



TÜRK LOYDU

TECHNICAL CIRCULAR

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Related Requirement: Rec.109 Rev.1, UI GC11 Rev.1, MSC.5(48) as amended and Part C, Chapter 10, Liquefied Gas Tankers , Section 15, Filling Limits for Cargo Tanks.

Subject : Filling/Loading limits for cargo tanks on ships carrying liquefied gases in bulk and constructed before 1 July 2016.

Entry into Force Date: 01.01.2018

1. Acceptance criteria for cargo tank filling limits higher than 98% (on ships constructed before 1 July 2016)

The International Code for the Construction and Equipment of Ships Carrying Liquefied 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), 15.1.3 reads:

“The Administration may allow a higher filling limit (FL) than the limit of 98% specified in 15.1.1 at the reference temperature, taking into account the shape of the tank, arrangements of pressure relief valves, accuracy of level and temperature gauging and the difference between the loading temperature and the temperature corresponding to the vapour pressure of the cargo at the set pressure of the pressure relief valves, provided the conditions specified in 8.2.17 are maintained.”

Following acceptance criteria may be used for application of paragraph 15.1.3 subject to Administration approval:

1.1 General

1.1.1 Functional requirements

The maximum filling limit of cargo tanks shall be so determined that the vapour space has a minimum volume at reference conditions (temperature of liquid corresponding to the opening pressure of pressure relief valves) to account for:

- tolerance of level gauges and temperature gauges;
- volume expansion due to pressure rise in cargo tanks above set opening pressure of pressure relief valves under maximum relieving conditions;
- an operational margin to account for liquid drained back to cargo tanks after stop of loading, closing time of valves and operator reaction time.

1.1.2 Definitions

Filling limit (FL) means the maximum liquid volume in a cargo tank relative to the accepted total tank volume when the liquid cargo has reached the reference temperature.

Loading limit (LL) means the maximum allowable liquid volume relative to the tank volume to which the tank may be loaded.

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1.2 Acceptance criteria for a higher filling limit than 98%

1.2.1 According to para. 15.1.3 a higher filling limit than 98% may be allowed at the reference temperature taking into account the following parameters:

- .1 accuracy of level gauges;
- .2 accuracy of temperature gauges;
- .3 pressure rise above opening pressure when pressure relief valves are relieving at maximum flow rate under fire condition;
- .4 an operational margin to account for liquid in loading lines drained back to cargo tanks, closing time of loading valves and operators reaction time; and
- .5 shape of the tank and arrangement of pressure relief valves, provided the conditions specified in 8.2.17 are maintained.

1.2.2 The parameters specified under 2.1.1 – 2.1.5 may be expressed by the expansion factors α_1 through α_4 as follows:

α_1 = relative increase in liquid volume due to tolerance of level gauges

α_2 = relative increase in liquid volume due to the tolerance of temperature gauges

α_3 = expansion of cargo volume due to pressure rise when pressure relief valves are relieving at maximum flow rate

α_4 = operational margin of 0.1%

The factors α_1 through α_4 are to be determined as follows:

$$\alpha_1 = dV/dh \cdot \Delta h/V \cdot 100(\%)$$

where:

dV/dh = variation of tank volume per metre filling height at the filling height h (m^3/m)

h = filling height (m) at the filling limit FL to be investigated ($FL > 98\%$)

V = accepted total tank volume (m^3)

Δh = max. total tolerance of level gauges (m)

$$\alpha_2 = \beta \cdot \Delta T (\%)$$

where:

β = volumetric thermal expansion coefficient at reference temperature ($\%/^{\circ}K$)

ΔT = max. tolerance of temperature gauge ($^{\circ}K$)

$\alpha_3 = (\rho_{PRV} / \rho_{PRV \cdot 1,2} - 1) \cdot 100(\%)$ expansion due to pressure rise when relieving at full capacity

ρ_{PRV} = ρ_R cargo density at reference conditions, i.e. corresponding to the temperature of the cargo at set opening pressure of the pressure relief valve (PRV)

$\rho_{PRV \cdot 1,2}$ = cargo density corresponding to the temperature of the cargo at 1.2 times the set opening pressure of the pressure relief valve (PRV)

α_4 = 0.1% operational margin

1.2.3 Based on the factors α_1 through α_4 the following total expansion factor α_t is to be determined

$$\alpha_t = \sqrt{\alpha_1^2 + \alpha_2^2} + \alpha_3 + \alpha_4 (\%)$$

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1.2.4 The filling limit at reference temperature may now be taken

$$FL(\max) = (100 - \alpha_t) \%$$

In no case is $FL(\max)$ to exceed 99.5%.

1.2.5 Subsequently the sloped liquid level under conditions of 15° list and 0.015L trim is to be determined.

It is to be verified that under these conditions the suction funnels of the pressure relief valves remain above the sloped liquid level at a minimum distance of 40% of the diameter of the suction funnel measured at the centre of the funnel. Risk of vapour pockets formed not communicating with the vapour / liquid domes, where the vapour line and cargo tank pressure relief valves (PRVs) are located, should be considered.

1.2.6 The maximum allowable loading limit results from the following formula:

$$LL = (100 - \alpha_t) \rho_R / \rho_L (\%)$$

ρ_L, ρ_R = cargo densities as defined in 15.1.2 of the Code.

2. 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)) (UI GC11 Rev.1)

(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;

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

ρ_L = 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:

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

where:

LL = loading limit as specified in 15.1.2;

FL = filling limits as specified in 15.1.1 or 15.1.3;

ρ_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

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ρ_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 of IGC Code adopted by MSC.5(48) as amended by Res.MSC.32(63).