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	DEPARTMENT OF MARINE SERVICES AND MERCHANT SHIPPING (ADOMS)
	ENCLOSED SPACE ENTRY

Enclosed Space Entry

Due to the number of incidents involving injury and death to seafarers as a result of entering enclosed spaces, SOLAS Chapter III Regulation 19 amendments came into effect on 1st January 2015.

Between 1st September 2015 and 30th November 2015, many regions will be conducting Port State Control Concentrated Inspection Campaigns related to this subject with the objectives of:


- Ensuring compliance with applicable requirements of SOLAS and STCW conventions
- Ensuring seafarers are familiar with relevant equipment and have received training in carrying out their duties;
- Raising safety awareness among crew serving on board
- Ensuring that ship's crew identify and understand the hazards associated with entry into enclosed spaces

As part of this CIC an enclosed space entry and rescue drill will be conducted with the crew's familiarity with procedures being assessed. Related equipment will be inspected and checks made that procedures and related manuals and instructions have been developed specifically for the vessel and its equipment. For safety reasons the drill MUST NOT BE IN AN ENCLOSED SPACE or any space which has been designated as such.

The aim of the drill is to demonstrate that the crew are familiar with the established procedures and are able to conduct enclosed space entry and rescue drills competently and in a safe manner, in accordance with the recommendations of the IMO.

The drill will serve to further confirm that the requirements for familiarization, training and instruction have been met, and is to be conducted in a safe area on the ship and in a safe manner. Annex 1 to this notice contains a summary of some further basic guidance which is based on information from the IMO and other organizations.

There are numerous other sources of useful information, posters etc. including that produced by P & I clubs, plus organizations such as MAIF <http://www.maiif.org/index.php/enclosed-space-entry> and the Nautical Institute <http://www.nautinst.org/en/forums/enclosed-spaces/seaways-articles.cfm>.

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Annex; Enclosed Space Entry Guidance

PREAMBLE

The objective of this basic guidance is to encourage the prevention of casualties to ships' personnel entering enclosed spaces where there may be an oxygen-deficient, oxygen-enriched, flammable and/or toxic atmosphere.

Investigations into the circumstances of casualties that have occurred have shown that accidents on board ships are in most cases caused by an insufficient knowledge of, or disregard for, the need to take precautions.

It should be noted that on ships where entry into enclosed spaces may be infrequent, the dangers may be less apparent, and accordingly there may be a need for increased vigilance.


This very basic guidance is intended to complement national laws or regulations, accepted standards or particular procedures which may exist for specific trades, ships or types of shipping operations, it also contains extracts from IMO Resolution A.1050 (27).

1 INTRODUCTION

The atmosphere in any enclosed space may be oxygen-deficient or oxygen-enriched and/or contain flammable and/or toxic gases or vapours. Such unsafe atmospheres could also subsequently occur in a space previously found to be safe. Unsafe atmospheres may also be present in spaces adjacent to those spaces where a hazard is known to be present.

Every crew member shall be given instructions which shall include but not necessarily be limited to the risks associated with enclosed spaces and onboard procedures for safe entry into such spaces. Crew members need to be familiar with all the safety systems related to enclosed space entry and familiar with their duties as well as the contents of the training manual which will contain both generic and ship specific information.

Atmosphere testing equipment must be properly maintained and those crew members with responsibility for its use need to have been appropriately trained. It is important that arrangements are made to ensure that the atmosphere is checked not just prior to entry but throughout the period that personnel are in the enclosed space.

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2 DEFINITION

2.1 *Enclosed space* means a space which has any of the following characteristics:

- .1 limited openings for entry and exit;
- .2 inadequate ventilation; and
- .3 is not designed for continuous worker occupancy,

2.2 Such *enclosed spaces* include, but are not limited to; cargo spaces, double bottoms, fuel tanks, ballast tanks, cargo pump-rooms, cargo compressor rooms, cofferdams, chain lockers, void spaces, duct keels, inter-barrier spaces, boilers, engine crankcases, engine scavenge air receivers, sewage tanks, and adjacent connected spaces. Spaces such as battery rooms and enclosed lifeboats should also be considered when ventilation to them is restricted.

