



## CLIMBING SUTRA TESTING FOR PERFORMER FLYING HARNESSSES 3-12-2022

### STUNT VESTS

An adjunct to ANSI E1.43-2016 Entertainment Technology- Performer Flying Systems

#### FORWARD

These safety requirements and test methods have been prepared by Trade Holdings Inc. DBA Climbing Sutra, a manufacturer of performer flying harnesses for over 25 years.

In addition to the requirements specified in **ANSI E1.43-2016 Entertainment Technology- Performer Flying Systems**, these are the testing procedures that Climbing Sutra uses for certification of Climbing Sutra **STUNT VEST** Performer Flying Harnesses. We hope it is a helpful resource to others for the evaluation of STUNT VEST Performer Flying Harnesses.

Please note, Fall safety harnesses and Mountaineering harnesses are not designed for performer flying and lie outside the scope of these requirements. Performer Flying Harnesses are built for use in performer flying systems and shall not be used for fall safety. For the standard governing performer flying systems see **ANSI E1.43-2016 Entertainment Technology- Performer Flying Systems**.

#### 1 SCOPE

This standard specifies safety requirements and tensile test methods for Climbing Sutra STUNT VEST performer flying harnesses. Other types of Climbing Sutra performer flying harnesses include Martial Arts Hong Kong Harnesses, Corsets, Flying Shorts, Positioning Belts, Two Point harnesses, Swivel Harnesses, Full Body Strap Harnesses, Twisting rings, Shoulder Harnesses,

Ankle Harnesses, and Climbing Style Single Point Harnesses. The test methods for these types of Climbing Sutra performer flying harnesses are addressed in separate standards.

## **2 PRINCIPLE**

A single **Stunt Vest** performer flying harness is placed on a rigid test dummy and subjected to the specified tensile loads applied in sequence to 9 different load bearing points.

During the sequence of tests each specified load bearing point must support the working load of 405 lbs. and meet the minimum breaking strengths of 4050 lbs. (18 kN) or 5170 lbs. (23 kN) as specified. The test is designed to target the structurally weakest picks and all five types of picks through out the stunt vest to provide the most accurate sampling of Working Load Limits and Minimum Breaking Strengths.

## **3 TERMS AND DEFINITIONS**

### **3.1 PERFORMER FLYING SYSTEM:**

A system of components specifically designed to suspend an aerial performer or transport a performer through the air. The performer flying system includes the attachment to the facility/structural support down to and including the harness which attaches to the performer.

### **3.2 PERFORMER FLYING HARNESS:**

A component that is worn by the performer to support their weight or secure the performer to a prop or performer flying system.

### **3.3 PICK:**

Load bearing attachment point on a harness for supporting the performers weight. A soft pick is a pick made of webbing and stitching only. A hard pick has an 'O' ring or 'D' ring or other

manufacturer supplied connection hardware. For purposes of this test, all picks referred to are SOFT PICKS.

#### 3.4 BUCKLE:

A load bearing connector that is an integral part of the harness used to connect and adjust two pieces of webbing.

#### 3.5 STUNT VEST

Also called a jerk vest, jerk harness, flying vest, theatrical vest.

Stunt vests are a type of performer flying harnesses used for stunts and flying effects. A stunt vest is a performer flying harness that covers the shoulders and torso and includes 2 leg straps that pass around each leg. It is optimized for support of the upper body and concealment under wardrobe. It will have multiple load bearing attachment points called “picks”, each of which must be able to support the performers weight throughout a performance. It will have picks covering the body of the vest typically ranging in number from 12 to over 50. It is made with layers of fabric, webbing, buckles, and thread. Stunt Vests used for film typically have soft picks made from webbing only. Some Stunt Vests used for live performance may have steel “O” or “D” ring hardware integrated as load bearing attachment points.

##### 3.5.1 PHOTO STUNT VEST:



### 3.6 STUNT VEST COMPONENTS:

3.6.1 **Body Panels.** The vest body is constructed from four (or more) fabric panels seamed together making a shape like a vest. Webbing components are stitched to the panels. With the vest body opened and laid flat (outside facing up), the four Stunt Vest body panels from left to right are named: Left Front Panel, Left Back Panel, Right Back Panel, and Right Front Panel.

3.6.2 **Cross Straps** are webbing straps that run horizontally from left to right around the body of the Stunt Vest and are attached to the front buckles and front adjuster straps. A series of picks are created by sewing the Cross Straps to the vest body at intervals creating individual “pockets” (Picks) in the webbing. Cross Straps usually number 3 to 5 straps per harness.

3.6.3 **Vertical Strap.** Webbing strap that runs from the Front Left Panel Hem Loop up over the left shoulder, down the Left Back Panel to the Back Left Panel Hem Loop, up to the Neck Loop, down to the Right Back Panel Hem Loop, up over the Right Shoulder and down the Right Front Panel to the Right Front Panel Hem Loop. A series of picks are created by sewing the Vertical Strap to the vest body at intervals creating individual pockets or loops (Picks) in the Vertical Strap webbing. The vertical strap may be a single strand or multiple strands of webbing.

3.6.4 **Hem Loops.** There are 4 loops (Picks) at the bottom edge of each panel of the vest body typically formed by extensions of the Vertical Strap.

3.6.5 **Neck Loop.** The Pick at the top of the center back of the harness typically formed by an extension of the Vertical Strap. The Neck Loop and the Upper Back “X” and Lower Back “X” are three of the strongest picks on the vest.

**3.6.6 Back “X” s.** Pick(s) formed by crossed webbing strands located at the center back below the Neck Loop. Usually two per harness: Upper Back “X” and Lower Back “X”. Along with the Neck Pick are typically the three strongest picks on the vest

### 3.7 WORKING LOAD LIMIT (WLL)

The Working Load Limit is defined as the maximum allowable working load the harness shall be subjected to during normal performance. For a standard Climbing Sutra stunt vest the Working Load Limit is 405 lbs. using a safety factor of 10 to 1 with a Minimum Breaking Strength of 4050 lbs. (18 kN).

### 3.8 MINIMUM BREAKING STRENGTH (MBS)

**3.8.1** Minimum Breaking Strength (MBS) aka Minimum Breaking Load is 4050 lbs. (18 kN) for all picks on Climbing Sutra Stunt Vests. MBS is the minimum force required to completely break a stunt vest pick as defined by test procedures in this standard.

**3.8.2** The Neck Pick, Upper Back “X”, and Lower Back “X” shall have a **higher** Minimum Breaking Strength of 5170 lbs. (23 kN).

**Note: the higher breaking strength and positions of the Neck Pick and back ‘X’ Picks make them suitable choices for shock loads or for use as a ‘back-up’ to other picks when shock loads could occur.** While Stunt Vests are **not** fall safety harnesses, the MBS of **23kN** for these picks meets or exceeds the static / tensile requirements for the mid-back ‘D’ ring attachments in several fall safety harness standards including:

ANSI/ASSE Z359.11-2014 4.3.5 Static Feet First Test: 3600 pounds (**16kN**) for 1 minute.

NFPA 1983 2006 8.3.10 Static Upright Class III harness: **16 kN** (3597 lbf) for 2 minutes.

AS/NZS 1891.1:2007 APPENDIX C STATIC LOADING TESTS C5.1(c): **15 kN** (3372 lbf) for 3 minutes.

#### **4 APPARATUS**

The apparatus shall consist of the following:

4.1 **Tensile Testing Equipment** constructed so that a rigid test dummy may be suspended and pull testing be performed without interference. The tensile test equipment shall pull at a uniform rate of not greater than 60 inches (1524 mm) per minute and not less than 30 inches (762 mm) per minute.

4.2 **Load Cell.** The tensile testing equipment shall include a load cell with current calibration and recording equipment capable of registering momentary peak loads up to 10,000 lbs. (45 kN) within an accuracy of +/- 3% of the specified load. The recording data channel shall have a minimum sampling rate of 1,000 samples per second.

4.3 **Rigid Test Dummy** shall be sized for adults and meet the specifications described in one of the following safety standards: ANSI/ASSE Z359, or CSA Z259, or NFPA1983, or EN12277.

4.4 **Shackle** used to attach to the harness picks shall be polished (smooth finish) stainless or titanium alloy "bow" style shackle with a cross section (diameter) of 9-13mm. The bow end of the shackle shall connect to the harness picks.

Shackles with rough finish, sharp edges, or raised markings shall NOT contact Picks.

#### **5 TEST SPECIMENS**

5.1 Test Harnesses shall be new and in unused condition, selected randomly from a given model of harness. Harness model shall be retested after any design or materials change.

Manufacture date, serial number, model name, and a picture of the harness (pre-test) shall be included with the final test report.

5.2 Harness shall be properly sized and fitted to the test torso as per the manufacturers fitting instructions. For Climbing Sutra STUNT VESTS the correct harness size is MEN'S MEDIUM SHORT for test torsos conforming to ANSI/ASSE Z359, or CSA Z259, or NFPA1983.

5.3 In this standard it is accepted that stitching and/or webbing may tear while testing for the Minimum Breaking Strengths (MBS), but stitching or webbing shall NOT tear while testing the Working Load Limit (405 lbs.)

## **6 CONDITIONING**

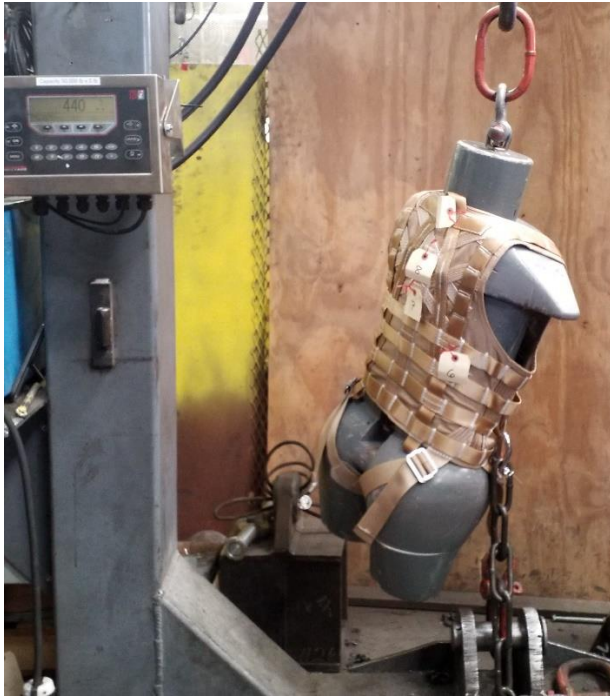
Test sample shall be dry and conditioned in an atmosphere of 15 to 38 degrees Celsius for a minimum of 24 hours. Then sample shall be tested within 15 minutes. Only one harness sample may be used for 7.1 through 7.8.

## **7 PROCEDURE**

7.1 The Stunt Vest harness shall be **sized** as per the manufacturer's instructions and placed on a standardized rigid adult test dummy.

7.2 All harness buckles shall be tightened as per the manufacturer's instructions. Leg straps shall be evenly tensioned. There shall be space to insert a finger under each tensioned strap.

7.3 The rigid test dummy shall be suspended from the test apparatus by the neck ring (upright) for tests 1, 2, and 3; then suspended from the buttocks ring (inverted) for tests 4 through 9.



Upright



Inverted

7.4 The shackle shall be attached to the specified pick with the bow side pulling on the pick. Force is applied in the direction pulling away (down) from the designated suspension ring on the test dummy.

7.5 Working Load Limit (WLL) test. Force shall be applied over a period of 10 to 40 seconds until 405 +80/-0 lbs. (1.8 kN) is reached. The force of 405 +80/-0 lbs. shall be maintained for a period of 2 minutes, +15/-0 seconds, then immediately released. Inspect for any tearing of stitching or webbing. Any tearing of stitching or webbing fails the WLL test.

7.6 Minimum Breaking Strength (MBS) test. Immediately following the WLL test and using the same pick as in 7.5, the force shall be increased over a period of 10 to 40 seconds until the Minimum Breaking Strength is reached, then the force shall be immediately released. Tearing of stitching and webbing is acceptable in the MBS test.



The Minimum Breaking Strength of 4050 lbs. (18kN) shall be obtained for picks 1 (8.1) through pick 6 (8.6). If not, the harness fails this test. The Minimum Breaking Strength of 5170 lbs.

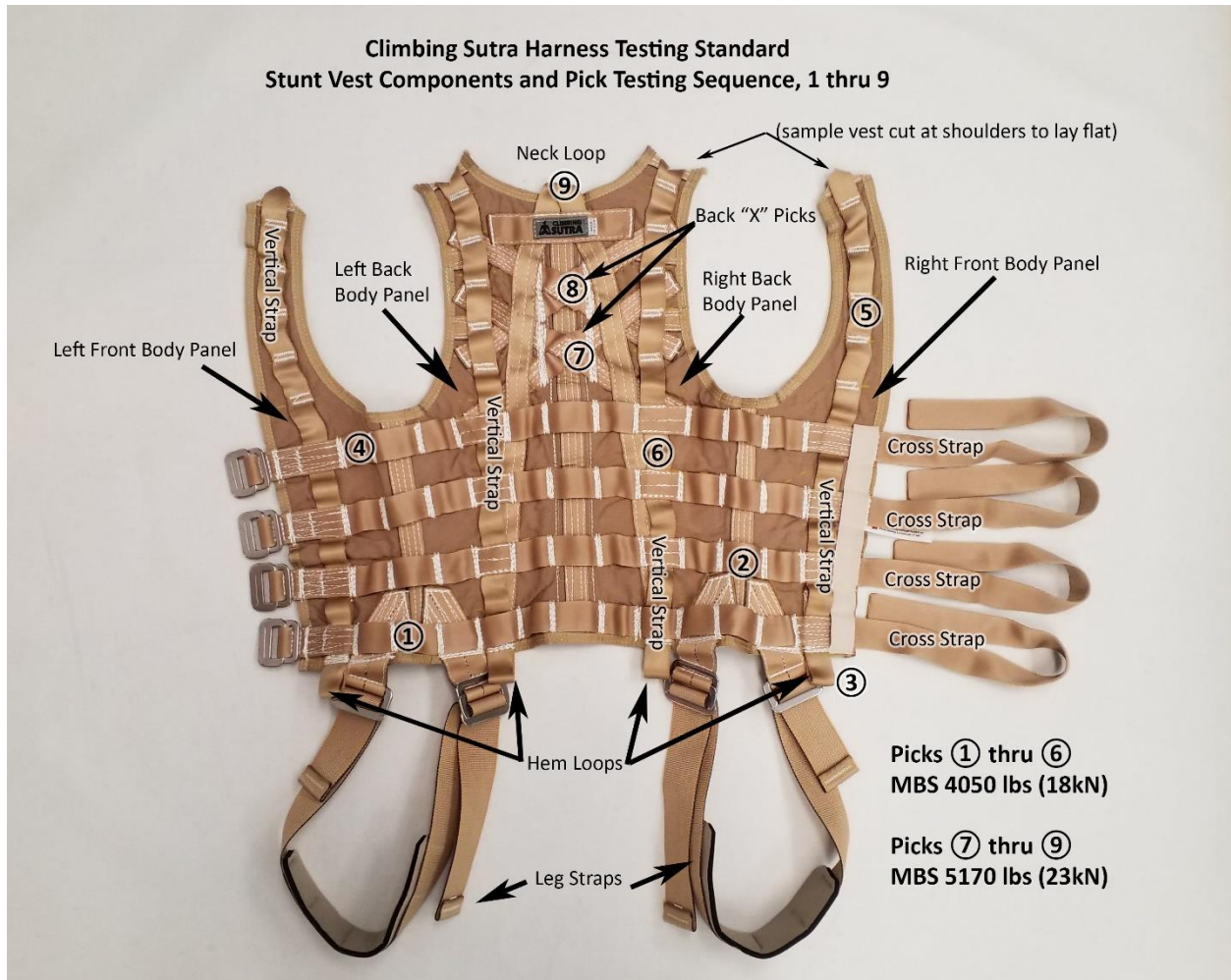
(23 kN) shall be obtained for picks 7 (8.7) through pick 9 (8.9). If not, the harness fails this test.

7.7 Record the results of the tests. FAILURE OF ANY INDIVIDUAL TEST SHALL EQUAL FAILURE OF THE ENTIRE TEST.

7.8 The Test Dummy and the shackle shall be rigged for testing the next designated pick in the sequence. Repeat 7.2 through 7.7. Each MBS test shall be separated by a minimum of one minute and a maximum of 1 hour from the previous MBS test.

## 8 TEST SEQUENCE

Follow this sequence for testing 9 Picks on a single STUNT VEST.



8.1 Pick 1: Left side of vest, lowest cross strap, centered at side seam between Left Front Panel and Left Back Panel. Dummy is suspended from neck ring (upright). MBS 4050 lbs. Follow 7.2 through 7.7

8.2 Pick 2: Right Front Panel, cross strap that is second from lowest, closest pick to front opening. Dummy is suspended from neck ring. MBS 4050 lbs. Follow 7.2 through 7.7

8.3 Pick 3: Right Front Panel, hem loop. Dummy is suspended from neck ring. MBS 4050 lbs. Follow 7.2 through 7.7

8.4 Pick 4: Left Front Panel, highest cross strap, pick closest to front opening. Dummy is suspended from buttocks ring (inverted). MBS 4050 lbs. Follow 7.2 through 7.7

8.5 Pick 5: Right Front Panel, vertical strap. Pick midway between the highest cross strap and the top of the shoulder. Dummy is suspended from buttocks ring. MBS 4050 lbs. Follow 7.2 through 7.7

8.6 Pick 6: Right Back Panel, vertical strap. Pick between the highest cross strap and the next cross strap down. Dummy is suspended from buttocks ring. MBS 4050 lbs.

Follow 7.2 through 7.7

8.7 Pick 7: Lower Back "X". Dummy is suspended from buttocks ring. MBS is 5170 lbs. (23 kN)

Follow 7.2 through 7.7

8.8 Pick 8: Upper back "X". Dummy is suspended from buttocks ring. MBS is 5170 lbs. (23 kN)

Follow 7.2 through 7.7

8.9 Pick 9: Neck Loop. Dummy is suspended from buttocks ring. MBS is 5170 lbs. (23 kN)

Follow 7.2 through 7.7.

## **9 TEST REPORT / CERTIFICATE OF CONFORMANCE**

9.1 Testing shall be performed, and a test report created by a company that is NOT the manufacturer or distributor; or a competing manufacturer or distributor of the harness being tested.

9.2 Test report shall include the testing company name with logo, address, website, contact information, contact person(s), and the supervisor of the test.

9.3 Test report shall include the manufacturer of the sample harness, the model number, serial number, manufacture date, and photograph of each sample tested.

9.4 Result of the test shall include a list of the peak loads captured for **each** of the individual tested picks 8.1 through 8.9. for each harness. Any single Working Load Limit test that does not meet or exceed the required WLL for that pick equals failure of the **entire** harness. Any single peak load that does not meet or exceed the required Minimum Breaking Strength for that pick equals failure of the **entire** harness. Result shall be shown as PASS or FAIL at conclusion of report along with the date of the test and name of supervisor.

End of Climbing Sutra test for Performer Flying Harness STUNT VESTS