INTERNATIONAL MARITIME ORGANIZATION

E

SUB-COMMITTEE ON CARRIAGE OF CARGOES AND CONTAINERS
6th session
Agenda item 8

CCC 6/8/1
7 June 2019
Original: ENGLISH
Pre-session public release: ☒

UNIFIED INTERPRETATION OF PROVISIONS OF IMO SAFETY, SECURITY AND ENVIRONMENT-RELATED CONVENTIONS

Unified interpretations on the International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk (IGC Code)

Submitted by IACS

SUMMARY

Executive summary:	This document provides four (4) new IACS unified interpretations (in relation to paragraphs 5.13.1.1.2, 8.1, 13.2.2, and 13.9.3 of the IGC Code) and a revised version of IACS UI GC25 (in relation to paragraph 5.12.3.1 of the IGC Code). These have been developed to facilitate the consistent and global implementation of the IGC Code. The document also provides ten (10) draft unified interpretations (in relation to paragraphs 4.4 and 5.13.2.4, 5.5.7, 5.6.5 and 18.9, 5.6.6, 5.11.4, 12.1.8, 13.3.7 and Table 18.1, 13.6.2.7, 13.6.4, and 16.7.1.4 of the IGC Code). Finally, the document seeks clarification regarding paragraph 15.4.1 of the IGC Code.
Strategic direction, if applicable:	6
Output:	6.1
Action to be taken:	Paragraph 65
Related documents:	MSC 83/25/15; CCC 5/8/7 and CCC 5/13 paragraphs 8.30 and 8.31

Introduction

1 The International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk, as amended by resolution MSC.370(93) (hereafter referred to as the "IGC Code"), provides revised international standards for the design and construction of ships carrying liquefied gases in bulk.

2 IACS members, acting as recognized organizations, have discussed the implementation of the requirements of the IGC Code and concluded that some requirements need further clarification in order to facilitate their global and uniform implementation.

Discussion

Paragraphs 5.4.4 and 5.13.2.4 of the IGC Code:

3 Paragraphs 5.4.4 and 5.13.2.4 of the IGC Code state:

5.4.4 The design pressure of the outer pipe or duct of gas fuel systems shall not be less than the maximum working pressure of the inner gas pipe. Alternatively, for gas fuel piping systems with a working pressure greater than 1 MPa, the design pressure of the outer duct shall not be less than the maximum built-up pressure arising in the annular space considering the local instantaneous peak pressure in way of any rupture and the ventilation arrangements.

5.13.2.4 In double wall gas-fuel piping systems, the outer pipe or duct shall also be pressure tested to show that it can withstand the expected maximum pressure at gas pipe rupture.

4 IACS has concluded that the following terms should be clarified:

.1 "duct" in paragraphs 5.4.4 and 5.13.2.4: IACS understands that "duct" means the equipment enclosure (e.g. Gas Valve Unit (GVU) enclosure) intended to contain any release of gas from inner pipes or equipment.

.2 "design pressure of the outer pipe or duct" in paragraph 5.4.4: IACS understands that the value of the design pressure of the outer pipe or duct may be assumed as being not less than:

.1 the maximum pressure that can act on the outer pipe or equipment enclosure after the inner pipe ruptures, as documented by suitable calculations taking into account the venting arrangements; or

.2 for gas fuel systems with an inner pipe working pressure greater than 1 MPa, the "maximum built-up pressure arising in the annular space", after the inner pipe ruptures, which is to be calculated in accordance with paragraph 9.8.2 of the International Code of Safety for Ship Using Gases or Other Low-flashpoint Fuels (IGF Code), as adopted by resolution MSC.391(95).

.3 "maximum pressure at gas pipe rupture" in paragraph 5.13.2.4: IACS understands that, for testing purposes, the expected maximum pressure on the outer pipe or duct, after the inner pipe ruptures, is the same as the design pressure used in paragraph 5.4.4 of the IGC Code.

5 To clarify the issues discussed in paragraph 4 above, IACS has prepared a draft unified interpretation, a copy of which is set out in annex 1 to this document.

Paragraph 5.5.7 of the IGC Code

6 Paragraph 5.5.7 of the IGC Code requires an adequately sized Pressure Relief Valve (PRV) on pipelines with a liquid volume which may be isolated automatically due to a fire i.e.:

5.5.7 All pipelines or components which may be isolated automatically due to a fire with a liquid volume of more than 0.05 m^3 entrapped shall be provided with PRVs sized for a fire condition.

7 IACS notes that it is expected that liquid is trapped in a cargo vapour line or a fuel gas line in normal operation. However, IACS considers it is necessary for designers also to consider the possibility that liquid can accidentally be trapped in these pipe systems.

8 To clarify the issues discussed in paragraph 7 above, IACS has prepared a draft unified interpretation, a copy of which is set out in annex 2 to this document.

Paragraphs 5.6.5 and 18.9 of the IGC Code

9 Paragraphs 5.6.5 and 18.9 of the IGC Code specify the requirements regarding the arrangement of cargo sampling connections and the taking of cargo samples i.e.:

5.6.5 Cargo sampling connections

5.6.5.1 Connections to cargo piping systems for taking cargo liquid samples shall be clearly marked and shall be designed to minimize the release of cargo vapours. For vessels permitted to carry toxic products, the sampling system shall be of a closed loop design to ensure that cargo liquid and vapour are not vented to atmosphere.

[…]

5.6.5.6 Sampling operations shall be undertaken as prescribed in 18.9.

18.9 Cargo sampling

18.9.1 Any cargo sampling shall be conducted under the supervision of an officer who shall ensure that protective clothing appropriate to the hazards of the cargo is used by everyone involved in the operation.

[…]

18.9.5 After sampling operations are completed, the officer shall ensure that any sample valves used are closed properly and the connections used are correctly blanked.

