



Standard Specification for Nonpowered Bicycle Trailers Designed for Human Passengers¹

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1. Scope

1.1 This specification covers nonpowered trailers intended to be pulled behind bicycles in order to transport one or two children with accessory loads with a maximum weight of 45.4 kg (100 lb). It includes test methods for confirming that this specification is satisfied.

1.2 The values stated in SI units are to be regarded as the standard. The units given in parentheses are for information only.

1.3 The following caveat pertains only to the test methods portion, Section 5, of this specification: *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 ASTM Standards:

- B 117 Practice for Operating Salt Spray (Fog) Apparatus²
- D 1230 Test Method for Flammability of Apparel Textiles³
- D 4329 Practice for Fluorescent UV Exposure of Plastics⁴
- G 23 Practice for Operating Light-Exposure Apparatus (Carbon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials⁵

2.2 ANSI Standard:⁶

ANSI Z535.4, Product Safety Signs and Labels

2.3 Federal Standards:⁷

Title 16, CFR 1500.3(b)(4)(i) Hazardous Substance

Title 16, CFR 1500.3(c)(6)(vi) Flame Testing

Title 16, CFR 1500.44 Flammability

Title 16, CFR 1500.48 Sharp Points

Title 16, CFR 1500.49 Sharp Edges

Title 16, CFR 1501 Small Parts

Title 16, CFR 1303 Lead in Coatings

Title 16, CFR 1512 Requirements for Bicycles, Sections:
1512.18(n), Reflector Test

3. Terminology

3.1 Definitions of Terms Specific to This Standard:

3.1.1 *backrest, n*—the segment of the seat that is designed to support the occupant's back. This may or may not include support for the upper body, including the head and neck.

3.1.2 *bicycle trailer (trailer), n*—a transporting device designed to provide a restrained seating position to one or more occupants, with fastening arrangements for attaching the device, and towing it, behind a bicycle.

3.1.3 *hard horizontal surface, n*—a surface, perpendicular to the direction of gravity, such as level ground or building floor, whose surface is either concrete, pavement, or similar rigid material whose deflection, while carrying the weight of a fully loaded trailer, does not exceed 12.7 mm (0.5 in.) from the unloaded horizontal plane at any point.

3.1.4 *normal use, n*—applications described as intended use for the product found within the manufacturer's instructional literature.

3.1.5 *normal use temperatures, n*—temperature range within which it should be anticipated that the trailer may be used to transport children. The range is from $-7 \pm 2^\circ\text{C}$ to $+50 \pm 2^\circ\text{C}$.

3.1.6 *occupant, n*—a child or person who is restrained in a seated position inside the trailer and whose skills do not contribute to the overall operation and performance of the vehicle.

3.1.7 *restrain, v*—to prevent the occupant(s) of the trailer from leaving the seated position on the seat of the trailer by means of a restraint system (designed by the manufacturer) when used in accordance with the manufacturer's instructions.

3.1.8 *rider, n*—a person whose skills contribute to the overall operation and performance of the vehicle.

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² *Annual Book of ASTM Standards*, Vol 03.02.

³ *Annual Book of ASTM Standards*, Vol 07.01.

⁴ *Annual Book of ASTM Standards*, Vol 08.03.

⁵ *Annual Book of ASTM Standards*, Vol 14.04.

⁶ Available from American National Standards Institute, 11 W. 42nd St., 13th Floor, New York, NY 10036.

⁷ *Code of Federal Regulations*, available from U.S. Government Printing Office, Washington, DC 20402.

3.1.9 *seated height space, n*—a dimension of space that is within the protective structure of a trailer. This space is the measured height of the occupant’s protective cavity, measured from the seat bottom and along the backrest to the top of the space allowed for occupants.

3.1.10 *test dummy, n*—a dummy that shall be of a design consistent with the use of the trailer seat and restraint system. It shall have adequate head/neck, shoulder, and arm geometry to ensure proper application of the upper body restraints. The weight of the dummy shall be 22.7 kg (50 lb). The upper legs, measured perpendicularly from the dummy’s back, shall extend a minimum of 375 mm (14.8 in.). The dummy’s back is the surface of the dummy that is in contact with the seat back when the dummy is seated. The dummy’s bottom is the surface of the dummy that is in contact with the seat bottom when the dummy is in the seated position. The weight distribution throughout the dummy shall result in a center of gravity position that is 230 ± 10 mm (9.1 ± 0.4 in.) from the dummy’s bottom and 130 ± 10 mm (5.0 ± 0.4 in.) from the dummy’s back when in the seated position.

