

TRANSPORT  
CANADA

TP3177E

COAST GUARD

STANDARD  
FOR  
THE CONTROL OF  
GAS HAZARDS IN VESSELS  
TO BE REPAIRED OR ALTERED

SHIP SAFETY BRANCH  
March 1984

## CONTENTS

	PAGE
PART I: Application and Interpretation.....	3
PART II: Minimum Requirements before Issuance of Marine Chemist's Certificate - Applicable in all Cases .....	6
PART III: Mandatory Requirements for Vessels.....	9
PART IV: Additional Requirements for Bulk Chemical Cargo Tanks.....	15
PART V: Additional Requirements for Flammable Cryogenic Liquid Carriers.....	15
APPENDIX A: Illustrations of Safe Conditions for Work .....	20
APPENDIX B: Marine Chemist Certificate .....	21
APPENDIX B .....	21

# STANDARD FOR THE CONTROL OF GAS HAZARDS ON VESSELS TO BE REPAIRED OR ALTERED

## Short Title

1. This standard may be cited as the Gas Hazard Control Standard.

## PART I

### APPLICATION AND INTERPRETATION AND STANDARD SAFETY DESIGNATIONS

#### Application

#### Scope

2. (1) This standard applies to vessels, including ships, barges, rigs and similar floating structures.
- (2) This standard applies to vessels carrying or burning as fuel flammable or combustible liquids; it also applies to vessels carrying or having carried flammable compressed gases, chemicals in bulk, or other products able to create a hazardous condition.
- (3) This standard describes the condition required before a space may be entered, or work may be started, on any vessel repair or alteration.
- (4) This standard applies to cold work, application or removal of protective coatings, and work involving riveting, welding, burning, or similiar fire-producing operations.
- (5) This standard applies to vessels in Canadian waters and to all Canadian-registered vessels, both within and outside of yards for ship repair or alteration.
- (6) This standard applies specifically to those vessel spaces subject to concentrations of combustible, flammable, and toxic liquids, vapors, gases, and chemicals (refer to section 6); the standard also applies to those spaces that may not permit safe entry due to insufficient oxygen or excess oxygen.
- (7) As defined and allowed in the "Safe Working Practices" Regulations, a "qualified person" may carry out the functions of a marine chemist.

## Purpose

3. This standard provides minimum requirements and conditions for use in determining that a space or area on a vessel is safe for entry or work (see illustrations in Appendix A).

## Emergency Exemption

4. Nothing in this standard shall prohibit the immediate drydocking of a vessel in peril (e.g., in a sinking condition or by having been seriously damaged), thereby making it impracticable to clean and free of gas in advance; nonetheless all necessary precautionary measures should be undertaken as soon as practicable to provide safe conditions satisfactory to the marine chemist.

## Governmental Regulations

5. Nothing in this standard shall supersede existing more stringent requirements of any governmental or local authority.

## Interpretation

### Definitions

6. In this Standard, unless the context otherwise requires,

"coiled vessels" means tank vessels using a closed system of heating coils carrying thermal oil as the heating media;

"hollow structures" means rudders, rudder stocks, skegs, castings, masts and booms, rails and other vessel attachments that enclose a void space;

11 "marine chemist" means a person who has

(a) graduated from a recognized educational institute and has completed

(i) courses in chemical engineering, or

(ii) a general course with a major in chemistry; or

(b) obtained a fellowship in the Chemical Institute of Canada;

(c) at least three years' experience in chemical or engineering work after completing the educational requirements, of which a minimum of 150 working hours shall have been spent under the supervisor of a marine chemist on shipboard work involving the testing and inspection of tank vessels and other vessels in the application of the Gas Hazard Control Standard TP 3177; and

(d) shall have evidenced where certifying "flamable cryogenic liquid carriers," the required additional experience, training and knowledge necessary for these vessels.

The activities of a marine chemist are limited to the inspection and certification, procedures described in this standard and associated consulting services.

"marine chemist's certificate" means a written statement issued by a marine chemist in the form and manner prescribed by this standard; it states the conditions that the marine chemist found at the time of inspection.

#### Materials

(a) "chemical" means any compound, mixture, or solution, as a solid, liquid, or gas, that may be hazardous because of its properties other than or in addition to flammability, or because of the properties of compounds that might be produced by hot or cold work.

