

STANDARDS FOR VAPOUR EMISSION CONTROL SYSTEMS

(92-98 MARPOL reg VI/15)

1 The Maritime Safety Committee, at its sixtieth session, recognized the necessity of the international standards for vapour emission control systems and approved the standards developed by the BCH Sub-Committee at its twenty-first session for use by Administrations, as contained in the annex.

2 Member Governments are invited to note this development.

1 GENERAL

1.1 These standards have been developed for the design, construction, and operation of vapour collection systems on tankers and vapour emission control systems at terminals. The standards are intended to apply to vapour emission control systems which collect vapours of flammable cargoes from tanker cargo tanks during cargo loading or ballasting operations. Vapour emission control systems which collect vapour of cargoes having characteristics which may pose hazards in addition to or other than flammability should be subject to special consideration by the Administration. These standards are not intended to require the use of vapour emission control systems but rather to recommend safety standards when such systems are utilized. The requirement to collect vapours will stem from a port Administration or terminal regulation. These standards are intended to promote the safety of terminals, tankers, and their personnel, recognizing the unique design features and characteristics of these systems.

1.2 Definitions

1.2.1 "Diluted": the condition in which the concentration of a flammable gas in a flammable gas/air mixture is less than 50% of the lower explosive limit of the gas.

1.2.2 "Enriched": the condition in which the concentration of a flammable gas in a flammable gas/air mixture is not less than 150% of the upper explosive limit of the gas. When flammable gases are mixed to achieve an enriched condition, the upper explosive limit of the flammable gas mixture shall be used.

1.2.3 "Flammable cargoes" means cargoes of crude oil, petroleum products, and chemicals having a flashpoint not exceeding 60 degrees C (closed cup test), as determined by an approved flashpoint apparatus, and a Reid vapour pressure which is below atmospheric pressure and other liquid products having a similar fire hazard.

1.2.4 "Inerted:" the condition in which the oxygen content in a flammable gas/air mixture is 8% or less by volume.

1.2.5 "Independent" as applied to two systems means that one system will operate with a failure of any part of the other system except power sources and electrical feeder panels.

1.2.6 "Maximum allowable transfer rate" means the maximum volumetric rate at which a tanker may receive cargo or ballast.

1.2.7 "Tanker vapour connection" means the point in a tanker's fixed vapour collection system where it connects to a vapour collection hose or arm.

1.2.8 "Terminal vapour connection" means the point in a terminal's vapour collection system where it connects to a vapour collection hose or a vapour collection arm.

1.2.9 "Vapour balancing" means the transfer of vapour displaced by incoming cargo from the tank of a tanker receiving cargo into a tank of a facility delivering cargo via a vapour collection system.

1.2.10 "Vapour collection system" means an arrangement of piping and hoses used to collect vapour emitted from a tanker's cargo tanks and transport the vapour to a vapour processing unit.

1.2.11 "Vapour destruction unit" means a vapour processing unit that destroys cargo vapour by a means such as incineration.

1.2.12 "Vapour dispersion system" means a vapour processing unit which releases cargo vapour to the atmosphere through a venting system not located on the tanker being loaded or ballasted.

1.2.13 "Vapour emission control system" means an arrangement of piping and hoses used to control vapour emissions collected from a tanker, and includes the vapour collection system and the vapour processing unit.

1.2.14 "Vapour processing unit" means the components of a vapour control system that recovers, destroys, or disperses vapour collected from a tanker.

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

2 TANKERS

2.1 Tanker vapour processing unit

2.1.1 In addition to the requirements of this section, each tanker which has a vapour processing unit located onboard should, to the satisfaction of the Administration, meet

the vapour collection and processing design requirements for a shoreside terminal contained in section 3.

2.2 General

2.2.1 Each chemical, product or crude carrier should have vapour collection piping which is permanently installed with a tanker vapour connection located as close as practical to the loading manifold. In lieu of permanent piping, Administrations may permit chemical tankers to have a permanent vapour connection at each cargo tank for connection to a vapour hose which should be kept as short as practicable.

2.2.2 If a tanker simultaneously collects vapours from cargoes which react in a hazardous manner with other cargoes, it should keep these incompatible vapours separate throughout the entire vapour collection system.

2.2.3 A means should be provided to eliminate liquid condensate which may collect in the system, such as draining and collecting liquid from each low point in the line.

2.2.4 Vapour collection piping should be electrically bonded to the hull and should be electrically continuous.

2.2.5 When inert gas distribution piping is used for vapour collection piping, means to isolate the inert gas supply from the vapour collection system should be provided. The inert gas main isolation valve required by SOLAS 74, as amended, chapter II-2, regulation 62.10.8 may be used to satisfy this requirement.