10 The question has been asked as to whether the above requirements apply to all gas carriers.

11 The cargo sampling device, as an industrial practice, has only been provided on board gas carriers carrying liquefied petroleum gases, chemical gases or dual-code chemicals. Cargo sampling for gas carriers carrying liquefied natural gas (LNG) has been carried out ashore.

12 Some shipowners have raised concern regarding the risks involved if the sampling device for a cryogenic cargo is provided onboard, as the ship's crew on an LNG carrier is not familiar with taking samples of such cargoes.

13 Having again reviewed document MSC 83/25/15 (United Kingdom and SIGTTO), which initiated the revision of the IGC Code, it is understood that the requirement for cargo

sampling was developed to carry out environmentally acceptable cargo sampling of LPG and chemical gases.

14 IACS, therefore, understands that the requirements for cargo sampling are applicable only if a sampling system is fitted onboard. Connections in relation to systems that control the atmosphere in cargo tanks during inerting or gassing up are not considered as cargo sampling connections.

15 To clarify the issues discussed in paragraphs 10 to 14 above, IACS has prepared a draft unified interpretation, a copy of which is set out in annex 3 to this document.

Paragraph 5.6.6 of the IGC Code

16 Paragraph 5.6.6 of the IGC Code requires that filters can be fitted in the cargo liquid and vapour systems; that means shall be provided to indicate that these filters are becoming blocked; and to isolate, depressurize and clean the filters safely i.e.:

> *5.6.6 The cargo liquid and vapour systems shall be capable of being fitted with filters to protect against damage by extraneous objects. Such filters may be permanent or temporary, and the standards of filtration shall be appropriate to the risk of debris, etc., entering the cargo system. Means shall be provided to indicate that filters are becoming blocked, and to isolate, depressurize and clean the filters safely.*

17 IACS notes the joint SIGTTO/OCIMF publication entitled "Recommendations for Liquefied Gas Carrier Manifolds" and considers that special consideration needs to be given to the situation where a filter is fitted between two presentation flanges (ship flange and shore flange). With regards to monitoring the filter condition and cleaning the filter, the shore connection will have a pressure gauge and valve as a standard fitting, which, together with the ship pressure gauge and the valve at the cross-over, allow the filter condition to be assessed and the device cleaned. Control of the condition of such filters is performed using a shore connection pressure gauge, which is outside the scope of the IGC Code.

18 To clarify the issues discussed in paragraph 17 above, IACS has prepared a draft unified interpretation, a copy of which is set out in annex 4 to this document.

Paragraph 5.11.4 of the IGC Code

19 Paragraph 5.11.4 of the IGC Code includes the term "critical pressure" for fuel gas piping systems. However, this pressure is not defined i.e.:

> *5.11.4 High-pressure gas fuel outer pipes or ducting scantlings*
>
> *In fuel gas piping systems of design pressure greater than the critical pressure, the tangential membrane stress of a straight section of pipe or ducting shall not exceed the tensile strength divided by 1.5 (Rm /1.5) when subjected to the design pressure specified in 5.4. The pressure ratings of all other piping components shall reflect the same level of strength as straight pipes.*

20 IACS notes that the same term "critical pressure" is in paragraph 9.8.2 of the IGF Code. However, in the IGF Code this term is defined i.e.:

> *9.8.2 For high-pressure fuel piping the design pressure of the ducting shall be taken as the higher of the following:*

.1…

.2 local instantaneous peak pressure in way of the rupture: this pressure shall be taken as the critical pressure given by the following expression:

$$p = p_0 \left(\frac{2}{k+1}\right)^{\frac{k}{k-1}}$$

where:

p_0 = maximum working pressure of the inner pipe

k = C_p/C_v constant pressure specific heat divided by the constant volume specific heat

k = *1.31 for CH_4*

21 To clarify the term "critical pressure" in terms of paragraph 5.11.4 of the IGC Code, IACS has prepared a draft unified interpretation, a copy of which is set out in annex 5 to this document.

Paragraph 5.12.3.1 of the IGC Code

22 Paragraph 5.12.3.1 of the IGC Code states:

5.12.3.1 Cargo piping systems shall be provided with a thermal insulation system as required to minimize heat leak into the cargo during transfer operations and to protect personnel from direct contact with cold surfaces.

23 In the annex to document CCC 5/8/7, IACS provided a copy of its UI GC25. This was developed to clarify the terms "to minimize heat leak" and "to protect personnel". The Sub-Committee's consideration of document CCC 5/8/7 is reported in paragraphs 8.30 and 8.31 of document CCC 5/13 i.e.:

8.30 Following discussion, the Sub-Committee noted concerns that the proposed draft UIs could allow elements of the system, such as bellows, to be uninsulated and unprotected from contact in an area where personnel were likely to contact them under normal conditions. In this context, the Sub-Committee noted that design features, such as physical screening measures, should be used to prevent personnel directly contacting the exposed cold surfaces.

8.31 The Sub-Committee also noted a proposal to include, in the draft interpretation, a reference to surfaces of cargo piping systems where personnel seldom approach as an additional point to the section on "Surfaces of cargo piping systems with which personnel is likely to contact under normal conditions". In this context, the Sub-Committee agreed that the proposed addition was unnecessary as this was not a system "which personnel is likely to contact under normal conditions", i.e. as referred to in the phrase in the chapeau of the provision.

24 To address the above concerns, IACS has reviewed UI GC25 in order to:

.1 improve the clarity of the first sentence of the interpretation;

.2 simplify and re-word the second sentence of the interpretation; and

.3 delete "bellows" from the list of components excluded from "Surfaces of cargo piping systems with which personnel is likely to contact under normal conditions".

