

GC 12 Secondary Barrier Testing and Effectiveness Assessment

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Interpretations of paragraphs 4.4.1, 4.5, 4.6.2.1, 4.6.2.4 and 4.6.2.5 of the International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk (2014 IGC Code) as amended by MSC.370(93),

- Paragraph 4.4.1 reads:

"The containment systems shall be provided with a full secondary liquid-tight barrier capable of safely containing all potential leakages through the primary barrier and, in conjunction with the thermal insulation system, of preventing lowering of the temperature of the ship structure to an unsafe level."

- Table on Paragraph 4.5 reads:

Membrane Tank Type requires *"Complete secondary barrier"*

- Paragraph 4.6.2.1 reads:

4.6.2.1. "it is capable of containing any envisaged leakage of liquid cargo for a period of 15 days...."

- Paragraph 4.6.2.4 reads:

4.6.2.4 "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;"

- Paragraph 4.6.2.5 reads:

4.6.2.5 "the methods required in .4 above shall be approved by the Administration or recognized organization acting on its behalf and shall include, where applicable to the test procedure:

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.
4. Rev.3 of this Unified Interpretation is to be applied by all Members to tests commenced on or after 1 January 2027.

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- .1 *details on the size of defect acceptable and the location within the secondary barrier, before its liquid-tight effectiveness is compromised;*
- .2 *accuracy and range of values of the proposed method for detecting defects in .1 above;*
- .3 *[...]*
- .4 *effects of thermal and mechanical cyclic loading on the effectiveness of the proposed test; and"*

And

Interpretations of paragraphs 4.7.1, 4.7.3, 4.7.4.1 and 4.7.7 of the International Code for the Construction and Equipment of Ships Carrying Liquid Gases in Bulk (1983 IGC Code),

- Paragraph 4.7.1 reads:

4.7.1 "...to act as a temporary containment for any envisaged leakage of liquid cargo through the primary barrier."

- Table on Paragraph 4.7.3 reads:

Membrane Tank Type requires *"Complete secondary barrier"*

- Paragraph 4.7.4.1 reads:

4.7.4.1 "it is capable of containing any envisaged leakage of liquid cargo for a period of 15 days"

- Paragraph 4.7.7 reads:

4.7.7 "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."

Application

These unified interpretations apply to all gas carriers provided with membrane containment systems as defined in paragraph 4.1.5 of the IGC Code and in paragraph 4.2.2 of the 1983 IGC Code, except as otherwise explicitly indicated.

Interpretations

The following five (5) interpretations apply in relation to the content of the above-listed paragraphs of the IGC Code and the 1983 IGC Code.

1 "Any envisaged leakage of liquid cargo"

1.1 The expression "any envisaged leakage of liquid cargo" (paragraph 4.6.2.1 of the IGC Code and paragraphs 4.7.1 and 4.7.4.1 of the 1983 IGC Code) is to be interpreted as a leakage, which may have resulted from a failure of the primary barrier resulting in filling of the inter-barrier space with liquid until a static equilibrium state is reached between the tank space and the inter-barrier space.

1.2 For ships in service equipped with containment systems where potential failure modes to the primary barrier tightness have been identified and documented through in-service experience, envisaged leakage scenarios may be determined by suitable engineering and risk analyses carried out by the cargo containment system designer. The envisaged leakage scenarios calculations are to demonstrate the probability of tightness failures of the primary barrier, cargo flow and thermal analysis within the inter-barrier space and thermal effects to the inner hull structure. The flow and thermal analyses are to determine the cargo liquid filling level of the inter-barrier space at the end of a 15-day period. The studies leading up to the conclusion are to be to the satisfaction of the Administration or the recognized organization acting on its behalf.

2 "Capable of being periodically checked"

2.1 The expression "capable of being periodically checked" (paragraph 4.6.2.4 of the IGC Code and paragraph 4.7.7 of the 1983 IGC Code) means that the design arrangement of the containment system and the secondary barrier are to be such that the effectiveness of the secondary barrier may be reliably confirmed by a suitable test and/or inspection programme specified in the approved "inspection and survey plan" required by paragraph 4.3.6 of the IGC Code. The effectiveness of the secondary barrier is to be checked at the initial survey during the time of construction, as required by paragraph 1.4.2.1 of the IGC Code, and no less than at each renewal survey when the Certificate of Fitness is due to be renewed, as required by paragraph 1.4.2.2 of the IGC Code or paragraph 1.5.2 of the 1983 IGC Code. Additionally:

- .1 for containment systems with glued secondary barriers:
 - at the time of construction, a tightness test is to be carried out in accordance with the approved system designer's procedures to demonstrate compliance with the acceptance criteria before and after initial cool down, to verify the effectiveness of the secondary barrier;
 - the initial cargo tank cool down could be achieved during gas trial or could be carried out prior to proceeding with gas trial with limited amount of cargo or another refrigerating medium inside the tank. In case there is a refrigerating medium inside the tank, details of the minimum average temperature and cooling time to be achieved at the secondary barrier during tank cool down are to be agreed between the cargo containment designer and the Administration or the recognized organization acting on its behalf; and
 - the values recorded are to be used as reference for future assessment of secondary barrier tightness; and
- .2 for containment systems with welded metallic secondary barriers, a tightness test after initial cool down, at the time of construction, is not required.