3.1.11 *tongue, n*—a rigid structure or pole that extends from the frame of the trailer to the hitch to the bicycle.

3.1.12 *useful product lifecycle, n*—allowable range of time for continued use of product from date of manufacture as described within the manufacturer’s instructional literature.

4. Requirements

4.1 *General*—Bicycle trailers shall be designed and manufactured in such a way that components with which an occupant may come in contact do not cause injury when used in accordance with the manufacturer’s instructions. Exposed surfaces shall be free from burrs, sharp edges, and points. Refer to Title 16, CFR 1500, Parts 48 and 49, and Title 16, CFR 1501. No openings with which the occupants’ hands can come in contact shall have dimensions between 6 mm (0.236 in.) and 13 mm (0.512 in.). Trailers shall be equipped with rear reflectors; side reflectors are required on wheels. Refer to Title 16, CFR 1512, Parts 16 and 18(n). The manufacturer shall warn the rider that a load added to the bicycle will alter the stability and riding characteristics of the bicycle.

4.2 *Equipment*—Trailers shall be equipped with the following equipment: seating area, footrest area, space for helmeted head, devices that reduce contact of the hands and feet with moving or movable components of the trailer or the bicycle that could cause injury, and adjustable belt(s) or other capturing devices designed to restrain the occupant when seated.

4.3 *Attachment*—The attachment process for connecting the trailer to the bicycle shall be of a simple and secure procedure. If tools are required for attachment, attaching shall be accomplished with common household tools.

4.4 *Dimensions*—Backrests shall have a minimum height of 350 mm (13.8 in.). The seated height space shall be a minimum of 55 cm (22 in.).

4.5 Materials:

4.5.1 All nonmetallic materials that compose structural components will be subjected to either (1) 100 h of accelerated weathering in accordance with Method 1 of Practice G 23, or (2) 60 h of accelerated weathering in accordance with Practice D 4329. The material sample will then be subjected to a tensile

strength test with increasing load until failure. An identical sample of the same material, not subjected to the accelerated weathering test, will then be subjected to the same tensile strength test. The failure load of the accelerated weathering sample shall be a minimum of 60 % of the failure load of the unweathered sample.

4.5.2 All metallic materials from structural components shall be tested in accordance with the Salt Spray Test in Practice B 117 for a period of 96 h. Materials should be placed in the test environment in a condition consistent with their application on the trailer, with surface coatings and openings sealed or open as in normal use. After exposure to the salt spray, inspect for evidence of corrosion. No corrosion beyond 20 % of the primary metal material wall thickness is permitted. Painted portions shall comply with Title 16, CFR 1303.

4.5.3 Mechanical properties of materials used in the construction of bicycle trailers shall not fail under normal use applications, and within useful product lifecycle, as a result of exposure to the temperature variances defined as normal use temperatures in 3.1.5.

4.5.4 Materials known to be a hazardous substance, as defined in Title 16, CFR 1500.3(b)(4)(i), shall not be used.

4.5.5 Materials other than fabrics shall not support flame propagation in excess of the requirements of Title 16, CFR 1500.3(c)(6)(vi) when flame tested to Title 16, CFR 1500.44. Fabrics shall achieve a Class 1 rating when tested in accordance with Test Method D 1230.

5. Test Methods

5.1 *Strength Tests*—The dummy, or dummies, to be used in the following tests shall comply with the dummy specification in 3.1.10.

5.1.1 *Impact Drop Test*—Erect the trailer in the manufacturer’s suggested use configuration. Stow or remove the tongue and hitch and other coupling system elements that have been designed for stowing or removal. Restrain a dummy into each seating position in accordance with the manufacturer’s instructions for restraining occupants and for achieving maximum occupancy for the trailer. Mark a point on the seat back and a second point on the front frame of the trailer. Select both points on the front/rear centerline of the trailer. Measure the distance between these two points. This represents the first measure. By a convenient method, elevate the trailer above a hard horizontal surface. The closest part of the trailer to that surface shall be a minimum of 1.2 m (3.9 ft) above the surface. The trailer’s normal direction of motion shall be oriented along a path that is in the acceleration of gravity and perpendicular to the horizontal surface. Release the trailer to drop onto the surface. The method of release shall ensure that the initial impact is on the forward part of the trailer’s protective frame. Measure the distance between the two marked points. This is the second measure. The difference between the first and second measures shall be no greater than 25 mm (1.0 in.). Inspect the seat restraints and seat anchors. No part of the restraint system, including anchors, shall have failed.

