
Inspection and Testing of Automatic Sprinkler Systems

Notice to ship owners, managers, Masters, Approved Nautical Inspectors, Recognised Organisations and surveyors

This Notice supersedes BMA Information Bulletin No.150

1. Purpose

- 1.1. This Marine Notice describes the Bahamas Maritime Authority (BMA) requirements for the inspection and testing of automatic sprinkler systems.

2. Application

- 2.1. This Notice applies to all Bahamian ships fitted with automatic sprinkler systems of an approved type complying with the requirements of the Fire Safety Systems Code, as required by Regulations 10.4, 10.5 & 10.6 of Chapter II-2 of the International Convention for the Safety of Life at Sea, 1974, as amended (SOLAS II-2), or other International Maritime Organization (IMO) Codes such as the International Code of Safety for High Speed Craft 1994 or 2000 (HSC Code).
- 2.2. This Notice **does not** apply to “dry pipe” water based fixed local application fire-extinguishing systems meeting the requirements of Regulation 10.5.6 of SOLAS II-2 or “dry pipe” systems as defined in IMO Resolution MSC.44(65).

3. Definitions

- 3.1. For the purpose of this Notice the following definitions are used, unless expressly provided otherwise:
- i. **Automatic Sprinkler Systems** – sprinkler & water-spraying systems required by Regulations 10.4, 10.5 and 10.6 of SOLAS II-2 or HSC Code. This includes fixed pressure “water mist systems” and “water spray systems”.
 - ii. **Sprinkler** – means sprinkler heads, water mist nozzles or water spray nozzles as applicable to the system in question.
 - iii. **Annual Survey** – unless stated otherwise in this document, means Cargo Ship Safety Equipment annual, periodical and renewal surveys; HSC Code periodical and renewal surveys and Passenger Ship Safety Certificate renewal surveys; and, for other Codes which either refer to Regulations 10.4, 10.5 & 10.6 of SOLAS II-2, or

require similar such systems, their applicable annual, intermediate, periodical or renewal surveys.

- iv. **Pilot Pressure** – The minimum operating pressure of the automatic sprinkler system as defined in the maker’s manual or Type Approval Certification. This may also be referred to as “stand-by pressure” by some manufacturers.
- v. **Operating Pressure** – The actual pressure, during extended testing, at which the sprinkler operated, when the pressure is raised from pilot pressure on sprinklers that failed to operate at pilot pressure.

4. Background

- 4.1. Since the introduction of BMA Information Bulletin No.150 Rev.0 in August 2013, testing has been carried out on a number of different makes of automatic sprinkler system. The testing has found failures on both high pressure and low pressure automatic sprinkler systems produced by a number of different manufacturers. Failures have occurred exclusively on ships over 5 years of age.
- 4.2. Due to the severity of these findings and the need to determine the extent of these failures, the Bahamas Maritime Authority (BMA) has decided to instigate increased testing for Bahamian ships fitted with automatic sprinkler systems. This Notice takes into account the findings related to failures on both high pressure and low pressure systems.
- 4.3. The extent of testing required is dependent on the age of the automatic sprinkler system. Testing consists of:
 - i. “Initial” testing of two sprinklers;
 - ii. “Basic” testing of 20 sprinklers to assess the general condition of the system; and,
 - iii. “Extended” testing, where it is necessary to obtain a more detailed assessment of the condition of the system through testing an increased sample size of sprinklers.

5. Maintenance of automatic sprinkler systems

- 5.1. Companies operating Bahamian ships shall ensure that the relevant parts of MSC.1/Circ.1432, as amended by MSC.1/Circ.1516, and manufacturer’s inspection and maintenance instructions for automatic sprinkler systems are incorporated into their Safety Management System.
- 5.2. The BMA recommends that automatic sprinkler system water quality be assessed through periodic sampling and analysis in accordance with the manufacturer’s instructions.

- 5.3. Records of automatic sprinkler system water quality should be maintained for monitoring purposes to ensure that any deterioration in water quality is identified and to reduce the possibility of damage to sprinklers resulting in failure to operate. Base line water quality should be established at the following times:
- i. Prior to the delivery of the ship from the building yard but, after all installation testing has been completed;
 - ii. Whenever the system is flushed and re-filled with water in accordance with manufacturer's maintenance instructions or after operation/testing.

