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Inspection and Testing of Automatic Sprinkler Systems

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

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 August 2013, testing has been carried out on a number of different makes of automatic sprinkler system. The testing found failures on both high-pressure and low-pressure automatic sprinkler systems produced by a number of different manufacturers. Failures have occurred on ships over 5 years of age, and in one case on a ship less than five years old.

4.2. Due to the severity of these findings and the need to determine the extent of these failures, the BMA instigated 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[1] operating Bahamian ships shall ensure that the relevant provisions of MSC.1/Circ.1432, as amended by MSC.1/Circ.1516, together with the 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

[1] The 'Company' is the entity responsible for the operation and management of the ship in accordance with the ISM Code (SOLAS Chapter IX), as applied under the Merchant Shipping Act, 2021. Where the ISM Code is not applicable, the Company is the entity recorded as responsible for the operation of the ship in accordance with regulation 5(3)(d) of the Merchant Shipping (Registration) Regulations, 2026.

instructions. Where manufacturer maintenance procedures and guidelines do not address water quality, the Company shall verify optimum condition and parameters to be achieved at commissioning and during service for the installed system on each ship with the manufacturer.

5.3. Records of automatic sprinkler system water quality should be maintained to support monitoring, identify any deterioration in water quality, and reduce the risk of damage or malfunction to sprinkler nozzles and system components that could fail to operate.

5.4. Baseline water quality should be established at the following times:

i. Before the delivery of the ship from the building yard, after all installation testing has been completed; and

ii. Whenever the system is flushed and re-filled with water in accordance with the manufacturer's maintenance instructions or after operation/testing.

5.5. Where a manufacturer's maintenance and safety bulletins are limited or slow to develop, companies should consider feedback on testing from ships within their managed fleet when developing best practices to improve sprinkler system resilience.

5.6. System drawings should be used to support visual verification of sprinkler nozzle locations by section, deck, and type installed, and to maintain records for traceability of identified issues relating to testing.

5.7. Details of results for all sprinkler nozzles tested should be recorded in planned maintenance records for reference to support maintenance tasks and repair planning.

5.8. Long-term maintenance preventive measures, including additional tasks within the planned maintenance system, should be developed taking account of the findings of investigations into the issues identified during a failed test procedure.

5.9. In the case of one company, this resulted in the development of a 60-month period for testing and maintenance schedule designed to distribute as evenly as possible the number of nozzles that may require replacement in the event of failure.

5.10. Where necessary, an independent root-cause analysis should be undertaken on nozzles which have failed. They shall be preserved in their ''as-found condition'' to assist in identification of the precise root cause of component failure. Findings should be shared across the fleet, with relevant safety forums, and with system manufacturers.

5.11. Manufacturers are expected to develop continuous improvements to support component and system resilience in collaboration with the companies on whose ships these sprinkler systems are installed.

5.12. Where increased failure rates of sprinkler system testing are identified across a fleet, and independent analysis confirms a suspected material or design fault, the results of the independent analysis should be shared with the manufacturer, who should review and provide necessary guidance, including Safety Bulletins, to companies with ships fitted with the affected components.

5.13. It is important that ships' engineer officers have a full understanding of the system operation and can articulate any peculiar or unusual arrangements to surveyors, inspectors etc. (e.g., when systems are split into different "legs" whereby one leg operates automatically whilst another is operated manually).

6. Instructions to Recognised Organisation surveyors.

6.1. ***Testing***

6.1.1. As a general guide, these requirements apply to ships holding a Passenger Ship Safety Certificate, Special Purpose Ship Certificate, or High-Speed Craft (HSC) Code Certificate. However, Recognised Organisations and their surveyors remain responsible for determining the applicability of these requirements to each Bahamian ship. Recognised Organisations should refer to each ship's survey records to remind surveyors where these requirements apply.

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 the BMA accepts shore-side testing in accordance with section 6.2 of this Notice.

6.1.5. Testing on passenger ships may commence up to three months before the start of the PSSC Renewal Survey window and may still be credited to the subsequent Renewal Survey, provided all testing is completed by the PSSC renewal due date.

6.1.6. Testing on all other ship types shall be completed within the Annual Survey window.

6.1.7. Annual Surveys shall not be regarded as complete until all testing has been completed.

6.1.8. The Company and Recognised Organisation shall ensure that all required testing is completed without reducing the extent of survey of other items forming part of the Annual Survey.

