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An American National Standard

Standard Test Method for Treestand Fall Arrest System[1]

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1. Scope

1.1 This test method covers the determination of the load capacities for treestand fall arrest systems (FAS) and components or subsystems.

1.2 This test method addresses equipment used in hunting situations requiring personal protection against falls from heights and applies to the manufacturers, distributors, purchasers, and users of such equipment.

1.3 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.

1.4 *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:*[2]

F1749 Specification for Fitness Equipment and Fitness Facility Safety Signage and Labels

2.2 *ANSI Standard:*

ANSI Z359.1 Safety Requirements for Personal Fall Arrest Systems, Subsystems and Components[3]

2.3 *Other Document:*

Individual Manufacturer's FAS Instruction

3. Terminology

3.1 The terminology and definitions in the referenced documents are applicable to this practice.

3.2 *Definitions:*

3.2.1 *anchorage, n*—a component/structure to which a FBH is attached to the tree trunk.

3.2.2 *climbing belt, n*—a strap/belt (or system of straps) which is fastened about the person in a manner so as to contain the torso and stabilize the users horizontal load while either working from a vertical position to attach treestands, climbing devices, and so forth, or during ascent/descent of tree or ladder. A FBH may be constructed to additionally serve this function.

3.2.3 *connecting hardware, n*—includes snap hooks, D-rings, carabineers, links, anchorage hardware, and buckles. Any hardware that connects the FAS components in series, thus creating a linear linkage along which the maximum arrest force (MAF) acts.

3.2.4 *fall arrest system (FAS), n*—a system which is assembled for the purpose of arresting an accidental fall of its user. A FAS consists of a full body harness, lanyard, anchorage means, and connecting hardware.

3.2.5 *full body harness (FBH), n*—a component with a design of straps which is fastened about the person in a manner so as to contain the torso and distribute the fall arrest forces over at least the upper thighs, pelvis, chest, and shoulders with means for attaching it to other components or subsystems.

3.2.6 *lanyards, n*—a component consisting of a flexible strap, rope, or wire rope for connecting a component such as a FBH directly or indirectly to an anchorage.

3.2.7 *maximum arrest force, n*—the maximum force acting on the body at the instant of an arrest of its free fall.

3.2.8 *shock absorbers, n*—a component used to reduce/absorb the energy gained by the user of the FAS when falling.

3.2.9 *suspension relief device, n*—a device to allow relief of a person's weight on the lower extremities if suspended in a harness, or allow the user to descend to the ground. The device is to help maintain circulation in the legs and help prevent suspension trauma (blood pooling).

3.2.10 *thigh/leg straps, n*—the straps, which are integrated with the buttock strap (optional) and are routed from back to front across the groin area or loop around the upper part of the thigh.

3.2.11 *treestand, n*—a device designed to be affixed to a tree so as to permit an individual to sit or stand thereon for the

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[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] Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036.

purpose of attaining an elevated position from which to observe, photograph, or hunt.

4. Summary of Test Method

4.1 One system test shall consist of the testing of one individual fall arrest system unit for maximum arrest force (MAF) in accordance with the procedures in 7.1.

4.2 One system test shall consist of the testing of one individual fall arrest system unit for performance in accordance with the procedures in 7.2.

4.3 One system test shall consist of testing one individual fall arrest system unit for dynamic strength in accordance with the procedures in Section 8.

4.4 One climbing belt test shall consist of testing one individual climbing belt (for use only if FAS includes integral climbing belt) in accordance with the procedures in Section 9.

4.5 For each test a test weight torso having the physical properties described in 6.3 or 6.4 shall be dropped from an adequate elevation to simulate a free-fall motion from a treestand platform.

4.6 One static load test shall consist of testing one (1) individual Suspension Relief Device (for use only if FAS includes integral SRD) in accordance with the procedures in Section 10 of this standard.

5. Significance and Use

5.1 This test method is intended to measure the maximum arrest force and dynamic strength on treestand FAS and components or subsystems. This test is intended for program quality assurance and production quality control purposes. It is not intended to be an independent material or product acceptance test.

6. Apparatus

6.1 A vertical, rigid, round wood pole shall be used to mount the test weight torso and fall arrest system (FAS) such that pole deflection is minimized during testing.

