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Regulations
Governing the Control of
GAS HAZARDS
on Vessels to be Repaired

1948

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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 the public in establishing proper safeguards against loss of life and property by fire.

Committee on Gas Hazards.

{ Joint Committee of the American Bureau of Shipping and the Marine Section of the National Fire Protection Association }

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Control of Gas Hazards on Vessels.

These standards were adopted by the NFPA in 1947 on recommendation of the NFPA Marine Section and subsequent amendments recommended by the joint committee were approved by the Executive Committee of the Marine Section and by the NFPA Board of Directors in January 1948. These standards have been adopted also by the American Bureau of Shipping. The present text supersedes the original "Standards for Freeing Oil Tanks, Bunkers and Compartments of Dangerous Concentration of Flammable, Explosive or Toxic Gases Previous to Entering for Any Purpose or Making Repairs on Oil Burning or Oil Tank Vessels". The original standards were developed by the Committee on Marine Fire Hazards in 1922 in cooperation with the Committee on Flammable Liquids. They were adopted by the Association in 1922 and published as Appendix A of the "Regulations Governing Marine Fire Hazards". Further editions with minor additions were published in 1923, 1926 and 1930.

Concurrent with the development of the original standards, similar standards for land tanks were developed by the Committee on Flammable Liquids and adopted by the Association in 1922 under the title "Suggested Good Practice for Freeing Fuel Oil and Other Oil Tanks at Refineries, Tank Farms, Distilleries and Other Industrial Plants, of Flammable and Explosive Vapors Previous to Entering for Making Repairs or Other Purpose". This standard was substantially identical with the standards for marine oil tanks in its technical provisions, differing only in provisions dealing with the details of application. This standard has not been currently revised since its original adoption and is not reprinted here. The original text appears in the 1922 NFPA Proceedings, page 186.

Regulations for Certifying Oil Cargo Tanks, Fuel Oil Tanks, and Other Compartments Free of Dangerous Concentrations of Flammable, Explosive and Toxic Gases, Previous to Entering for Making Repairs on Tank Vessels and Vessels Carrying or Burning Oil.

SECTION 1.

110. General.

111. (a) **Tank Ship Entering Repair Yard.** Except as otherwise provided for in Sections 3 and 4 of these regulations, before a tank ship, which has carried flammable or combustible liquid in bulk as cargo, enters a repair yard for repairs or alterations, all compartments subject to gas accumulation other than bunker tanks containing fuel oil are to be cleaned. Such cleaning shall be in general accordance with the provisions of 320 or 330 of these regulations and shall include the removal of sediment, the flushing of cargo lines and cargo pumps with water and the blowing of cargo heating coils and cargo smothering lines, preferably with steam. Before any repairs or alterations involving riveting, welding, burning or like fire-producing operations are undertaken on the vessel at the repair yard a Gas Chemist's Certificate must be obtained from a Certificated Gas Chemist.

(b) **Tank Barge Entering Repair Yard.** Except as otherwise provided for in Sections 3 and 4 of these regulations, before a tank barge, which has carried flammable or combustible liquid in bulk as cargo, enters a repair yard for repairs or alterations, all compartments subject to gas accumulation are to be cleaned. Such cleaning shall be in general accordance with the provisions of 320 or 330 of these regulations and shall include the removal of sediment, the flushing of cargo lines and cargo pumps, etc. Before any repairs or alterations involving riveting, welding, burning or like fire-producing operations, are undertaken on the vessel at the repair yard a Gas Chemist's Certificate must be obtained from a Certificated Gas Chemist.

112. (a) **Tank Ship Not Entering Repair Yard.** On tank ships elsewhere in port than in a repair yard, no repairs or alterations, involving riveting, welding, burning or like fire-producing operations, shall be made in and on the boundaries of tanks, pump rooms, cargo pumps, cargo lines, cargo heating coils and cargo smothering lines; until such space or spaces shall have been freed of sediment and dangerous concentrations of flammable, explosive or toxic gases and certified as such by a Certificated Gas Chemist. Where fire or open flame equipment including electric welding is to be used in the compartment under repair, the adjacent tanks or spaces shall also be similarly cleaned as provided for in 320 or alternatively inerted as provided for in 330. Alternatively the tank ships may be inerted as provided for in 340.