6.1.9. The BMA will normally consider postponement beyond the survey window only in cases of *force majeure*.

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

6.2.1. If, in exceptional cases, it is impracticable to complete the full Extended testing programme on board, the remaining sprinklers may be tested ashore at a shore-side facility.

6.2.2. To conduct Extended testing at a shore-side facility, the Recognised Organisation shall submit a fully justified proposal identifying the testing facility and interim measures to maintain operation of the ship during this period in accordance with BMA Marine Notice 08. The proposal shall also address compliance with paragraphs 6.2.3 below.

6.2.3. The following requirements apply to shore-side testing:

i. All shore-side testing shall be conducted under the 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 so that there can be no suggestion of tampering before testing or of testing having been carried out incorrectly;
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 ship.

6.3. ***Replacement of sprinklers***

6.3.1. Where test results indicate that all sprinklers in some or all sections on board require replacement, the relevant requirements of Annex I shall be followed.

6.3.2. Sections in which all sprinklers have been replaced shall be treated as new installations, and subsequent testing shall be carried out at the next Annual Survey in accordance with the age of the sprinklers.

6.3.3. Details of sections in which all sprinklers have been replaced shall be maintained by the shipowner and the Recognised Organisation to ensure that the appropriate testing is carried out at each subsequent Annual Survey.

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

6.4. ***Reporting requirements***

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

6.4.2. The completed spreadsheet shall be reviewed by the Recognised Organisation against the applicable acceptance criteria in Annex I to determine any further action required.

6.4.3. Once the Recognised Organisation has determined the required action, it shall advise the BMA. The submission shall 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 showing examples of any sprinkler heads that failed testing;
v. A written summary of test results;
vi. A copy of the spreadsheet;
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. Where considered 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 test results require further testing or replacement of sprinklers, the Recognised Organisation shall request permission from the BMA to issue the relevant short-term certification in accordance with BMA Marine Notice 08.

7. Queries

7.1. Any queries on this Notice may be addressed to tech@bahamasmaritime.com or any BMA office.

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, some ships have automatic sprinkler systems from different manufacturers or different sprinkler types from the same manufacturer installed (e.g. Marioff Hi-Fog 1000 and Hi-Fog 2000 sprinklers, or Marioff Hi-Fog and another proprietary brand).

2. Where more than one sprinkler type is installed on board a ship to which this Notice applies, each type shall be assessed separately against the requirements of this Notice.

3. The starting point for testing, based on system age, is set out 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 in accordance with paragraph 7.5.17 of MSC.1/Circ.1432, as amended by MSC.1/Circ.1516 (see the flowchart in Annex II of Marine Notice 80).

5. Water quality shall be assessed in accordance with paragraph 26 below.

6. 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 tested sprinklers 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. It consists of testing a limited number of sprinklers and taking water samples from the system.

9. Basic testing shall be carried out at the system pilot pressure.

10. Two sprinklers in each of 10 sprinkler sections shall be tested (20 sprinklers in total). Samples should be taken from different areas of the ship. For consistency, two sprinkler tests shall be recorded and documented for each tested section.

11. If fewer than 10 sprinkler sections are installed on board, two sprinklers per section shall be tested. The BMA shall be consulted on the acceptance criteria to be applied in such cases.

12. Water samples shall be taken in accordance with paragraphs 26 and 27 below, assessed against paragraph 30, and, where necessary, the system shall be dealt with in accordance with paragraph 32.

13. Test results shall be recorded in accordance with section 6.4 of BMA Marine Notice 80 and compared with the acceptance criteria in paragraphs 14, 15 and 16 below.

Basic testing acceptance criteria

14. If 0, 1 or 2 (≤10%) of the tested sprinklers fail to operate at pilot pressure, no further action is required. The condition shall be monitored through repeat testing at the next Annual Survey.

15. If 3 or more of the 20 tested sprinklers fail (>10%), an Extended testing programme shall be initiated in accordance with paragraphs 18 to 22 below.

16. If two sprinklers from the same sprinkler section fail, it shall be verified that the remaining sprinklers in that section are not impaired in the ability to operate. Typically, an additional 10 sprinklers should be tested in the same section. If 2 or more of the additional sprinklers fail, the section shall be deemed inoperable ~~contaminated,~~ and all sprinklers within that section should be replaced.

