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Standard Specification for Determination of Child Resistance of Portable Fuel Containers for Consumer Use¹

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1. Scope

1.1 This specification establishes recognized requirements for determining the child resistance of portable gasoline, kerosene, and diesel containers intended for use by consumers. This specification does not cover single-trip prepackaged containers.

1.1.1 “Containers” as defined herein means the receptacle for gasoline, kerosene, or diesel fuel, including its spouts, retrofit spouts, caps and other closure mechanisms and components intended for use by consumers. If any such spout, retrofit spout, cap or other closure mechanism is sold separately for use with or on portable gasoline, kerosene, or diesel receptacles, it must be designed to and function in compliance with this specification when installed on any such receptacle.

1.2 This specification includes gas/oil mixtures as commonly used for two-cycle engines.

1.3 This specification includes single- and multi-compartment containers.

1.4 This standard addresses the effectiveness of the child resistance (CR) device only after closure cycling, but does not address closure effectiveness:

1.4.1 When at high or low temperatures,

1.4.2 After thermal aging of polymers,

1.4.3 After exposure to sunlight,

1.4.4 After exposure to intended fuels, and

1.4.5 After physical abuses, such as drops or impacts.

NOTE 1—Please see [Appendix X2](#) for additional information on these exemptions.

1.5 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.6 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the*

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responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.

1.7 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*²

F852 Specification for Portable Gasoline Containers for Consumer Use (Withdrawn 2017)³

F976 Specification for Portable Kerosene and Diesel Containers for Consumer Use (Withdrawn 2017)³

2.2 *CARB Documents:*⁴

CP-501 Certification Procedure 501 For Portable Fuel Containers And Spill-Proof Spouts

TP-501 Test Procedure for Determining Integrity of Spill-Proof Spouts and Spill-Proof Systems

TP-502 Test Procedure for Determining Diurnal Emissions from Portable Fuel Containers

2.3 *Other Document:*

40 CFR 59.623 What must I include in my application?⁵

3. Requirements

3.1 *General Requirements:*

3.1.1 Containers and closures shall first meet all requirements of Specifications F852 and F976 where applicable, and also those feasible and appropriate test requirements of CARB CP-501, TP-501, TP-502, and EPA Regulation 40 CFR 59.623,

² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

³ The last approved version of this historical standard is referenced on www.astm.org.

⁴ Available from California Air Resources Board, 1001 “I” Street, Sacramento, CA 95814, <http://www.arb.ca.gov>.

⁵ Available from U.S. Government Printing Office Superintendent of Documents, 732 N. Capitol St., NW, Mail Stop: SDE, Washington, DC 20401, <http://www.access.gpo.gov>.

capable of being adapted to portable fuel containers having CR closures, including ultraviolet (UV) exposure (5.13.1) and immersion (5.11) tests of the closures.

3.1.2 Containers, components, and closures shall be new with container one-quarter full of water for testing in accordance with Sections 4 and 5.

3.1.3 Individual containers, closed with closures shall be tested as described in Section 4 after having been subjected, in sequence, to:

3.1.3.1 Low-temperature exposure at 0°F (−17.8°C) for 8 h.

3.1.3.2 Elevated temperature exposure at 140°F (60°C) for 8 h.

3.1.3.3 Opening and closing of each closure for 250 cycles.

3.1.4 Containers shall then be inverted and inspected visually before and after testing to determine any leakage. Containers indicating leakage shall not be used in further testing.

3.1.5 Containers tested by the methods described in Sections 4 and 5 shall meet the following specifications:

3.1.5.1 Child-resistant effectiveness for each and every closure on a container of not less than 85 %, without a demonstration, and not less than 80 % after a demonstration, of the proper means of opening when 200 children are tested per closure.

3.1.5.2 *Senior Adult Test*—Containers shall have a senior adult-use effectiveness (SAUE) of not less than 90 % for the senior adult panel test of Section 5 for all closures of the container.

4. Test Procedure

4.1 General:

4.1.1 For testing in accordance with Section 4, containers with multiple closures shall have each closure accessible at the same time as would be the likely scenario that a child would encounter the closure.

4.1.1.1 However, for each closure, test using a panel of at least 50 children, and up to 200 children, using a demonstration for that closure.

