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REVISION OF THE GUIDELINES FOR THE APPLICATION OF PLASTIC PIPES ON SHIPS (RESOLUTION A.753(18))

Proposed amendments to resolution A.753(18)

Submitted by IACS

SUMMARY

Executive summary:	This document is aimed at assisting the Sub-Committee in initiating the work on this agenda item and contains proposals to amend the *Guidelines for the application of plastic pipes on ships* (resolution A.753(18)), with a view to aligning it with the state-of-the-art of plastic pipes and joints.
Strategic direction, if applicable:	7
Output:	7.32
Action to be taken:	Paragraph 18
Related documents:	SSE 11/17/2; MSC 104/15/18 and MSC 110/21

Introduction

1 MSC 105 agreed to include the new output on "Revision of the Guidelines for the application of plastic pipes on ships (resolution A.753(18))" to address the growing trend of using plastic pipes on board ships, instead of steel pipes, and to promote uniform implementation of the relevant test standards. MSC 110 approved the provisional agenda for SDC 12 containing this item (MSC 110/21, paragraph 18.106 and MSC 110/21/Add.4, annex 31).

Discussion

2 Document MSC 104/15/18 (China) highlighted some of the shortcomings and ambiguities with respect to the L3 fire endurance test for plastic piping which should be clarified by the proposed revision, in particular:

.1 the lack of specifying the diameter group to be used for determining necessary rows of burners, i.e. inner, nominal or outer diameter;

.2 the possibility of having test specimens designed so that the fittings are not exposed to the flame; and

.3 the possibility of specimen designs including several typical joints and fittings which are not exposed to the flame during the test.

3 A more detailed comparison between the existing resolution and current relevant industry standards resulted in a comprehensive list of areas to be addressed in the review of resolution A.753(18) which was submitted as document SSE 11/17/2 (China and IACS).

4 IACS prepared draft amendments to resolution A.753(18), as set out in the annex. The proposals concern the parts of the resolution as shown in the following paragraphs of this document.

Definitions

5 The current definition for "joint", in paragraph 1.4.3 of the existing resolution considers only permanent methods of joining plastic pipes like adhesive bonding or welding. However, today, other types of joints are commonly in use and have demonstrated their safety. This is the case, for instance, of flanges or grip type slip-on joints. Therefore, it is proposed that this definition be enhanced to consider all relevant types of joints, i.e. permanently and non-permanently.

Requirements applicable to all pipe systems

6 Section 2.1.3 "External pressure" does not include the requirements of SOLAS introduced by resolution MSC.436(99) which, for passenger ships, require that essential systems shall remain operational in case of flooding (safe return to port (SRtP)). In particular, the current text does not explicitly mention accidental load cases as relevant for passenger ship SRtP requirements. Therefore, it is proposed to improve clarity by explicitly mentioning external pressure loads resulting from flooded compartments.

Testing after installation on board

7 Paragraph 2.1.2.2 requires dividing the hydrostatic test failure pressure by a factor of 4. IACS is of the opinion that the minimum design pressure for essential service pipes should be not lower than 1 bar. However, the current text of the resolution does not consider a minimum test pressure, i.e. allows a test pressure of less than 1 bar. To establish an appropriate test regime for essential service pipes, it is proposed to include a minimum test pressure of 4 bar in paragraph 4.5.1, in line with the corresponding rules of classification societies based on IACS unified requirement (UR) P4.6.10.1.

Appendix 1: Test method for fire endurance testing of plastic piping in the dry condition

8 In order to ensure consistency with the proposed changes to paragraph 1.4.3 "joints", corresponding changes to the wording in paragraph 2 of appendix 1 are proposed, as set out in the annex.

9 Furthermore, IACS considers that the test specimen should be selected for the most stringent test conditions achievable for the smallest pipe diameter, as these have the highest coverage by the burner flames and have the smallest volume of water, i.e. minimal cooling effect. Typically, pipes having a diameter of more than 200 mm are fabricated in certain categories with a constant ratio of wall thickness to diameter (t/D) and for each of these categories a fire endurance test should be performed. Based on this, the test specimen should be selected, as follows:

.1 for pipe diameters ≤ 200 mm: one specimen with the minimal diameter of the series; and

.2 for pipe diameters > 200 mm: one specimen for each t/D category.

Appendix 2: Test method for fire endurance testing of water-filled plastic piping

10 For section 1, "test method", it is noted that the mentioned burner is no longer available, and it is therefore proposed that the resolution be updated accordingly. In addition, the diameter of the burner head is aligned with figure 1.