6. Instructions to Recognised Organisation surveyors

6.1. Testing

- 6.1.1. As a general guide these requirements will be applicable to ships holding a Passenger Ship Safety Certificate, Special Purpose Ship Certificate or High Speed Craft (HSC) Code Certificate. However, it is the responsibility of Recognised Organisations and their surveyors to identify the applicability of these requirements to each Bahamian ship. It is suggested that Recognised Organisations make reference in the survey records for each ship to which these requirements may apply to remind their surveyors of these requirements.
- 6.1.2. Annex I to this Notice gives detailed testing requirements and acceptance criteria.
- 6.1.3. All Initial and Basic testing shall be conducted on board during the Annual Survey in the presence of a Recognised Organisation surveyor.
- 6.1.4. Extended testing shall be conducted on board during the Annual Survey in the presence of a Recognised Organisation surveyor, except where shore-side testing may be accepted by the BMA as per section 6.2 of this Notice.
- 6.1.5. Testing on passenger ships may be commenced up to three (3) months ahead of the start of the PSSC Renewal Survey window. This testing may still be credited towards the subsequent Renewal Survey provided all testing is completed by the PSSC Renewal due date.
- 6.1.6. Testing on all other ship types is to be completed within the Annual Survey window.
- 6.1.7. Annual Surveys shall not be considered complete until all testing has been completed.
- 6.1.8. The Company and Recognised Organisation shall ensure that all necessary testing is completed without any detriment to the extent of survey of other survey items forming part of the Annual Surveys.

6.1.9. Postponement of testing past the end of the survey window will normally only be considered by the BMA in force majeure circumstances.

6.2. ***Testing at shore side facilities***

6.2.1. If, in exceptional cases, it becomes impracticable to do the entire Extended testing on board, it may be possible to conduct testing ashore by sending the remaining sprinklers to a shore side testing facility.

6.2.2. For Extended testing to be carried out at a shore side testing facility, the Recognised Organisation must submit a fully justified proposal including identification of the testing facility in accordance with BMA Information Bulletin No.8. Measures to meet the requirements of paragraphs 6.2.3 & 6.2.4 below are also to be addressed in the proposal.

6.2.3. The following requirements are to be in put in place for shore side testing:

- i. All testing at shore side facilities is to be carried out under full supervision of an RO surveyor;
- ii. The traceability of the sprinklers shall be maintained throughout the removal/shipping/testing process in such a way that the sprinklers are clearly identifiable with respect to their original position on board;
- iii. Custody of the sprinklers shall be controlled in such a way that there can be no suggestion that the sprinklers may have been tampered with prior to testing, or that the testing has been incorrectly carried out;
- iv. Sending of sprinklers direct to the manufacturer for unsupervised in-house testing is not acceptable.
- v. Where the shore side test facility is not that of the automatic sprinkler system manufacturer, the details of the test rig and testing procedures shall be reviewed by the Recognised Organisation and confirmed to the BMA as accurately simulating the system on board the vessel.

6.3. ***Replacement of sprinklers***

6.3.1. Where test results indicate that it is necessary to replace all sprinklers in some or all sections on board, the relevant requirements of Annex I are to be followed.

6.3.2. Sections where all Sprinklers have been replaced are to be regarded as “new” installations and testing in subsequent years is to be conducted as appropriate for the age of the sprinklers at the next Annual Survey.

6.3.3. Details of sections where all sprinklers have been replaced are to be maintained by the ship owner and Recognised Organisation to ensure the appropriate testing is conducted at each subsequent Annual Survey.

6.3.4. If there is any doubt as to the extent of testing to be carried out on ships where all Sprinklers have been replaced in a section, the scope of testing may be agreed with the BMA's Inspections and Surveys Department.

6.4. **Reporting requirements**

6.4.1. All Basic and Extended testing is to be reported using the spreadsheet provided to all Bahamas Recognised Organisations for use by surveyors carrying out annual Surveys on Bahamian ships fitted with automatic sprinkler systems.

6.4.2. The completed spreadsheet is to be reviewed by the Recognised Organisation against the appropriate acceptance criteria in Annex I to determine what further action, if any, is to be taken.

6.4.3. Once the action required is determined by the Recognised Organisation, the BMA is to be advised. The submission to the BMA should include the following information:

- i. Identification of the ship;
- ii. Details of the automatic sprinkler system(s) on board (make, type, etc.);
- iii. Photographs showing examples of the Sprinkler Heads fitted on board;
- iv. Photographs of examples of any Sprinkler Heads which failed testing;
- v. A written summary of test results;
- vi. A copy of the spread sheet;
- vii. The Recognised Organisation's recommendations for further testing or sprinkler replacement and conditions for issuance of short term certification, as appropriate; and,
- viii. The Company's intentions for completion of further testing or replacement of sprinklers, as appropriate.