25 Consequently, IACS has adopted Revision 1 of UI GC25, a copy of which is set out in annex 6 to this document.

Paragraph 5.13.1.1.2 of the IGC Code

26 Paragraph 5.13.1.1.2 of the IGC Code states:

5.13.1.1 Valves

Each type of valve intended to be used at a working temperature below -55°C shall be subject to the following type tests:

.1 …

.2 the flow or capacity shall be certified to a recognized standard for each size and type of valve;

27 IACS considers that certification requirements for valves may be differentiated according to the intended application of the valve. IACS understands that the wording "shall be certified to a recognized standard" means that for valves considered as essential for the safety of the system, i.e. pressure relief valves, the flow properties are to be certified by the Administration or recognized organization; while the manufacturer is to certify the flow properties of other types of valves on the basis of tests carried out according to recognized standards.

28 To clarify the issues discussed in paragraph 27 above, IACS has adopted UI GC26, a copy of which is set out in annex 7 to this document.

Paragraph 8.1 of the IGC Code

29 The second sentence of paragraph 8.1 of the IGC Code states:

Hold spaces and interbarrier spaces, which may be subject to pressures beyond their design capabilities, shall also be provided with a suitable pressure relief system.

30 In order to assess whether "a suitable pressure relief system" is provided for interbarrier spaces for various type of cargo tanks, IACS considers the following issues need to be taken into account:

.1 leakage rate as provided in paragraph 4.7.2 of the IGC Code, taking due account for evaporation of the liquid;

.2 pumping capacity; and

.3 other relevant factors.

Also, it is noted that the interbarrier space pressure relief system is an emergency feature to protect the hull structure from being overstressed in case of failure of the primary barrier.

31 To clarify the issues discussed in paragraph 30 above, IACS has adopted UI GC28, a copy of which is set out in annex 8 to this document.

Paragraph 12.1.8 of the IGC Code

32 Paragraph 12.1.8 of the IGC Code refers to "spare parts" for fans i.e.:

> *12.1.8 Where fans are required by this chapter, full required ventilation capacity for each space shall be available after failure of any single fan, or <u>spare parts</u> shall be provided <u>comprising a motor, starter spares and complete rotating element, including bearings of each type</u>.*

33 Paragraph 12.1.8 of the IGC Code refers to "a motor, starter spares and complete rotating element, including bearings of each type"; but it does not mention the shaft itself. It is questioned whether shafts were not included in this required list of spare parts because it was considered that the risk of damage to shafts is very low.

34 However, IACS is of the view that damage to the shaft itself should not be ignored, noting that the wording "including bearings of each type" specified in paragraph 12.1.8 takes into account damage to bearings. Therefore, IACS considers their contacting parts (the shafts) also need to be taken into account in applying the provisions of this paragraph.

35 To clarify the issues discussed in paragraphs 33 and 34, IACS has prepared a draft unified interpretation, a copy of which is set out in annex 9 to this document.

Paragraph 13.2.2 of the IGC Code

36 The second sentence of paragraph 13.2.2 of the IGC Code states:

> *Where only one liquid level gauge is fitted, it shall be arranged so that it can be maintained in an operational condition without the need to empty or gas-free the tank.*

37 In order to assess whether or not only one level gauge is acceptable in relation to the above provision, IACS considers that the phrase "can be maintained" means that any part of the level gauge other than passive parts can be overhauled while the cargo tank is in service.

> .1 Note: passive parts are those parts assumed not subject to failures under normal service conditions.

38 To clarify the issue discussed in paragraph 37 above, IACS has adopted UI GC27, a copy of which is set out in annex 10 to this document.

Paragraph 13.3.7 and table 18.1 of the IGC Code

39 Note 4 to table 18.1 of the IGC Code specifies operational inhibition of cargo pumps and the opening of manifold ESD valves during use of the override system permitted by paragraph 13.3.7 of the IGC Code with continuous visual indication at the relevant control station(s) and the navigation bridge i.e.:

> *Note 4: The override system permitted by 13.3.7 may be used at sea to prevent false alarms or shutdowns. <u>When level alarms are overridden, operation of cargo pumps and the opening of manifold ESD valves shall be inhibited</u> except when high-level alarm testing is carried out in accordance with 13.3.5 (see 18.10.3.4).*

13.3.7 Where arrangements are provided for overriding the overflow control system, they shall be such that inadvertent operation is prevented. When this override is operated, continuous visual indication shall be given at the relevant control station(s) and the navigation bridge.

40 With regard to the phrase "operation ... shall be inhibited", IACS has discussed whether operational measures such as following a caution plate posted at the relevant control station(s) may be considered as an acceptable means of satisfying the underlined part of note 4 shown above. However, IACS notes that fatal incidents may occur when cargo pumps/manifold ESD valves are inadvertently operated/opened while the override system is used.

41 Therefore, IACS is of the view that operational measures as described in paragraph 40 above are not acceptable; and a hardware system is necessary to prevent inadvertent operation/opening of cargo pumps/manifold ESD valves for the override operation (with the exception that such an interlock is required to be disabled during high-level alarm testing).

42 To clarify the issues discussed in paragraphs 40 and 41 above, IACS has prepared a draft unified interpretation, a copy of which is set out in annex 11 to this document.

Paragraph 13.6.2.7 of the IGC Code

43 Paragraph 13.6.2.7 of the IGC Code states:

13.6.2 A permanently installed system of gas detection and audible and visual alarms shall be fitted in:

[…]

.7 inert gas generator supply headers; and

44 The inert gas supply header addressed in paragraph 13.6.2.7 of the IGC Code is understood to be the header supplying inert gas to cargo spaces for purging and inerting purposes and for which portable connections are generally used. Therefore, the requirement is not considered to address nitrogen headers for supply of nitrogen to insulation spaces, shaft glands, purging of fuel gas lines and pressurizing of LNG suction drums from nitrogen lines where nitrogen is supplied via buffer tanks kept under nitrogen pressure.

45 To clarify the issue discussed in paragraph 44 above, IACS has prepared a draft unified interpretation, a copy of which is set out in annex 12 to this document.