11 For the section "test specimen", it is proposed that the wording be updated to ensure consistency with the proposed changes to paragraph 1.4.3 "joints".

12 Furthermore, based on IACS experience, the straight pipe with the joint is the weakest part of a piping system, which should be tested in the fire endurance test. The definition for connections has been changed and, therefore, deletion of the term "adhesive" is proposed.

13 Regarding figure 2, IACS recommends some minor changes to increase the clarity with regard to the joint and the device to maintain the pressure as required. The updated figure is presented in the annex.

Appendix 4: Fire endurance requirements matrix

14 IACS proposes to amend the table in appendix 4 of the resolution, with a view to including plastic piping systems currently installed on board ships, including related footnotes to the table, notably:

.1 exhaust gas cleaning system effluent line; and

.2 urea transfer/supply system (SCR installation).

15 In the context of the table in appendix 4 of the resolution, it is also proposed to include a new paragraph in section 2.2.1.3 "system/location matrix" highlighting the need for plastic piping systems on board passenger ships to consider requirements of SOLAS regulation II-2/21.4 (SRtP) and that plastic pipes can be considered to remain operational after a fire casualty, if tested to the L1 standard.

16 Finally, it is proposed to update the reference to SOLAS for column D - Ro-Ro cargo holds.

Proposal

17 In view of fostering the discussion, IACS has prepared draft amendments to the resolution, as set out in the annex for consideration of the Sub-Committee.

Action requested of the Sub-Committee

18 The Sub-Committee is invited to consider the foregoing and the proposal set out in the annex, and to take action, as appropriate.

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ANNEX

DRAFT AMENDMENTS TO THE GUIDELINES FOR THE APPLICATION OF PLASTIC PIPES ON SHIPS (RESOLUTION A.753(18))*

1.4 **Definitions**

…

1.4.3 Joint – the term joint refers to the ~~permanent~~ method of joining pipes either permanently by adhesive bonding, laminating, welding, ~~etc.~~ or non-permanently by flange or mechanical joints, e.g. of the slip-on joint types slip or grip.

…

2.1.3 External pressure

…

2.1.3.2 Piping should be designed for an external pressure not less than the sum of the maximum potential head of liquid outside the pipe, plus full vacuum (1 bar). This is applicable to all pipe installations that must remain operational in the event of flooding damage, as per SOLAS regulation II-1/8-1 or for all pipes that would allow progressive flooding to other compartments through damaged piping or through open ended pipes in the compartments. The nominal external pressure for a pipe should be determined by dividing the collapse test pressure by a safety factor of 3. The collapse test pressure should be verified experimentally or by a combination of testing and calculation methods to the satisfaction of the Administration.

…

2.2.1.3 System/location matrix

…

2.2.1.3.4 For passenger ships subject to SOLAS regulation II-2/21.4 (Safe return to port), plastic pipes for services that must remain functional in the part of the ship not affected by the casualty thresholds, such as systems supporting safe areas, are considered essential services. According to *Explanatory notes for safe return to port and orderly evacuation and abandonment after a fire or flooding casualty* (MSC.1/Circ.1369), as amended, interpretation 12, plastic piping can be considered functional for the purpose of safe return to port after a fire casualty if the plastic pipes and joints ~~fittings~~ have been tested in accordance with the L1 standard.

4.5 Testing after installation on board

4.5.1 Piping systems for essential services should be subjected to a test pressure not less than 1.5 times the design pressure of the system or 4 bar, whichever is higher.

…

* Tracked changes are indicated using "grey shading" to highlight new insertions and “strikethrough” to highlight deletion of the text.

APPENDIX 1

TEST METHOD FOR FIRE ENDURANCE TESTING
OF PLASTIC PIPING IN THE DRY CONDITION

…

Test specimen

2 The test specimen should be prepared with the joints ~~and fittings~~ intended for use in the proposed application. The number of specimens should be sufficient to test typical joints (permanently and non-permanently) ~~and fittings~~ including joints between non-metal and metal pipes ~~and fittings~~ to be used. The ends of the specimen should be closed. The pipe ends and closures may be outside the furnace. The general orientation of the specimen should be horizontal and it should be supported by one fixed support with the remaining supports allowing free movement. The free length between supports should not be less than 8 times the pipe diameter.

Notes:

…

2 The number and size of test specimens required for the approval test should be specified by the Administration. ~~At least largest and smallest diameter or wall thickness should be tested for approval.~~ The specimen should be representative for the most demanding conditions achieved for the minimal diameter. For pipes with a nominal diameter of up to 200 mm (≤ 200 mm), it is recommended that the pipe with the minimal diameter be tested. For pipes with diameter greater than 200 mm, it is recommended that one specimen be selected for each t/D category (D = outer diameter, t = structural wall thickness).