17. Where Extended testing is required, sections that have undergone and passed the additional testing referred to in paragraph 16 need not be included in Extended testing and shall instead be monitored at the next Annual Survey.

18. For sections containing more than one sprinkler head type, paragraphs 14 to 17 apply to each type separately (i.e. the 10% threshold is calculated for each sprinkler type separately).

Extended testing

19. The purpose of Extended testing is to determine, in greater detail, either the general condition of the automatic sprinkler system or the condition of individual sprinkler sections. Based on the results, a decision can be made as to whether sections may remain in service or require replacement of sprinkler heads.

20. Based on the results of Basic testing, the Extended testing programme in Table 19 shall be applied.

Case	Failure rate, R_{FB}, from Basic testing	Number of sprinklers to be tested.
i	10% <R_{FB}≤ 20%	2 sprinklers to be tested from sprinkler sections selected as follows: • If number of sections <20, test all sections; • If the number of sections is between 20 and 40, test 20 sections; • If the 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 shall be carried out at pilot pressure. Where sprinklers fail to operate at pilot pressure, the actual opening pressure shall be determined. Under no circumstances shall a sprinkler be tested at a pressure exceeding the maximum operating pressure identified by the system manufacturer.

22. Water samples shall be taken in accordance with paragraphs 28 and 29 and assessed against paragraph 30. Where necessary, the system shall be dealt with in accordance with paragraph 32.

23. Test results shall be recorded in accordance with section 6.4 of Marine Notice 80 and checked against the acceptance criteria in paragraphs 24, 25 and 26.

Extended testing acceptance criteria

24. A case-by-case review shall always be carried out, taking into account the failure rate at pilot pressure, the actual opening pressure, the number of sprinklers within the protected spaces in question (e.g. a single sprinkler installed is more critical

than 20), the number and percentage of sprinklers tested in the section, and water quality.

25. Case i. (from Table 19):

- If ≤10% of all tested sprinklers fail to operate at pilot pressure, no further action is required. The condition shall be monitored through repeat testing at the next Annual Survey (but see paragraphs 27, 28 and 29 below).

- If two sprinklers from the same sprinkler section fail, it shall be verified that the remaining sprinklers in that 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 section shall be deemed inoperable, and all sprinklers within that section should be replaced.

- If >10% of all tested sprinklers fail to operate at pilot pressure, the test programme shall be expanded in accordance with Table 19, Case ii.

26. Case ii. (from Table 19):

- Each section shall be assessed individually. For sections with a failure rate ≤15%, no further action is required, and the condition shall be monitored through repeat testing 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 a particular section represents less than 10% of all sprinklers installed in that section, further testing may be carried out up to 30% of the total number of sprinklers in that section, and the results may then be reassessed on the basis of all sprinklers tested in that section. The acceptance criterion remains a failure rate ≤15%.

27. For sections containing more than one sprinkler type, paragraphs 24 to 26 apply to each type separately (i.e. the 10% and 15% thresholds are calculated separately for each type, and where the 15% failure rate is exceeded, all sprinklers of that type within the section should be replaced).

Water samples

28. Water samples should be taken from the sprinkler tank, pump unit and relevant sections, as close as practicable to the sprinkler, as this best represents the water in the branch pipe.

29. Where only Initial testing is required, on-board water quality records shall be reviewed against the system manufacturer's water quality requirements, and random verification samples shall be taken if considered necessary.

30. Where only Basic testing is required, samples may be taken and analysed on board by the crew.

31. Where Extended testing is required, a test laboratory should be used to analyse the water samples.

Water sample acceptance criteria

32. Water quality shall be assessed against the system manufacturer's water quality requirements and shall 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 should be recognised that the water may previously have been exchanged and that the system may have been charged with better or worse water in the past.

34. Where any water sample does not comply with the manufacturer's water quality recommendations, the tank water shall be replenished and all pipes in the affected sections shall be thoroughly flushed. The manufacturer's water specifications shall be followed to prevent progressive damage to sprinklers.

Replacement of sprinklers

35. Where all sprinklers in a section are to be replaced, care shall be taken to ensure that all contaminated water is drained from the piping.

