



Fall Arrest System Drop Testing Report

**Vertical 3/8" aircraft cable
anchored to structural steel**

August 2, 2016

Prepared by,

**MSC Safety Solutions
12071 Tejon St. STE 200
Westminster, CO 80234
www.mscss.us**



1. Introduction

1.1. Objective:

The objective is to proof test all the components involved in the vertical life line 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:

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

Simulaid 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:

- Static wire rope grab for 3/8" steel cable



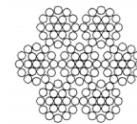
- One 8-foot retractable web lanyard with swivel top and carabiner, 3600 lb. gate hook



- Two 3/8" galvanized drop forged cable clips



- 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. Testing Conditions:

Ambient Temperature= 91 Degrees Fahrenheit

Wind= SE 11.185 MPH

Condition= Scattered clouds

Humidity = 22 %

Barometer= 29.97 hg

1.5. Testing method:

- One 225 lb. test simulaid was dropped on a vertical life line (VLL), made of 3/8" aircraft cable. The cable was anchored to structural steel by wrapping the cable around a wide flange beam and applying two 3/8" drop forged cable clips. The simulaid was attached (tied off) to the VLL using an 8' retractable web lanyard with swivel top and carabiner, which in turn, was connected to the VLL using a static wire rope grab. The determination to use one 225 lb. test simulaid 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.

1.6. Anchorage Configuration:



1.7. Testing configuration:



2. Test Observations:

2.1. Fall Metrics

Lanyard Length Pre Test	Lanyard Length Post Test	Total Fall Distance	Free Fall Distance	Deceleration Distance	Damage /distortion to anchorage	Damage /distortion to cable	Cable grab slippage
3'	8'	9' 10"	4' 10"	5'	None	Minor bending	< 1/2"



Post Drop



Height from
ground
7' 6"



Cable grab
slipped less
than 1/2" upon
impact

3. Conclusions:

The results and recommendations presented from this successful drop test (proof test) on the a 3/8" aircraft cable vertical life line, provided invaluable data for the actual total fall distance that can be expected when using this system. 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 it was wrapped around the wide flange beam. The drop tests performed and the data shown above provides documentation for proof tests of the safety systems in question. There are a couple of items to note which make these results conservative to real-life conditions. First, the simulaid does 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 less pull out in the deceleration components of the lanyard. This would result in less total fall distance.

It is reasonable to assume the following:

1. A worker "tied off" using an 8' retractable web lanyard, attached to a static wire rope grab, attached to 3/8" vertical life line, would not contact the next lower walking/working surface of => 10' in height.
2. If the worker kept the wire rope grab elevated above his/her head as high as possible, the total fall distance could be decreased by as much as 3-4'. This would allow workers to work safely at heights of 6-7' above the next lower walking working surface without contacting that level during a fall.
3. Conversely, if the worker keeps the cable grab at the same elevation of his/her feet, the total fall distance could be increased by 3-4' increasing the total fall distance to 13-14'.
4. The manufacturer of the static cable grab recommends using only a 4' max length energy absorbing lanyard with their product. In subsequent tests performed on this system a drop was conducted using a 6' adjustable shock absorbing lanyard. The slippage of the cable grab was the same in both tests, < 1/2". The only change was in the total fall distance, which was greater with the 6' lanyard.

Please understand that all information provided herein is proprietary information from SESAC and may only be reviewed by appropriate parties within this project and under no circumstances may be used, shared, distributed, or regenerated for use by other individuals, organizations, or companies for any reason unless direct consent is granted by SESAC.

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.