

SCHEDULE 15

TEST PROCEDURES

PART III—

TESTS FOR PACKAGES

Preparation of a specimen for testing

1. All specimens shall be examined before testing in order to identify and record faults or damage including the following:

- (a) divergence from the design;
- (b) defects in construction;
- (c) corrosion or other deterioration; and
- (d) distortion of features.

2. The containment system of the package shall be clearly specified.

3. The external features of the specimen shall be clearly identified so that reference may be made simply and clearly to any part of such specimen.

Testing the integrity of the containment system, shielding and criticality safety

4. After the applicable tests specified in paragraphs 6–20 below:

- (a) Faults and damage shall be identified and recorded;
- (b) It shall be determined whether the integrity of the containment system and shielding has been retained to the extent required in Schedules 2, 7, 9, 11, 12 and 13 for the packaging under test; and
- (c) For packages containing fissile material, it shall be determined whether the assumptions made in paragraphs 1 to 6 of Schedule 7 regarding the most reactive configuration and degree of moderation of the fissile contents, of any escaped material, and of one or more packages are valid.

Target for drop tests

5. The target for the drop tests specified in paragraphs 9, 12(a) and 14 shall be a flat, horizontal surface of such a character that any increase in its resistance to displacement or deformation upon impact by the specimen would not significantly increase the damage to the specimen.

Test for demonstrating ability to withstand normal conditions of transport

6. The tests are: the water spray test, the free drop test, the stacking test, and the penetration test. Specimens of the package shall be subjected to the free drop test, the stacking test and the penetration test, preceded in each case by the water spray test. One specimen may be used for all the tests, provided that the requirements of paragraph 7 are fulfilled.

7. The time interval between the conclusion of the water spray test and the succeeding test shall be such that the water has soaked in to the maximum extent, without appreciable drying of the exterior of the specimen. In the absence of any evidence to the contrary, this interval shall be taken to be two hours if the water spray is applied from four directions simultaneously. No time interval shall elapse, however, if the water spray is applied from each of the four directions consecutively.

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Water spray test:

8. The specimen shall be subjected to a water spray test that simulates exposure to rainfall of approximately 5 cm per hour for at least one hour.

Free drop test:

9. The specimen shall drop on to the target so as to suffer maximum damage in respect of the safety features to be tested and—

- (a) The height of drop measured from the lowest point of the specimen to the upper surface of the target shall be not less than the distance specified in Table XIII of Schedule 36 for the applicable mass. The target shall be as defined in paragraph 5 above.
- (b) For packages containing fissile material the free drop test specified above shall be preceded by a free drop from a height of 0.3 metres on to each corner or, in the case of a cylindrical package, on to each of the quarters of each rim.
- (c) For rectangular fibreboard or wood packages not exceeding a mass of 50 kg, a separate specimen shall be subjected to a free drop on to each corner from a height of 0.3 metres.
- (d) For cylindrical fibreboard packages not exceeding a mass of 100 kg, a separate specimen shall be subjected to a free drop on to each of the quarters of each rim from a height of 0.3 metres.

Stacking test:

10. Unless the shape of the packaging effectively prevents stacking, the specimen shall be subjected, for a period of 24 hours, to a compressive load equal to the greater of the following:

- (a) The equivalent of 5 times the mass of the actual package; and
- (b) The equivalent of 13 kPa multiplied by the vertically projected area of the package.

The load shall be applied uniformly to two opposite sides of the specimen, one of which shall be the base on which the package would normally rest.

Penetration test:

11. The specimen shall be placed on a rigid, flat, horizontal surface which will not move significantly while the test is carried out.

- (a) A bar of 3.2 cm in diameter with a hemispherical end and a mass of 6 kg shall be dropped and directed to fall, with its longitudinal axis vertical, on to the centre of the weakest part of the specimen, so that, if it penetrates sufficiently far, it will hit the containment system. The bar shall not be significantly deformed by the test performance.
- (b) The height of drop of the bar measured from its lower end to the intended point of impact on the upper surface of the specimen shall be 1 metre.

Additional tests for Type A packages designed for liquids and gases

12. A specimen or separate specimens shall be subjected to each of the following tests unless it can be demonstrated that one test is more severe for the specimen in question than the other, in which case one specimen shall be subjected to the more severe test:

- (a) Free drop test: The specimen shall drop on to the target so as to suffer the maximum damage in respect of containment. The height of the drop measured from the lowest part of the specimen to the upper surface of the target shall be 9 metres. The target shall be as defined in paragraph 5 above.

- (b) Penetration test: The specimen shall be subjected to the test specified in paragraph 11 above except that the height of drop shall be increased to 1.7 metres from the 1 metre specified in paragraph 11(b).

Tests for demonstrating ability to withstand accident conditions of transport

13. The specimen shall be subjected to the cumulative effects of the tests specified in paragraphs 14 and 15, in that order. Following these tests, either this specimen or a separate specimen shall be subjected to the effect(s) of the water immersion test(s) as specified in paragraph 16 and, if applicable, paragraph 17.

Mechanical test:

14. The mechanical test consists of three different drop tests. Each specimen shall be subjected to the applicable drops as specified in paragraph 8 of Schedule 12. The order in which the specimen is subjected to the drops shall be such that, on completion of the mechanical test, the specimen shall have suffered such damage as will lead to the maximum damage in the thermal test which follows.

- (a) For drop I, the specimen shall be dropped on to the target so as to suffer the maximum damage, and the height of the drop measured from the lowest point of the specimen to the upper surface of the target shall be 9 metres. The target shall be as defined in paragraph 5 above.
- (b) For drop II, the specimen shall be dropped so as to suffer the maximum damage on to a bar rigidly mounted perpendicularly on the target. The height of the drop measured from the intended point of impact of the specimen to the upper surface of the bar shall be 1 metre. The bar shall be of solid mild steel of circular section, (15.0 ± 0.5) cm in diameter, and 20 cm long unless a longer bar would cause greater damage, in which case a bar of sufficient length to cause maximum damage shall be used. The upper end of the bar shall be flat and horizontal with its edges rounded off to a radius of not more than 6 mm. The target on which the bar is mounted shall be as described in paragraph 5.
- (c) For drop III, the specimen shall be subjected to a dynamic crush test by positioning the specimen on the target so as to suffer maximum damage by the drop of a 500 kg mass from 9 metres on to the specimen. The mass shall consist of a solid mild steel plate 1 metre \times 1 metre and shall fall in a horizontal attitude. The height of the drop shall be measured from the underside of the plate to the highest point of the specimen. The target on which the specimen rests shall be as defined in paragraph 5.

Thermal test:

15. The thermal test shall consist of the exposure of a specimen fully engulfed, except for a simple support system, in a hydrocarbon fuel/air fire of sufficient extent and in sufficiently quiescent ambient conditions to provide an average emissivity coefficient of at least 0.9, with an average flame temperature of at least 800°C for a period of 30 minutes, or shall be any other thermal test which provides the equivalent total heat input to the package. The fuel source shall extend horizontally at least 1 metre, and shall not extend more than 3 metres, beyond any external surface of the specimen, and the specimen shall be positioned 1 metre above the surface of the fuel source. After the cessation of external heat input, the specimen shall not be cooled artificially and any combustion of materials of the specimen shall be allowed to proceed naturally. For demonstration purposes, the surface absorptivity coefficient shall be either 0.8 or that value which the package may be demonstrated to possess if exposed to the fire specified; and the convective coefficient shall be that value which the designer can justify if the package were exposed to the fire specified. With respect to the initial conditions for the thermal test, the demonstration of compliance shall be based upon the assumption that the package is in equilibrium at an ambient temperature of 38°C. The effects of solar radiation

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may be neglected prior to and during the tests, but must be taken into account in the subsequent evaluation of the package response.

Water immersion test:

16. The specimen shall be immersed under a head of water of at least 15 metres for a period of not less than eight hours in the attitude which will lead to maximum damage. For demonstration purposes, an external gauge pressure of at least 150 kPa shall be considered to meet these conditions.

Water immersion test for packages containing irradiated nuclear fuel

17. The specimen shall be immersed under a head of water of at least 200 metres for a period of not less than one hour. For demonstration purposes, an external gauge pressure of at least 2 MPa shall be considered to meet these conditions.

Water leakage test for packages containing fissile material

18. Packages for which water in-leakage or out-leakage to the extent which results in greatest reactivity has been assumed for purposes of assessment under paragraphs 3 to 6 of Schedule 7 shall be excepted from the test specified in paragraph 20.

19. Before the specimen is subjected to the water leakage test specified in paragraph 20, it shall be subjected to the tests in paragraph 14(b), and either paragraph 14(a) or (c) as required by paragraph 8 of Schedule 12, and the test specified in paragraph 15.

20. The specimen shall be immersed under a head of water of at least 0.9 metres for a period of not less than eight hours and in the attitude for which maximum leakage is expected.