2.2.6 The vapour collection system should not interfere with the proper operation of the cargo tank venting system.

2.3 Vapour line connections

2.3.1 An isolation valve capable of manual operation should be provided at each tanker vapour connection. The operating position of this valve should be readily determined visually.

2.3.2 The end of each vapour collection pipe or vapour collection hose should be readily identifiable to prevent misconnection.

2.3.3 In order to prevent the possible misconnection of the vapour manifold to a shoreside terminal liquid loading line, each tanker vapour connection flange should conform to the applicable industry standard.* This provision is applicable regardless of the size of the vessel.

* OCIMF Recommendations for Oil Tanker Manifolds and Associated Equipment, Fourth Edition 1991, section A.5.2.2.

2.3.4 Each vapour collection hose should meet the following:

- .1 be suitable for the service;
- .2 be electrically continuous and
- .3 have an extra hole in each flange in accordance with the applicable industry standard.**

** Ibid. Section A.5.2.4

Footnotes:

2.4 Cargo gauging equipment

2.4.1 Each cargo tank of a tanker that is connected to a vapour collection system should be equipped with a cargo gauging device which:

- .1 provides a closed gauging arrangement that does not require opening the tank to the atmosphere during cargo transfer;
- .2 allows the operator to determine the liquid level in the tank for the full range of liquid levels in the tank;
- .3 indicates at the location where cargo transfer is controlled, the liquid level in the tank; and
- .4 if portable, is installed on the tank during the entire transfer operation.

2.5 Liquid overflow protection

2.5.1 Each cargo tank of a tanker should be equipped with an overflow control system.

2.5.2 The overflow control system required by paragraph 2.5.1 should:

- .1 be independent of the cargo gauging system;
- .2 come into operation when the normal tank loading procedures fail to stop the tank liquid level exceeding the normal full condition;
- .3 give a visual and audible tank overflow alarm to the ship's operator;
- .4 provide an agreed signal for sequential shutdown of onshore pumps or valves or both and of the ship's valves. The signal as well as the pump and valve shutdown may be dependent on operator's intervention. The use of shipboard automatic closing valves should be permitted only when specific approval has been obtained from the Administration and the Port Administration concerned;
- .5 have alarms fitted in the cargo control room, where provided, but in each case in such a position that they are immediately received by responsible members of the crew;
- .6 alarm in the event of loss of power to the alarm system or failure of the electrical circuitry to the tank level sensor; and
- .7 be able to be checked at the tank for proper operation prior to each transfer or contain an electronic self-testing feature which monitors the condition of the alarm circuitry and sensor.

2.6 Vapour overpressure and vacuum protection

2.6.1 Each cargo tank should have a controlled pressure venting system which is designed on the basis of the maximum designed loading rate multiplied by a factor of at least 1.25 to take account of gas evolution, in order to prevent the pressure in the tank from exceeding the design pressure.

2.6.2 Each cargo tank should have a controlled vacuum venting system which is capable of preventing a vacuum in the cargo tank vapour space, whether generated by withdrawal of cargo or vapour at maximum rates, that exceeds the maximum design vacuum for the tank.

2.6.3 A prototype of each pressure or vacuum or pressure/vacuum venting device should be bench tested for venting capacity by a test method acceptable to the Administration.

2.6.4 Each tanker equipped with a vapour collection system that is common to two or more tanks should be fitted with a pressure sensing device that senses the pressure in the main vapour collection line for those tanks, and which:

- .1 has a high pressure alarm that alarms at a pressure of not more than the lowest pressure relief valve setting in the cargo tank venting system; and
- .2 has a low pressure alarm that alarms at a pressure of not less than atmospheric pressure for an inerted tanker, or the lowest vacuum relief valve setting (i.e. that setting nearest to atmospheric pressure) in the cargo tank venting system for a non-inerted tank vessel.

2.7 Operational procedures

2.7.1 The procedures set forth in relevant IMO guidance and established industry guidelines should be observed, as applicable, with regard to preparation for transfer, and transfer of cargo and of ballast into cargo tanks.*

* ISGOTT
MSC/Circ.299
ICS Tanker Safety Guide (Chemical)

Footnote :

2.7.2 The rate of cargo transfer should not exceed the maximum allowable transfer rate as determined by the lesser of the following:

- .1 the venting capacity of the pressure relief valves in the cargo tank venting system divided by a factor of at least 1.25.
- .2 the vacuum relieving capacity of the vacuum relief valves in the cargo tank venting system; and
- .3 The rate based on pressure drop calculations for a given pressure at the facility vapour connection, such that the pressure in any cargo tank connected to the vapour collection system does not exceed 80% of the opening set pressure of

any pressure relief valve in the cargo tank venting system.

2.7.3 A cargo tank should not be filled higher than the level at which the overflow alarm required by paragraph 2.5.1 is set.

