

# **Interpretations of the IMO Gas Code**

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# GC1 Deleted

(1977)  
(Rev 1  
1996)



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## GC2 Interpretation of the second sentence of (1977) paragraph 13.2.1

The second sentence of paragraph 13.2.1 reads as follows:

'Where only one level gauge is fitted it should be arranged so that any necessary maintenance can be carried out while the cargo tank is in service.'

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



## GC3 Deleted 1997



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## GC4 Deleted 1997



## GC5 Closing Devices for Air Intakes

(1985)  
(Rev.1  
Feb  
2016)

**Interpretation of paragraph 3.2.6 of the IMO International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk (MSC.5(48)) as amended by resolutions MSC.17(58), MSC.30(61), MSC.32(63), MSC.59(67), MSC.103(73), MSC.177(79) and MSC.220(82)**

Paragraph 3.2.6 may be interpreted as follows:

1. The requirement for fitting air intakes and openings with closing devices operable from inside the space in ships intended to carry toxic products should apply to spaces which are used for the ships' radio and main navigating equipment, cabins, mess rooms, toilets, hospitals, galleys, etc., but should not apply to **spaces not normally manned** such as deck stores, forecastle stores, engine room casings, steering gear compartments, workshops. The requirement does also not apply to cargo control rooms located within the cargo area.
2. When internal closing is required, this should include both ventilation intakes and outlets.
3. The closing devices should give a reasonable degree of gas tightness. Ordinary steel fire-flaps without gaskets/seals should normally not be considered satisfactory.

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1. Rev.1 of this Unified Interpretation is to be uniformly implemented by IACS Societies on ships constructed on or after 1 January 1986 but before 1 July 2016.
  2. For ships whose keels are laid, or which are at a similar stage of construction, on or after 1 July 2016 refer to UI GC15.

End of Document
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# GC6 Cargo tank clearances

(1986)  
(Rev.1  
Feb  
2016)

**Interpretation of section 3.5 of the INTERNATIONAL CODE FOR THE CONSTRUCTION AND EQUIPMENT OF SHIPS CARRYING LIQUEFIED GASES IN BULK (MSC.5(48)) as amended by resolutions MSC.17(58), MSC.30(61), MSC.32(63), MSC.59(67), MSC.103(73), MSC.177(79) and MSC.220(82)**

This section may be interpreted as follows:

1. Designated passage ways below and above cargo tanks should have at least the cross sections as required by 3.5.3.1.3.
2. For the purpose of 3.5.1 or 3.5.2 the following should apply:
  - .1 Where the surveyor requires to pass between the surface to be inspected, flat or curved, and structural elements such as deckbeams, stiffeners, frames, girders etc., the distance between that surface and the free edge of the structural elements should be at least 380 mm. The distance between the surface to be inspected and the surface to which the above structural elements are fitted, eg deck, bulkhead or shell, should be at least 450 mm in case of a curved tank surface (eg in case of type C-tank) or 600 mm in case of a flat tank surface (eg in case of type A-tank). (See figure 1).
  - .2 Where the surveyor does not require to pass between the surface to be inspected and any part of the structure, for visibility reasons the distance between the free edge of that structural element and the surface to be inspected should be at least 50 mm or half the breadth of the structure's face plate, whichever is the larger. (See figure 2).
  - .3 If for inspection of a curved surface the surveyor requires to pass between that surface and another surface, flat or curved, to which no structural elements are fitted, the distance between both surfaces should be at least 380 mm. (See figure 3). Where the surveyor does not require to pass between that curved surface and another surface, a smaller distance than 380 mm may be accepted taking into account the shape of the curved surface.
  - .4 If for inspection of an approximately flat surface the surveyor requires to pass between two approximately flat and approximately parallel surfaces, to which no structural elements are fitted, the distance between those surfaces should be at least 600 mm. (See figure 4).

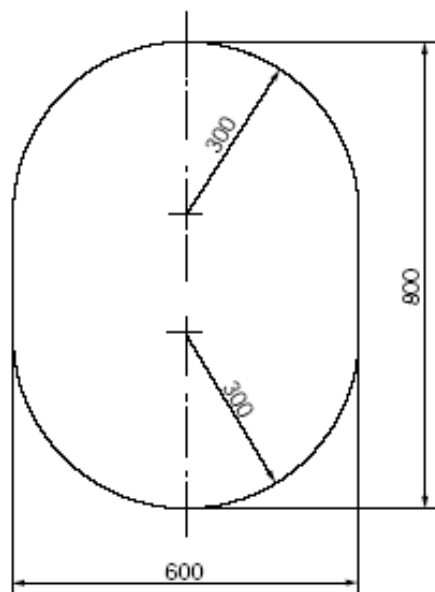
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Note:

1. This Unified Interpretation is to be uniformly implemented by IACS Societies on ships constructed on or after 1 January 1986 but before 1 July 2016.
2. For ships whose keels are laid, or which are at a similar stage of construction, on or after 1 July 2016 refer to UI GC16.

**GC6**  
(cont)

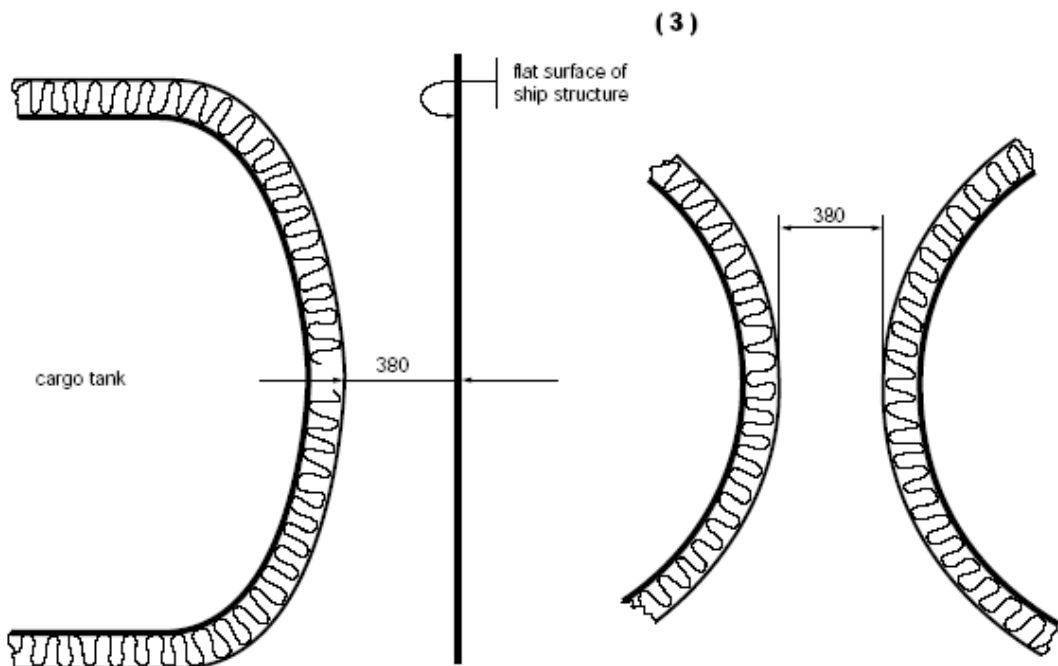
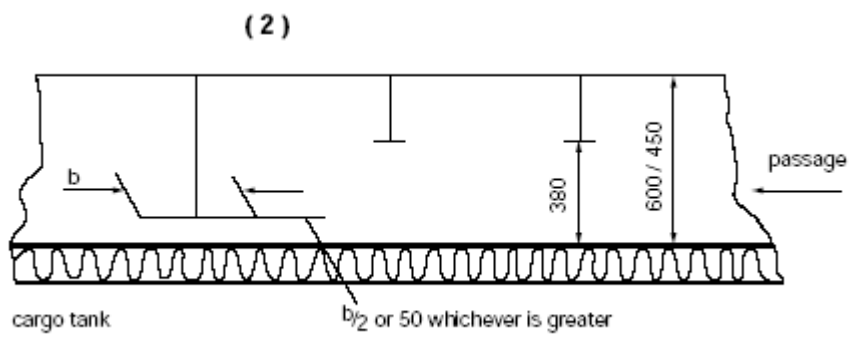
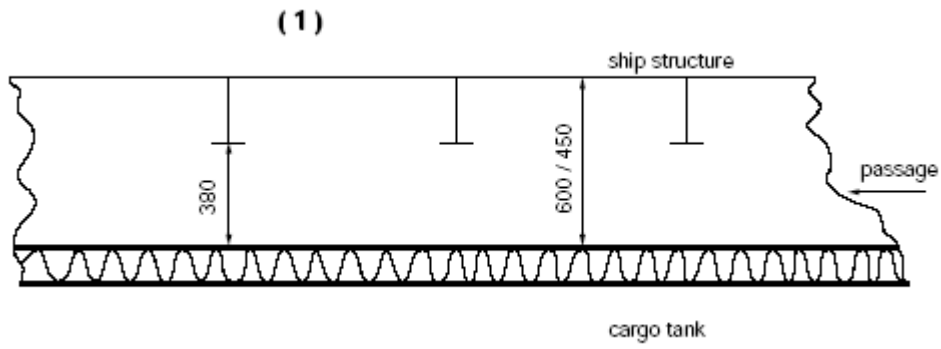
- .5 The minimum distances between a cargo tank sump and adjacent double bottom structure in way of a suction wells should not be less than shown in figure 5. If there is no suction well, the distance between the cargo tank sump and the inner bottom should not be less than 50 mm.
  - .6 The distance between a cargo tank dome and deck structures should not be less than 150 mm. (See figure 6).
  - .7 If necessary for inspection fixed or portable staging should be installed. This staging should not impair the distances required under .1 to .4.
  - .8 If fixed or portable ventilation ducting has to be fitted in compliance with 12.2 such ducting should not impair the distances required under .1 to .4.
3. For the purpose of sub-paragraph 3.5.3.1.2 and .1.3 the following should apply:
- .1 The term "minimum clear opening of not less than 600 x 600 mm" means that such openings may have corner radii up to 100 mm maximum.
  - .2 The term "minimum clear opening of not less than 600 x 800 mm" includes also an opening of the following size:

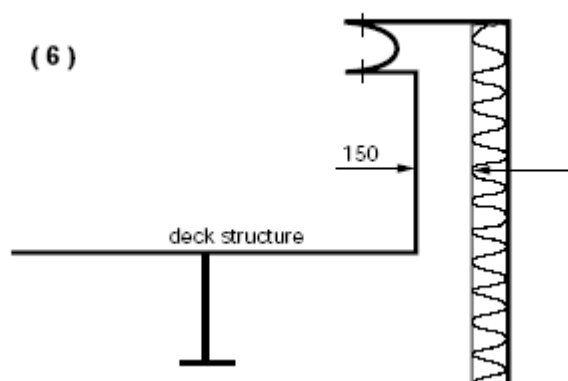
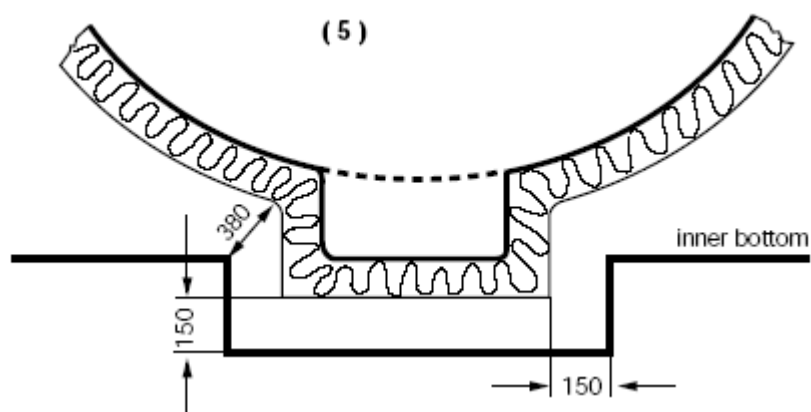
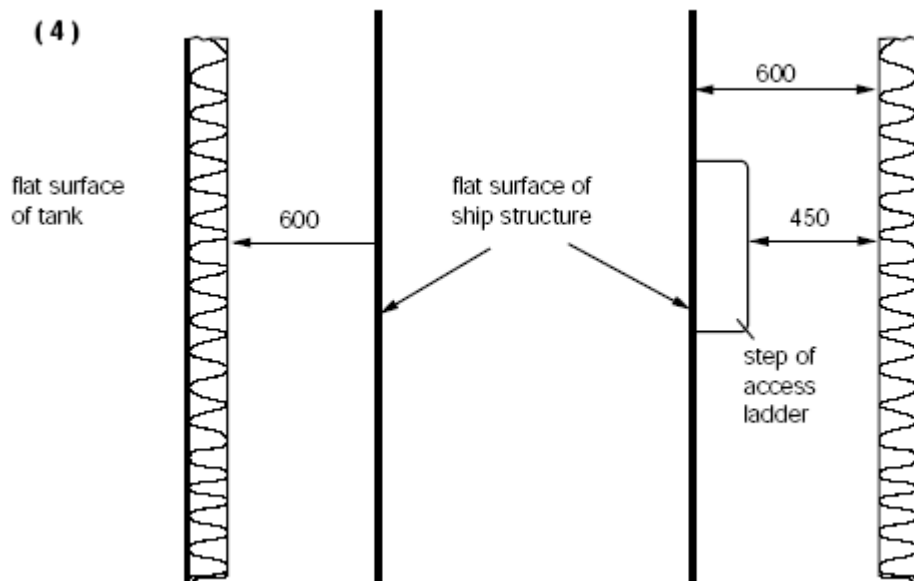


- .3 Circular access openings in type-C cargo tanks should have diameters of not less than 600 mm.

# GC6

(cont)



**GC6**  
(cont)

End of  
Document

**GC7**

(1986)  
(Rev.1  
June  
2016)

**Carriage of products not covered by the code**

**Section 4.23.1.2 of the IMO INTERNATIONAL CODE FOR THE CONSTRUCTION AND EQUIPMENT OF SHIPS CARRYING LIQUEFIED GASES IN BULK (MSC.370(93)) reads:**

*“4.23.1.2 The design vapour pressure shall not be less than:*

$$P_o = 0.2 + AC(\rho_r)^{1.5} \text{ (MPa)}$$

where:

$$A = 0.00185 \left( \frac{\sigma_m}{\Delta\sigma_A} \right)^2$$

with:

$\sigma_m$  = design primary membrane stress;  
 $\Delta\sigma_A$  = allowable dynamic membrane stress (double amplitude at probability level  $Q = 10^{-8}$ ) and equal to:

- 55 N/mm<sup>2</sup> for ferritic-perlitic, martensitic and austenitic steel;
- 25 N/mm<sup>2</sup> for aluminium alloy (5083-O);

$C$  = a characteristic tank dimension to be taken as the greatest of the following:

$h$ ,  $0.75b$  or  $0.45\ell$ ,

with:

$h$  = height of tank (dimension in ship's vertical direction) (m);  
 $b$  = width of tank (dimension in ship's transverse direction)(m);  
 $\ell$  = length of tank (dimension in ship's longitudinal direction) (m);  
 $\rho_r$  = the relative density of the cargo ( $\rho_r = 1$  for fresh water) at the design temperature.