Paragraph 13.6.4 of the IGC Code

46 Paragraph 13.6.4 of the IGC Code specifies in which cases an oxygen deficiency monitoring system is required i.e.:

13.6.4 Where indicated by an "A" in column "f" in the table of chapter 19 ships certified for carriage of non-flammable products, oxygen deficiency monitoring shall be fitted in cargo machinery spaces and hold spaces for independent tanks other than type C tanks. Furthermore, oxygen deficiency monitoring equipment shall be installed in enclosed or semi-enclosed spaces containing equipment that may cause an oxygen-deficient environment such as nitrogen generators, inert gas generators or nitrogen cycle refrigerant systems.

47 Oxygen deficiency monitoring is required:

.1 in the cargo machinery spaces and in the cargo tank hold spaces of ships certified for the carriage of non-flammable products, where indicated by an "A" in column "f" of the table in chapter 19; and

.2 in enclosed or semi-enclosed spaces containing equipment that may cause an oxygen-deficient environment.

48 It is understood that the requirement for oxygen deficiency monitoring in enclosed or semi-enclosed spaces containing equipment that may cause an oxygen-deficient environment, applies to all spaces containing the inert gas system, on all gas carriers, irrespective of the cargo carried by the ship indicated by an "A" in column "f" of the table in chapter 19.

49 To clarify the issues discussed in paragraphs 47 and 48 above, IACS has prepared a draft unified interpretation, a copy of which is set out in annex 13 to this document.

Paragraph 13.9.3 of the IGC Code

50 Paragraph 13.9.3 of the IGC Code states:

13.9.3 Key hazards of the integrated system shall be identified using appropriate risk-based techniques.

51 In accordance with paragraph 13.9.3 of the IGC Code, a risk assessment is to be conducted for an "integrated system". However, since the cargo handling system on liquefied gas carriers comprises a lot of systems and the related systems are different depending on the type of liquefied gas carrier; it is not clear which systems are included in the "integrated system" and for which systems a risk assessment is required.

52 Accordingly, in order to make this requirement clear, IACS has adopted a unified interpretation, taking account of MSC/Circ.891 on *Guidelines for the on-board use and application of computers*. A copy of IACS UI GC29 is set out in annex 14 to this document

Paragraph 15.4.1 of the IGC Code

53 Paragraph 15.4.1 of the IGC Code specifies the conditions under which a filling limit higher that 98% under the trim and list conditions specified in 8.2.17 of the IGC Code may be allowed i.e.:

.1 no isolated vapour pockets are created within the cargo tank;

.2 the PRV inlet arrangement shall remain in the vapour space; and

.3 allowances need to be provided for:

.1 volumetric expansion of the liquid cargo due to the pressure increase from the MARVS to full flow relieving pressure in accordance with 8.4.1;

.2 an operational margin of minimum 0.1% of tank volume; and

.3 tolerances of instrumentation such as level and temperature gauges.

54 There are cases where, in order to avoid the formation of isolated vapour pockets under the trim and list conditions specified in paragraph 8.2.17 of the IGC Code; interconnection pipes are fitted that connect the vapour pocket to the tank dome (where pressure relief valves are fitted).

55 Regarding these interconnection pipes, IACS is unclear on the principles to be used in their design, and in particular if:

.1 the trim and list as specified in paragraph 8.2.17; and

.2 the fire condition leading to full flow relief in accordance with paragraph,

are to be considered separately, or, in combination.

56 IACS would note that in case the combined effects are to be taken into account:

.1 the quantity of vapours passing through the interconnecting pipe, depending on the fire exposure of the vapour space, will need to be evaluated; and

.2 the interconnecting pipe will need to have a size such that the back pressure related to the flow of vapours generated by the above fire exposure does not cause the liquid level in the dome to reach the PRV inlet.

57 The comments and advice of the Sub-Committee are sought on the issues discussed in paragraphs 54 to 56 above.

Paragraph 16.7.1.4 of the IGC Code

58 Paragraph 16.7.1.4 of the IGC Code specifies the special requirements for gas-fired internal combustion engines regarding arrangements against overpressure due to ignited gas leaks i.e.:

> *16.7.1.4 Unless designed with the strength to withstand the worst case overpressure due to ignited gas leaks, air inlet manifolds, scavenge spaces, exhaust system and crank cases shall be fitted with suitable pressure relief systems. (…)*

59 Typically, there are two types of gas fuel engines – a premixed combustion type (Otto-cycle) and a direct injection combustion type (diesel cycle).

60 IACS members have been asked by shipbuilders and engine manufacturers whether paragraph 16.7.1.4 of the IGC Code should be applied to both engine types; notwithstanding that each engine type has a different risk profile depending upon the type of combustion.

61 IACS considers that a suitable pressure relief system for the air inlet, scavenge space and exhaust system shall be provided unless the design accommodates the worst case overpressure due to ignited gas leaks or otherwise justified by the safety concept of the engine (a document in which a detailed evaluation of the hazard potential of overpressure in air inlet manifolds, scavenge spaces and exhaust system shall be reflected).

62 In case of the crankcase, the explosion relief valves required by SOLAS are considered as a suitable pressure relief system. This is on the basis that the maximum pressure level in the crankcase when the engine is operated in the gas mode is lower than when the engine is operated in the liquid fuel mode.

63 To clarify the issues discussed in paragraphs 59 to 62 above, IACS has prepared a draft Unified Interpretation, a copy of which is set out in annex 15 to this document.

Date of implementation of the UIs that have been adopted by IACS

64 The Sub-Committee is invited to note that IACS Members intend to implement:

.1 IACS Unified Interpretations GC26, GC28 and GC27 (as set out in annexes 7, 8 and 10 to this document respectively) from 1 January 2020; and

.2 IACS Unified Interpretations GC25 and GC29 (as set out in annexes 6 and 14 to this document respectively) from 1 July 2020;

.3 unless they are provided with written instructions to apply a different interpretation by the Administration on whose behalf they are authorized to act as a recognized organization.

