Interpretations of the IMCO code for the Construction and Equipment of Ships carrying Liquefied Gases in Bulk

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GC1 Deleted

(1977)
(Rev 1
1996)

GC2 (1977) Interpretation of the second sentence of 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.

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GC3 Deleted 1997

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GC4 Deleted 1997

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GC5 Closing Devices for Air Intakes
(1985)

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))

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. ◄◄

GC6 Cargo tank clearances
(1986)

Interpretation of section 3.5 of the INTERNATIONAL CODE FOR THE CONSTRUCTION AND EQUIPMENT OF SHIPS CARRYING LIQUEFIED GASES IN BULK (MSC.5(48))

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).

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.

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.6 The distance between a cargo tank dome and deck structures should not be less than 150 mm. (See figure 6).

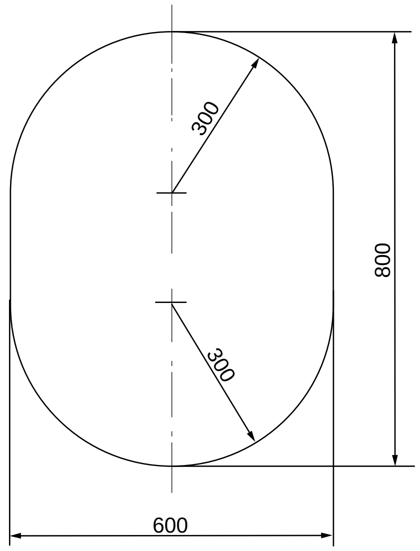
.7 If necessary for inspection fixed or portable staging should be installed. This staging should not impair the distances required under .1 to .4.

.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.

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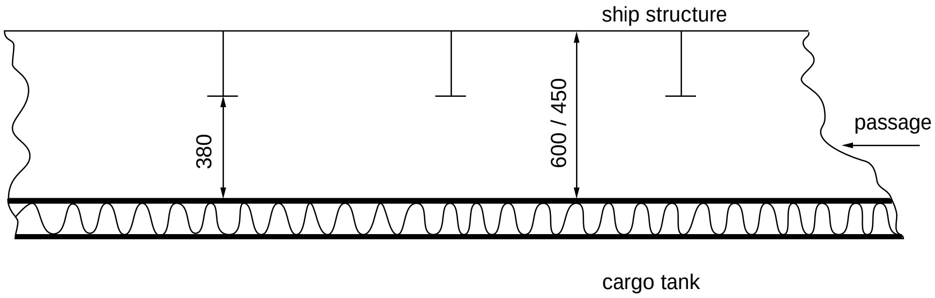
(1)



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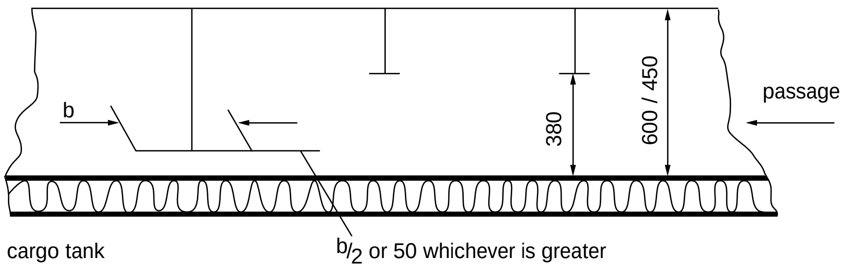

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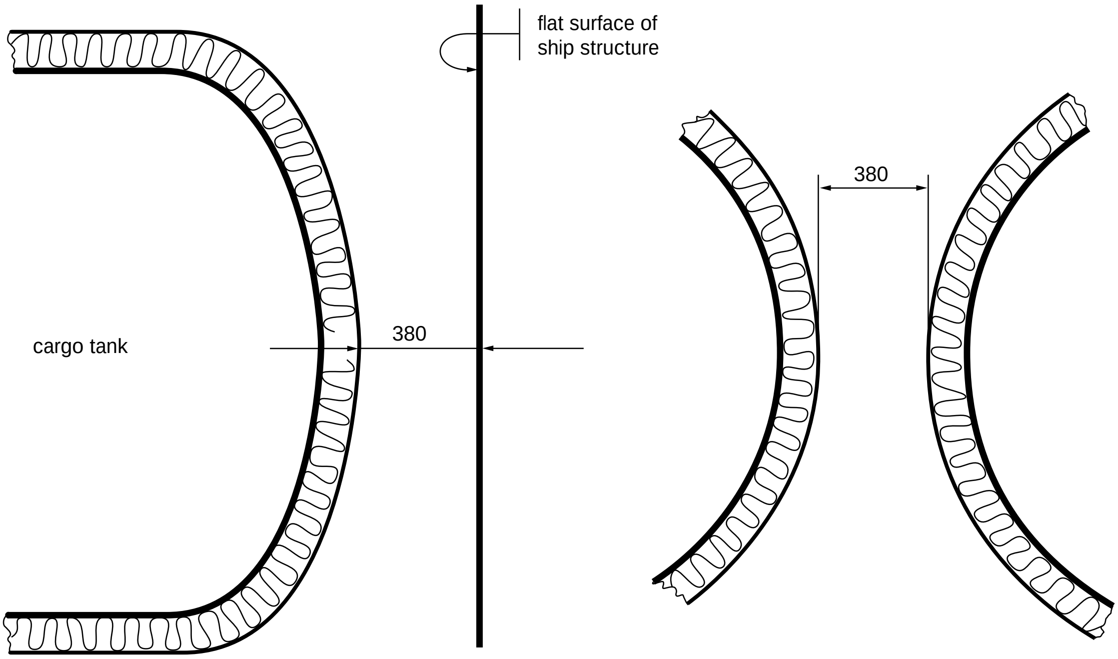