*When a specified design life of the tank is longer than  $10^8$  wave encounters,  $\Delta\sigma_A$  shall be modified to give equivalent crack propagation corresponding to the design life.”*

Note:

1. Rev.1 of this UI is to be uniformly implemented by IACS Societies on ships the keels of which are laid or which are at a similar stage of construction on or after 1 July 2016.

# GC 7 (cont)

## Interpretation

1. If the carriage of products not covered by the Code\* is intended, it should be verified that the double amplitude of the primary membrane stress  $\Delta\sigma_m$  created by the maximum dynamic pressure differential  $\Delta P$  does not exceed the allowable double amplitude of the dynamic membrane stress  $\Delta\sigma_A$  as specified in paragraph 4.23.1.2 of the Code, ie:

$$\Delta\sigma_m \leq \Delta\sigma_A$$

2. The dynamic pressure differential  $\Delta P$  in MPa should be calculated as follows:

$$\Delta P = \frac{\rho}{1,02 \cdot 10^5} (a_{\beta 1} Z_{\beta 1} - a_{\beta 2} Z_{\beta 2})$$

where:

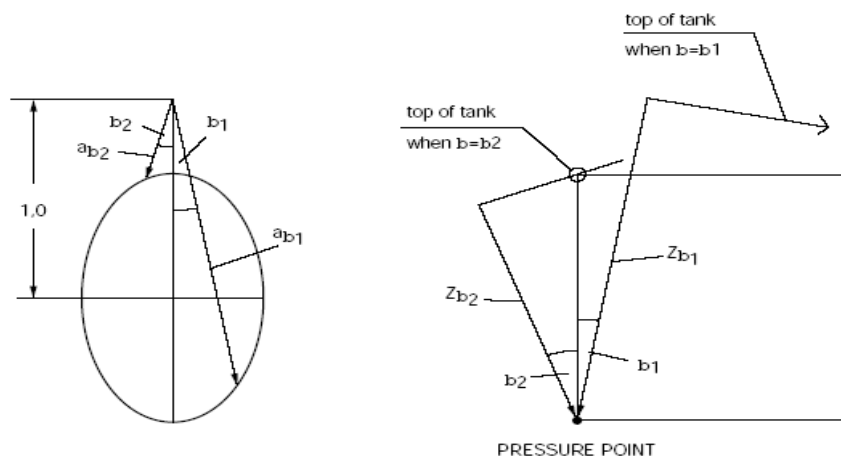
$\rho$  is maximum liquid cargo density in  $\text{kg/m}^3$  at the design temperature

$a_\beta, Z_\beta$  are as defined in 4.28.1.2 of the Code, see also Figure below

$a_{\beta 1}, Z_{\beta 1}$  are the  $a_\beta$  and  $Z_\beta$  values giving the maximum liquid pressure  $(P_{gd})_{\max}$

$a_{\beta 2}, Z_{\beta 2}$  are the  $a_\beta$  and  $Z_\beta$  values giving the minimum liquid pressure  $(P_{gd})_{\min}$

In order to evaluate the maximum pressure differential  $\Delta P$ , pressure differentials should be evaluated over the full range of the acceleration ellipse as shown in the sketches given below.



NOTE:

\*The outlined procedure is only applicable to products having a relative density exceeding 1.0.

End of  
Document

**GC8**

(1986)  
(Rev.1  
June  
2016)

## Permissible stresses in way of supports of type C cargo tanks

Section 4.23.3.1 of the IMO INTERNATIONAL CODE FOR THE CONSTRUCTION AND EQUIPMENT OF SHIPS CARRYING LIQUEFIED GASES IN BULK (MSC.370(93)) reads:

“4.23.3.1 Plastic deformation

For type C independent tanks, the allowable stresses shall not exceed:

$$\begin{aligned}\sigma_m &\leq f \\ \sigma_L &\leq 1.5f \\ \sigma_b &\leq 1.5f \\ \sigma_L + \sigma_b &\leq 1.5f \\ \sigma_m + \sigma_b &\leq 1.5f \\ \sigma_m + \sigma_b + \sigma_g &\leq 3.0f \\ \sigma_L + \sigma_b + \sigma_g &\leq 3.0f,\end{aligned}$$

where:

$$\begin{aligned}\sigma_m &= \text{equivalent primary general membrane stress;} \\ \sigma_L &= \text{equivalent primary local membrane stress;} \\ \sigma_b &= \text{equivalent primary bending stress;} \\ \sigma_g &= \text{equivalent secondary stress; and} \\ f &= \text{the lesser of } R_m / A \text{ or } R_e / B,\end{aligned}$$

with  $R_m$  and  $R_e$  as defined in 4.18.1.3. With regard to the stresses  $\sigma_m$ ,  $\sigma_L$ ,  $\sigma_b$  and  $\sigma_g$ , the definition of stress categories in 4.28.3 are referred. The values A and B shall be shown on the International Certificate of Fitness for the Carriage of Liquefied Gases in Bulk and shall have at least the following minimum values:

	<b>Nickel steels and carbon-manganese steels</b>	<b>Austenitic steels</b>	<b>Aluminium alloys</b>
A	3	3.5	4
B	1.5	1.5	1.5

”

Note:

1. Rev.1 of this UI is to be uniformly implemented by IACS Societies on ships the keels of which are laid or which are at a similar stage of construction on or after 1 July 2016.

**GC8**

(cont)

**Interpretation**

The circumferential stresses at supports shall be calculated by a procedure acceptable to the Classification Society for a sufficient number of load cases.

**1. Permissible stresses in stiffening rings:**

For horizontal cylindrical tanks made of C-Mn steel supported in saddles, the equivalent stress in the stiffening rings shall not exceed the following values if calculated using finite element method:

$$\sigma_e \leq \sigma_{all}$$

where:

$$\sigma_{all} = \min(0.57R_m; 0.85R_e)$$

$$\sigma_e = \sqrt{(\sigma_n + \sigma_b)^2 + 3\tau^2}$$

$\sigma_e$  = von Mises equivalent stress in N/mm<sup>2</sup>

$\sigma_n$  = normal stress in N/mm<sup>2</sup> in the circumferential direction of the stiffening ring

$\sigma_b$  = bending stress in N/mm<sup>2</sup> in the circumferential direction of the stiffening ring

$\tau$  = shear stress in N/mm<sup>2</sup> in the stiffening ring

$R_m$  and  $R_e$  as defined in 4.18.1.3 of the Code.

Equivalent stress values  $\sigma_e$  should be calculated over the full extent of the stiffening ring by a procedure acceptable to the Classification Society, for a sufficient number of load cases.

**2. The following assumptions should be made for the stiffening rings:**

2.1 The stiffening ring should be considered as a circumferential beam formed by web, face plate, doubler plate, if any, and associated shell plating.

The effective width of the associated plating should be taken as:

.1 For cylindrical shells:

an effective width (mm) not greater than  $0.78 \sqrt{rt}$  on each side of the web. A doubler plate, if any, may be included within that distance.

where:

$r$  = mean radius of the cylindrical shell (mm)

$t$  = shell thickness (mm)

.2 For longitudinal bulkheads (in the case of lobe tanks):

the effective width should be determined according to established standards. A value of  $20 t_b$  on each side of the web may be taken as a guidance value.

where:



**GC8**

(cont)

$t_b$  = bulkhead thickness (mm).

2.2 The stiffening ring should be loaded with circumferential forces, on each side of the ring, due to the shear stress, determined by the bi-dimensional shear flow theory from the shear force of the tank.

