Drop Testing of Rope Access Backup Devices

By Shaun Reed and Dr. David Tordonato

Special thanks to PMI, CAMP, Rhino Staging, and Andrew Blackstock!
Tested Devices

- CAMP Goblin
- Heightec-PMI Vector
- Safe Tec Duck-R
- Petzl Rescucender
- Petzl Shunt
- Petzl ASAP with Absorbica
- Kong Backup
- ISC Red
Test Setup 1
50kg Test Weight w/ 100kg Weighted Line

Load Cell
Backup Device
Lowering Device

RECLAMATION
Rappel Simulation
Test 2 – Goblin w/ Goblin Lanyard
50kg Test Weight w/ 100kg Weighted Line

Goblin Lanyard:
40 cm (~23 in. ‘biner to ‘biner)
FF (Fall Factor) 2

Peak Force: 1,303 lb
Tests 5 and 6 – Goblin w/ PMI CT
50kg Test Weight w/ 100kg Weighted Line

WARNING: Test is not to manufacturer’s recommendations

PMI CowsTail:
25 in. (31.5 in. ‘biner to ‘biner)

Note differences in test due to differences in rappel simulation

Test 5: FF2 – 1,081 lb

Test 6: FF2 – 1,263 lb
Tests 8 and 9 – Vector w/ PMI CT
50kg Test Weight w/ 100kg Weighted Line

PMI CowsTail: 25 in. (31.5 in. ‘biner to ‘biner)

Note: Fall arrest in Test 8 may have been assisted by 100kg Weight. Vector appears to be “held” by test weight.

Test 8: FF2 – 1,186 lb
Test 38: FF2 – 1,254 lb
Tests 11 and 12 – Duck w/ PMI CT
50kg Test Weight w/ 100kg Weighted Line

Test 11: FF1 – 844 lb

Test 12: FF0 – 832 lb

Note: Difference in Fall Factors

PMI CowsTail: 25 in. (31.5 in. ‘biner to ‘biner)

2 of 3 tests on Duck FAILED
Tests 15 and 16 – Rescucender w/ PMI CT
50kg Test Weight w/ 100kg Weighted Line

PMI CowsTail:
25 in. (31.5 in. ‘biner to ‘biner)

Note: Difference in Fall Factors

Test 15: FF0 - 633
Test 16: FF2 – 992 lb
Tests 22 and 24 – Kong Backup
50kg Test Weight w/ 100kg Weighted Line

Test 22: Yates Short Lanyard
13 in. (‘biner to ‘biner) – 841 lb

Test 24: Yates Long Lanyard
18 in. (‘b to ‘b) – 1,011 lb

Note: Difference in lanyards
Tests 25 and 26 – Red w/ PMI CT
50kg Test Weight w/ 100kg Weighted Line

Test 25: FF0 – 1,178

PMI CowsTail:
25 in. (31.5 in. ‘biner to ‘biner)

Note: Repeated Tests

Test 26:
FF0 – 887 lb
Tests 27 and 28 – Shunt w/ PMI CT
50kg Test Weight w/ 100kg Weighted Line

WARNING: Test is not to manufacturer’s recommendations

Test 27: FF0 – 826 lb

Test 28: FF0 – 761 lb

Note: Repeated Tests

PMI CowsTail:
25 in. (31.5 in. ‘biner to ‘biner)
<table>
<thead>
<tr>
<th>Backup Device</th>
<th>Lanyard</th>
<th>~ FF</th>
<th>No. of Tests</th>
<th>Ave. Pk. Load (lb)</th>
<th>Ave. Slip (in.)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASAP</td>
<td>Absorbica</td>
<td>2</td>
<td>1</td>
<td>820</td>
<td>0</td>
<td>Few stitches blew</td>
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<tr>
<td>Duck</td>
<td>Cows Tail</td>
<td>1</td>
<td>1</td>
<td>840</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Duck</td>
<td>Cows Tail</td>
<td>0</td>
<td>3</td>
<td>790/NA</td>
<td>16/∞</td>
<td>2 of 3 FAIL</td>
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<tr>
<td>Goblin</td>
<td>Gob. Lan.</td>
<td>2</td>
<td>2</td>
<td>1300</td>
<td>30.5</td>
<td></td>
</tr>
<tr>
<td>Goblin</td>
<td>Cows Tail</td>
<td>2</td>
<td>5</td>
<td>1,060</td>
<td>6.5</td>
<td></td>
</tr>
<tr>
<td>Goblin</td>
<td>Cows Tail</td>
<td>0</td>
<td>2</td>
<td>690</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Kong</td>
<td>Yates Short</td>
<td>2</td>
<td>1</td>
<td>NA</td>
<td>∞</td>
<td>FAIL</td>
</tr>
<tr>
<td>Kong</td>
<td>Yates Long</td>
<td>2</td>
<td>2</td>
<td>NA</td>
<td>∞</td>
<td>FAIL</td>
</tr>
<tr>
<td>Red</td>
<td>Cows Tail</td>
<td>0</td>
<td>2</td>
<td>NA</td>
<td>∞</td>
<td>FAIL</td>
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<tr>
<td>Rescucender</td>
<td>Cows Tail</td>
<td>0</td>
<td>4</td>
<td>860</td>
<td>1</td>
<td></td>
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<tr>
<td>Rescucender</td>
<td>Cows Tail</td>
<td>2</td>
<td>1</td>
<td>992</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Shunt</td>
<td>Cows Tail</td>
<td>0</td>
<td>3</td>
<td>790</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Shunt</td>
<td>Cows Tail</td>
<td>1</td>
<td>2</td>
<td>890</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Vector</td>
<td>Cows Tail</td>
<td>2</td>
<td>3</td>
<td>1250</td>
<td>45</td>
<td></td>
</tr>
<tr>
<td>Vector</td>
<td>Cows Tail</td>
<td>0</td>
<td>1</td>
<td>700</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>
Test Setup 2 – Two Person Load
200kg Test Weight w/ 50kg Weighted Line