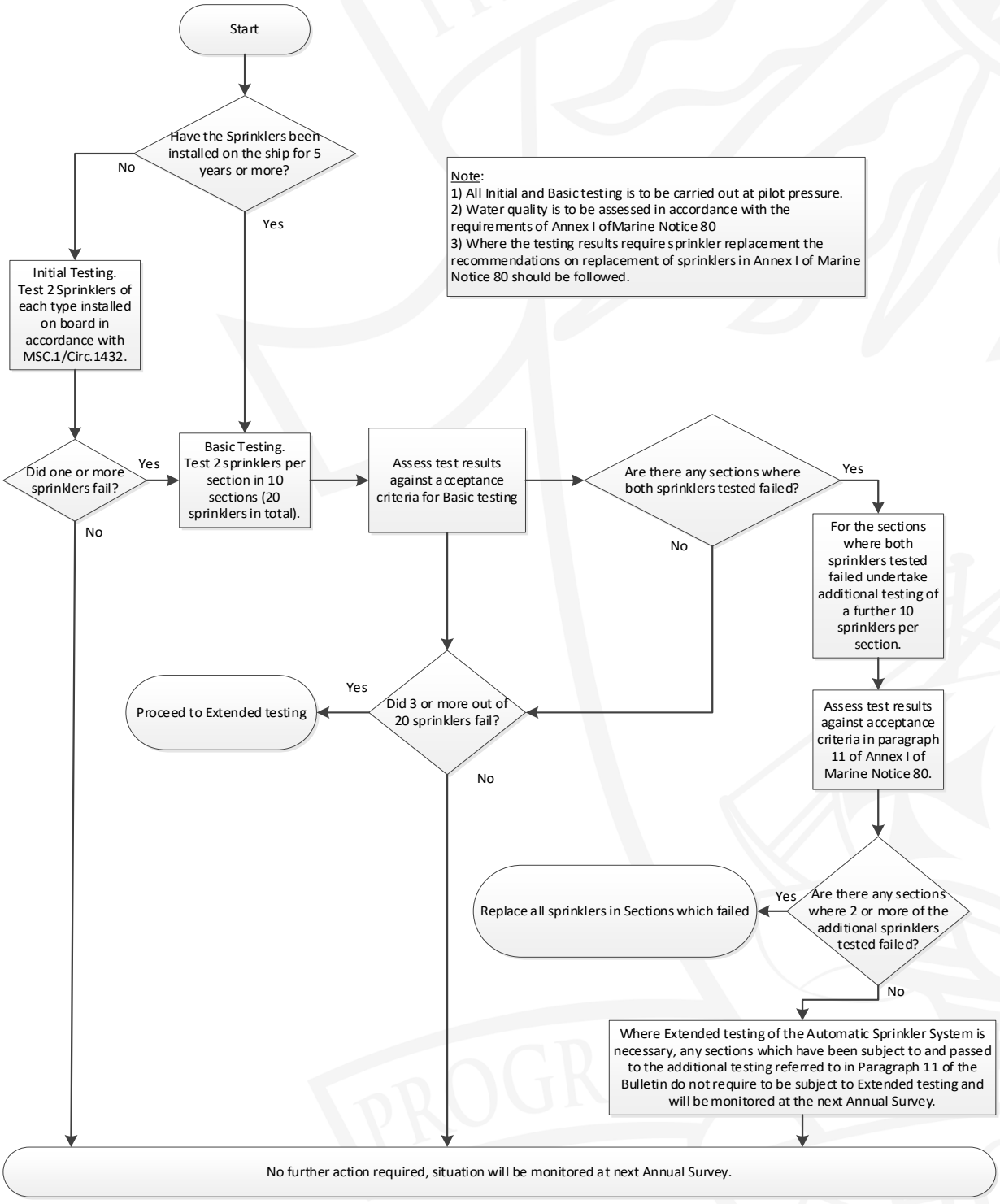
36. Sprinklers shall be removed from all branch piping, and all piping shall be blown through with air or properly flushed with water that complies with the manufacturer's recommendations.

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.

