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UNIFIED INTERPRETATION OF PROVISIONS OF IMO SAFETY, SECURITY, AND ENVIRONMENT-RELATED CONVENTIONS

Penetrations in watertight divisions – pressure testing after a fire test (SOLAS regulation II-1/13)

Submitted by IACS

SUMMARY

Executive summary:	This document seeks clarification of the application of SOLAS regulation II-1/13 with regard to types of penetrations required to be pressure tested after a fire endurance testing
Strategic direction, if applicable:	6
Output:	6.1
Action to be taken:	Paragraph 11
Related documents:	None

Introduction

1 IACS extensively discussed the requirements of SOLAS regulation II-1/13 and studied the annex to *Revised Explanatory Notes to the SOLAS chapter II-1 subdivision and damage stability regulations* (resolution MSC.429(98)) to gain clarity with regard to penetrations which are subject to the requirements of the prototype testing of watertightness after having undergone the standard fire test appropriate for the location where those penetrations are to be installed.

Discussion

2 Paragraphs 1, 2.1, 2.2 and 2.3 of SOLAS regulation II-1/13 state:

> "1 The number of openings in watertight bulkheads shall be reduced to the minimum compatible with the design and proper working of the ship, satisfactory means shall be provided for closing these openings.
>
> 2.1 Where pipes, scuppers, electric cables, etc., are carried through watertight bulkheads, arrangements shall be made to ensure the watertight integrity of the bulkheads.

2.2 Valves not forming part of a piping system shall not be permitted in watertight bulkheads.

2.3 Lead or other heat sensitive materials shall not be used in systems which penetrate watertight bulkheads, where deterioration of such systems in the event of fire would impair the watertight integrity of the bulkheads."

3 The Revised Explanatory Notes to SOLAS regulation II-1/13.2.3 contained in the annex to resolution MSC.429(98), state:

"3 Materials used in systems which penetrate watertight bulkheads should be of sufficient strength after exposure to heat or be considered as part of an open piping system.

Closing devices using intumescent material (swelling when exposed to heat) for open piping systems should not be considered equivalent to the fitting of a valve, since the fire might be located too far from the device to create a watertight seal.

4 Approval of pipe penetrations fitted to ensure the watertight integrity of a bulkhead or deck where heat-sensitive materials are used should include a prototype test of watertightness after having undergone the standard fire test appropriate for the location in which the penetrations are to be installed.*

The fire tested pipe penetration should then be tested to a test pressure of not less than 1.5 times the design pressure as defined in regulation 2.18. The pressure should be applied to the same side of the division as the fire test.

The fire tested pipe penetration should be tested for a period of at least 30 minutes under hydraulic pressure equal to the test pressure, but minimum 1.0 bar. There should be no leakage during this test.

The fire tested pipe penetration should continue to be tested for a further 30 minutes with the test pressure. The quantity of water leakage is not to exceed a total of 1 litre.

The prototype test should be considered valid only for the pipe typology (e.g. thermoplastic and multilayer), pressure classes, the maximum/minimum dimensions tested, and the type and fire rating of the division tested.

5 The pressure test need not be carried out on the hot penetration arrangement. Ample time may be given to prepare for the pressure test, i.e. dismantling the fire testing equipment and rigging the pressure test equipment.

The pressure test should be carried out with the pipe section used in the fire test still in place.

Any pipe insulation fitted for the purpose of the fire test may be removed before the pressure test.

Prototype testing need not be carried out if the pipe penetration is made of steel or equivalent material having a thickness of 3 mm or greater and a length of not less than 900 mm (preferably 450 mm on each side of the division), and there are no openings. Such penetrations shall be suitably insulated by extension of the insulation

* Refer to the requirements for A-class division set out in part 3 of annex 1 to the 2010 FTP Code.

at the same level of the division. See also regulation II-2/9.3.1 with respect to piping. However, the penetration must still comply with the watertight integrity requirement in regulation 2.17."