- Load Cell
- Backup Device
- Lowering Device

Diagram:
- 100kg
- 100kg
- 50kg
- 24"

RECLAMATION
Test 33 – Goblin w/ PMI CT
200kg Test Weight w/ 50kg Weighted Line

WARNING: Test is not to manufacturer’s recommendations

Fall Factor: 1
Slippage: 35 in.
Peak Force: 1,316 lb
Tests 34 and 43 – ASAP/Absorbica
200kg Test Weight w/ 50kg Weighted Line

Test 34
Fall Factor: 1
Slippage: 6.5 in.
Deployment: 5.5 in.
Pk. Force: 1,423 lb

Test 43
Fall Factor: 2
Slippage: 15 in.  
(includes trailing)
Deployment: 22.5 in.
Pk. Force: 1,481 lb

Test 24 (not shown)
Pk. Force: 1,445 lb
Ave. Pk. F.: 1,450 lb

Test 34: FF1
Test 43: FF2
Test 35 – Vector w/ PMI CT
200kg Test Weight w/ 50kg Weighted Line

WARNING: Test is not to manufacturer’s recommendations

Fall Factor: 2
Pk. Force: 2,107 lb
## Test Setup No. 2

<table>
<thead>
<tr>
<th>Backup Device</th>
<th>Lanyard</th>
<th>~ FF</th>
<th>No. of Tests</th>
<th>Ave. Pk. Load (lb)</th>
<th>Ave. Slip (in.)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASAP</td>
<td>Absorbica</td>
<td>1</td>
<td>3</td>
<td>1,450</td>
<td>8</td>
<td>Ave. Deploy: 14 in.</td>
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<tr>
<td>Goblin</td>
<td>Cows Tail</td>
<td>1</td>
<td>1</td>
<td>1,320</td>
<td>11</td>
<td>Sheath glazed</td>
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<tr>
<td>Vector</td>
<td>Cows Tail</td>
<td>2</td>
<td>1</td>
<td>2,110</td>
<td>89</td>
<td>Sheath severed, core intact</td>
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</tbody>
</table>
Test Setup 3

- Load Cell
- Backup Device
- 13.5 lb Buckle

Lowering Device

24"
Breakaway Buckle

Measured buckle strength: 13.5 lb
Pinch Grip Strength: 20 lb (4mm cord – no knot)
Test Setup 3 - w/ Tied Lanyard

Test A: Duck

Test B: Kong (Tow Mode)

Test C: Red
THE END
Appendix
<table>
<thead>
<tr>
<th>Test Scenario</th>
<th>Test Weight (kg)</th>
<th>Rope Weight (kg)</th>
<th>Backup Device</th>
<th><strong>Rope</strong></th>
<th>Lanyard</th>
<th>Fall Factor (approx.)</th>
<th>Peak Load (lb)</th>
<th>Backup Device Slip (inches)</th>
<th>Comments</th>
<th>Rope damage</th>
</tr>
</thead>
<tbody>
<tr>
<td>21</td>
<td>50</td>
<td>100</td>
<td>ASAP #1</td>
<td>#6</td>
<td>Absorbica</td>
<td>2</td>
<td>816</td>
<td>-14</td>
<td>Rope length 65&quot;, Shockpack blew a couple stitches which was not completely obvious at first</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>50</td>
<td>100</td>
<td>Kong #2</td>
<td>#7</td>
<td>13&quot; lanyard with Kong biner</td>
<td>2</td>
<td>841</td>
<td>Failure, Device bounced a few times and rode down to bag Slid halfway down initially due to crossed biner, but as we lowered everything with crane, kong and 50 kg bag fell to the ground</td>
<td>Minor sheath abrasion</td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>50</td>
<td>100</td>
<td>Kong #2</td>
<td>#7</td>
<td>18&quot; lanyard</td>
<td>2</td>
<td>508</td>
<td>Biner was cross loaded</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>50</td>
<td>100</td>
<td>Goblin #4</td>
<td>#5</td>
<td>31.5&quot; lanyard*</td>
<td>0</td>
<td>710</td>
<td>Maybe had 6&quot; of slack in safety</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>50</td>
<td>100</td>
<td>Goblin #4</td>
<td>#5</td>
<td>31.5&quot; lanyard*</td>
<td>0</td>
<td>675</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>50</td>
<td>100</td>
<td>Goblin #5</td>
<td>#6</td>
<td>31.5&quot; lanyard</td>
<td>2</td>
<td>984</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>50</td>
<td>100</td>
<td>Goblin #3</td>
<td>#4</td>
<td>31.5&quot; lanyard</td>
<td>2</td>
<td>974</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>50</td>
<td>100</td>
<td>Duck #2</td>
<td>#5</td>
<td>31.5&quot; lanyard*</td>
<td>0</td>
<td>844</td>
<td>Failure, Device rode down to bag</td>
<td>63&quot; knot to orange tape</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>50</td>
<td>100</td>
<td>Duck #3</td>
<td>#5</td>
<td>31.5&quot; lanyard*</td>
<td>0</td>
<td>791</td>
<td>Bounced and slipped 16&quot; before catching</td>
<td>63&quot; knot to orange tape</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>50</td>
<td>100</td>
<td>Duck #3</td>
<td>#5</td>
<td>31.5&quot; lanyard*</td>
<td>0</td>
<td>844</td>
<td>Failure, Device rode down to bag</td>
<td>No visible damage to duck</td>
<td>Slight wear on rope</td>
</tr>
<tr>
<td>2</td>
<td>50</td>
<td>100</td>
<td>Goblin #1</td>
<td>#1</td>
<td>23&quot; lanyard</td>
<td>2</td>
<td>1303</td>
<td>Goblin tested in self trailing mode, not holding safety line off the bag</td>
<td>Very minor sheath abrasion visible, core feels compressed but not damaged.</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>50</td>
<td>100</td>
<td>Goblin #1</td>
<td>#1</td>
<td>23&quot; lanyard*</td>
<td>2</td>
<td>1291</td>
<td>Goblin tested in self trailing mode, not holding safety line off the bag</td>
<td>Very minor sheath abrasion visible, core feels compressed but not damaged.</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>50</td>
<td>100</td>
<td>Goblin #1</td>
<td>#1</td>
<td>31.5&quot; lanyard</td>
<td>2</td>
<td>1081</td>
<td>Goblin tested in self trailing mode, not holding safety line off the bag</td>
<td>Very minor sheath abrasion visible, core feels compressed but not damaged.</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>50</td>
<td>100</td>
<td>Goblin #1</td>
<td>#1</td>
<td>31.5&quot; lanyard*</td>
<td>2</td>
<td>1263</td>
<td>Goblin tested in self trailing mode, 88&quot; measured from knot to orange tape</td>
<td>Very minor sheath abrasion visible, core feels compressed but not damaged.</td>
<td></td>
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<tr>
<td>7</td>
<td>50</td>
<td>100</td>
<td>Goblin #2</td>
<td>#2</td>
<td>31.5&quot; lanyard</td>
<td>2</td>
<td>1001</td>
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<td></td>
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</tr>
<tr>
<td>15</td>
<td>50</td>
<td>100</td>
<td>Goblin #2</td>
<td>#2</td>
<td>31.5&quot; lanyard</td>
<td>2</td>
<td>984</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>50</td>
<td>100</td>
<td>Goblin #2</td>
<td>#2</td>
<td>31.5&quot; lanyard</td>
<td>2</td>
<td>974</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>50</td>
<td>100</td>
<td>Duck #2</td>
<td>#5</td>
<td>31.5&quot; lanyard*</td>
<td>0</td>
<td>832</td>
<td>Failure, Device rode down to bag</td>
<td>63&quot; knot to orange tape</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>50</td>
<td>100</td>
<td>Goblin #4</td>
<td>#5</td>
<td>31.5&quot; lanyard*</td>
<td>0</td>
<td>675</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>50</td>
<td>100</td>
<td>ASAP #1</td>
<td>#6</td>
<td>Absorbica</td>
<td>2</td>
<td>816</td>
<td>-14</td>
<td>Rope length 65&quot;, Shockpack blew a couple stitches which was not completely obvious at first</td>
<td></td>
</tr>
</tbody>
</table>
Note: Backup Device Slip is measured from 24-inches below backup device start position to incorporate 24-inch rappel simulation. Negative slip is taken as zero.