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RESOLUTION A 521(13)

adopted on 17 November 1983

RECOMMENDATION ON TESTING OF LIFE-SAVING APPLIANCES

THE ASSEMBLY,

RECALLING Article 16(j) of the Convention on the International Maritime Organization concerning the functions of the Assembly in relation to regulations concerning maritime safety,

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, 1974,

BEARING IN MIND that life-saving appliances should be adequately tested to ensure that they meet the requirements of chapter III of the Convention, as amended in 1983,

DESIRING to facilitate reciprocal recognition by Contracting Governments 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 forty-eighth session,

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

2. RECOMMENDS Contracting Governments to the International Convention for the Safety of Life at Sea, 1974, 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. REQUESTS the Maritime Safety Committee to keep this recommendation under review and to report as necessary to the Assembly;

4. REVOKES Assembly resolution A.169(ES.IV).

ANNEX

RECOMMENDATION ON TESTING OF LIFE-SAVING APPLIANCES

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 in 1983.

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, as amended.

PART 1

PROTOTYPE TESTS FOR LIFE-SAVING APPLIANCES

1 LIFEBUOYS

1.1 Lifebuoy 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 paragraph 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 4 times the outside diameter of the body of the buoy in length and secured in four equal loops.

1.2 Temperature cycling test

1.2.1 The following test should be carried out on two lifebuoys.

1.2.2 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;

.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.

1.2.3 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 sea-going condition, or 30 m, whichever is the greater, without suffering damage. In addition, one lifebuoy should be dropped 3 times from a height of 2 m onto 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-igniting light tests

1.9.1 Three self-igniting lights should be subjected to temperature cycling as prescribed in paragraph 1.2.2.

1.9.2 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.

1.9.3 A self-igniting light should be subjected to two drop tests into water as prescribed in paragraph 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.

1.9.4 A self-igniting light should be subjected to a salt spray (20% natrium chloride solution) at a temperature of +35 ± 3°C for at least 100 h. The light should operate satisfactorily after this spray test.

1.9.5 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.

1.9.6 The remaining self-igniting light, which has been subjected to the test in 1.9.1, 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.

1.9.7 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 onto 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.

1.9.8 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 onto the case 3 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 water-tightness.

1.9.9 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.

1.10 Lifebuoy self-activating smoke signal tests

1.10.1 Three self-activating smoke signals should be subjected to temperature cycling as prescribed in paragraph 1.2.2.

1.10.2 One smoke signal should then be activated and operated in seawater at a temperature of −1°C and the second 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 signal should not ignite explosively or in a manner dangerous to persons close by.

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

1.10.4 Smoke signals should also be subjected to the tests and examinations prescribed in paragraphs 4.1.2, 4.1.3, 4.2.1, 4.2.3, 4.3.2, 4.4.5, 4.4.6, 4.7.2, 4.7.3 and 4.7.4.

1.10.5 A smoke signal should be tested in waves at least 300 mm high. The signal should function properly 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 paragraph 1.2.2 and should then be externally examined. If the buoyancy material has not been subjected to the tests prescribed in paragraph 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 changes of mechanical qualities.

2.2 Buoyancy test

The buoyancy of the lifejacket should be measured before and after 24 h submersion 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 paragraph 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 paragraph 1.4.

2.4.2 If the buoyancy material has not been subjected to the tests prescribed in paragraph 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, resistant to deterioration from exposure to sunlight and that they are not unduly affected by seawater, oil or fungal attack.

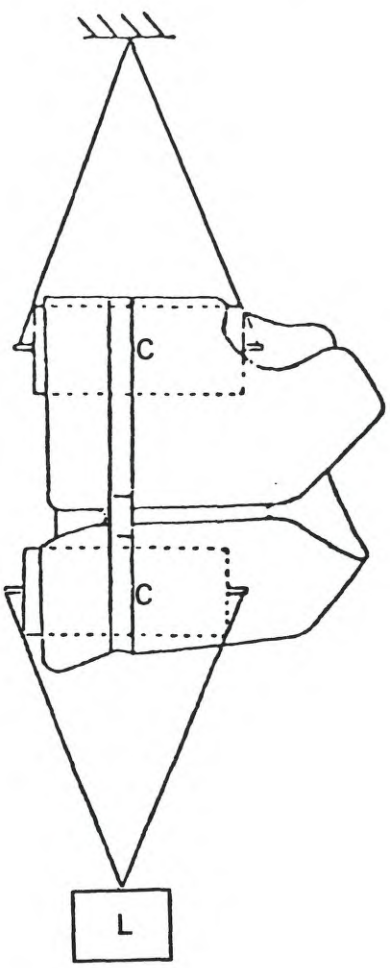
2.6 Strength tests

2.6.1 *Body strength tests*

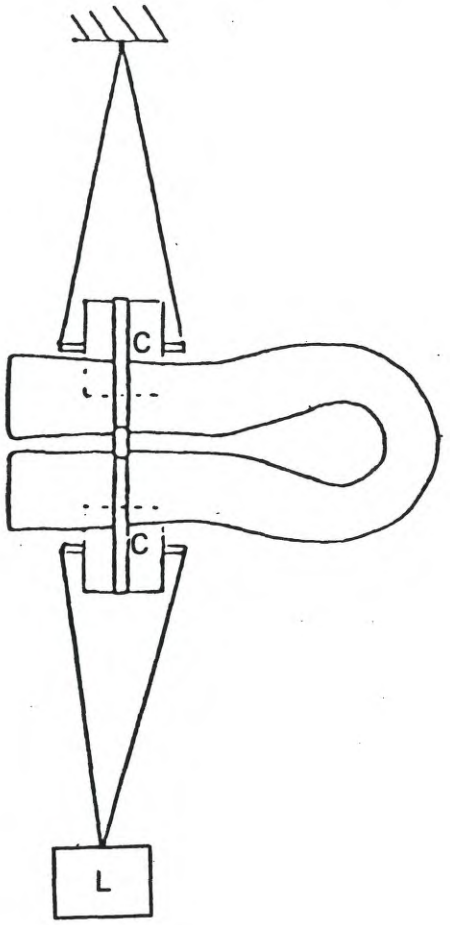
The lifejacket should be immersed in water for a period of 2 min. It should then be removed from the water and closed in the same manner as when it is worn by a person. A force of 1350 N (1050 N in the case of a child-size lifejacket) should be applied for 30 min to the part of the lifejacket that secures it to the body of the wearer (see figure 1). The lifejacket should not be damaged as a result of this test.

2.6.2 *Shoulder or lifting loop strength test*

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 750 N (520 N in the case of a child-size lifejacket) should be applied for 30 min to the shoulder section or lifting loop of the lifejacket (see figure 2). The lifejacket should not be damaged as a result of this test.



Vest-type lifejacket

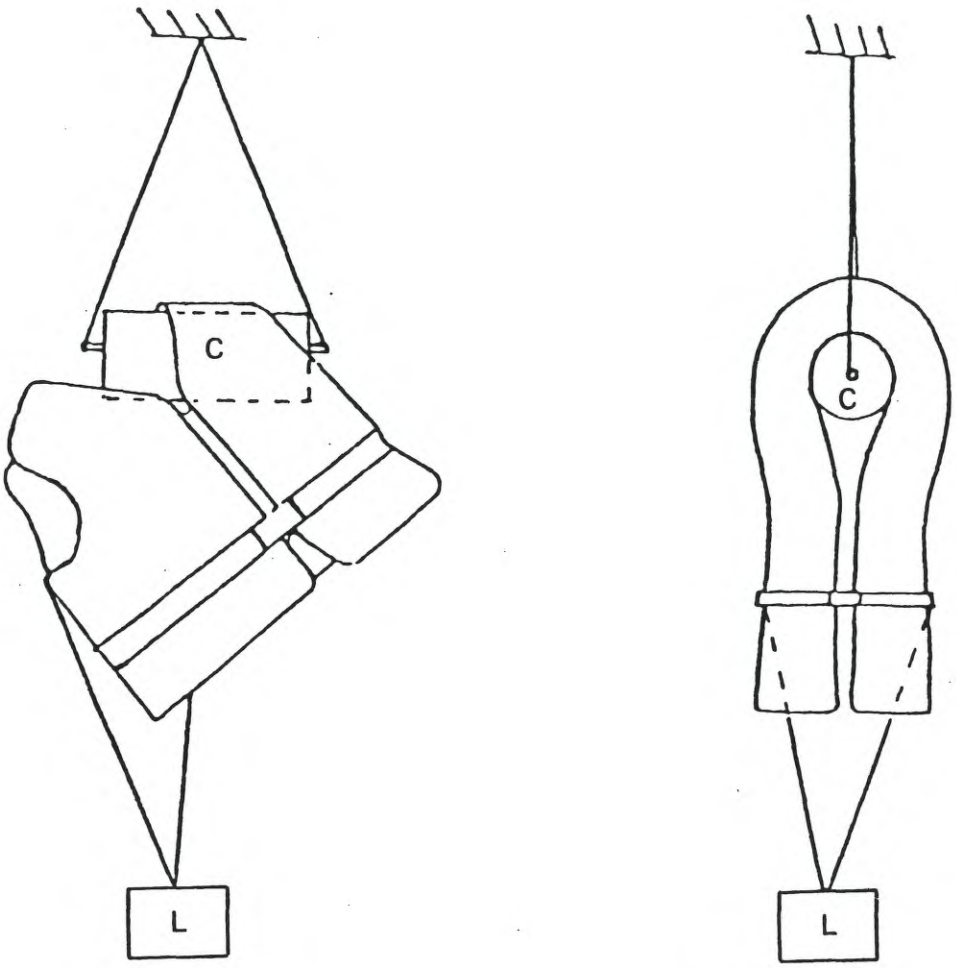


Yoke or over-the-head-type lifejacket

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

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

2.7.2 ***Test for stability under temperature cycling:***

2.7.2.1 The 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;

.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.

2.7.2.2 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.

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

2.7.2.4 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 paragraph 1.4.

2.7.3 *Tests for water absorption*

2.7.3.1 The tests should be carried out in fresh water and the specimens should be immersed for a period of 7 days under a 1.25 m head of water.

2.7.3.2 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 2.7.2.1; and

.3 on two specimens which have been subjected to the temperature cycling as prescribed in 2.7.2.1 followed by the diesel oil test as prescribed in 2.4.

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

2.7.3.4 The results should state the mass in kilograms, which each specimen could support out of the water after one and 7 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 must not exceed 5% and the specimens should show no sign of damage such as shrinking, cracking, swelling, dissolution or change of mechanical qualities.

Note: Manufacturers should guarantee that the buoyancy material of a lifejacket will not adversely affect the covering material or vice versa.

2.8 Donning test

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.

2.8.1 *Test subjects*

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.

2.8.2 *Clothing*

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

2.8.3 *Test*

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

2.8.4 *Assessment*

The observer should note:

.1 ease and speed of donning; and

.2 proper fit and adjustment.

2.9 Water performance tests

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.

2.9.1 *Test subjects*

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.

2.9.2 *Clothing*

Subjects should wear only swimming costumes.

2.9.3 *Preparation for water performance tests*

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 paragraph 2.8.4.

2.9.4 *Righting tests*

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 should be recorded from the water surface to the mouth with the test subject at rest.

2.9.5 *Drop test*

Without readjusting the lifejacket, the test subject should jump vertically into the water, feet first, from a height of at least 4.5 m. The freeboard to the mouth should be recorded after the test subject comes to rest.

2.9.6 *Assessment*

After each of the water tests described above, the test subject should come to rest with the trunk floating inclined backwards at an angle of not less than 20° and not more than 50° from the vertical with the mouth clear of the water by at least 120 mm. In the righting tests, 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.

2.9.7 *Swimming and water emergence test*

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.

2.11 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 paragraphs 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 is necessary to perform the test once with each compartment in the uninflated condition.

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

2.11.3 The tests in paragraph 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 is necessary to perform the test once with each compartment in the uninflated condition.

2.12 Lifejacket light tests

2.12.1 Twelve lifejacket lights should be subjected to temperature cycling as prescribed in paragraph 1.2.2.

2.12.2 Four of these lifejacket lights should then be operated immersed in seawater, at a temperature of −1°C, four 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.

2.12.3 One light attached to a lifejacket should be subjected to a drop test as prescribed in paragraph 2.9.5. The light should not suffer damage, should not be dislodged from the lifejacket and should function as prescribed in paragraph 2.12.2.

2.12.4 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 paragraph 1.9.2).

3 IMMERSION SUITS AND THERMAL PROTECTIVE AIDS

3.1 Tests common to non-insulated and insulated immersion suits

3.1.1 *Test subjects*

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

3.1.2 *Tests with a lifejacket*

If the immersion suit is to be worn in conjunction with a lifejacket, a lifejacket should be worn over the immersion suit for the tests prescribed in paragraphs 3.1.3 to 3.1.10 inclusive.

3.1.3 *Donning test*

3.1.3.1 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, 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.

3.1.3.2 The immersion suit should be capable of being donned in a reasonable time at ambient temperatures as low as –30°C.

3.1.4 *Ergonomic test*

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.

3.1.5 *Field of vision test*

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.

3.1.6 *Flotation test*

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.

3.1.7 *Righting test*

When wearing the immersion suit, the test subjects should each demonstrate that they can turn themselves from a face-down to face-up position in not more than 5 s.

3.1.8 *Water ingress and jump test*

3.1.8.1 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.

3.1.8.2 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.

3.1.9 *Leak test*

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 paragraph 3.1.8.1.

3.1.10 *Swimming and water emergence test*

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.

3.1.11 *Test for oil resistance*

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 paragraph 3.1.9. The ingress of water should not exceed a mass of 200 g.

3.1.12 *Fire test*

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.

3.1.13 *Temperature cycling test*

An immersion suit should be subjected to the temperature cycling as prescribed in paragraph 1.2.2 and should show no sign of damage such as shrinking, cracking, swelling, dissolution or change of mechanical qualities.

3.1.14 *Buoyancy test*

A buoyancy test, as prescribed in paragraph 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.

3.1.15 *Strength test*

The immersion suit should be subjected to the body strength tests prescribed in paragraph 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

3.2.1 *Test clothing*

3.2.1.1 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.

3.2.1.2 In addition, for the thermal protective test prescribed in paragraph 3.2.2, the test subject should wear two woollen pullovers.

3.2.2 *Test for thermal protective qualities*

3.2.2.1 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.

3.2.2.2 Immediately on leaving the water after completion of the test prescribed in paragraph 3.2.2.1, the test subject should be able to pick up a pencil and write.

3.3 Specific tests for insulated immersion suits

3.3.1 *Test clothing*

The test subjects should wear the standard range of clothing prescribed in paragraph 3.2.1.1 and a lifejacket if the immersion suit is to be worn in conjunction with a lifejacket.

3.3.2 *Test for thermal protective qualities*

3.3.2.1 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 of 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.

3.3.2.2 Immediately on leaving the water after completion of the test prescribed in paragraph 3.3.2.1, the test subject should be able to pick up a pencil and write.

3.4 Thermal protective aids for survival craft

3.4.1 *Fabric test*

3.4.1.1 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.

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

3.4.2 *Temperature cycling test*

A thermal protective aid should be subjected to temperature cycling as prescribed in paragraph 1.2.2 and should show no sign of damage such as shrinking, cracking, swelling, dissolution or change of mechanical qualities.

3.4.3 *Test subjects*

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.

3.4.4 *Test clothing*

The test clothing worn by the test subjects should be as prescribed in paragraph 3.2.1.

3.4.5 *Donning test*

3.4.5.1 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.

3.4.5.2 The thermal protective aid should be capable of being unpacked and donned at an ambient temperature of –30°C.

3.4.6 *Discarding test*

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.

3.4.7 *Test for oil resistance*

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 Temperature tests

A specimen of each type of pyrotechnic should be subjected to:

.1 temperature cycling as prescribed in paragraph 1.2.2 and then function efficiently 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; and

.4 a temperature of +65°C and 90% relative humidity for at least 96 h, followed by 10 days at 20° to 25°C and 65% relative humidity and then function effectively.

4.2 Water and corrosion resistance test

Each type of pyrotechnic should function effectively after being:

.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; and

.3 subjected to a salt spray (20% natrium chloride solution) at a temperature of +35 ± 3°C for at least 100 h.

4.3 Handling safety test

A specimen of each type of pyrotechnic should:

.1 be dropped in turn end-on and horizontally from a height of 2 m onto a steel plate about 6 mm thick cemented onto 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 to establish that it can be operated without injury to the operator, or any person in close proximity, during firing or burning.

4.4 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 contain 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.

4.5 Rocket parachute flares test

4.5.1 A rocket 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.

4.5.2 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".*

4.5.3 A rocket should function efficiently when tested by firing it at an angle of 45° to the horizontal.

4.5.4 If operated from a hand held position, it should be demonstrated that the recoil of the rocket is minimal.

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* Special Publication 440, National Bureau of Standards, Washington, D.C. 20402, U.S.A.

4.6 Hand flares test

4.6.1 A flare should be activated and should burn for a period of not less than 1 min. After burning for 30 s it 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.

4.6.2 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".*

4.6.3 A flare 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.

4.7 Buoyant smoke signals test

4.7.1 Following temperature cycling as prescribed in paragraph 1.2.2, one smoke signal should be activated and then should operate in seawater at a temperature of −1°C. A second smoke signal should be activated and then should operate in seawater at a temperature of +30°C. After the 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.

4.7.2 A smoke signal should function in water covered by a 2 mm layer of heptane without igniting the heptane.

4.7.3 Laboratory testing of the smoke signal should establish that at least 30% 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".*

4.7.4 A smoke signal should be tested in waves at least 300 mm high. The signal should function properly 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.

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* Special Publication 440, National Bureau of Standards, Washington, D.C. 20402, U.S.A.

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, 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 paragraph 5.18.3. The thorough inspection prescribed in paragraph 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 hazard the liferaft. Damage to any item of equipment is acceptable subject to the Administration being satisfied that the operational efficiency has not been impaired. In particular, damage to any fresh water receptacles may be accepted provided they do not leak.

5.1.5 An equipment container which is not an integral part of the liferaft should be capable of floating for 30 min without harm to any of its contents.

5.2 Jump test

5.2.1 It should be demonstrated that a person can jump onto 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 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 lifeboat is to be approved.

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

5.3 Weight test

The fully packed liferaft container should be weighed to determine whether its mass exceeds 185 kg.

5.4 Towing test

It should be demonstrated by towing that the fully laden liferaft is capable of being satisfactorily towed at up to 3 knots in calm water.

5.5 Mooring out tests

The liferaft should be loaded with mass equal to 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. The liferaft should not sustain any damage that would impair its performance. After this test, an inflatable liferaft should be subjected to the pressure test prescribed in paragraph 5.18.4.

5.6 Liferaft painter system test

5.6.1 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.

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

5.7 Liferaft light tests

5.7.1 Twelve liferaft canopy lights and 12 interior liferaft lights should be subjected to the temperature cycling as prescribed in paragraph 1.2.2. If the same type of light is used for both canopy and interior only 12 lights of that type need to be tested.

5.7.2 Four liferaft lights of each type should then be operated immersed in seawater at a temperature of −1°C, four of each type in seawater at a temperature of +30°C and four of each type in fresh water at ambient temperature. The canopy 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.

5.7.3 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.

5.8 Loading and seating test

The freeboard of the liferaft in the light condition 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.

5.9 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.

5.10 Stability test

5.10.1 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.

5.10.2 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.

5.11 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.

5.12 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 remain seaworthy. The liferaft should not seriously deform in this condition. Trials may be required to show that the liferaft does not flex significantly in waves.

5.13 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.

5.14 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.

5.15 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.

5.16 Hydrostatic release units

5.16.1 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 paragraphs 5.16.2 and 5.16.3.

5.16.2 *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 (20% natrium chloride solution) at a temperature of +35 ± 3° for 160 h without interruption. After completion 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 paragraph 1.2.2.

.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 ± 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 *Resistance to seawater*

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.

5.16.3 *Performance test*

5.16.3.1 A liferaft should be placed horizontally in a rack or platform of sufficient weight to submerge the liferaft. The hydrostatic release unit and the painter should be installed as on board ship.

5.16.3.2 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.

5.17 Davit-launched liferafts – strength test of lifting components

5.17.1 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 6 times the mass of the liferaft when loaded with the number of persons for which it is to be approved and equipment.

5.17.2 *Impact test*

The liferaft should be loaded with a mass equal to 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.

5.17.3 *Drop test*

The liferaft, loaded as prescribed in 5.17.2, should be suspended from its releasing gear 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.

5.17.4 *Davit-launched liferaft boarding test*

A davit-launched liferaft should, in addition to the boarding test prescribed in paragraph 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 is to simulate actual shipboard conditions and should be timed and recorded.

5.18 Additional tests applicable to inflatable liferafts only

5.18.1 *Damage test*

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.

5.18.2 *Righting test*

For this test the liferaft should be inverted. 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 preconditioning as in paragraph 5.9. Each person should attempt to right the liferaft unaided. The water should be of a depth sufficient to prevent any external assistance when mounting the inverted liferaft. The righting arrangements will be considered satisfactory if each person rights the liferaft unaided.

5.18.3 *Inflation test*

5.18.3.1 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. buoyancy tubes 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 in:

.3.1 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.

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

5.18.3.3 For the inflation test at –30°C the packed liferaft should be placed in a refrigerated chamber at a temperature of –30°C for 24 h prior to inflation by pulling the painter. Under these conditions the liferaft should reach working pressure in 3 min. The liferaft should be subjected to two inflation tests 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.

5.18.3.4 For the inflation test at +65°C the packed liferaft should be 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.

5.18.4 *Pressure test*

5.18.4.1 Each inflatable compartment in the liferaft should be tested to a pressure equal to 3 times the working pressure. There should be no seam slippage, cracking or other defect in the liferaft.

5.18.4.2 The relief valves should be tested to show that the pressure inside the inflated chambers of the liferaft cannot reach twice the working pressure of the liferaft. There should be no seam slippage, cracking or other defect in the liferaft.

5.18.5 *Seam strength test*

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

5.18.6 *Davit-launched inflatable liferafts – strength test*

5.18.6.1 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:

.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 inflated;

.3 when fully inflated, all relief valves should be closed; and

.4 the liferaft should then be loaded with a distributed mass equivalent to 4 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.

5.18.6.2 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.

5.18.6.3 The pressure before and after the test in paragraph 5.18.6.1 above should be recorded.

5.18.6.4 Any dimensional deflections or distortions of the liferaft during the test in paragraph 5.18.6.1 above should be recorded.

5.18.6.5 A liferaft should be lowered against a structure erected to represent the side of a ship having a 20° adverse list.

5.19 Additional tests applicable to rigid liferafts only

5.19.1 *Buoyancy material test*

Buoyancy material should be subjected to the tests described in paragraphs 6.11.2 to 6.11.5 inclusive.

5.19.2 *Floor strength test*

In order to ensure that the floor of the liferaft is able to withstand concentrated loads and that the floor is effectively joined to the buoyancy, the following overload test should be performed.

The liferaft should be placed on a firm and level surface and loaded, over the floor area, to represent 100% overload. Deflection of the floor and buoyancy section should be recorded. No permanent distortion should be noticeable when the load has been removed.

5.19.3 *Righting test*

For this test the liferaft should be inverted. The righting test should be carried out by the same team of persons required for the boarding test similarly clothed and wearing approved lifejackets and after preconditioning as in paragraph 5.9. Each person should attempt to right the liferaft unaided. The water should be of a depth sufficient to prevent any external assistance when mounting the inverted liferaft. The righting arrangements will be considered satisfactory if each person rights the liferaft unaided.

5.19.4 *Davit-launched rigid liferafts — strength test*

It should be demonstrated by an overload test on the liferaft hanging from its centre support that the bridle system has the required factor of safety. The liferaft should be loaded with a distributed mass equivalent to 4 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.

5.19.5 *Float-free test*

When the design of a liferaft incorporates holding down arrangements provided with automatic release or breaking restraints, or when a cover is provided to protect the liferaft in its stowed position, it should be demonstrated that the arrangements will not inhibit the float-free characteristics of the liferaft.

6 LIFEBOATS

6.1 Strength test

It should be demonstrated that the lifeboat has sufficient strength to enable it to be lowered into the water when loaded with a distributed mass equal to the number of persons for which it is to be approved and its equipment, and that it is capable of being launched and towed at a speed of up to 5 knots in calm water.

6.2 Material test

The material should be 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 determined and should be to the satisfaction of the Administration.

6.3 Stability test

It should be demonstrated that the lifeboat has positive stability in the water when loaded with a distributed mass equal to the number of persons for which it is to be approved and its equipment. The lifeboat should also have positive stability in the above loaded condition 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.

6.4 Lifeboat overload test

6.4.1 The unloaded lifeboat should be placed on blocks, or suspended from the lifting hooks, and sights erected for recording keel sag. It should then be loaded with weights evently distributed and representing incremental overloads of 25%, 50%, 75% and 100% of the total mass of the number of persons for which it is to be approved, at 75 kg per person, and its equipment. Weights should be so disposed as to represent the loading of the lifeboat in its service condition, but they need not be placed 300 mm above the seats to represent the centre of gravity of the seated persons. The weights for the various overloads should be correspondingly disposed. For this reason, testing by filling with water should not be accepted as this method does not give the proper disposition of weight. Parts of the machinery may be removed in order to avoid damage to them; weights should be added to the lifeboat to compensate for the removal of such machinery parts.

6.4.2 Measurement at full load, 25%, 50%, 75% and 100% overloads should be recorded as follows:

.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.

6.4.3 The keel deflection and change in breadth at paragraphs 6.4.2.1 and 6.4.2.3 should not exceed 1/400th part of the lifeboat's length when the lifeboat is subjected to 25% overload and the results at 100% overload should be approximately in proportion to those obtained at 25% overload. For example, for a deflection of the keel or gunwale at 25% overload of 16 mm, the deflection of the keel or gunwale at 100% overload should not exceed approximately $\frac{16 \times 200}{125}$ = 25 mm.

6.4.4 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; such measurement should be taken after a suitable lapse of time sufficient to permit the glass reinforced plastic construction to recover to its original form, i.e. approximately 18 h.

6.4.5 A lifeboat constructed of metal should be submitted to an overload of 25% by adding weights equal to the sum of 25% of the mass of the lifeboat and 125% of the total mass of all equipment and the number of persons for which it is to be approved. The weights should then be removed and the dimensions of the lifeboat checked; no significant residual deflection should result.

6.5 Lifeboat impact test

The fully equipped lifeboat, including engine, should be loaded with weights equal to the mass of the number of persons for which the lifeboat is to be approved and with skates or fenders, if required, in position. With the lifeboat 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. It should then be released to impact against the rigid vertical surface. No damage should be sustained that would affect the lifeboat's efficient functioning. In the case of self-righting partially enclosed and totally enclosed lifeboats, measurements should be taken of acceleration forces on dummies at different positions within the lifeboat to determine acceptability.

6.6 Lifeboat drop test

The fully equipped lifeboat, including engine, should be loaded with weights equal to the mass of all persons for which the lifeboat is to be approved. 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. No damage should be sustained that would render the lifeboat unserviceable.

6.7 Lifeboat seating strength test

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.

6.8 Lifeboat seating 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 all wearing lifejackets and any other essential equipment required should then 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 to demonstrate that it can be operated without difficulty or 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 test

The lifeboat with its engine fitted 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; it should not be less than 1.5% of the lifeboat's length and in no case less than 100 mm.

6.10 Release mechanism test

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 from each fall simultaneously without binding or damage to any part of the lifeboat or the release mechanism. It should also be confirmed that the lifeboat will release from the falls simultaneously when fully waterborne in the light condition and in a 10% overload condition. The above requirements also apply to single-fall launching appliances.

6.10.2 The release mechanism should be mounted on a tensile strength testing device. The load should be increased to at least 6 times the working load on the mechanism without failure.

6.10.3 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.

6.10.4 It should be demonstrated that the release device can release the painter of 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 of up to 5 knots.

6.11 Lifeboat buoyancy test

6.11.1 When inherent buoyant material is required, the material should be subjected to the tests prescribed in paragraph 2.7 except that in 2.7.3.2.3 high octane petroleum spirit should be substituted for diesel oil.

6.11.2 In addition, two specimens should be immersed for a period of 14 days under a 100 mm head of:

.1 crude oil

.2 fuel oil

.3 diesel oil

.4 high octane petroleum spirit and

.5 kerosene.

6.11.3 These specimens should be tested as supplied, the tests being carried out at normal room temperature (approximately 18°C).

6.11.4 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 paragraph 2.7.3.

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

6.11.6 The buoyancy should be stated as for the water absorption tests.

6.12 Lifeboat operational test

6.12.1 *Operation of engine and fuel consumption*

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.

6.12.2 *Cold engine starting test*

The engine may be removed from the lifeboat for this test, however, it should be equipped with all accessories and the transmission that will be used in the lifeboat. The engine should be placed in a chamber at a temperature of −15°C and allowed to remain until temperatures of all parts have reached the temperature of the chamber. Temperature of the fuel, lubricating oil (together with a separate sample of each), and cooling fluid (if any) should be measured for this test. The engine should be started 3 times. The first 2 times, the engine should be allowed to operate long enough to demonstrate that it runs at operating speed. After the first 2 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 at least 10 min and during this period the transmission should be operated through its gear positions.

6.12.3 *Engine-out-of-water test*

If the engine is a watercooled engine, it should be operated for at least 5 min at idling speed under conditions simulating the boat out of water. The engine should not be damaged as a result of this test.

6.12.4 *Submerged engine test*

The engine should be operated for at least 5 min 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.

6.13 Lifeboat light tests

The lifeboat light should be subjected to the tests prescribed in paragraph 5.7.