6.2 The mounting pole diameter shall be 10 ± 1 in. and shall have a minimum height necessary for free fall to meet the provisions of 7.1.4, 7.2.4, 8.1.3, and 9.1.3.

6.3 The test weight torso used during the performance test shall weigh 220 ± 2 lb. The test weight torso shall be in accordance with ANSI Z359.1, Appendix B, Figs. 18 and 19.

6.4 The test weight torso used during the dynamic strength test shall weigh not less than 300 lb or shall equal the weight of the stated weight capacity of the test subject ±3 lb, or whichever is greater. The torso shall also be designed such that it closely resembles the human shape and human center of gravity.

6.5 The test weight torso and test operator shall be raised to the required elevation by means of a man lift, forklift/basket, or other device capable of providing means to ascend to the proper elevation and provide a stable and safe working environment.

6.6 The free fall may be induced by manual or automatic means, and shall accomplish an unobstructed, continuous free fall of the test weight torso.

6.7 The instrumentation used to measure the MAF of the FAS should consist of a force sensor or load cell capable of measuring peak loads up to 3375 lb (15 kN). The recording data channel shall have a minimum sampling rate of 1000 samples per second and an active frequency response band up to a corner frequency of 100 Hz + 1.2 dB, −3 dB.

7. Performance Test Procedure

7.1 The following procedures shall apply to one individual unit of a given FAS with the test torso as given in 6.3 dropped "feet first."

7.1.1 Read instructions accompanying the test subject to ascertain the proper procedure for use and donning. Secure the FAS anchorage to the mounting pole and the test torso in accordance with the device manufacturer's instructions.

7.1.2 The force sensor or load cell shall be placed in series with the full body harness and lanyard or anchorage. The total fall distance required is a distance of 6 ft or twice the maximum lanyard length or whichever is less. Any length added from the force sensor or load cell and any connecting hardware must be subtracted from the total fall distance.

7.1.3 Prior to performing the drop test, the anchorage shall be properly secured with a permanent stop placed directly under the anchorage to the backside of the pole to eliminate movement during test.

7.1.4 Attach the quick release mechanism to the test weight torso. The test weight torso shall be raised to an elevation such that its free fall begins at the point above the anchorage equal to the maximum length of the lanyard (if adjustable) or a distance which allows 6 ft of free fall, whichever is less. The test weight torso shall be located as close to the pole as practical or not greater than 1 ft with no tension in the lanyard prior to release. In such a manner, the free-fall distance will equal twice the maximum available length or 6 ft, whichever is less.

7.1.5 The test weight torso shall be dropped "feet first" or otherwise released as if to simulate a free-fall from a treestand platform. The fall should be essentially vertical with minimal "swinging" of the test subject. The fall shall be closely observed for any unusual or unsafe action. Measure and record the maximum arrest force (MAF), deceleration distance, and whether or not any test weight torso detaches from the harness. After the drop, the test weight torso is to remain suspended by the FAS for a period of 2 min.

7.1.6 After the FAS has been engaged, the test weight torso shall be lowered to the ground and the FAS inspected for damage. Compare test results to the requirements set forth in 12.1 – 12.3.

7.2 The following procedures shall apply to one individual unit of a given FAS with the test weight torso as given in 6.3 dropped "face first."

7.2.1 Read instructions accompanying the test subject to ascertain the proper procedure for use and donning. Secure the FAS anchorage to the mounting pole and the test weight torso in accordance with the device manufacturer's instructions.

7.2.2 The total fall distance required is a distance of 6 ft or twice the maximum lanyard length, or whichever is less. Any added length from any connecting hardware must be subtracted from the total fall distance.

7.2.3 Prior to performing the drop test, the anchorage shall be properly secured with a permanent stop placed directly under the anchorage to the backside of the pole to eliminate movement during test.

7.2.4 Attach the quick release mechanism to the test weight torso at a point located at the buttocks or other means of attachment that will allow the test torso to be released appropriately. The test weight torso shall be raised to an elevation such that its free-fall begins at the point above the anchorage equal to the maximum length of the lanyard (if adjustable) or a distance which allows 6 ft of free fall, whichever is less. The test weight torso shall be located as close to the pole as practical or not greater than 1 ft with no tension in the lanyard prior to release. In such a manner, the free-fall distance will equal twice the maximum available length or 6 ft, whichever is less.