5.1.2 Structural Integrity in Rollover (Two-Wheel Trailers):

5.1.2.1 Erect the trailer in the manufacturer’s suggested use position and mark a point in the middle of the seat. Then mark similar points around the seating area at points on the trailer’s

frame that lie along the perimeter of the protective shell for the occupant. Mark as many perimeter points as needed to define head clearance and shoulder width for the range of occupant sizes allowed by the manufacturer. Measure and record the straight-line distance from the point marked on the seat to each point on the perimeter. Restrain a dummy into the trailer seat. For multiple-occupant trailers, restrain additional dummies as required to bring the trailer to maximum occupancy as defined by the manufacturer.

5.1.2.2 Construct a tilt table 1.0 m (39.4 in.) wide and long enough to support the trailer in its normal use configuration, where “long” refers to the length of the trailer from front-to-back, including the length of the coupling system. The tilt table is intended to roll the trailer over sideways onto a hard flat surface. The table will be hinged along one edge of its width and will be capable of a downward rotation from horizontal of 60° about that hinge. An antislip bar with a height of 3.2 mm (0.125 in.) is fixed in a position to contact the trailer wheel, furthest from the hinge, when the trailer is placed in a centered position along the width of the table. The bar shall be long enough to engage the wheel along its area of contact with the table to prevent the trailer from slipping as the table is tilted. The trailer hitch will be simply supported at the hitch by a flat horizontal surface at the height normal for attachment to a bicycle.

5.1.2.3 Place the trailer on the tilt table with one wheel in contact with the antislip bar and the hitch resting on the surface

provided to support it. By a convenient method, gradually rotate the table about the hinges to lower the trailer. The speed of rotation should be slow enough to ensure that the downside wheel remains in contact with the table until rollover separates the wheels from the table. Allow the trailer to roll over freely onto the horizontal surface until it comes to rest. The trailer frame shall not fracture or fail at any point. Remove each dummy from the trailer and then measure and record the straight-line distance from the marked seat point to each point on the perimeter. Compare these measurements to those taken prior to the test. The difference between any pre-test measurement and the corresponding post-test measurement, indicating the rack, bend, or deformation of any point on the geometry of the frame as measured from the middle of the seat bottom, shall be less than 25 mm (1.0 in.).

5.2 Tipover Resistance Tests:

5.2.1 *Tilting Procedure*—Tilt the table until the uphill wheel starts to lift off the table. The tilt rate should be sufficiently slow, so that the point at which the uphill tire lifts off can be easily identified. Record the angle at which the uphill tire lifts off the table. Repeat the tilting of the table two more times. The results of these tests should agree within $\pm 1.0^\circ$. If they do not, verify that the dummy is properly restrained. (There should be no excess slack in the restraint system and the dummy should be properly seated.) Also verify that the trailer is correctly assembled. (There should be no excess play in any of the joints.) Record and average the test results.

