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adopted on 6 November 1991

TESTING OF LIFE-SAVING APPLIANCES

THE ASSEMBLY,

RECALLING Article 15(j) of the Convention on the International Maritime Organization concerning the functions of the Assembly in relation to regulations and guidelines concerning maritime safety,

RECALLING ALSO resolution A.521(13) - Recommendation on Testing of Life-saving Appliances,

CONSIDERING resolution MSC.6(48) whereby the Maritime Safety Committee adopted a revised chapter III of the International Convention for the Safety of Life at Sea (SOLAS), 1974,

BEARING IN MIND that life-saving appliances should be adequately tested to ensure that they meet the requirements of chapter III of the 1974 SOLAS Convention, as amended,

DESIRING to facilitate reciprocal recognition by Contracting Governments to SOLAS 1974 of approved life-saving appliances by ensuring that they meet established safety standards and have demonstrated their ability to function satisfactorily by passing appropriate tests,

HAVING CONSIDERED the recommendation made by the Maritime Safety Committee at its fifty-ninth session,

1. ADOPTS the Recommendation on Testing of Life-Saving Appliances, set out in the annex to the present resolution;

2. RECOMMENDS Governments to ensure that life-saving appliances are subjected to the tests recommended in the annex to this resolution or to such tests as the Administration is satisfied are substantially equivalent to those recommended;

3. AUTHORIZES the Maritime Safety Committee to keep this Recommendation under review and to adopt, when appropriate, amendments thereto;

4. REVOKES resolution A.521(13).

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ANNEX

RECOMMENDATION ON TESTING OF LIFE-SAVING APPLIANCES

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INTRODUCTION

The tests in this Recommendation have been developed on the basis of the requirements of chapter III of the International Convention for the Safety of Life at Sea, 1974, as amended.

Life-saving appliances which are tested on or after 1 May 1992 should meet the applicable requirements of this Recommendation or substantially equivalent ones, as may be specified by the Administration.

Life-saving appliances which are tested before 1 May 1992 may meet the applicable requirements of the Recommendation on Testing of Life-saving Appliances adopted by resolution A.521(13) or substantially equivalent ones, as may be specified by the Administration.

Tests for requirements referred to in chapter III, as amended, which are not included in this Recommendation, should be to the satisfaction of the Administration.

It should be verified that life-saving appliances not covered by tests referred to in this Recommendation meet the applicable requirements of regulations 30 to 50 of chapter III of the International Convention for the Safety of Life at Sea, 1974, as amended.

PART 1

PROTOTYPE TESTS FOR LIFE-SAVING APPLIANCES

1 LIFEBUOYS

1.1 Lifebuoys specification

It should be established by measurement, weighing and inspection that:

.1 the lifebuoy has an outer diameter of not more than 800 mm and an inner diameter of not less than 400 mm;

.2 the lifebuoy has a mass of not less than 2.5 kg;

.3 if it is intended to operate the quick-release arrangement provided for a self-activated smoke signal and self-igniting light, the lifebuoy has a mass sufficient to operate such quick-release arrangement or 4 kg, whichever is greater (see 1.8); and

.4 the lifebuoy is fitted with a grabline of not less than 9.5 mm in diameter and of not less than four times the outside diameter of the body of the buoy in length and secured in four equal loops.

1.2 Temperature cycling test

The following test should be carried out on two lifebuoys.

1.2.1 The lifebuoys should be alternately subjected to surrounding temperatures of -30°C and +65°C. These alternating cycles need not follow

immediately after each other and the following procedure, repeated for a total of 10 cycles, is acceptable:

.1 an 8 h cycle at +65°C to be completed in one day; and

.2 the specimens removed from the warm chamber that same day and left exposed under ordinary room conditions until the next day;

.3 an 8 h cycle at -30°C to be completed the next day; and

.4 the specimens removed from the cold chamber that same day and left exposed under ordinary room conditions until the next day.

1.2.2 The lifebuoys should show no sign of loss of rigidity under high temperatures and, after the tests, should show no sign of damage such as shrinking, cracking, swelling, dissolution or change of mechanical qualities.

1.3 Drop test

The two lifebuoys should be dropped into the water from the height at which they are intended to be stowed on ships in their lightest seagoing condition, or 30 m, whichever is the greater, without suffering damage. In addition, one lifebuoy should be dropped three times from a height of 2 m on to a concrete floor.

1.4 Test for oil resistance

One of the lifebuoys should be immersed horizontally for a period of 24 h under a 100 mm head of diesel oil at normal room temperature. After this test the lifebuoy should show no sign of damage such as shrinking, cracking, swelling, dissolution or change of mechanical qualities.

1.5 Fire test

The other lifebuoy should be subjected to a fire test. A test pan 30 x 35 x 6 cm should be placed in an essentially draught-free area. Water should be put in the bottom of the test pan to a depth of 1 cm followed by enough petrol to make a minimum total depth of 4 cm. The petrol should then be ignited and allowed to burn freely for 30 s. The lifebuoy should then be moved through flames in an upright, forward, free-hanging position, with the bottom of the lifebuoy 25 cm above the top edge of the test pan so that the duration of exposure to the flames is 2 s. The lifebuoy should not sustain burning or continue melting after being removed from the flames.

1.6 Flotation test

The two lifebuoys subjected to the above tests should be floated in fresh water with not less than 14.5 kg of iron suspended from each of them and should remain floating for a period of 24 h.

1.7 Strength test

A lifebuoy body should be suspended by a 50 mm wide strap. A similar strap should be passed around the opposite side of the body with a 90 kg mass suspended from it. After 30 min, the lifebuoy body should be examined. There should be no breaks, cracks or permanent deformation.

1.8 Test for operation with a light and smoke signal

A lifebuoy intended for quick release with a light and smoke signal should be given this test. The lifebuoy should be arranged in a manner simulating its installation on a ship for release from the navigating bridge. A lifebuoy light and smoke signal should be attached to the lifebuoy in the manner recommended by the manufacturers. The lifebuoy should be released and should activate both the light and the smoke signal.

1.9 Lifebuoy self-activating smoke signal tests

1.9.1 Nine self-activating smoke signals should be subjected to temperature cycling as prescribed in 1.2.1.

1.9.2 The first three smoke signals should be taken from a stowage temperature of -30°C and be activated and operated in seawater at a temperature of -1°C and the next three should be taken from a stowage temperature of +65°C and be operated in seawater at a temperature of +30°C. After the smoke signals have been emitting smoke for 7 min the smoke-emitting ends of the smoke signals should be immersed to a depth of 25 mm for 10 s. On being released the smoke signals should continue operating for the remainder of the required emitting time. The signals should not ignite explosively or in a manner dangerous to persons close by.

1.9.3 The last three smoke signals attached by a line to a lifebuoy should undergo the drop test into water prescribed in 1.3. The lifebuoy should be dropped from a quick-release fitting. The smoke signals should not be damaged and should function for a period of at least 15 min.

1.9.4 Smoke signals should also be subjected to the tests and examinations prescribed in 4.2.2, 4.2.3, 4.2.4, 4.3.1, 4.3.3, 4.4.2, 4.5.5, 4.5.6, 4.8.2 and 4.8.3.

1.9.5 A smoke signal should be tested in waves at least 300 mm high. The signal should function effectively and for the minimum time required.

2 LIFEJACKETS

2.1 Temperature cycling test

A lifejacket should be subjected to the temperature cycling as prescribed in 1.2.1 and should then be externally examined. If the buoyancy material has not been subjected to the tests prescribed in 2.7, the lifejacket should also be examined internally. The lifejacket materials should show no sign of damage such as shrinking, cracking, swelling, dissolution or change of mechanical qualities.

2.2 Buoyancy test

The buoyancy of the lifejacket should be measured before and after 24 h complete submersion to just below the surface in fresh water. The difference between the initial buoyancy and the final buoyancy should not exceed 5% of the initial buoyancy.

2.3 Fire test

A lifejacket should be subjected to the fire test prescribed in 1.5. The lifejacket should not sustain burning or continue melting after being removed from the flames.

2.4 Test for oil resistance

2.4.1 The lifejacket should be tested for oil resistance as prescribed in 1.4.

2.4.2 If the buoyancy material has not been subjected to the tests prescribed in 2.7, the lifejacket should also be examined internally and the effect determined. The material must show no sign of damage such as shrinking, cracking, swelling, dissolution or change of mechanical qualities.

2.5 Tests of materials for cover, tapes and seams

The materials used for the cover, tapes, seams and additional equipment should be tested to the satisfaction of the Administration to establish that they are rot-proof, colour-fast and resistant to deterioration from exposure to sunlight and that they are not unduly affected by seawater, oil or fungal attack.

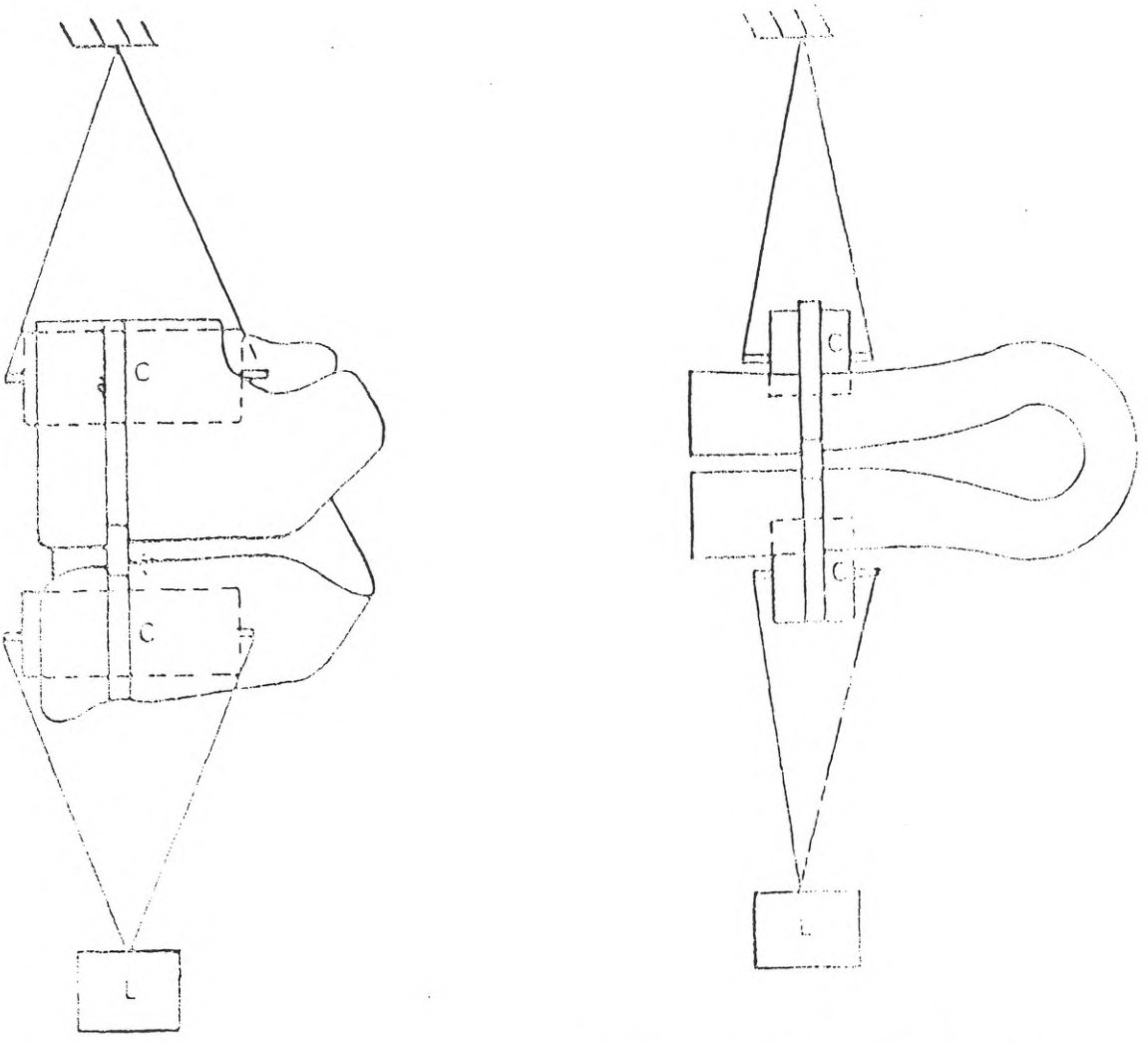
2.6 Strength tests

Body or lifting loop strength tests

2.6.1 The lifejacket should be immersed in water for a period of 2 min. It should then be removed from the water and closed in the same manner as when it is worn by a person. A force of not less than 3,200 N (2,400 N in the case of a child-size lifejacket) should be applied for 30 min to the part of the lifejacket that secures it to the body of the wearer (see figure 1) or to the lifting loop of the lifejacket. The lifejacket should not be damaged as a result of this test.

Shoulder strength test

2.6.2 The lifejacket should be immersed in water for a period of 2 min. It should then be removed from the water and closed in the same manner as when it is worn by a person. A force of not less than 900 N (700 N in the case of a child-size lifejacket) should be applied for 30 min to the shoulder section of the lifejacket (see figure 2). The lifejacket should not be damaged as a result of this test.



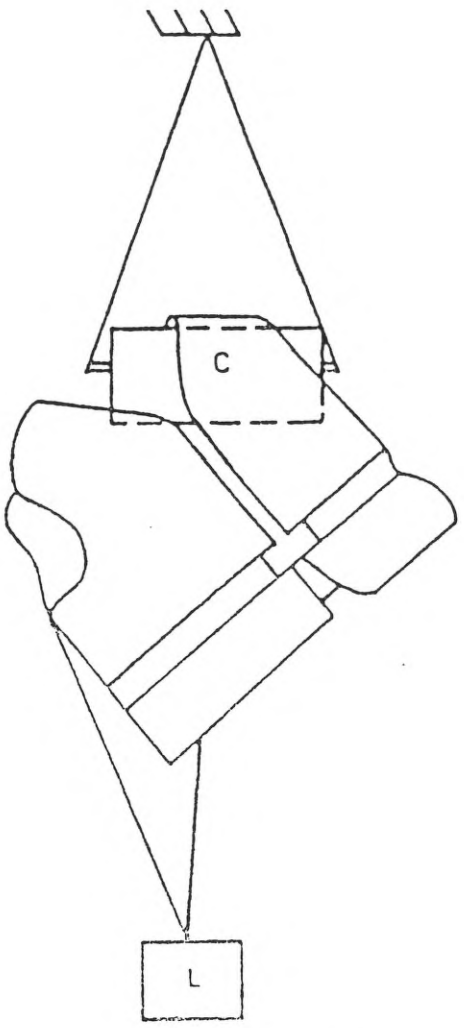
Vest-type lifejacket

Yoke or over-the-head type lifejacket

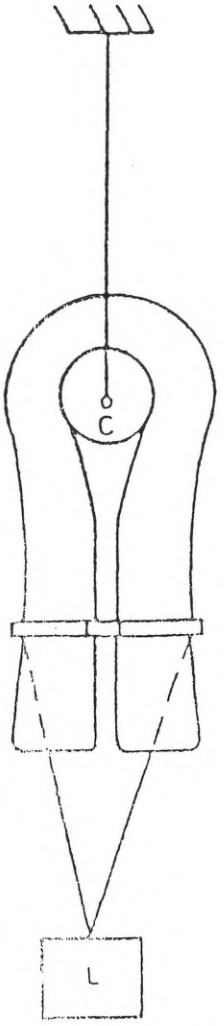
C – Cylinder
125 mm diameter for adult sizes
50 mm diameter for child sizes

L – Test load

Figure 1 - Body strength test arrangement for lifejackets



Vest-type lifejacket



Yoke-type lifejacket

C – Cylinder
125 mm diameter for adult sizes
50 mm diameter for child sizes

L – Test load

Figure 2 - Shoulder strength test arrangement for lifejackets

2.7 Additional tests for lifejacket buoyancy material other than cork or kapok

The following tests should be carried out on eight specimens of lifejacket buoyancy materials other than cork or kapok.