**3. For calculation of reaction forces at the supports, the following factors should be taken into account:**

3.1 Elasticity of support material (intermediate layer of wood or similar material).  
3.2 Change in contact surface between tank and support, and of the relevant reactions, due to:

- thermal shrinkage of tank.
- elastic deformations of tank and support material.

The final distribution of the reaction forces at the supports should not show any tensile forces.

**4. The buckling strength of the stiffening rings should be examined.**

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# GC9 Guidance for sizing pressure relief systems for interbarrier spaces

(1988)

## 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 4.7.6.1 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 8.2.9 and 8.2.10 of the IGC-Code.

## 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:

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

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 ( $\text{m}^2$ )

$$A_c = \frac{\pi}{4} \delta \cdot l \quad (\text{m}^2)$$

$\delta$  = max, crack opening width (m)

$\delta$  = 0,2.t (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.

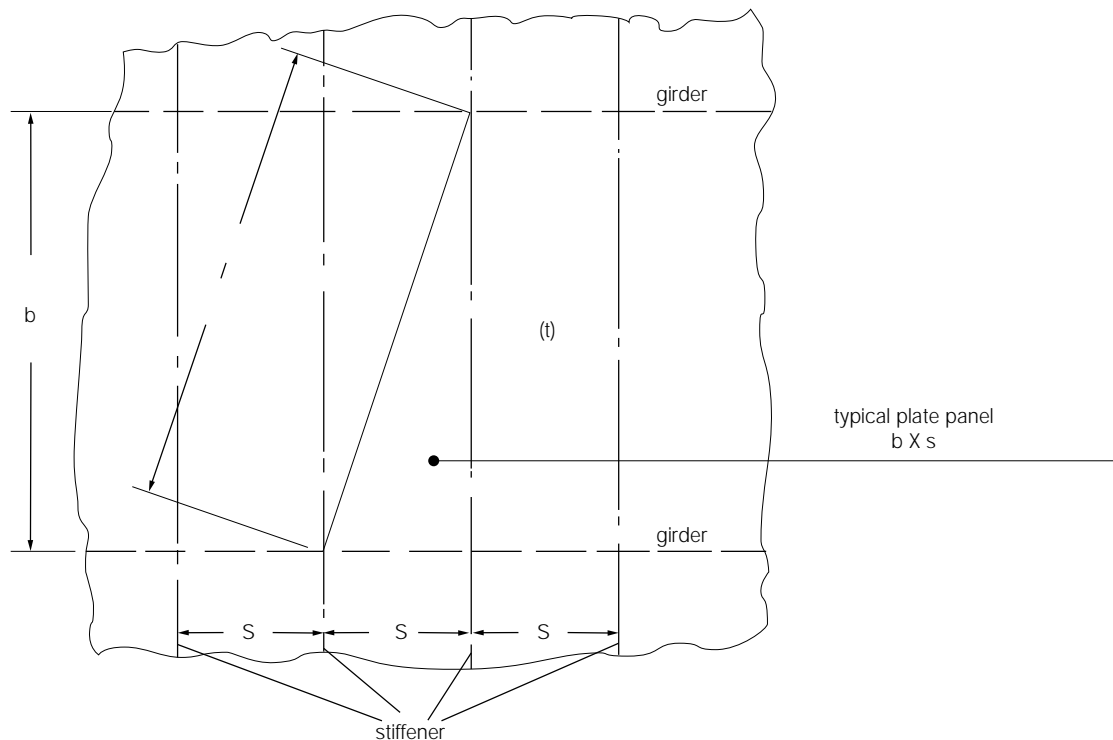
h = max liquid height above tank bottom plus 10.MARVS (m)

$\rho$  = density of product liquid phase ( $\text{kg}/\text{m}^3$ ) at the set pressure of the interbarrier space relief device

$\rho_v$  = density of product vapour phase ( $\text{kg}/\text{m}^3$ ) 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). ▶

## GC9 cont'd



## GC10 Reliquefaction plant of moter-driven LNG-carriers (1988)

### 1 Mechanical refrigeration fitted as the primary system for cargo pressure control

- 1.1 Section 7.2 is based on the assumption that paragraph 7.1.1 is being compiled with by using means defined in sub-paragraph 7.1.1.1. That is to say, a mechanical refrigeration system is fitted as the primary means of maintaining the cargo tank pressure below MARVS.
- 1.2 Section 7.2 should apply to refrigeration systems when fitted on LNG carriers, ie standby capacity will be required as detailed in 7.2.1. A stand-by LNG/refrigerant heat exchanger need not be provided and the fitted LNG/refrigerant heat exchanger will not be required to have 25% excess capacity over that for normal requirements<sup>1</sup>). Other heat exchangers utilizing water cooling should have a stand-by or have at least 25 per cent excess capacity.
- 1.3 Paragraph 7.2.1 states that unless an alternative means of controlling the cargo pressure/temperature is provided to the satisfaction of the Administration, a stand-by unit (or units) affording spare capacity at least equal to the largest required single unit should be fitted. For the purpose of complying with the above, a suitable alternative means of pressure/temperature control would be:



**GC10**  
cont'd

1.3.1 Auxiliary boiler(s) capable of burning the boil-off vapours and disposing of the generated steam or an alternative waste heat system acceptable to the Society. Consideration will be given to systems burning only part of the boil-off vapour if it can be shown that MARVS will not be reached within a period of 21 days.

1.3.2 Controlled venting of cargo vapours as specified in paragraph 7.1.1.5 if permitted by the Administrations concerned.

**2 Mechanical refrigeration fitted as secondary system for cargo pressure control**

Where a refrigeration plant is fitted as a means of disposing of excess energy as detailed in the 2nd sentence of paragraph 7.1.1.2, no stand-by unit will be required for the refrigeration plant.

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1) The reason for this relaxation is that corrosion and fouling problems are not expected in LNG/refrigerant heat exchangers.



**GC  
11**

(Mar  
2006)  
(Rev.1  
Feb  
2016)

# Loading of cargo C tanks for ships constructed before 1 July 2016 and subject to IMO International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk (MSC.5(48))

(Paragraphs 15.1.2 and 15.1.5 of the IMO International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk (MSC.5(48)) as amended by Res.MSC.32(63))

Paragraph 15.1.2 reads:

*“The maximum loading limit (LL) to which a cargo tank may be loaded should be determined by the following formula:*

$$LL = FL\rho_R/\rho_L$$

where:

*LL = loading limit expressed in percent which means the maximum allowable liquid volume relative to the tank volume to which the tank may be loaded;*

*FL = filling limits as specified in 15.1.1 or 15.1.3;*

*$\rho_R$  = relative density of cargo at the reference temperature; and*

*$\rho_L$  = relative density of cargo at the loading temperature and pressure.”*

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Note:

1. This Unified Interpretation is to be applied by all Members and Associate on or after 1 July 2006.
2. Changes in the Rev.1 of this Unified Interpretation is to be applied by Members on or after 1 July 2016.

**GC  
11**  
(cont)

Paragraph 15.1.5 reads:

*“The Administration may allow type C tanks to be loaded according to the following formula provided that the tank vent system has been approved in accordance with 8.2.18:*

$$L_L = FL\rho_R/\rho_L$$

where:

*LL = loading limit as specified in 15.1.2;*

*FL = filling limits as specified in 15.1.1 or 15.1.3;*

*$\rho_R$  = relative density of cargo at the highest temperature which the cargo may reach upon termination of loading, during transport, or at unloading, under the ambient design temperature conditions described in 7.1.2; and*

*$\rho_L$  = as specified in 15.1.2.*

*This paragraph does not apply to products requiring a type 1G ship.”*

**Interpretation**

For ships constructed before 1 July 2016 and subject to IMO International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk (MSC.5(48)), type C cargo tanks can be loaded in accordance with the provisions of paragraph 15.1.5 or, alternatively, to the provisions of paragraph 15.1.2.