(b) "combustible liquid" means any combustible liquid with a flashpoint above 27 degrees Celsius;

(c) "flammable" and "inflammable" are synonymous;

(d) "flammable compressed gas" means any flammable gas compressed and/or liquefied for transportation, and with a Reid vapor pressure exceeding 276 kPa;

(e) "flammable liquid" means any liquid with a flashpoint (closed cup) below 27 degrees Celsius and a vapor pressure not exceeding 2069 mm Hg at 27 degrees Celsius;

(f) "lower flammable limit" and "lower explosive limit" are synonymous;

(g) "toxic material" means any material that can produce injury, depending on concentration, rate, method of use, site of absorption, the person's general state of health, and differences between individuals.

#### Repair Classifications

(a) "hot work" means any repair or alteration involving riveting, welding, burning, or similar fire-producing operations; grinding, drilling, sand-or shot-blasting, or similar spark-producing operations are considered hot work except when circumstances do not necessitate a classification;

(b) "cold work" means any repair or alteration without heat, fire, or spark-producing operations;

(c) "work below deck" means work in or on enclosed spaces surrounded by shells, bulkheads and overheads;

(d) "work in the open" means work performed from open decks or in spaces from which the overhead has been completely removed;

(e) "secured" means closed so as to avoid accidental opening or operation.

#### Tanker Designation

"tank vessel" means any vessel especially constructed or converted to carry liquid bulk cargo in tanks;

#### Vessel

"vessel" means any ship or boat or any other description of vessel used or designed to be used in navigation.

#### Standard Safety Designations

7. These shall be used, where applicable, in preparing marine chemist's certificates, cargo tank labels and other references.

(1) "Safe for workers" means that in the compartment or space so designated:

(a) the oxygen content of the atmosphere is at least 19.5 percent and not more than 23 percent by volume;

(b) toxic materials in the atmosphere are within permissible concentrations; and

(c) the residues cannot produce toxic materials under existing atmospheric conditions while maintained as directed on the marine chemist's certificate.

Note: For (b) and (c) above, refer to "Threshold Limit Values for Chemical Substances and Physical Agents", American Conference of Governmental Industrial Hygienists, P.O. Box 1937, Cincinnati, Ohio, 45201.

(2) "Not safe for workers" means that in the compartment or space so designated the requirements of "safe for workers" have not been met.

(3) "Safe for hot work" means that in the compartment or space so designated,

(a) the oxygen content of the atmosphere is at least 19.5 percent and not more than 23 percent by volume, except for inerted spaces or where external hot work is to be performed;

(b) the concentration of flammable materials in the atmosphere is below 10 percent of the lower flammable limit;

(c) the residues cannot produce a higher concentration than permitted by (b) under existing atmospheric conditions in the presence of fire and while maintained as directed on the marine chemist's certificate; and

(d) all adjacent spaces containing, or having contained, flammable or combustible materials have been cleaned sufficiently to prevent the spread of fire; or are satisfactorily inerted; or, in the case of fuel tanks or lube oil tanks, or engine room or boiler room bilges, have been treated in accordance with the marine chemist's requirements.

(4) "Not safe for hot work" means that in the compartment so designated, the requirements of "safe for hot work" have not been met.

(5) "Inerted" means that one of these procedures has been completed in the compartment or space so designated:

(a) Carbon dioxide or other nonflammable gas acceptable to the marine chemist has been introduced into the space in sufficient volume to maintain the oxygen content of its atmosphere at or below 8.0 percent, or 50 percent of the amount required to support combustion, whichever is least.

Note: The improper introduction of an inerting gas may generate sufficient static electricity for ignition.

(b) The space has been flooded with water, provided that any hot work is performed at least 0.9 metres below the water level, that the gas content of the atmosphere above the water does not exceed 10 percent of the lower flammable limit, and that the procedure is approved by a marine chemist.

(c) The marine chemist shall note, on the certificate, the kind of gas and the safe disposal or securing of gas inerting medium upon completion of repairs; closing and securing of hatches and other openings, except vents, may be considered as "safe disposal" by the marine chemist.