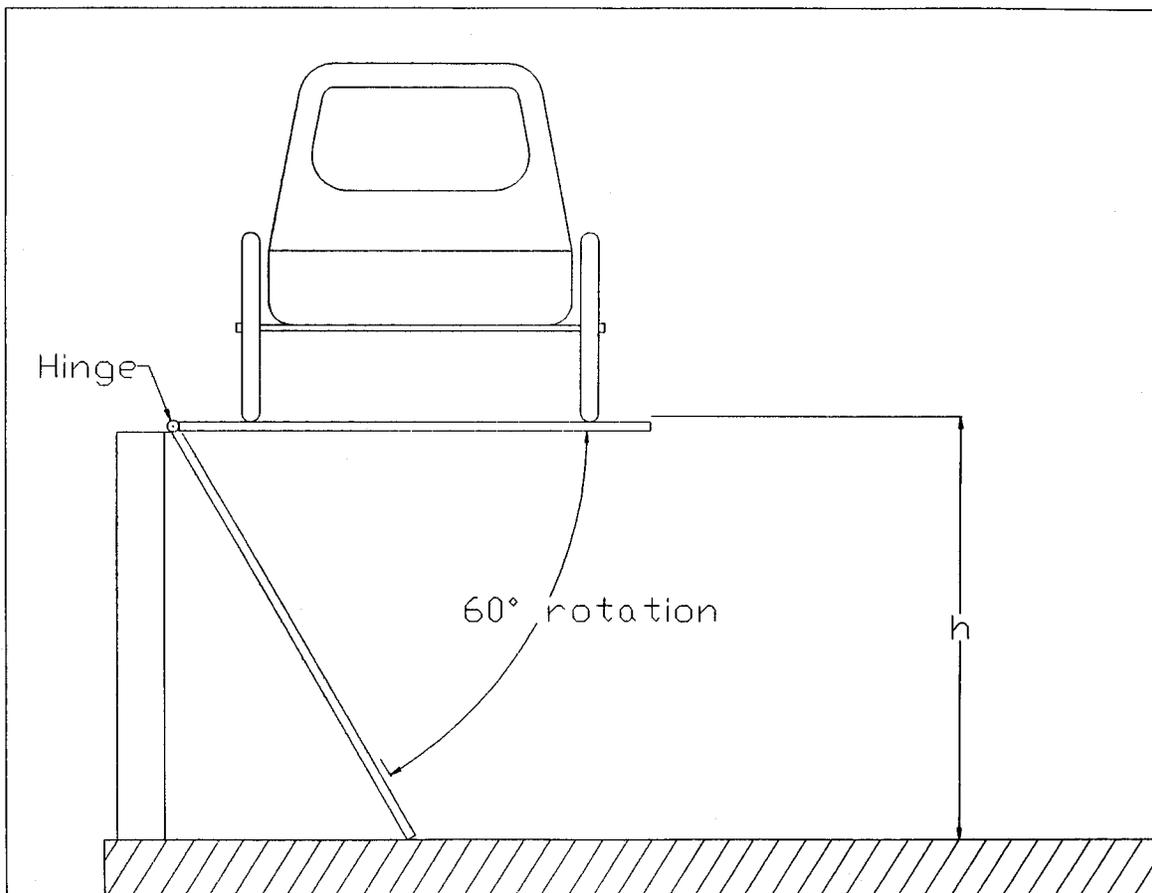


FIG. 1 Tilt Table for Rollover Test

5.2.2 *Single-Occupant Trailer Test*—Erect the trailer in the manufacturer’s suggested use configuration and inflate the tires to the maximum suggested air pressure. Restrain a dummy into the seat restraints as suggested by the manufacturer. The minimum allowable tilt angle for the single-occupant trailer is 30.0°.

5.2.3 *Double-Occupant Trailer Test (Fully Loaded)*—Erect the trailer in the manufacturer’s suggested use configuration and inflate the tires to the maximum suggested air pressure. Restrain two dummies into the seat restraints as suggested by the manufacturer, to bring the trailer to maximum occupancy as defined by the manufacturer. The minimum allowable tilt angle for the fully loaded double-occupant trailer is 30.0°.

5.2.4 *Double-Occupant Trailer Test (Single-Occupant Manufacturer’s Suggested Positioning)*—Erect the trailer in the manufacturer’s suggested use configuration and inflate the tires to the maximum suggested air pressure. Restrain one dummy into the seat restraints and seating position for a single passenger as suggested by the manufacturer. The minimum

allowable tilt angle for the double occupant trailer when loaded with a single occupant in the manufacturer’s suggested position is 30.0°.

5.2.5 *Double-Occupant Trailer Test (Single-Occupant Downhill Seating Position)*—Erect the trailer in the manufacturer’s suggested use configuration and inflate the tires to the maximum suggested air pressure. Restrain one dummy into the seating position on the downhill side of the trailer, as the table is tilted. Attach the seat restraints as suggested by the manufacturer for this seating position. The minimum allowable tilt angle for the double-occupant trailer when loaded with a single occupant on the downhill side of the trailer is 25.0°.

5.3 *Coupling Security Tests:*

5.3.1 The test equipment shall consist of a bicycle frame or simulation thereof, including the portion of the frame to which the trailer attaches in accordance with the manufacturer’s instructions (see Fig. 2). The bicycle frame/simulator shall be capable of continuous push/pull motion in the direction of

