

## TMS 06

# Standard Test Method for Treestand Fall Arrest System

### 1. Scope

- 1.1 This test method covers the determination of the load capacities for Treestand Fall Arrest Systems (FAS) and components or sub systems.
- 1.2 The values stated are in English units.
- 1.3 This standard 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.
- 1.4 *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 to determine the applicability of regulatory limitations prior to use.*

### 2. Referenced Documents

- 2.1 American National Standard ANSI Z359.1-1992 (R1999)
- 2.2 Individual manufacturer's FAS instruction.
- 2.3 Manufacturing Standard: Treestand Manufacturing Standards TMS 03

### 3. Terminology

- 3.1 The terminology and definitions in the referenced documents are applicable to this practice.
- 3.2 *Definitions*
- 3.2.1 *Fall Arrest System (FAS):* a system, which is assembled for the purpose of arresting an accidental fall of its user. FAS consists of a Full Body Harness, lanyard, anchorage means, and connecting hardware.
- 3.2.2 *Full Body Harness (FBH):* 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.
- 3.2.3 *Lanyards:* 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.
- 3.2.4 *Anchorage:* a component/structure to which a FBH is attached to the tree trunk.
- 3.2.5 *Shock Absorbers:* a component used to reduce/absorb the energy gained by the user of the FAS when falling.
- 3.2.6 *Connecting Hardware:* 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.
- 3.2.7 *Thigh/Leg Straps:* 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.
- 3.2.8 *Maximum Arrest Force:* maximum force acting on the body at the instant of an arrest of its free fall.
- 3.2.9 *Climbing Belt:* 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, etc. or during ascend/descend of tree or ladder. A FBH may be constructed to additionally serve this function.
- 3.2.10 *Suspension Relief Device:* a device to allow relief of a person's weight on the lower extremities if suspended in a harness. The device is to help maintain circulation in the legs and help prevent suspension trauma (blood pooling).

### 4. Summary of Test Method

- 4.1 One system test shall consist of the testing of one (1) individual Fall Arrest System unit for maximum arrest force (MAF) in accordance with the procedures in Section 7.1.

- 4.2 One system test shall consist of the testing of one (1) individual Fall Arrest System unit for performance in accordance with the procedures in Section 7.2.
- 4.3 One system test shall consist of testing one (1) individual Fall Arrest System unit for dynamic strength in accordance with the procedures in Section 8 of this Standard.
- 4.4 One climbing belt test shall consist of testing one (1) individual climbing belt (for use only if FAS includes integral climbing belt) in accordance with the procedures in Section 9 of this Standard.
- 4.5 For each test a test weight torso having the physical properties described in Sections 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 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 sub systems. 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 mannequin and Fall Arrest System (FAS) such that pole deflection is minimized during testing.
- 6.2 The mounting pole diameter shall be ten ( $10 \pm 1$ ) inches and shall have a minimum height necessary for free fall to meet the provisions of Sections 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 pounds plus or minus 2 pounds. The test weight torso shall be per ANSI Z359-1 Standard, Appendix B Fig. 18 and 19.
- 6.4 The test weight torso used during the dynamic strength test shall weigh not less than three hundred pounds (300 lbs) or shall equal the weight of the stated weight capacity of the test subject plus or minus 3 pounds, 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 MAF of the FAS should consist of a force sensor or load cell capable of measuring peak loads up to 3,375 pounds (15kN). The recording data channel shall have a minimum sampling rate of 1,000 samples per second and an active frequency response band up to a corner frequency of 100 Hz plus 1.2 dB, minus 3 dB.

## 7. Performance Test Procedure

- 7.1 The following procedures shall apply to one (1) individual unit of a given FAS with the test torso as given in Section 6.3 dropped "feet first".
  - 7.1.1 Read instructions accompanying the test subject to ascertain the proper procedure for 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 six (6) feet or twice (2X) 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 or a distance which allows six (6) feet of free fall, whichever is less. The test weight torso shall be located as close to the pole as practical or not greater than one (1) foot with no tension in the lanyard prior to release. In such a manner, the free-fall distance will equal twice (2X) the maximum available length or six (6) feet, 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 (two) minutes.
- 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 Sections 12.1, 12.2, and 12.3.
- 7.2 The following procedures shall apply to one (1) individual unit of a given FAS with the test weight torso as given in Section 6.3 dropped "face first".
  - 7.2.1 Read instructions accompanying the test subject to ascertain the proper procedure for 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 six (6) feet or twice (2X) 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 or a distance which allows six (6) feet of free fall, whichever is less. The test weight torso shall be located as close to the pole as practical or not greater than one (1) foot with no tension in the lanyard prior to release. In such a manner, the free-fall distance will equal twice (2X) the maximum available length or six (6) feet, 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 (two) minutes.
  - 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 Sections 12.1 and 12.2.

## 8. Dynamic Strength Test Procedure

- 8.1 The following procedures shall apply to one (1) individual unit of a given FAS and test weight torso as given in Section 6.4 and dropped "feet first".
  - 8.1.1 Read instructions accompanying the test subject to ascertain the proper procedure for 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 six (6) feet of free fall, whichever is less. The test weight torso shall be located as close to the pole as practical

or not greater than one (1) foot with no tension in the lanyard prior to release. In such a manner, the free-fall distance will equal twice (2X) the maximum available lanyard length or six (6) feet, 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 (two) minutes.
- 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 Section 12.4.

## 9. Climbing Belt Test Procedure (for use only if FAS includes integral climbing belt)

- 9.1 The following procedures shall apply to one (1) individual unit of a given FAS with climbing belt (if provided) and test weight torso as given in Section 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 and consistent 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 inches +/- 1 (610 mm) or the maximum length of the climbing belt, whichever is less, between the test torso and the closest perimeter point 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 three (3) inch +/- 1 (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 (2X) 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 (two) minutes.
  - 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 Section 12.4

## 10. Suspension Relief Device Test Procedure

- 10.1 The following procedure shall apply to the suspension relief device accompanying the test subject.
- 10.2 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.
- 10.3 For the SRD type that attached 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 (2X) 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 two (2) minutes.
- 10.4 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 (2X) 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 two (2) minutes.

- 10.5 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.

11.1.7 Name of engineer responsible for tests.

## 12. Pass-Fail Criterion

12.1 All tests must result in passing conditions prior to qualification approval of the test subject. A FAS (or SRD) is considered failed if it allows the test weight to come in contact with the ground or loses components to the FAS (or SRD) itself or the test weight torso, or the test weight torso does not remain suspended for a period of 2 (two) minutes.

12.2 During the performance test, 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 one thousand eight hundred (1800) lbs., the FAS does not bring the fall to a complete stop with a deceleration distance of not more than forty two (42) inches, or test torso detaches from the FAS.

12.4 Dynamic Strength Test Pass-Fail Criteria

12.4.1 During the Dynamic Strength Test, the FAS is considered failed if the test weight torso comes in contact with the ground or the test weight torso does not remain suspended by the FAS for a period of 2 (two) minutes.

12.5 The FAS shall also be inspected for the following Label Criteria:

12.5.1 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.

12.5.2 The label shall contain:

12.5.2.1 Year of manufacture.

12.5.2.2 Warning! Failure to discard and remove this FAS device from service after five (5) years from manufacture date or after arresting a fall, could cause serious injury or death.

12.5.2.3 Capacity rating.

12.5.2.4 Part number and model designation.

12.5.2.5 Manufacturer's name or logo.

12.5.2.6 Warning! Failure to read and follow manufacturer's instructions could cause serious injury or death.

12.5.2.7 Size of the harness (if applicable).

12.6 In addition to meeting the test criteria stated in Sections 12.1, 12.2, 12.3, 12.4, and 12.5 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.

12.6.1 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.

12.6.2 Further, if sub-contractors contribute to the manufacture of the FAS a certification of conformance to the manufacturing specifications by the manufacturer must accompany the affidavit.

12.7 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.

### SUMMARY OF CHANGES

This section identifies the location of principal changes to this standard that have been incorporated since its last issue. Changes or additions are underlined on the section reference number.

Revision A – Section 7.1.1, 7.1.4 and 7.2.4 revised

Revision B – Section 7.1.6, 7.2.5, 7.2.6, 8.1.4, 9.1.4, and 11.1 revised.

Revision C – Section 7.1.5, 7.2.5, 8.1.4, 9.1.4, 11.1 and 11.4.1 revised.

Revision D – Section 10 added and subsequent sections renumbered and 12.1 revised.

Revision E – Section 9.1.3 revised.



8/28/09

 8-28-09

(Sign and Date)

Robert Ransom, President  
Treestand Manufacturers Association

(Sign and Date)

Paul Meeks, Secretary  
Treestand Manufacturers Association