3 "Full secondary liquid-tight barrier"

The expressions "full secondary liquid-tight barrier" (paragraph 4.4.1 of the IGC Code) and "Complete secondary barrier" (table 4.5 of the IGC Code and paragraph 4.7.3 of the 1983 IGC Code) are to be interpreted as a secondary barrier forming a liquid-tight secondary containment capable of containing any envisaged leakage from the tank through its primary barrier, as interpreted in paragraph 1.1 above.

4 "Effectiveness"

4.1 The expression "effectiveness" (paragraphs 4.6.2.4, 4.6.2.5.1 and 4.6.2.5.4 of the IGC Code and paragraph 4.7.7 of the 1983 IGC Code), in the context of the secondary barrier being "capable of containing any envisaged leakage of liquid cargo" (paragraph 4.6.2.1 of the IGC Code and paragraphs 4.7.1 and 4.7.4.1 of the 1983 IGC Code), means the ability of the secondary barrier to prevent passage of liquid cargo in ways and quantities likely to cause unsafe cold spots to the ship structure. The effectiveness of the secondary barrier is to be verified by an approved method described in the "inspection/survey plan" required by paragraph 4.3.6 of the IGC Code, such as but not limited to:

- .1 a tightness test, in accordance with the approved system designer's procedure and acceptance criteria. If the approved threshold values are exceeded, an investigation is to be carried out along with additional testing, such as thermographic or acoustic emissions testing, to locate any secondary barrier indications exceeding threshold values as per approved method;
- .2 a thermographic examination of the cargo tank boundaries in accordance with the approved system designer's procedure and the approved designer's acceptance criteria, in combination with acoustic emission testing in areas, such as the domes, where thermographic examination cannot be performed effectively; or
- .3 other equivalent methods suitable for the specific cargo containment system design.

4.2 At each renewal survey, all detected indications are to be evaluated to confirm whether or not they preclude the function of the secondary barrier. When evaluating whether the detected indications compromise the secondary barrier "liquid-tight effectiveness" as defined on 4.6.2.5.1, the primary barrier leakage scenario described in interpretation 1.1 above is to be taken into account to confirm that the result of such leakages will not result in filling the inter-barrier space with cargo liquid above the position of the detected indication. The interpretation given in 1.2 above may be applied in the evaluation if this is demonstrated to represent an equivalent level of safety considering the probability and extent of tightness failures of the primary barrier. The evaluation is to take into consideration the requirements of paragraphs 4.6.2.5.1 and 4.6.2.5.2 of the IGC Code. All indications identified as compromising the function of the secondary barrier are to be repaired.

4.3 Special considerations, in concurrence with the Administration, may be given when the detected indication(s) are confirmed to be located above the anticipated highest liquid level accumulated inside the inter-barrier space. In such cases, the owners, in collaboration with the cargo containment system designer, are to submit to the Administration or the recognized organization acting on its behalf, suitable documentation to demonstrate the equivalent level of safety and describe the necessary mitigating measures to be implemented to ensure that the function of the cargo containment system is not compromised. In addition:

- .1 arrangements are to be made for owners to submit an annual health monitoring report to confirm that the cargo containment system remains satisfactory for the service for which the ship is intended, as required by paragraph 1.4.2 of the IGC Code, or by paragraph 1.5.2 of the 1983 IGC Code;
- .2 the monitoring arrangements and procedures are to be documented, endorsed by the cargo containment system designer and submitted to the Administration or the recognized organization acting on its behalf;
- .3 verification of the continued effectiveness of the monitoring arrangements and procedures is to be carried out at each annual survey;

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- .4 those indications under special considerations are to be documented and information is to be made available to the next survey attending surveyor; and
- .5 at renewal surveys, tightness test, as indicated in 4.1.1 above, is not considered to be an acceptable test method to determine the effectiveness of the secondary barrier. Approved testing procedures capable of localizing the indications are to be used.

5 "Other suitable means" and "another suitable method"

The expressions "other suitable means" (paragraph 4.6.2.4 of the IGC Code) and "another suitable method" (paragraph 4.7.7 of the 1983 IGC Code) are to be interpreted to mean that any other suitable means or another suitable method is to be described within the "inspection and survey plan" required by paragraph 4.3.6 of the IGC Code.

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