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# GC Secondary Barrier Testing Requirements

**12**  
(Sept 2007)

The International Code for the Construction and Equipment of Ships Carrying Liquid Gases in Bulk (IGC Code), 4.7.7 reads:

(Corr.1  
Nov 2007)  
(Rev.1  
Oct 2013)  
(Rev.2  
Aug 2015)

*"The secondary barrier should be capable of being periodically checked for its effectiveness, by means of a pressure/vacuum test, a visual inspection or another suitable method acceptable to the Administration. The method should be submitted to the Administration for approval."*

The International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk (IGC Code) as amended by MSC.370(93), entering into force on 1 January 2016, 4.6.2.4 reads:

*"it is capable of being periodically checked for its effectiveness by means acceptable to the Administration or recognized organization acting on its behalf. This may be by means of a visual inspection or a pressure/vacuum test or other suitable means carried out according to a documented procedure agreed with the Administration or the recognized organization acting on its behalf;"*

## Interpretation

For containment systems with glued secondary barriers:

- At the time of construction, a tightness test should be carried out in accordance with approved system designers' procedures and acceptance criteria before and after initial cool down. Low differential pressures tests are not considered an acceptable test.
- If the designer's threshold values are exceeded, an investigation is to be carried out and additional testing such as thermographic or acoustic emissions testing should be carried out.
- The values recorded should be used as reference for future assessment of secondary barrier tightness.

For containment systems with welded metallic secondary barriers, a tightness test after initial cool down is not required.

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Note:

1. This Unified Interpretation is to be applied by all Members and Associate to tests commenced on or after 1 July 2008.
2. Rev.1 of this Unified Interpretation is to be applied by all Members to tests commenced on or after 1 July 2014.
3. Rev.2 of this Unified Interpretation is to be applied by all Members to tests commenced on or after 1 July 2016.

End of Document
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## GC 13 Examination before and after the first loaded voyage

(Jan  
2008)  
(Rev.1  
Mar  
2016)

Interpretation of paragraphs 4.10.14 and 4.10.16 of the International Code for the Construction and Equipment of Ships Carrying Liquid Gases in Bulk (IGC Code), MSC.5(48) as amended by resolutions MSC.17(58), MSC.30(61), MSC.32(63), MSC.59(67), MSC.103(73), MSC.177(79) and MSC.220(82)

- paragraph 4.10.14 states:

*"The overall performance of the cargo containment system should be verified for compliance with the design parameters during the initial cool-down, loading and discharging of the cargo. Records of the performance of the components and equipment essential to verify the design parameters should be maintained and be available to the Administration."*

- paragraph 4.10.16 states:

*"The hull should be inspected for cold spots following the first loaded voyage."*

and,

Interpretation of paragraphs 4.20.3.5 and 4.20.3.7 of the International Code for the Construction and Equipment of Ships Carrying Liquid Gases in Bulk (IGC Code), as amended by Res. MSC.370(93),

- paragraph 4.20.3.5 states:

*The overall performance of the cargo containment system shall be verified for compliance with the design parameters during the first full loading and discharging of the cargo, in accordance with the survey procedure and requirements in 1.4 and the requirements of the Administration or recognized organization acting on its behalf. Records of the performance of the components and equipment essential to verify the design parameters, shall be maintained and be available to the Administration.*

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Note:

1. This Unified Interpretation is to be applied by all Members and Associates to ships whose keels are laid, or which are at a similar stage of construction, on or after the 1 July 2008.
2. Rev.1 is to be applied by IACS Members to ships whose keels are laid, or which are at a similar stage of construction, on or after 1 July 2016.



**GC  
13**  
(cont)

- paragraph 4.20.3.7 states:

*The cargo containment system shall be inspected for cold spots during, or immediately following, the first loaded voyage. Inspection of the integrity of thermal insulation surfaces that cannot be visually checked shall be carried out in accordance with recognized standards.*

The above paragraphs shall be interpreted as follows:

**Application**

This UI applies to all vessels carrying liquefied natural gases (LNG) in bulk which have satisfactorily completed gas trials.

**Certification**

The following initial certificates shall be “conditionally” issued at delivery subject to satisfactory completion of the first cargo loading and unloading survey requirements below in the presence of a Surveyor:

1. Classification Certificate
2. Short Term Certificate of Fitness for the Carriage of Liquefied Gases in Bulk

Note: The conditions may either be stated on the Classification Certificate or issued as a Condition of Class/Outstanding Recommendation in the vessel’s Record.

**Survey Requirements****• First Loading (considered to be full loading):**

1. Priority to be given to latter stages of loading (approximately last 6 hours).
2. Review cargo logs and alarm reports.
3. Witness satisfactory operation of the following:
  - Gas detection system.
  - Cargo control and monitoring systems such as level gauging equipment, temperature sensors, pressure gauges, cargo pumps and compressors, proper control of cargo heat exchangers, if operating, etc.
  - Nitrogen generating plant or inert gas generator, if operating.
  - Nitrogen pressure control system for insulation, interbarrier, and annular spaces, as applicable.
  - Cofferdam heating system, if in operation.
  - Reliquefaction plant, if fitted.
  - Equipment fitted for the burning of cargo vapors such as boilers, engines, gas combustion units, etc., if operating.
4. Examination of on-deck cargo piping systems including expansion and supporting arrangements.
5. Witness topping off process for cargo tanks including high level alarms activated during normal loading.

**GC  
13**  
(cont)

6. Advise master to carry out cold spot examination of the hull and external insulation during transit voyage to unloading port.
- **First Unloading:**
    1. Priority to be given to the commencement of unloading (approximately first 4 - 6 hours).
    2. Witness emergency shutdown system testing prior to commencement of unloading.
    3. Review cargo logs and alarm reports.
    4. Witness satisfactory operation of the following:
      - Gas detection system.
      - Cargo control and monitoring systems such as level gauging equipment, temperature sensors, pressure gauges, cargo pumps and compressors, proper control of cargo heat exchangers, if operating, etc.
      - Nitrogen generating plant or inert gas generator, if operating.
      - Nitrogen pressure control system for insulation, interbarrier, and annular spaces, as applicable.
      - On membrane vessels, verify that the readings of the cofferdam and inner hull temperature sensors are not below the allowable temperature for the selected grade of steel. Review previous readings.
      - Cofferdam heating system, if in operation.
      - Reliquefaction plant and review of records from previous voyage.
      - Equipment fitted for the burning of cargo vapors such as boilers, engines, gas combustion units, etc., if operating.
    5. Examination of on-deck cargo piping systems including expansion and supporting arrangements.
    6. Obtain written statement from the Master that the cold spot examination was carried out during the transit voyage and found satisfactory. Where possible, the surveyor should examine selected spaces.