6.4.4. If deemed necessary, the BMA may require the test results to be shared with the system manufacturer and/or the body responsible for issuing the Type Approval Certification for further investigation or comment.

6.5. **Short Term Certification**

6.5.1. Where the test results require further testing or replacement of sprinklers, the Recognised Organisation is to request permission from the BMA to issue relevant short-term certification, in accordance with BMA Information Bulletin No.8.

Annex I - Test Procedures

Introduction.

1. In general, only one type of automatic sprinkler system will be installed on a ship to which this Notice applies. However, there are some ships where automatic sprinkler systems from different makers are installed or different types of sprinklers from the same maker installed (e.g., Marioff Hi-Fog 1000 and Hi-Fog 2000 sprinklers, or Marioff Hi-fog and another proprietary brand).
2. If more than one type of sprinkler is installed on board a ship to which this Notice applies, then the different types of sprinkler are to be assessed separately against the requirements of this Notice.
3. The starting point for testing, based on age of system, is shown in table 3 below.

Age of System	<5 years	Initial Testing
	≥5 years	Basic Testing

Table 3. – Starting point for testing based on system age.

Initial testing

4. Test a minimum of two sprinklers for proper operation at pilot pressure as per Paragraph 7.5.17 of MSC.1/Circ.1432, as amended by MSC.1/Circ.1516 (see flowchart in Annex II of Marine Notice 80).
5. Water quality is to be assessed as per paragraph 26, below.
6. The test results shall be recorded in accordance with section 6.4 of BMA Marine Notice 80 and assessed against paragraph 7 below.

Initial testing acceptance criteria

7. If one or both of the sprinklers tested fail to operate at pilot pressure, proceed to basic testing.

Basic testing

8. The purpose of basic testing is to determine the general condition of the automatic sprinkler system and consists of testing of a limited number of sprinklers and taking water samples from the system.

9. Basic testing is to be carried out at the system's pilot pressure.
10. Two sprinklers in 10 sprinkler sections should be tested (20 sprinklers in total). The test samples should be taken from different areas of the ship. For consistency, it is important that two sprinkler tests are recorded and documented from each tested section.
11. If there are less than 10 sprinkler sections installed on board then testing should be 2 sprinklers per section on board. The BMA shall be consulted on the acceptance criteria to be applied in such cases.
12. Water samples are to be taken in accordance with paragraphs 26 & 27 below and assessed against paragraph 30 and where necessary the system dealt with as per paragraph 32.
13. The test results shall be recorded in accordance with section 6.4 of BMA Marine Notice 80 and compared to the acceptance criteria defined in paragraphs 14, 15 & 16 below.

Basic testing acceptance criteria

14. If 0, 1 or 2 ($\leq 10\%$) of the sprinklers fail to operate at the pilot pressure, no further action is required, and the situation will be monitored by new tests at the next annual survey.
15. If 3 or more sprinklers out of the 20 sprinklers tested fail ($>10\%$) an extended testing programme in accordance with paragraphs 18, 19, 20, 21 & 22 below should be initiated
16. In the special case of 2 sprinklers from the same sprinkler section failing, it should be ensured that the remaining sprinklers in the same section are not impaired. Typically, an additional 10 sprinklers should be tested in the same section. If 2 or more of the additional sprinklers fail the test, the section is to be deemed contaminated and all sprinklers within that section should be replaced.
17. Where extended testing of the automatic sprinkler system is necessary, any sections which have been subject to and passed the additional testing referred to in paragraph 16 do not require to be subject to extended testing and will be monitored at the next annual survey.
18. For sections with more than one sprinkler type, paragraphs 14 to 17 apply to each type (i.e. the 10% is calculated for each sprinkler type separately).

Extended testing

19. The purpose of extended testing is to determine in more detail either the general condition of the automatic sprinkler system or the condition of each individual sprinkler section. Based on the results of the test a decision can be made whether sprinkler sections may be left in service or whether replacement is needed.
20. Based on the results from basic testing the following extended test programme in Table 19 is implemented:

Case	Failure rate, R_{FB} , from Basic testing	Number of sprinklers to be tested.
i	$10\% < R_{FB} \leq 20\%$	2 sprinklers to be tested from sprinkler sections selected as follows: <ul style="list-style-type: none"> • If number of sections < 20, test all sections; • If number of sections is between 20 and 40, test 20 sections; • If number of sections > 40, test 50% of the sections.
ii	$R_{FB} > 20\%$	7 sprinklers from each sprinkler section. All sprinkler sections to be tested except for sections where the Company prefers to replace all sprinklers at this stage.