7.2.5 The test weight torso shall be dropped "face first" or otherwise released as if to simulate a free-fall from a treestand platform. The fall should be essentially vertical with minimal "swinging" of the test subject. The fall shall be closely observed for any unusual or unsafe action. Determine whether or not any test torso detaches from the harness. After the drop, the test weight torso is to remain suspended by the FAS for a period of 2 min.

7.2.6 After the FAS has been engaged, the test weight torso shall be lowered to the ground and the FAS inspected for damage. Compare test results to the requirements set forth in 12.1 and 12.2.

8. Dynamic Strength Test Procedure

8.1 The following procedures shall apply to one individual unit of a given FAS and test weight torso as given in 6.4 and dropped "feet first."

8.1.1 Read instructions accompanying the test subject to ascertain the proper procedure for use and donning. Secure the FAS to the mounting pole and the test weight torso in accordance with the device manufacturer's instructions.

8.1.2 Prior to performing the drop test, the anchorage shall be properly secured with a permanent stop placed directly under the anchorage to the backside of pole to eliminate movement during test.

8.1.3 Attach the quick release mechanism to the test weight torso. The test weight torso shall be raised to an elevation such that its free-fall begins at the point above the anchorage equal to the maximum length available by the lanyard or a distance which allows 6 ft of free fall, whichever is less. The test weight torso shall be located as close to the pole as practical or not greater than 1 ft with no tension in the lanyard prior to release. In such a manner, the free-fall distance will equal twice the maximum available lanyard length or 6 ft, whichever is less.

8.1.4 Release the test weight torso using the quick release mechanism. The test weight torso shall be dropped "feet first" or otherwise released as if to simulate a free-fall from a treestand platform. The fall should be essentially vertical with minimal "swinging" of the test subject. The fall shall be closely observed for any unusual or unsafe action. After the drop, the test weight torso is to remain suspended by the FAS for a period of 2 min.

8.1.5 After the FAS has been engaged, the test weight torso shall be lowered to the ground and the FAS inspected for damage. Record the test results and whether or not the test weight torso detaches from the FBH. Compare the test results to the requirements set forth in 12.1.

9. Climbing Belt Test Procedure

NOTE 1—For use only if FAS includes integral climbing belt.

9.1 The following procedures shall apply to one individual unit of a given FAS with climbing belt (if provided) and test weight torso as given in 6.4 dropped "feet first."

9.1.1 Read instructions accompanying the test subject to ascertain the proper procedure for use and donning. Secure the FAS to the mounting pole and the test weight torso in accordance with the device manufacturer's instructions.

9.1.2 Prior to performing the drop test, the climbing belt shall be properly secured with a permanent stop placed directly under the climbing belt to the backside of pole to eliminate movement during the test.

9.1.3 Attach the quick release mechanism to the neck ring on the test weight torso. The climbing belt length shall be adjusted to a length that allows a horizontal gap distance of 24 ± 1 in. (610 mm) or the maximum length of the climbing belt, which ever is less, between the test torso and the closest perimeter of the test pole. Record the effective length of the climbing belt used as measured in a horizontal plane from the connecting point on one side of the harness, around the test pole, and returning to the opposite harness connection point. The test weight torso shall be raised to an elevation such that there is a 3 ± 1-in. (76-mm) horizontal gap distance between the test torso and the closest perimeter of the test pole while maintaining no slack (taut) in the adjusted climbing belt length. Free-fall begins at this elevation point. In such a manner, the free-fall distance will result in an equivalent of twice (2×) its adjusted length in use.

9.1.4 The test weight torso shall be dropped "feet first" or otherwise released as if to simulate a free-fall from a treestand platform, ladder or other tree climbing means. The fall should be essentially vertical with minimal "swinging" of the test subject. The fall shall be closely observed for any unusual or unsafe action. After the drop, the test weight torso is to remain suspended by the FAS for a period of 2 min.

9.1.5 After the FAS has been engaged, the test weight torso shall be lowered to the ground and the FAS inspected for damage. Record the test results and whether or not the test weight mannequin detaches from the FBH. Compare the test results to the requirements set forth in 12.1.