4 IACS believes that an ambiguity exists where the word "system" is used in SOLAS regulation II-1/13.2.3, that is whether this applies to the penetration system or to the piping system. Piping systems are either constructed of steel or equivalent materials, where the pipe's integrity is unlikely to be compromised by a fire, or constructed of other materials, such as thermoplastics, which are considered as heat sensitive and where the pipe's integrity is likely to be compromised by a fire.

5 IACS observes that SOLAS regulation II-1/13.2.3 mentions "heat sensitive materials". This can be considered as a reference to materials of the piping systems (i.e. piping systems, which will not maintain structural integrity after a standard "A" class fire test) and, therefore, only penetrations containing heat sensitive piping systems need to undergo a prototype pressure test post fire. If the application of the requirement for watertightness post fire is also applicable to the penetration systems, then the material of the penetration seal should also be considered and subjected to a prototype pressure test post a fire test, as mentioned in resolution MSC.429(98) for passenger ships contracted for construction on or after 1 January 2020.

6 IACS notes that post fire, the most significant flooding risk in a watertight compartment is from flooding by a liquid from within the piping system between adjacent compartments, caused by a breach of a pipe constructed from heat sensitive material; the flooding risk is significantly less from a penetration seal containing materials, which will pass an "A" class fire test, but may not necessarily maintain watertightness post fire. Also, IACS noted that the position of such penetrations is more likely to be in the top half of a bulkhead, hence, flooding between watertight compartments due to a failure of a penetration seal post fire is much less likely than flooding from an open piping system.

7 On the basis of the above, IACS seeks the view of the Sub-Committee regarding the following:

.1 whether the intent of SOLAS regulation II-1/13.2.3 was to consider flooding scenarios from heat sensitive piping systems or flooding scenarios from heat sensitive piping and penetration systems, i.e. does SOLAS regulation II-1/13.2.3 apply to the penetration systems containing heat sensitive piping systems only;

.2 regarding applicability of watertightness test post fire test (the prototype test) of bulkhead/deck penetrations to cargo ships; IACS notes that SOLAS regulation II-1/13-1 does not refer to heat sensitive materials, unlike SOLAS regulation II-1/13, which can be interpreted as the prototype testing stated in resolution MSC.429(98) is not being required for cargo ships. However, there is also the fact that the penetration systems undergo testing at a test laboratory during type approval; at that stage, it is not relevant whether the penetration system would be fitted to a passenger ship or a cargo ship. IACS seeks clarification if the requirement is based on whether the penetration system uses "heat sensitive materials", "steel or equivalent material only" or if the regulations intend to apply the prototype test to passenger ships only; and

.3 regarding application to the cable penetrations in watertight bulkheads and decks; if SOLAS regulation II-1/13 is applicable only to systems containing heat sensitive pipes, then IACS considers that it would be logical for this regulation not to apply to the cable penetrations in watertight bulkheads and decks.

Conclusions

8 In light of the above, IACS considers that any penetration used for the passage of heat sensitive piping systems through a watertight bulkhead on a passenger ship must be tested with the heat sensitive piping and approved for watertight integrity post fire. Specifically, for cable penetrations, IACS understands that due to the considered flooding risk, SOLAS regulation II-1/13 is only considered for heat sensitive piping systems and not intended to be applied to cable penetrations.

9 IACS requests clarification as to the applicability of the prototype pressure test post fire for cargo ships.

Proposal

10 While seeking guidance on the issues raised in paragraph 7 of this document at this session, IACS would be ready to draft an interpretation on the application of SOLAS regulations II-1/13 and II-1/13-1 with regard to water integrity testing post fire endurance tests, as per the understanding stated above, taking into account the views of the Sub-Committee, and present it to the next session.

Action requested of the Sub-Committee

11 The Sub-Committee is invited to consider the issues raised in paragraph 7, the view of IACS in paragraph 8, the request in paragraph 9 and the proposal in paragraph 10, and take action, as appropriate.