances do not necessitate such classification.

b. COLD WORK: Any repair or alteration which does not involve heat, fire and spark-producing operations.

220. Standard Safety Designations:

The following standard safety designations shall be used in preparing Gas Chemists' Certificates, cargo tank labels and other references:

221. SAFE FOR MEN — SAFE FOR FIRE: Means that in the compartment or space so designated and in the adjacent* compartments or spaces:

a. The gas content of the atmosphere by volume is within the permissible limits given in Table I, and that;

b. In the judgment of the Certificated Gas Chemist, the residues are not capable of producing dangerous gases under atmospheric conditions and in the presence of fire.

222. SAFE FOR MEN — NOT SAFE FOR FIRE: Means that in the compartment or space so designated:

a. The gas content of the atmosphere by volume is within the permissible limits given in Table I, and that;

b. In the judgment of the Certificated Gas Chemist, the residues are not capable of producing dangerous gases under atmospheric conditions and in the absence of fire.

*Note: Except that adjacent compartments may be inerted and, in the case of fuel tanks, may be treated as deemed necessary by the Certificated Gas Chemist.

TABLE I.

Permissible Concentrations for Exposure Not Exceeding a Total of 8 Hours Per Day.

Item	*Number of Parts per 1,000,000 Parts of Air*	*Corresponding Per Cent by Volume in Air*
Aromatic Hydrocarbons:		
Benzene (Benzol)	25	0.0025
Toluene (Toluol)	200	0.02
Xylene (Xylol)	200	0.02
Paraffinic Hydrocarbons:		
Normal Petroleum Gases . .	1000	0.10

223. NOT SAFE FOR MEN — NOT SAFE FOR FIRE: Means that in the compartment or space so designated, either:

a. The gas content of the atmosphere by volume is not within the permissible limits given in Table I, or that;

b. In the judgment of the Certificated Gas Chemist, the residues are capable of producing dangerous gases under atmospheric conditions, or that;

c. The compartment was not tested because it contained ballast, slops, bunkers, etc. In such cases this safety designation shall be followed by a statement of the condition of the compartment which prevented it from being tested.

224. INERTED: Means that in the compartment or space so designated, either:

a. Carbon Dioxide or other nonflammable gas, approved by the American Bureau of Shipping, has been introduced into the space in sufficient volume to maintain the oxygen content of the atmosphere of the space at or below 10 per cent during the whole of the inerting period, and to insure that the volume of the inerting gas shall never be less than 50 per cent of that of the void space; or that

b. The space has been filled to the top with water.

c. The kind of gas and the safe disposal or securing of gas inerting media shall be noted on the Gas Chemist's Certificate by the Certificated Gas Chemist upon the completion of repairs. Closing and securing of hatches and other openings, except vents, may be considered as "safe disposal" of the gas by the Certificated Gas Chemist.

225. INERTED, FOR FLAMMABLE COMPRESSED GAS: Means that individual pressure tanks with a working pressure of 50 pounds per square inch or over may be considered inerted when a

positive pressure is maintained on the tanks by the flammable vapors remaining after the cargo has been discharged.

SECTION 3.

310. Minimum Requirements Precedent to the Issuance of a Gas Chemist's Certificate — Applicable in All Cases.

311. Before a Certificated Gas Chemist shall issue a certificate setting forth in writing that the contemplated repairs and alterations to a vessel can, in his judgment, be undertaken with safety he shall personally determine that the applicable minimum requirements have been complied with to his satisfaction.

312. When the Certificated Gas Chemist has satisfied himself that these minimum requirements and any other requirements, deemed by him to be necessary in order that the repairs and alterations can be undertaken with safety, have been carried out, a Gas Chemist's Certificate shall be issued by him setting forth in writing those facts, qualified as may be necessary and prepared in form and manner prescribed by the American Bureau of Shipping. (See page 306–15.)

313. It shall be the responsibility of the vessel repairer to retain the services of the Certificated Gas Chemist and to secure copies of his inspection certificate and provide the master of the vessel and the representatives of the vessel owner with copies for their information.

320. Minimum Requirements Which Shall Prevail Prior to the Issuance of a Gas Chemist's Certificate, Where a Safe Condition Is to Be Obtained Entirely by Cleaning.

321. All cargo heater coils shall have been steamed and blown. All cargo pumps, cargo lines, cargo smothering and vent lines shall have been flushed with water or blown with steam or air.

322. Compartments shall be so cleaned that the gas content by volume of the atmosphere in all cargo compartments and other spaces subject to gas accumulation (with the exception of bunker tanks containing fuel oil[1]) shall be within the permissible limits of Table I.

[1]Note: If, however, the work involved is within the cargo compartment adjacent to fuel oil bunker boundaries, then the bunker tanks should be treated as deemed necessary by the Certificated Gas Chemist.

323. The residues in all cargo compartments and other spaces (with the exception of bunker tanks containing fuel oil*) shall not be capable, in the opinion of the Certificated Gas Chemist of releasing gas which will raise the concentration in any such space above the limits of Table I.