Action requested of the Sub-Committee

65 The Sub-Committee is invited to consider the foregoing, in particular:

.1 the five IACS unified interpretations set out in annexes 6, 7, 8, 10 and 14 to this document, and their implementation provisions as explained in paragraph 64 above, and take action as appropriate in this regard;

.2 the 10 draft unified interpretations set out in annexes 1, 2, 3, 4, 5, 9, 11, 12, 13 and 15, and provide its comments and advice in this regard;

.3 the comments and analysis provided in paragraphs 54 to 56 above and provide its comments and advice in this regard; and

.4 take action as appropriate.

***

ANNEX 1

Draft Unified Interpretation to paragraphs 5.4.4 and 5.13.2.4 of the IGC Code – Outer Duct in Gas Fuel Piping Systems

The International Code for the Construction and Equipment of Ships Carrying Liquid Gases in Bulk (IGC Code), as amended by resolution MSC.370(93), 5.4.4 & 5.13.2.4 reads:

5.4.4 The design pressure of the outer pipe or duct of gas fuel systems shall not be less than the maximum working pressure of the inner gas pipe. Alternatively, for gas fuel piping systems with a working pressure greater than 1 MPa, the design pressure of the outer duct shall not be less than the maximum built-up pressure arising in the annular space considering the local instantaneous peak pressure in way of any rupture and the ventilation arrangements.

5.13.2.4 In double wall gas-fuel piping systems, the outer pipe or duct shall also be pressure tested to show that it can withstand the expected maximum pressure at gas pipe rupture.

Interpretation

For the purpose of this UI:

1) the term "duct" in 5.4.4 and 5.13.2.4 is meant to be the equipment enclosure (e.g. GVU enclosure) intended to contain any release of gas from inner pipe or equipment.

2) the term "design pressure of the outer pipe or duct" in 5.4.4 is:

- the maximum pressure that can act on the outer pipe or equipment enclosure after the inner pipe rupture as documented by suitable calculations taking into account the venting arrangements; or

- for gas fuel systems with inner pipe working pressure greater than 1 MPa, the "maximum built-up pressure arising in the annular space", after the inner pipe rupture, which is to be calculated in accordance with paragraph 9.8.2 of the IGF Code as adopted by MSC.391(95).

3) The "maximum pressure at gas pipe rupture" in 5.13.2.4 is the maximum pressure to which the outer pipe or duct is subjected after the inner pipe rupture and for testing purposes it is the same as the design pressure used in 5.4.4.

***

ANNEX 2

Draft Unified Interpretation to paragraph 5.5.7 of the IGC Code – Pipelines or components which may be isolated automatically due to a fire

The International Code for the Construction and Equipment of Ships Carrying Liquid Gases in Bulk (IGC Code), as amended by resolution MSC.370(93), 5.5.7 reads:

5.5.7 All pipelines or components which may be isolated automatically due to a fire with a liquid volume of more than 0.05 m^3 *entrapped shall be provided with PRVs sized for a fire condition.*

Interpretation

Due consideration is to be made in instances where liquid cargo could be entrapped in a cargo vapor line or a fuel gas line.

***

ANNEX 3

Draft Unified Interpretation to paragraphs 5.6.5 and 18.9 of the IGC Code – Cargo Sampling

The International Code for the Construction and Equipment of Ships Carrying Liquid Gases in Bulk (IGC Code), as amended by Res. MSC.370(93), 5.6.5 and 18.9 read:

5.6.5 *Cargo sampling connections*

5.6.5.1 *<u>Connections to cargo piping systems</u> for taking cargo liquid samples shall be clearly marked and shall be designed to minimize the release of cargo vapours. For vessels permitted to carry cargoes noted as toxic in chapter 19, the sampling system shall be of a closed loop design to ensure that cargo liquid and vapour are not vented to atmosphere.*

5.6.5.2 *<u>Liquid sampling systems</u> shall be provided with two valves on the sample inlet. One of these valves shall be of the multi-turn type to avoid accidental opening and shall be spaced far enough apart to ensure that they can isolate the line if there is blockage, by ice or hydrates for example.*

5.6.5.3 *On closed loop systems, the valves on the return pipe shall also comply with 5.6.5.2.*

5.6.5.4 *<u>The connection to the sample container</u> shall comply with recognized standards and be supported so as to be able to support the weight of a sample container. Threaded connections shall be tack-welded, or otherwise locked, to prevent them being unscrewed during the normal connection and disconnection of sample containers. The sample connection shall be fitted with a closure plug or flange to prevent any leakage when the connection is not in use.*

5.6.5.5 *Sample connections used only for vapour samples may be fitted with a single valve in accordance with 5.5, 5.8 and 5.13, and shall also be fitted with a closure plug or flange.*

5.6.5.6 *Sampling operations shall be undertaken as prescribed in 18.9.*

.1 *all personnel shall be adequately trained in the use of protective equipment provided on board and have basic training in the procedures, appropriate to their duties, necessary under emergency conditions; and*

.2 *officers shall be trained in emergency procedures to deal with conditions of leakage, spillage or fire involving the cargo and a sufficient number of them shall be instructed and trained in essential first aid for the cargoes carried.*

18.9 *Cargo sampling*

18.9.1 *Any cargo sampling shall be conducted under the supervision of an officer who shall ensure that protective clothing appropriate to the hazards of the cargo is used by everyone involved in the operation.*

18.9.2 *When taking liquid cargo samples, the officer shall ensure that the sampling equipment is suitable for the temperatures and pressures involved, including cargo pump discharge pressure, if relevant.*

18.9.3 *The officer shall ensure that any cargo sample equipment used is connected properly to avoid any cargo leakage.*

18.9.4 *If the cargo to be sampled is designated as toxic in accordance with column "f" in the table of chapter 19, the officer shall ensure that a "closed loop" sampling system as defined in 1.2.15 is used to minimize any cargo release to atmosphere.*

18.9.5 *After sampling operations are completed, the officer shall ensure that any sample valves used are closed properly and the connections used are correctly blanked.*

Interpretation

The requirements are applicable only if such sampling system is fitted onboard. Connections used for control of atmosphere in cargo tanks during inerting or gassing up are not considered as cargo sampling connections.