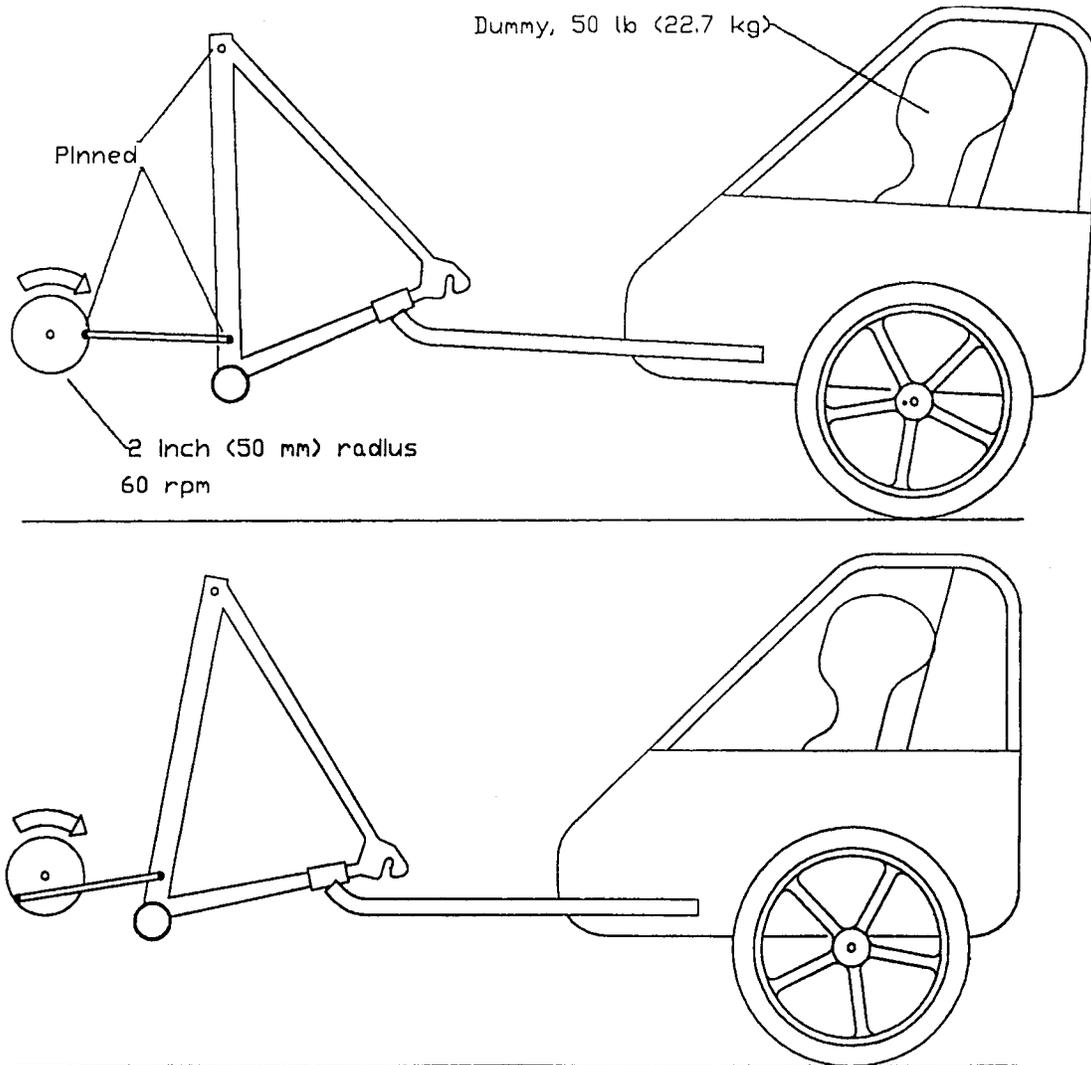


FIG. 2 Coupling Security Test

travel with an acceleration of 2.0 m/s² (6.6 ft/s²) to change the direction of motion. The acceleration shall be measured at the hitch.

5.3.2 Erect the trailer in the manufacturer's use position and restrain the dummy in the seat restraints. For multiple-occupant trailers, add the appropriate number of dummies required to achieve full occupancy of the trailer. If the manufacturer specifies separate cargo and occupant capacities which, when totaled, exceeds the dummy weight, then add sufficient weight to reach the total manufacturer's stowing cargo weight. Measure the tongue weight at the hitch. This is the design load value for tongue weight. Add an additional 5.7 kg (12.5 lb) of weight into the trailer seat region for each dummy. Position the additional weight in the trailer as needed to bring the tongue weight to 125 % of the design load value. Hitch the trailer to the test equipment and conduct push/pull motion for 100 000 complete cycles.

5.3.3 Inspect the hitch, tongue, and structure for mounting the tongue to the trailer. No part of the construction shall have failed or have incurred a fracture or crack, and slippage shall not exceed 15 mm (0.6 in.).