End of Document
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**GC 14**  
(Apr 2015)

# **Pump Vents in Machinery Spaces (IGC Code Chapters 3.7.4 as amended by Res. MSC. 103(73) and IGC Code Chapters 3.7.5 as amended by Res. MSC. 370(93))**

## **IGC Code 3.7.4 as amended by Res. MSC. 103(73)**

*Ballast spaces, including wet duct keels used as ballast piping, fuel-oil tanks and gas-safe spaces may be connected to pumps in the machinery spaces. Dry duct keels with ballast piping passing through, may be connected to pumps in the machinery spaces, provided the connections are led directly to the pumps and the discharge from the pumps lead directly overboard with no valves or manifolds in either line which could connect the line from the duct keel to lines serving gas-safe spaces. Pump vents should not be open to machinery spaces.*

## **IGC Code 3.7.5 as amended by Res. MSC. 370(93)**

*Ballast spaces, including wet duct keels used as ballast piping, oil fuel tanks and non-hazardous spaces, may be connected to pumps in the machinery spaces. Dry duct keels with ballast piping passing through may be connected to pumps in the machinery spaces, provided the connections are led directly to the pumps, and the discharge from the pumps is led directly overboard with no valves or manifolds in either line that could connect the line from the duct keel to lines serving non-hazardous spaces. Pump vents shall not be open to machinery spaces.*

### **Interpretation**

The requirements of "Pump vents should not be open to machinery spaces" and "Pump vents shall not be open to machinery spaces" apply only to pumps in the machinery spaces serving dry duct keels through which ballast piping passes.

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### Notes

1. This Unified Interpretation is to be uniformly implemented by IACS Societies not later than 1 July 2016.

End of Document
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# GC15 Closing Devices for Air Intakes

(Feb 2016)  
(Rev.1  
Aug 2017)

**Interpretation of paragraph 3.2.6 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 3.2.6 reads:**

*All air intakes, outlets and other openings into the accommodation spaces, service spaces and control stations shall be fitted with closing devices. When carrying toxic products, they shall be capable of being operated from inside the space. The requirement for fitting air intakes and openings with closing devices operated from inside the space for toxic products need not apply to spaces not normally manned, such as deck stores, forecastle stores, workshops. In addition, the requirement does not apply to cargo control rooms located within the cargo area.*

## **Interpretation**

1. The closing devices that need not be operable from within the single spaces may be located in centralized positions.
2. Engine room casings, cargo machinery spaces, electric motor rooms and steering gear compartments are generally considered as spaces not covered by paragraph 3.2.6 and, therefore, the requirement for closing devices need not be applied to these spaces.
3. The closing devices should give a reasonable degree of gas tightness. Ordinary steel fire-flaps without gaskets/seals should not be considered satisfactory.
4. Regardless of this interpretation, the closing devices shall be operable from outside of the protected space (SOLAS regulation II-2/5.2.1.1).

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## Note:

1. This Unified Interpretation is to be uniformly implemented by IACS Societies on ships constructed on or after 1 July 2016.
2. Changes in the Rev.1 of this Unified Interpretation are to be applied by Members on or after 1 January 2018.

End of Document
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# GC 16

## Cargo tank clearances (on ships constructed on or after 1 July 2016)

(Mar 2016)

The International Code for the Construction and Equipment of Ships Carrying Liquid Gases in Bulk (IGC Code) as amended by Res. MSC.370(93), 3.5.3.1.2 reads:

*“access through horizontal openings, hatches or manholes. The dimensions shall be sufficient to allow a person wearing a breathing apparatus to ascend or descend any ladder without obstruction and also to provide a clear opening to facilitate the hoisting of an injured person from the bottom of the space. The minimum clear opening shall be not less than 600 mm x 600 mm;”*

### Interpretation

The minimum clear opening of 600 mm x 600 mm may have corner radii up to 100 mm maximum. In such a case where as a consequence of structural analysis of a given design the stress is to be reduced around the opening, it is considered appropriate to take measures to reduce the stress such as making the opening larger with increased radii, e.g. 600 x 800 with 300 mm radii, in which a clear opening of 600 mm x 600 mm with corner radii up to 100 mm maximum fits.

### Technical Background

The interpretation is based upon the established Guidelines in MSC/Circ.686.

### Ref.

Paragraphs 9 of Annex of MSC/Circ.686.

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### Note:

1. This UI is to be uniformly implemented by IACS Members on ships whose keels are laid, or which are at a similar stage of construction, on or after 1 July 2016.
2. For ships with keels laid, or at a similar stage of construction, before 1 July 2016, refer to UI GC6.

# GC 16

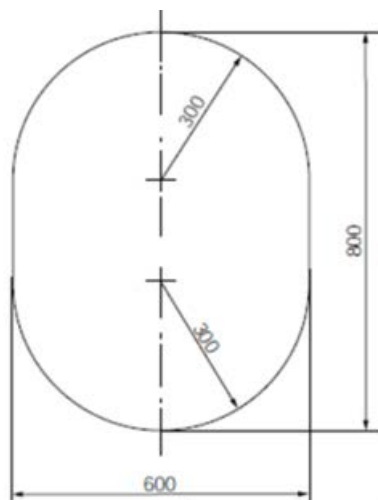
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The International Code for the Construction and Equipment of Ships Carrying Liquid Gases in Bulk (IGC Code) as amended by Res. MSC.370(93), 3.5.3.1.3 reads:

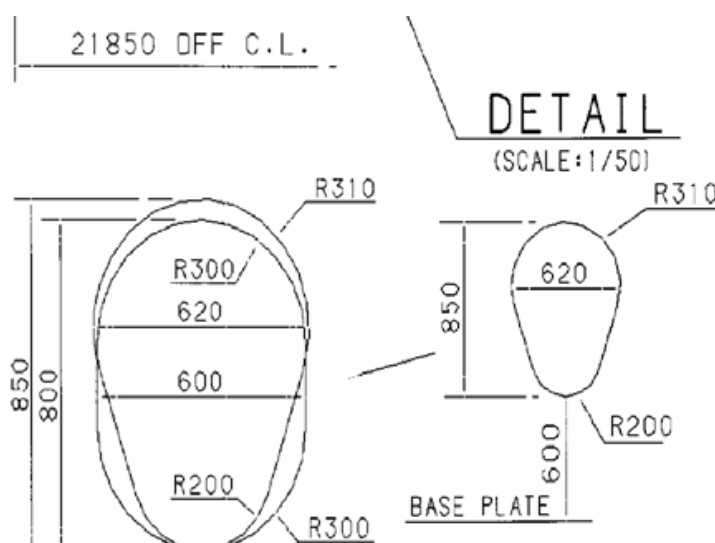
*“access through vertical openings or manholes providing passage through the length and breadth of the space. The minimum clear opening shall be not less than 600 mm x 800 mm at a height of not more than 600 mm from the bottom plating unless gratings or other footholds are provided;”*

## Interpretation

1. The minimum clear opening of not less than 600 mm x 800 mm may also include an opening with corner radii of 300 mm. An opening of 600 mm in height x 800 mm in width may be accepted as access openings in vertical structures where it is not desirable to make large opening in the structural strength aspects, i.e. girders and floors in double bottom tanks.



2. Subject to verification of easy evacuation of injured person on a stretcher the vertical opening 850 mm x 620 mm with wider upper half than 600 mm, while the lower half may be less than 600 mm with the overall height not less than 850 mm is considered an acceptable alternative to the traditional opening of 600 mm x 800 mm with corner radii of 300 mm.



**GC  
16**

(cont)

3. If a vertical opening is at a height of more than 600 mm steps and handgrips are to be provided. In such arrangements it is to be demonstrated that an injured person can be easily evacuated.

**Technical Background**

The interpretation is based upon the established Guidelines in MSC/Circ.686 and an innovative design is considered for easy access by humans through the opening.

**Ref.**

Paragraphs 11 of Annex of MSC/Circ.686.