(6) "Inerting for flammable compressed gas" means that individual tanks with a working pressure of 345 kPa or more are considered safe for work not directly involving these tanks or their pipelines when a positive pressure is maintained on the tanks by the flammable vapors remaining after the cargo has been discharged and special precautions are observed under carefully controlled conditions as specified on the marine chemist's certificate.

## PART II

### MINIMUM REQUIREMENTS BEFORE ISSUANCE OF MARINE CHEMIST'S CERTIFICATE - APPLICABLE IN ALL CASES

#### Determination of Condition by Marine Chemist

8. A marine chemist may issue a certificate stating that the prescribed work to a vessel can be undertaken with safety; the marine chemist shall physically inspect the conditions and carry out tests within each compartment or space, ensuring compliance with the minimum applicable requirements to his satisfaction before he issues a certificate specifying "safe for workers" or "safe for hot work".

(1) The calibration of all instruments used by the marine chemist shall be checked before and after each day's use; a record shall be maintained on all calibration checks.

(2) The marine chemist's determination shall include a visual internal inspection and tests of the spaces to be certified and their adjacent spaces.

(3) The marine chemist's determination shall include tests appropriate to designations of section 7; the determination shall include:

- (a) knowledge of the three previous cargoes carried;
- (b) the nature and extent of the present work;



- (c) starting time and duration of this work;
  - (d) tests of cargo and vent lines at manifolds and accessible openings;
  - (e) assurance that cargo valves in prescribed work areas are tagged and secured to avoid accidental opening or operation, and
  - (f) tests of cargo heating coils at the main deck level.
- (4) Tanks that have carried combustible liquids with flash points 93 degrees Celsius or above may be partially cleaned for minor hot work; these spaces, and adjacent spaces directly affected, shall be cleaned back a sufficient distance from the work to meet the requirements of paragraph 7(3)(d); the rest the space and adjacent spaces shall meet the requirements of paragraphs 7(3)(a), (b) and (c).

#### Preparation of Certificates

9. When the marine chemist is satisfied that the requirements of this standard and any other safety requirements related to the work have been met, he shall prepare a certificate in the form and manner prescribed by this standard.

- (1) The certificate shall include the frequency and type of such additional tests, inspections, qualifications, and other instructions as the marine chemist specifies.
- (2) The certificate shall state the conditions under which the marine chemist should be consulted or recalled.
- (3) Such qualifications and requirements shall include precautions concerning protective equipment and devices necessary to eliminate or minimize hazards that may be present from protective coatings or residues from cargoes.

Issuance of Certificates

10. The marine chemist's certificate shall be completed and a signature for receipt of it shall be obtained, signifying an understanding of the conditions and limitations under which it is issued.

(1) If the certificate is issued in connection with commencement of repair work, it shall be delivered to, and signed by, the ship repairer or his authorized representative.

(2) If the certificate is issued for purposes other than the commencement of repair work, it shall be delivered to, and signed by, the person who authorized the inspection or his authorized representative.

(3) The person signing for receipt of the certificate shall securely post it in a conspicuous place aboard the vessel.

(4) All certificates shall be issued within 24 hours prior to the time the prescribed work is commenced, unless otherwise noted on the certificate.

Responsibility for Obtaining Certificate

11. (1) The vessel repairer shall retain the services of the marine chemist, secure copies of his certificate, and provide the master of the vessel and the representatives of the vessel owner with copies; receipt and understanding of the certificate shall be acknowledged by signature of the person or his representative requesting the service.

(2) Throughout the course of repairs or alterations, safe conditions shall be maintained on the vessel by full observance of all qualifications and requirements listed by the marine chemist.

PART III

MANDATORY REQUIREMENTS FOR VESSELS

Tank Vessels

12. Tank vessels may be repaired when cleaned, or cleaned and inerted, in accordance with the provisions in sections 17 or 18 respectively; a marine chemist's certificate to this effect shall be required; repairs or alterations involving hot work shall not be undertaken unless specifically authorized by the certificate.

Exception 1. Tank vessels may enter a repair yard for examination, afloat or in dry dock, provided that all bulk cargo compartments and cofferdams are kept closed.

Exception 2. Tank vessels may enter a repair yard for scraping, washing down and painting, afloat or in dry dock, provided that all bulk cargo compartments and cofferdams are kept closed.

Exception 3. Tank vessels may enter a repair yard for work (hot or cold) to be performed outside the vessel, afloat or in dry dock, on the propeller, tailshaft, or rudder, or for work off the vessel, such as on the anchors or chains, provided that all bulk cargo compartments and cofferdams are kept closed.

Exception 4. Tank vessels may enter a repair yard, afloat or in dry dock, for work within boiler and machinery spaces and/or other locations provided that, where hot work is to be undertaken, a marine chemist's certificate is obtained; this certificate shall note each location for which hot work is approved; all bulk cargo compartments, cofferdams, and/or other areas where the flammable content of the atmosphere is above 10 percent of the lower flammable limit shall be kept closed and secured; the securing of the compartments, cofferdams, and other areas shall be noted on the certificate.

Exception 5. Tank vessels that proceed to a dry dock or special berth, selected with due regard to the hazards of the location and to hazards to adjacent property, may undergo specific limited, local repairs when the compartments or spaces involved and the adjacent compartments or spaces are prepared as in sections 19 and 20.

Requirements for Use of a Special Berthing  
Area for Cleaning, Gas Freeing, or Inerting

13. (1) Vessels that have not been cleaned, gas-freed, or inerted shall proceed to a special berth, selected and set apart with due regard to the hazards of the location and to hazards to adjacent property.

(2) The degassing, cleaning, or inerting shall be carried out as in sections 17 or 18 before vessels are shifted to other berths; no repairs involving hot work, other than in boiler or machinery spaces when specifically certified by a marine chemist, shall be undertaken in a special berth until the vessel has been degassed and cleaned or inerted as in sections 17 or 18; such repairs shall not be undertaken if another vessel, which has not complied with these requirements, is also in the special berth.

#### Vessels carrying Flammable Compressed Gas

14. On any vessels that have carried flammable compressed gas in bulk, no repairs or alterations involving hot work shall be made unless the provisions of section 12 have been met; however, individual pressure tanks inerted in accordance with subsection 7(6), are considered safe for such work not directly involving these tanks or their pipelines.

#### Vessels other than Tank Vessels

15. On any vessels that have carried flammable or combustible liquids in bulk as fuel or cargo, or cargoes that may produce hazardous atmospheres (including those of decomposition or reaction with atmospheric oxygen), no repairs involving hot work shall be made in or on the external boundaries (shell, tank top, or deck) of cargo tanks, fuel tanks, oil pipelines, heating coils or hollow structures, and machinery spaces, unless such compartments and pipelines, as deemed necessary by the marine chemist, have been cleaned or inerted to meet the appropriate designation requirements of section 7; repairs and alterations shall not be undertaken until a marine chemist's certificate is obtained.

#### Electric Welding Operations

16. For all electrical welding operations, grounded cables shall be connected to the ship's structure as close as possible to the point of welding; they shall have a safe current-carrying capacity equal to or exceeding the specified maximum output capacity of the unit which they service.

Minimum Requirements for Issuance of a Marine  
Chemist's Certificate

Where a Safe Condition is to be Obtained Entirely by Cleaning (Appendix A)

17. (1) All steam-supplied cargo heater coils shall be made safe by steaming, flushing with water, blowing with air, or inerting.

(2) All cargo pumps, cargo lines, piped cargo fire extinguishing systems, and vent lines shall be flushed with water, blown with steam or air, or inerted.

Exception: Coils in cargo tanks used for chemicals that may react with water or steam shall be cleaned as in subsection 23(2).

(3) On vessels using thermal heating coils with flashpoints of 260 degrees Celsius or above, the marine chemist shall be satisfied of the integrity of these heater coils in the prescribed work areas.

(4) Compartments shall be cleaned so that the atmosphere in all cargo compartments and other spaces subject to gas accumulation is in accordance with subsection 7(1) and/or 7(3).

Exception: Spaces covered by subsection 8(4).

(5) The residues in all compartments concerned (except for tanks containing combustible liquids with flashpoints of 93 degrees Celsius or above) shall meet the conditions of subsection 7(1) and/or 7(3).

(6) Satisfactory compliance with all the foregoing requirements shall be noted on the marine chemist's certificate.

Where a Safe Condition is to be Obtained by both Cleaning and Inerting or Entirely by Inerting (Appendix A).

18. (1) The marine chemist shall approve the use of the inerting medium; he shall personally supervise introduction of the inerting medium into the space, except where the inerting medium has been introduced before the vessel arrived at the repair facility; the marine chemist always shall personally conduct tests to determine that the oxygen content of the inerted space is at or below 8 percent, or 50 percent of the amount required to support combustion, whichever is least; the marine chemist shall be readily available during the entire period of work, and he shall determine that the oxygen level in the inerted space is maintained at or below 8 percent or 50 percent of the amount required to support combustion, whichever is least; the marine chemist shall supervise the safe disposal or securing of the inerting medium after completion of the repair work on the inerted space and adjacent spaces.

(2) All steam-supplied cargo heater coils shall be made safe by steaming, flushing with water, blowing with air, or inerting; all piped cargo fire extinguishing systems within the cargo tanks and vent lines, except those in the inerted spaces, shall be flushed with water, blown with steam or air, or inerted; all valves to the inerted spaces shall be tagged and secured so as to avoid accidental opening or operation; all cargo pumps and cargo lines shall be flushed with water, blown with steam or air, or inerted.

Exception 1: Coils to cargo tanks used for chemicals that may react with water or steam shall be cleaned as in subsection 23(2).

Exception 2: on coiled vessels using thermal heating oils with flashpoints of 260 degrees Celsius or above, the marine chemist shall be satisfied of the integrity of the heater coils in the prescribed work areas.

(3) 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, shall be closed and secured.

(4) All access openings to an inerted space shall be appropriately labelled with a warning sign "Not Safe for Workers" that shall remain in place throughout the course of repairs.

(5) Compartments or spaces in which internal repairs or alterations are to be undertaken shall be cleaned to comply with the requirements of section 17 and all other spaces (except for tanks containing combustible liquids with flashpoints of 93 degrees Celsius or above) shall be inerted as in subsection 7(5) or 7(6).

(6) 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 section 18; all other spaces (except for tanks containing combustible liquids with flashpoints of 93 degrees Celsius or above) shall be inerted as in subsection 7(5) or 7(6).

(7) Satisfactory compliance with all the foregoing requirements shall be noted on the marine chemist's certificate.

Where a Safe Condition is to be Obtained Entirely by Cleaning Certain Compartments and by Securing the Others (Appendix A).

19. (1) Nonadjacent spaces containing atmospheres exceeding 10 percent of the lower flammable limit shall be secured, and those spaces noted on the marine chemist's certificate.

(2) All steam-supplied cargo heater coils to the spaces involved shall have been made safe by steaming, flushing with water, blowing with air, or inerting; all piped cargo fire extinguishing systems and vent lines to the spaces involved shall be flushed with water, blown with steam or air, or inerted; valves to all other compartments shall be closed and secured; all cargo pumps and cargo lines shall have been flushed with water, blown with steam or air, or inerted, and the valves closed and secured so as to avoid accidental opening or operation.

Exception 1: Coils in cargo tanks used for chemicals that may react with water or steam shall be cleaned as in subsection 23(2).

Exception 2: On coiled vessels using thermal heating oils with flashpoints of 260 degrees Celsius or above, the marine chemist shall be satisfied of the integrity of the heater coils in the prescribed work areas.

(3) Compartments or spaces in which internal repairs or alterations are to be undertaken, and all adjacent compartments (including those diagonally adjacent) shall be cleaned as in section 17; all other applicable spaces shall be closed and secured so as to avoid accidental opening or operation.

(4) Satisfactory compliance with all the foregoing requirements shall be noted on the marine 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 Others (Appendix A).

20. (1) All steam-supplied cargo heater coils to the spaces involved, except those to the inerted spaces, shall be made safe by steaming, flushing with water, blowing with air, or inerting; all piped cargo fire extinguishing systems and vent lines to the spaces involved, except those to the inerted spaces, shall be flushed with water, blown with steam or air, or inerted; the valves to all other compartments shall be closed and secured so as to avoid accidental opening or operation; all cargo pumps and cargo lines shall be flushed with water, blown with steam or air, or inerted: the valves shall be closed and secured so as to avoid accidental opening or operation.