Table 19 – Extended testing requirements.

21. Extended testing is carried out at pilot pressure. In cases where sprinklers fail to operate at pilot pressure the actual opening pressure shall be ascertained but in no circumstances shall the sprinkler be tested to a pressure greater than the maximum operating pressure of the system identified by the system manufacturer.
22. Water samples are to be taken in accordance with paragraphs 26 & 29 and assessed against paragraph 30 and where necessary the system dealt with as per paragraph 32.
23. The test results shall be recorded as per section 6.4 of Marine Notice 80 and checked with regard to the acceptance criteria in paragraphs 23, 24 & 25.

Extended testing acceptance criteria

24. A case-by-case review should always be carried out taking into account the failure rate at the pilot pressure, the actual opening pressure, number of sprinklers within the protected spaces in question (e.g. only 1 sprinkler installed being more critical than 20), number and percentage of sprinklers tested in the section in question and water quality.

25. Case i (from Table 19):
- If $\leq 10\%$ of all sprinklers tested failed to operate at the pilot pressure, no further action is required and the situation will be monitored by new tests at the next Annual Survey (but see paragraphs 27, 28 & 29 below).
 - In the special case of 2 sprinklers from the same sprinkler section failing, it should be ensured that the remaining sprinklers in the same section are not impaired. Typically, an additional 10 sprinklers should be tested in the same section. If 2 or more of the additional sprinklers fail the test, the section is to be deemed contaminated and all sprinklers within that section should be replaced.
 - If $> 10\%$ of all sprinklers tested fail to operate at the pilot pressure the test programme should be expanded to the extent required by Table 19, case ii.
26. Case ii (from Table 19):
- Each section is assessed and for sections with a failure rate $\leq 15\%$, no further action is required and the situation will be monitored by new tests at the next Annual Survey.
 - For sections with a failure rate $> 15\%$, all sprinklers within that section should be replaced.
 - Alternatively, if the number of sprinklers tested in that particular section represents less than 10% of all sprinklers installed in this section, further testing limited to 30% of the total number of sprinklers in that section may be carried out and the results can be reassessed with all sprinklers tested in that section being considered. The acceptance criterion still remains a failure rate $\leq 15\%$.
27. For sections with more than one sprinkler type, paragraphs 24 to 26 apply to each type (i.e. the 10% and 15% is calculated for each type separately and where the 15% failure rate is exceeded, all sprinklers of the same type within that section should be replaced.

Water samples

28. It is recommended that water samples are taken from the sprinkler tank, pump unit and relevant sections (as close as practicable to the sprinkler as this represents the water in the branch pipe).

29. If only Initial testing is required, on-board water quality records are to be reviewed against system manufacturer's water quality requirements and random verification samples to be taken if deemed necessary.
30. If only Basic testing is required, the samples can be taken and analysed on board by the crew.
31. If Extended testing is required, it is recommended that a test laboratory is employed for the analysis of the water samples.

Water sample acceptance criteria

32. The water quality shall be assessed against the system manufacturer's water quality requirements and should address, as a minimum:
 - pH;
 - chloride content;
 - Conductivity of the water.

Water test results shall be reported to the BMA in accordance with section 6.4 of BMA Marine Notice 80.

33. It must be remembered that the water may have been exchanged and that the system may have been charged with better or worse water in the past.
34. For any water samples found not to be in compliance with the manufacturer's recommendations for water quality, replenishment of the water in the tanks and thorough flushing of all pipes in the affected sections shall be conducted. **It is of the utmost importance that the manufacturer's water specifications are followed to prevent progressive damage to sprinklers.**