***

ANNEX 4

Draft Unified Interpretation to paragraph 5.6.6 of the IGC Code – Cargo Filters

The International Code for the Construction and Equipment of Ships Carrying Liquid Gases in Bulk (IGC Code) as amended by Res. MSC.370(93), 5.6.6 reads:

5.6.6 The cargo liquid and vapour systems shall be capable of being fitted with filters to protect against damage by extraneous objects. Such filters may be permanent or temporary, and the standards of filtration shall be appropriate to the risk of debris, etc., entering the cargo system. Means shall be provided to indicate that filters are becoming blocked, and to isolate, depressurize and clean the filters safely.

Interpretation

Means to indicate that filters are becoming blocked and filter maintenance is required are to be provided for fixed in-line filter arrangement and portable filter installations where dedicated filter housing piping is provided.
Where portable filters for fitting to manifold presentation flanges are used without dedicated filter housing and these can be visually inspected after each loading and discharging operation, no additional arrangements for indicating blockage or facilitating drainage are needed.

***

ANNEX 5

Draft Unified Interpretation to paragraph 5.11.4 of the IGC Code – Critical pressure in fuel gas piping systems

The International Code for the Construction and Equipment of Ships Carrying Liquid Gases in Bulk (IGC Code) as amended by Res. MSC.370(93), 5.11.4 reads:

5.11.4 High-pressure gas fuel outer pipes or ducting scantlings

In fuel gas piping systems of design pressure greater than the critical pressure, the tangential membrane stress of a straight section of pipe or ducting shall not exceed the tensile strength divided by 1.5 (R_m/1.5) when subjected to the design pressure specified in 5.4. The pressure ratings of all other piping components shall reflect the same level of strength as straight pipes.

Interpretation

The critical pressure is given by the following expression:

$$\mathrm{p} = \mathrm{p}_0 \left(\frac{2}{k+1}\right)^{\frac{k}{k-1}}$$

where

p_0 = maximum working pressure of the inner pipe

$k =$ Cp/Cv constant pressure specific heat divided by the constant volume specific heat

$k = 1.31$ for CH_4

***

ANNEX 6

GC25 Cargo piping insulation

(July 2018 Withdrawn)
(Rev.1 Apr 2019)

Interpretation of paragraph 5.12.3.1 of the IMO International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk (resolution MSC.5(48) as amended by resolution MSC.370(93))

Paragraph 5.12.3.1 reads:

Cargo piping systems shall be provided with a thermal insulation system as required to minimize heat leak into the cargo during transfer operations and to protect personnel from direct contact with cold surfaces.

Interpretation

The phrase "a thermal insulation system as required to minimize heat leak into the cargo during transfer operations" means that properties of the piping insulation are to be taken into consideration when calculating the heat balance of the containment system and capacity of the pressure/temperature control system.

The phrase "cargo piping systems shall be provided with a thermal insulation system as required ... to protect personnel from direct contact with cold surfaces" means that surfaces of cargo piping systems with which personnel is likely to contact under normal conditions shall be protected by a thermal insulation, with the exception for the below examples:

- surfaces of cargo piping systems which are protected by physical screening measures to prevent such direct contact;
- surfaces of manual valves, having extended spindles that protect the operator from the cargo temperature; and
- surfaces of cargo piping systems whose design temperature (to be determined from inner fluid temperature) is above minus 10 °C.

Note:

1. The original version of this unified interpretation was withdrawn prior to coming into force on 1 July 2019.

2. Rev. 1 of this Unified Interpretation is to be uniformly implemented by IACS Societies on ships constructed on or after 1 July 2020.

***

ANNEX 7

GC26 Type testing requirements for valves

(Oct 2018)

Interpretation of paragraph 5.13.1.1.2 of the IMO International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk (resolution MSC.5(48) as amended by resolution MSC.370(93))

Paragraph 5.13.1.1.2 reads:

Each type of valve intended to be used at a working temperature below -55°C shall be subject to the following type tests:

.2 the flow or capacity shall be certified to a recognized standard for each size and type of valve

Interpretation

The expression "Each type of valve…shall be certified to a recognized standard" is interpreted to mean that:

1. for pressure relief valves (PRVs) that are subject to IGC Code paragraph 8.2.5, the flow or capacity are to be certified by the Administration or Recognized Organization acting on its behalf; and

2. for other types of valves, the manufacturer is to certify the flow properties of the valves based on tests carried out according to recognized standards.

Note:

1. This unified interpretation is to be uniformly implemented by IACS Societies on ships constructed on or after 1 January 2020.

***

ANNEX 8

GC28 (Dec 2018) Guidance for sizing pressure relief systems for interbarrier spaces

Interpretation of the second sentence of paragraph 8.1 of the IMO International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk (resolution MSC.5(48) as amended by resolution MSC.370(93))

The second sentence of paragraph 8.1 reads as follows:

Hold spaces and interbarrier spaces, which may be subject to pressures beyond their design capabilities, shall also be provided with a suitable pressure relief system

Interpretation

1 General

1.1 The formula for determining the relieving capacity given in section 2 is developed for interbarrier spaces surrounding independent type A cargo tanks, where the thermal insulation is fitted to the cargo tanks.

1.2 The relieving capacity of pressure relief devices of interbarrier spaces surrounding independent type B cargo tanks may be determined on the basis of the method given in section 2, however, the leakage rate is to be determined in accordance with 4.7.2 of the IGC Code.

1.3 The relieving capacity of pressure relief devices for interbarrier spaces of membrane and semi-membrane tanks is to be evaluated on the basis of specific membrane/semi-membrane tank design.

