



## **Fall Arrest System Drop Testing Report BeamSafe Portable HLL System**

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# 1. Introduction

## 1.1. Objective:

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The objective is to proof test all the components involved in the BeamSafe Portable Horizontal Lifeline system. This testing was done in accordance with the performance standards set forth in the Occupational Safety and Health Administration standard 1926.502 and under the guidance of the Safety Standards for Fall Protection in the Construction Industry Preamble.

## 1.2. Definitions:

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For the purposes of this report, the following definitions apply:

### **Anchorage**

The terminating component of a fall protection system that is intended to support any forces applied to the system.

### **Deceleration Distance**

The vertical distance between the user's fall arrest attachment at the onset of fall arrest forces during a fall, and after the fall arrest attachment comes to a complete stop.

### **Energy Absorbing Lanyard**

The type of equipment tested. A component of a fall arrest system, the main purpose of which is to absorb fall energy as it limits fall distances. Each energy absorbing lanyard has a catalog record of 6 ft in length.

### **Fall Arrest System**

The collection of equipment components that are configured to arrest a free fall.

### **Free Fall**

The act of falling before a fall protection system begins to apply forces to arrest the fall.

### **Free Fall Distance**

The amount of distance fallen by simulaid before any deployment of the energy absorbing lanyard.

### **Hanging Load**

Load as measured by the load cell and data collection system when the simulaid was hanging on the HLL after the fall.

### **Harness, Full Body**

A body support designed to contain the torso and distribute the fall arrest forces over at least the upper thighs, pelvis, chest and shoulders.

### **Horizontal Lifeline(HLL).**

A component of a horizontal lifeline subsystem, consisting of a flexible line with connectors or other coupling means at both ends for securing it horizontally between two anchorages or anchorage connectors.

### **Lanyard**

A component consisting of a flexible rope, wire rope, or strap, which typically has a connector at each end for connecting to the body support and to a fall arrester, energy absorber, anchorage connector, or anchorage.

### **Peak Load**

Maximum load measured by the load cell and the data collection system.

### **Self-Retracting Lanyard (SRL)**

A device containing a drum wound line that automatically locks at the onset of a fall to arrest the user, but that automatically pays out from and retracts onto the drum during normal movement of the person to whom the line is attached. After onset of a fall, the device automatically locks the drum and arrests the fall.

### **Simulaid**

Simulaids are manikins that represent an actual human, they are the best way to maintain the reality of a fall without using a live subject. The head and body are built of dense, flexible, life-like vinyl.

### **Swing Fall.**

A pendulum like motion that occurs during and/or after a vertical fall. A swing fall results when an authorized person begins a fall from a position that is located horizontally away from a fixed anchorage.

### **Total Fall Distance**

The total amount of distance fallen by the simulaid including deployment of energy absorbing lanyard, harness stretch, and HLL sag.

### **Vertical Lifeline.**

A component, element or constituent of a lifeline subsystem consisting of a vertically suspended flexible line and along which a fall arrester travels.

### 1.3. Components:

- Two BeamSafe portable stanchions



- Type 1 six foot adjustable length shock absorbing web lanyard w/pack, #74N locking snaps at each end.42” deceleration.



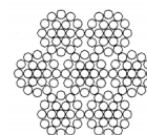
- Six 3/8” galvanized steel malleable wire rope cable clips (3 per end)



- Two double locking snap hooks



- 3/8” 7 x 19 Galvanized Aircraft Cable  
Specification Requirements:  
 Performance Standard & Dimensions:  
 Federal Specification MIL-DTL-83420M  
 Type: I  
 Composition: A  
 Construction: 7 x 19  
 Material: Drawn galvanized high carbon steel  
 per Federal Specification  
 MIL-DTL-83420M  
 Minimum Breaking Strength: 14,400 lbs



Part Numbers	Nominal (inch)	Working Load Limit (lbs)	Minimum Breaking Strength (lbs)
0545502	3/32	200	1,000
0545503	1/8	400	2,000
0545504	5/32	560	2,800
0545505	3/16	840	4,200
0545506	1/4	1400	7,000
0545507	5/16	1960	9,800
0545508	3/8	2880	14,400

## 1.4. Recording Apparatus:

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1. One Dillon ED Xtreme 5000 LB capacity dynamometers



2. One Dillon Communicator



3. One Surface Pro 4



### 1.5. Testing Conditions:

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Ambient Temperature= 93 Degrees Fahrenheit  
Wind= N 13.05 MPH  
Condition= Scattered clouds  
Humidity = 11%  
Barometer= 29.86hg

### 1.6. Testing method:

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Two 225 lbs. test simulaids were dropped semi-simultaneously on a 3/8" aircraft cable Horizontal Life Line (HLL) anchored by BeamSafe portable stanchions. Both simulaids were attached (tied off) to the HLL using 6' adjustable shock absorbing lanyards. The determination to use two 225 lb. test simulaids with a 1.4 multiplier was based on the widely accepted practice that the multiplier compensates for the damping effect, or absorption, of a falling workers body, and ensures the equipment is tested to maximum capacity.

The formula used is as follows:

225 lb Rigid Simulaid x 1.4 (force absorbed by dynamic human body) = 315 lb. Fully clothed / tooled worker.

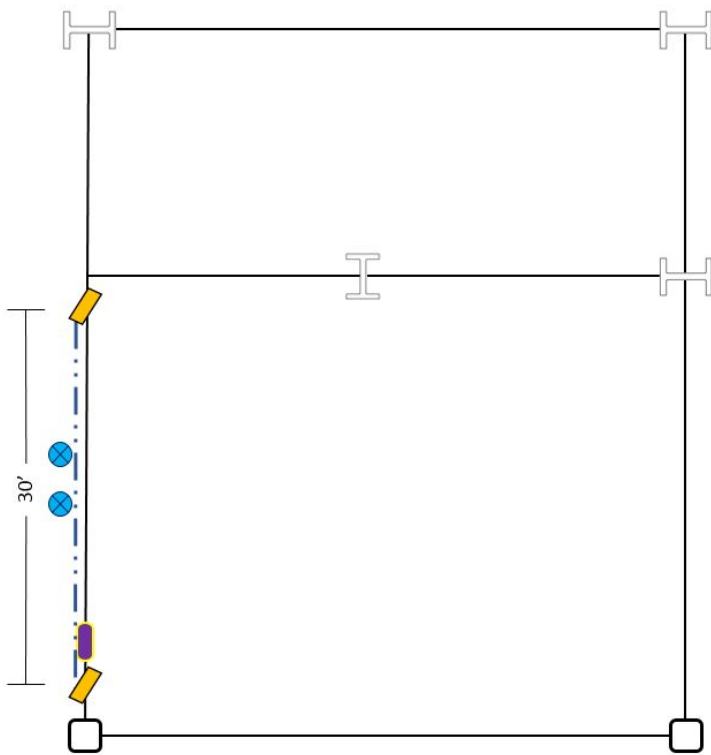
The purpose for dropping two simulaids semi simultaneously was to create a worst-case scenario that might be experienced in a real life situation if two workers were attached to the same HLL with 6' adjustable shock absorbing lanyards.





### 1.7. Anchorage Configuration:

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### 1.8. Testing configuration:



Legend	
	BeamSafe Stanchion
	225 lb. Test Simuloids
	Dynamometer
	3/8" Aircraft Cable

MSC Safety Solutions Testing Plan  
3/8" Aircraft cable anchored by BeamSafe Stanchions



## 2. Test Observations:

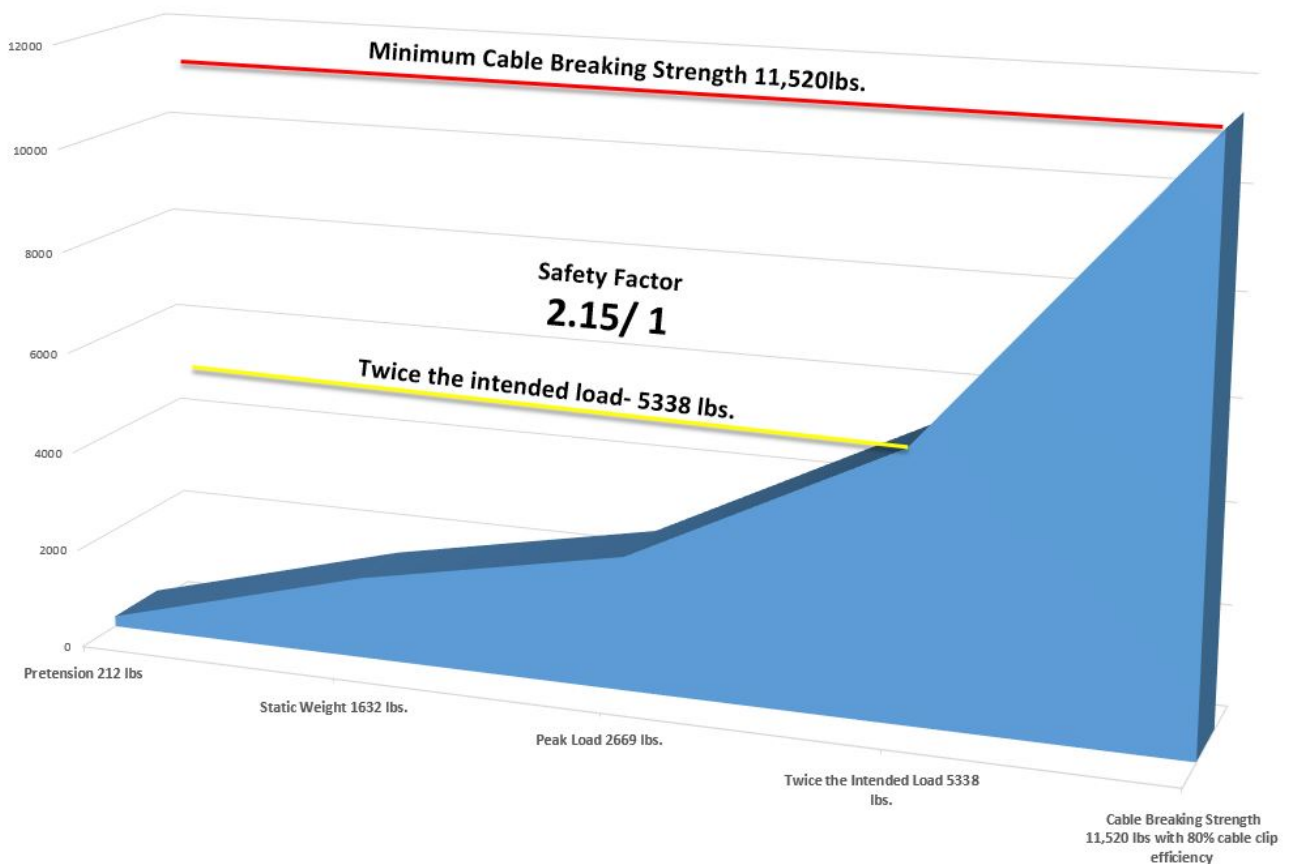
### 2.1. Fall Metrics

All results are given as the average between the two simulaid

Lanyard Length Pre Test	Lanyard Length Post Test	Total Fall Distance	Free Fall Distance	Deceleration Distance	Damage to stanchion	Damage to cable	HLL sag Pre fall	HLL Sag Post fall
6' 1"	9' 8"	13' 9"	10' 2"	3' 7"	None	Minor bending	4"	1' 7"

### 2.2. Loading Metrics

3/8" aircraft cable Horizontal Life Line (HLL) anchored by BeamSafe portable stanchions



### 3. Conclusions:

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The results and recommendations presented from these successful drop tests (proof tests) on the BeamSafe Portable HLL safety system provided invaluable data for the actual loads introduced to the system during a fall with two men. All safety system components were examined after the tests and there was no major physical damage or failure other than minor bends in the cables at the anchorage locations where they were attached to the BeamSafe stanchions. The drop tests performed, and the data shown above, provides documentation for proof tests of the system in question. There are a couple of items to note which make these results conservative to real-life conditions. First, the simulaids do not have the elasticity that a human body can achieve during a fall. This elastic state that a human body exerts during a fall will absorb some of the energy from the safety system and the result would be slightly lower maximum tension values than shown above. Lastly, our history shows that it is extremely unlikely that two men will fall on the same HLL. However, to be conservative we dropped both simulaids within the same span and the results were accounted for in the above data.

It is reasonable to assume the following:

1. A worker “tied off” using a 6’ adjustable length shock absorbing web lanyard, attached to a BeamSafe portable HLL system with a span  $\leq$  30’ would not contact the lower walking/working surface of  $\Rightarrow$  14’.
2. The total fall distance could be reduced if the worker performed either of these actions:
  1. Shortening the adjustable length lanyard. This test was conducted on a 6’ long adjustable lanyard that could be shortened to 4’. Using a 4’ long lanyard would reduce the total fall distance to 11’ 9” allowing this system to be used safely for walking working surfaces that are  $\Rightarrow$  12’ from the lower level.
  2. Raise the anchorage point by straddling the beam that the BeamSafe system was attached to. This would reduce the total fall distance and reduce the impact on the shock absorbing lanyard, thus reducing deceleration distance.

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The information contained within this report is for informational purposes only. Fall arrest systems must be installed, evaluated and used only by a competent person.



## 4. Photographic Evidence:

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