No. 149 (May 2017)

Guidance for applying the requirements of 15.4.1.2 and 15.4.1.3 of the IGC Code (on ships constructed on or after 1 July 2016)

The International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk (IGC Code) as amended by Res. MSC.370(93), 15.4 states:

15.4 Determination of increased filling limit

15.4.1 A filling limit greater than the limit of 98% specified in 15.3 may be permitted under the trim and list conditions specified in 8.2.17, providing:

.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.

15.4.2 In no case shall a filling limit exceeding 99.5% at reference temperature be permitted.

1. Determining PRV inlet remains in vapour space (15.4.1.2)

The PRV inlet shall remain in the vapour space at a minimum distance of 40% of the diameter of the suction funnel measured at the centre of the funnel above the liquid level under conditions of 15° list and 0.015L trim.

2. Calculation of Allowances (15.4.1.3)

The following method may be used to determine the allowance. The Society may accept other methods to determine the allowance provided the method meets an equivalent level of safety.

The parameters specified under 15.4.1.3 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

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α_4 = operational margin of 0.1%

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

$$\alpha_1 = \frac{dV}{dh} \cdot \frac{\Delta h}{V} \cdot 100(\%)$$

where:

$\frac{dV}{dh}$ = 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 (%/ºK)

ΔT = max. tolerance of temperature gauge (ºK)

$$\alpha_3 = \left(\frac{\rho_{PRV}}{\rho_{PRV \cdot 1.2}} - 1\right) \cdot 100(\%)$$ 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)

$$\alpha_4 = 0.1\% \text{ operational margin}$$

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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