(b) **Tank Barge Not Entering Repair Yard.** On tank barges elsewhere in port than in a repair yard, no repairs or alterations, involving riveting, welding, burning or like fire-producing operations, shall be made in and on the boundaries of tanks, pump rooms, cargo pumps, cargo lines, etc., until such space or spaces shall have been freed of sediment and dangerous concentrations of flammable, explosive or toxic gases and certified as such by a Certificated Gas Chemist. Where fire or open flame equipment including electric welding is to be used in the compartment under repair, the adjacent tanks or spaces shall also be similarly cleaned as provided for in 320 or alternatively inerted as provided for in 330. Alternatively the tank barges may be inerted as provided for in 340.

113. Any Vessel Other Than a Tank Vessel Carrying or Burning Oil. On any vessel which has carried flammable or combustible liquid in bulk as fuel or cargo whether in a repair yard or elsewhere in port, no repairs or alterations involving riveting, welding, burning or like fire-producing operations, shall be made in and on the boundaries of oil bunkers, oil tanks, oil pipe lines and heating coils, until similar precautionary measures are taken with respect to the compartment or tank involved and a like Gas Chemist's Certificate shall have been obtained.

120. Emergency Exception.

Nothing in these regulations shall be construed as prohibiting the immediate dry-docking of a vessel whose safety is imperilled, as by being in a sinking condition or by having been seriously damaged, making it impracticable to clean and gas-free her tanks 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 called to the general regulations of the government covering repairs to tank vessels. Nothing in these regulations shall be construed as superseding existing requirements of any governmental or local authority.

SECTION 2.

210. Standard Definitions.

For the purpose of these regulations 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.

213. FLAMMABLE AND COMBUSTIBLE LIQUIDS:

(a) FLAMMABLE LIQUID*. A flammable liquid is any liquid having a flash point at or below a temperature of 75° F. as determined by means of a Tag closed tester in accordance with the standard method specified in A.S.T.M. Designation D56—.

(b) COMBUSTIBLE LIQUID: A combustible liquid is any liquid having a flash point above 75° F. as determined by means of a Tag closed tester in accordance with the standard method specified in A.S.T.M. Designation D56—.

(c) EQUIVALENT FLASH POINTS:

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

*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.

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: Implies 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.

(b) in the judgment of the certifying chemist, the residues are not capable of producing dangerous gases under atmospheric conditions or in the presence of fire.

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 Percent by Volume in Air
Aromatic Hydrocarbons:		
Benzene (Benzol)	100(1)	.01
Toluene (Toluol)	200(1)	.02
Xylene (Xylol)	200(1)	.02
Paraffinic Hydrocarbons:		
Normal Petroleum Gases	1000(2)	.10

222. SAFE FOR MEN—NOT SAFE FOR FIRE: Implies 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.

(b) in the judgment of the certifying chemist, the residues are not capable of producing dangerous gases under atmospheric conditions.

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

†Notes:

(a) The values indicated as (1) are standard toxicity limits of the American Standards Association.

(b) The value indicated as (2), half the usually accepted limit, is that adopted by the Chemists' Sub-Section, NFPA.

(a) the gas content of the atmosphere by volume is not within the permissible limits given in Table I.

(b) in the judgment of the certifying chemist, the residues are capable of producing dangerous gases under atmospheric conditions or,

(c) that the compartment was not tested because it contained ballast, slops, bunkers, etc. In such cases the above safety designation shall be followed by a statement of the contents of the compartment which prevented it from being tested.

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

(a) the oxygen content of the atmosphere has been reduced to 10% (for CO_2) or less by the introduction into the space of a non-flammable gas approved by the American Bureau of Shipping and that the quantity of non-flammable gas be not less than 50% (for CO_2) of the void space and that these conditions be so maintained continuously; or,

(b) that the space has been filled to the top with water.

SECTION 3.

310. Minimum Requirements Precedent to the Issuance of a Gas Chemist's Certificate.

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 minimum requirements of 320, 330 or 340 have been complied with to his satisfaction.

312. When the Certificated Gas Chemist has satisfied himself that these minimum requirements then prevail and that 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.

313. It shall be the responsibility of the vessel repair yard 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 representative of the vessel owner with copies for their information.

314. The kinds of inerting media and the manner in which they may be used for the inerting of tank barges and tank ships shall be:

(a) CARBON DIOXIDE OR OTHER NONFLAMMABLE GASES when approved by the American Bureau of Shipping, and when introduced into spaces to be inerted in sufficient volume to maintain the oxygen content of the atmosphere of these spaces at or below 10% (for CO_2) during the whole of the inerting period but not less volume than 50% (for CO_2) of the void space or,

(b) WATER when the spaces to be inerted are filled under the following conditions and except for conditions described in 341 and 342: The vessel's cargo system shall be used to fill the space but such use shall be discontinued when the liquid level reaches twelve inches below the deck and additional water shall be added slowly under close supervision until the space is full to prevent gases or oil on the surface of the water being displaced into spaces in which the repair work is to be undertaken.