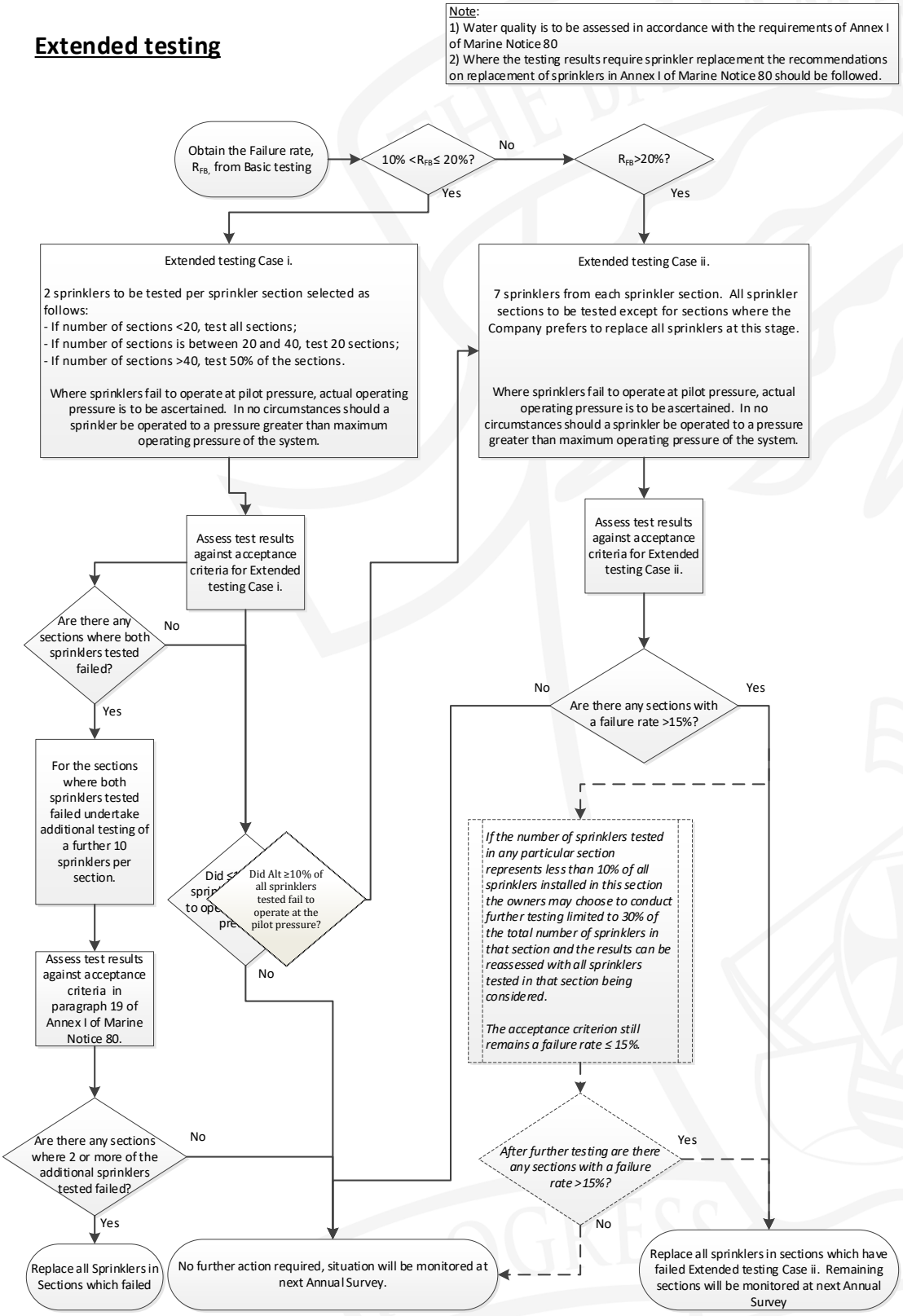
38. Where extensive sprinkler replacement is required, the RO shall submit a replacement plan to the BMA in accordance with paragraph 6.4.3 of BMA Marine Notice 80.

Annex II – Test Procedure Flow Charts

Initial and Basic Testing



Extended testing



Revision History

Version	Description of Revision
1.0	First Issue
1.1	Periodic review. References to Bulletin 8 in paras. 6.2.2 and 6.5.1 updated to MN08, references to Bulletin 150 in Annex II updated to MN 80
1.2	Experience gained in testing is used to enhance section 5 with new paragraphs 5.5 to 5.12; editorial changes to section 6.