10. Suspension Relief Device Test Procedure

10.1 The following procedure will apply to the suspension relief device accompanying the test subject.

10.1.1 Read instructions supplied with the test subject to determine the manner in which the suspension relief device (SRD) is intended to be used. There are at least two basic types

of SRD. One type attaches to the FAS and another attaches to the tree. Another is an integral SRD.

10.1.2 For the SRD type that attaches to the FAS, the FAS should be suspended from a rigid structure with the SRD properly attached to it according to the instructions. A static load equal to twice (2×) the rated capacity of the FAS shall be suspended from the intended center load point of the SRD and remain suspended for a period of 2 min.

10.1.3 For the SRD type that attaches to the tree, the SRD should be attached to the vertical, rigid round wood pole (used for FAS testing) according to the instructions. A static load equal to twice (2×) the rated capacity of the FAS shall be suspended from the intended center load point of the SRD and remain suspended for a period of 2 min.

10.1.4 After the load is removed the SRD shall be inspected for damage and the results recorded.

11. Recording of Test Results

11.1 Recording of results shall include the following:

11.1.1 Identification of FAS model, manufacturer, and rated capacity,

11.1.2 Photographs of FAS before each test and after testing,

11.1.3 Maximum Arrest Force measurement determined from Section 7,

11.1.4 Verification of calibration,

11.1.5 Written description and photos of any damage incurred as a result of testing,

11.1.6 Date of testing, and

11.1.7 Name of engineer responsible for tests.

12. Pass-Fail Criterion

12.1 A FAS (or SRD) is considered failed if the test weight torso comes into contact with the ground or does not remain suspended for a period of 2 min.

12.2 Connecting hardware is considered failed if it cracks breaks or has permanent deformation visible to the unaided eye. Some FAS use shock absorbers that are designed to tear or separate during their engagement. This type of apparent "damage" shall be considered normal for these systems and does not constitute failure.

12.3 A FAS is considered failed during the performance test if the MAF recorded exceeds 1800 lb, the FAS does not bring the fall to a complete stop with a deceleration distance of not more than 42 in., or test torso detaches from the FAS.

12.4 The FAS shall also be inspected for the following label criteria:

12.4.1 The Label material shall be constructed of a material to allow the legibility and attachment of required markings to endure the life of the FAS being marked.

12.4.1.1 The methods of labeling in Specification F1749 and so described herein shall be followed.

12.4.1.2 Labels or lettering, or both, shall be highly visible by use of the signal word "WARNING" with black letters on orange background.

12.4.1.3 Labels shall be placed such that they are visible to the user when wearing the harness. The following placement locations are recommended: *(1)* on the tether or *(2)* on the front of a leg or shoulder strap.

12.4.2 The label shall contain:

12.4.2.1 Year of manufacture.

12.4.2.2 ⚠**Warning—**Failure to discard and remove this FAS device from service after 5 years or less (see Note 2) from manufacture date or after arresting a fall could cause serious injury or death.

NOTE 2—Five years is the maximum and less than 5 years is acceptable.

12.4.2.3 Capacity rating.

12.4.2.4 Part number and model designation.

12.4.2.5 Manufacturer's name or logo.

12.4.2.6 ⚠**Warning—**Failure to read and follow manufacturer's instructions could cause serious injury or death.

12.4.2.7 Size of the harness (if applicable).

12.5 In addition to meeting the test criteria stated in 12.1 – 12.4, the FAS must be accompanied by an affidavit from the manufacturer stating that all material used in the manufacture of the FAS are certified to meet the material specifications of the manufacturer.

12.5.1 The affidavit must state that the manufacturer possesses material certifications to insure that materials from suppliers of strapping/webbing, hardware, thread, and any other load bearing component meet the manufacturers' specifications.

12.5.2 Further, if subcontractors contribute to the manufacture of the FAS a certification of conformance to the manufacturing specifications by the manufacturer must accompany the affidavit.

12.6 Following testing, whether pass or fail, the tested devices and a copy of the test results shall be returned to the manufacturer and the FAS used in the testing shall not be considered safe to use.

13. Precision and Bias

13.1 No information is presented about either the precision or bias of tests in Sections 7 – 9 since the test results are non-quantitative.

14. Keywords

14.1 anchorage; climbing belt; harness; torso; treestand