5.4 *System Fatigue Test (Axle/Frame):*

5.4.1 The test equipment shall be capable of simulating the passing of the trailer over a bump. The device is a flywheel or drum tester with the trailer positioned so the wheel or wheels sit atop the flywheel (Fig. 3). The placement of the wheel axle

shall be between 25 and 50 mm (1.0 in to 2.0 in.) rearward in the horizontal direction from the highest point on the flywheel. The minimum width of the flywheel shall be wide enough to permit the trailer to move side-to-side a distance of 150 mm (6 in.) in either direction. The flywheel shall have one cleat if testing a single-wheel trailer and two cleats if testing a two-wheel trailer. The dimensions of the cleat are no less than 38 mm (1.5 in.) high and no greater than 100 mm (3.9 in.) in the direction of motion. The leading edge shall be inclined at 45° from horizontal, and the drop at the trailing edge shall be 90° from horizontal. The single cleat shall be centered across the trailer path and occupy the minimum width of the flywheel. The two cleats shall each be a minimum of 300 mm (11.8 in.) long and centered across the track of each trailer wheel in a manner where the first cleat strikes the wheel on one side only, and no less than 0.1 s later the second wheel strikes the second cleat. The horizontal speed at which the trailer's axle approaches the cleat shall be no more than 13 km/h (8 mph) and no less than 12 km/h (7.5 mph). If multiple cleats for a single-wheel trailer or multiple sets of cleats for a two-wheel trailer are employed, the minimum spacing shall ensure that each cleat strikes no less than 0.1 s after the previous cleat.

5.4.2 Erect the trailer in the manufacturer's suggested use position and restrain a dummy into the seat restraints. Restrain additional dummies as required to attain full occupancy of the trailer. The total dummy weight shall meet or exceed the