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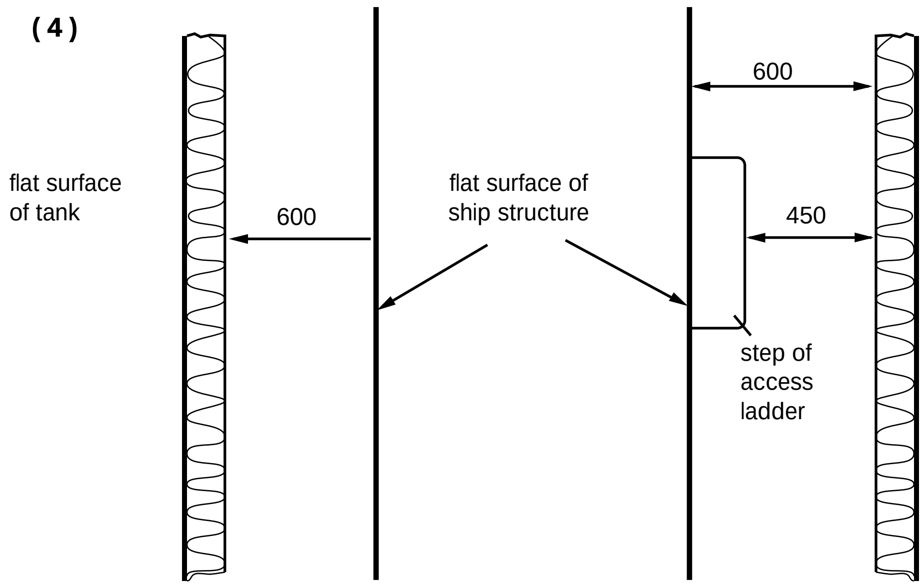

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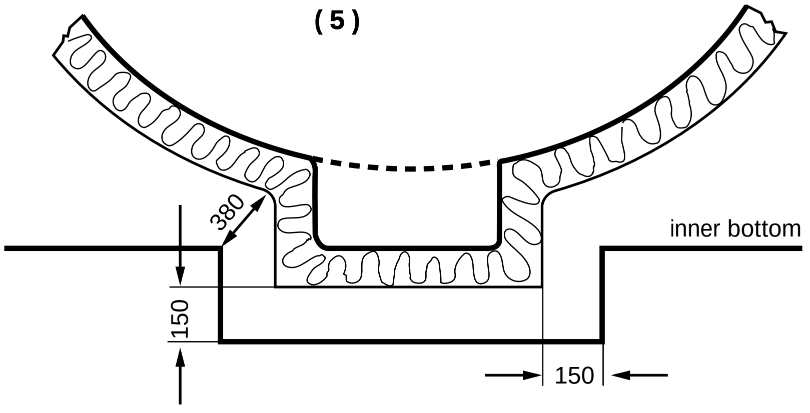

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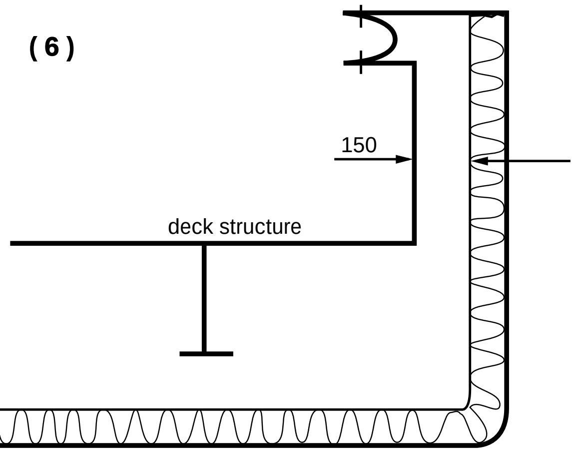