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

320. Minimum Requirements Which Shall Prevail Prior to the Issuance of a Gas Chemist's Certificate When the Repairs and Alterations Are Not of a Minor Nature and Where a Safe Condition Is to Be Secured by the Removal of Dangerous Concentration of Gases and Sediments:

321. All cargo heater coils and cargo smothering and vent lines shall have been steamed and blown.

322. All cargo pumps and cargo lines shall have been blown with steam or flushed with water.

323. The gas content of the atmosphere by volume in compartments and spaces subject to gas accumulation (with the exception of bunker tanks containing fuel oil) shall be within the permissible limits of Table I.

324. The residues in 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 and under the circumstances, of releasing gas which will raise the concentration in any such space above the limits of Table I.

330. Minimum Requirements Which Shall Prevail Prior to the Issuance of a Gas Chemist's Certificate When the Repairs and Alterations Are on a Tank Barge or Are of a Minor Nature on a Tank Ship and Where a Safe Condition Is to Be Secured by the Removal of Dangerous Concentrations of Gases and Sediments in the Space or Spaces Where the Work Is to Be Performed and by the Inerting of Surrounding Spaces:

331. The use of inerting media in the repair of Tank Barges shall be permitted under the following conditions:

(a) When the conditions under which the work is to be performed, including all the particulars with respect to the use of the inerting medium, shall first have been approved by a gas chemist certificated by the American Bureau of Shipping. [Where an inerting gas medium is to be used, no substitute for the Certificated Gas Chemist shall be permitted as provided under other conditions in Coast Guard Regulations, Title 46, Chap. I, Sub-Chap. D, Part 35, Sec. 35.6-1(a).]

(b) Except when the inerting medium is water a Certificated Gas Chemist is to be *continuously* present and actively supervise the control of the inerting medium and the gas hazards from the time the inerting medium is first taken aboard until the repairs and the safe disposal of the inerting medium are completed.

(c) The space or spaces in which the repair work is to be done are to be in compliance with the requirements of 320 and all valves to such spaces are to be closed and secured and all vent openings are to be plugged.

(d) All of the spaces other than those in which the repair work is to be done are to be inerted in accordance with the provisions of 314 and 315 and all valves, hatches and other openings to the inerted spaces except those controlling the inerting medium are to be closed and secured.

332. The use of inerting media in the repair of Tank Ships shall be permitted only when the following conditions prevail:

(a) When there is a specific minor repair to be made which has resulted from damage or failure and which can be rectified by continuous work and completed within a 24-hour period. (The use of inerting media during a periodic, scheduled or protracted repair period shall not be permitted.)

(b) When the conditions under which the work is to be performed, including all of the particulars with respect to the use of the inerting media, shall first have been approved by a gas chemist certificated by the American Bureau of Shipping. [Where an inerting gas medium is to be used no substitute for the Certificated Gas Chemist shall be permitted as provided under other conditions in Coast Guard Regulations, Title 46, Chap. I, Sub-Chap. D, Part 35, Sec. 35.6-1(a).]

(c) Except when the inerting medium is water a Certificated Gas Chemist is to be *continuously* present during all repairs and actively supervise the control of the inerting medium and the gas hazards from the time the inerting medium is first taken aboard until the repairs and the safe disposal or sealing of the inerting medium are completed.

(d) Only authorized personnel and those actually necessary in effecting the repairs should be permitted on board the vessel from the time the inerting medium is taken aboard until the repairs and the safe disposal or sealing of the inerting medium are completed.

(e) The space or spaces in which the emergency repair work is to be done are to be in compliance with the requirements of 320 and all valves to such spaces are to be closed and secured and all vent openings are to be plugged.

(f) All of the spaces surrounding those in which the repair work is to be done (including those which may be diagonally adjacent thereto) are to be inerted in accordance with the provisions of 314 and 315 and all valves, hatches and other openings to the inerted spaces except those controlling the inerting medium are to be closed and secured.

(g) All hatches and other openings to the other cargo spaces and cofferdams are to be closed and secured.