324. Satisfactory compliance with all the foregoing requirements shall be noted on the Gas Chemist's Certificate.

330. Minimum Requirements Which Shall Prevail Prior to the Issuance of a Gas Chemist's Certificate Where a Safe Condition Is to Be Obtained by Both Cleaning and Inerting or Entirely by Inerting.

331. A Certificated Gas Chemist shall approve the use of the inerting procedure. Except where water is the inerting medium he shall be present continuously and actually supervise the control of the inerting medium and the hazards from the time the inerting medium is first taken aboard until the repairs and the safe disposal or securing of the inerting medium are complete. (Where gas inerting is being performed, a substitute for the Certificated Gas Chemist shall not be permitted as provided under other conditions in U. S. Coast Guard regulations.)

332. Only authorized persons and those actually necessary in connection with the repairs should be permitted on board the vessel from the time the inerting gas is taken aboard until the repairs and the safe disposal or securing of the inerting gas are completed.

333. All cargo heater coils, except those in the inerted spaces shall have been steamed and blown. All cargo smothering and vent lines, except those in the inerted spaces, shall have been flushed with water, or blown with steam or air, or inerted. All valves to the inerted spaces shall have been closed and secured. All cargo pumps and cargo lines shall have been flushed with water, or blown with steam or air, or inerted.

334. All spaces to be inerted shall be sufficiently intact to retain the inerting medium. All valves, hatches and other openings to the inerted spaces, except those controlling the inerting medium, are to be closed and secured.

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*Note: If, however, the work involved is within the cargo compartment adjacent to fuel oil bunker boundaries, then the bunker tanks should be treated as deemed necessary by the Certificated Gas Chemist.

335. Compartments or spaces in which internal repairs or alterations are to be undertaken shall be cleaned to comply with the requirements of paragraphs 320- and all other spaces (with the exception of bunker tanks containing fuel oil*) shall be inerted in accordance with the requirements of Section 2, paragraph 224.

336. Compartments or spaces on which external repairs or alterations are to be undertaken on the external boundaries (deck or shell) may be inerted by gas instead of being cleaned as described in paragraph 335, and all other spaces (with the exception of bunker tanks containing fuel oil*) shall be inerted, such inerting to be in accordance with the requirements of Section 2, paragraph 224.

337. Satisfactory compliance with all the foregoing requirements shall be noted on the Gas Chemist's Certificate.

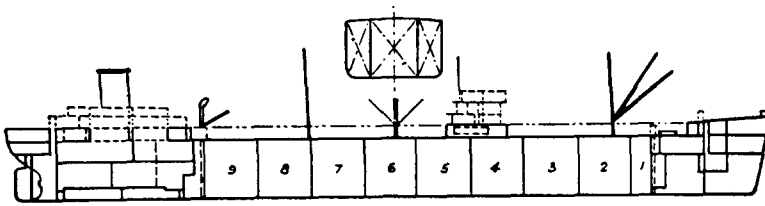
340. Minimum Requirements Which Shall Prevail Prior to the Issuance of a Gas Chemist's Certificate Where a Safe Condition Is to Be Obtained Entirely by Cleaning Certain Compartments and by Securing the Other Compartments.

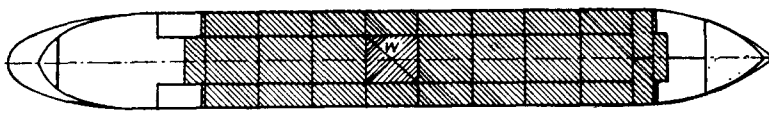
341. All cargo heater coils to the spaces involved shall have been steamed and blown; all cargo smothering and vent lines to the spaces involved shall have been flushed with water or blown with steam or air; and the valves to all other compartments closed and secured. All cargo pumps and cargo lines shall have been flushed with water or blown with steam or air and the valves closed and secured.

342. Compartments or spaces in which internal repairs or alterations are to be undertaken and all adjacent compartments, including those diagonally adjacent thereto, shall be cleaned to comply with the applicable requirements of paragraphs 320- and all other compartments shall be closed and secured.

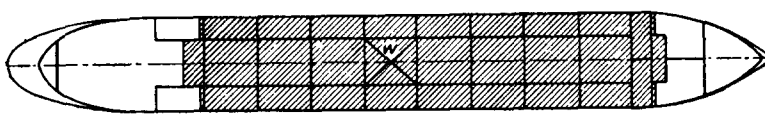
343. Satisfactory compliance with all the foregoing requirements shall be noted on the Gas Chemist's Certificate.

*Note: If, however, the work involved is within or on the cargo compartment adjacent to fuel oil bunker boundaries, then the bunker tanks should be treated as deemed necessary by the Certificated Gas Chemist.