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GC7 Carriage of products not covered by the code
(1986)

Interpretation of section 4.2.4.4 of the IMO INTERNATIONAL CODE FOR THE CONSTRUCTION AND EQUIPMENT OF SHIPS CARRYING LIQUEFIED GASES IN BULK (MSC.5(48))

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 ΔP does not exceed the allowable double amplitude of the dynamic membrane stress $\Delta\ \sigma_A$ as specified in paragraph 4.2.4.4 of the Code, ie:

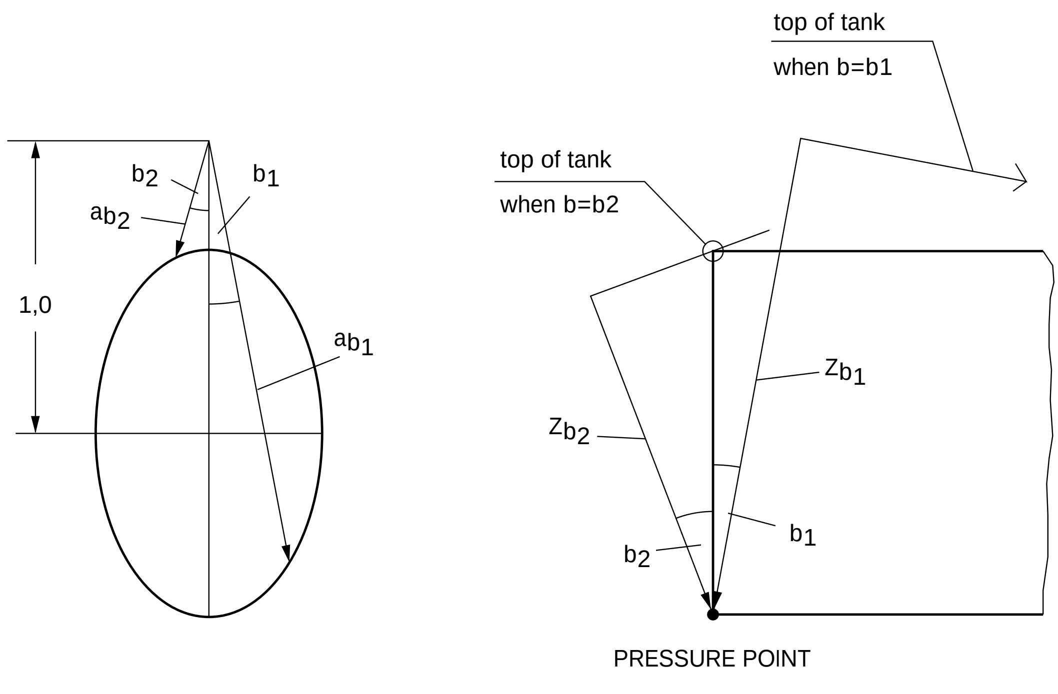
$$\Delta\ \sigma_m \leq \Delta\ \sigma_A$$

2 The dynamic pressure differential ΔP should be calculated as follows:

$$\Delta\ \rho = \frac{P}{1{,}02\ .\ 10^4}\ (a_{\beta 1}\ Z_{\beta 1} - a_{\beta 2}\ Z_{\beta 2})\ \text{(bar)}$$

where ρ, a_β, Z_β are as defined in 4.3.2.2 of the Code, see also sketches below. $a_{\beta 1}$ and $Z_{\beta 1}$ are the a_β - and Z_β - values giving the maximum liquid pressure hgd_{max} as defined in 4.3.2 of the Code. $a_{\beta 2}$ and $Z_{\beta 2}$ are the a_β and Z_β values giving the minimum liquid pressure hgd min.

In order to evaluate the maximum pressure differential Δ 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.

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GC8 Interpretation of paragraph 4.5.1 (Permissible stresses in way of supports of type C cargo tanks)

(1986)

1 With reference to para 4.5.1 of the IGC-Code, the following criterion for the allowable stresses in way of supports of type C-cargo tanks made of carbon manganese steel may be used:

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

where:
σ_e = equivalent stress (N/mm^2)
σ_n = normal stress in the circumferential direction of the stiffening ring (N/mm^2)
σ_b = bending stress in the circumferential direction of the stiffening ring (N/mm^2)
τ = shear stress in the stiffening ring (N/mm^2)
σ_a = allowable stress (N/mm^2), to be taken as the smaller of the values:

$$0{,}57\ R_m \text{ or } 0{,}85\ R_e$$

R_m and R_e as defined in 4.5.1.7.1 of the Code.

Equivalent stress values σ_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 as defined in 4.6.2 and 4.6.3 of the Code.

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:
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 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:

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

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 = 0,2.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)

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).