End of Document
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# GC17 Unprotected openings

(June  
2016)

## IGC Code - 2.7

### Survival requirements

*2.7.2.1 At final equilibrium after flooding, the righting lever curve shall have a minimum range of 20° beyond the position of equilibrium in association with a maximum residual righting lever of at least 0.1 m within the 20° range; the area under the curve within this range shall not be less than 0.0175 m-radians. The 20° range may be measured from any angle commencing between the position of equilibrium and the angle of 25° (or 30° if no deck immersion occurs). Unprotected openings shall not be immersed within this range unless the space concerned is assumed to be flooded. Within this range, the immersion of any of the openings listed in 2.7.1.1 and other openings capable of being closed weathertight may be permitted.*

### Interpretation

Other openings capable of being closed weathertight do not include ventilators (complying with ILLC 19(4)) that for operational reasons have to remain open to supply air to the engine room or emergency generator room (if the same is considered buoyant in the stability calculation or protecting openings leading below) for the effective operation of the ship.

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#### Note:

1. This Unified Interpretation is to be uniformly implemented by IACS Societies on ships contracted for construction on or after 1 January 2017.
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.

End of Document
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# GC18 Test for cargo tank's high level alarm (on ships built on or after 1 July 2016)

(Nov 2016)  
(Corr.1 Mar 2017)  
(Rev.1 July 2017)  
Withdrawn)

**The International Code for the Construction and Equipment of Ships Carrying Liquid Gases in Bulk (IGC Code) as amended by Res. MSC.370(93), 13.3.5 reads:**

*“The position of the sensors in the tank shall be capable of being verified before commissioning. At the first occasion of full loading after delivery and after each dry-docking, testing of high-level alarms shall be conducted by raising the cargo liquid level in the cargo tank to the alarm point.”*

## Interpretation

The expression “each dry docking” is considered to be the survey of the outside of the ship's bottom required for the renewal of the Cargo Ship Safety Construction Certificate and or the Cargo Ship Safety Certificate.

## Technical Background

The interpretation is based upon the fact that:

- the expression dry-docking is not defined along the Code
- all kinds of the surveys verifications are set by the Code under paragraph 1.4.2, and
- the one under paragraph 13.3.5 is linked to those required under paragraph 1.4.2.2 relevant to the renewal survey of the “International Certificate of Fitness of Liquefied Gases in Bulk”, which requires:

*A renewal survey at intervals specified by the Administration, but not exceeding five years, except where regulation 1.4.6.2.1, 1.4.6.5, 1.4.6.6 or 1.4.6.7 is applicable. The renewal survey shall be such as to ensure that the structure, equipment, fittings, arrangements and material fully comply with the applicable provisions of the Code.*

- the renewal of the “International Certificate of Fitness of Liquefied Gases in Bulk” is linked to the renewal of the Cargo Ship Safety Construction Certificate and or the Cargo Ship Safety Certificate.

The Code does not expect specifically any dry-docking survey or inspection of the outside of the ship's bottom under paragraph 1.4.2. Therefore considering also the preamble of this paragraph it is concluded that the dry-docking recalled in paragraph 13.3.5 is the inspection of the outside of the ship's bottom of the ship required by the SOLAS Regulation I/10(v) to be carried out in conjunction with the renewal survey of the Cargo Ship Safety Construction Certificate and or the Cargo Ship Safety Certificate.

## Ref.

SOLAS Reg. I/10.

End of Document
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## Note:

1. This UI is to be uniformly implemented by IACS Members on or after 1 January 2018.
2. Rev.1 of this UI was withdrawn prior to coming into force on 1 July 2018.

**GC19**  
(Aug 2017)

## External surface area of the tank for determining sizing of pressure relief valve (paragraph 8.4.1.2 and figure 8.1)

### Regulation

IMO IGC Code, as amended by MSC.370(93), Ch. 8/8.4.1.2

8.4.1.2 Vapours generated under fire exposure computed using the following formula:

$$Q = FGA^{0.82} \text{ (m}^3\text{/s),}$$

where:

$Q$  = minimum required rate of discharge of air at standard conditions of 273.15 Kelvin (K) and 0.1013 MPa;

$F$  = fire exposure factor for different cargo types as follows:

- 1 for tanks without insulation located on deck;
- 0.5 for tanks above the deck, when insulation is approved by the Administration. Approval will be based on the use of a fireproofing material, the thermal conductance of insulation and its stability under fire exposure;
- 0.5 for uninsulated independent tanks installed in holds;
- 0.2 for insulated independent tanks in holds (or uninsulated independent tanks in insulated holds);
- 0.1 for insulated independent tanks in inerted holds (or uninsulated independent tanks in inerted, insulated holds);
- 0.1 for membrane and semi-membrane tanks. For independent tanks partly protruding through the weather decks, the fire exposure factor shall be determined on the basis of the surface areas above and below deck.

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### Note:

1. This Unified Interpretation is to be uniformly implemented by IACS Societies on ships contracted for construction on or after 1 January 2018.

# GC19

(Cont)

$G$  = gas factor according to formula:

$$G = \frac{12.4}{LD} \sqrt{\frac{ZT}{M}}$$

with:

$T$  = temperature in degrees Kelvin at relieving conditions, i.e. 120% of the pressure at which the pressure relief valve is set;

$L$  = latent heat of the material being vaporized at relieving conditions, in kJ/kg;

$D$  = a constant based on relation of specific heats  $k$  and is calculated as follows:

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

where:

$k$  = ratio of specific heats at relieving conditions, and the value of which is between 1 and 2.2. If  $k$  is not known,  $D = 0.606$  shall be used;

$Z$  = compressibility factor of the gas at relieving conditions. If not known,  $Z = 1$  shall be used; and

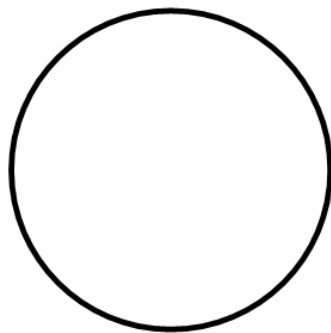
$M$  = molecular mass of the product.

The gas factor of each cargo to be carried shall be determined and the highest value shall be used for PRV sizing.

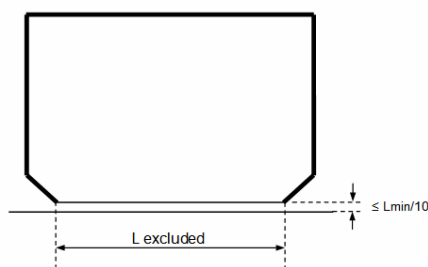
$A$  = external surface area of the tank ( $m^2$ ), as defined in 1.2.14, for different tank types, as shown in figure 8.1.

# GC19

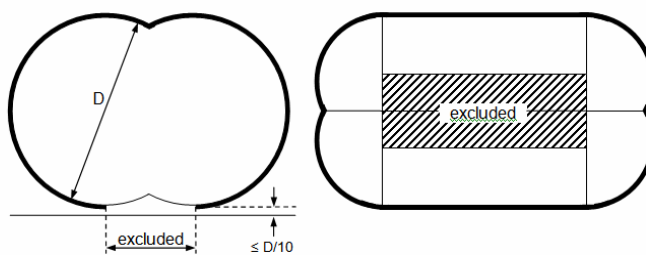
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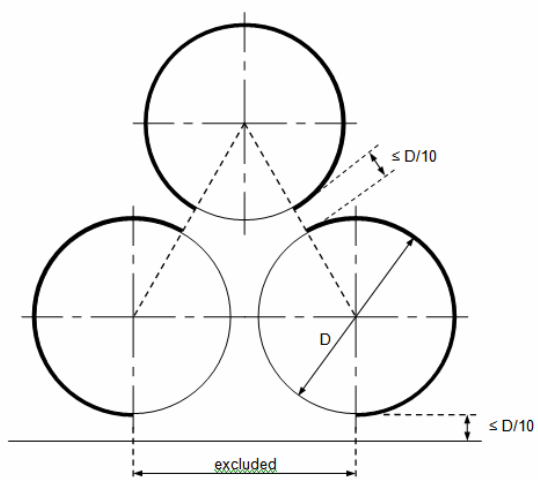
Cylindrical tanks with spherically dished, hemispherical or semi-ellipsoidal heads or spherical tanks



Prismatic tanks



Bilobe tanks



Horizontal cylindrical tanks arrangement

Figure 8.1

# GC19

(Cont)

## Interpretation

*For prismatic tanks*

$L_{\min}$ , for non-tapered tanks, is the smaller of the horizontal dimensions of the flat bottom of the tank. For tapered tanks, as would be used for the forward tank,  $L_{\min}$  is the smaller of the length and the average width.