1.4 The relieving capacity of pressure relief devices for interbarrier spaces adjacent to integral type cargo tanks may, if applicable, be determined as for type A independent cargo tanks.

1.5 Interbarrier space pressure relief devices in the scope of this interpretation are emergency devices for protecting the hull structure from being unduly overstressed in case of a pressure rise in the interbarrier space due to primary barrier failure. Therefore such devices need not comply with the requirements of 8.2.10, 8.2.11.1 and 8.2.11.2 of the IGC-Code.

Note:

1. This unified interpretation is to be uniformly implemented by IACS Societies on ships constructed on or after 1 January 2020.

2 Size of pressure relief devices

The combined relieving capacity of the pressure relief devices for interbarrier spaces surrounding type A independent cargo tanks where the insulation is fitted to the cargo tanks may be determined by the following formula:

$$Q_{sa} = 3{,}4 \; . \; A_c \frac{\rho}{\rho_v} \; \sqrt{h} \quad (m^3/s)$$

Where:

Q_{sa} = minimum required discharge rate of air at standard conditions of 273 K and 1.013 bar

A_c = design crack opening area (m^2)

$$A_c = \frac{\pi}{4} \; \delta \, . \, 1 \; (m^2)$$

δ = max, crack opening width (m)

δ = 0.2t (m)

t = thickness of tank bottom plating (m)

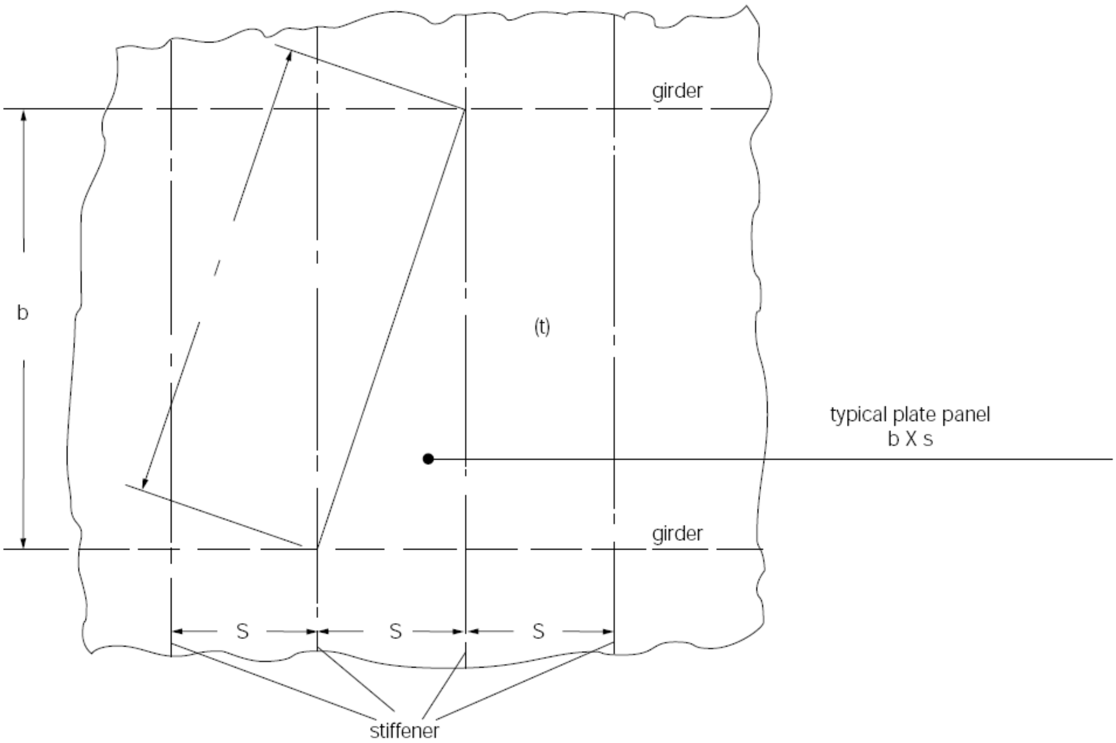
l = design crack length (m) equal to the diagonal of the largest plate panel of the tank bottom, see sketch below.

h = max liquid height above tank bottom plus 10.MARVS (m)

ρ = density of product liquid phase (kg/m^3) at the set pressure of the interbarrier space relief device

ρ_v = density of product vapour phase (kg/m^3) at the set pressure of the interbarrier space relief device and a temperature of 273 K

MARVS = max allowable relief valve setting of the cargo tank (bar).



***

ANNEX 9

Draft Unified Interpretation to paragraph 12.1.8 of the IGC Code – Spare Parts of Ventilation Fans

The International Code for the Construction and Equipment of Ships Carrying Liquid Gases in Bulk (IGC Code), as amended by resolution MSC.370(93), 12.1.8 reads:

12.1.8 Where fans are required by this chapter, full required ventilation capacity for each space shall be available after failure of any single fan, or spare parts shall be provided comprising a motor, starter spares and complete rotating element, including bearings of each type.

Interpretation

The "rotating element" includes the shaft.

***

ANNEX 10

GC27 Interpretation of paragraph 13.2.2

(Dec 2018)

Interpretation of paragraph 13.2.2 of the IMO International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk (resolution MSC.5(48), as amended by resolution MSC.370(93))

Paragraph 13.2.2 reads as follows:

Where only one liquid level gauge is fitted it shall be arranged so that it can be maintained in an operational condition without the need to empty or gas-free the tank.

Interpretation

In order to assess whether or not only one level gauge is acceptable in relation to the aforesaid sentence, 'can be maintained' means that any part of the level gauge other than passive parts can be overhauled while the cargo tank is in service.

Note: passive parts are those parts assumed not subject to failures under normal service conditions.

Note:

1. This unified interpretation is to be uniformly implemented by IACS Societies on ships constructed on or after 1 January 2020.