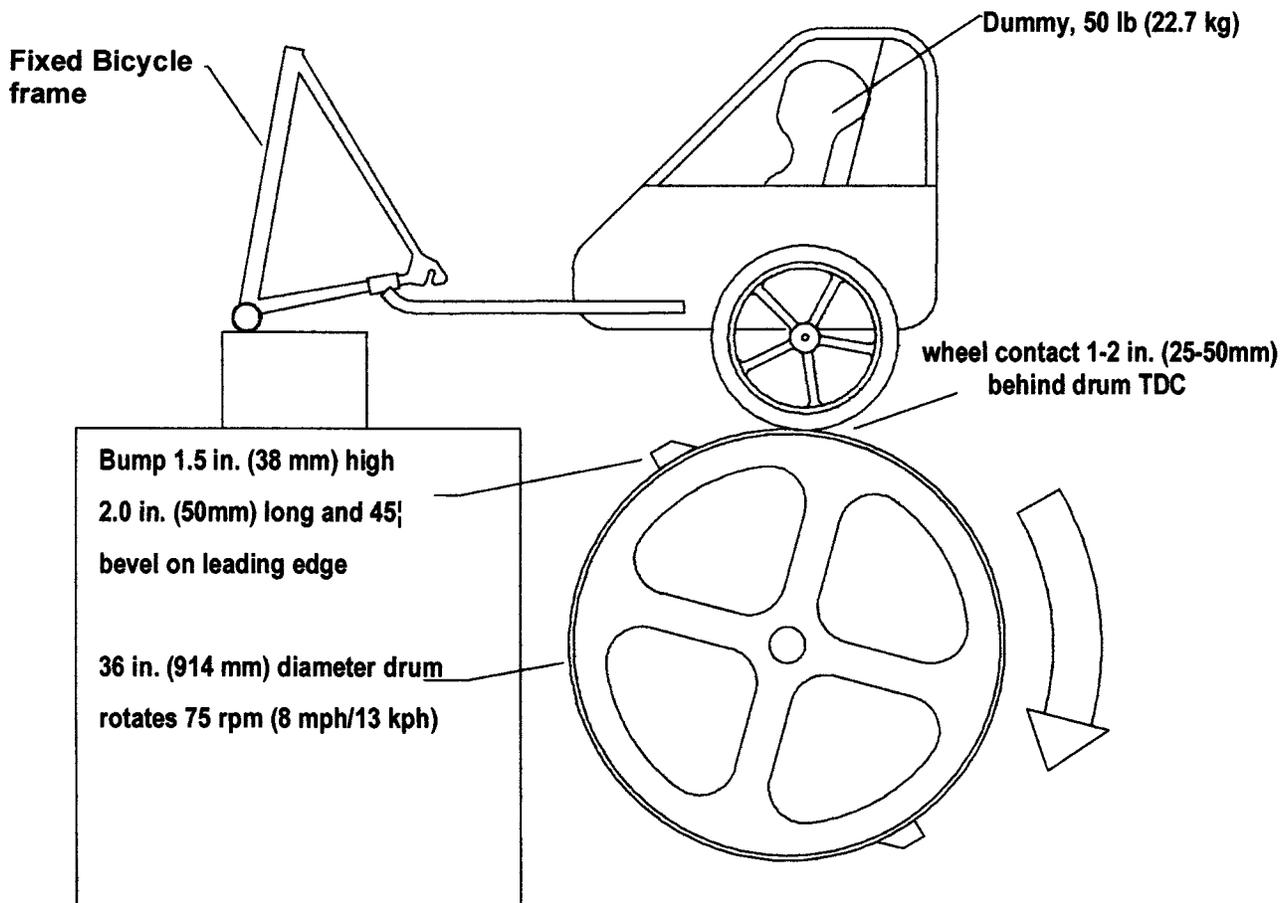


FIG. 3 Axle/Frame Fatigue Test

manufacturer's specified maximum occupant and cargo weight. If the manufacturer has specified a separate location and capacity for cargo that is in addition to occupant capacity, then enough weight shall be added to the defined cargo area(s) to bring the total weight up to the manufacturer's total specified cargo and occupant weight. Inflate the tires to the pressure stated on the tire sidewall. Mount the trailer onto the test equipment as previously described, and conduct the test for 10 000 cycles of wheels passing over cleats. If the manufacturer's recommended tire pressure is different from the pressure stated on the tire sidewall, then conduct the test with the tires inflated to the manufacturer's recommended pressure as well as with the tires inflated to the sidewall pressure.

5.4.3 Remove the trailer from the test equipment and inspect the wheel and frame assemblies. No part of these assemblies shall have failed, or have incurred a fracture or a crack. Inspect the interior of the trailer to ensure that there are no exposed holes or sharp objects. Inspect the dummies and seat restraints to ensure that they are still in the proper seating positions and that their restraints are not damaged beyond their functional limits.

5.5 Conspicuity:

5.5.1 *Colors*—This specification recognizes the desirability of making bicycle trailers highly visible to motorists and other road or trail users during daytime use, and recommends the use of bright contrasting colors for that purpose, but does not attempt to specify exact colors.

5.5.2 Reflectors:

5.5.2.1 The trailer shall have one or more rear red reflectors mounted so that they are visible when viewing from behind the trailer, and there shall be one or more reflectors mounted on each wheel. The reflector(s) shall meet the current CPSC standard (Title 16, CFR 1512.18 n) requirements for reflectivity.

5.5.2.2 Nothing in this specification is intended to suggest that placing reflectors or lights on a trailer make the trailer safe to operate at night or in darkness.

5.5.3 *Flag*—The trailer shall be equipped with a flag that is triangular in shape and made of high-visibility orange material. The flag shall be a minimum of 290 cm² (45 in.²) in area (580 cm² [90 in.²] of exposed surface area), with the bottom of the flag no lower than 1.37 m (4.5 ft) above the ground and the top of the flag no higher than 2.13 m (7.0 ft) above the ground. The manufacturer may imprint the surface of the flag with a logo or writing. The amount of imprinting cannot reduce the amount of highly visible surface area of the flag to less than 520 cm² (81 in.²).

6. Marking, Labeling, and Instructions

6.1 *General*—All trailers shall be permanently marked with information concerning the safe usage of the trailer. The markings shall be in locations easily visible to the assembler and installer. The trailer shall also be accompanied by instructions on the proper assembly, attachment, usage, removal, disassembly, storage, and maintenance of the trailer, and general bicycle safety. Instructions shall be written in the native language(s) of the country(s) in which the trailer will be offered for sale, and attached to the trailer at the time of purchase by the original user.

6.2 Where Cautions, Warnings, and Danger signals are used by the manufacturer, they shall comply with the requirements of ANSI Z535.4.

6.3 *Marking and Labeling*—All trailers shall be permanently marked with the following information:

6.3.1 Name and address of the manufacturer or importer.

6.3.2 Month and year of manufacture.

6.3.3 Recommended maximum safe towing speed.

6.3.4 Seating diagram for any number of intended passengers up to the maximum recommended for the trailer, including proper positioning and fastening of harnesses and belts.

6.3.5 Proper inflation level for trailer tires.

6.3.6 Maximum weight capacity of trailer (passengers and cargo combined).

6.3.7 Minimum age or physical requirements, or both, for passengers.

6.3.8 Required passenger-fitted safety equipment, including helmets that comply to a recognized bicycle helmet performance standard.