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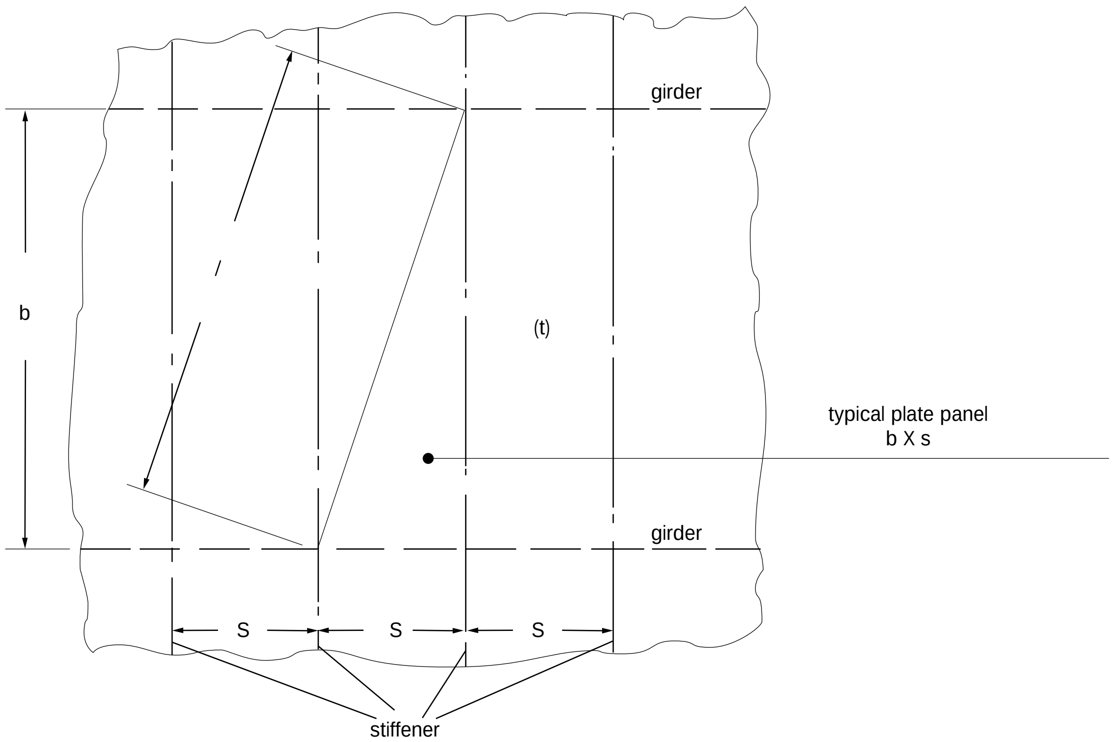

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GC10 Reliquefaction plant of moter-driven LNG-carriers
(1988)

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[1]). 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:

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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.

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GC11 (Mar 2006) Loading of cargo C tanks

(paragraphs 15.1.2 and 15.1.5)

Paragraph 15.1.2 reads: 15.1.2 *"The maximum loading limit (LL) to which a cargo tank may be loaded should be determined by the following formula :*

L L = F L _R/_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

PR= relative density of cargo at the reference temperature; and

PL= relative density of cargo at the loading temperature and pressure."

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:*

where :

LL= loading limit as specified in 15.1.2;

FL= filling limits as specified in 15.1.1 or 15.1.3;

PR= 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

PL= as specified in 15.1.2.

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

Interpretation

Regardless of the date of construction of the ship, 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.

Note:

This Unified Interpretation is to be applied by all Members and Associate on or after 1 July, 2006.

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GC 12 Secondary Barrier Testing Requirements

(Sept 2007) (Corr.1 Nov 2007)

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

"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."

Paragraph 4.7.7 shall be interpreted as follows:

For containment systems with glued secondary barriers:

- A tightness test should be carried out in accordance with approved system designers' procedures before and after initial cool down.
- If significant differences in the results before and after cool down for each tank or between tanks or if other anomalies are observed, an investigation is to be carried out and additional testing such as differential pressure, thermographic or acoustic emissions testing should be carried out as necessary.
- 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.

Note:

This Unified Interpretation is to be applied by all Members and Associate to tests commenced on or after 1 July 2008.

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GC 13 Examination before and after the first loaded voyage

(Jan 2008)

The International Code for the Construction and Equipment of Ships Carrying Liquid Gases in Bulk (IGC Code), 4.10.14 reads:

“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.”

IGC Code, 4.10.16 reads:

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

Paragraphs 4.10.14 and 4.10.16 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.

Note:
This Unified Interpretation is to be applied by all Members and Associates for surveys commenced on or after the 1 July 2008.

GC 13 (cont)

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.

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.

GC 13 (cont)

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.

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