Test for stability under temperature cycling

2.7.1 Six specimens should be alternately subjected for 8 h to surrounding temperatures of -30°C and +65°C. These alternating cycles need not follow immediately after each other and the following procedure, repeated for 10 cycles, is acceptable:

.1 an 8 h cycle at +65°C to be completed in one day; and

.2 the specimens removed from the warm chamber that same day and left exposed under ordinary room conditions until the next day;

.3 an 8 h cycle at -30°C to be completed the next day; and

.4 the specimens removed from the cold chamber that same day and left exposed under ordinary room conditions until the next day.

2.7.2 The dimensions of the specimens should be recorded at the end of the 10 cycle period. The specimens should be carefully examined and should not show any sign of external change of structure or of mechanical qualities.

2.7.3 Two of the specimens should be cut open and should not show any sign of internal change of structure.

2.7.4 Four of the specimens should be used for water absorption tests, two of which should be so tested after they have also been subjected to the diesel oil test as prescribed in 1.4.

Tests for water absorption

2.7.5 The tests should be carried out in fresh water and the specimens should be immersed for a period of seven days under a 1.25 m head of water.

2.7.6 The tests should be carried out:

.1 on two specimens as supplied;

.2 on two specimens which have been subjected to the temperature cycling as prescribed in 2.7.1; and

.3 on two specimens which have been subjected to the temperature cycling as prescribed in 2.7.1 followed by the diesel oil test as prescribed in 2.4.

2.7.7 The specimens should be at least 300 mm square and be of the same thickness as used in the lifejacket. Alternatively, the entire lifejacket may be subjected to the test. The dimensions should be recorded at the beginning and end of these tests.

2.7.8 The results should state the mass in kilograms which each specimen could support out of the water after one and seven days immersion (the selection of a test method suitable for obtaining this result directly or indirectly is left to the discretion of the testing authority). The reduction of buoyancy should not exceed 16% for specimens which have been exposed to the diesel oil test and must not exceed 10% for all other specimens. The specimens should show no sign of damage such as shrinking, cracking, swelling, dissolution or change of mechanical qualities.

2.8 Donning test

2.8.1 As lifejackets will be used by uninitiated persons, often in adverse conditions, it is essential that risk of incorrect donning be minimized. Ties and fastenings necessary for proper performance should be few and simple. Lifejackets should readily fit various sizes of adults, both lightly and heavily clad. Lifejackets should be capable of being worn inside-out, or clearly in only one way.

Test subjects

2.8.2 Persons unfamiliar with the use of lifejackets should be selected to perform donning tests. The individuals chosen should include large and small able-bodied persons, both male and female, in the high, medium and low weight range. At least six test subjects should be used.

Clothing

2.8.3 Each test subject should be tested wearing normal clothing. The test should be repeated with the test subject wearing heavy-weather clothing.

Test

2.8.4 After demonstration, the test subjects should correctly don lifejackets within a period of 1 min, without assistance.

Assessment

2.8.5 The observer should note:

.1 ease and speed of donning; and

.2 proper fit and adjustment.

2.9 Water performance tests

2.9.1 This portion of the test is intended to determine the ability of the lifejacket to assist a helpless person or one in an exhausted or unconscious state and to show that the lifejacket does not unduly restrict movement. All tests should be carried out in fresh water under still conditions.

Test subjects

2.9.2 The individuals chosen should include large and small able-bodied persons, both male and female, in the high, medium and low weight range. Only good swimmers should be used, since the ability to relax in the water is rarely otherwise obtained. At least six test subjects should be used.

Clothing

2.9.3 Subjects should wear only swimming costumes.

Preparation for water performance tests

2.9.4 The test subjects should be made familiar with each of the tests set out below, particularly the requirement regarding relaxing and exhaling in the face-down position. The test subject should don the lifejacket, unassisted, using only the instructions provided by the manufacturer. The observer should note the points prescribed in 2.8.5.

Righting tests

2.9.5 The test subject should swim at least three gentle strokes (breast stroke) and then with minimum headway relax, with the head down and the lungs partially filled, simulating a state of utter exhaustion. The period of time should be recorded starting from the completion of the last stroke until the mouth of the test subject comes clear of the water. The above test should be repeated after the test subject has exhaled. The time should again be ascertained as above. The freeboard from the water surface to the mouth should be recorded with the test subject at rest.

Drop test

2.9.6 Without readjusting the lifejacket, the test subject should jump vertically into the water, feet first, from a height of at least 4.5 m. When jumping into the water, the test subject should be allowed to hold on to the lifejacket during water entry to avoid possible injury. The freeboard to the mouth should be recorded after the test subject comes to rest.

Assessment

2.9.7 After each of the water tests described above, the test subject should come to rest with the mouth clear of the water by at least 120 mm. The average of all subjects' trunk angles should be at least 30° back of vertical, and each individual subject's angle should be at least 20° back of vertical. The average of all subjects' faceplane (head) angles should be at least 40° above horizontal, and each individual subject's angle should be at least 30° above horizontal. In the righting test, the mouth should be clear of the water in not more than 5 s. The lifejacket should not become dislodged or cause harm to the test subject.

2.9.8 When evaluating the results of a test in accordance with 2.9.5, 2.9.7 and 2.9.8, the Administration may, in exceptional circumstances, disregard the results of a test on a subject if the results show a very slight deviation from the specified criteria, provided the Administration is satisfied that the deviation can be attributed to the unusual size and stature characteristics of the test subject and the results of tests on other subjects, chosen in accordance with 2.9.2, show the satisfactory performance of the lifejacket.

Swimming and water emergence test

2.9.9 All test subjects, without wearing the lifejacket, should attempt to swim 25 m and board a liferaft or a rigid platform with its surface 300 mm above the water surface. All test subjects who successfully complete this task should perform it again wearing the lifejacket. At least two thirds of the test subjects who can accomplish the task without the lifejacket should also be able to perform it with the lifejacket.

2.10 Children's lifejacket tests

As far as possible, similar tests should be applied for approval of lifejackets suitable for children.

2.10.1 When conducting water performance tests under 2.9, child-size lifejackets should meet the following requirements for their critical flotation stability characteristics. The range of sizes for child-size lifejackets should be considered based on the test results. Devices should be sized by height or by height and weight.

2.10.2 Test subjects should be selected to fully represent the range of sizes for which the device is to be approved. Devices for smaller children should be tested on children as small as approximately 760 mm tall and 9 kg mass. At least six test subjects should be used for each 380 mm and 16 kg of size range:

.1 Turning time. Each individual subject must turn face-up in not more than 5 s.

.2 Freeboard. The combined results for clearance of the mouth above the water for all subjects should average at least 90 mm; each individual subject under 1,270 mm and 23 kg should have at least 50 mm clearance, and each individual subject over 1,270 mm and 23 kg should have at least 75 mm clearance.

.3 Trunk angle. The average of all subjects' results should be at least 40° back of vertical, and each individual subject's result should be at least 20° back of vertical.

.4 Faceplane (head) angle. The average of all subjects' results should be at least 35° above horizontal, and each individual subject's result should be at least 20° above horizontal.

.5 Mobility. Mobility of the subject both in and out of the water should be given consideration in determining the acceptability of a device for approval.

2.11 Tests for inflatable lifejackets

2.11.1 Two inflatable lifejackets should be subjected to the test in paragraph 2.1 in the uninflated condition. One should then be inflated using the automatic inflation system and the other should be inflated manually. Each of these lifejackets should then be subjected to the tests in 2.2 to 2.6. For the fire test one lifejacket should be inflated and one uninflated. A lifejacket that has been inflated automatically with one compartment uninflated should be subjected to the test in paragraph 2.2 and the test repeated as many times as necessary to perform the test once with each compartment in the uninflated condition.

2.11.2 The test in 2.8 should be conducted using lifejackets both in the inflated and uninflated conditions.

2.11.3 The tests in 2.9 should be conducted using lifejackets that have been inflated both automatically and manually, and also with one of the compartments uninflated. The tests with one of the compartments uninflated should be repeated as many times as necessary to perform the test once with each compartment in the uninflated condition.

3 IMMERSION SUITS AND THERMAL PROTECTIVE AIDS

3.1 Tests common to non-insulated and insulated immersion suits

Test subjects

3.1.1 For these tests a variety of able-bodied persons, both male and female, in the large, medium and small size range should be selected.

Tests with a lifejacket

3.1.2 If the immersion suit is to be worn in conjunction with a lifejacket, the lifejacket should be worn over the immersion suit for the tests prescribed in 3.1.3 to 3.1.12 inclusive.

Donning test

3.1.3 Following a demonstration, each test subject should be able to unpack, don and secure the immersion suit over their test clothing without assistance in less than 2 min. This time should include the time to don any associated clothing, and a lifejacket, if such is to be worn in conjunction with the immersion suit, and the test subjects should be able to don such lifejacket without assistance.

3.1.4 The immersion suit should be capable of being donned in a reasonable time at an ambient temperature as low as -30°C. Before the donning test the packed immersion suit should be kept in a refrigerated chamber at a temperature of -30°C for 24 h.

Ergonomic test

3.1.5 When wearing the immersion suit, the test subjects should be able to climb up and down a vertical ladder of at least 5 m in length and demonstrate no restriction in walking, bending over or arm movement. The test subjects should be able to pick up a pencil and write.

Field of vision test

3.1.6 With the heads of the seated test subjects in a fixed position, the lateral fields of vision should be at least 120° when wearing the immersion suit.

Flotation test

3.1.7 When wearing the immersion suit, the test subjects should float face-up with their mouths clear of the water by at least 120 mm and be stable in that position. The freeboard should be measured from the water surface to the nose and mouth with the test subject at rest.

Righting test

3.1.8 Except where it has been demonstrated that the immersion suit will right the test subjects within 5 s, the test subjects should each demonstrate that they can turn themselves from a face-down to a face-up position in not more than 5 s.

Water ingress and jump test

3.1.9 Following a jump by each test subject into water from a height sufficient to totally immerse the body, the ingress of water into the immersion suit should not exceed a mass of 500 g. This may be determined from the difference in the combined mass of the test subject and the immersion suit (pre-wetted), as measured prior to the jump and immediately after the jump. Weighings should be performed on a machine accurate to ±100 g.

3.1.10 The immersion suit should not be damaged or dislodged in any way following a jump from a height of 4.5 m vertically into the water.

Leak test

3.1.11 The ingress of water into the pre-wetted immersion suit should not exceed a mass of 200 g following a period of flotation in calm water of 1 h. The mass of water ingress should be measured by weighing the test subject and the immersion suit in accordance with the method prescribed in 3.1.9.

Swimming and water emergence test

3.1.12 All test subjects, each wearing a lifejacket but not the immersion suit, should attempt to swim 25 m and board a liferaft or a rigid platform with its surface 300 mm above the water surface. Test subjects who successfully complete this task should also perform it wearing the immersion suit.

Tests for oil resistance

3.1.13. After all its apertures have been sealed, an immersion suit should be immersed under a 100 mm head of diesel oil for 24 h. The surface oil should then be wiped off and the immersion suit subjected to the test prescribed in 3.1.11. The ingress of water should not exceed a mass of 200 g.

3.1.14 In lieu of the test for oil resistance prescribed in 3.1.13, either of the following tests may be conducted:

.1 After all apertures have been sealed, the suit should be immersed under a 100 mm head of diesel oil for a period of 24 h at normal room temperature, if necessary using weights to keep the suit submerged.

Any surface oil should then be wiped off and the suit turned inside out. The suit should then be laid on a table suitable for collecting and draining off any leakage and be supported at the neck aperture by a suitably designed hanger. The suit should then be filled with water to neck level which should be 300 mm above the table.

The suit should be left in this position for 1 h and the leakage collected and weighed. The leakage should not exceed a mass of 200 g.

.2 Representative samples of the exterior fabric and seams should be immersed under a 100 mm head of diesel oil for 24 h. After removal from the oil, samples should be wiped off before being subjected to a hydrostatic test of a 1 m water head and a tensile seam strength of 150 N.

Fire test

3.1.15 An immersion suit should be subjected to the fire test as prescribed in paragraph 1.5. If necessary, the immersion suit should be draped over a hanger to ensure the whole immersion suit is enveloped in the flames. The immersion suit should not sustain burning or continue melting after being removed from the flames.

Temperature cycling test

3.1.16 An immersion suit should be subjected to the temperature cycling as prescribed in 1.2.1 and should show no sign of damage such as shrinking, cracking, swelling, dissolution or change of mechanical qualities.

Buoyancy test

3.1.17 A buoyancy test, as prescribed in 2.2, should be carried out to establish that the buoyancy of an immersion suit designed to be worn without a lifejacket is not reduced by more than 5% after 24 h submersion in fresh water.

Strength test

3.1.18 The immersion suit should be subjected to the body strength tests prescribed in 2.6.1. The immersion suit may be cut if necessary to accommodate the test device.

3.2 Specific tests for non-insulated immersion suits

Test clothing

3.2.1 The test subjects should wear a standard range of clothing consisting of:

.1 underwear (short sleeved, short legged);

.2 shirt (long sleeved);

.3 trousers (not woollen); and

.4 woollen socks.

3.2.2 In addition, for the thermal protective test prescribed in 3.2.3 and 3.2.4, the test subject should wear two woollen pullovers.

Test for thermal protective qualities

3.2.3 Following a jump into the water from a height of 4.5 m and a 1 h period of immersion, with the hands gloved, in circulating calm water at +5°C, each test subject's body core temperature should not fall more than 2°C below the normal level of the subject's temperature. Testing should be stopped

if the skin temperature of the hand, foot and lumbar region should fall below 10°C. If the immersion suit is to be worn in conjunction with a lifejacket, the lifejacket should be worn during the thermal protective test.

3.2.4 Immediately on leaving the water after completion of the test prescribed in 3.2.3, the test subject should be able to pick up a pencil and write.

3.3 Specific tests for insulated immersion suits

Test clothing

3.3.1 The test subjects should wear the standard range of clothing prescribed in 3.2.1 and a lifejacket if the immersion suit is to be worn in conjunction with a lifejacket.

Test for thermal protective qualities

3.3.2 Following a jump into the water from a height of 4.5 m, the immersion suit should provide sufficient thermal protection to ensure that when subjected to a 6 h period of immersion, with the hands gloved, in circulating calm water at between 0° and +2°C, each test subject's body core temperature should not fall more than 2°C below the normal level of the test subject's temperature. Testing should be stopped if the skin temperature of the hand, foot and lumbar region should fall below 10°C.

3.3.3 The immersion suit should provide sufficient thermal protection to ensure that immediately on leaving the water after a 1 h period of immersion, with hands gloved, in circulating calm water at +5°C, each test subject can pick up a pencil and write. Alternatively, at the manufacturer's option, the ability to pick up a pencil and write may be demonstrated immediately on leaving the water after completion of the test prescribed in 3.3.2.

3.4 Thermal protective aids for survival craft

Fabric test

3.4.1 It should be demonstrated that the fabric from which the thermal protective aid is constructed can maintain its watertight integrity when supporting a column of water 2 m high.

3.4.2 It should be demonstrated by test that the fabric has a thermal conductivity of not more than 0.25 W/(m.K).

Temperature cycling test

3.4.3 A thermal protective aid should be subjected to temperature cycling as prescribed in 1.2.1 and should show no sign of damage such as shrinking, cracking, swelling, dissolution or change of mechanical qualities.

Test subjects

3.4.4 For these tests a group of at least six test subjects of different ages, both male and female in the large, medium and small size range should be selected.

Test clothing

3.4.5 The test clothing worn by the test subjects should be as prescribed in 3.2.1 and 3.2.2.

Donning test

3.4.6 Following a demonstration, the test subjects should be able to unpack and don the thermal protective aid over a lifejacket when seated in a survival craft.

3.4.7 The thermal protective aid should be capable of being unpacked and donned at an ambient temperature of -30°C. Before the donning test the thermal protective aid should be kept in a refrigerated chamber at a temperature of -30°C for 24 h.

Discarding test

3.4.8 If the thermal protective aid impairs the ability of the test subjects to swim, it should be demonstrated that it can be discarded by the test subjects, when immersed in water, in not more than 2 min.

Test for oil resistance

3.4.9 After all its apertures have been sealed a thermal protective aid should be immersed under a 100 mm head of diesel oil for 24 h. The surface oil should then be wiped off and it should be established that the thermal conductivity is not more than 0.25 W/(m.K).

4 PYROTECHNICS - ROCKET PARACHUTE FLARES, HAND FLARES AND BUOYANT SMOKE SIGNALS

4.1 General

A minimum of three specimens of each type of pyrotechnic should be subjected to each individual test. All three specimens should pass each individual test.

4.2 Temperature tests

Three specimens of each type of pyrotechnic should be subjected to:

.1 temperature cycling as prescribed in 1.2.1 and then function effectively at ambient temperature;

.2 a temperature of -30°C for at least 48 h and then function effectively at that temperature;

.3 a temperature of +65°C for at least 48 h and then function effectively at that temperature;

.4 a temperature of +65°C and 90% relative humidity for at least 96 h, followed by ten days at 20°C to 25°C at 65% relative humidity and then function effectively.

4.3 Water and corrosion resistance test

Nine rocket parachute flares, nine hand flares and nine buoyant smoke signals should function effectively after being subjected to the following tests (three specimens to each test):

.1 immersed horizontally for 24 h under 1 m of water;

.2 immersed in the ready-to-fire condition for 5 min under 10 cm of water;

.3 subjected to a salt spray (5% natrium chloride solution) at a temperature of +35 ± 3°C for at least 100 h.

4.4 Handling safety test

Three specimens of each type of pyrotechnic should:

.1 be dropped in turn end-on and horizontally from a height of 2 m on to a steel plate about 6 mm thick cemented on to a concrete floor. It should remain in a safe condition after this test and should subsequently be operated and function effectively; and

.2 be activated in accordance with the manufacturer's operating instructions by an operator wearing an insulated buoyant immersion suit or the gloves taken from an insulated buoyant immersion suit, to establish that it can be operated effectively without injury to the operator, or any person in close proximity, during firing or burning.

4.5 Safety inspection

It should be established by visual inspection that each type of pyrotechnic:

.1 is indelibly marked with clear and precise instructions on how it should be operated and that the danger end can be identified by day or night;

.2 can, if hand operated, be operated from the bottom (safe end) or that it contains an operational safety delay of 2 s;

.3 has, in the case of a rocket parachute flare and hand flare, an integral means of ignition;

.4 has a simple means of ignition which requires the minimum of preparation and can be readily operated in adverse conditions without external aid and with wet, cold or gloved hands;

.5 does not depend on adhesive tapes or plastic envelopes for its water-resistant properties; and

.6 can be indelibly marked with means for determining its age.

4.6 Rocket parachute flares test

4.6.1 Three rockets should be fired vertically. After firing it should be established by means of accurate measuring instruments that the parachute flare is ejected at a height of not less than 300 m. The height at which the flare burns out and the burning period should also be measured. It should be established from these measurements that the rate of descent is not more than 5 m/s and the burning period is not less than 40 s.

4.6.2 Laboratory testing of the flare material should establish that it will burn uniformly with an average luminous intensity of not less than 30,000 cd and that the colour of the flame is a vivid red as defined by section 11 of the publication "Color; Universal Language and Dictionary of Names".*

4.6.3 Three rockets should function efficiently when tested by firing at an angle of 45° to the horizontal.

4.6.4 If the rocket is hand-held when operated, it should be demonstrated that its recoil is minimal.

4.7 Hand flares test

4.7.1 Three flares should be activated and should burn for a period of not less than 1 min. After burning for 30 s each flare should be immersed under 100 mm of water for a period of 10 s and should continue burning for at least a further 20 s.

4.7.2 Laboratory testing of the flare material should establish that it will burn with an average luminous intensity of at least 15,000 cd and that the colour of the flame is a vivid red as defined in section 11 of the publication "Color; Universal Language and Dictionary of Names".*

4.7.3 Three flares should be activated 1.2 m above a test pan 1 m square containing 2 ℓ of heptane floating on a layer of water. The test should be conducted at an ambient temperature of +20°C to +25°C. The flare should be allowed to burn completely and the heptane should not be ignited by the flare or material from the flare.

4.8 Buoyant smoke signals test

4.8.1 Following temperature cycling as prescribed in 1.2.1, three smoke signals should be taken from a stowage temperature of -30°C, be activated and should then operate in seawater at a temperature of -1°C. The next three smoke signals should be taken from a stowage temperature +65°C, be activated and should then operate in seawater at a temperature of +30°C. After a further three smoke signals have been emitting smoke for 1 min, they should be fully submerged for a period of not less than 10 s and should continue emitting smoke during and after submersion and demonstrate a total period of smoke emission of not less than 3 min.

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* Special Publication 440, National Bureau of Standards, Washington, D.C. 20402, United States of America.

4.8.2 Three smoke signals should function in water covered by a 2 mm layer of heptane without igniting the heptane.

4.8.3 Laboratory testing of the smoke signal should establish that at least 70%(*) obscuration throughout the minimum emission time is attained when the smoke is drawn through a 19 cm diameter duct by a fan capable of producing an entrance air flow of 18.4 m^3/min. The colour of the smoke should be orange as defined by sections 34, 48, 49 or 50 of the publication "Color; Universal Language and Dictionary of Names".*

4.8.4 A smoke signal should be tested in waves at least 300 mm high. The signal should function effectively for not less than 3 min.

5 LIFERAFTS - RIGID AND INFLATABLE

5.1 Drop test

5.1.1 Each type of liferaft should be subjected to a minimum of two drop tests. Where the liferaft in its operational condition is packed in a container or valise, one such test should be carried out with the liferaft packed in each type of container or valise in which the manufacturer proposes to market it.

5.1.2 The liferaft, in the operationally packed condition, should be suspended and then dropped from a height of 18 m into the water. If it is to be stowed at a height greater than 18 m, it should be dropped from the height at which it is to be stowed. The free end of the painter should be attached to the point of suspension so that it pays out as the liferaft drops, thus simulating actual conditions.

5.1.3 The liferaft should be left floating for 30 min:

.1 in the case of a rigid liferaft it should be lifted from the water to permit thorough inspection of the liferaft, the contents of the equipment container and, where applicable, the container or valise; and

.2 in the case of an inflatable liferaft, it should then be inflated. The liferaft should inflate upright and in the time prescribed in 5.17.3 to 5.17.6. The thorough inspection prescribed in 5.1.3.1 should then be carried out.

5.1.4 Damage to the container or valise, if the liferaft is normally within it when launched, is acceptable provided the Administration is satisfied that it would not be a hazard to the liferaft. Damage to any item of equipment is acceptable subject to the Administration being satisfied that the operational efficiency has not been impaired. Damage to fresh water receptacles may be accepted provided they do not leak. However, for drop tests from heights exceeding 18 m, leakage from up to 5% of the receptacles may be accepted provided that:

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* Special Publication 440, National Bureau of Standards, Washington, D.C. 20402, United States of America.

.1 the equipment list for the inflatable liferaft specifies the carriage of 5% excess water or means of desalination adequate to produce an equivalent amount; or

.2 the water receptacles are contained in a waterproof overwrap.

5.2 Jump test

5.2.1 It should be demonstrated that a person can jump on to the liferaft, with and without the canopy erected, from a height above the floor of at least 4.5 m without damaging the liferaft. The test subject should weigh not less than 75 kg and should be wearing hard bottom shoes with smooth soles and no protruding nails. The number of jumps performed should be equal to the total number of persons for which the liferaft is to be approved.

5.2.2 The jump test may be simulated by dropping a suitable and equivalent mass.

5.2.3 There should be no torn fabric, or damage to seams as a result of the test.

5.3 Weight test

The fully packed liferaft container should be weighed to determine whether its mass exceeds 185 kg. The weight test should be performed on the heaviest variation of the liferaft, considering different containers and equipment packs which may be used. If the mass exceeds 185 kg, the different combinations of containers and equipment packs should be weighed to determine which will and which will not exceed 185 kg.

5.4 Towing test

It should be demonstrated by towing that the fully loaded and equipped liferaft is capable of being satisfactorily towed at speeds of up to 3 knots in calm water. Towing should be by a line attached to the liferaft's towing connection. The sea anchor should be streamed while the liferaft is towed. The liferaft should be towed for a distance of at least 1 km.

5.5 Mooring out tests

The liferaft should be loaded with mass equal to the mass of the total number of persons for which it is to be approved and its equipment and moored in a location at sea or in a seawater harbour. The liferaft should remain afloat in that location for 30 days. In the case of an inflatable liferaft, the pressure may be topped up once a day using the manual pump; however, during any 24 h period the liferaft should retain its shape. The liferaft should not sustain any damage that would impair its performance. After this test, the inflatable liferaft should be subjected to the pressure test prescribed in 5.17.7 and 5.17.8.

5.6 Liferaft painter system test

The rope to be used as a painter should be tensile tested and should have a breaking strain as follows:

.1 10.0 kN for liferafts to carry nine persons or more; and

.2 7.5 kN for any other liferaft.

5.7 Loading and seating test

The freeboard of the liferaft in the light condition, including its full equipment but no personnel, should be recorded. The freeboard of the liferaft should again be recorded when the number of persons for which the liferaft is to be approved, having an average mass of 75 kg, and each wearing a lifejacket, have boarded and are seated. It should be established that all the seated persons have sufficient space and headroom and it should be demonstrated that the various items of equipment can be used within the liferaft in this condition and, in the case of an inflated liferaft, with the floor inflated. The freeboard, when loaded with the mass of the number of persons for which it is to be approved and its equipment, with the liferaft on an even keel and, in the case of an inflatable liferaft, with the floor not inflated, should not be less than 300 mm.

5.8 Boarding test

The boarding test should be carried out in a swimming pool by a team of not more than four persons who should be of mature age and of differing physiques as determined by the Administration. Preferably they should not be strong swimmers. For this test they should be clothed in shirt and trousers or a boiler suit and should wear approved lifejackets suitable for an adult. They must each swim about 100 m before reaching the liferaft for boarding. There must be no rest period between the swim and the boarding attempt. Boarding should be attempted by each person individually with no assistance from other swimmers or persons already in the liferaft. The water should be of a depth sufficient to prevent any external assistance when boarding the liferaft. The arrangements will be considered satisfactory if three of the persons board the liferaft unaided and the fourth boards with the assistance of any of the others.

5.9 Stability test

5.9.1 The number of persons for which the liferaft is to be approved should be accommodated on one side and then at one end and in each case the freeboard should be recorded. Under these conditions the freeboard should be such that there is no danger of the liferaft being swamped. Each freeboard measurement should be taken from the waterline to the top surface of the uppermost main buoyancy tube at its lowest point.

5.9.2 The stability of the liferaft during boarding may be ascertained as follows:

two persons each wearing approved lifejackets should board the empty liferaft. It should then be demonstrated that the two persons in the liferaft can readily assist from the water a third person who is required to feign unconsciousness. The third person must have his back towards the entrance so that he cannot assist the rescuers. It should be demonstrated that the water pockets adequately counteract the upsetting moment on the liferaft and there is no danger of the liferaft capsizing.

5.10 Manoeuvrability test

It should be demonstrated that with the paddles provided, the liferaft is capable of being propelled when fully laden in calm conditions over a distance of at least 25 m.

5.11 Swamp test

It should be demonstrated that if the liferaft is fully swamped, it is capable of supporting the number of persons for which it is to be approved and remains seaworthy. The liferaft should not seriously deform in this condition. The swamped inflatable liferaft should be tested in at least 10 waves at least 0.3 m high. The waves may be produced by the wake of a boat, or by other acceptable means.

5.12 Canopy closure test

To ensure the effectiveness of the canopy closures in preventing water entering the liferaft, the efficiency of the closed entrances should be demonstrated by means of a hose test or by any other equally effective method. The requirement for the hose test is that about 2,300 ℓ of water per minute be directed at and around the entrances through a 63.5 mm hose from a point 3.5 m away and 1.5 m above the level of the buoyancy tubes for a period of 5 min. There should be no significant accumulation of water inside the liferaft.

5.13 Buoyancy of float-free liferafts

It should be demonstrated that the liferafts packed in containers which are float-free have sufficient inherent buoyancy to inflate the liferaft by means of the actuating line in the event of the ship sinking. The combination of equipment and container or valise should be that which produces the maximum packed weight.

5.14 Detailed inspection

A liferaft, complete in all respects and, if an inflatable liferaft, in a fully inflated condition should be subjected to a detailed inspection in the manufacturer's works to ensure that all the Administration's requirements are fulfilled.

5.15 Weak link test

The weak link in the painter system should be tensile tested and should have a breaking strain of 2.2 $\pm$ 0.4 kN.

5.16 Davit-launched liferafts - strength test of lifting components

5.16.1 The breaking strength of the webbing or rope and the attachments to the liferaft used for the lifting bridle should be established by tests on three separate pieces of each different item. The combined strength of the lifting bridle components should be at least six times the mass of the liferaft when loaded with the number of persons for which it is to be approved and its equipment.

Impact test

5.16.2 The liferaft should be loaded with a mass equal to the mass of the number of persons for which it is to be approved and its equipment. With the liferaft in a free hanging position it should be pulled laterally to a position so that when released it will strike a rigid vertical surface at a velocity of 3.5 m/s. The liferaft should then be released to impact against the rigid vertical surface. After this test the liferaft should show no signs of damage which would affect its efficient functioning.

Drop test

5.16.3 The liferaft, loaded as prescribed in 5.16.2, should be suspended from an on-load release at a height of 3 m above the water, be released and allowed to fall freely into the water. The liferaft should then be examined to ensure that no damage has been sustained which would affect its efficient functioning.

Davit-launched liferaft boarding test

5.16.4 A davit-launched liferaft should, in addition to the boarding test prescribed in 5.8, be subjected to the following test. The liferaft, hanging from a launching appliance and bowsed in to the ship's side or simulated ship's side, should be boarded by the number of persons for which it is to be approved of average mass 75 kg. There should be no undue distortion of the liferaft. The bowsing should then be released and the liferaft left hanging for 5 min. It should then be lowered to the sea or floor and unloaded. At least three tests are required in succession, with the hook of the lowering appliance so positioned that its distance from the ship's side is:

.1 half the beam of the liferaft +150 mm;

.2 half the beam of the liferaft; and

.3 half the beam of the liferaft -150 mm.

The boarding, which is intended to simulate actual shipboard conditions, should be timed and the time recorded.

5.17 Additional tests applicable to inflatable liferafts only

Damage test

5.17.1 It should be demonstrated that, in the event of any one of the buoyancy compartments being damaged or failing to inflate, the intact compartment or compartments should support, with positive freeboard over the liferaft's periphery, the number of persons for which the liferaft is to be approved. This can be demonstrated with persons each having a mass of 75 kg and seated in their normal positions or by an equally distributed mass.

Righting test

5.17.2 For this test the liferaft should be inverted so as to simulate inverted inflation.

.1 the inflatable liferaft should be loaded with its heaviest equipment pack. All of the entrances, ports, and other openings in the liferaft canopy should be open in order to allow the infiltration of water into the canopy when capsized;

.2 the canopy of the liferaft should then be completely filled with water, if necessary by partially collapsing the canopy support. If the inflatable liferaft does not self-right, it should be allowed to remain in an inverted position for at least 10 min before righting is attempted;

.3 the righting test should be carried out by the same team of persons required for the boarding test similarly clothed and wearing lifejackets and after completing the swim required in 5.8. At least one of the persons righting the inflatable liferaft should weigh less than 75 kg. Each person should attempt to right the liferaft unaided. The water should be of sufficient depth to give no external assistance to the swimmers when mounting the inverted liferaft;

.4 the righting arrangements will be considered satisfactory if each person rights the liferaft unaided. There should be no damage to the structure of the inflatable liferaft, and the equipment pack should remain secured in its place.

Inflation test

5.17.3 A liferaft, packed in each type of container, should be inflated by pulling the painter and the time recorded:

.1 for it to become boardable, i.e. when buoyancy tubes are inflated to full shape and diameter;

.2 for the cover to be erect; and

.3 for the liferaft to reach its full operational pressure* when tested:

.3.1 at an ambient temperature of between 18°C and 20°C;

.3.2 at a temperature of -30°C; and

.3.3 at a temperature of +65°C.

5.17.4 When inflated in an ambient temperature of between 18°C and 20°C, it should achieve total inflation in not more than 1 min.

5.17.5 For the inflation test at -30°C the packed liferaft should be kept at room temperature for at least 24 h, then placed in a refrigerated chamber at a temperature of -30°C for 24 h prior to inflation by pulling the painter. Under

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* The term "operational pressure" has the same meaning as the term "working pressure"; i.e. the pressure determined by the designed reseat pressure of the relief valves, if fitted.

these conditions the liferaft should reach working pressure in 3 min. Two liferafts should be subject to an inflation test at this temperature. There should be no seam slippage, cracking, or other defect in the liferaft and it should be ready for use after the tests.

5.17.6 For the inflation test at +65°C the packed liferaft should be kept at room temperature for at least 24 h, then placed in a heating chamber at a temperature of +65°C for not less than 7 h prior to inflation by pulling the painter. Under these conditions the gas pressure relief valves must be of sufficient capacity to prevent damage to the liferaft by excess pressure and to prevent the maximum pressure during the inflation from reaching twice the reseat pressure of the release valve. There must be no seam slippage, cracking or other defect in the liferaft.

Pressure test

5.17.7 Each inflatable compartment in the liferaft should be tested to a pressure equal to three times the working pressure. Each pressure relief valve should be made inoperative, compressed air should be used to inflate the inflatable liferaft and the inflation source removed. The test should continue for at least 30 min. The pressure should not decrease by more than 5% as determined without compensating for temperature and atmospheric pressure changes, and there should be no seam slippage, cracking or other defect in the liferaft.

5.17.8 The measurement of pressure drop due to leakage can be started when it has been assumed that compartment rubber material has been completed stretching due to the inflation pressure and stabilized. This test should be conducted after equilibrium condition has been achieved.

Seam strength test

5.17.9 It should be demonstrated that sample seams can withstand a test load equal to the liferaft fabric tensile strength.

Davit-launched inflatable liferafts - strength test

5.17.10 It should be demonstrated by an overload test on the liferaft hanging from its centre support that the bridle system has an adequate factor of safety as follows:

.1 the liferaft should be placed in a temperature of 20 ± 3°C for a period of at least 6 h;

.2 following this period of conditioning, the liferaft should be suspended from its lifting hook or bridle and the buoyancy chambers (not including an inflatable floor) inflated;

.3 when fully inflated and when the relief valves have reseated themselves, all relief valves should be made inoperative;

.4 the liferaft should then be lowered and loaded with a distributed mass equivalent to four times the mass of the number of persons for which it is to be approved and its equipment, the mass of each person being taken as 75 kg;

.5 the liferaft should then be raised and remain suspended for at least 5 min;

.6 the pressure before and after the test after the weight is removed and while it remains suspended, should be recorded; and

.7 any dimensional deflections or distortions of the liferaft should be recorded. During the test and after its completion, the inflatable liferaft should remain suitable for its intended use.

5.17.11 It should be demonstrated, after a period of 6 h in a chamber at a temperature of -30°C, that the liferaft will support a load of 1.1 times the number of persons for which it is to be approved and its equipment with all relief valves operative. The liferaft should be loaded with the test weight in the refrigerated chamber. The floor should not be inflated. The loaded inflatable liferaft should remain suspended for at least 5 min. If the inflatable liferaft must be removed from the chamber in order to suspend it, the inflatable liferaft should be suspended immediately upon removal from the chamber. During the test and after its completion, the inflatable liferaft should remain suitable for its intended use.

5.17.12 The inflatable liferaft should be loaded with a weight equal to the mass of its heaviest equipment pack and the number of persons for which it is to be approved, the mass of each person being taken as 75 kg. Except for the floor which should not be inflated, the inflatable liferaft should be fully inflated with all relief valves operative. A liferaft should be lowered for a distance of at least 4.5 m in continuous contact against a structure erected to represent the side of a ship having a 20° adverse list. During the test and after its completion, the liferaft should not sustain damage or distortion, or assume a position which would render it unsuitable for its intended purpose.

Material tests

5.17.13 The materials used in the construction of inflatable liferafts should be tested for the following characteristics to the satisfaction of the Administration:

.1 tensile strength;

.2 tear strength;

.3 heat resistance;

.4 cold resistance;

.5 heat ageing;

.6 weathering;

.7 gas permeability (except canopy);

.8 water-proofing;

.9 coating adhesion;

.10 oil resistance;

.11 abrasion test; and

.12 seam strength.

6 LIFEBOATS

6.1 Definitions and general conditions

6.1.1 The mass of an average person as used herein shall be taken to be 75 kg.

6.1.2 When weights are placed in the lifeboat to simulate the effects of an occupant sitting in a seat, the centre of gravity of the weight in each seat shall be placed 300 mm above the seat pan along the seat back.

6.2 Lifeboat material tests

Material fire-retardancy test

6.2.1 The hull and canopy material should be flame tested to determine its fire-retarding characteristics by placing a test specimen in a flame. After removal from the flame the burning time and burning distance should be measured and should be to the satisfaction of the Administration.

Lifeboat buoyant material test

6.2.2 When inherent buoyant material is required, the material should be subjected to the tests prescribed in section 2.7 except that in 2.7.6.3 high octane petroleum spirit should be substituted for diesel oil.

6.2.3 In addition to the test in 6.2.2, specimens of the material should be immersed in each of the following for a period of 14 days under a 100 mm head:

.1 two specimens in crude oil;

.2 two specimens in fuel oil;

.3 two specimens in diesel oil;

.4 two specimens in high octane petroleum spirit; and

.5 two specimens in kerosene.

6.2.4 The specimens should be tested as supplied by the manufacturer and at normal room temperature (approximately 18°C).

6.2.5 Two additional specimens, which have already been subjected to the temperature cycling tests, should be tested against high octane petroleum spirit and afterwards subjected to the water absorption test as prescribed in 2.7.5 to 2.7.8.

6.2.6 The dimensions of the specimens should be recorded at the beginning and end of these tests.

6.2.7 The reduction of buoyancy must not exceed 5% and the specimens should show no sign of damage such as shrinking, cracking, swelling, dissolution or change of mechanical qualities.

6.3 Launch test

It should be demonstrated that the fully equipped lifeboat, loaded with a properly distributed mass equal to the mass of the number of persons for which it is to be approved, can be launched from a ship proceeding ahead at a speed of not less than 5 knots in calm water and on an even keel. There should be no damage to the lifeboat or its equipment as a result of this test.

6.4 Lifeboat overload test

Davit-launched lifeboats

6.4.1 The unloaded lifeboat should be placed on blocks or suspended from the lifting hooks and sights should be erected for measuring keel sag. The measurements required in 6.4.4 should then be made.

6.4.2 The lifeboat should then be loaded with properly distributed weights to represent the fully equipped lifeboat loaded with the full complement of persons for which it is to be approved. The measurements required in 6.4.4 should again be made.

6.4.3 Additional weights should then be added so that the suspended load is 25%, 50%, 75% and 100% greater than the weight of the fully equipped and loaded lifeboat. In the case of metal lifeboats, the testing should stop at 25% overload. The weights for the various overload conditions should be distributed in proportion to the loading of the lifeboat in its service condition, but the weights used to represent the persons need not be placed 300 mm above the seatpan. Testing by filling the lifeboat with water should not be accepted as this method of loading does not give the proper distribution of weight. Machinery may be removed in order to avoid damage to it, in which case weights should be added to the lifeboat to compensate for the removal of such machinery. At each incremental overload, the measurements required in 6.4.4 should be made.

6.4.4 The following should be measured and recorded at each condition of load specified in 6.4.1 through 6.4.3:

.1 deflection of keel amidships;

.2 change in length as measured between the top of stem and stern posts;

.3 change in breadth over the gunwale at the quarter length forward, amidships and the quarter length aft; and

.4 change in depth measured from gunwale to keel.

6.4.5 The keel deflection and change in breadth in 6.4.4.1 and 6.4.4.3 should not exceed 1/400th of the lifeboat's length when the lifeboat is subjected to 25% overload; the results at 100% overload, if required by 6.4.3, should be approximately in proportion to those obtained at 25% overload.

6.4.6 The weights should then be removed and the dimensions of the lifeboat checked. No significant residual deflection should result. Any permanent deflection as a result of these tests should be recorded. If the lifeboat is made of GRP, such measurement should be taken after a lapse of time sufficient to permit the GRP to recover its original form (approximately 18 h).

Free-fall lifeboats

6.4.7 It should be demonstrated that the lifeboat has sufficient strength to withstand the forces acting upon it when loaded with a distributed mass equal to the mass of the number of persons for which it is to be approved and its equipment when free-fall launched from a height of 1.3 times the height for which it is to be approved. If the lifeboat is normally ramp-launched, and a ramp is not available, this test may be conducted by dropping the lifeboat vertically with the keel at the same angle that normally occurs during water entry.

6.4.8 After this test the lifeboat should be unloaded, cleaned and carefully examined to detect the position and extent of damage that may have occurred as a result of this test. An operational test should then be conducted in accordance with 6.11.1. After this test the lifeboat should again be unloaded, cleaned, and inspected for possible damage.

6.4.9 This test should be considered successful if the lifeboat passes the operational test to the satisfaction of the Administration and there is no significant damage to it.

6.5 Davit-launched lifeboat impact and drop test

Impact test

6.5.1 The fully equipped lifeboat, including its engine, should be loaded with weights equal to the mass of the number of persons for which the lifeboat is to be approved. The weights should be distributed to represent the normal loading in the lifeboat. Skates or fenders, if required, should be in position. The lifeboat, in a free hanging position, should be pulled laterally to a position so that when released it will strike a fixed rigid vertical surface at a velocity of 3.5 m/s. It should be released to impact against the rigid vertical surface.

6.5.2 In the case of self-righting partially enclosed and totally enclosed lifeboats, the acceleration forces should be measured and evaluated in accordance with 6.18 at different positions within the prototype lifeboat to determine the most severe occupant exposure to acceleration considering the effects of fenders, lifeboat elasticity, and seating arrangement.

Drop test

6.5.3 The fully equipped lifeboat, with its engine, should be loaded with weights equal to the mass of the maximum number of persons for which the lifeboat is to be approved. The weights should be distributed to represent the normal loading condition but need not be placed 300 mm above the seatpan. The lifeboat should then be suspended above the water so that the distance from the lowest point of the lifeboat to the water is 3 m. The lifeboat should then be released so that it falls freely into the water.

6.5.4 The drop test should be conducted with the lifeboat that was used in the impact test.

Operational test after impact and drop test

6.5.5 After the impact and drop tests, the lifeboat should be unloaded, cleaned and carefully examined to detect the position and extent of damage that may have occurred as a result of the tests. An operational test should then be conducted in accordance with 6.11.1.

Acceptability criteria for impact and drop tests

6.5.6 After the tests required in this section, the lifeboat should be unloaded, cleaned, and inspected for possible damage.

6.5.7 The impact and drop tests should be considered successful if:

.1 no damage has been sustained that would affect the lifeboat's efficient functioning;

.2 the damage caused by the impact and drop tests has not increased significantly as a result of the test specified in 6.5.5;

.3 machinery and other equipment has operated to full satisfaction;

.4 no significant ingress of seawater has occurred; and

.5 accelerations measured during the impact and subsequent rebound, if required during the impact test, are in compliance with the criteria of either 6.18.9 to 6.18.12 or 6.18.13 to 6.18.17 when using the emergency limits specified in table 2 or table 3, respectively.

6.6 Free-fall lifeboat free-fall test

Required free-fall tests

6.6.1 A lifeboat designed for free-fall launching should be subjected to test launches conducted from the height at which the lifeboat is intended to be stowed taking into account conditions of unfavourable list and trim, unfavourable locations of the centre of gravity, and extreme conditions of load.

6.6.2 During the free-fall launches required in this section, acceleration forces should be measured and the data evaluated in accordance with 6.18 at different locations in the lifeboat to determine the worst occupant exposure to acceleration taking into consideration the seating arrangement.

6.6.3 The tests required in this section may be conducted with correctly scaled models that are at least 1 m in length. If models are used, sufficient full-scale tests should be conducted to verify the accuracy of the model measurements. As a minimum, the following full-scale tests should be conducted with the ship on an even keel using the same type of launching arrangement as the production lifeboat and from the height for which the lifeboat is to be approved:

.1 lifeboat fully loaded;

.2 lifeboat loaded with its required equipment and minimum launching crew only;

.3 lifeboat loaded with its required equipment and one half of the full complement of persons distributed in the forward half of the seating positions of the lifeboat; and

.4 lifeboat loaded with its required equipment and one half of the full complement of persons seated in the after half of the seating positions of the lifeboat.

Acceptability criteria for free-fall tests

6.6.4 The free-fall tests required in this section should be considered acceptable if:

.1 the acceleration forces are in compliance with the "Training" condition specified in tables 2 and 3 of 6.18 during the launch, free-fall, and subsequent water entry; and

.2 the lifeboat makes positive headway immediately after water entry.

6.7 Lifeboat seating strength test

Davit-launched lifeboats

6.7.1 The seating should be loaded with a mass of 100 kg in each position allocated for a person to sit in the lifeboat. The seating should be able to support this loading without any permanent deformation or damage.

Free-fall lifeboats

6.7.2 The seats experiencing the highest acceleration forces, and those seats which are supported in a manner different from the other seats in the lifeboat, should be loaded with a mass of 100 kg. The load should be arranged in the seat so that both the seatback and the seatpan are affected. The seating should be able to support this load during a free-fall launch from a height of 1.3 times the approved height, without any permanent deformation or damage. This test may be conducted as part of the test in 6.4.7 to 6.4.9.

6.8 Lifeboat seating space test

6.8.1 The lifeboat should be fitted with its engine and its equipment. The number of persons for which the lifeboat is to be approved having an average mass of 75 kg and wearing a lifejacket and any other essential equipment should be able to board the lifeboat and be properly seated within a period of 3 min in the case of a lifeboat intended for a cargo ship and as rapidly as possible in the case of a lifeboat intended for a passenger ship. The lifeboat should then be manoeuvred and all equipment on board tested by an individual to demonstrate that the equipment can be operated without difficulty and without interference with the occupants.

6.8.2 The surfaces on which persons might walk should be visually examined to determine that they have a non-skid finish.

6.9 Lifeboat freeboard and stability tests

Flooded stability test

6.9.1 The lifeboat should be loaded with its equipment. If provision lockers, water tanks and fuel tanks cannot be removed, they should be flooded or filled to the final waterline resulting from the test in 6.9.3. Lifeboats fitted with watertight stowage compartments to accommodate individual drinking water containers should have these containers aboard and placed in the stowage compartments which should be sealed watertight during the flooding tests. Ballast of equivalent weight and density should be substituted for the engine and any other installed equipment that can be damaged by water.

6.9.2 Weights representing persons who would be in the water when the lifeboat is flooded may be omitted. Weights representing persons who would not be in the water when the lifeboat is flooded should be placed in the normal seating positions of such persons.

6.9.3 When loaded as specified in 6.9.1 and 6.9.2, the lifeboat should have positive stability when filled with water to represent flooding which would occur when the lifeboat is holed in any one location below the waterline assuming no loss of buoyancy material and no other damage. Several tests may have to be conducted if holes in different areas would create different flooding conditions.

Freeboard test

6.9.4 The lifeboat with its engine should be loaded with a mass equal to that of all the equipment. One half of the number of persons for which the lifeboat is to be approved should be seated in a proper seating position on one side of the centreline. The freeboard should then be measured on the low side.

6.9.5 This test should be considered successful if the measured freeboard on the low side is not less than 1.5% of the lifeboat's length or 100 mm, whichever is greater.

6.10 Release mechanism test

Davit-launched lifeboats

6.10.1 The lifeboat with its engine fitted should be suspended from the release mechanism just clear of the ground or the water. The lifeboat should be loaded so that the total mass equals 1.1 times the mass of the lifeboat, all its equipment and the number of persons for which the lifeboat is to be approved. The lifeboat should be released simultaneously from each fall to which it is connected without binding or damage to any part of the lifeboat or the release mechanism.

6.10.2 It should be confirmed that the lifeboat will simultaneously release from each fall to which it is connected when fully waterborne in the light condition and in a 10% overload condition.

6.10.3 The release mechanism should be mounted on a tensile strength testing device. The load should be increased to at least six times the working load of the release mechanism without failure of the release mechanism.

6.10.4 It should be demonstrated that the release mechanism can release the fully equipped lifeboat when loaded with weights equal to the mass of the number of persons for which the lifeboat is to be approved, when the lifeboat is being towed at speeds up to 5 knots. In lieu of a waterborne test, this test may be conducted as follows:

.1 A force equal to the force necessary to tow the lifeboat at a speed of 5 knots should be applied to the hook in the lengthwise direction of the boat at an angle of 45° to the vertical. This test should be conducted in the aftward as well as the forward direction, depending upon the design of the release hook;

.2 A force equal to the safe working load of the hook should be applied to the hook in an athwartships direction at an angle of 20° to the vertical. This test should be conducted on both sides;

.3 A force equal to the safe working load of the hook should be applied to the hook in a direction half-way between the positions of tests 1 and 2 and within the ellipse segment formed by 1 and 2. This test should be conducted in four positions.

Free-fall lifeboats

6.10.5 It should be demonstrated that the free-fall release mechanism can operate effectively when loaded with a force equal to at least 200% of the normal load caused by the fully equipped lifeboat when loaded with the number of persons for which it is to be approved.

6.10.6 The release mechanism should be mounted on a tensile strength testing device. The load should be increased to at least six times the working load of the release mechanism without failure of the release mechanism.

6.11 Lifeboat operational test

Operation of engine and fuel consumption test

6.11.1 The lifeboat should be loaded with weights equal to the mass of its equipment and the number of persons for which the lifeboat is to be approved. The engine should be started and the lifeboat manoeuvred for a period of at least 4 h to demonstrate satisfactory operation. It should be demonstrated that the lifeboat can tow a 25-person liferaft loaded with the number of persons for which it is to be approved and its equipment at a speed of 2 knots. The lifeboat should be run at a speed of not less than 6 knots for a period which is sufficient to ascertain the fuel consumption and to establish that the fuel tank has the required capacity.

Cold engine starting test

6.11.2 The engine may be removed from the lifeboat for this test, however, it should be equipped with accessories and the transmission that will be used in the lifeboat. The engine, along with its fuel and coolant, should be placed in a chamber at a temperature of -15°C.

6.11.3 The temperature of the fuel, lubricating oil and cooling fluid (if any) should be measured at the beginning of this test and should not be higher than -15°C. Samples of each fluid at this temperature should be collected in a container for observation.

6.11.4 The engine should be started three times. The first two times, the engine should be allowed to operate long enough to demonstrate that it runs at operating speed. After the first two starts the engine should be allowed to stand until all parts have again reached chamber temperature. After the third start, the engine should be allowed to continue to run for a least 10 min and during this period the transmission should be operated through its gear positions.

Engine-out-of-water test

6.11.5 The engine should be operated for at least 5 min at idling speed under conditions simulating normal storage. The engine should not be damaged as a result of this test.

Submerged engine test

6.11.6 The engine should be operated for a least 5 min while submerged in water to the level of the centreline of the crankshaft with the engine in a horizontal position. The engine should not be damaged as a result of this test.

Compass

6.11.7 It should be determined that the compass performance is satisfactory and that it is not unduly affected by magnetic fittings and equipment in the lifeboat.

6.12 Lifeboat towing and painter release test

Towing test

6.12.1 It should be demonstrated that the fully equipped lifeboat, loaded with a properly distributed mass equal to the mass of the number of persons for which it is to be approved, can be towed at a speed of not less than 5 knots in calm water and on an even keel. There should be no damage to the lifeboat or its equipment as a result of this test.

Davit-launched lifeboat painter release test

6.12.2 It should be demonstrated that the painter release mechanism can release the painter on a fully equipped and loaded lifeboat that is being towed at a speed of not less than 5 knots in calm water.

6.12.3 The painter release mechanism should be tested in several distinct directions of the upper hemisphere not obstructed by the canopy or other constructions in the lifeboat. The directions specified in 6.10.4 should be used if possible.

6.13 Lifeboat light tests

The lifeboat light should be subjected to the tests prescribed in 10.1.

6.14 Canopy erection test

6.14.1 This test is required only for partially enclosed and self-righting partially enclosed lifeboats. During the test the lifeboat should be loaded with the number of persons for which it is to be approved.

6.14.2 If the lifeboat is partially enclosed, but not self-righting, it should be demonstrated that the canopy can be easily erected by not more than two persons.

6.14.3 If the lifeboat is partially enclosed and self-righting, it should be demonstrated that the canopy can be erected easily by not more than two persons in two minutes or less.

6.15 Additional tests for self-righting partially enclosed and totally enclosed lifeboats

Self-righting test

6.15.1 A suitable means should be provided to rotate the lifeboat about a longitudinal axis to any angle of heel and then release it. The lifeboat, in the enclosed condition, should be incrementally rotated to angles of heel up to and including 180° and should be released. After release, the lifeboat should always return to the upright position without the assistance of the occupants. These tests should be conducted in the following conditions of load:

.1 when the lifeboat with its engine is loaded in the normal position with properly secured weights representing the fully equipped lifeboat with a full complement of persons on board. The weight used to represent each person, assumed to have an average mass of 75 kg, should be secured at each seat location and have its centre of gravity approximately 300 mm above the seatpan so as to have the same effect on stability as when the lifeboat is loaded with the number of persons for which it is to be approved; and

.2 when the lifeboat is in the light condition.

6.15.2 At the beginning of these tests, the engine should be running in neutral position and:

.1 unless arranged to stop automatically when inverted, the engine should continue to run when inverted and for 30 min after the lifeboat has returned to the upright position;

.2 if the engine is arranged to stop automatically when inverted, it should be easily restarted (in the case of a self-righting partially enclosed lifeboat after the water has drained from the lifeboat) and run for 30 min after the lifeboat has returned to the upright position.

Flooded capsizing test

6.15.3 The lifeboat should be placed in the water and fully flooded until the lifeboat can contain no additional water. All entrances and openings should be secured to remain open during the test.

6.15.4 Using a suitable means, the lifeboat should be rotated about a longitudinal axis to a heel angle of 180° and then released. After release, the lifeboat should attain a position that provides an above-water escape for the occupants.

6.15.5 For the purpose of this test, the mass and distribution of the occupants may be disregarded. However, the equipment, or equivalent mass, should be secured in the lifeboat in the normal operating position.

Engine inversion test

6.15.6 The engine and its fuel tank should be mounted on a frame that is arranged to rotate about an axis equivalent to the longitudinal axis of the boat. A pan should be located under the engine to collect any oil which may leak from the engine so that the quantity of such oil can be measured.

6.15.7 The following procedure should be followed during this test:

.1 start the engine and run it at full speed for 5 min;

.2 stop the engine and rotate it in a clockwise direction through 360°;

.3 restart the engine and run it at full speed for 10 min;

.4 stop the engine and rotate it in a counter-clockwise direction through 360°;

.5 restart the engine, run it at full speed for 10 min, and then stop the engine;

.6 allow the engine to cool;

.7 restart the engine and run it at full speed for 5 min;

.8 rotate the running engine in a clockwise direction through 180°, hold at the 180° position for 10 s, and then rotate it 180° further in a clockwise direction to complete one revolution;

.9 if the engine is arranged to stop automatically when inverted, restart it;

.10 allow the engine to continue to run at full speed for 10 min;

.11 shut the engine down and allow it to cool;

.12 repeat the procedure in 6.15.7.7 through 6.15.7.11, except that the engine should be turned in a counter-clockwise direction;

.13 restart the engine and run it at full speed for 5 min;

.14 rotate the engine in a clockwise direction through 180° and stop the engine. Rotate it 180° further to complete a full clockwise revolution;

.15 restart the engine and run it at full speed for 10 min;

.16 repeat the procedure in 6.15.7.14, turning the engine counter-clockwise;

.17 restart the engine, run it at full speed for 10 min and then shut it down; and

.18 dismantle the engine for examination.

6.15.8 During these tests, the engine should not overheat, fail to operate or leak more than 250 ml of oil during any one inversion. When examined after being dismantled the engine should show no evidence of overheating or excessive wear.

6.16 Air supply test for lifeboats with a self-contained air support system

All entrances and openings of the lifeboat should be closed, the air supply to the inside of the lifeboat turned on and the engine run at full speed for a period of 10 min. During this time the atmospheric pressure within the enclosure should be continuously monitored to ascertain that a small positive air pressure is maintained within the lifeboat and to confirm that noxious gases cannot enter. Even if the engine should stop, the internal air pressure should never fall below the outside atmospheric pressure nor should it exceed outside atmospheric pressure by more than 20 mbar during the test. It should be ascertained that when the air supply is depleted automatic means are activated to prevent dangerously low pressure being developed within the lifeboat.

6.17 Additional tests for fire-protected lifeboats

Fire test

6.17.1 The lifeboat should be moored in the centre of an area which is not less than five times the maximum projected plan area of the lifeboat. Sufficient kerosene should be floated on the water within the area so that when ignited it will sustain a fire which completely envelops the lifeboat for the period of time specified in 6.17.3. The boundary of the area should be capable of completely retaining the fuel.

6.17.2 The engine should be run at full speed; however, the propeller need not be turning. The gas- and fire-protective systems should be in operation throughout the fire test.

6.17.3 The kerosene should be ignited. It should continue to burn and envelop the lifeboat for 8 min.

6.17.4 During the fire test, the temperature should be measured and recorded as a minimum at the following locations:

.1 at not less than 10 positions on the inside surface of the lifeboat;

.2 at not less than five positions inside the lifeboat at locations normally taken by occupants and away from the inside surface; and

.3 on the external surface of the lifeboat.

The positions of such temperature recorders should be to the satisfaction of the Administration. The method of temperature measurement should allow the maximum temperature to be recorded.

6.17.5 The atmosphere inside the lifeboat should be continuously sampled and representative retained samples should be analysed for the presence and quantity of essential, toxic, and injurious gases or substances. The analysis should cover the range of anticipated gases or substances that may be produced and which can vary according to the materials and fabrication techniques used to manufacture the lifeboat. The analysis should indicate that there is sufficient oxygen and no dangerous levels of toxic or injurious gases or substances.

6.17.6 The pressure inside the lifeboat should be continuously recorded to confirm that a positive pressure is being maintained inside the lifeboat.

6.17.7 At the conclusion of the fire test, the condition of the lifeboat should be such that it could continue to be used in the fully-loaded condition.

Note: The Administration may waive this test for any totally enclosed lifeboat which is identical in construction to another lifeboat which has successfully completed this test, provided the lifeboat differs only in size, and retains essentially the same form. The protective system should be as effective as that of the lifeboat tested. The water delivery rate and film thickness at various locations around the hull and canopy should be equal to or exceed the measurements made on the lifeboat originally fire tested.

Water spray tests

6.17.8 Start the engine and the spray pump. With the engine running at its designed output, the following should be measured to obtain the rated value and speed:

.1 the rpm of the engine and the pump to obtain the rated speed;

.2 the pressure at the suction and delivery side of the pump to obtain the rated water pressure.

6.17.9 With the lifeboat in an upright position, on an even keel and in the light condition, run the pump at the rated speed. Measure the delivery rate of water or the thickness of the sprayed water film at the external surface of the lifeboat. The delivery rate of water or the sprayed water film thickness over the lifeboat should be to the satisfaction of the Administration.

6.17.10 Successively trim the lifeboat 5° by the head and 5° by the stern, and heel it 5° to port and 5° to starboard. In each condition the sprayed water film should cover the whole surface of the lifeboat.

6.18 Measuring and evaluating acceleration forces

Selection, placement and mounting of accelerometers

6.18.1 The accelerometers used to measure the acceleration forces in the lifeboat should:

.1 have adequate frequency response for the test in which they are to be used but the frequency response should at least be in the range of 0 to 200 Hz;

.2 have adequate capacity for the acceleration forces that will occur during the tests;

.3 have an accuracy of ±5%.

6.18.2 Accelerometers should be placed in the lifeboat, parallel to the principal axes of the lifeboat, at those locations necessary to determine the worst occupant exposure to acceleration.

6.18.3 The accelerometers should be mounted on a rigid part of the interior of the lifeboat in a manner to minimize vibration and slipping.

6.18.4 A sufficient number of accelerometers should be used at each location at which acceleration forces are measured so that all likely acceleration forces at that location can be measured.

6.18.5 The selection, placement, and mounting of the accelerometers should be to the satisfaction of the Administration.

Recording method and rate

6.18.6 The measured acceleration forces may be recorded on magnetic media as either an analog or a digital signal or a paper plot of the acceleration signal may be produced.

6.18.7 If the acceleration forces are to be recorded and stored as a digital signal, the sampling rate should be at least 500 samples per second.

6.18.8 Whenever an analog acceleration signal is converted to a digital signal, the sampling rate should be at least 500 samples per second.

Evaluation with the dynamic response model

6.18.9 The dynamic response model is the preferred method to evaluate potential for the occupant in a lifeboat to be injured by exposure to acceleration forces. In the dynamic response model, the human body is idealized as a single-degree-of-freedom spring-mass acting in each co-ordinate direction as shown in figure 1. The response of the body mass relative to the seat support, which is excited by the measured accelerations, can be evaluated using a procedure acceptable to the Administration. The parameters to be used in the analysis are shown in table 1 for each co-ordinate direction.

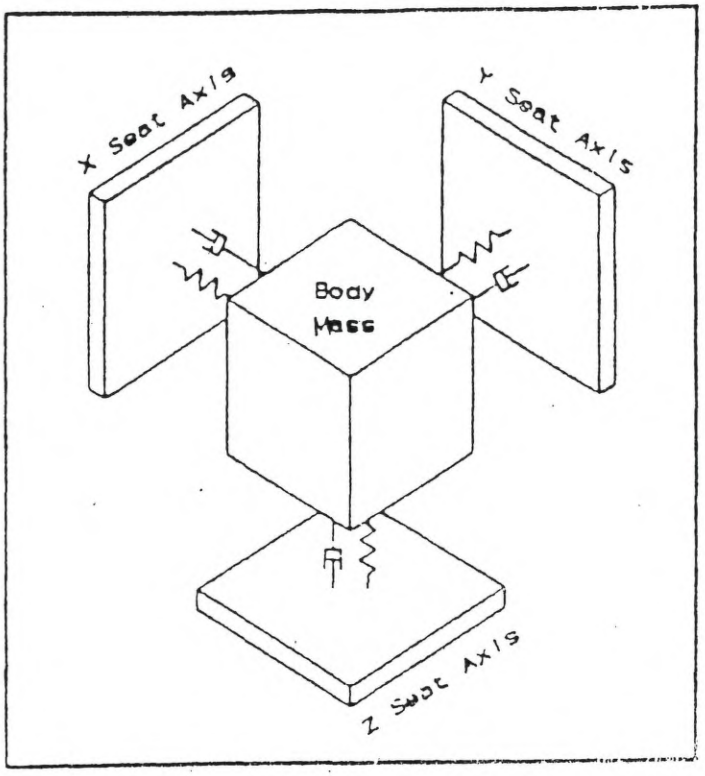

Figure 1 - Independent single-degree-of-freedom representation of human body

Table 1

PARAMETERS OF THE DYNAMIC RESPONSE MODEL

Co-ordinate axis	Natural frequency (rad/s)	Damping ratio
X	62.8	0.100
Y	58.0	0.090
Z	52.9	0.224

6.18.10 Before performing the dynamic response analysis, the measured accelerations should be oriented to the primary axes of the seat.

6.18.11 The desired outcome from the dynamic response analysis is the displacement time-history of the body mass relative to the seat support in each co-ordinate direction.

6.18.12 At all times, the following expression should be satisfied:

$$\sqrt{\left(\frac{d_x}{S_x}\right)^2 + \left(\frac{d_y}{S_y}\right)^2 + \left(\frac{d_z}{S_z}\right)^2} \leq 1$$

where d_x, d_y, and d_z are the concurrent relative displacements of body mass with respect to the seat support, in the x, y, and z body axes, as computed from the dynamic respose analysis and S_x, S_y, and S_z are relative displacements which are presented in table 2 for the appropriate launch condition.

Table 2

SUGGESTED DISPLACEMENT LIMITS FOR LIFEBOATS

Acceleration direction	Displacement (Cm)	
	Training	Emergency
+X--Eyeballs in	6.96	8.71
-X--Eyeballs out	6.96	8.71
+Y--Eyeballs right	4.09	4.95
-Y--Eyeballs left	4.09	4.95
+Z--Eyeballs down	5.33	6.33
-Z--Eyeballs up	3.15	4.22

Evaluation using the SRSS method

6.18.13 In lieu of the procedure in 6.18.9 to 6.18.12, the potential for an occupant in a lifeboat to become injured by an acceleration can be evaluated using the procedure presented in this section.

6.18.14 Before performing the SRSS analysis, the measured accelerations should be oriented to the primary axes of the seat.

6.18.15 Full-scale acceleration data should be filtered with no less than the equivalent of a 20 Hz low-pass filter. Any filtering procedure acceptable to the Administration may be used.

6.18.16 Acceleration data measured on a model should be filtered with a low-pass filter having a frequency not less than that obtained with the following expression:

$$f_{model} = \frac{20}{\sqrt{\frac{L_{model}}{L_{prototype}}}}$$

where f_{model} is the frequency of the filter to be used, L_{model} is the length of the model lifeboat, and $L_{prototype}$ is the length of the prototype lifeboat.

6.18.17 At all times, the following expression should be satisfied:

$$\sqrt{\left(\frac{g_x}{G_x}\right)^2 + \left(\frac{g_y}{G_y}\right)^2 + \left(\frac{g_z}{G_z}\right)^2} \leq 1$$

where g_x, g_y, and g_z are the concurrent accelerations in the x, y, and z seat axes and G_x, G_y and G_z are allowable accelerations which are presented in table 3 for the appropriate launch condition.

Table 3

SRSS ACCELERATION LIMITS FOR LIFEBOATS

Acceleration direction	Acceleration (G)	
	Training	Emergency
+X--Eyeballs in	15.0	18.0
-X--Eyeballs out	15.0	18.0
+Y--Eyeballs right	7.0	7.0
-Y--Eyeballs left	7.0	7.0
+Z--Eyeballs down	7.0	7.0
-Z--Eyeballs up	7.0	7.0

7 RESCUE BOATS

7.1 Rigid rescue boats

7.1.1 Rigid rescue boats should be subjected to the tests prescribed in 6.2 to 6.12, except 6.8.1, and to the test prescribed in 7.2.4.2.

7.1.2 The largest size of fully loaded liferaft which the rigid rescue boat can tow at a speed of at least 2 knots should be determined.

Rigid rescue boat seating test

7.1.3 The rigid rescue boat should be fitted with its engine and all its equipment. The number of persons for which the rescue boat is to be approved, having an average mass of at least 75 kg and all wearing lifejackets and any other essential equipment required should then board; one person should lie down and the others should be properly seated in the rescue boat. The rigid rescue boat should then be manoeuvred and all equipment on board tested to demonstrate that it can be operated without difficulty or interference with the occupants.

7.2 Inflated rescue boats

7.2.1 The inflated rescue boat should be subjected to the tests prescribed in 6.5.1 and 6.5.2, 6.7, 6.10, 6.11, 6.13 and 7.1.3.

Drop tests

7.2.2 The inflated rescue boat complete with all its equipment and with a mass equivalent to its engine and fuel in the position of its engine and fuel tank should be dropped three times from a height of at least 3 m on to water. The drops should be from the 45° bow-down, level-trim and 45° stern-down attitudes.

7.2.3 On completion of these drop tests the rescue boat and its equipment should be carefully examined and show no signs of damage which would affect their efficient functioning.

Loading tests

7.2.4 The freeboard of the inflated rescue boat should be taken in the various loading conditions as follows:

.1 rescue boat with all its equipment;

.2 rescue boat with all its equipment, engine and fuel, or an equivalent mass positioned to represent engine and fuel;

.3 rescue boat with all its equipment and the number of persons for which it is to be approved having an average mass of 75 kg so arranged that a uniform freeboard is achieved at the side buoyancy tubes; and

.4 rescue boat with the number of persons for which it is to be approved and all its equipment, engine and fuel or an equivalent mass to represent engine and fuel and the rescue boat being retrimmed as necessary.

7.2.5 With the rescue boat in any of the conditions prescribed in 7.2.4, the minimum freeboard should be not less than 300 mm at the buoyancy tubes and not less than 250 mm from the lowest part of the transom.

Stability test

7.2.6 The following tests should be carried out with engine and fuel or an equivalent mass in place of the engine and fuel tanks:

.1 the number of persons for which the inflated rescue boat is to be approved should be crowded to one side with half this complement seated on the buoyancy tube, and then to one end. In each case the freeboard should be recorded. Under these conditions the freeboard should be everywhere positive; and

.2 the stability of the rescue boat during boarding should be ascertained by two persons in the rescue boat demonstrating that they can readily assist from the water a third person who is required to feign unconsciousness. The third person should have his back towards the side of the rescue boat so that he cannot assist the rescuers. All persons should wear approved lifejackets.

7.2.7 These stability tests may be carried out with the rescue boat floating in still water.

Damage test

7.2.8 The following tests should be carried out with the inflated rescue boat loaded with the number of persons for which it is to be approved both with and without engine and fuel or an equivalent mass in the position of the engine and fuel tank:

.1 with forward buoyancy compartment deflated;

.2 with the entire buoyancy on one side of the rescue boat deflated; and

.3 with the entire buoyancy on one side and the bow compartment deflated.

7.2.9 In each of the conditions prescribed by 7.2.8, the full number of persons for which the rescue boat is to be approved should be supported within the rescue boat.

Manoeuvrability and towing tests

7.2.10 It should be demonstrated that the inflated rescue boat can be propelled and manoeuvred by its oars or paddles in calm water conditions at a speed of at least 0.5 knots over a distance of at least 25 m, when laden with the number of persons, all wearing lifejackets, for which it is to be approved.

7.2.11 Speed and manoeuvring trials should be carried out with engines of various powers to assess the rescue boat's performance.

Righting test

7.2.12 It should be demonstrated that both with and without engine and fuel or an equivalent mass in place of the engine and fuel tank, the inflated rescue boat is capable of being righted by not more than two persons if it is inverted on the water.

Simulated heavy weather test

7.2.13 To simulate use in heavy weather the inflated rescue boat should be fitted with a larger powered engine than is intended to be fitted and driven hard in a wind of force 4 or 5 or equivalent rough water for at least 30 min. As a result of this test the rescue boat should not show undue flexing or permanent strain nor have lost more than minimal pressure.

Swamp test

7.2.14 It should be demonstrated that the rescue boat, when fully swamped, is capable of supporting its full equipment, the number of persons for which it is to be approved and a mass equivalent to its engine and full tank. It should also be demonstrated that the rescue boat does not seriously deform in this condition.

Overload tests

7.2.15 The inflated rescue boat should be loaded with four times the mass of the full complement of persons and equipment for which it is to be approved and suspended from its bridle at an ambient temperature of +20 $\pm$ 3°C with all relief valves inoperative. The rescue boat and bridle should be examined after the test is conducted and should not show any signs of damage.

7.2.16 The inflated rescue boat after 6 h conditioning at a temperature of -30°C should be loaded with 1.1 times the mass of the full complement of persons and equipment for which it is to be approved and suspended from its bridle with all relief valves operative. The rescue boat and bridle should be examined after the test is conducted and should not show any signs of damage.

Material tests

7.2.17 The material used in the construction of inflated rescue boats should be tested for the following characteristics to the satisfaction of the Administration:

.1 tensile strength;

.2 tear strength;

.3 heat resistance;

.4 cold resistance;

.5 heat ageing;

.6 weathering;

.7 flex cracking;

.8 abrasion;

.9 coating adhesion;

.10 oil resistance;

.11 elongation at break;

.12 piercing strength;

.13 ozone resistance;

.14 gas permeability;

.15 seam strength; and

.16 ultraviolet light resistance.

Detailed inspection

7.2.18 The inflated rescue boat complete in all respects should be fully inflated in the manufacturer's works and subjected to detailed inspection to ensure that all the requirements are fulfilled.

7.3 Outboard motors for rescue boats

7.3.1 When the rescue boats are fitted with outboard motors, the following tests should be applied to the motor in place of those tests specified in 6.11 and prescribed in 7.1.1.

Power test

7.3.2 The motor, fitted with a suitable propeller, should be placed in a test rig such that the propeller is completely submerged in a water tank, simulating service conditions.

7.3.3 The motor should be run at the maximum continuous rated speed using the maximum power obtainable for 20 min, and should not overheat or be damaged.

Water drench test

7.3.4 The motor protective cover should be removed and the motor thoroughly drenched with water, by hose, except for the intake to the carburettor. The motor should be started and run at speed for at least 5 min while it is still being drenched. The motor should not falter or be damaged by this test.

Hot start test

7.3.5 While still in the test rig referred to in 7.3.2, the motor should be run at idling speed in order to heat up the cylinder block. At the maximum temperature achievable, the motor should be stopped and immediately restarted. This test should be carried out at least twice. The motor should not fail to restart.

Manual start test

7.3.6 The motor should be started at ambient temperature by manual means. The means should be either a manual automatic-rewind system or a pull cord round the top flywheel of the motor. The motor should be started twice within 2 min of commencement of the start procedure.

7.3.7 The motor should be run until normal operating temperatures are reached, then it should be stopped and started manually twice within 2 min, in accordance with 7.3.6.

Cold start test

7.3.8 The motor, together with the fuel, fuel lines and battery, should be placed in a chamber at a temperature of -15°C and allowed to remain until the temperature of all parts has reached the temperature of the chamber. The temperature of the fuel, battery and motor should be measured for this test. The motor should be started twice, within 2 min of commencement of the start procedure, and allowed to run long enough to demonstrate that it runs at operating speed. It is recommended that this period should not exceed 15 s.

7.3.9 Where, in the opinion of the Administration, having regard to the particular voyages in which the ship carrying the boat is constantly engaged, a lower temperature is appropriate, that lower temperature should be substituted for -15°C in 7.3.8 for the cold start test.

8 LAUNCHING AND EMBARKATION APPLIANCES

8.1 Testing of davits and launching appliances

8.1.1 For lifeboats other than free-fall lifeboats, davits and launching appliances, except the winch brakes, should be subjected to a static proof load of 2.2 times their maximum working load. With the load at the full outboard position, the load should be swung through an arc of approximately 10° to each side of vertical in the intended fore and aft plane. The test should be done first in the upright position, followed by tests simulating a shipboard condition of list of 20° both inboard and outboard. There should be no evidence of significant deformation or other damage as a result of this test. For free-fall lifeboats, the launching appliances for lowering a free-fall lifeboat by falls, except the winch brakes, should be subjected to a static proof load of 2.2 times the maximum working load at the full outboard position. There should be no evidence of significant deformation or other damage as a result of this test.

8.1.2 For lifeboats other than free-fall lifeboats, a mass equal to 1.1 times the maximum working load should be suspended from the lifting points with the launching appliance in the upright position. The load should be moved from the full inboard to the full outboard position using the means of operation that is used on the ship. The test should be repeated with the launching appliance positioned to simulate a combined 20° inboard list and 10° trim. All the tests should be repeated with a mass equal to that of a fully equipped lifeboat, without persons, or the lightest survival craft intended for the use with the davit to ensure the satisfactory functioning of the davit under very light load conditions. The appliance should successfully lower the load under all of the conditions, and there should be no evidence of significant deformation or other damage as a result of the tests. For free-fall lifeboats, a mass equal to 1.1 times the maximum working load should be suspended from the lifting points. The load should be moved from the full inboard to the full outboard position using the means of operation that is to be used on the ship. The test should be repeated with a mass equal to that of the fully equipped lifeboat, without persons, to ensure the satisfactory functioning of the appliance under light load conditions. The appliance

should successfully lower the load under both conditions and there should be no evidence of significant deformation or other damage as a result of the tests.

8.1.3 A mass equal to 1.1 times the maximum working load should be suspended from the lifting points with the launching appliance in the upright position. The load should be moved from the full inboard to the full outboard position using the means of operation that is used on the ship. The appliance should successfully move the maximum designed hoisting load from the outboard to the inboard position without causing permanent deformation or other damage.

8.1.4 Winch drums should be wound to the maximum number of turns permitted and a static test load of 1.5 times the maximum working load should be applied and held by the brake. This load should then be lowered for at least one complete revolution of the barrel shaft. A test load of 1.1 times the maximum working load should then be lowered at maximum lowering speed through a distance of at least 3 m and stopped by applying the hand brake sharply. The test load should drop no more than 1 m when the brake is applied. This test should be repeated a number of times. If the winch design incorporates an exposed brake, one of these tests should be carried out with the brake wetted, but in this case the stopping distance may be exceeded. The various tests should achieve a cumulative lowering distance of at least 150 m. Operation of the winch with a load of a mass equal to that of a fully equipped lifeboat, without persons, or the lightest survival craft intended for use with the winch should also be demonstrated.

8.1.5 It should be demonstrated that a winch intended for use with a rescue boat is capable of recovering the rescue boat with the number of persons for which it is to be approved and its equipment or an equivalent mass at a rate of not less than 0.3 m/s.

8.1.6 The hand operation of the winch should be demonstrated. If the winch is designed for quick recovery by hand with no load, this should be demonstrated with a load of 1.5 times the mass of the empty lifting arrangements.*

8.1.7 Following completion of the tests the winch should be stripped for inspection. These tests and the inspection should normally be witnessed by a representative of the Administration.

8.2 Davit-launched liferaft automatic release hook test

Definitions

8.2.1 In this section and in 6.2.1 to 6.2.7 of part 2, the following definitions apply:

.1 Actuating force means the force required to set the actuating mechanism.

.2 Actuating mechanism means the mechanism which, when operated, allows the liferaft to be released automatically.

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* This paragraph does not apply to free-fall lifeboats.

.3 Automatic release mechanism means the mechanism which opens the hook automatically to release the liferaft.

.4 Hook means a hook to be used for the launching of liferafts which can be activated to automatically release the liferaft when it is waterborne.

.5 Load limit for automatic release means the minimum load at which the automatic release mechanism opens the hook and automatically and completely releases the liferaft.

.6 Manual release force means the force required at the actuating mechanism to release the hook manually.

.7 Safe working load means the load for which the hook is to be approved.

.8 Securing force means the force required to close the hook manually.

.9 Testing establishment means an establishment accepted by the Administration having the equipment and the qualifications necessary for the testing and approval of liferaft release hooks.

Hook and documents required for tests

8.2.2 The following should be submitted to the testing establishment for the prototype testing of the hook:

.1 two hooks which have been passed for delivery; and

.2 a functional description of the hook together with any other documents necessary to carry out the tests.

Corrosion resistance test

8.2.3 Two hooks should be submitted to a corrosion resistance test which should be made in a salt mist chamber in accordance with International Standard ISO 3768-1976 for 1,000 h or equivalent national standard. Any corrosion effects and other damage to the hooks should be recorded.

8.2.4 Both hooks should then be subjected five times to the tests required by 8.2.5 to 8.2.10.

Load test

8.2.5 The maximum load on the hook to allow for automatic release loads should be determined as follows:

.1 the hook should be loaded with a mass of 200 kg and the actuating mechanism set;

.2 the load should be reduced gradually in stages until the hook releases automatically, but at not more than 30 kg, to establish load "F";

.3 the load "F" should be measured and recorded. The minimum allowable load "F" is the minimum obtained at release which should be not less than 5 kg.

8.2.6 The hook should be loaded with a mass of 200 kg and the actuating mechanism set. The hook should then be subjected to cyclic loading between 30 kg and 200 kg using a frequency of 1 ± 0.2 Hz. The hook should not release before 300 cycles. The number of cycles at which the hook opened or whether the test was discontinued at 300 cycles should be recorded.

8.2.7 The hook should then be reloaded to 200 kg and the actuating mechanism set. The hook should be subjected to a cyclic loading, the upper limit of which is +200 kg, and the lower limit being "F1" using a frequency of 1 ± 0.2 Hz. The automatic release mechanism should operate within 3 cycles. The number of cycles at which the hook opened or whether the test was discontinued after 3 cycles should be recorded. "F1" is to be taken as the minimum load on the hook to allow for automatic release, as established in 8.2.5.2, reduced by 2 kg.

8.2.8 The hook should be loaded to 0, 25%, 50%, 75% and 100% of the safe working load of the hook. At each load level, the actuating force required at the actuating mechanism should be measured and recorded. The actuating force should be between 150 and 250 N if the hook is lanyard-operated, or the action required to set the actuating mechanism should be readily performed by a single person without difficulty.

8.2.9 The securing force, which should be less than 120 N, should be determined with an unloaded hook and should be recorded.

8.2.10 The manual release force should be determined as follows:

.1 the hook should be loaded with a mass of 150 kg;

.2 the actuating mechanism should be set;

.3 the force required to release the hook manually should be established and recorded; and

.4 the manual release force for a mass of 150 kg on the hook should be at least 600 N for lanyard-operated designs. Alternative designs should be demonstrated to the satisfaction of the Administration to provide adequate protection from inadvertent release under load.

8.2.11 One hook should be proof loaded to six times the safe working load and this load held for at least 5 min. After the removal of the load, the hook should be dismantled and examined for damage.

Compatibility of liferaft and release hook

8.2.12 Where automatic release hooks are supplied for use with liferafts made by different manufacturers, operational tests with each type and size of lifting or attachment fitting used by the different manufacturers of the liferafts should be carried out before the particular combination of liferaft and release hook is accepted by the Administration.

9 LINE-THROWING APPLIANCES

9.1 Tests for pyrotechnics

Rockets used in line-throwing appliances should be subjected to the tests prescribed in 4.3.1.1, 4.3.1.3, 4.4, 4.5.1 (if appropriate), 4.5.5 and 4.5.6.

9.2 Function test

Three projectiles should be fired connected to a line and should carry the line at least 230 m in calm conditions. The lateral deflection from the line of firing should not exceed 10% of the length of flight of the projectile. If the projectile is fired using an explosive charge, then one of the projectiles should be fired using double the normal charge.

9.3 Line tensile test

The line should be subjected to a tensile test and should have a breaking strain of not less than 2 kN.

9.4 Visual examination

It should be established by visual examination that the appliance:

.1 is marked with clear and precise instructions on how it should be operated; and

.2 is marked with a means of determining its age.

9.5 Temperature test

Three individual units, consisting of projectile, firing system and line should be subjected to the tests prescribed in 4.2.

10 POSITION-INDICATING LIGHTS FOR LIFE-SAVING APPLIANCES

10.1 Survival craft light tests

10.1.1 Twelve liferaft canopy lights, lifeboat enclosure or lifeboat cover lights, as the case may be, and twelve survival craft interior lights should be subjected to the temperature cycling as prescribed in 1.2.1. If the same type of light is used for both canopy, enclosure or cover and interior, only twelve lights of that type need to be tested. If the lifeboat enclosure light, the lifeboat cover light or the lifeboat internal light is connected to the lifeboat's electrical network and can be supplied with electrical power from any one of the lifeboat's batteries as well as from the lifeboat's engine-driven generator set, the light should only be subject to the test as far as practicable.

10.1.2 In the case of sea-activated power sources, four survival craft lights of each type should, following the test described in 10.1.1, be taken from a stowage temperature of -30°C and be operated immersed in seawater at a temperature of -1°C; four of each type should be taken from a stowage temperature of +65°C and be operated in seawater at a temperature of +30°C; and four of each type in fresh water at ambient temperature. The canopy, enclosure or cover lights should provide a luminous intensity sufficient to be

visible at a distance of 2 miles on a dark night with a clear atmosphere and should operate for a period of not less than 12 h. The interior lights should provide sufficient luminous intensity to read survival instructions and equipment instructions for a period of not less than 12 h.

10.1.3 In the case of dry-activated power sources, provided they will not come into contact with seawater, four survival craft lights of each type should, following the test described in 10.1.1, be operated at an air temperature of -30°C, four of each type at an air temperature of +65°C, and four of each type at ambient temperature. The canopy, enclosure or cover lights should provide a luminous intensity sufficient to be visible at a distance of 2 miles on a dark night with a clear atmosphere and should operate for a period of not less than 12 h. The interior lights should provide sufficient luminous intensity to read survival instructions and equipment instructions for a period of not less than 12 h.

10.1.4 In the case of a flashing light, it should be established that the rate of flashing during the first 2 h of the 12-h operative period is not less than 50 flashes per minute.

10.2 Lifebuoy self-igniting light tests

10.2.1 Three self-igniting lights should be subjected to temperature cycling as prescribed in 1.2.1.

10.2.2 One self-igniting light should then be operated in seawater at a temperature of -1°C and another in seawater at a temperature of +30°C. Both lights should continue to provide a luminous intensity of not less than 2 cd or, in the case of a flashing light, flash at a rate of not less than 50 flashes per minute with at least the corresponding effective luminous intensity. The effective luminous intensity is to be found from the formula:

$$\left[\frac{\int_{t_1}^{t_2} I \, dt}{0.2 + (t_2 - t_1)}\right]_{max}$$

where:

I is the instantaneous intensity
0.2 is the Blondel-Rey constant
and
t_1 and t_2 are time limits of integration in seconds

At the end of the first hour of operation the lights should be immersed to a depth of 1 m for 1 min. The lights should not be extinguished and should continue operating for at least an hour longer.

10.2.3 A self-igniting light should be subjected to two drop tests into water as prescribed in 1.3. The light should be dropped twice, first by itself and then attached to a lifebuoy. The light should operate satisfactorily after each drop.

10.2.4 A self-igniting light should be subjected to a salt spray test (5% natrium chloride solution) at a temperature of 35 ± 3°C for at least 100 h. The light should operate satisfactorily after this spray test.

10.2.5 A self-igniting light should be allowed to float in water in its normal operating position for 24 h. If the light is an electric light, it should be disassembled at the end of the test and examined for the presence of water. There should be no evidence of water inside the light.

10.2.6 The remaining self-igniting light, which has been subjected to the test in 10.2.1 should be immersed horizontally under 300 mm of water for 24 h. If the light is an electric light, it should be dismantled at the end of the test and examined for the presence of water. There should be no evidence of water inside the light.

10.2.7 If a self-igniting light has a lens, the light should be cooled to -18°C and dropped twice from a height of 1 m on to a rigidly mounted steel plate or concrete surface. The distance should be measured from the top of the lens to the impact surface. The light should strike the surface on the top centre of the lens. The lens should not break or crack.

10.2.8 A self-igniting light should be placed on its side on a rigid surface and a steel sphere having a mass of 500 g should be dropped from a height of 1.3 m on to the case three times. The sphere should strike the case near its centre on one drop, approximately 12 mm from one end of the case on another drop and approximately 12 mm from the other end of the case on the third drop. The case should not break or crack, or be distorted in a way that would affect its watertightness.

10.2.9 A force of 225 N should be applied to the fitting that attaches the light to a lifebuoy. Neither the fitting nor the light should be damaged as a result of this test.

10.3 Lifejacket light tests

10.3.1 Twelve lifejacket lights should be subjected to temperature cycling as prescribed in 1.2.1.

10.3.2 Four of these lifejacket lights should be taken from a stowage temperature of -30°C and then be operated immersed in seawater at a temperature of -1°C. Four should be taken from a stowage temperature of +65°C and then immersed in seawater at a temperature of +30°C and four immersed in fresh water at ambient temperature. Water-activated lights should commence functioning within 2 min and have reached a luminous intensity of 0.75 cd within 5 min in seawater. In fresh water a luminous intensity of 0.75 cd should have been attained within 10 min. At least 11 out of the 12 lights should continue to provide a luminous intensity of 0.75 cd for a period of at least 8 h.