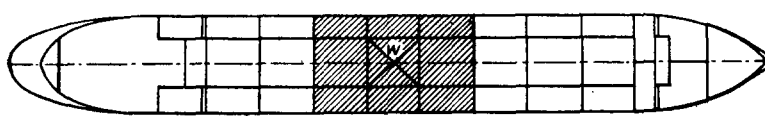




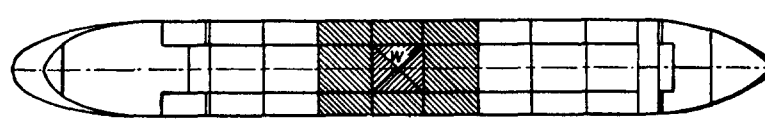
Paragraphs 320 — Safe Condition Obtained Entirely by Cleaning in a Repair Yard.



Paragraphs 330 — Safe Condition Obtained by Cleaning and Inerting in a Repair Yard.



Paragraphs 340 — Safe Condition Obtained by Cleaning and Securing Not in a Repair Yard.



Paragraphs 350 — Safe Condition Obtained by Cleaning, Inerting and Securing Not in a Repair Yard.

Key: /// /// - Clean; \\\ \\\ - Inert; W-Work.

350. Minimum Requirements Which Shall Prevail Prior to the Issuance of a Gas Chemist's Certificate Where a Safe Condition Is to Be Obtained by Both Cleaning and Inerting or Entirely by Inerting Certain Compartments and by Securing the Other Compartments.

351. All cargo heater coils to the spaces involved, except those to the inerted spaces, shall have been steamed and blown; all cargo smothering and vent lines to the spaces involved, except those to the inerted spaces, shall have been flushed with water or blown with steam or air or inerted; and the valves to all other compartments closed and secured. All cargo pumps and cargo lines shall have been flushed with water, or blown with steam or air or inerted and the valves closed and secured.

352. Compartments or spaces in which internal repairs or alterations are to be undertaken shall be cleaned to comply with the requirements of paragraphs 320- and all adjacent compartments, including those diagonally adjacent thereto, shall be inerted to comply with the applicable requirements of paragraphs 330- and all other compartments shall be closed and secured.

353. Compartments or spaces on which external repairs or alterations are to be undertaken on the external boundaries (deck or shell) may be inerted by gas instead of being cleaned as described in paragraph 352, and all adjacent compartments, including those diagonally adjacent thereto, shall be inerted to comply with the applicable requirements of paragraphs 330- and all other spaces shall be closed and secured. Flooding with water may be used in lieu of gas inerting provided that the work is confined to the exterior shell at least three (3) feet below the water level and further provided that the gas content of the atmosphere above the water does not exceed one half of one per cent by volume in air, and if approved by a Certificated Gas Chemist.

354. Satisfactory compliance with all the foregoing requirements shall be noted on the Gas Chemist's Certificate.

SECTION 4.

410. Exemptions from the Requirements of Section 1 for Vessels Entering a Repair Yard.

411. Vessels which enter the repair yard for examination, either afloat or in drydock, provided, that all bulk cargo compartments and cofferdams are kept closed.

412. Vessels which enter the repair yard for scraping, washing down and painting afloat or in drydock, provided, that all bulk cargo compartments and cofferdams are kept closed.

413. Vessels which enter the repair yard for work (hot or cold) to be performed outside of the vessel, either afloat or in drydock, on the propeller, tailshaft or rudder (except hollow rudders in which case a Gas Chemist's Certificate shall be required for the rudder) or for work to be performed off the vessel such as on the anchors or chains, provided, that all bulk cargo compartments and cofferdams are kept closed.

414. Vessels which enter the repair yard for work, either afloat or in drydock, within boiler and machinery spaces, and at other locations remote from the cargo compartments but not less than twenty-five (25) feet from the nearest cargo compartment which has not been cleaned or inerted to meet the appropriate designation requirements of Section 2, paragraphs 220-; provided, that where hot work is to be undertaken a Gas Chemist's Certificate shall be required and this certificate shall set forth each specific location for which such work is approved, and further provided, that all bulk cargo compartments and cofferdams are kept closed.

415. Vessels which proceed to a special berth selected and set apart in the repair yard for a degassing, cleaning and inerting berth with due regard to the hazards of the location and to hazards to adjacent property.

416. The degassing, cleaning and inerting of vessels at such special berths shall be carried out in accordance with the requirements of Section 3, paragraphs 320- or 330- before they are shifted to other berths. No repairs involving hot work shall be undertaken on any vessel in such special berth until it has been degassed and cleaned or inerted in accordance with the requirements of Section 3, paragraphs 320- or 330- nor shall such repairs be then undertaken if another vessel or vessels, which have not complied with these requirements, are in the special berth at the same time.

417. A Gas Chemist's Certificate shall be obtained before shifting a vessel to another berth from the special berth, or before undertaking the repair work at the special berth.

418. Vessels which proceed to a drydock or special berth selected and set apart with due regard to the hazards of the location and to hazards to adjacent property may undergo specific limited repair of a local nature when the compartments or spaces involved and the adjacent compartments or spaces are prepared in accordance with the provisions in Section 3, paragraphs 340- or paragraphs 350-. Not more than one vessel shall be located at each special berth. A Gas Chemist's Certificate shall be obtained before undertaking such repairs.