4.1.1.2 If the container is stored in a different configuration than when it is being used, test with a child panel for each configuration in which it is possible the package will be encountered. (For example, if the spout is stored in the container and then the spout is attached for use, test it once with the spout out and once with the spout in, with the demonstration appropriate for that configuration.)

4.1.1.3 A failure shall be accessing the liquid using any of the openings, regardless of which opening was demonstrated.

4.1.2 Reclosable containers, if assembled by the testing agency, shall be properly secured at least 72 h before beginning

the test to allow the materials (for example, the closure liner) to “take a set.” Torque-dependent closures shall be secured at the same torque as applied normally by adult consumers. The torque value shall be recorded. Document the method to arrive at the torque value.

4.1.3 All containers shall be handled so that no damage or jarring will occur during storage or transportation.

4.1.4 The containers shall be tested at room temperature (23 ± 3°C).

4.2 Child-Resistant Test (Test Subjects/Selection Criteria):

4.2.1 Use from 1 to 4 groups of 50 children, as required under the sequential testing criteria in Table 1. Consent shall be documented for each child participating in the testing, at the child or site level. If the testing is conducted at a central location, a consent form (Appendix X4) shall be completed for each child participating in the testing.

4.2.2 No more than 20 % of the children tested for each closure shall be tested at one site. To assure geographical diversity if testing is completed at a central location, no more than 20 % of the children shall be drawn from a single ZIP code, city, or town.

4.2.3 Each group of children shall be randomly selected as to age, subject to the limitations set forth below.

4.2.4 Thirty percent of the children in each group shall be of age 42 to 44 months, 40 % of the children in each group shall be of age 45 to 48 months, and 30 % of the children in each group shall be of age 49 to 51 months.

4.2.5 The children’s ages in months shall be calculated as follows:

4.2.5.1 Arrange the birth date and test date by the numerical designations for month, day, and year (for example, test date: 8/3/1990; birth date: 6/23/1986).

4.2.5.2 Subtract the month, day, and year numbers for the birth date from the respective numbers for the test date. It is possible that this will result in negative numbers for the months or days.

4.2.5.3 Multiply the difference in years by 12 to obtain the number of months in the difference in years and add this value to the number of months that was obtained when the birth date was subtracted from the test date (that is, $4 \times 12 = 48$; $48 + 2 = 50$). This figure either will remain the same or be adjusted up or down by one month, depending on the number of days obtained in the subtraction of the birth date from the test date.

4.2.5.4 If the number of days obtained by subtracting the days in the birth date from the days in the test date is +16 or more, one month is added to the number of months obtained above. If the number of days is −16 or less, subtract 1 month.

TABLE 1 Number of Closure Openings: Acceptance (Pass), Continue Testing, and Rejection (Fail) Criteria for the First 5 min and the Full 10 min of the Children’s Protocol Test

Test Panel	Cumulative Number of Children	Closure Openings						
		First 5 min			Full 10 min			
		Pass	Continue	Fail	Pass	Continue	Fail	
1	50	0–3	4–10	11+	0–5	6–14	15+	
2	100	4–10	11–18	19+	6–15	16–24	25+	
3	150	11–18	19–25	26+	16–25	26–34	35+	
4	200	19–30		31+	26–40		41+	

If the number of days is between -15 and $+15$ inclusive, no change is made in the number of months. Thus, for the example given above, the number of days is -20 and the number of months is therefore $50 - 1 = 49$ months.

4.2.5.5 The difference between the number of boys and the number of girls in each age range shall not exceed 10 % of the number of children in that range. Select children without an obvious or overt physical or mental handicap.

4.3 *Child-Resistant Tests (Test Failures)*—A test failure shall be any child who opens the closure or gains access to the container’s contents.

4.4 *Sequential Test*—The sequential test is initially conducted using 50 children, and depending on the results, the criteria in **Table 1** determines whether the container is either child resistant or not child resistant or whether further testing is required. Further testing is required if the results are inconclusive and involves the use of one or more additional groups of 50 children each, up to a maximum of 200 children. No individual shall administer the test to more than 30 % of the children tested in each group. **Table 1** gives the acceptance (pass), continue testing, and rejection (fail) criteria to be used for the first 5 min and the full 10 min of the children’s test. If the test continues past the initial 50-child panel, the container openings shown in **Table 1** are cumulative.

4.5 *Test Procedures*—The children shall be divided into groups of two. The testing shall be done in a location that is familiar to the children, for example, their customary nursery school. No child shall test more than two closures. When more than one closure is being tested, each closure shall be dissimilar, and they shall be presented to the paired children in random order. This order shall be recorded. The children shall be tested by the procedure incorporated in the following test instructions:

4.5.1 Alternatively, testing at a central location after the children are made comfortable in that location shall be allowed.

4.6 *Detailed Standardized Child Test Instructions:*

4.6.1 The children shall have no overt physical or mental handicaps. No child with a permanent or temporary illness, injury, or handicap that would interfere with his/her effective participation shall be included in the test.

4.6.2 The testing shall take place in a well-lit location that is or becomes familiar to the children and is isolated from all distractions.

4.6.3 The tester, or another adult, shall escort a pair of children to the test area. The tester shall seat the two children so that there is no visual barrier between the children and the tester.

4.6.4 The tester shall talk to the children to make them feel at ease.

4.6.5 The children shall not be given the impression that they are in a race or contest. They are not to be told that the test is a game or that it is fun. They are not to be offered a reward.

4.6.6 The tester shall record all data before, or after, the test so that full attention can be on the children during the test period.

4.6.7 The tester shall use a stopwatch(s) or other timing devices to time the number of seconds it takes the child to open the container and to time the 5-min test periods.

4.6.8 To begin the test, the tester shall hand the children identical containers, indicate by gesture which opening is being tested and say, “*Please try to open this for me or to get the liquid out.*”

4.6.9 If a child refuses to participate after the test has started, the tester shall reassure the child and gently encourage the child to try. If the child continues to refuse, the tester shall ask the child to hold the container in his/her lap until the other child is finished. This pair of children shall not be eliminated from the results unless the refusing child disrupts the participation of the other child.

4.6.10 Each child shall be given up to 5 min to open his/her container. The tester shall watch the children at all times during the test. The tester shall minimize conversation with the children as long as they continue to attempt to open their containers. The tester shall not discourage the children verbally or with facial expressions. If a child gets frustrated or bored and stops trying to open his/her container, the tester shall reassure the child and gently encourage the child to keep trying (for example, “*Please keep trying to open this for me or to get the liquid out.*”).

4.6.11 The children shall be allowed freedom of movement to work on their containers as long as the tester can watch both children (for example, they can stand up, get down on the floor, or bang or pry the package).

4.6.12 If a child is endangering himself or others at any time, the test shall be stopped and the pair of children eliminated from the final results.

4.6.13 The children shall be allowed to talk to each other about opening the containers and shall be allowed to watch each other try to open the containers.

4.6.14 A child shall not be allowed to try to open the other child’s container.

4.6.15 If a child opens, unlocks any child restraint mechanisms, or otherwise accesses the liquid in the container, the tester shall say, “*thank you,*” take the container from the child, and put it out of the child’s reach. The child shall not be asked to open the container a second time or open any other closure on the container.

4.6.16 At the end of the 5-minute period, the tester shall demonstrate how to open the container using the designated closure if either child has not opened his or her container using the designated closure. The demonstration will include opening and closing only the designated closure. A separate “demo” package shall be used for the demonstration.

4.6.17 Before beginning the demonstration, the tester shall ask the children to set their containers aside. The children shall not be allowed to continue to try to open their containers during the demonstration period.

4.6.18 The tester shall say, “*Watch me open my container.*”

4.6.19 Once the tester gets the children’s full attention, the tester shall hold the demo container approximately 2 ft (0.6 m) from the children and open or unlock the designated closure at a normal speed as if the tester were going to use the contents. There shall be no exaggerated opening movements.

4.6.20 The tester shall not discuss or describe how to open the container.

4.6.21 To begin the second 5-minute period, the tester shall say, “*Now you try to open your container or get the liquid out.*”

4.6.22 If one or both children have not used their teeth to try to open their containers during the first 5 min, the tester shall say immediately before beginning the second 5-min period, “*You can use your teeth if you want to.*” This is the only statement that the tester shall make about using teeth.

4.6.23 At the end of the test period, the tester shall say, “*Thank you for helping.*” If children were told that they could use their teeth, the tester shall say, “*I know I told you that you could use your teeth today, but you should not put things like this in your mouth again.*” In addition, the tester shall say, “*Never open containers like this when you are by yourself. This kind of container will have something in it that will make you sick.*”

4.6.24 The children shall be escorted back to their classroom or other supervised area by the tester or another adult.

4.6.25 If the children are to participate in a second test, the tester shall have them stand up and stretch for a short time before beginning the second test. The tester shall take care that the children do not disrupt other tests in progress.

5. Senior Testing

5.1 *Senior Adult Panel, Test Subjects*—Use a group of 100 senior adults. Recruit a mix of adults that represent the socio-economic profile of the test community. To assure geographical diversity if testing is completed at a central location, no more than 20 % of the adults shall be drawn from a single ZIP code, city, or town. Each group of senior adults shall be randomly selected as to age, subject to the limitations set forth below. Twenty-five percent of the participants shall be 50 to 54 years of age, 25 % of participants shall be 55 to 59 years of age, and 50 % of the participants shall be 60 to 70 years old. Seventy percent of the participants of ages 50 to 59 and ages 60 to 70 shall be female (17 or 18 females shall be apportioned to the 50- to 54-year age group). No individual tester shall administer the test to more than 35 % of the senior adults tested. Select adults with no obvious or overt physical or mental disability.

5.2 *Screening Procedures*—Participants who are unable to open the container being tested in the first 5-min time period are given a screening test. The screening tests for this purpose shall use two containers with conventional (not child-resistant (CR) or “special”) closures. The containers shall be the same as those being tested for child resistance but shall have conventional (not child-resistant) closures. Persons who cannot open and close both of the screening containers in 1-min screening tests shall not be counted as participants in the senior adult panel.

5.3 *Senior Adult Use Effectiveness (SAUE)*—The percentage of adults who both opened all closures of the container in the first (5-min) test period and opened and (if appropriate) properly resecured all closures of the container in the 1-min test period.

5.4 *Test Procedures*—The senior adults shall be tested individually rather than in groups of two or more. The senior

adults shall receive only such printed instructions on how to open and secure properly the special packaging as will appear on or accompany the container as it is delivered to the consumer. The senior adult panel is tested according to the procedure incorporated in the following senior adult panel test instructions:

5.5 *Test Instructions*—The following test instructions are used for all senior tests. If non-reclosable containers are being tested, the commands to close the package are eliminated.

5.5.1 No adult with a permanent or temporary illness, injury, or disability that would interfere with his/her effective participation shall be included in the test.

5.5.2 Each adult shall read and sign a consent form (Appendix X3) before participating. Use any appropriate language from the consent form to recruit potential participants. Before beginning the test, the tester shall say, “*Please read and sign this consent form.*” If an adult cannot read the consent form for any reason (forgot glasses, illiterate, and so forth), he/she shall not participate in the test.

5.5.3 Each adult shall participate individually and not in the presence of other participants or onlookers.

5.5.4 The tests shall be conducted in well-lit and distraction-free areas.

5.5.5 Records shall be filled in before or after the test, so that the tester’s full attention is on the participant during the test period. Recording the test times to open and re-secure the container are the only exceptions.

5.5.6 To begin the first 5-min test period, the tester says, “*I am going to ask you to open and properly close all the caps on these two identical containers according to the instructions found on the caps.*” (Specify other instruction locations if appropriate.)

5.5.7 The first container is handed to the participant by the tester, who says, “*Please open all the caps on this container according to the instructions on the caps.*” (Specify other instruction locations if appropriate.)

5.5.8 Participants are allowed up to 5 min to read the instructions and open and close the package. The tester uses a stopwatch(s) or other timing device to time the opening and resealing times. The elapsed times in seconds to open the container and to close the container are recorded on the datasheet as two separate times.

5.5.9 After 5 min, or when the participant has opened and closed the container, whichever comes first, the tester shall take all test materials from the participant. The participant shall be permitted to remove and replace the closure more than once if the participant initiates these actions. If the participant does not open the container and stops trying to open it before the end of the 5-min period, the tester shall say, “*Are you finished with that container, or would you like to try again?*” If the participant indicates that he/she is finished or cannot open the container and does not wish to continue trying, skip to 5.5.13.

5.5.10 To begin the second test period, the tester shall give the participant another, but identical, container and say, “*This is an identical container. Please open all the caps on it according to the instructions on the caps.*” (Specify other instruction locations if appropriate.) After the participant opens the container, the tester says, “*Please close all the caps on the*