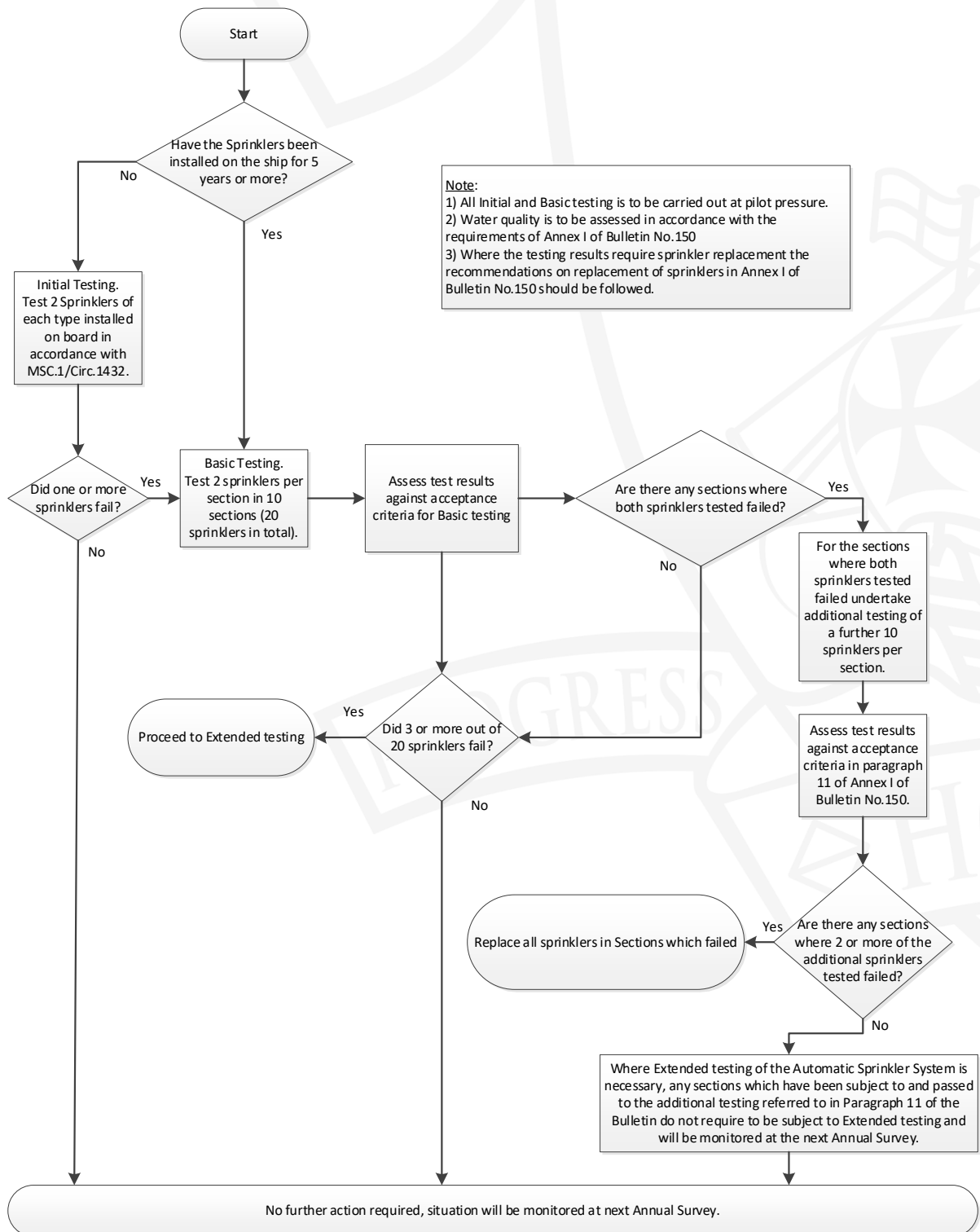
Replacement of Sprinklers

35. If replacement of all sprinklers in a section is required, care shall be taken to ensure that all contaminated water is drained from the piping.
36. Sprinklers shall be removed from all branch piping and all piping shall be blown through with air or flushed properly with water complying with the manufacturer's recommendations.

37. Replacement sprinklers shall be of the correct type and approved for use in the system. Unapproved modifications to the system or sprinklers will render the system's Type Approval invalid.
38. Where extensive replacement of sprinklers is required a replacement plan shall be submitted to the BMA by the RO, in accordance with paragraph 6.4.3 of BMA Marine Notice 80.

Annex II – Test Procedure Flow Charts

Initial and Basic Testing



Extended testing

Note:
 1) Water quality is to be assessed in accordance with the requirements of Annex I of Bulletin No.150
 2) Where the testing results require sprinkler replacement the recommendations on replacement of sprinklers in Annex I of Bulletin No.150 should be followed.

