STEEL ERECTORS SAFETY ASSOCIATION OF COLORADO

Fall Arrest System Drop Testing Report

3”x3”x1/4” Welded Angle HLL

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1. Introduction

1.1. Objective:

The objective is to proof test all the components involved in the 3" X 3" X ¼" welded angle 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.

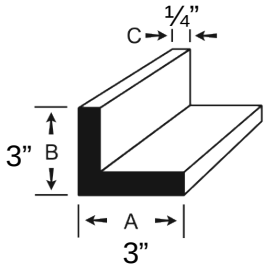
1.2. Definitions:

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:

- A36 steel angles 3”x 3” x ¼”

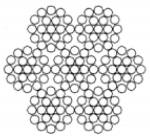


- Type 1 six foot adjustable length shock absorbing web lanyard w/pack, #74N locking snaps at each end.42” deceleration.

- Eight 3/8” galvanized drop forged cable clips

- 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:

1. One Dillon ED Xtreme 5000 LB capacity dynamometers

2. One Dillon Communicator

3. One Surface Pro 4

1.5. Testing Conditions:

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

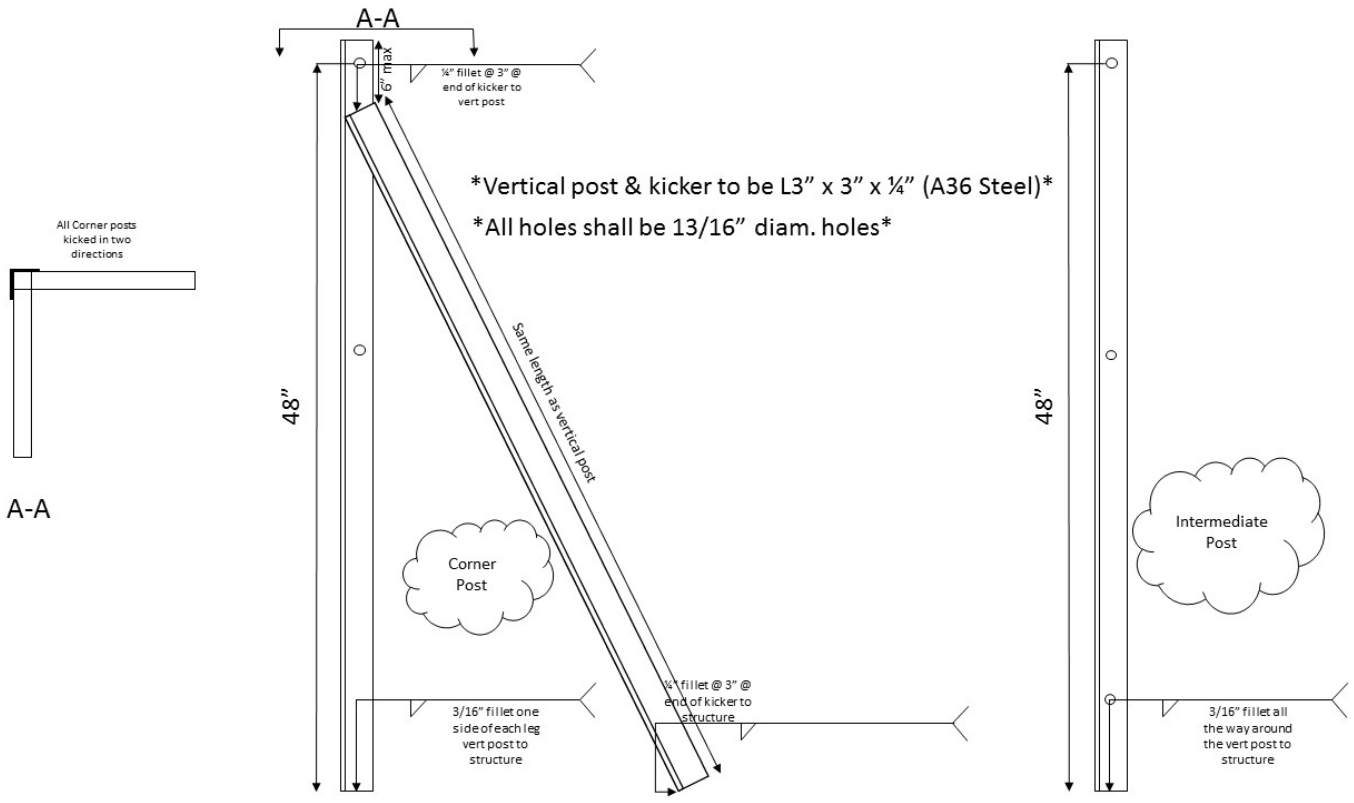
1.6. Testing method:

Two 225 lbs. test simulaids were dropped semi-simultaneously on a 3/8" aircraft cable Horizontal Life Line (HLL) anchored by welded angle posts. 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:

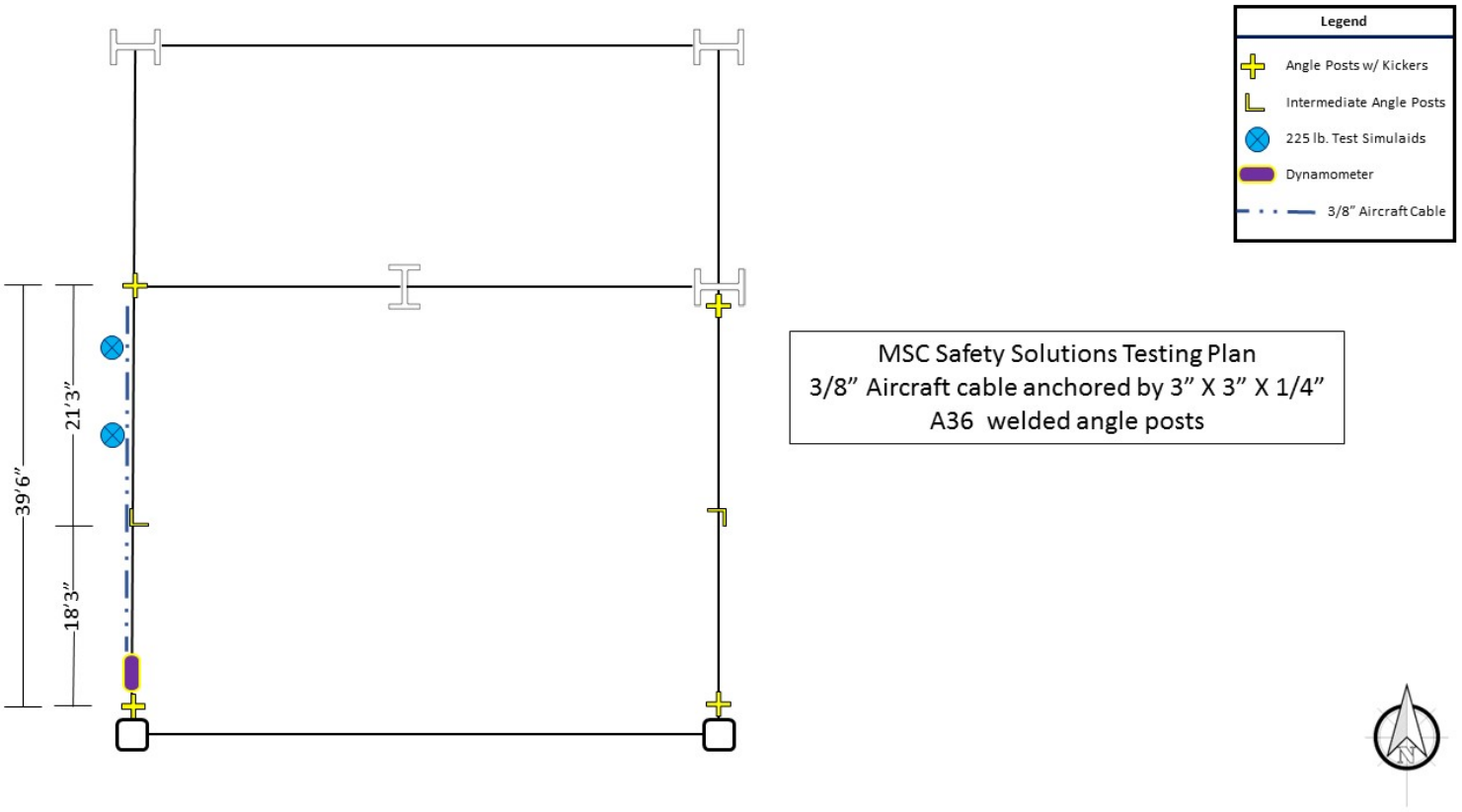
225 lb Rigid Simulaid x 1.4 (force absorbed by dynamic human body) = 315 lb. Fully clothed / tooled worker.

