Department of Transportation

United States Coast Guard

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NAVIGATION AND VESSEL INSPECTION CIRCULAR NO.

Subj: SAFETY STANDARDS FOR THE DESIGN AND OPERATION OF A MARINE VAPOR CONTROL SYSTEM (VCS) AT TANK BARGE CLEANING FACILITIES

1. Purpose. The purpose of this Circular is to provide recommended safety standards for the design and operation of a marine VCS at tank barge cleaning facilities.

2. Background.

a. Tank barge cleaning facilities are utilized by the barge industry to gas-free and clean cargo tanks on tank barges prior to a change of cargo or conducting repair/retrofit work. The vapor space in the cargo tanks of barges entering these facilities contains cargo vapors from the last cargo carried and sometimes from cargoes previous to the last cargo. These vapors may contain high levels of Volatile Organic Compounds (VOCs) and/or Hazardous Air Pollutants (HAPs). Existing work practices for gas-freeing and cleaning of cargo tanks result in the release of these VOCs and HAPs to the atmosphere, causing a degradation of air quality reductions.

b. In 1990, Congress amended the Federal Clean Air Act. One section of the Amendments requires states to achieve and maintain a 15 percent (%) reduction in their VOC emissions level below the 1990 base year level by 1996 in non-attainment areas within individual states. This amendment has required states to review their State Implementation Plans (SIPs) in order to determine potential sources of emissions reductions. The tank barge cleaning industry has been identified in several states as a viable source of emissions reductions, and two states have subsequently passed regulations requiring the control of emissions from tank barge cleaning facilities. Controlling vapor emissions at tank barge cleaning facilities will require the installation and use of a marine VCS.

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c. In June 1990, the Coast Guard promulgated safety regulations for the design and operation of marine vapor control systems for facilities contained in Title 33, Code of Federal Regulations (CFR) Part 154, Subpart E and vessels contained in Title 46 CFR 39. These regulations were developed from recommendations submitted to the Coast Guard by the Chemical Transportation Advisory Committee (CTAC) and apply to the control of emissions from vapors collected during vessel lightering operations and from vapors collected by a marine transfer facility during cargo loading operations. During the CTAC study and subsequent development of the regulations by the Coast Guard, it was not anticipated that tank barge cleaning facilities would employ a VCS in their operations. Consequently, tank barge cleaning facility operations were not included as part of the CTAC study, and the current VCS regulations are not applicable to these facilities.

d. The Coast Guard recognized a need to conduct a detailed review of cleaning facility operations to determine the technical feasibility of utilizing a VCS during gas-freeing and tank cleaning operations, to identify pertinent safety issues, and to develop standards for the safe design and operation of a VCS. In April 1994, the CTAC Subcommittee on Marine Vapor Control Systems, at the request of the Coast Guard, convened to commence work on evaluating the technical and safety aspects of the application of a VCS during tank barge cleaning operations, and develop recommended safety standards for implementation by the Coast Guard. The Subcommittee was comprised of members representing the tank barge industry, cleaning facility operators, marine chemists, third party VCS certifying entities, and cargo shippers. The Subcommittee completed its work in June 1995 and forwarded its recommendations to CTAC. These recommendations were approved by the CTAC membership and forwarded to the Coast Guard in January 1996. These recommendations have been utilized by the Coast Guard to form the basis for the enclosed safety standards.

3. Discussion.

a. The enclosed safety standards for the design and operation of a VCS have been developed for use by tank barge cleaning facilities during gas-freeing and tank cleaning operations on tank barges, and represent the minimum acceptable level of system safety. The Coast Guard recognizes that the design and installation of a VCS represents a major capital investment on the part of cleaning facilities and barge operators, and has attempted to provide as much flexibility as possible in the design options for both cleaning facilities and tank barges.

b. The Coast Guard does not have, nor does it seek, the statutory authority to require cleaning facilities to control emissions of VOCs and HAPs during gas-freeing and tank cleaning operations. Accordingly, the Coast Guard does not require the use of a VCS at cleaning facilities. Rather, the Coast Guard's role is to promote safety within the maritime industry and to protect the marine environment. This can be accomplished through the development and implementation of uniform national safety standards.

4. Implementation. Captains of the Port and Officers in Charge, Marine Inspection are encouraged to bring this Circular to the attention of appropriate individuals in the maritime industry within their zones. The Coast Guard fully intends to further publish these recommended safety standards as statutory regulations. Therefore, adherence to these safety standards is strongly recommended for tank barge cleaning facilities.

Encl: (1) Safety Standards for the Design and Operation of A Marine VCS at Tank Barge Cleaning Facilities

Non-Standard Distribution:				
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C:e	New Orleans, Houston, Galveston (30),		All other offices (5).	
C:m	New York (10).			
E:n	Baton Rouge (5).			

Safety Standards For The Design And Operation Of A Marine Vapor Control System (VCS) At Tank Barge Cleaning Facilities

Part A - Safety Standards For Tank Barge Cleaning Facilities

Section One - Applicability

A. Except as specified by paragraph C. of this section, these standards apply to each facility which collects vapors emitted from tank barge cargo tanks during or in preparation for tank cleaning. These standards do not apply to the collection of vapors emitted during tank barge cargo loading or lightering operations.

B. These standards do not apply to the collection of vapors of liquefied flammable gases as defined in 46 CFR 30.10-39.

C. When a facility VCS which receives vapor during a barge cleaning operation is connected to a facility VCS that serves tank storage areas and other facility processes, these standards apply between the barge vapor connection and the point where the VCS connects to the facility's main VCS.

Section Two - Definitions

The following definitions apply to terms used in this part:

Barge vapor connection means the point in a barge's piping system where it connects to a vapor collection hose or arm. This may be the same as the barge's cargo connection.

Certifying entity means an individual or organization accepted by Commandant (G-MOS) to review plans and calculations for VCS designs, and to conduct initial inspections and witness tests of VCS installations.

Cleaning facility means a facility used or capable of being used to conduct cleaning operations on a tank barge.

Cleaning operation means any stripping, gas-freeing, or tank washing operation of a barge's cargo tanks conducted at a cleaning facility.

Combustible liquid means a liquid as defined in 46 CFR 30.10-15.

Elevated temperature means the temperature that exceeds 70% of the auto-ignition temperature of the vapors being collected.

Facility means an onshore or mobile facility which includes, but is not limited to structures, equipment, and appurtenances thereto, used or capable of being used to transfer and control vapors.

Facility vapor connection means the point in a facility's fixed vapor collection system where it connects to a vapor collection hose or the base of a vapor collection arm.

Fixed stripping line means a pipe extending to the low point of each cargo tank, which is welded through the deck and terminates above the deck with a valve, plugged at the open end.

Flammable liquid means a liquid as defined in 46 CFR 30.10-22.

Flame arrester means a device which is designed, built, and tested in accordance with Appendix B to 33 CFR 154 for use in end-of-line applications for arresting flames.

Fluid displacement system means a system that removes vapors from a barge's cargo tanks during gas-freeing through the addition of an inert gas or other medium into the cargo tank.

Fluid injection connection means the point in a fluid displacement system at which the fixed piping or hose that supplies the inert gas or other medium connects to a barge's cargo tanks or fixed piping system.

Gas-freeing means the removal of vapors from a tank barge.

High flash point cargoes means Grade E cargoes and cargoes having a closed cup flash point greater than 600 C, carried at a temperature no higher than 50 C below their flash points.

Inerted means the oxygen content of the vapor space in a barge's cargo tank is reduced to 8% or less by volume in accordance with the inert gas requirements of 46 CFR 32.53.

Liquid knockout vessel means a device designed to separate liquids from vapors.

Maximum allowable gas-freeing rate means the maximum volumetric rate at which a barge may be gas-freed during cleaning operations.

Maximum allowable stripping rate means the maximum volumetric rate at which a barge may be stripped during cleaning operations prior to the opening of any hatch and/or fitting in the cargo tank being stripped.

Multiple facility vapor collection system connection means the point in the vapor collection system where two or more branch lines originating from separate facility vapor connections are connected.

Stripping means the removal, to the maximum extent practicable, of cargo residue remaining in the barge's cargo tanks and associated fixed piping system after cargo transfer or during cleaning operations.

Vacuum displacement system means a system that removes vapors from a barge's cargo tanks during gas-freeing by sweeping air through the cargo tank hatch openings.

Vapor collection system means an arrangement of piping and hoses used to collect vapor emitted from a barge's cargo tanks and transport the vapor to a vapor processing unit.

Vapor control system (VCS) means an arrangement of piping and equipment used to control vapor emissions collected from a barge, and includes the vapor collection system and the vapor processing unit.

Vapor destruction unit means a vapor processing unit that destroys cargo vapor by a means such as incineration.

Vapor dispersion unit means a vapor processing unit which releases cargo vapor to the atmosphere through a venting system not located on the barge undergoing cleaning operations.

Vapor processing unit means the components of a VCS that recovers, destroys, or disperses vapor collected from a barge.

Vapor recovery unit means a vapor processing unit that recovers cargo vapor by a non-destructive means such as lean oil absorption, carbon bed adsorption, or refrigeration.

Section Three - Review, Certification and Initial Inspection

A. A VCS installed at a cleaning facility must be certified by a certifying entity, acceptable to the Coast Guard in accordance with 33 CFR 154.806, as meeting the requirements of these standards prior to operation.

B. Plans and information submitted to the certifying entity must include a qualitative failure analysis. The analysis must demonstrate the following:

1. The VCS is designed to permit the system to continuously operate safely during cleaning operations of tank barges;

2. The VCS is provided with the proper alarms and automatic control systems to prevent unsafe operation;

3. The VCS is equipped with sufficient automatic or passive devices to minimize damage to personnel, property, and the environment if an accident were to occur; and

4. If a quantitative failure analysis is conducted in lieu of a qualitative failure analysis, the level of safety attained is at least one order of magnitude greater than that calculated for operating without a VCS.

Note: The American Institute of Chemical Engineers publications, Guidelines for Hazard Evaluation Procedures and Chemical Process Quantitative Risk Assessment, may be used as guidance when preparing a qualitative or quantitative failure analysis, respectively.

C. The certifying entity must conduct all initial inspections and witness all tests required to demonstrate that the facility:

1. Conforms to certified plans and specifications;

2. Meets the safety requirements of this part; and

3. Is operating properly.

D. Upon receipt of written certification from the certifying entity that a facility's VCS complies with these safety standards, the Captain of the Port shall endorse the facility operations manual, as described in Section Sixteen of this part, to indicate that the facility is acceptable for collecting vapors during cleaning operations.

E. Any design or configuration alteration involving a certified VCS must be reviewed by a certifying entity. After conducting any inspections and witnessing tests necessary to verify that the modified VCS meets the standards of this part, the certifying entity must recertify the installation.

F. Certifications issued in accordance with this section, as well as a copy of all plans, calculations and specifications for the VCS must be maintained at the facility.

G. A certifying entity, accepted under 33 CFR 154.806, may not certify a cleaning facility VCS if the certifying entity was involved in the design or installation of the system.

Section Four - Vapor Control System (VCS), General

A. A VCS design and installation must eliminate potential overpressure and vacuum hazards, and sources of ignition to the maximum extent practical. Each remaining hazard source which is not eliminated must be specifically addressed in the protection system design and operational requirements.

B. Vapor collection system piping and fittings must be in accordance with the American National Standards Institute (ANSI) standard B31.3 and designed for a maximum allowable working pressure of at least 150 pounds per square inch gauge (psig). Valves and flanges must be in accordance with ANSI B16.5 or B16.24, 150 pound class.

C. All electrical equipment used in a VCS must comply with the National Fire Protection Association (NFPA) standard 70, National Electric Code, 1987.

D. Any pressure, flow, or concentration indication listed in these standards must provide a remote indicator at the cleaning facility where the VCS is controlled.

E. Any alarm condition specified in this part must activate an audible and visible alarm at the cleaning facility where the VCS is controlled.

F. The VCS must be separated or insulated from external heat sources to limit VCS piping surface temperature to not more than 70% of the auto-ignition temperature in degrees Celsius of the vapors being gas-freed during normal operation.

G. A means must be provided to eliminate any liquids from the vapor collection system.

H. A liquid knockout vessel must be installed between the facility vapor connection and any vapor moving device in systems that have the potential for two phase (vapor/liquid) flow from the barge or has the potential for liquid condensate forming as a result of the enrichment process. The liquid knockout vessel must have:

1. A means to indicate the level of liquid in the device;

2. A high liquid level sensor that activates an alarm; and

3. A high high liquid level sensor that closes the remotely operated cargo vapor shutoff valve described in Section Five, paragraph A. and shuts down any vapor moving device prior to liquid carrying over to the vapor moving device. The high high liquid level sensor must be independent of the high liquid level sensor listed in H.2 of this section.

I. Vapor collection piping must be electrically grounded and electrically continuous.

J. If the facility handles inerted vapors of cargoes containing sulfur, provisions must be made to control heating from pyrophoric iron sulfide deposits in the vapor collection line.

K. Each cleaning facility that utilizes a vapor collection system must maintain a list of cargoes for which the system is approved. This list must be made part of the facility operations manual and be approved by the certifying entity during the initial system review. If a facility wishes to add more cargoes to this list, a certifying entity must be contacted to complete a recertification of the facility.

Section Five - Vapor Line Connections

A. A remotely operated cargo vapor shutoff valve must be installed in the vapor collection line between the facility vapor connection and nearest point where any inerting, enriching, or diluting gas is introduced into the vapor collection line or where a detonation arrester is fitted. The valve must:

1. Close within thirty (30) seconds after detection of a shutdown condition by components listed in this part;

2. Close automatically if the control signal is lost;

3. Activate an alarm when a signal to shutdown is received;

4. Be capable of manual operation or manual activation;

5. Have a local valve position indicator or be designed so that the valve position can be readily determined from the valve handle or valve stem position; and

6. If the valve seat is fitted with resilient material, not allow appreciable leakage when the resilient material is damaged or destroyed. The definition of "appreciable" may be found in 46 CFR 56.20-15(c)(1).

B. A fluid displacement system must have a remotely operated shutoff valve installed in the fluid injection supply line between the point where the inert gas or other medium is generated and the fluid injection connection. The valve must:

1. Close within thirty (30) seconds after detection of a shutdown condition by components listed in this part;

2. Close automatically if the control signal is lost;

3. Activate an alarm when a signal to shutdown is received;

4. Be capable of manual operation or manual activation;

5. Have a local valve position indicator or be designed so that the valve position can be readily determined from the valve handle or valve stem position; and

6. If the valve seat is fitted with resilient material, not allow appreciable leakage when the resilient material is damaged or destroyed. The definition of "appreciable" may be found in 46 CFR 56.20-15(c)(1).

C. Each hose used for transferring vapors must:

1. Have a design burst pressure of at least 25 psig;

2. Have a maximum allowable working pressure of at least 5 psig;

3. Be capable of withstanding at least the maximum vacuum rating of the vapor moving device without collapsing or constricting when subject to a vacuum;

4. Be electrically continuous with a maximum resistance of ten thousand (10,000) ohms;

5. Have flanges with a bolt hole arrangement complying with the requirements for ANSI B16.5 150 pound class flanges; and

6. Be abrasion resistant, resistant to kinking, and compatible with the vapors being transferred.

D. Vapor hose handling equipment must be provided with hose saddles which provide adequate support to prevent kinking or collapse of hoses.

E. Fixed vapor collection arms must meet the standards of paragraph C. of this section.

F. The facility vapor connection must be electrically insulated from the barge vapor connection in accordance with section 6.10 of the Oil Companies International Marine Forum (OCIMF) publication International Safety Guide for Oil Tankers and Terminals.

Section Six - Facility Requirements For Barge Vapor Overpressure And Vacuum Protection

A. A facility's vapor collection system must have a capacity for collecting cleaning facility vapors at a rate of not less than 1.1 times the facility's maximum allowable gas-freeing rate, plus any inerting, diluting, or enriching gas which may be added to the system.

B. A facility vapor collection system must maintain the pressure in the barge's cargo tanks between 80% of the highest setting of any of the barge's vacuum relief valves and 80% of the lowest setting of any of the barge's pressure relief valves. The system must be capable of maintaining the pressure in the barge's cargo tanks within this range at any gas-freeing rate less than or equal to the maximum gas-freeing rate determined by the requirements in Section Seven, paragraph C. in Part B of these standards.

C. A fluid displacement system must provide a pressure sensing device which activates an alarm when the pressure at the fluid injection connection exceeds either the pressure corresponding to the upper pressure determined in paragraph B. of this section or a lower pressure agreed upon by the facility and barge persons in charge. The pressure sensing device must be located in the fluid displacement system's piping down stream of any devices that could potentially isolate the barge from the pressure sensing device. The pressure measured by the sensing device must be corrected for pressure drops across any barge piping, hoses, or arms used to inject the fluid.

D. A fluid displacement system must provide a pressure sensing device, independent of the device required by paragraph C. of this section, which activates the fluid displacement system emergency shutdown and closes the remotely operated cargo vapor shutoff valve of Section Five, paragraph A. and the remotely operated shutoff valve of Section Five, paragraph B.when the pressure at the fluid injection connection reaches 90% of the lowest setting of any pressure relief valve on the barge. The pressure sensing device must be located in the fluid displacement system's piping downstream of any device that could potentially isolate the barge from the pressure sensing device. The pressure measured by the sensing device must be corrected for pressure drops across any barge piping, hoses or arms used to inject the fluid.

E. If a compressor, blower, eductor or other vapor moving device capable of drawing more than 0.5 psig vacuum is used to draw vapor, air, inert gas or other medium from the barge, a vacuum relief valve must be installed on the facility's fixed vapor collection system piping between the facility vapor connection and the vapor moving device. The vacuum relief valve must meet the following standards:

1. Relieves at a pressure not to exceed 0.5 psig vacuum;

2. Has a relieving capacity equal to or greater than the maximum capacity of the vapor moving device;

3. Has a flame screen or flame arrester fitted at the relief opening;

4. Has been tested for relieving capacity in accordance with paragraph 1.5.1.3. of American Petroleum Institute (API) standard 2000 with a flame screen or flame arrester fitted; and

5. Has materials of construction compatible with the vapors being gas-freed.

F. The vacuum relief valve standard of paragraph E. of this section may include a valve to isolate it from the facility vapor collection piping, provided the following criteria are met:

1. The isolation valve must be interlocked with any blower, vacuum pump, or other vapor moving device such that start-up of the vapor mover can not occur unless the isolation valve is in the full open position (i.e., the vacuum relief valve is not isolated); and

2. The isolation valve can only be closed after the facility person in charge has acknowledged that the hatch opening required by Section Thirteen, paragraph I. of this part is open and secured.

G. If a compressor, blower, eductor, or other vapor moving device capable of drawing more than 0.5 psig vacuum is used to draw vapor, air, inert gas, or other medium from the barge, the facility must install portable, intrinsically safe pressure sensing devices on any cargo tank at the connection required by Section Five, paragraph B. in Part B of these standards before any cleaning operation begins on the tank. A pressure sensing device must be provided which activates:

1. An alarm when the pressure in the cargo tank being cleaned falls below 80% of the highest setting of any of the barge's vacuum relief valves, or a higher pressure agreed upon by the facility and barge persons in charge; and

2. The emergency shutdown system for the vapor moving device and closes the remotely operated cargo vapor shutoff valve described in Section Five, paragraph A. of this part when the pressure in the cargo tank being cleaned falls below 90% of the highest setting of any of the barge's vacuum relief valves, or a higher pressure agreed upon by the facility and barge persons in charge. This pressure sensing device must be independent of the device used to activate the alarm required by paragraph G. of this section.

H. The pressure sensing devices required by paragraph G. of this section must meet the following criteria:

1. Have suitable means, such as approved intrinsic safety barriers able to accept passive devices, to ensure that the underpressure alarm circuits of the barge side of the underpressure control system, including cabling, normally closed switches, and pin and sleeve connectors, are intrinsically safe;

2. Are connected to the underpressure alarm system by a 4 wire, 16 amp shielded flexible cable; and

3. The cable shielding must be grounded to the underpressure alarm system.

I. A pressure indicating device must be provided within 6 meters (19.7 feet) of the facility vapor connection which indicates the pressure in the vapor collection line.

J. A fluid displacement system must include a pressure indicating device within 6 meters (19.7 feet) of the fluid injection connection which indicates the pressure in the fluid displacement system injection line.

K. If a fluid displacement system used to inject inert gas or other medium into the cargo tank of a barge being gas-freed is capable of producing a pressure greater than 2.0 psig, a pressure relief valve must be installed in the fluid displacement system injection line between the fluid injection source and the fluid injection connection which:

1. Relieves at a pressure such that the pressure in the fluid displacement system at the fluid injection connection does not exceed 1.5 psig;

2. Has a relieving capacity equal to or greater than the maximum volumetric flow capacity of the fluid displacement system;

3. Has a flame screen or flame arrester fitted at the relief opening; and

4. Has been tested for relieving capacity in accordance with paragraph 1.5.1.3. of API 2000 with a flame screen or flame arrester fitted.

L. When using the fluid displacement system, if the pressure in the facility's fixed vapor collection system can exceed 2.0 psig due to a malfunction in an inerting, enriching, or diluting system a pressure relief valve must:

1. Be installed between the point where inerting, enriching, or diluting gas is introduced into the facility's fixed vapor collection system piping and the facility vapor connection;

2. Relieve at a pressure such that the pressure in the vapor collection system at the facility vapor connection does not exceed 1.5 psig;

3. Have a relieving capacity equal to or greater than the maximum capacity of the facility inerting, enriching, or diluting gas source;

4. Has a flame screen or flame arrester fitted at the relief opening; and

5. Has been tested for relieving capacity in accordance with paragraph 1.5.1.3. of API 2000 with a flame screen or flame arrester fitted;

6. Has materials of construction compatible with the vapors being gas-freed.

M. For fluid displacement systems, the fluid injection connection must be electrically insulated from the fluid injection source in accordance with section 6.10 of the Oil Companies International Marine Forum (OCIMF) publication International Safety Guide for Oil Tankers and Terminals.

N. The relieving capacity test required by paragraphs K.4. and L.5. of this section must be carried out with a flame screen or flame arrester fitted at the discharge opening if the pressure relief valve is not designed to ensure a minimum vapor discharge velocity of 30 meters (98.4 feet) per second.

O. A pressure indicating device must be provided by the facility for installation on the connection required by Section Five, paragraph B. in Part B of these standards.

Section Seven - Fire, Explosion, And Detonation Protection

A. A VCS with a single facility vapor connection that processes vapor other than high flash point cargoes with a vapor recovery unit must:

1. Have a detonation arrester located within 6 meters (19.7 feet) of the facility vapor connection; or

2. Have an inerting, enriching, or diluting system that meets the standards contained in Section Nine of this part.

B. A VCS with a single facility vapor connection that processes vapor other than high flash po in cargoes with a vapor destruction unit must:

1. Have a detonation arrester located within 6 meters (19.7 feet) of the facility vapor connection; and

2. Have an inerting, enriching, or diluting system that meets the standards contained in Section Nine of this part.

C. A VCS with multiple facility vapor connections that processes vapor other than high flash point cargoes with a vapor recovery unit must have a detonation arrester located within 6 meters (19.7 feet) of each facility vapor connection.

D. A VCS with multiple facility vapor connections that processes vapor other than high flash point cargoes with a vapor destruction unit must:

1. Have a detonation arrester located within 6 meters (19.7 feet) of the facility vapor connection; and

2. Have an inerting, enriching, or diluting system that meets the standards contained in Section Nine of this part.

E. Except for a discharge vent from a vapor destruction unit, each outlet of a VCS that vents to atmosphere and is not isolated with a pressure-vacuum relief valve (fitted with a flame screen at valve outlet) must have a flame arrester located at the outlet.

Section Eight - Detonation Arresters, Flame Arresters, And Flame Screens

A. Each detonation arrester required by the standards in this part must:

1. Be capable of arresting a detonation from either side of the device; and

2. Be acceptable to Commandant (G-MOS). A detonation arrester designed, built, and tested in accordance with Appendix A to 33 CFR 154 will be acceptable to Commandant (G-MOS).

B. Each flame arrester required by the standards in this part must be acceptable to Commandant (G-MOS). A flame arrester designed, built, and tested in accordance with Appendix B to 33 CFR 154 will be acceptable to Commandant (G-MOS).

C. Each flame screen required by the standards of this part must be either a single screen of corrosion resistant wire of at least 30 by 30 mesh, or two screens, both of corrosion resistant wire, of at least 20 by 20 mesh, spaced not less than 12.5 millimeters (0.5 inch) or more than 37.5 millimeters (1.5 inches) apart.

Section Nine - Inerting, Enriching, And Diluting Systems

A. A VCS which uses an inerting, enriching, or diluting system must be equipped with a gas injection and mixing arrangement located as close as practicable but not more than 10 meters (32.8 feet) from the facility vapor connection that ensures complete mixing of the gases within 20 pipe diameters of the injection point.

B. A VCS that uses an inerting or enriching system may not be operated at a vacuum after the injection point unless:

1. There are no sleeve-type couplings, vacuum relief valves, or other devices which could allow air into the vapor collection system downstream of the injection point; or

2. An additional analyzer is used to monitor the downstream vapor concentration and a means is provided to inject additional inerting or enriching gas.

C. A VCS that uses analyzers to control the amount of inerting, enriching, or diluting gas injected into the vapor collection piping must be equipped with at least two analyzers. The analyzers must be connected so that:

1. When two oxygen analyzers are used, the higher oxygen concentration reading controls the inerting or enriching system and activates the alarm and automatic shutdown system required by paragraph G., I., or J.2. of this section. When more than two analyzers are used, the majority pair controls the inerting or enriching system and activates the alarm and automatic shutdown system required by paragraphs G., I., or J.2. of this section;

2. When two hydrocarbon analyzers are used, the lower hydrocarbon concentration reading controls the inerting or enriching system and activates the alarm and automatic shutdown system required by paragraph H. of this section. When more than two analyzers are used, the majority pair controls the inerting or enriching system and activates the alarm and automatic shutdown system required by paragraph H. of this section;

3. When two hydrocarbon analyzers are used, the higher hydrocarbon concentration reading controls the diluting system and activates the alarm and automatic shutdown system required by paragraph K. of this section. When more than two analyzers are used, the majority pair controls the diluting system and activates the alarm and automatic shutdown system required by paragraph K. of this section.

D. A VCS that uses volumetric measurements to control the amount of inerting, enriching or diluting gas injected into the vapor collection piping must be equipped with at least one analyzer to activate the alarms and automatic shutdown systems required by this section.

E. Each oxygen or hydrocarbon analyzer required by this section must:

1. Be installed in accordance with API Recommended Practice 550;

2. Have a response time of not more than 30 seconds from the time the vapor is sampled; and

3. Sample the vapor concentration continuously not more than 30 pipe diameters from the gas injection point.

F. Oxygen analyzers which operate at elevated temperatures (i.e., zirconia oxide or thermomagnetic) must not be used.

G. An inerting system must:

1. Supply sufficient inert gas to the vapor stream to ensure that the oxygen concentration down stream of the injection point is maintained below 60% of the minimum oxygen concentration by volume necessary for combustion for the specific combination of cargo vapors and inerting gas being processed;

2. Activate an alarm when the oxygen concentration in the vapor collection piping exceeds 60% of the minimum oxygen concentration by volume necessary for combustion for the specific combination of cargo vapors and inerting gas being processed;

3. Close the remotely operated cargo vapor shutoff valve required by Section Five, paragraph A. of this part and shutdown any vapor moving device when the oxygen concentration in the vapor collection piping exceeds 70% of the minimum oxygen concentration by volume necessary for combustion for the specific combination of cargo vapors and inerting gas;

4. The alarm value in paragraph 2. of this section must be at least 1% less than the shutdown value in paragraph 3. of this section. If the oxygen analyzer used to measure oxygen concentrations cannot accurately differentiate between the alarm value and the shutdown value, the alarm value must be lowered until the analyzer becomes operable;

5. If a combustion device is used to produce the inert gas, a detonation arrester and a means to prevent the backflow of flammable vapors must be installed between the combustion device and the inert gas injection point.

H. An enriching system must:

1. Supply sufficient compatible hydrocarbon vapor to the vapor stream to ensure that the hydrocarbon concentration after the injection point is maintained above 170% by volume of the upper flammable limit;

2. Activate an alarm when the hydrocarbon concentration in the vapor collection piping falls below 170% by volume of the upper flammable limit;

3. Close the remotely operated cargo vapor shutoff valve required by Section Five, paragraph A. of this part and shutdown any vapor moving device when the hydrocarbon concentration in the vapor collection piping falls below 150% by volume of the upper flammable limit; and

4. For those cargoes with an upper flammable limit too high to operate under the 170% and 150% by volume constraints in this section, the hydrocarbon analyzer must activate an alarm at no less than the upper flammable limit + 10% and shutdown at no less than the upper

flammable limit + 7.5%. The upper flammable limit is either the cargo's upper flammable limit or the enriching gas upper flammable limit, whichever is higher.

I. Oxygen analyzers may be used in lieu of hydrocarbon analyzers in an enriching system at a facility that receives cargo vapor only from a barge with non-inerted cargo tanks, provided that the analyzers:

1. Activate an alarm when the oxygen concentration in the vapor collection piping exceeds a level corresponding to a hydrocarbon concentration of 170% of the upper flammable limit;

2. Close the remotely operated cargo vapor shutoff valve required by Section Five, paragraph A. of this part and shutdown any vapor moving device when the oxygen concentration in the vapor collection piping exceeds a level corresponding to a hydrocarbon concentration of 150% of the upper flammable limit;

3. For those cargoes with an upper flammable limit too high to operate under the 170% and 150% by volume constraints, the oxygen analyzers must activate an alarm and shutdown when the oxygen concentration exceeds a level corresponding to the upper flammable limit + 10%, and the upper flammable limit + 7.5%, respectively. For this purpose, the upper flammable limit is either the cargo's upper flammable limit or the enriching gas upper flammable limit, whichever is higher; and

4. The alarm value in paragraph H.1. of this section must be at least 1% less than the shutdown value in paragraph H.2. of this section. If the oxygen analyzer used to measure oxygen concentrations cannot accurately differentiate between the alarm value and the shutdown value, the alarm value must be lowered until the analyzer becomes operable.

J. An enriching system may be used in a vapor collection system that collects vapors from a barge with inerted cargo tanks if:

1. Hydrocarbon analyzers are used to comply with paragraphs G.2. through G.4. of this section; or

2. If oxygen analyzers are used, the analyzers must activate an alarm when the oxygen concentration in the vapor collection piping exceeds 60% by volume of the minimum oxygen concentration for the specific combination of cargo vapors and inerting gas. The analyzers shall also close the remotely operated cargo vapor shutoff valve required by Section Five, paragraph A. of this part and shutdown any vapor moving device when the oxygen concentration exceeds 70% by volume of the minimum oxygen concentration necessary for combustion for the specific combination of cargo vapors and inerting gas.

K. An air dilution system must:

1. Supply sufficient additional air to the vapor stream to ensure that the hydrocarbon concentration throughout the vapor collection system is maintained below 30% by volume of the lower flammable limit;

2. Activate an alarm when the hydrocarbon concentration in the vapor collection piping exceeds 30% by volume of the lower flammable limit; and

3. Close the remotely operated cargo vapor shutoff valve required by Section Five, paragraph A. of this part and shutdown any vapor moving device when the hydrocarbon concentration in the vapor collection piping exceeds 50% by volume of the lower flammable limit.

Section Ten - Compressors, Blowers, And Other Vapor Moving Devices

A. Each inlet and outlet to a compressor, blower, or other vapor moving device which handles vapor other than high flash point cargo that has not been inerted, enriched, or diluted prior to the inlet of the vapor moving device in accordance with the standards contained in Section Nine of this part must be fitted with a detonation arrester. The detonation arrester must be located within 6 meters (19.7 feet) of the inlet and outlet of the vapor moving device.

B. If a reciprocating or screw-type compressor handles vapor in the vapor collection system, it must be provided with indicators and audible and visible alarms to warn against the following conditions:

1. Excessive discharge gas temperature at each compressor chamber or cylinder;

2. Excessive cooling water temperature;

3. Excessive vibration;

4. Low lube oil level;

5. Low lube oil pressure; and

6. Excessive shaft bearing temperatures.

C. If a liquid ring-type compressor handles vapor in the vapor collection system, it must be provided with indicators and audible and visible alarms to warn against the following conditions:

1. Low level of liquid sealing medium;

2. Lack of flow of liquid sealing medium; and

3. Excessive temperature of the liquid sealing medium.

D. If a centrifugal compressor, fan, or lobe blower handles vapor other than high flash point cargoes in the vapor collection system, construction of the blades and/or housing must meet one of the following:

1. Blades or housing of nonmetallic construction;

2. Blades and housing of nonferrous material;

3. Blades and housing of corrosion resistant steel;

4. Ferrous blades and housing with one-half inch or more design tip clearance; or

5. Blades of aluminum or magnesium alloy and a ferrous housing with a nonferrous insert sleeve at the periphery of the impeller.

E. Before initial use of a blower, compressor, or other vapor moving device in a cleaning operation, the maximum flow capacity of the device must be determined for the installed piping configuration. This shall be done by installing a temporary flow measuring device at the point where the vapor collection hose would attach to the facility vapor connection. For the test, no hose or barge should be connected to the system. The vapor moving device should then be allowed to run at its maximum capacity, and the actual flow of air into the system determined.

Section Eleven - Vapor Recovery And Vapor Destruction Units

A. The inlet to a vapor recovery unit which receives vapor other than from high flash point cargo that has not been inerted, enriched, or diluted in accordance with the standards contained in Section Nine of this part must be fitted with a detonation arrester. The detonation arrester must be located within 6 meters (19.7 feet) of the inlet to the vapor recovery unit.

B. The inlet to a vapor destruction unit that processes vapors other than high flash point cargo must:

1. Have a liquid seal, or other acceptable means to prevent backflow of vapors provided that the manufacturer of the vapor destruction unit certifies the unit to be as safe from a flame-back occurrence as a vapor destruction unit with a liquid seal; and

2. Have installed two quick closing stop valves in the vapor collection piping. At least one of these valves must be located immediately upstream of the detonation arrester required by paragraph C. of this section.

C. The manufacturer's certification allowed under paragraph B. of this section must be submitted in writing to the certifying entity prior to a review of the qualitative failure analysis required in Section Three of this part. Commandant (G-MOS) may be consulted for assistance.

D. A vapor destruction unit processing vapors other than high flash point cargoes must:

1. Not be within 30 meters (98.8 feet) of any tank barge berth or mooring at the facility;

2. Have a detonation arrester fitted in the vapor collection piping. This detonation arrester must be located within 6 meters (19.7 feet) of the inlet to the vapor destruction unit;

3. Alarm and shutdown when a flame is detected on the detonation arrester; and

4. Have an inerting, enriching, or diluting system meeting the standards contained in Section Nine of this part installed in the vapor collection piping so that any vapors entering the combustion device have been rendered noncombustible in the piping system.

E. A vapor destruction unit processing vapors of only high flash point cargoes must:

1. Not be within 30 meters (98.8 feet) of any tank barge berth or mooring at the facility;

2. Have a detonation arrester fitted in the vapor collection piping. This detonation arrester must be located within 6 meters (19.7 feet) of the inlet to the vapor destruction unit;

3. Alarm and shutdown when a flame is detected on the detonation arrester.

F. When a vapor destruction unit shuts down or has a flame-out condition, the vapor destruction unit control system must:

1. Close the quick closing stop valves required by paragraph B. of this section;

2. Close the remotely operated cargo vapor shutoff valve required by Section Five, paragraph A. of this part;

3. Automatically shutdown any compressors, blowers, or other vapor moving devices installed in the vapor collection system; and

4. For fluid displacement systems, close the remotely operated shutoff valve required by Section Five, paragraph B. of this part.

Section Twelve - Personnel Training

A. A facility person in charge of a cleaning operation utilizing a VCS must have completed a training program covering the particular system installed at the facility and on the barge. Training must include drills or demonstrations using the installed VCS covering normal operations and emergency procedures.

B. The training program required by paragraph A. of this section must cover the following subjects:

1. Purpose of a stripping, gas-freeing and VCS;

2. Principles of the stripping, gas-freeing and VCS;

3. Components of the stripping, gas-freeing and VCS;

4. Hazards associated with the stripping, gas-freeing and VCS;

5. Special hazards associated with the accumulation and discharge of static electricity;

6. Coast Guard standards in this part; and

7. Operating procedures, including:

(a) Testing and inspection requirements;
(b) Pre-cleaning procedures;
(c) Chemicals approved for collection;
(d) Material safety data sheet review;
(e) Connection sequence;
(f) Start-up procedures;
(g) Safeguards to prevent static electricity discharge;
(h) Normal operations; and
(i) Emergency procedures.

Section Thirteen - Operational Requirements

A. A facility can receive vapors only from a barge which meets the standards contained in Part B.

B. The following test and checks must be performed by the facility person in charge not more than 24 hours prior to each cleaning operation:

1. Pressure alarms and automatic shutdown systems required by this part must be tested. Each test must include a realistic application of pressure and vacuum necessary to provide an operating test;

2. The analyzers required by Section Nine, paragraph E. of this part must be checked for calibration according to the manufacturer's recommendations; and

3. The vacuum relief valve required by Section Six, paragraph E. of this part and the pressure relief valves required by Section Six, paragraphs K. and L. of this part must be checked to make sure they are operating freely and flame screens or flame arresters are not damaged.

C. The position of all valves in the vapor line between the barge's cargo tanks and the facility vapor collection system must be verified prior to the start of the cleaning operation.

D. The gas-freeing rate must not exceed the maximum allowable gas-freeing rate as determined by the lesser of the following:

1. A gas-freeing rate corresponding to the maximum vapor processing rate for the cleaning facility VCS, as specified in the facility operations manual; or

2. The barge's maximum gas-freeing rate determined in accordance with Section Seven, paragraph C. in Part B of these standards.

E. Mixing of incompatible vapors is prohibited. The vapor collection system piping, equipment, hoses, valves, and arresters must be purged between gas-freeing operations that involve incompatible chemical vapors. The purge must be inert gas, air or enriching gas, and must be adequate to reduce the level of residual vapor to a level where reaction with the subsequent vapor cannot occur. The required duration of purge time must be determined by calculation and approved by the certifying entity during the initial review. Chemical compatibility must be determined by using the procedures contained in 46 CFR 150 - Compatibility of Cargoes.

F. If one or more analyzers required by Section Nine, paragraph C. become inoperable during gas-freeing operations, the operation may continue provided that at least one analyzer remains operational. However, no further gas-freeing operations may be started until all inoperable analyzers are repaired or replaced.

G. Whenever a condition results in a shutdown of the VCS, the facility person in charge shall immediately terminate cleaning operations. The operation may not be restarted until the cause of the shutdown has been investigated and corrective action taken.

H. If it is suspected that a flare in the VCS has had a flashback, or if a flame is detected on the detonation arrester required by Section Eleven, paragraph D.2. or paragraph E.2. of this part,

the cleaning operation must be stopped and may not be restarted until the detonation arrester has been inspected and found to be in satisfactory condition.

I. If a vacuum displacement system is used for gas-freeing, the following items must be verified by the facility person in charge of the cleaning operation:

1. The minimum amount of open area for air flow on the barge has been determined so that the pressure in the cargo tank cannot be less than 0.2 psig vacuum, which is equivalent to 14.5 pounds per square inch absolute (psia), at the maximum flow capacity of the vapor moving device;

2. The hatch and/or fitting providing the minimum open area has been secured open so that accidental closure is not possible;

3. The hatch and/or fitting must be opened before the pressure in the cargo tank falls below 10% of the highest setting of any of the barge's vacuum relief valves.

J. All alarms, shutdowns and other operating systems should be tested at least once a year in accordance with the standards contained in 33 CFR 156.170(g). This test must be witnessed by a representative of the local Coast Guard Captain of the Port. The test procedure must be approved by the certifying entity during the initial certification of the system and incorporated into the facility operations manual.

K. Prior to commencing any cleaning operation, the freezing point of the cargo must be determined and adequate precautions taken to prevent the cargo vapor from condensing and freezing if there is a possibility that the ambient air temperature during cleaning operations will be at or below the freezing point of the cargo vapor.

L. Prior to commencing any cleaning operation, the cargo vapor must be evaluated for the potential to polymerize and adequate precautions taken to prevent and detect polymerization of the cargo vapors.

M. The maximum allowable stripping rate must be determined prior to commencing stripping operations. The maximum allowable stripping rate can not exceed the volumetric capacity of the barge's vacuum relief valve at the valve's set point for the cargo tank being stripped.

N. When required by Section Six, paragraph G. of this part, the pressure sensing devices must be installed and tested in accordance with paragraph B. of this section prior to commencement of cleaning operations.

Section Fourteen - Special Requirements

A. A vapor collection system that collects vapors with the potential to polymerize must meet the following:

1. The VCS must be designed to prevent condensation of monomer vapor. Methods such as heat tracing and insulation are permitted if they will not result in an increased risk of polymerization;

2. The facility vapor collection system must be designed so that polymerization can be detected. Any points suspected of being sites for potential polymerization buildup should be equipped with inspection openings meeting the requirements of Section Four, paragraph B.; and

3. The facility vapor collection system must include devices to measure the pressure drop across detonation arresters due to polymerization. Any device used for this purpose, including differential pressure monitors, must not be capable of transmitting a detonation across the detonation arrester.

B. A vapor collection system that collects vapors with the potential to freeze at normal ambient conditions must be designed to prevent condensation of the cargo vapors, or to remove the condensation before it can accumulate.

Section Fifteen - Equipment Tests And Inspections

A. The following must be verified by the facility person in charge prior to commencing cleaning operations:

1. Each manual valve in the vapor collection system is correctly positioned to allow the collection of vapors;

2. A vapor collection hose or arm is connected to the barge's vapor collection system;

3. The electrical insulating devices required by Section Five, paragraph F. and Section Six, paragraph M. of this part are installed;

4. The maximum allowable gas-freeing rate is determined;

5. The maximum allowable stripping rate is determined;

6. The maximum and minimum operating pressures of the barge are determined;

7. Each vapor collection hose has no unrepaired loose covers, kinks, bulges, soft spots, or any other defect which would permit the discharge of vapor through the hose material, and no external gouges, cuts, or slashes that penetrate the first layer of hose reinforcement.

B. A vapor collection system must not be used unless the following tests and inspections are satisfactorily completed:

1. Each vapor collection hose, vapor collection arm, pressure or vacuum relief valves, and pressure sensors are tested and inspected in accordance with 33 CFR 156.170(b), (c) and (f);

2. Each remote operating or indicating device is tested for proper operation in accordance with 33 CFR 156.170(f); and

3. Each detonation arrester has been inspected internally within the last year, or more frequently if operational experience has shown that frequent clogging or rapid deterioration is likely.

Section Sixteen - Facility Operations Manual

A. In addition to the requirements contained in 33 CFR 154.310, the facility operations manual shall include the following information:

1. A physical description of the cleaning facility including a plan of the facility showing mooring areas, locations where cleaning operations are conducted, control stations, and locations of safety equipment;

2. The sizes, types, and number of barges the facility can conduct cleaning operations from simultaneously; and

3. The minimum number of persons required to be on duty during cleaning operations and their duties.

B. Cleaning operations using a VCS may not be conducted unless the facility operator has a valid endorsement for the facility operations manual from the Coast Guard Captain of the Port.

Section Seventeen - Facility Person In Charge: Designation And Qualifications

A. In addition to the requirements contained in 33 CFR 154.710, the designation and qualifications for the facility person in charge shall include the following:

1. No person may serve, and the facility operator may not use the services of a facility person in charge of a cleaning operation unless the person has been properly trained and certified by the facility with a minimum of at least 60 hours of experience in cleaning operations.

Part B - Safety Standards For Tank Barges

Section One - Applicability

A. These standards apply to each tank barge which collects vapors emitted from a barge's cargo tanks through a VCS during gas-freeing or cleaning operations at a cleaning facility. These standards do not apply to the collection of vapors emitted during tank barge cargo loading or lightering operations.

B. These standards do not apply to the collection of vapors of liquefied flammable gases as defined in 46 CFR 30.10-39.

Section Two - Definitions

The following definitions apply to terms used in this part:

Barge vapor connection means the point in a barge's piping system where it connects to a vapor collection hose or arm. This may be the same as the barge's cargo connection.

Cargo tank venting system means the venting system required by 46 CFR 32.55.

Cleaning facility means a facility used or capable of being used to conduct cleaning operations on a tank barge.

Cleaning operation means any stripping, gas-freeing, or tank washing operation of a barge's cargo tanks conducted at a cleaning facility.

Combustible liquid means a liquid as defined in 46 CFR 30.10-15.

Gas-freeing means the removal of vapors from a tank barge.

Facility means an onshore or mobile facility which includes, but is not limited to structures, equipment, and appurtenances thereto, used or capable of being used to transfer and control vapors.

Facility vapor connection means the point in a facility's fixed vapor collection system where it connects to a vapor collection hose or the base of a vapor collection arm.

Fixed stripping line means a pipe extending to the low point of each cargo tank, which is welded through the deck and terminates above deck with a valve, plugged at the open end.

Flammable liquid means a liquid as defined in 46 CFR 30.10-22.

Flame arrester means a device which is designed, built, and tested in accordance with Appendix B to 33 CFR 154 for use in end-of-line applications for arresting flames.

Fluid displacement system means a system that removes vapors from a barge's cargo tanks during gas-freeing through the addition of an inert gas or other medium into the cargo tank.

Fluid injection connection means the point in a fluid displacement system at which the fixed piping or hose that supplies the inert gas or other medium connects to a barge's cargo tanks or fixed piping system.

High flash point cargoes means Grade E cargoes and cargoes having a closed cup flash point greater than 600 C, carried at a temperature no higher than 50 C below their flash points.

Inerted means the oxygen content of the vapor space in a barge's cargo tank is reduced to 8% or less by volume in accordance with the inert gas requirements of 46 CFR 32.53.

Maximum allowable gas-freeing rate means the maximum volumetric rate at which a barge may be gas-freed during cleaning operations.

Maximum allowable stripping rate means the maximum volumetric rate at which a barge may be stripped during cleaning operations prior to the opening of any hatch and/or fitting on the cargo tank being stripped.

Stripping means the removal, to the maximum extent practicable, of cargo residue remaining in the barge's cargo tanks and associated fixed piping system after cargo transfer or during cleaning operations.

Vacuum displacement system means a system that removes vapors from a barge's cargo tanks during gas-freeing by sweeping air through the cargo tank hatch openings.

Vapor collection system means an arrangement of piping and hoses used to collect vapor emitted from a barge's cargo tanks and transport the vapor to a vapor processing unit.

Vapor control system (VCS) means an arrangement of piping and equipment used to control vapor emissions collected from a barge, and includes the vapor collection system and the vapor processing unit.

Vapor processing unit means the components of a VCS that recovers, destroys, or disperses vapor collected from a barge.

Section Three - Submission Of Vapor Control System (VCS) Designs

A. Plans, calculations, and specifications for a tank barge's vapor collection and stripping systems must be submitted to the Marine Safety Center for approval prior to utilization in cleaning operations.

B. Upon satisfactory completion of plan review and inspection of the vapor collection system, the Officer in Charge, Marine Inspection shall endorse the Certificate of Inspection that the barge is acceptable for collecting vapor during a cleaning operation.

Section Four - Design And Equipment Of Vapor Collection And Stripping Systems

A. Each barge engaged in cleaning operations at an approved cleaning facility must have a conductive fixed stripping line installed in each cargo tank. The line must extend to the low point of each cargo tank, extend through and be welded to the top of the cargo tank, and terminate above deck with a full port valve plugged at the open end.

B. An existing fixed stripping system may be used in lieu of the stripping line required in paragraph A. of this section.

C. Each stripping line must be labeled with the words "Stripping Line-Tank # XXX" in an on-deck location.

D. Vapors may be collected from the barge's cargo tanks through a common fixed vapor header, through the fixed liquid cargo header, or through flanged flexible hoses located at the top of each cargo tank.

E. The vapor collection system must not interfere with the proper operation of the cargo tank venting system.

F. A barge being gas-freed by a fluid displacement system must meet the following:

1. If the fluid medium is a compressible fluid, such as inert gas, it may be injected into the barge's cargo tanks through a common fixed vapor header, through the fixed liquid cargo header, or through flanged flexible hoses located at the top of each cargo tank;

2. If the fluid medium is a non-compressible fluid, such as water, it must be injected into the barge's cargo tanks through the fixed liquid cargo header only;

3. If the fluid medium is a non-compressible fluid, such as water, the barge must be equipped with and meet the requirements for tank barge liquid overfill protection contained in 46 CFR 39.20-9.

G. The barge vapor connection must be electrically insulated from the facility vapor connection and the fluid injection connection must be electrically insulated from the fluid injection source, if fitted, in accordance with section 6.10 of the OCIMF publication International Safety Guide for Oil Tankers and Terminals.

H. Vapor collection piping must be electrically bonded to the barge hull and must be electrically continuous.

I. All equipment used on the barge during cleaning operations must be electrically bonded to the barge and tested to ensure electrical continuity prior to each use.

J. Each hose used for the transfer of vapors during cleaning operations must:

1. Have a design burst pressure of at least 25 psig;

2. Have a maximum allowable working pressure of at least 5 psig;

3. Be capable of withstanding at least the maximum vacuum rating of the cleaning facility's vapor moving device without collapsing or constricting when subject to a vacuum;

4. Be electrically continuous with a maximum resistance of ten thousand (10,000) ohms; and

5. Have flanges with a bolt hole arrangement complying with the requirements for ANSI B16.5 150 pound class flanges; and

6. Be abrasion resistant, resistant to kinking, and compatible with the vapors being transferred.

K. Each hose used for the transfer of liquids during cleaning operations must:

1. Have a design burst pressure of at least 600 psig;

2. Have a maximum allowable working pressure of at least 150 psig;

3. Be capable of withstanding at least the maximum vacuum rating of the cleaning facility's vapor moving device without collapsing or constricting;

4. Be electrically continuous with a maximum resistance of ten thousand (10,000) ohms; and

5. Have flanges with a bolt hole arrangement complying with the requirements for ANSI B16.5 150 pound class flanges; and

6. Be abrasion resistant, resistant to kinking, and compatible with the liquids being transferred.

L. If hose is used to transfer either vapor or liquid from the barge during cleaning operations, hose handling equipment must be provided with hose saddles which provide adequate support to prevent kinking or the collapse of hoses.

Section Five - Underpressure Protection During Stripping And Gas-freeing Operations

A. The cargo tank venting system required by 46 CFR 32.55 must:

1. Not exceed the maximum design working pressure for the cargo tank; and

2. Not exceed the maximum design vacuum for the cargo tank.

B. Each barge must be fitted with a means for connecting the pressure sensors and pressure indicating devices required by Section Six, paragraphs G. and O. of Part A on each cargo tank top. The valved connection point must be labeled "Pressure Sensor Connection".

C. For stripping operations with closed cargo tanks, the maximum stripping rate must not exceed the volumetric flow capacity of the vacuum relief valve protecting the cargo tank to be stripped.

Section Six - Inspection Prior To Conducting Gas-freeing Operations

A. The following inspections must be conducted by the barge person in charge prior to commencing gas-freeing operations:

1. Each part of the barge's vapor collection system is aligned to allow vapor to flow to a cleaning facility VCS;

2. If a fluid displacement system is used to conduct gas-freeing operations:

(a) The fluid supply line is connected to the fluid injection connection; and

(b) The maximum fluid injection rate is determined in accordance with Section Seven, paragraph C.2. of this part;

3. The maximum stripping or gas-freeing rate is determined in accordance with Section Five, paragraph C. of this part or Section Seven, paragraph C. of this part, respectively, and adequate openings required by Section Seven, paragraph C.1. of this part are available and identified;

4. The pressure sensors and pressure indicators required by Section Six, paragraph G. and M of Part A are connected as required by Section Five, paragraph B. of this part;

5. The maximum and minimum operating pressures of the barge being cleaned are determined;

6. Each vapor recovery hose has no unrepaired loose covers, kinks, bulges, soft spots, or any other defect which would permit the discharge of vapors through the hose material, and no gouges, cuts, or slashes that penetrate the first layer of hose reinforcement;

7. The facility vapor connection must be electrically insulated from the barge vapor connection and the fluid injection connection must be electrically insulated from the fluid injection source, if fitted, in accordance with section 6.10 of the OCIMF publication International Safety Guide for Oil Tankers and Terminals; and

8. All equipment is bonded in accordance with Section Four, paragraph H. of this part.

Section Seven - Operational Requirements

A. Vapors from a tank barge may not be transferred during cleaning operations to a cleaning facility which does not have its facility operations manual endorsed by the Captain of the Port as meeting the standards contained in Part A.

B. Prior to commencing stripping operations, the maximum allowable stripping rate must be determined. The maximum allowable stripping rate must not exceed the volumetric flow capacity of the vacuum relief valve protecting the cargo tank to be protected.

C. The gas-freeing rate must not exceed the maximum allowable gas-freeing rate as determined by the following:

1. For a vacuum displacement system:

(a) The maximum allowable gas-freeing rate is a function of the area open to the atmosphere for the cargo tank being gas-freed. The area open to the atmosphere must be large enough to prevent the pressure in the cargo tank being gas-freed from becoming no less than 0.2 psi vacuum (14.5 psia). The maximum allowable gas-freeing rate shall be calculated from Table One (attached) using the area open to the atmosphere for the cargo tank being gas-freed as the entering argument.

2. For a fluid displacement system, the maximum allowable gas-freeing rate is determined by the lesser of the following:

(a) Eighty (80%) percent of the total venting capacity of the pressure relief valve in the cargo venting system when relieving at its set pressure;

(b) Eighty (80%) percent of the total vacuum relieving capacity of the vacuum relief valve in the cargo tank venting system when relieving at its set pressure; or

(c) The rate based on pressure drop calculations at which, for a given pressure at the facility vapor connection, the pressure in the cargo tank being gas-freed exceeds 80% of the setting of any pressure relief valve in the cargo tank venting system.

D. Any hatch and/or fitting used to calculate the minimum area required to be open to the atmosphere must be opened and secured in such a manner as to prevent accidental closure during gas-freeing. All flame screens for the hatch and/or fitting opened shall be removed in order to allow for maximum air flow. The hatch and/or fitting must be secured open before the pressure in the cargo tank falls below 10% of the highest setting of any of the barge's vacuum relief valves.

E. "Do Not Close Hatch/Fitting" signs are conspicuously posted near the hatch and/or fitting opened during gas-freeing operations.

F. In order to minimize the dangers of static electricity, all equipment used on the barge during gas-freeing and cleaning operations must be electrically bonded to the barge and tested to ensure electrical continuity before each use.

G. If the barge is equipped with an inert gas system, the inert gas main isolation valve must remain closed during cleaning operations.

H. Vapors from incompatible cargoes that are collected simultaneously must be kept separated throughout the barge's entire vapor collection system. Chemical compatibility must be determined in accordance with the procedures contained in 46 CFR 150, Part A.

Section Eight - Barge Person In Charge: Designation and

A. The designation and qualification requirements contained in 33 CFR 155.700 and 33 CFR 155.710(a)(2) apply to the barge person in charge.

TABLE ONE - Minimum Open Area for Barge Cleaning Hatches

Air Flow (CFM)	Air Flow (CFS)	Open Area	Diameter Opening	Square Opening
(cubic feet/min.)	(cubic feet/sec.)	(square inches)	(inches)	(inches)
500	8.3	10.7	3.7	3.3
600	10.0	12.8	4.0	3.6
700	11.7	15.0	4.4	3.9
800	13.3	17.1	4.7	4.1
900	15.0	19.3	5.0	4.4
1000	16.7	21.4	5.2	4.6
1100	18.3	23.6	5.5	4.9
1200	20.0	25.7	5.7	5.1
1300	21.7	27.8	6.0	5.3
1400	23.3	30.0	6.2	5.5
1500	25.0	32.1	6.4	5.7
1600	26.7	34.3	6.6	5.9
1700	28.3	36.4	6.8	6.0
1800	30.0	38.5	7.0	6.2
1900	31.7	40.7	7.2	6.4
2000	33.3	42.8	7.4	6.5
2100	35.0	45.0	7.6	6.7
2200	36.7	47.1	7.7	6.9
2300	38.3	49.3	7.9	7.0
2400	40.0	51.4	8.1	7.2

TABLE ONE - Minimum Open Area for Barge Cleaning Hatches

Air Flow (CFM)	Air Flow (CFS)	Open Area	Diameter Opening	Square Opening
(cubic feet/min.)	(cubic feet/sec.)	(square inches)	(inches)	(inches)
2500	41.7	53.5	8.3	7.3
2600	43.3	55.7	8.4	7.5
2700	45.0	57.8	8.6	7.6
2800	46.7	60.0	8.7	7.7
2900	48.3	62.1	8.9	7.9
3000	50.0	64.2	9.0	8.0
3100	51.7	66.4	9.2	8.1
3200	53.3	68.5	9.3	8.3
3300	55.0	70.7	9.5	8.4
3400	56.7	72.8	9.6	8.5
3500	58.3	75.0	9.8	8.7
3600	60.0	77.1	9.9	8.8
3700	61.7	79.2	10.0	8.9
3800	63.3	81.4	10.2	9.0
3900	65.0	83.5	10.3	9.1
4000	66.7	85.7	10.4	9.3