2.7.4 A cargo tank should not be opened to the atmosphere for gauging or sampling while the tanker is connected to a vapour emission control system unless loading to the tank is stopped, the tank is isolated from any other tank which is in the process of being loaded, and precautions are taken to reduce any pressure in the cargo tank vapour space and prevent an electrostatic spark from occurring.

2.7.5 If the tanker is equipped with an inert gas system the isolation valve required by paragraph 2.2.5 should remain closed during vapour transfer.

2.7.6 Unless equipped with an automatic self-test and circuit monitoring feature, each tank overflow control system alarm required by paragraph 2.5.1, on a cargo tank being loaded, should be tested at the tank for proper operation prior to the start of cargo transfer.

2.8 Training

2.8.1 Each person in charge of a transfer operation utilizing a vapour emission control system should have completed a training programme covering the particular system installed on the tanker. The training should encompass the purpose and principles of operation of the vapour emission control system and provide an understanding of the equipment involved and associated hazards. In addition the training should provide an understanding of operating procedures including testing and inspection of equipment, pre-transfer procedures, piping connection sequence, start-up procedures, normal operations and emergency procedures. Training should also include an understanding of the shoreside terminal equipment and operating procedures.

2.9 Transfer procedures

2.9.1 Tanker transfer procedures should contain information on the tanker's vapour collection system including:

- .1 a line diagram of the tanker's vapour collection piping indicating the locations and purpose of all control and safety devices;
- .2 the maximum allowable transfer rate as limited by the venting capacity of the pressure or vacuum relief valves, or any other factor which would limit the transfer rate;
- .3 the maximum pressure drop in the vessel's vapour collection system for various transfer rates;
- .4 the relief settings of each pressure and vacuum relief valve;
- .5 pre-transfer procedures; and
- .6 procedures to be followed in the event of a fault during vapour collection operations.

3 SHORESIDE TERMINALS

3.1 General

3.1.1 A vapour emission control system design and installation should eliminate potential tanker overfill hazards, tanker overpressure and vacuum hazards, and sources of ignition to the maximum practical extent, in accordance with good design and engineering practice. Each remaining hazard source which is not eliminated should be specifically addressed in the protection system design and operational requirements.

3.1.2 A hazards analysis should be conducted on the design and operation which demonstrates the following:

- .1 the vapour emission control system is designed to permit the system to continuously operate safely when receiving cargo vapour from tankers over the full range of transfer rates expected at the terminal,
- .2 the vapour emission control system is provided with the proper alarms and automatic control systems to prevent unsafe operation;
- .3 the vapour emission control system is equipped with sufficient safety systems to minimize damage to personnel, property, and the environment if an accident were to occur, and
- .4 the operating procedures minimize the potential for improper or unsafe operation by personnel.

3.1.3 Vapour collection system piping, fittings and equipment should be suitable for the intended service. Material generally should be of steel or equivalent.

3.1.4 Electrical installations in hazardous locations should be to the satisfaction of the national authority for the intended service.

3.1.5 Due consideration should be given to the effect of external sources of heat generated as a result of fire or proximity of other equipment on the components of vapour emission control systems.

3.1.6 Where cargoes are handled which, because of their properties may introduce additional ignition hazards, such hazards should be included in the hazard analysis referred to in paragraph 3.1.2. In particular, if the terminal handles inerted vapour of cargoes containing sulphur, the hazard of heating from pyrophoric iron sulphide deposits in the vapour collection line should be considered, and appropriate precautions taken.

3.1.7 If a terminal simultaneously processes vapour from cargoes which react in a hazardous manner with other cargoes it should be designed to keep these incompatible vapours separate throughout the entire process.

3.2 Vapour line connections

3.2.1 A remotely operated cargo vapour shutoff valve should be provided in close proximity to each terminal vapour connection. This valve should meet the following:

- .1 be located between any point where inerting, enriching, or diluting gas is introduced into the vapour collection line and the terminal vapour connection;
- .2 be capable of manual operation or manual activation,
- .3 have valve operating position readily determined visually; and
- .4 be resistant to fire.

The end of each vapour collection pipe, vapour collection hose, or vapour collection arm should be readily identifiable to prevent misconnection.

3.2.3 Each terminal vapour connection flange should conform to the provisions referred to in section 2.3.3 of these standards.

3.2.4 Each vapour collection hose or arm should meet the following:

- .1 be suitable for the intended service;
- .2 be electrically continuous; and
- .3 have an extra hole in each flange in accordance with the applicable industry standard.*

* OCIMF Recommendations for Oil Tanker Manifolds and Associated Equipment, Fourth Edition 1991, Section A.5.2.4

3.2.5 The terminal vapour connection should be electrically insulated from the tanker vapour connection by the use of an insulating flange or a single section of insulating hose.