6.14 Canopy erection test

With the partially enclosed or self-righting partially enclosed lifeboat loaded with the number of persons for which it is to be approved it should be demonstrated that the canopy can be easily erected by not more than two persons. In the case of the self-righting partially enclosed lifeboat the two persons should erect it in not more than 2 min.

6.15 Self-righting partially enclosed and totally enclosed lifeboats

In addition to the tests prescribed in paragraphs 6.1 to 6.13, self-righting partially enclosed and totally enclosed lifeboats should be subjected to the following tests.

6.15.1 *Self-righting test*

The equipment should be secured in the lifeboat in the normal operating position. Mass representing each person having an average mass of 75 kg should be secured at each seat belt position with its centre of gravity approximately 300 mm above the seat, so as to provide the same effect on stability as when the lifeboat is loaded with the number of persons for which it is to be approved. Using a suitable means capable of rotating the lifeboat about a fore and aft axis to any angle of heel and releasing it, the lifeboat in the enclosed mode should be incrementally turned to angles of heel up to and including 180° and should, on being released, always return to the upright without the assistance of the occupants. The test should be repeated in the light condition. The engine, unless arranged to stop automatically when inverted, should be running in neutral position at the beginning of this test and no water should enter the engine. The engine should continue to run when inverted and for 10 min after being righted. If arranged to stop automatically 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 10 min after the lifeboat has returned to the upright.

6.15.2 *Flooded capsizing test*

The lifeboat should be flooded with water and all entrances allowed to remain open. Using a suitable means of rotating the lifeboat about a fore and aft axis to any angle of heel, the lifeboat should be turned to an angle of 180° and then released. The lifeboat should attain a position that provides an above-water escape for the occupants. For the purpose of this test, the mass and distribution of the occupants may be disregarded, whilst the equipment, or equivalent mass, should be secured in the lifeboat in the normal operating position.

6.15.3 *Engine inversion test*

The engine and its fuel tank should be mounted on a rotatable frame arranged to rotate about an axis equivalent to the fore and aft axis of the boat. A pan should be located under the engine to collect any oil which leaks from the engine, so that it can be measured. The following procedure should be followed:

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

.2 stop engine and turn through 360° in a clockwise direction;

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

.4 stop engine and turn through 360° in an anti-clockwise direction;

.5 restart engine, run for 10 min at full speed then shut down;

.6 allow engine to cool down;

.7 start engine and run at full speed for 5 min;

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

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

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

.11 allow engine to cool down;

.12 repeat procedure in paragraph 6.15.3.8, turning the engine in an anti-clockwise direction;

.13 repeat procedures in paragraphs 6.15.3.10 and 6.15.3.11;

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

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

.16 repeat procedure in paragraph 6.15.3.14, turning the engine anti-clockwise;

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

.18 strip engine for examination.

During this test, the engine should not overheat, fail to operate or leak more than 250 ml of oil during any one inversion. When dismantled the engine should show no evidence of overheating or excessive wear.

6.15.4 *Free-fall test*

A lifeboat designed for free-fall launching should have a test launch from the height at which it is intended to be stowed, taking into account unfavourable conditions of trim and list. The lifeboat should be fully loaded. The test launch should not result in any significant damage to the lifeboat which would impair its operating capabilities.

6.16 Lifeboats with self-contained air support system

In addition to the tests prescribed in paragraphs 6.1 to 6.15 such a lifeboat should be subjected to the following tests.

6.16.1 *Air supply test*

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 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 it 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 Fire-protected lifeboats

In addition to the tests prescribed in paragraphs 6.1 to 6.16 fire-protected lifeboats should be subjected to the following tests.

6.17.1 *Fire test.*

6.17.1.1 The lifeboat should be moored in the centre of an area which is not less than 5 times the maximum projected plan area of the lifeboat, with boundaries capable of completely retaining the fuel. Kerosene should be floated on the water which when ignited will sustain a fire which completely envelops the lifeboat for a period of 8 min.

6.17.1.2 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.

6.17.1.3 The kerosene should be lighted and should continue to burn and envelop the lifeboat for 8 min.

6.17.1.4 The temperature should be recorded at not less than 10 positions on the inside surface and internally away from the inside surface at not less than five positions that would be taken by the occupants. 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.

6.17.1.5 The external surface temperature and temperatures within the fire should be recorded.

6.17.1.6 The inside atmosphere should be continuously sampled and the representative retained samples analysed for the presence and quantity of essential, toxic, or injurious gases or substances. The analysis should cover the range of anticipated gases of substances that may be produced and which can vary according to the materials used and the fabricating techniques employed.

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

6.17.1.8 At the conclusion of the 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.

6.17.2 *Water spray tests*

6.17.2.1 *Spray fire-protection system function test*

Start the engine and spray pump. With the engine running at its designed output measure the rpm of the engine and the pump and the pressure at the suction and delivery side of the pump to obtain the rated values of speed and water pressure.

6.17.2.2 *Spray test when inclined*

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 run the pump at the rated speed and measure the pressure at the suction and delivery side. The pressure obtained in each condition should be satisfactory and the spraying condition observed such that the spray film covers the whole surface of the lifeboat.

6.17.2.3 *Measurement of the thickness of the sprayed water film*

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

7 RESCUE BOATS

7.1 Rigid rescue boats

7.1.1 Rigid rescue boats should be subjected to the tests prescribed in paragraphs 6.1 to 6.13, except paragraph 6.8.1, and to the test prescribed in paragraph 7.2.3.1.2.

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.

7.1.3 *Rigid rescue boat seating test*

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 paragraphs 6.5, 6.7, 6.10, 6.12, 6.13 and 7.1.3.

7.2.2 *Drop tests*

7.2.2.1 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 3 times from a height of at least 3 m onto water. The drops should be from the 45° bow-down, level-trim and 45° stern-down attitudes.

7.2.2.2 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.

7.2.3 *Loading tests*

7.2.3.1 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.

7.2.3.2 With the rescue boat in any of the conditions prescribed in paragraph 7.2.3.1, 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.

7.2.4 *Stability test*

7.2.4.1 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.

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

7.2.5 *Damage test*

7.2.5.1 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.

7.2.5.2 In each of the conditions prescribed by paragraph 7.2.5.1, the full number of persons for which the rescue boat is to be approved should be supported within the rescue boat.

7.2.6 *Manoeuvrability and towing tests*

7.2.6.1 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 knot 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.

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

7.2.7 *Righting test*

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.

7.2.8 *Simulated heavy weather test*

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.

7.2.9 *Swamp test*

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.

7.2.10 *Overload tests*

The inflated rescue boat, loaded with 3 times the mass of the rescue boat, its engine and fuel, equipment and the number of persons for which it is to be approved, should be suspended from its bridle at a temperature of +20°C with all relief valves inoperative. The rescue boat should then be loaded to 1.1 times the mass of the rescue boat, its engine and fuel, equipment and the number of persons for which it is to be approved and should be suspended from its bridle at a temperature of −30°C with all relief valves operative. The rescue boat and bridle should be examined after each test is conducted and should not show any signs of damage.

7.2.11 *Detailed inspection*

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.

8 LAUNCHING AND EMBARKATION APPLIANCES

8.1 Testing of davits and launching appliances before installation

8.1.1 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.

8.1.2 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 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.

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 outboard to 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 a fully equipped lifeboat, without persons, or the lightest survival craft intended for use with the winch should also be demonstrated.

8.1.5 A winch intended for use with a rescue boat should be demonstrated to recover 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.

9 LINE-THROWING APPLIANCES

9.1 Tests for pyrotechnics

Rockets used in line-throwing appliances should be subjected to the tests prescribed in paragraphs 4.2.1, 4.2.3, 4.3, 4.4.1 (if appropriate), 4.4.5 and 4.4.6.

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 paragraph 4.1.

PART 2

PRODUCTION AND INSTALLATION TESTS

1 GENERAL

1.1 Except where all appliances of a particular type are required by chapter III 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

2.1.1 *Production tests*

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

2.1.2 *Inspections by the Administration*

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 not satisfied a flotation test should be undertaken.

3 PORTABLE BUOYANCY EQUIPMENT

3.1 Lifebuoys

3.1.1 *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

4.1 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. It must be observed that undue effort is not required to secure inflation and that the time of inflation is normal.

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 The gas-tight integrity of each inflated compartment of each liferaft produced should be checked by inflating with air to its working pressure. After 30 min, the pressure should be checked and adjusted to the working pressure as necessary. After 1 h the pressure should not have decreased by more than 2% after compensation for temperature and barometric pressure changes. More than one compartment may be tested at one time, but adjacent compartments with common pressure barriers should be open to the atmosphere during the test.

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 2% after compensation for temperature and barometric pressure changes.

5.2 Davit-launched liferafts and inflatable rescue boats

Every new davit-launched liferaft 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 10% overload to be 10% of the mass of the liferaft assembly together with its equipment and full complement of persons calculated at 75 kg per person; and

.2 the liferaft must be inflated to normal working pressure determined by the reseat of the relief valves.

5.3 Lifeboats and rescue boats

5.3.1 Each new 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 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

6.1.1 *Factory overload test*

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.

6.1.2 *Light lowering test*

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 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. 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.

6.1.3 *Loaded lowering test*

6.1.3.1 The survival craft or rescue boat loaded with its normal equipment or an equivalent mass and a distributed mass equal to 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.

6.1.3.2 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.

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

6.1.4 *Recovery test*

6.1.4.1 It should be demonstrated that the survival craft can be recovered to its stowage position by means of operating the hand gear and can be safely and properly secured.

6.1.4.2 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.

6.1.4.3 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 the number of persons it is approved to carry can be recovered at a rate of not less than 0.3 m/s.

6.1.4.4 It should be demonstrated that the rescue boat can be recovered with the same winch as described in paragraph 6.1.4.3 by means of a hand gear.

6.2 Installation tests of liferaft launching appliances

6.2.1 *Testing of release arrangements*

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.

6.2.2 *Lowering test*

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.

6.2.3 *Recording of lowering test*

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.

6.2.4 *Towing strain test*

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