Exception 1: Coils in cargo tanks used for chemicals that may react with water or steam shall be cleaned as in subsection 23(2).

Exception 2: On coiled vessels using thermal heating oils with flashpoints of 260 degrees Celsius or above, the marine chemist shall be satisfied of the integrity of the heater coils in the prescribed work areas.

(2) Nonadjacent spaces containing atmospheres exceeding 10 percent of the lower flammable limit shall be closed and secured so as to avoid accidental opening or operation, and those spaces noted on the marine chemist's certificate.

(3) Compartments or spaces in which internal repairs or alterations are to be undertaken shall be cleaned to comply with the requirements of section 17; all adjacent compartments, including those diagonally adjacent, shall be inerted as in subsection 7(5); all other compartments shall be closed and secured as in subsection 19(1).

(4) 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 section 17; all adjacent compartments, including those diagonally adjacent shall be inerted or cleaned as in section 18; all other applicable spaces shall be closed and secured as in subsection 19(1).

(5) Satisfactory compliance with all the foregoing requirements shall be noted on the marine chemist's certificate.



## PART IV

### ADDITIONAL REQUIREMENTS FOR BULK CHEMICAL CARGO TANKS

#### Scope

21. (1) This section describes the conditions required before making repairs in spaces that have carried, or have been exposed to, chemicals in bulk; the remaining spaces shall comply with the applicable provisions in sections 12 through 15.

#### Minimum Requirements

22. (1) All minimum requirements for issuance of the marine chemist's certificate set forth in PART II apply to spaces that have carried, or have been exposed to, chemicals in bulk.

(2) The designation "Not Safe for Workers" shall be used for spaces that have carried material that could create unknown chemical hazards (see subsection 9(3)).

(3) Results of any chemical hazard tests may be noted on the marine chemist's certificate.

#### Minimum Conditions

23. (1) Minimum conditions to be met before issuance of a marine chemist's certificate for spaces that have contained chemicals in bulk shall be as in sections 17 through 20 (insofar as they are applicable) and as specified in this section.

(2) All pipelines, including heating coils, fire-extinguishing systems and vents, together with the cargo pumps and cargo lines serving the chemical-carrying spaces, shall be initially dealt with to the satisfaction of the marine chemist; methods and materials used for cleaning or inerting shall be selected carefully to avoid noncompatibility with previous cargoes.

(3) Compartments that carried chemicals in bulk shall be cleaned so that the atmosphere is as specified in subsections 7(1) and 7(3), as applicable.

(4) The residues in these compartments concerned shall be as specified in subsections 7(1) and 7(3), as applicable.

## PART V

## ADDITIONAL REQUIREMENTS FOR FLAMMABLE CRYOGENIC LIQUID CARRIERS

### Scope

24. (1) The design and operational characteristics of tank, cargo handling and related systems on vessels carrying flammable cryogenic liquid cargoes must be fully appreciated by the marine chemist where he makes the determinations required by section 8; this Part describes the conditions required before repairs are made in spaces that have carried, or have been exposed to, flammable cryogenic liquid cargoes as liquids or vapors.

(2) This Part supplements the factors to be considered prior to issuance of the marine chemist's certificate as in section 8.

### Interpretation

25. The following definitions apply.

"cargo area" means that part of the ship with the cargo containment system and cargo pump and compressor rooms; it includes deck areas over the full beam and length above this part of the ship; the cofferdams, ballast, or void spaces at the after end of the aftermost hold space or the forward end of the forwardmost hold space are excluded from the cargo area.

"cargo containment system" means the arrangement for containment of cargo, including any primary and secondary barriers, associated insulation, and any intervening spaces and adjacent structure for the support of these elements; if the secondary barrier is part of the hull structure it may be a boundary of the hold space.

"cryogenic liquid" means a refrigerated liquefied gas having a boiling point colder than -90 degrees Celsius.

