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Helix Test Report

Sterling 8mm Prusik Compatability Tests

Version no: 1
Date of Issue: 19/07/2021

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Purpose of Tests

This series of tests is aimed to determine the compatability of the Sterling 8mm sewn prusiks with 3 key ropes sold and used by Helix Operations.

Tests

Tests will be conducted in two phases:

Phase 1 - Tensile tests to determine the slip point of the Sterling Prusik on each rope

Phase 2 - Drop tests to establish the effects of dropping 200kg mass (Rescue load) onto a dual rope hauling system, single prusik on each line.

The aim is to mimic the test criteria set out by the British Columbia Council for Technical Rescue, the system should arrest a 200kg load free falling 1m with an initial rope length of 3m (fallfactor 0.3).

The peak force seen by the system should be less than 15kN and the load should be arrested within 1m. The BCCTR tests also require the rope to retain 80% of its rated strength, however this element was not examined as part of these tests.

Components

Sterling 8mm BLP (Bound Loop Prusik) - EN795 2012

DMM Worksafe Plus 11mm - EN1891:1998 Type A

Edelrid Interstatic Protect 11mm - EN1891:1998 Type A

Teufelberger KMIII 11mm - EN1891:1998 Type A

Knots

All prusiks tested were tied to the ropes using a 3 wrap classic prusik knot.

The Sterling BLP is a sewn prusik so there is no knot used in it's manufacture.

Phase 1: Tensile Tests

Method - Sterling 8mm Prusik Slip Testing

The following tests were conducted at DMM Wales on 29th July 2021 by Paul Edwards and Jed Stone of Helix Operations Limited.

Three tests were conducted on each rope, 9 tests in total. Each test was pulled at a rate of 150mm/min.

Prusiks were Sterling 8mm AZ Bound Loop Prusik 18 inches. EN795 2012 CE marked.

Each Prusik was tied by the same person to ensure consistency.

Teufelberger KMIII. Tests 1/2/3

The tests conducted on the Teufelberger KMIII all slipped between 8.113 and 9.969

In all three tests the Prusik slipped at a steady rate and showed a force limiting characteristic with no large peaks and troughs in the forces.

The rope and prusik were solidly bound together following the test, however the glazing to the rope was minimal.

Results:

Test 1: 9.969 kN

Test 2: 8.449 kN

Test 3: 8.113 kN

All three tests on KMIII slipped consistently between 8.113kN and 9.969kN.

At the point of slippage the rope continued to slip at a steady rate and did not tighten or reapply pressure..

Our view is that this rope prusik combination would have continued to slip between 8 - 10kN without increasing grip.

Edelrid Interstatic. Tests 1/2/3

The tests conducted on the Edelrid Interstatic 11mm rope slipped between 13.2kN and 16.19kN

The test result graph shows that there were multiple small slips starting at around 6kN with the first major slips at around 8-10kN, however the ropes regained grip following major slips and continued to provide grip into the 13 – 17kN range, had we continued the tests after these large and definitely user noticeable slips then I am certain the rope sheath would have failed (this was demonstrated on the last test we ran on Worksafe Plus where we pulled through until failure).

Significant rope glazing witnessed.

Results:

Test 1: 13.2 kN

Test 2: 14.27 kN

Test 3: 16.19 kN

The first slips at 8 - 10kN were obvious and would gain the attention of an operator, however following each slip the prusik re-gripped and the forces increased until the next set of slips occured in the 13 - 17kN range.

At 13 - 17kN the slips were significant seeing an average 7kN drop.

Tests were stopped at this point however prusik did regrip and continue to apply force.

Further tests required if we want to continue until failure.

DMM Worksafe Plus. Tests 1/2/3

The test conducted on the Worksafe Plus slipped between 16.36 and 17.28 (17.28 was the failure point of the final rope pulled to failure after a noticeable slip event).

The test graph shows the Worksafe Plus beginning to slip at around 4kN, these were small settling in slips as the knots and rope bit into each other, the first large slips were between 8-10kN and these would have been noticeable to an observant operator. The prusik then regripped and continued to apply force until further large slips at 13-14kN were noted, the prusiks then re-gripped again and continued to build force until around the 16kN mark where significant slips were noted on all three tests.

Significant rope glazing witnessed.

Test nine was then allowed to run until failure, the prusik regripped following the 16kN slip and ran up to 17.28. At this point the sheath failed.

Results:

Test 1: 16.36 kN

Test 2: 16.83 kN

Test 3: 17.28 kN (pulled to sheath failure)

The first significant (user visible) slips occured at 9-10kN and were consistent between all 3 tests.

The second significant slips occured at 13-14kN and quickly re-gripped to build up to above 16kN where they slipped again.

Test three was allowed to regrip following its 15kN slip, regripped and failed the sheath at 17.28kN.

Phase 1: Collated Results

Teufelberger KMIII. Tests 1/2/3

Test 1: 9.969 kN

Test 2: 8.449 kN

Test 3: 8.113 kN

Edelrid Interstatic. Tests 1/2/3

Test 1: 13.2 kN

Test 2: 14.27 kN

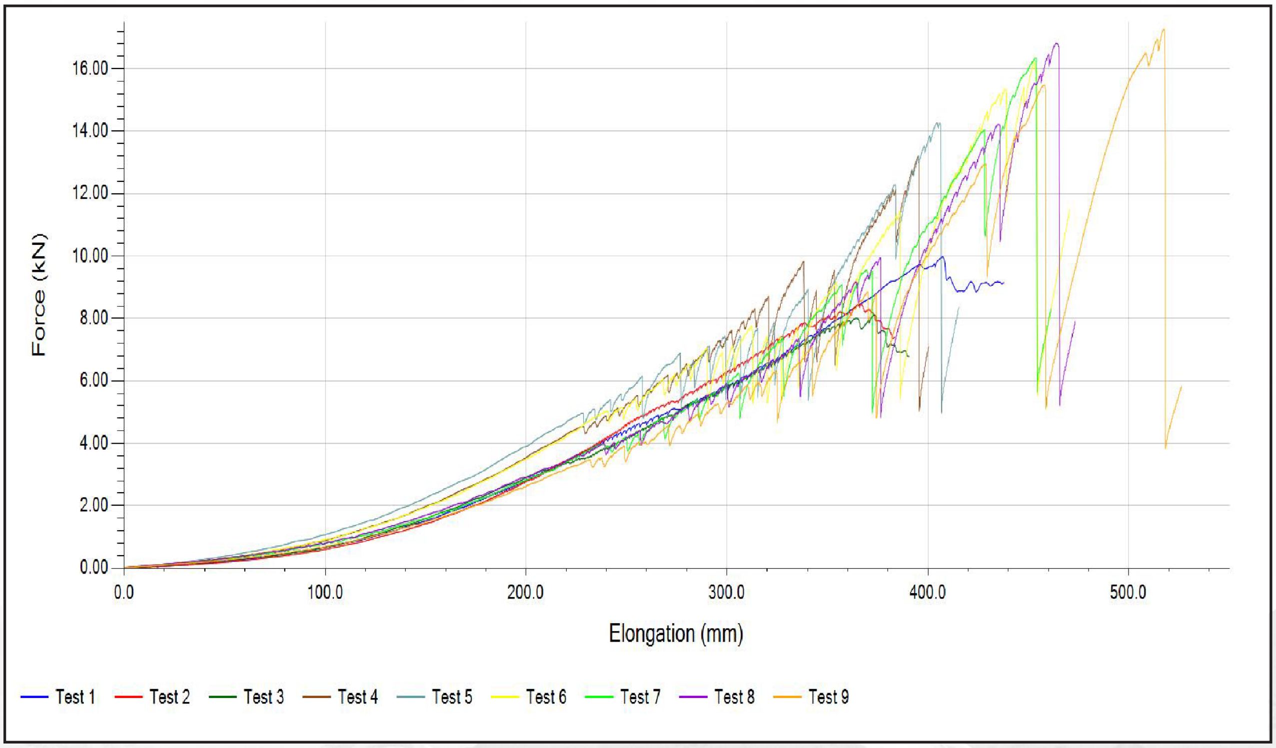
Test 3: 16.19 kN

DMM Worksafe Plus. Tests 1/2/3

Test 1: 16.36 kN

Test 2: 16.83 kN

Test 3: 17.28 kN (pulled to sheath failure)



During the tests the Teufelberger KMIII began slipping and continued to slip consistently.

The other ropes (Edelrid Interstatic & DMM Worksdafe Plus) initially slipped significantly glazing the rope, then re-gripped with enough force to apply greater loads to the system before slipping again, this cycle of slip/re-grip continued until the forces became high enough to fail the sheath on the rope (Test nine).

It appeared that the combination of Sterling 8mm Prussic and Teufelberger KMIII rope gave the most consistent slip and force limiting characteristics out of the 3 combinations tested here.

Phase 2: Drop Tests

Method - Sterling 8mm Prusik Drop Testing

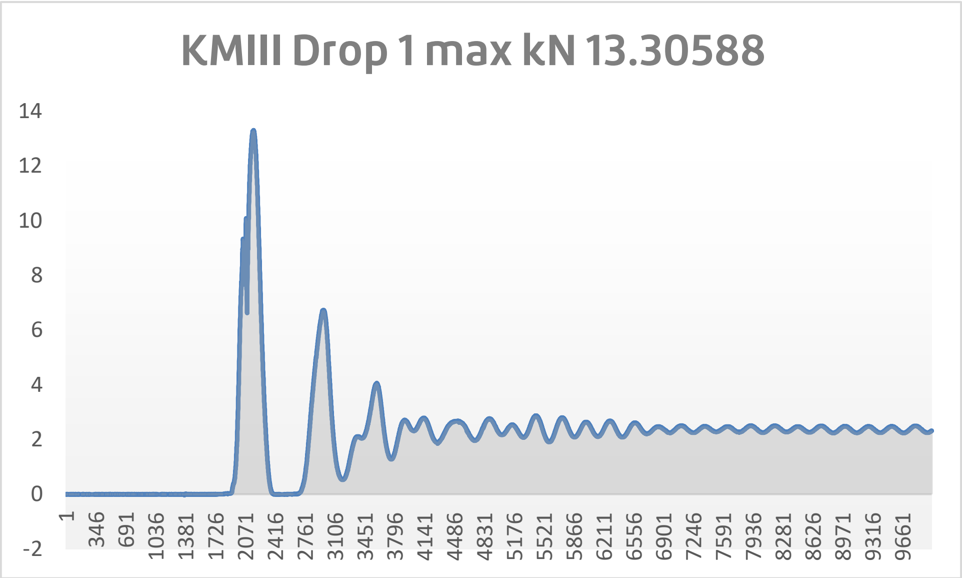
Set Up

- 200kg Mass.
- Two rope system.
- Interlocking bowline knot at the main connection point to the load.
- DMM Gyro Pulleys on steel D shape carabiners (12mm).
- Prusik on D shaped carabiner set against the back bar of carabiners.
- Steel carabiners connected to DMM rigging plate.
- Rigging plate attached at single (centre) point to load cell.

Test

- 3m of rope measured out from contact point with prusik.
- Prusiks dressed and gripped tight under load.
- Load lifted 1m prior to drop.
- Prusik broken by pulling against PMP to simulate a haul.
- Prusik gently re-set into the 3m position.
- Tested - 3m of rope in play, 1m drop.

Teufelberger KMIII. Drop Tests 1/2/3



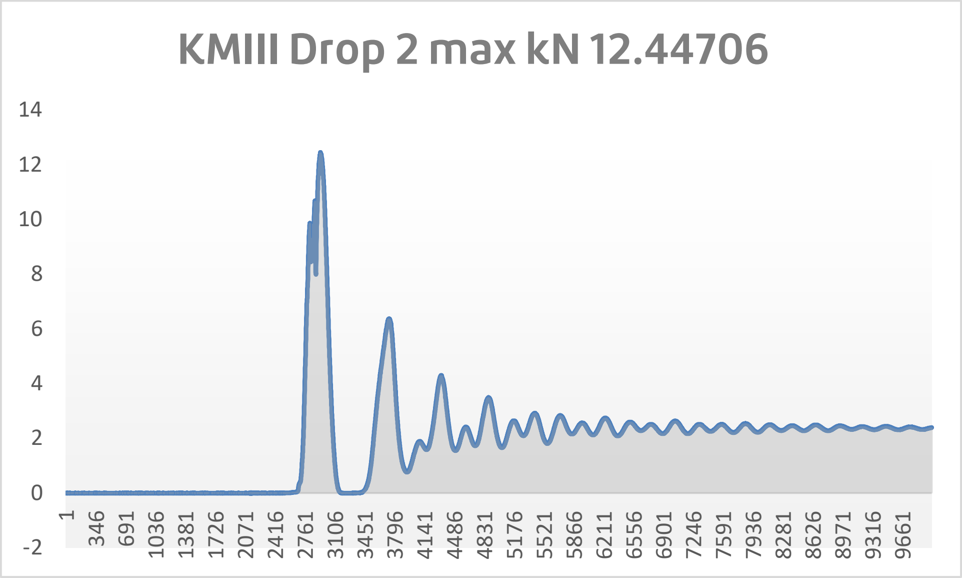
Slip Distance:

Rope 1:

165mm

Rope 2:

140mm



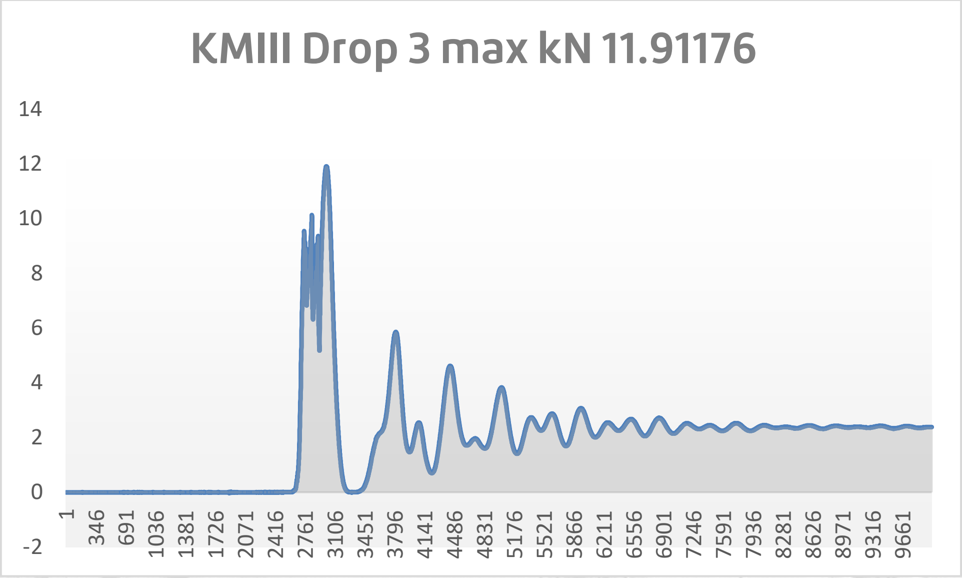
Slip Distance:

Rope 1:

230mm

Rope 2:

110mm



Slip Distance:

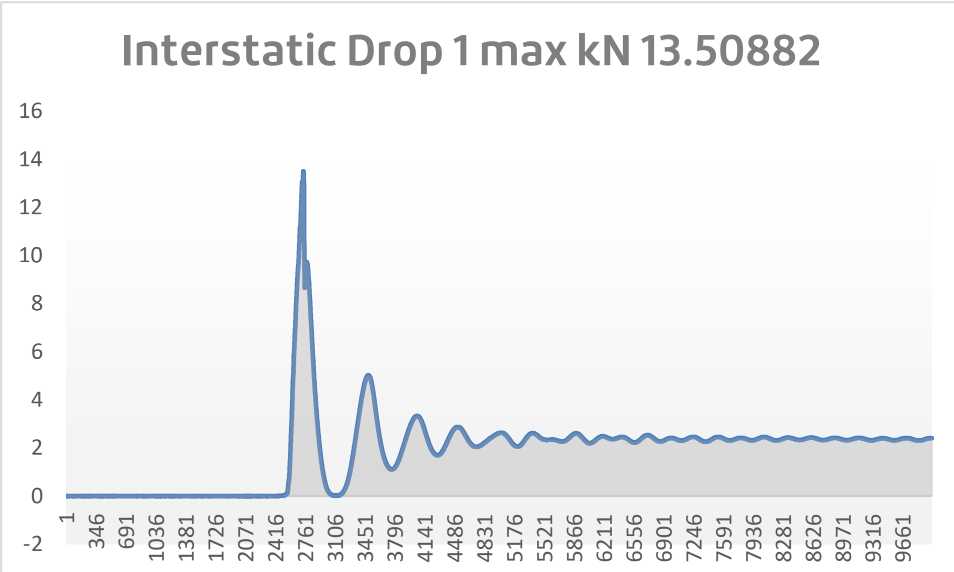
Rope 1:

530mm

Rope 2:

550mm

Edelrid Interstatic. Drop Tests 1/2/3



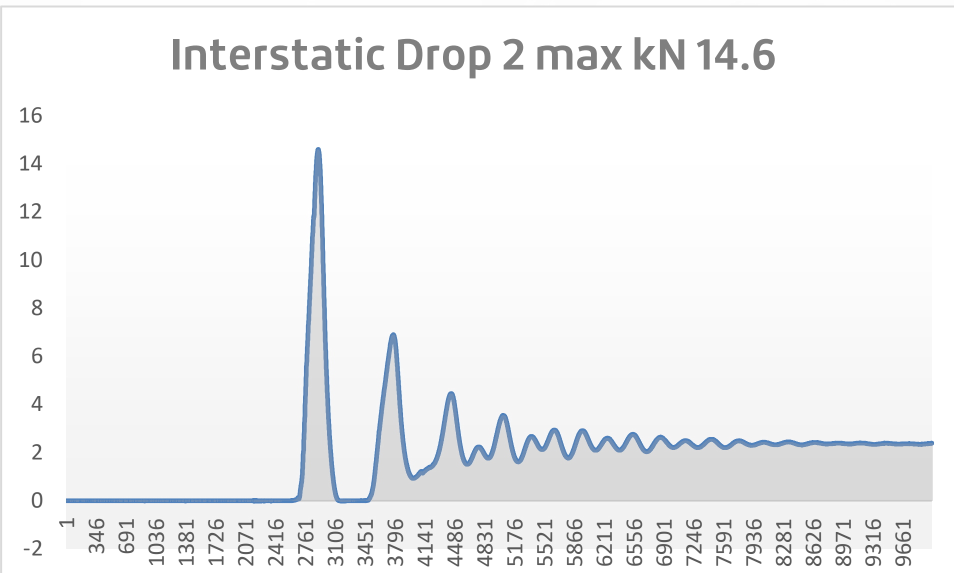
Slip Distance:

Rope 1:

20mm

Rope 2:

80mm



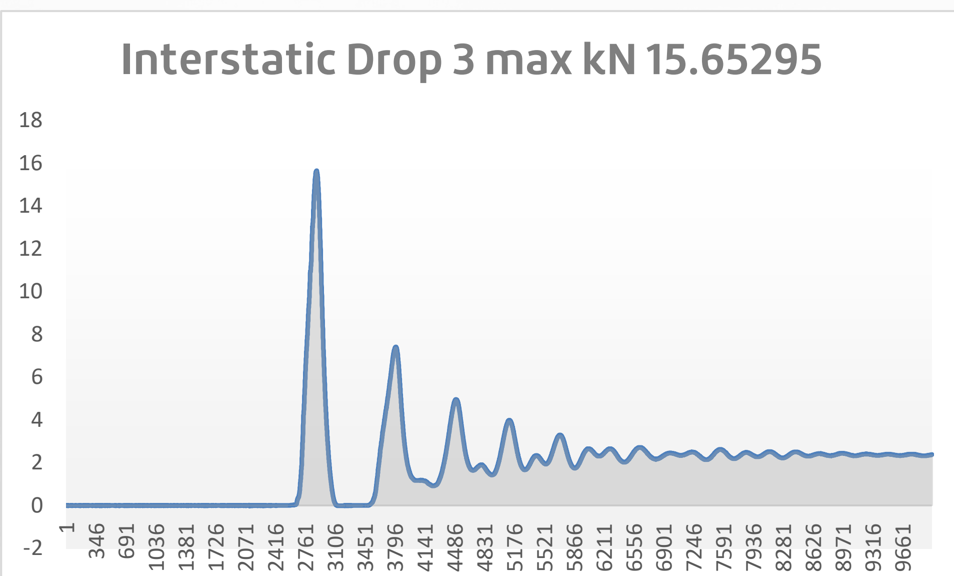
Slip Distance:

Rope 1:

45mm

Rope 2:

40mm



Slip Distance:

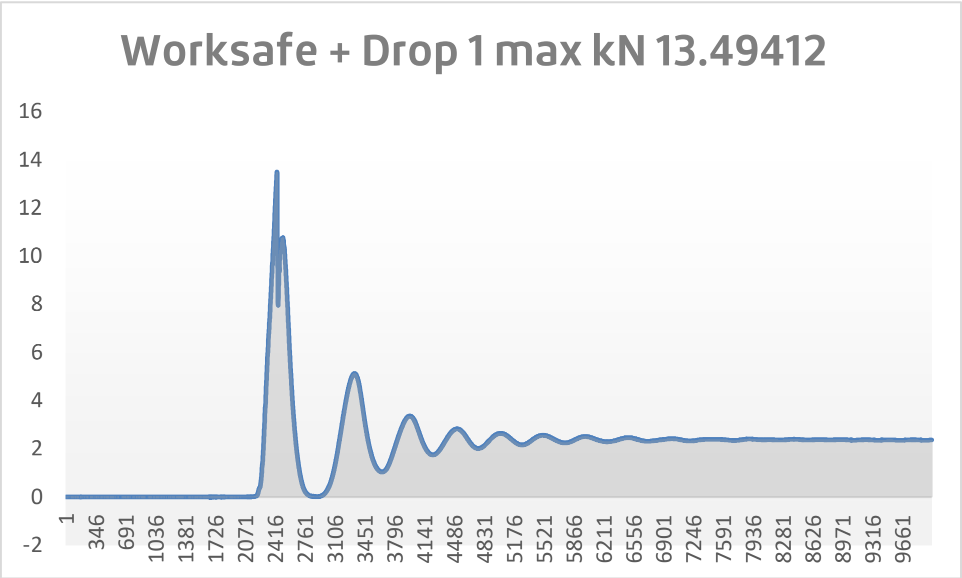
Rope 1:

35mm

Rope 2:

40mm

DMM Worksafe Plus. Drop Tests 1/2/3



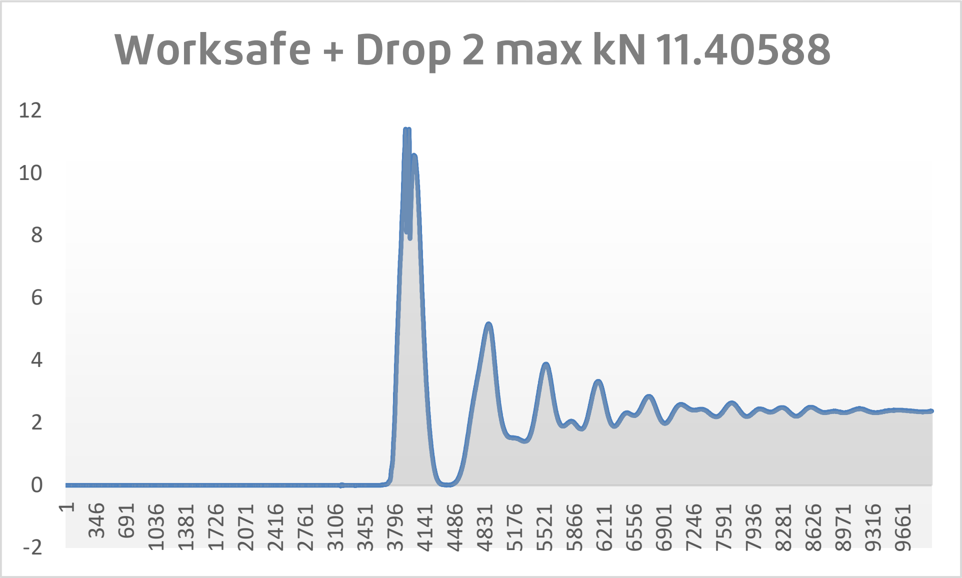
Slip Distance:

Rope 1:

35mm

Rope 2:

210mm



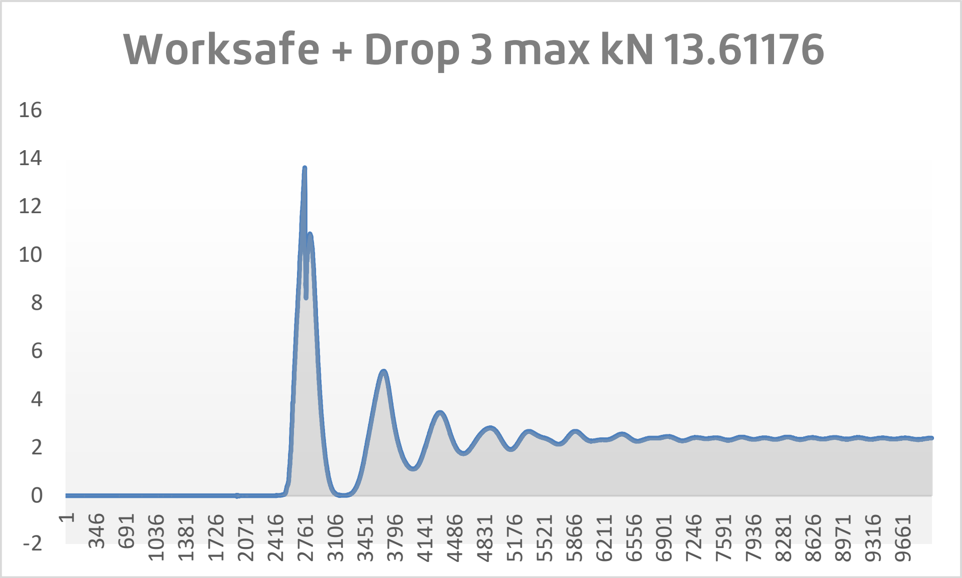
Slip Distance:

Rope 1:

165mm

Rope 2:

130mm



Slip Distance:

Rope 1:

60mm

Rope 2:

200mm

Phase 2: Collated Results

Teufelberger KMIII. Drop Tests 1/2/3

Drop Test 1: 13.30588kN

Slip distance 1. 165mm

Slip distance 2. 140mm

Drop Test 2: 12.44706kN

Slip distance 1. 230mm

Slip distance 2. 110mm

Drop Test 3: 11.91176kN

Slip distance 1. 530mm

Slip distance 2. 550mm

Edelrid Interstatic. Drop Tests 1/2/3

Drop Test 1: 13.50882kN

Slip distance 1. 20mm

Slip distance 2. 80mm

Drop Test 2: 14.6000kN

Slip distance 1. 45mm

Slip distance 2. 40mm

Drop Test 3: 15.64295kN

Slip distance 1. 35mm

Slip distance 2.40mm

DMM Worksafe Plus. Drop Tests 1/2/3

Drop Test 1: 13.49412kN

Slip distance 1. 35mm

Slip distance 2. 210mm

Drop Test 2: 11.40588kN

Slip distance 1. 165mm

Slip distance 2. 130mm

Drop Test 3: 13.61176kN

Slip distance 1. 60mm

Slip distance 2. 200mm

Phase 2: Conclusion

The set up of these drop tests simulates the worst case scenario in a DCTTRS hauling system where both ropes are set up using only pulleys and prusik's (i.e. no auto-locking/force limiting device such as an MPD or Clutch).

The drop tests conducted in phase 2 split the loads between two rope systems but concentrated the forces into one load cell, although the twin ropes in each system slipped at slightly different rates they were mostly similar so we could assume that in the majority of the drop tests the loads would be fairly equally dispersed between the two rope systems/focal points.

When divided between the two ropes in each system the highest approximate peak force experienced by a single line/prusik during the tests was 7.8kN.

All of the rope/prusik combinations tested were either badly glazed or strongly bound together making the rope system innoperable following the drop event. The tests show that the prusiks arrest the fall within the parameters of the BCCTR however in a raise are not subsequently releasable.

All of the ropes tested arrested the 200kg mass within 1m (550mm max witnessed).

Further testing using double load cells could identify more accurately the distribution of forces between each individual rope system.

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