3 SAFETY MANAGEMENT FOR ENTRY INTO ENCLOSED SPACES

3.1 A list of enclosed spaces should be produced on a ship-by-ship basis to identify enclosed spaces.

3.2 The company should ensure that the procedures for entering enclosed spaces are included among the key shipboard operations concerning the safety of the personnel and the ship.

3.3 The company should elaborate a procedural implementation scheme which provides for training in the use of atmospheric testing equipment in such spaces and a schedule of regular onboard drills for crews which should be held at intervals of not more than 2 months


3.4 Competent and responsible persons should be identified and trained in enclosed space hazard recognition, evaluation, measurement, control and elimination.

3.5 Crew members should be trained, as appropriate, in enclosed space safety, including familiarization with onboard procedures for recognizing, evaluating and controlling hazards associated with entry into enclosed spaces.

4 ASSESSMENT OF RISK

4.1 The company should ensure that a risk assessment is conducted which includes identifying all of the enclosed spaces and adjacent connected spaces on board the ship. This risk assessment should be periodically revisited to ensure its continued validity.

4.2 In order to ensure safety, a competent person should always make a preliminary assessment of any potential hazards in the space to be entered, taking into account as

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applicable such items as: previous cargo carried, ventilation of the space, coating of the space and other relevant factors.


- .1 The competent person's preliminary assessment should determine the potential for the presence of an oxygen-deficient, oxygen-enriched, flammable or toxic atmosphere.
- .2 The competent person should bear in mind that the ventilation procedures for an adjacent connected space may be different from the procedures for the ventilation of the enclosed space itself.
- 4.3 The procedures to be followed for testing the atmosphere in the space and for entry should be decided on the basis of the preliminary assessment. These will depend on whether the preliminary assessment shows that:
 - .1 there is minimal risk to the health or life of personnel entering the space; or
 - .2 there is no immediate risk to health or life but a risk could arise during the course of work in the space; or
 - .3 a risk to health or life is identified.
- 4.4 Throughout the assessment process, there should be an assumption that the space to be entered is considered to be hazardous until positively proved to be safe for entry.

5 AUTHORIZATION OF ENTRY

- 5.1 No person should open or enter an enclosed space unless authorized by the master or the nominated responsible person and unless the appropriate safety procedures laid down for the particular ship have been followed.
- 5.2 Entry into enclosed spaces should be planned and an Enclosed Space Entry Permit should be issued by the master or the nominated responsible person, which shall be completed by the personnel who enter the space prior to entry. An example of the Enclosed Space Entry Permit is provided in the appendix.

6 GENERAL PRECAUTIONS


- 6.1 Entry doors or hatches leading to enclosed spaces should be appropriately placarded and at all times be secured against entry, when entry is not required.
- 6.2 A door or hatch cover which is opened to provide natural ventilation of an enclosed space may, wrongly, be taken to be an indication of a safe atmosphere and therefore, an attendant may be stationed at the entrance or the use of a mechanical barrier, such as a rope or chain positioned across the opening with an attached warning sign, could prevent such accidental entry.

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- 6.3 The master or the responsible person should determine that it is safe to enter an enclosed space by ensuring that all appropriate parts of the Enclosed Space Entry Permit are completed;
- 6.4 Only trained personnel should be assigned the duties of entering, functioning as attendants or functioning as members of rescue teams. Ships' crews with rescue and first aid duties should be drilled periodically in rescue and first aid procedures. Training should include as a minimum:
 - .1 identification of the hazards likely to be faced during entry into enclosed spaces;
 - .2 recognition of the signs of adverse health effects caused by exposure to hazards during entry; and
 - .3 knowledge of personal protective equipment required for entry.
- 6.5 All equipment used in connection with entry should be in good working condition and inspected prior to use.
- 6.6 Appropriate communication systems should be in use for both routine and emergency use

7 TESTING THE ATMOSPHERE


- 7.1 Appropriate testing of the atmosphere of a space should be carried out with properly calibrated equipment by persons trained in the use of the equipment. The manufacturers' instructions should be strictly followed. Testing of the space should be carried out before any person enters the space and at regular intervals thereafter until all work is completed. Where appropriate, the testing of the space should be carried out at as many different levels as is necessary to obtain a representative sample of the atmosphere in the space.
- 7.2 In some cases it may be difficult to test the atmosphere throughout the enclosed space without entering the space (e.g. the bottom landing of a stairway) and this should be taken into account when assessing the risk to personnel entering the space. The use of flexible hoses or fixed sampling lines, which reach remote areas within the enclosed space, may allow for safe testing without having to enter the space.
- 7.3 For entry purposes, steady readings of all of the following should be obtained:
 - .1 21% oxygen by volume by oxygen content meter;
 - .2 not more than 1% of lower flammable limit (LFL) on a suitably sensitive combustible gas indicator, where the preliminary assessment has determined that there is potential for flammable gases or vapours; and

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- .3 not more than 50% of the occupational exposure limit (OEL)* of any toxic vapours and gases. If these conditions cannot be met, additional ventilation should be applied to the space and re-testing should be conducted after a suitable interval.
- 7.4 Any gas testing should be carried out with ventilation to the enclosed space stopped, and after conditions have stabilized, in order to obtain accurate readings.
- 7.5 Where the preliminary assessment has determined that there is potential for the presence of toxic gases and vapours, appropriate testing should be carried out, using fixed or portable gas or vapour detection equipment. The readings obtained by this equipment should be below the occupational exposure limits for the toxic gases or vapours given in accepted international standards, in accordance. It should be noted that testing for flammability or oxygen content does not provide a suitable means of measuring for toxicity, nor vice versa.
- 7.6 It should be emphasized that the internal structure of the space, cargo, cargo residues and tank coatings may also present situations where oxygen-deficient areas may exist, and should always be suspected, even when an enclosed space has been satisfactorily tested as being suitable for entry.

8 PRECAUTIONS DURING ENTRY

- 8.1 The atmosphere should be tested frequently whilst the space is occupied and persons should be instructed to leave the space should there be a deterioration in the conditions.
- 8.2 Persons entering enclosed spaces should be provided with calibrated and tested multi-gas detectors that monitor the levels of oxygen, carbon monoxide and other gases as appropriate.
- 8.3 Ventilation should continue during the period that the space is occupied and during temporary breaks. Before re-entry after a break, the atmosphere should be re-tested. In the event of failure of the ventilation system, any persons in the space should leave immediately.
- 8.4 Particular care should be exhibited when working on pipelines and valves within the space. If conditions change during the work, increased frequency of testing of the atmosphere should be performed. Changing conditions that may occur include increasing ambient temperatures, the use of oxygen-fuel torches, mobile plant, work activities in the enclosed space that could evolve vapours, work breaks, or if the ship is ballasted or trimmed during the work.
- 8.5 In the event of an emergency, under no circumstances should the attending crew member enter the space before help has arrived and the situation has been evaluated to ensure the safety of those entering the space to undertake rescue operations. Only

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properly trained and equipped personnel should perform rescue operations in enclosed spaces.


9 ADDITIONAL PRECAUTIONS FOR ENTRY INTO A SPACE WHERE THE ATMOSPHERE IS KNOWN OR SUSPECTED TO BE UNSAFE

- 9.1 Spaces that have not been tested should be considered unsafe for persons to enter. If the atmosphere in an enclosed space is suspected or known to be unsafe, the space should only be entered when no practical alternative exists. Entry should only be made for further testing, essential operation, safety of life or safety of a ship. The number of persons entering the space should be the minimum compatible with the work to be performed.
- 9.2 Suitable breathing apparatus, e.g. of the air-line or self-contained type, should always be worn, and only personnel trained in its use should be allowed to enter the space. Air-purifying respirators should not be used as they do not provide a supply of clean air from a source independent of the atmosphere within the space.
- 9.3 Persons entering enclosed spaces should be provided with calibrated and tested multi-gas detectors that monitor the levels of oxygen, carbon monoxide and other gases as appropriate.
- 9.4 Rescue harnesses should be worn and, unless impractical, lifelines should be used.
- 9.5 Appropriate protective clothing should be worn, particularly where there is any risk of toxic substances or chemicals coming into contact with the skin or eyes of those entering the space.

10 HAZARDS RELATED TO SPECIFIC TYPES OF SHIPS OR CARGO

10.1 Dangerous goods in packaged form

.1The atmosphere of any space containing dangerous goods may put at risk the health or life of any person entering it. Dangers may include flammable, toxic or corrosive gases or vapours that displace oxygen, residues on packages and spilled material. The same hazards may be present in spaces adjacent to the cargo spaces. Information on the hazards of specific substances is contained in the International Maritime Dangerous Goods (IMDG) Code, the Emergency Procedures for Ships Carrying Dangerous Goods (EMS) and Material Safety Data Sheets (MSDS)*. If there is evidence or suspicion that leakage of dangerous substances has occurred, the precautions specified in section 9 should be followed.

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.2 Personnel required to deal with spillages or to remove defective or damaged packages should be appropriately trained and wear suitable breathing apparatus and appropriate protective clothing.

10.2 Liquid bulk

.1 The tanker industry has produced extensive advice to operators and crews of ships engaged in the bulk carriage of oil, chemicals and liquefied gases, in the form of specialist international safety guides. Information in the guides on enclosed space entry amplifies these recommendations and should be used as the basis for preparing entry plans.

10.3 Solid bulk

.1 On ships carrying solid bulk cargoes, dangerous atmospheres may develop in cargo spaces and adjacent spaces. The dangers may include flammability, toxicity, oxygen depletion or self-heating, as identified in the shipper's declaration. For additional information, reference should be made to the International Maritime Solid Bulk Cargoes (IMSBC) Code.

10.4 Use of Nitrogen as an inert gas*

.1 Nitrogen is a colourless and odourless gas that, when used as an inert gas, causes oxygen deficiency in enclosed spaces and at exhaust openings on deck during purging of tanks and void spaces and use in cargo holds. It should be noted that one deep breath of 100% nitrogen gas will be fatal.

10.5 Oxygen-depleting cargoes and materials

.1 A prominent risk with such cargoes is oxygen depletion due to the inherent form of the cargo, Oxygen depletion may also be caused by materials of vegetable or animal origin, by flammable or spontaneously combustible materials and by materials with a high metal content,


10.6 Fumigation

.1 When a ship is fumigated, the detailed recommendations contained in the Recommendations on the safe use of pesticides in ships (MSC.1/Circ.1358) should be followed. Spaces adjacent to fumigated spaces should be treated as if fumigated.

11 DRILLS

11.1 SOLAS requires that crew members with enclosed space entry or rescue responsibilities shall participate in an enclosed space entry and rescue drill to be held on board the ship at least once every two months. Such drills shall of course be planned and conducted in a safe manner and shall include;


- Checking and use of personal protective equipment required for entry;
- Checking and use of communication equipment and procedures to verify that crew can communicate effectively during both a planned entry and in an emergency situation.;

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- Checking and use of instruments for measuring the atmosphere in enclosed spaces;
 - Establishing what testing is needed to confirm that entry is safe and will remain safe and any limitations on the ability to confirm that conditions are safe;
 - Identifying any difficulties with access, or matters that may impede quick and effective rescue.
 - Checking and use of rescue equipment and procedures; and
 - Instructions in first aid and resuscitation techniques.
- 11.2 Drills should be varied to simulate situations that may arise in various identified enclosed spaces. Drill should not take place in an actual enclosed space.
- 11.3 Prior to the drill being undertaken, a scenario for a planned enclosed space entry and subsequent rescue should be discussed. The scenario should reflect a designated enclosed space on the ship, and the hazards associated with entry into that particular space. Ships general arrangement and construction plans can be utilised to identify potential restrictions on access so that means of overcoming these can be effectively simulated.

12 CONCLUSION

- 12.1 Failure to observe simple procedures can lead to persons being unexpectedly overcome when entering enclosed spaces. Observance of the principles and procedures outlined above will form a reliable basis for assessing risks in such spaces and for taking necessary precautions and always remember the following;
- Never enter a confined space unless absolutely necessary.
 - Complete the permit to work before entry
 - Alert rescue teams and the bridge
 - Assess the risks, including those presented by any cargo that may be in the space.
 - Ensure appropriate rescue equipment is readily available at the point of access.
 - Ensure that a safety monitor is in position outside the space who can raise the alarm.
 - Ventilate the space thoroughly before entry.
 - Test the atmosphere in the space thoroughly before entry.
 - If possible wear an O₂ monitor while inside the space.
 - When in doubt; stay out.

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**APPENDIX
EXAMPLE OF AN ENCLOSED SPACE ENTRY PERMIT**

This permit relates to entry into any enclosed space and should be completed by the master or responsible person and by any persons entering the space, e.g. competent person and attendant.

GENERAL

Location/name of enclosed space.....

Reason for entry

This permit is valid from: hrs Date to: hrs on Date (maximum 24hrs)

SECTION 1 – PRE-ENTRY PREPARATION


(To be checked by the master or nominated responsible person)

- Has the space been thoroughly ventilated by mechanical means?
- Has the space been segregated by blanking off or isolating all connecting pipelines or valves and electrical power/equipment?
- Has the space been cleaned where necessary?
- Has the space been tested and found safe for entry? (See note 1).....
- Pre-entry atmosphere test readings:
 - oxygen % vol (21%)* By:
 - hydrocarbon % LFL (less than 1%) By
 - toxic gases ppm (less than 50% OEL of the specific gas) Time: (See note 2)
- Have arrangements been made for frequent atmosphere checks to be made while the space is occupied and after work breaks? " "
- Have arrangements been made for the space to be continuously ventilated throughout the period of occupation and during work breaks? " "
- Are access and illumination adequate? " "
- Is rescue and resuscitation equipment available for immediate use by the entrance to the space? ""
- Has an attendant been designated to be in constant attendance at the entrance to the space? " "
- Has the officer of the watch (bridge, engine-room, cargo control room) been advised of the planned entry? " "
- Has a system of communication between all parties been tested and emergency signals agreed? ""
- Are emergency and evacuation procedures established and understood by all personnel involved with the enclosed space entry? " "
- Is all equipment used in good working condition and inspected prior to entry? " "
- Are personnel properly clothed and equipped? " "

SECTION 2 – PRE-ENTRY CHECKS

(To be checked by each person entering the space)

- I have received instructions or permission from the master or nominated responsible person to enter the enclosed space " "
- Section 1 of this permit has been satisfactorily completed by the master or nominated responsible person " "
- I have agreed and understand the communication procedures " "

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- I have agreed upon a reporting interval of minutes " "
- Emergency and evacuation procedures have been agreed and are understood " "
- I am aware that the space must be vacated immediately in the event of ventilation failure or if atmosphere tests show a change from agreed safe criteria " "

SECTION 3 – BREATHING APPARATUS AND OTHER EQUIPMENT

(To be checked jointly by the master or nominated responsible person and the person who is to enter the space)

- Those entering the space are familiar with any breathing apparatus to be used
- The breathing apparatus has been tested as follows:
 - gauge and capacity of air supply
 - low pressure audible alarm if fitted
 - face mask – under positive pressure and not leaking
- The means of communication has been tested and emergency signals agreed
- All personnel entering the space have been provided with rescue harnesses and, where practicable, lifelines

Signed upon completion of sections 1, 2 and 3 by:

Master or nominated responsible person Date Time.....
 Attendant Date Time.....
 Person entering the space Date Time.....

SECTION 4 – PERSONNEL ENTRY

(To be completed by the responsible person supervising entry)

Names.....
 Time in Time out

SECTION 5 – COMPLETION OF JOB

(To be completed by the responsible person supervising entry)

- Job completed Date Time
- Space secured against entry Date Time
- The officer of the watch has been duly informed Date Time

Signed upon completion of sections 4 and 5 by:

Responsible person supervising entry Date Time

THIS PERMIT IS RENDERED INVALID SHOULD VENTILATION OF THE SPACE STOP
 OR IF ANY OF THE CONDITIONS NOTED IN THE CHECKLIST CHANGE

Notes:

1 In order to obtain a representative cross-section of the space's atmosphere, samples should be taken from several levels and through as many openings as possible. Ventilation should be stopped for about 10 minutes before the pre-entry atmosphere tests are taken.

2 Tests for specific toxic contaminants, such as benzene or hydrogen sulphide, should be undertaken depending on the nature of the previous contents of the space.