"gas-dangerous space" means:

(a) a space in the cargo area not arranged or equipped in an approved manner to ensure that its atmosphere is always maintained in a gas-safe condition;

(b) an enclosed space outside the cargo area, through which any piping that may contain liquid or gaseous products passes, or within which the piping terminates, unless approved arrangements are installed to prevent any escape of product vapor into the atmosphere of that space;

- (c) a cargo containment system and cargo piping which is,
  - (i) a hold space where cargo is carried in a cargo containment system requiring a secondary barrier;
  - (ii) a hold space where cargo is carried in a cargo containment system not requiring a secondary barrier;
- (d) a space separated from a hold space described in (c)(i) by a single gas-tight steel boundary;
- (e) a cargo pump room and cargo compressor room;
- (f) a zone on the open deck, or semi-enclosed space on the open deck, within 3 metres of any cargo tank outlet, gas or vapor outlet, cargo pipe flange, cargo valve, or entrances and ventilation openings to cargo pump rooms and cargo compressor rooms;
- (g) the open deck over the cargo area, and 3 metres forward and aft of the cargo area on the open deck, up to a height of 2.4 metres above the weather deck;
- (h) a zone within 2.4 metres of the outer surface of a cargo containment system where the surface is exposed to the weather;
- (i) an enclosed or semi-enclosed space containing pipes carrying cargo;
- (j) a compartment for cargo hoses;
- (k) an enclosed or semi-enclosed space having a direct opening into any gas-dangerous space or zone.

"hold space" means the vessel space in which a cargo containment system is situated;

"interbarrier space" means that space between a primary and secondary barrier, whether or not completely or partially occupied by insulation or other material;

"primary barrier" means the inner element designed to contain the cargo when the cargo containment system includes two boundaries;

"secondary barrier" means the liquid-resisting outer element of a cargo containment system designed to temporarily contain leakage of liquid cargo through the primary barrier and to prevent cooling of the ship's structure to an unsafe level.

Minimum Requirements

26. (1) All minimum requirements for issuance of the marine chemist's certificate as stated in PART II shall be met prior to commencement of hot work or entry in spaces that have carried, or been exposed to, flammable cryogenic liquids or their vapors.
- (2) The special safety designation "Safe for Repair Yard Entry" applies only to flammable cryogenic liquid carriers; it describes vessels with compartments and spaces tested by sampling at remote sampling stations, and the atmospheres proved to be not less than 19.5 percent or more than 23 percent oxygen and less than 10 percent of the lower flammable limit, or with compartments inerted as in subsection 7(5).
- (3) Vessels with cargo containment systems that have not met the criteria of subsection 26(2) may undergo specific limited repairs in locations outside the gas-dangerous spaces; these repairs or alterations shall not be undertaken until a marine chemist's certificate is obtained.
- (4) When undergoing the repairs in subsection 26(3), the vessel shall be berthed in a special location with due regard to the hazards of the location and to hazards to adjacent property; if the marine chemist questions the safety of any aspect of the site selection, he shall consult the proper governmental authorities.
- (5) Interbarrier spaces or insulation may contain pockets of cargo vapors that can be released over varying time periods; the marine chemist shall inspect for gas concentration and combustible materials before work begins in or on the boundaries of these areas.
- (6) The marine chemist shall require the following information before making his inspection:
- (a) description and schematic arrangement of means for inerting cargo tanks, hold spaces, or interbarrier spaces, as applicable;
  - (b) description and instruction manual for calibration of the cargo leak detector equipment;
  - (c) schematic plan showing locations of leak detectors and sampling points;
  - (d) schematic plan(s) of liquid and vapor cargo piping;
  - (e) Canadian Coast Guard Letter of Compliance and .Certificate of Fitness for Canadian-flag vessels or the Certificate of Inspection and Certificate of Fitness for Canadian-flag vessels;

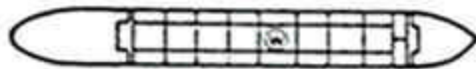
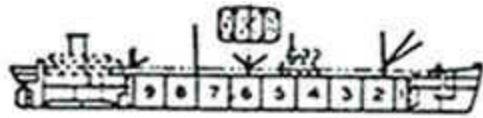
(f) the recent history of cargoes handled, with special reference to outturn and any pertinent unusual incidents encountered.