…

APPENDIX 2

TEST METHOD FOR FIRE ENDURANCE TESTING
OF WATER-FILLED PLASTIC PIPING

1 Test method

…

The burners should be type "Sievert No. 29402" or equivalent which produces an air mixed flame. The inner diameter of the burner heads should be ~~29~~ 32 mm (see figure 1). The burner heads should be mounted in the same plane and supplied with gas from a manifold. If necessary, each burner should be equipped with a valve in order to adjust the flame height.

…

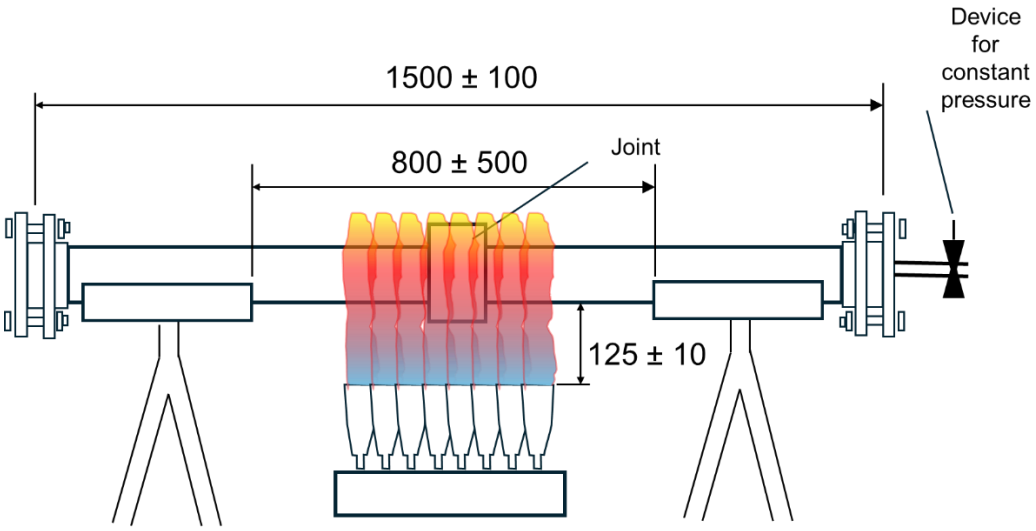

Figure 2: Fire endurance test, stand with mounted sample

2 Test specimen

Each pipe should have a length of approximately 1.5 m and be connected together permanently or non-permanently by a joint. The test pipe should be prepared with permanent and non-permanent joints ~~and fittings~~ intended to be used. ~~Only valves and~~ Straight joints versus elbows and bends should be tested as ~~the adhesive in~~ the joint is the primary point of failure.…

APPENDIX 4

FIRE ENDURANCE REQUIREMENTS MATRIX

	PIPING SYSTEMS	***LOCATION***										
		A	B	C	D	E	F	G	H	I	J	K
	MISCELLANEOUS											
28	Control air	L1[5/]	L1[5/]	L1[5/]	L1[5/]	L1[5/]	NA	0	0	0	L1[5/]	L1[5/]
29	Service air (non-essential)	0	0	0	0	0	NA	0	0	0	0	0
30	Brine	0	0	NA	0	0	NA	NA	NA	0	0	0
31	Auxiliary pressure low steam (≤ 7 bar)	L2W	L2W	0[9/]	0[9/]	0[9/]	0	0	0	0	0[9/]	0[9/]
32	Central vacuum cleaners	NA	NA	NA	0	NA	NA	NA	NA	0	0	0
33	Exhaust gas cleaning system effluent line	L3[1]	L3[1]	NA	NA	NA	NA	NA	NA	NA	L3[1,11]	0
34	Urea transfer/supply system (SCR installations)	L1[12]	L1[12]	NA	NA	NA	NA	NA	NA	NA	L3[11]	0

[11/] L3 for piping in service spaces, not allowed in accommodation and control spaces.

[12/] Type Approved plastic piping without fire endurance test (0) is acceptable downstream of the tank valve, provided that this valve is metal seated and arranged as fail-to-closed valve or with quick closing operable from a safe position outside the space in the event of fire.

Definitions

…

D - *Ro-ro cargo holds*

Ro-ro cargo holds are ro-ro cargo spaces and special category spaces as defined in SOLAS regulation II-2/3.~~14~~41 and 3.~~18~~46.