10.3.3 One light attached to a lifejacket should be subjected to a drop test as prescribed in 2.9.6. The light should not suffer damage, should not be dislodged from the lifejacket and should function as prescribed in 10.3.2.

10.3.4 In the case of a flashing light it should be established that:

.1 the light can be operated by a manual switch;

.2 means of concentrating the beam are not fitted;

.3 the rate of flashing is not less than 50 flashes per minute; and

.4 the effective luminous intensity is at least 0.75 cd (see 10.2.2).

11 HYDROSTATIC RELEASE UNITS

11.1 Visual and dimensional examination

Two samples of hydrostatic release units should be given a visual and dimensional examination. If the devices conform with the manufacturer's drawings and specifications, they should be accepted and assembled for further testing under the technical and performance tests as prescribed in 11.2 and 11.3.

11.2 Technical tests

Each hydrostatic release unit should undergo all the following technical tests. No parts should be renewed or repaired between the tests. The tests should be conducted in the following sequence:

.1 Corrosion resistance test

A hydrostatic release unit should be exposed to a salt water spray test (5% natrium chloride solution) at a temperature of 35 ± 3°C for 160 h without interruption. After completion of the test the hydrostatic release unit should show no corrosion which could affect its efficient functioning and should then be subjected to the following tests after which it should continue to function efficiently.

.2 Temperature tests

The hydrostatic release unit should then be subjected to the temperature cycling prescribed in 1.2.1.

.3 Submergence and manual release tests

The hydrostatic release unit should then be tested by applying a buoyant load equal to its designed capacity while the device is submerged in water or in a water-filled pressure testing tank. It should release at a depth of not more than 4 m. On completion of these tests and resetting, the hydrostatic release unit should be capable of being released manually if it is designed to allow manual release of the unit. It should then be opened for inspection and should show no significant signs of corrosion or degradation.

.4 Strength test

After reassembly the hydrostatic release unit should be subjected to a tensile test of at least 10 kN and, if designed to allow manual release of the unit, should then be capable of being operated manually.

.5 Technical tests on the membrane

The following test should be carried out on the membrane:

.5.1 Test of resistance to cold

Number of specimens	2 membranes
Temperature	-30°C
Exposure time	30 min
Flex testing	180° with both inside and outside stretched.

Requirements:

The membranes should show no visible cracking.

.5.2 Test of resistance to heat

Number of specimens	2 membranes
Temperature	+65°C
Exposure time	7 days

Requirements:

The membranes should show no visible cracking.

.5.3 Test for surface resistance to oil

Number of specimens	2 membranes
Temperature	+18°C to +20°C
Type of oil	A mineral oil meeting the following requirements: Aniline point: 120 $\pm$ 5°C Flashpoint: minimum 240°C Viscosity: 10-25 cSt at 99.0°C
The following oils may be used:	ASTM Oil No.1 ASTM Oil No.5 ISO Oil No.1
Testing period	3 h on each side

Requirements:

The material should show no deterioration.

.5.4 Two membranes should be immersed for 7 days in 5% natrium chloride solution:

Test temperature +18°C to +20°C

Requirements:

The material should show no deterioration.

.5.5 Resistance to detergents

The membranes should not be affected by detergents commonly used on board ship.

11.3 Performance test

11.3.1 This test should be performed using the smallest and the largest liferafts with which the hydrostatic release unit may be used. If the occupant range between the smallest and largest liferaft exceeds 25 persons then the intermediate size liferaft should also be tested. The liferaft should be placed horizontally on a rack or platform of sufficient weight to submerge the liferaft. The hydrostatic release unit and painter should be installed as aboard ship.

11.3.2 The following tests should be carried out in a suitable depth of water. The platform on which the liferaft is mounted should be lowered into the water as follows:

.1 horizontal;

.2 tilted 45° and then 100° with the hydrostatic release unit at the upper side;

.3 tilted 45° and then 100° with the hydrostatic release unit at the lower side; and

.4 vertically.

Under these conditions the hydrostatic release unit should release the liferaft at a depth of less than 4 m.

PART 2

PRODUCTION AND INSTALLATION TESTS

1 GENERAL

1.1 Except where all appliances of a particular type are required by chapter III of the International Convention for the Safety of Life at Sea, 1974, as amended, to be inspected, representatives of the Administration should make random inspection of manufacturers to ensure that the quality of life-saving appliances and the materials used comply with the specification of the approved prototype life-saving appliance.

1.2 Manufacturers should be required to institute a quality control procedure to ensure that life-saving appliances are produced to the same standard as the prototype life-saving appliance approved by the Administration and to keep records of any production tests carried out in accordance with the Administration's instructions.

1.3 Where the proper operation of life-saving appliances is dependent on their correct installation in ships, the Administration should require installation tests to ensure that the appliances have been correctly fitted in a ship.

2 INDIVIDUAL BUOYANCY EQUIPMENT

2.1 Lifejackets

Production tests

2.1.1 Manufacturers should be required to carry out a buoyancy test on at least 0.5% of each batch of lifejackets produced, subject to a minimum of one from every batch.

Inspections by the Administration

2.1.2 Inspections by a representative of the Administration should be made at intervals of at least one per 6,000 lifejackets produced, subject to a minimum of one inspection per calendar quarter. When the manufacturer's quality control programme results in lifejackets that are consistently free of defects, the rate of inspection may be reduced to one in every 12,000. At least one lifejacket of each type in production should be selected at random by the inspector and subjected to detailed examination including, if necessary, cutting open. He should also satisfy himself that the flotation tests are being conducted satisfactorily; if he is not satisfied, a flotation test should be undertaken.

3 PORTABLE BUOYANCY EQUIPMENT

3.1 Lifebuoys

Installation tests

The arrangements for quick release of the lifebuoys fitted with self-activated smoke signals and lights on the ship's navigating bridge should be tested to demonstrate that the lifebuoys and their attachments drop clear of the ship's side when released.

4 PYROTECHNICS

A statistically adequate sample of pyrotechnics from each batch produced should be activated and observed for proper operation. The tests in section 4 of part 1 should be performed once for every 10 batches of signals produced; however, such tests should be conducted at least once every year, but need not be conducted more often than once in every calendar quarter. Where production of a signal is continuous, the tests in section 4 need only be performed once every year if the Administration is satisfied that the quality control procedures being followed together with continuous production methods make more frequent testing unnecessary.

5 SURVIVAL CRAFT

5.1 Liferaft operational inflation test

5.1.1 The Administration should, at its discretion, select a completed and operationally packed liferaft at random and carry out an operational inflation test on a smooth dry floor or on water, e.g. a swimming pool, as a check on the packing and inflation.

5.1.2 The actual distribution of liferafts inflated during a period is left to the Administration's discretion so as to achieve an adequate sampling of the entire production. The selection of the inflatable liferaft or liferafts for the test should be on a random basis. Personnel fabricating and packing inflatable liferafts should not be made aware of which liferaft will be tested until after the liferaft has been packed in its container. The painter should be pulled from the liferaft using a device to measure the applied force. The force required to pull the painter and start inflation should not exceed 150 N. The inflatable liferaft should break free from its container and attain its design shape and full erection of the canopy support tubes in not more than 1 min.

5.1.3 Each liferaft produced should be inspected for defects and dimensional deviations.

5.1.4 Each liferaft produced should be inflated with air to at least 1.5 times its working pressure. After 30 min the liferaft should not show signs of seam slippage or rupture, nor should the pressure decrease by more than 5%. Relief valves should be inoperative for this test. Following the test, each relief valve should be tested for proper relief and reseating pressure.

5.1.5 After 6 h the pressure should not have decreased by more than 10% after compensation for changes in temperature within the buoyancy compartment and ambient barometric pressure.

5.1.6 If the insulation of the floor of the liferaft is obtained by inflation, it should be inflated to its designed pressure. After a period of 1 h the pressure should not have decreased by more than 5% uncorrected pressure change.

5.2 Davit-launched liferaft and inflated rescue boat test

Every new davit-launched liferaft and inflatable rescue boat should satisfactorily undergo a 10% overload test in accordance with the approved drawings or construction specification before the final inflation pressure test. The conditions of the 10% overload suspension test are:

.1 the liferaft or rescue boat should be inflated preferably with air and stabilized at its working pressure;

.2 the working pressure should be determined by the reseat of the relief valves. The pressure relief valves should be fully operational;

.3 the floor of the inflatable liferaft should not be inflated;

.4 the 10% overload to be 10% of the mass of the liferaft or rescue boat assembly together with its full equipment and complement of persons calculated at 75 kg per person;

.5 the loaded liferaft or rescue boat should remain suspended for not less than 5 min; and

.6 the inflatable liferaft or rescue boat should not sustain damage to its suspension members, their attachments, or any other structural component as a result of this test. The pressure relief valves should maintain the normal working pressure of the buoyancy tubes and their basic shape during suspension.

5.3 Lifeboat and rescue boat test

5.3.1 Each new davit-launched lifeboat and rescue boat should be loaded to 1.1 times its related load and suspended from its release mechanism. The lifeboat or rescue boat should then be released with the load on the release mechanism. It should also be confirmed that the lifeboat or rescue boat will release when fully waterborne in the light condition and in a 10% overload condition.

5.3.2 Each new free-fall lifeboat should be loaded to 1.1 times its related load and launched by free fall with the ship on an even keel and in its lightest seagoing condition.

5.3.3 Each lifeboat and rescue boat should be operated for at least 2 h before it is installed on the ship. The test should include operation of all systems, including operation of the transmission through all of its positions.

6 LAUNCHING AND STOWAGE ARRANGEMENTS

6.1 Launching appliances using falls and winches

Factory overload test

6.1.1 Each launching appliance, except the winch, should be tested with a static load of 2.2 times the working load with the appliance in the full outboard position. The appliance should not be deformed or damaged. Winches with the brakes applied should be tested by applying a static load of 1.5 times the maximum working load. Any cast components of the frame and arm should be hammer-tested to determine that they are sound and without flaw.

Loaded test

6.1.2 The survival craft or rescue boat, loaded with its normal equipment or an equivalent mass and a distributed mass equivalent to that of the number of persons, each weighing 75 kg, it is permitted to accommodate, should be released by operation of the launching control on deck. The speed at which the survival craft or rescue boat is lowered into the water should be not less than that obtained from the formula:

$$S = 0.4 + (0.02 \times H)$$

where S = speed of lowering in metres per second
and H = height in metres from davit head to the waterline at the lightest seagoing condition.

The maximum lowering speed established by the Administration should not be exceeded.

Light loaded test

6.1.3 The survival craft or rescue boat loaded with its normal equipment or an equivalent mass should be released by operation of the launching control on deck to demonstrate that the lifeboat's mass is sufficient to overcome the frictional resistance of the winch, falls, blocks and associated gear. The lowering speed should be as established by the Administration. If the launching gear is controlled from within the survival craft or rescue boat a person should then board the survival craft or rescue boat and perform a test of the launching operation.

6.1.4 The requirements of 6.1.2 and 6.1.3 do not apply to free-fall lifeboats.

Loaded lowering test (brake test only)

6.1.5 The survival craft or rescue boat loaded with its normal equipment or an equivalent mass and a distributed mass equal to that of the number of persons, each weighing 75 kg, it is permitted to accommodate +10% of the working load should be released by the operation of the launching controls on deck. When the craft has reached its maximum lowering speed, the brake should be abruptly applied to demonstrate that the attachments of the davits and winches to the ship's structure are satisfactory. The maximum lowering speed established by the Administration should not be exceeded.

6.1.6 If lowering of the lifeboat is controlled from within the lifeboat by means of a control wire paid off from an auxiliary drum on the winch, the following additional points should receive particular consideration after installation of the davits and winches:

.1 the mass on the control wire should be sufficient to overcome the friction of the various pulleys on the control wire, when turning out the lifeboat from the stowed to the embarkation position;

.2 it should be possible to operate the winch brake from within the lifeboat;

.3 the winch brake should not be affected by the mass of the fully extended control wire;

.4 there should be sufficient length of control wire available at the lifeboat, during all stages of lowering; and

.5 means should be provided to retain the free end of the control wire in the lifeboat until the lifeboat is detached from the launching appliance by the operator.

6.1.7 If the winch brake is exposed to the weather, the lowering test should be repeated with the braking surface wetted.

Recovery test

6.1.8 It should be demonstrated that the davit-launched lifeboat or rescue boat can be recovered to its stowage position by means of operating the hand gear and can be safely and properly secured.

6.1.9 For free-fall lifeboats it should be demonstrated that the survival craft can be recovered to its stowage position and can be safely and properly secured.

6.1.10 Where davits are recovered by power, it should be demonstrated that the power is automatically cut off before the davit arms come against the stops.

6.1.11 In the case of rescue boat launching appliances, it should be demonstrated that the fully equipped rescue boat when loaded with a mass equal to that of the number of persons it is approved to carry can be recovered by means of a winch at a rate of no less than 0.3 m/s.

6.1.12 It should be demonstrated that the rescue boat can be recovered by means of the winch referred to in 6.1.11 using a hand gear.

Adjustable ramp test

6.1.13 It should be demonstrated that adjustable ramps for free-fall launching may be adjusted satisfactorily with the free-fall lifeboat loaded to 1.2 times its related load.

6.2 Installation tests of liferaft launching appliances

Testing of release arrangements

6.2.1 When the hooks are made of cast steel, acceptable non-destructive tests should be carried out to establish that the material is free from surface or internal flaws.

Static load test

6.2.2 Each release hook should be statically proof tested to 2.5 times the safe working load and be provided with an approved testing establishment certificate certifying that it has been so tested.

Operational test

6.2.3 Each release hook should be submitted to an operational test with a mass equivalent to the safe working load being applied. The release arrangements should be demonstrated and checked with the liferaft loaded to ensure that the automatic release hook will not release while the load is still applied.

Marking

6.2.4 Each release hook should be checked to ensure it is permanently marked with:

.1 the manufacturer's name or the approved name of the release hook;

.2 the date of manufacture;

.3 the safe working load;

.4 the number of the test certificate required by 6.2.2; and

.5 clear, concise operating instructions.

Lowering test

6.2.5 One liferaft ballasted to represent a 10% overload or an equivalent mass should be lowered from each launching appliance to establish the rate of lowering. The 10% overload should be 10% of the mass of the liferaft assembly together with its equipment and full complement of persons calculated at 75 kg per person. It should be jerked to ensure that the liferaft launching appliance, its fastenings and the supporting structures can withstand the associated loads.

Recording of lowering test

6.2.6 The time should be recorded for the sequence of preparing, loading and launching three liferafts. If so desired, persons may be used only in the preparing and loading operations and ballast substituted for the lowering and launching part of the test. This sequence test need not be carried out on every launching appliance on a ship. However, at least one example of each launching appliance type and arrangement should be so tested on each ship.

Towing strain test

6.2.7 A moderate towing strain should be put on the liferaft when waterborne to check that the release arrangements are satisfactory under this condition.