#### Minimum Conditions

27. (1) Minimum conditions to be met before the issuance of a marine chemist's certificate for spaces that have contained, or been exposed to, flammable cryogenic liquids or their vapors shall be as in sections 17 through 20 (insofar as they are applicable) and as specified in this section.
- (2) When vessels are undergoing repairs, no venting of cargo tanks, systems, or other spaces that may contain inert gas or flammable vapors shall take place without approval of the marine chemist; any other activity that may similarly alter the atmosphere near the repair work may only be undertaken with such approval.
- (3) Vessels able to burn cargo boil-off as fuel for their main propulsion system or for other purposes shall be inspected to assure that gas supply lines to the boiler room or other spaces have been properly secured, inerted, or otherwise properly treated, prior to repairs to this system.
- (4) Cargo machinery or systems shall be adequately purged and ventilated to remove cargo vapor or inert gas before opening for repairs.

APPENDIX A

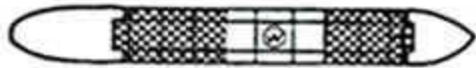
These illustrations are examples of safe conditions described in this standard. Although the single plan drawings show only horizontal separations, vertical compartmentation should be similarly treated.



SAFE CONDITION OBTAINED ENTIRELY BY CLEANING



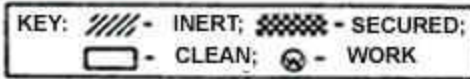
SAFE CONDITIONS OBTAINED BY CLEANING AND INERTING



SAFE CONDITION OBTAINED ENTIRELY BY CLEANING AND SECURING



SAFE CONDITIONS OBTAINED BY CLEANING, INERTING AND SECURING





## STANDARD SAFETY DESIGNATIONS

SAFE FOR WORKERS: Means that in the compartment or space so designated: (a) the oxygen content of the atmosphere is at least 19.5 percent and not more than 23 percent by volume; and that, (b) toxic materials in the atmosphere are within permissible concentrations; and that (c) the residues cannot produce toxic materials under existing atmospheric conditions while maintained as directed on the marine chemist's certificate.

NOT SAFE FOR WORKERS: Means that in the compartment or space so designated, the requirements of Safe for Workers have not been met.

SAFE FOR HOT WORK: Means that in the compartment so designated (a) oxygen content of the atmosphere is at least 19.5 per cent and not more than 23 percent by volume, except for inerted spaces or where external hot work is to be performed; and that, (b) the concentration of flammable materials in the atmosphere is below 10 per cent of the lower flammable limit; and that, (c) the residues cannot produce a higher concentration than permitted by (b) under existing atmospheric conditions in the presence of fire and while maintained as directed on the marine chemist's certificate; and further, that (d) all adjacent spaces containing, or having contained, flammable or combustible materials have been cleaned sufficiently to prevent the spread of fire; or are satisfactorily inerted; or, in the case of fuel tanks or lube oil tanks, or engine room, or fire room bilges, have been treated in accordance with the marine chemist's requirements.

NOT SAFE FOR HOT WORK: Means that in the compartment so designated, the requirements of Safe for Hot Work have not been met.

SAFE FOR REPAIR YARD ENTRY: Means that the compartments and spaces of the flammable cryogenic liquid carrier so designated (a) have been tested by sampling at remote sampling stations, and results indicate the atmosphere tested to be above 19.5 per cent oxygen and less than 10 percent of the lower flammable limit; or (b) the compartments are inerted.

## QUALIFICATIONS

Unless specifically approved in this certificate, transfer of ballast or manipulation of valves, closure equipment tending to alter conditions in pipe lines, tanks, or compartments subject to gas accumulation requires inspection and endorsement, or reissue of the certificate for the spaces so affected. All lines, vents, heating coils, valves and similarly enclosed appurtenances shall be considered "Not Safe" unless otherwise specifically designated.

## CHEMIST'S ENDORSEMENT



This is to certify that I have personally determined that all spaces in the foregoing list are in accordance with the Gas Hazard Control Standard TP 3177, and I have found the condition of each to be in accordance with its assigned designation.

This Certificate is based on conditions existing at the time the inspection herein set forth was completed and is issued subject to compliance with all qualifications and instructions.

Signed \_\_\_\_\_

—

Marine Chemist

The undersigned acknowledges receipt of this Certificate under section 10, Gas Hazard Control Standard, and understands the conditions and limitations under which it was issued.

Signed \_\_\_\_\_

—

Name

Company

Date