***

ANNEX 11

Draft Unified Interpretation to Table 18.1, Note 4 and paragraph 13.3.7 of the IGC Code - Inhibition of Cargo Pump Operation and Opening of Manifold ESD valves with Level Alarms Overridden

The International Code for the Construction and Equipment of Ships Carrying Liquid Gases in Bulk (IGC Code), as amended by Res. MSC.370(93), Ch.18/table 18.1, note 4 reads:

Note 4: The override system permitted by 13.3.7 may be used at sea to prevent false alarms or shutdowns. When level alarms are overridden, operation of cargo pumps and the opening of manifold ESD valves shall be inhibited except when high-level alarm testing is carried out in accordance with 13.3.5 (see 18.10.3.4).

The International Code for the Construction and Equipment of Ships Carrying Liquid Gases in Bulk (IGC Code), as amended by Res. MSC.370(93), 13.3.7 reads:

13.3.7 Where arrangements are provided for overriding the overflow control system, they shall be such that inadvertent operation is prevented. When this override is operated, continuous visual indication shall be given at the relevant control station(s) and the navigation bridge.

Interpretation
In applying the second sentence of note 4 of table 18.1, a hardware system such as an electric or mechanical interlocking device is to be provided to prevent inadvertent operation of cargo pumps and inadvertent opening of manifold ESD valves.

***

ANNEX 12

Draft Unified Interpretation to paragraph 13.6.2.7 of the IGC Code – Gas detection

The International Code for the Construction and Equipment of Ships Carrying Liquid Gases in Bulk (IGC Code), as amended by Res. MSC.370(93), 13.6.2.7 reads:

13.6.2 A permanently installed system of gas detection and audible and visual alarms shall be fitted in:

.7 inert gas generator supply headers; and

Interpretation

For purpose of this sub-paragraph, inert gas generator supply headers are lines used for inert gas supply to cargo tanks during change of cargo grade, tank cleaning or inerting of hold spaces for independent tanks.

Nitrogen supply headers which are kept under continuous inert gas pressure in normal operational condition need not be fitted with gas detection.

***

ANNEX 13

Draft Unified Interpretation of paragraph 13.6.4 to the IGC Code – Oxygen deficiency monitoring equipment in a nitrogen generator room area

The International Code for the Construction and Equipment of Ships Carrying Liquid Gases in Bulk (IGC Code), as amended by Res. MSC.370(93), 13.6.4 reads:

13.6.4 Where indicated by an "A" in column "f" in the table of chapter 19 ships certified for carriage of non-flammable products, oxygen deficiency monitoring shall be fitted in cargo machinery spaces and hold spaces for independent tanks other than type C tanks. Furthermore, oxygen deficiency monitoring equipment shall be installed in enclosed or semi-enclosed spaces containing equipment that may cause an oxygen-deficient environment such as nitrogen generators, inert gas generators or nitrogen cycle refrigerant systems.

Interpretation

Two oxygen sensors shall be positioned at appropriate locations in the space or spaces containing the inert gas system, according to FSS Code 15.2.2.4.5.4, for all gas carriers irrespective of carriage of cargo indicated by an "A" in column "f" in the table of chapter 19.

***

ANNEX 14

GC29 (May 2019) Integrated systems

**Interpretation of paragraph 13.9.3 of the IMO International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk
(resolution MSC.5(48), as amended by resolution MSC.370(93))**

Paragraph 13.9.3 reads:

13.9.3 Key hazards of the integrated system shall be identified using appropriate risk-based techniques.

Interpretation

An "integrated system" referred to in paragraph 13.9.3 of the IGC Code is a combination of computer-based systems which are used for the control, monitoring/alarm and safety functions required for the carriage, handling and conditioning of cargo liquid and vapours and are interconnected in order to allow communication between computer-based systems and to allow centralized access to monitoring/alarm and safety information and/or command/control.

Referenced guidelines

MSC/Circ.891 – Guidelines for the onboard use and application of computers

2.1 Computer
A programmable electronic device for storing and processing data, making calculations, or any programmable electronic system (PES), including main-frame, mini-computer or micro-computer.

2.2 Computer-based system
A system of one or more computers, associated software, peripherals and interfaces.

2.3 Integrated system
A combination of computer-based systems which are interconnected in order to allow centralized access to sensor information and/or command/control.

Note:

1. This unified interpretation is to be uniformly implemented by IACS Societies on ships contracted for construction on or after 1 July 2020.

2. The "contracted for construction" date means the date on which the contract to build the vessel is signed between the prospective owner and the shipbuilder. For further details regarding the date of "contract for construction", refer to IACS Procedural Requirement (PR) No. 29.

***

ANNEX 15

Draft Unified Interpretation to paragraph 16.7.1.4 of the IGC – Suitable pressure relief system for air inlet, scavenge spaces, exhaust system and crank case

The first sentence of the International Code for the Construction and Equipment of Ships Carrying Liquid Gases in Bulk (IGC Code), as amended by resolution MSC.370(93), 16.7.1.4 reads:

16.7.1.4 *Unless designed with the strength to withstand the worst case overpressure due to ignited gas leaks, air inlet manifolds, scavenge spaces, exhaust system and crank cases shall be fitted with suitable pressure relief systems. (…)*

Interpretation

Suitable pressure relief system for air inlet manifolds, scavenge spaces and exhaust system shall be provided unless designed to accommodate the worst case overpressure due to ignited gas leaks or justified by the safety concept of the engine. A detailed evaluation regarding the hazard potential of overpressure in air inlet manifolds, scavenge spaces and exhaust system shall be carried out and reflected in the safety concept of the engine.

For crankcases the explosion relief valves required by SOLAS regulation II-1 / 27.4 are considered suitable for the gas operation of the engine. For engines not covered by SOLAS regulation II-1 / 27.4 a detailed evaluation regarding the hazard potential of fuel gas accumulation in the crankcase shall be carried out.

____