Footnote :

3.3 Terminal requirements for vessel vapour overpressure and vacuum protection

3.3.1 A terminal's vapour emission control system should have the capacity for handling cargo vapour at a rate of not less than the facility's maximum designed loading rate multiplied by a factor of at least 1.25 to take account of gas evolution, and in addition any inerting, enriching, or diluting gas which may be added to the system.

3.3.2 A terminal's vapour emission control system should be capable of maintaining the pressure in a tanker's cargo tanks between the lowest setting (i.e. that setting nearest to atmospheric pressure) of any of the tanker's vacuum relief valves and the lowest setting of any of the tanker's pressure relief valves for a non-inerted tanker, and between atmospheric pressure and the lowest setting of any of the tanker's pressure relief valves for an inerted tanker. The system should be capable of maintaining the pressure in the tanker's cargo tanks within this range at any cargo transfer rate less than or equal to the maximum transfer rate.

3.3.3 Each terminal main branch line at a berth should be provided with a pressure sensing device located as close to the terminal vapour connection as practicable and this

device should:

- .1 come into operation prior to the pressure in the tanker's cargo tanks going outside the range given in paragraph 3.3.2;
- .2 give a visible and audible pressure alarm to the facility's operator;
- .3 provide an agreed signal for sequential shutdown of onshore pumps and the remotely operated cargo vapour shutoff valve required by paragraph 3.2.1. The pump and valve shutdown may be dependent on operator's interventions.

3.3.4 Safety features such as a back flow preventer or pressure relief device should be provided to ensure that a malfunction in an inerting, enriching, or diluting system does not overpressure the tanker.

3.3.5 If a compressor, blower or eductor unit is used to draw vapours from the tanker, a vacuum relief device should be installed in the vapour collection line between the unit and the terminal vapour connection. This relief device should have a vacuum relieving capacity greater than the capacity of the compressor, blower or eductor unit.

3.4 Fire, explosion and detonation protection

3.4.1 Where on the basis of the hazard analysis referred to in paragraph 3.1.2, in order to meet the requirements referred to in paragraph 3.1.2.1, it has been demonstrated that in certain sections of the vapour emission control system gases should be kept outside the flammable range, means should be provided to maintain such sections of the vapour emission control system gas concentration in the inerted, diluted or enriched condition with a suitable safety margin provided. A safety system should be provided in which the signal of an oxygen and/or hydrocarbon analyzer is used to automatically close the vapour shutoff valve referred to in paragraph

3.2.1 when the gas concentration in the vapour emission control system approaches the permitted limits for the inerted, diluted or enriched condition as given in section 1.2 of these standards.

3.4.2 Where on the basis of the hazard analysis referred to in paragraph 3.1.2, other operational procedures for explosion protection are applied such as flow, temperature and pressure control systems, the safety system referred to in paragraph 3.4.1 should come into operation if the monitoring of such operational procedures indicates that the safe limits of the procedures are approached.

3.4.3 At the terminal vapour connection a detonation arrester should be fitted in close proximity to such connection to protect against flame propagation originating in the vapour emission control system being transmitted to the ship's vapour collection system.

3.4.4 Detonation arresters should be tested in accordance with a test standard acceptable to the competent shoreside authorities*.

* Detonation arresters should also comply with the relevant provisions of MSC/Circ.373/Rev.1.

Footnote :

3.5 Operational procedures

3.5.1 The procedures set forth in relevant IMO guidance and established industry guidance should be observed, as applicable, with regard to preparation for transfer, and transfer of cargo and of ballast into cargo tanks.**

** ISGOTT
MSC/Circ.299

Footnote :

3.5.2 All alarms and automatic shutdown systems should be tested frequently and hydrocarbon or oxygen analyzers checked frequently for calibration by use of a span gas.

3.5.3 The cargo transfer rate should not exceed the lesser of the maximum vapour processing rate for the vapour emission control system (accounting for vapour generation and any inerting, enriching, or diluting gas which may be added to the system) or the maximum transfer rate for the tanker.

3.5.4 The high and low pressure alarm sensor set points should be verified as being matched to the tanker's acceptable pressure range prior to transfer operations commencing.

3.5.5 Detonation arresters should be checked regularly to ensure that they are not damaged or become blocked.

3.6 Training

3.6.1 Each person in charge of a transfer operation utilizing a vapour emission control system should have completed a training programme covering the particular system installed at the terminal. The training should encompass the purpose and principles of operation of the vapour control system and provide an understanding of the equipment involved and associated hazards. In addition the training should provide an understanding of operating procedures including testing and inspection of equipment, pre-transfer procedures, piping connection sequence, start-up procedures, normal operations and emergency procedures. Training should also include an understanding of the associated tanker equipment and operating procedures.