6.3.9 Description of how attaching a trailer to a bicycle will affect the stability, braking, and riding characteristics of the bicycle.

6.4 Labels shall be of durable materials, resistant to weather, fading, and abrasion, and shall be clearly visible on the trailer. Colors of informational labels (other than Caution, Warning, and Danger whose colors are defined in ANSI Z535.4) shall be contrasting colors, such as black on white, and clearly distinguishable from Caution, Warning, and Danger labels. All labels shall be clearly visible as mounted on the trailer.

6.5 Instructions:

6.5.1 *Assembly*—If the trailer is sold in an unassembled or partially assembled condition, the manufacturer shall provide instructions on how to complete the assembly so that the trailer can be attached to the bicycle and be ready to accept passengers.

6.5.2 *Attachment*—The instructions shall include information on the procedures to follow in attaching the trailer to the bicycle. The instructions shall identify the features of the bicycle required for proper coupling.

6.5.3 *Usage*—The instructions shall provide the user with detailed information on how to use the trailer properly and safely. The following information is the minimum required for compliance with this specification:

6.5.3.1 Maximum weight capacity of the trailer (passengers and cargo combined).

6.5.3.2 Maximum number of passengers.

6.5.3.3 General instructions on riding a bicycle while pulling a trailer, plus maximum safe operating speed, both straight line and cornering.

6.5.3.4 Safety requirements for pulling a trailer with and without passengers

(1) Proper and safe positioning of the passenger(s) or cargo, or both, in the trailer and how to secure the harness and seat belt system around them.

(2) Use of available safety equipment (such as certified helmets).

(3) Minimum age or physical condition requirements for the passenger(s)

6.5.3.5 Explicit information on how the attachment of the trailer and the added weight of its passengers or cargo, or both, affect the handling characteristics of the bicycle to which it is attached.

6.5.3.6 A recommendation to the user that the bicycle to which the trailer will be attached undergo a safety check by a qualified bicycle mechanic before attaching the trailer to it.

6.5.3.7 Information concerning road, weather, or other conditions under which the trailer should *not* be used.

6.5.3.8 A warning to be cognizant of exposure hazards such as windchill and heat exhaustion, either by less-active trailer passengers in prolonged exposure in colder temperatures, or by extended periods in warmer temperatures without adequate ventilation or hydration.

6.5.3.9 Proper inflation level for trailer tires.

6.5.3.10 Warning not to use cleaning solvents; clean only with mild soap and water.

6.5.4 *Removal*—The instructions shall contain information to the user regarding the following:

6.5.4.1 Proper removal of passengers or cargo, or both, from the trailer.

6.5.4.2 Proper removal of the trailer from the bicycle.

6.5.5 *Disassembly and Storage*:

6.5.5.1 If the trailer requires partial or complete disassembly for storage after removal from the bicycle, the instructions shall contain detailed information on the disassembly procedures.

6.5.5.2 The instructions shall also include any specific information necessary for the safe storage of the trailer between uses, including any safety checks of components prior to the next usage.

6.5.6 *Maintenance*—If any routine or special maintenance is required or recommended by the manufacturer, the instructions shall set forth the items to be maintained and the maintenance frequency for each, and state whether this maintenance can be performed by the owner or is to be done by a professional bicycle mechanic.

6.5.7 *Warnings*—The following warning statements shall be addressed by permanent marking on the trailers and be clearly visible to the user at all times.

6.5.7.1 Do not install a car seat or any other seating device not approved by the manufacturer inside the trailer.

6.5.7.2 Make no modifications to the trailer.

6.5.7.3 Do not allow any of the child's body, clothing, shoe laces, or toys to come in contact with moving parts.

6.5.7.4 Never leave a child unattended in the trailer.

6.5.7.5 A reflector that complies with CPSC regulations shall be visible on the rear of the trailer.

6.5.7.6 Before each ride, ensure the attached trailer does not interfere with braking, pedaling, or steering of the bicycle.

6.5.7.7 Never ride a bicycle at night without adequate lighting. Obey all local legal requirements for lighting.

6.5.7.8 Failure to comply with the manufacturer's instructions can lead to serious injury or death of the passenger/rider.

6.5.7.9 Do not use with children who exceed the weight limitations.

6.5.7.10 Do not use cleaning solvents. Clean only with mild soap and water.

6.5.7.11 When used with only one occupant, the occupant should be seated in a center seating position.

7. Keywords

7.1 bicycle; bicycle trailer; trailer

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