340. Minimum Requirements Which Shall Prevail Prior to the Issuance of a Gas Chemist's Certificate When the Repairs and Alterations Are to Be Made Only Upon the Exterior Boundaries of Tank Vessels in Which the Watertight Integrity of the Exterior Boundaries Is Not Impaired and Where a Safe Condition Is to Be Secured by the Inerting of the Space or Spaces in Way of the Work and of the Surrounding Spaces.

341. The use of carbon dioxide or other nonflammable gases approved by the American Bureau of Shipping as inerting media in the repairs on the exterior boundaries of tank barges shall be permitted under the following conditions:

(a) When the conditions under which the work is to be performed, including all the particulars with respect to the use of the inerting medium, shall first have been approved by a gas chemist certificated by the American Bureau of Shipping. [Where an inerting gas medium is to be used, no substitute for the Certificated Gas Chemist shall be permitted as provided under other conditions in Coast Guard Regulations, Title 46, Chap. I, Sub-Chap. D, Part 35, Sec. 35.6-1(a).]

(b) A Certificated Gas Chemist is to be *continuously* present during all repairs and actively supervise the control of the inerting medium and the gas hazards from the time the inerting medium is first taken aboard until the repairs and the safe disposal or sealing of the inerting medium are completed.

(c) The space or spaces on the exterior boundaries of which the work is to be done and all of the surrounding spaces are to be inerted with carbon dioxide, or with other nonflammable gases approved by the American Bureau of Shipping, in accordance with the provisions of 314 and 315, and all valves, hatches and other openings to the inerted spaces, except those controlling the inerting medium, are to be closed and secured.

342. The use of carbon dioxide or of other nonflammable gases approved by the American Bureau of Shipping as inerting media in the repairs on the exterior boundaries of tank ships shall be permitted under the following conditions:

(a) When there is a specific minor repair or alteration to be made only upon the exterior boundaries of or parts external to a tank ship where the watertight integrity of the exterior boundaries is not impaired and when such minor repair can be performed by continuous work and completed within a 24-hour period. (The use of inerting media during a periodic, scheduled or protracted repair period shall not be permitted.)

(b) When the conditions under which the work is to be performed, including all the particulars with respect to the use of the inerting medium, shall first have been approved by a gas chemist certificated by the American Bureau of Shipping. [Where an inerting gas medium is to be used, no substitute for the Certificated Gas Chemist shall be permitted as provided under other conditions in Coast Guard Regulations, Title 46, Chap. I, Sub-Chap. D, Part 35, Sec. 35.6-1(a).]

(c) A Certificated Gas Chemist is to be *continuously* present during all repairs and actively supervise the control of the inerting medium and the gas hazards from the time the inerting medium is first taken aboard until the repairs and the safe disposal or sealing of the inerting medium are completed.

(d) Only authorized personnel and those actually necessary in effecting repairs should be permitted on board the vessel from the time the inerting medium is taken aboard until the repairs and the safe disposal or sealing of the inerting medium are completed.

(e) The space or spaces on the exterior boundaries of which the work is to be done and all of the surrounding spaces, including those which may be diagonally adjacent thereto, are to be inerted with carbon dioxide or with other nonflammable gases approved by the American Bureau of Shipping, in accordance with the provisions of 314 and 315 and all valves, hatches and other openings to the inerted spaces, except those controlling the inerting medium, are to be closed and secured.

(f) All hatches and other openings to the other cargo spaces and cofferdams are to be closed and secured.

SECTION 4.

400. Requirements for Tank Vessels Which Enter Vessel Repair Yard for Repairs and Alterations.

No tank vessel which has carried as cargo flammable and combustible liquids in bulk shall enter a vessel repair yard for repairs and alterations except under the following conditions:

410. After Inspection by a Certificated Gas Chemist:

411. If an inspection has been made by a gas chemist certificated by the American Bureau of Shipping to determine that the repairs and alterations can be undertaken with safety. No such repairs and alterations shall be undertaken until a Gas Chemist's Certificate has been duly issued.

412. Where a vessel has entered a vessel repair yard without first having secured a Gas Chemist's Certificate under conditions provided for elsewhere in this Section 4 or where such certificate has been secured and is limited, and subsequently repairs or alterations are contemplated which are not authorized by a certificate, then these repairs and alterations shall not be started until an inspection has been made by a Certificated Gas Chemist and a certificate issued setting forth that such operations can be undertaken with safety.

420. For Examination, Cleaning, Painting and Specific Repairs:

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

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