

The logo for UTAC, featuring the letters 'UTAC' in a bold, white, sans-serif font. A white swoosh underline is positioned above the 'C' and extends to the right.

UTAC

ADVANCING MOBILITY SINCE 1924

R134

Drop test clarification

11/2024

R134 serie 1

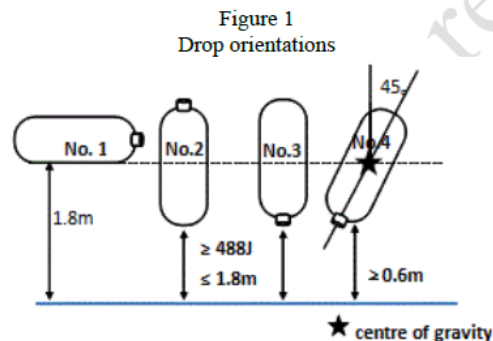
3.2. Drop (impact) test (unpressurized)

The storage container is drop tested at ambient temperature without internal pressurization or attached valves. The surface onto which the containers are dropped shall be a smooth, horizontal concrete pad or other flooring type with equivalent hardness.

The orientation of the container being dropped (in accordance with the requirement of paragraph 5.2.2.) is determined as follows: One or more additional container(s) shall be dropped in each of the orientations described below. The drop orientations may be executed with a single container or as many as four containers may be used to accomplish the four drop orientations.

- (i) Dropped once from a horizontal position with the bottom 1.8 m above the surface onto which it is dropped;
- (ii) Dropped once onto the end of the container from a vertical position with the ported end upward with a potential energy of not less than 488 J, with the height of the lower end no greater than 1.8 m;
- (iii) Dropped once onto the end of the container from a vertical position with the ported end downward with a potential energy of not less than 488 J, with the height of the lower end no greater than 1.8 m. If the container is symmetrical (identical ported ends), this drop orientation is not required;
- (iv) Dropped once at a 45° angle from the vertical orientation with a ported end downward with its centre of gravity 1.8 m above the ground. However, if the bottom is closer to the ground than 0.6 m, the drop angle shall be changed to maintain a minimum height of 0.6 m and a centre of gravity of 1.8 m above the ground.

The four drop orientations are illustrated in Figure 1.



→ One or more additional container(s) dropped in each of the 4 orientations

No attempt shall be made to prevent the bouncing of containers, but the containers may be prevented from falling over during the vertical drop tests described above.

If more than one container is used to execute all drop specifications, then those containers shall undergo pressure cycling according to Annex 3, paragraph 2.2. until either leakage or 22,000 cycles for a 15-year service life or 30,000 cycles for a 20-year service life without leakage have occurred. Leakage shall not occur within 11,000 cycles for a 15-year service life or 15,000 cycles for a 20-year service life.

The orientation of the container being dropped in accordance with the requirement of paragraph 5.2.2. shall be identified as follows:

- (a) If a single container was subjected to all four drop orientations, then the container being dropped in accordance with the requirement of paragraph 5.2.2. shall be dropped in all four orientations;
- (b) If more than one container is used to execute the four drop orientations, and if all containers reach 22,000 cycles for a 15-year service life or 30,000 cycles for a 20-year service life without leakage, then the orientation of the container being dropped in accordance with the requirement paragraph 5.2.2. is the 45° orientation (iv), and that container shall then undergo further testing as specified in paragraph 5.2.;
- (c) If more than one container is used to execute the four drop orientations and if any container does not reach 22,000 cycles for a 15-year service life or 30,000 cycles for a 20-year service life without leakage, then the new container shall be subjected to the drop orientation(s) that resulted in the lowest number of cycles to leakage and then will undergo further testing as specified in paragraph 5.2.

→ Updated in serie 2

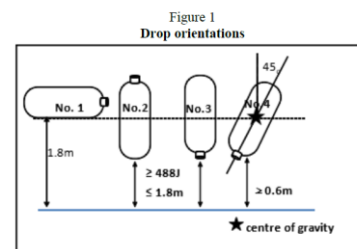
3.2. Drop (impact) test (unpressurized)

The container and its container attachments (if any) is drop tested without internal pressurization or attached valves. The surface onto which the test article is dropped shall be a smooth, horizontal concrete pad or other flooring type with equivalent hardness. No attempt shall be made to prevent the test article from bouncing or falling over during a drop test, but the test article shall be prevented from falling over during the vertical drop test.

The test article shall be dropped in any one of the following four orientations:

- (i) From a horizontal position with the bottom 1.8 m above the surface onto which it is dropped. In case of non-axisymmetric container, the largest projection area of the container shall be oriented downward and aligned horizontally, the shut-off valve interface location and its centre of gravity should be horizontally aligned as it is feasible;
- (ii) From a vertical position with the shut-off valve interface location upward, with a drop height calculated based on a potential energy of 488 J. In no case shall the height of the lower end be less than 0.1m or greater than 1.8m. In case of non-axisymmetric container, the shut-off valve interface location and its centre of gravity shall be vertically aligned;
- (iii) From a vertical position with the shut-off valve interface location downward, with a drop height calculated based on a potential energy of 488 J. In no case shall the height of the lower end be less than 0.1m or greater than 1.8m. If the container is symmetrical (identical ends), this drop orientation is not required. In case of non-axisymmetric container, the shut-off valve interface location and its centre of gravity shall be vertically aligned;
- (iv) From a 45° angle from the vertical orientation with the shut-off valve interface location downward with its centre of gravity at 1.8 m above the ground. However, if the bottom is closer to the ground than 0.6 m, the drop angle shall be changed to maintain a minimum height of 0.6 m and a centre of gravity at 1.8 m above the ground. In case of non-axisymmetric container, the line passing the shut-off valve interface location end and its centre of gravity shall be 45° angled from vertical orientation and the shut-off valve interface location shall become the lowest.

The four drop orientations are illustrated in Figure 1.



→ Our understanding : one container(s) dropped in one of the orientations

Justification from GTR13 amendment 1

147. Most test procedures for hydrogen storage systems derive from test procedures specified in historical national regulations and/or industry standards. Key differences are the execution of tests in sequence (as opposed to historical execution of tests in parallel, each on a separate new container), and slowing of the filling rate in burst testing to correspond to in-service fuelling rates. In addition, hold times at burst pressure test points have been extended to 4 minutes. These changes are designed to reduce the sensitivity of initial burst measurements to the fuelling rate and to evaluate capability to sustain pressure. An evaluation of the sufficiency and stringency of requirements in this UN GTR document compared to historical EU requirements is given in Transport Research Laboratory Project Report RPN1742 "Hydrogen-Powered Vehicles: A Comparison of the European Legislation and the draft ECE global technical regulation" by C. Visvikis.

(a) Due to the various speeds at which a hydraulic cycle may be performed, a provision has been added for container manufacturers to specify a pressure cycle profile (paragraph 6.2.3.2.). This will prevent the premature failure of the container due to test conditions outside of the design envelope while still maintaining the stringency of the tests.

(b) The drop test procedure has been streamlined such that only one container will be dropped once. The container shall withstand the one drop out of any impact orientations specified in the test procedure.

But in the sentence, it is not specified who choose the orientation ? Usually in regulations, it is specified if it is up to the Technical Service / authority, or the manufacturer, or an agreement between the two to take the decision.

Proposed update for 03 series / Supplement 2 to the 02 Serie:

The test article shall be dropped in any one of the following four orientations *The orientation chosen for the test shall be determined by the Technical Service, in consultation with the manufacturer.*

Justification:

In part I of UN Regulation No. 134, a drop test on the storage container is requested.

In the 01 series of amendment to UN Regulation No.134, the requirement was to drop one or more additional container(s) in each of the 4 orientations.

The drop test procedure was then modified in GTR 13 amendment 1 : it has been streamlined such that only one container will be dropped once (“The container shall withstand the one drop out of any impact orientations specified in the test procedure”).

This updated procedure was then transposed in 02 series of amendment to UN Regulation No. 134. But it is not specified in the test who choose this orientation. This is clarified in our proposal.



Thank you!