For prismatic tanks whose distance between the flat bottom of the tank and bottom of the hold space is equal to or less than  $L_{\min}/10$ :

A = external surface area minus flat bottom surface area.

For prismatic tanks whose distance between the flat bottom of the tank and bottom of the hold space is greater than  $L_{\min}/10$ :

A = external surface area.

End of Document
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# GC22 Water spray system

(Apr 2018)

**Interpretation of sections 11.3.1, 11.3.3 & 11.3.4 of the INTERNATIONAL CODE FOR THE CONSTRUCTION AND EQUIPMENT OF SHIPS CARRYING LIQUEFIED GASES IN BULK (Resolution MSC.370(93))**

## Regulation

**IGC Code 2016 edition, Chapter 11 reads as follows:**

*11.3.1 On ships carrying flammable and/or toxic products, a water-spray system, for cooling, fire prevention and crew protection shall be installed to cover:*

...

*.7 exposed lifeboats, liferafts and muster stations facing the cargo area, regardless of distance to cargo area; and*

...

*11.3.3 The capacity of the water-spray pumps shall be capable of simultaneous protection of the greater of the following:*

*.1 any two complete athwartship tank groupings, including any gas process units within these areas; or*

...

*11.3.4 The boundaries of superstructures and deckhouses normally manned, and lifeboats, liferafts and muster areas facing the cargo area, shall also be capable of being served by one of the fire pumps or the emergency fire pump, if a fire in one compartment could disable both fire pumps.*

## Interpretation

a) Survival crafts protection

With reference to sub-paragraph .7 of IGC Code 11.3.1, the survival crafts on board including remote survival crafts (ref. SOLAS III/Reg. 31.1.4) facing the cargo area shall be protected by a water-spray system taking into consideration cargo area extension for fire-fighting purposes as stated in 11.1.4.

Remote liferafts located in areas covered by water-spray protection as required in sub-paragraph .6 may be considered as adequately protected.

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Note:

1. This Unified Interpretation is to be uniformly implemented by IACS Societies on ships constructed on or after 1 July 2019.

**GC22**

(Cont)

## b) Tank groups in cargo area

Expression “two complete athwartship tank groupings” in sub-paragraph .1 of IGC Code 11.3.3 means any two groups of tanks where one group is defined as tanks located in transverse direction from ship side to ship side. Where there is only one cargo tank occupying a hold space from ship side to ship side, it will be considered as a “grouping” for the purpose of this interpretation.

“Any two complete athwartship tank groupings” represents an area equal to the combined area of the two largest tank groupings including any gas process units within these areas

## c) Fire pumps used as spray pumps:

11.3.4 highlights requirements for availability of fire pumps for water supply to the spray system for personnel and survival craft and muster station protection. The supply of fire water shall be redundant.

In view of the above in cases when the emergency fire pump is used to meet this requirement, its capacity, in addition to being capable of maintaining two jets of water as required by FSS Code Chap.12.2.2.1.1, shall be increased taking into account the spray application rates stated in 11.3.2.1, but limiting coverage to boundaries of normally manned superstructures and deckhouses, survival crafts and their muster areas.

For the purpose of this interpretation:

The expression “one of the fire pumps or emergency fire pump” is related to fire pumps located outside the space where spray pump(s) are located.

The expression “fire in one compartment”, means a compartment where fire pump(s) serving the water-spray system in accordance with 11.3.3 are located.

The expression “both fire pumps” means the fire pumps required in accordance with SOLAS II-2/ Reg. 10.2.2.2

End of Document
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# GC23 Cargo tank structure heating arrangement power supply

(July 2018)

The International Code for the Construction and Equipment of Ships Carrying Liquid Gases in Bulk (IGC Code) as amended by Res. MSC.370(93), 4.19.1.6 reads:

*4.19.1.6 The means of heating referred to in 4.19.1.5 shall comply with the following requirements:*

*.1 the heating system shall be arranged so that, in the event of failure in any part of the system, standby heating can be maintained equal to not less than 100% of the theoretical heat requirement;*

*.2 the heating system shall be considered as an essential auxiliary. All electrical components of at least one of the systems provided in accordance with 4.19.1.5.1 shall be supplied from the emergency source of electrical power; and*

*.3 the design and construction of the heating system shall be included in the approval of the containment system by the Administration or recognized organization acting on its behalf.*

## Interpretation

1. Heating system referred to on 4.19.1.6.1 is to be such that in case of a single failure of a mechanical or electrical component in any part of the system, heating can be maintained at not less than 100% of the theoretical heat requirement.

2. Where the above requirements are met by duplication of the system components, i.e., heaters, glycol circulation pumps, electrical control panel, auxiliary boilers etc., all electrical components of at least one of the systems are to be supplied from the emergency switch board.

3. Where duplication of the primary source of heat, e.g., oil-fired boiler is not feasible, alternative proposals such as an electric heater capable of providing 100% of the theoretical heat requirement provided and supplied by an individual circuit arranged separately on the emergency switchboard. Other solutions may be considered towards satisfying the requirements of 4.19.1.6.1 provided a suitable risk assessment is conducted to the satisfaction of the Administration. The requirement in paragraph 2 continues to apply to all other electrical components in the system.

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## Note:

1. This Unified Interpretation is to be uniformly implemented by IACS Societies on ships constructed on or after 1 July 2019.

End of Document
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# GC24 Fire Test for Emergency Shutdown Valves

(July 2018)

The International Code for the Construction and Equipment of Ships Carrying Liquid Gases in Bulk (IGC Code) as amended by Res. MSC.370(93), 5.13.1.1.4 reads:

## 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:*

*.4 for emergency shutdown valves, with materials having melting temperatures lower than 925°C, the type testing shall include a fire test to a standard acceptable to the Administration.*

### Interpretation

Emergency shutdown valves, with materials having melting temperatures lower than 925°C does not include emergency shutdown valves which use materials having melting temperatures lower than 925°C in components such as rubber handle covers where failure would not cause deterioration of shell or seat tightness intrinsically.

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#### Note:

1. This Unified Interpretation is to be uniformly implemented by IACS Societies on ships constructed on or after 1 July 2019.

End of Document
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# GC25 Cargo piping insulation

(July 2018)

## IGC Code paragraph 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.*

### Interpretation

The phrase 'a thermal insulation system as required to minimize heat leak into the cargo during transfer operations' means that the properties of the thermal insulation for cargo piping systems shall take into consideration the overall heat calculation undertaken for the tank containment system and the capacity of the proposed pressure/temperature control system (e.g. refrigeration plants) adopted on each ship in accordance with the requirements of chapter 7 of the Code.

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.

"Surfaces of cargo piping systems with which personnel is likely to contact under normal conditions" do not include areas such as:

- 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,
- bellows;
- surfaces of cargo piping systems whose design temperature (to be determined from inner fluid temperature) is above minus 10 °C.

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#### Note:

1. This Unified Interpretation is to be uniformly implemented by IACS Societies on ships constructed on or after 1 July 2019.

End of Document
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