In addition, a second simulaid of the same configuration was dropped semi simultaneously to recreate 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:



1.8. Testing configuration:



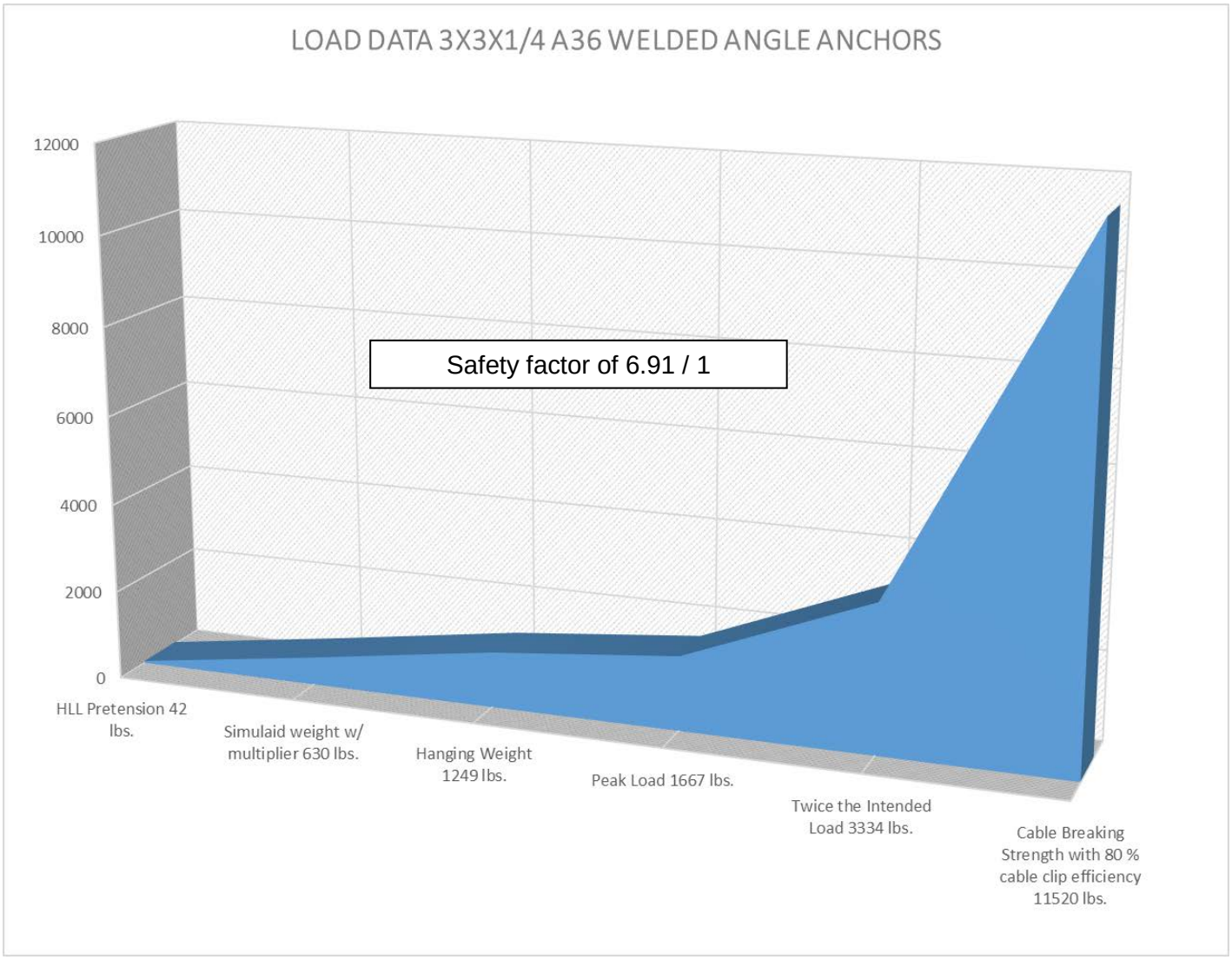
2.Test Observations:

2.1. Fall Metrics

All results are given as the average between the two simulaids

Lanyard Length Pre Test	Lanyard Length Post Test	Total Fall Distance	Free Fall Distance	Deceleration Distance	Damage/distortion to anchorage	Damage/distortion to cable	Initial Sag in HLL	HLL Sag Post fall
6’ 1”	9’ 8”	13’ 4”	9’ 9”	3’ 7”	None	Minor bending	4”	1’ 7 ½”

2.2. Loading Metrics



3.Conclusions:

The results and recommendations presented from these successful drop tests (proof tests) on the 3”x3”x1/4” A36 welded angle HLL safety system provided invaluable data for the actual loads induced into 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 wrapped around the anchorage components (except the shock absorbing lanyards pulling out as they were supposed to). 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 too real-life conditions. First, the weights 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 should be noted that this test was conducted on a 6’ long adjustable lanyard that could be shortened to 4’. It is reasonable to assume that a 4’ long lanyard would reduce the total fall distance to 11’ 4” allowing this system to be used safely for walking working surfaces that are => 12’ from the lower level.

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4.Photographic Evidence: