DROP TESTING ON PURCELL PRUSIKS:

A CRITICAL EVALUATION OF THEIR CAPABILITIES AS A POSITIONING LANYARD IN RESCUE AND CLIMBING

Presented by:

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Lanyards Part II:
An Examination of Purcell Prusiks
as Personal Restraint Lanyards

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Introduction:

In two independent drop test series conducted in 2002 and 2005, we examined the effects of a shock load on to various commercially made and user-configured personal restraint lanyards. Our primary focus in those two drop test series was to test daisy chains and other similar lanyards. We presented our findings at the 2005 ITRS held in Ft. Collins, Colorado.

Several of the lanyards examined in 2002 and 2005 demonstrated serious shortcomings in a shock loading scenario due to either (1) excessive maximum arrest force (MAF) and/or (2) the lanyard failed or its condition was severely compromised.

One of the lanyard configurations tested in 2002 and 2005 that showed some promise was the Purcell Prusik. Our intent in the 2006 drop test series was to conduct a number of drop tests on Purcell Prusiks in order to gain a better understanding of their capabilities and limitations as a personal restraint lanyard in a shock loading scenario. Our hope was to identify a suitable alternative choice to traditional lightweight personal restraint lanyards such as the daisy chain, for example.

Background Information:

Purcell Prusiks are a user-configured tie – commonly made out of either 6mm or 7mm cord. Purcells are used for a variety of ropework applications including ascending a fixed rope, use as a release hitch as well as a primary attachment lanyard for securing oneself to an anchor.

The tie itself is configured such that it includes a prusik hitch around two strands of cord creating an adjustable loop. The loop can be expanded or contracted through movement of the prusik hitch. The tie also includes a separate end loop for attachment purposes.

Suggested Performance Guidelines:

There are a number of criteria to choose from in selecting a personal lanyard such as weight, cost, adjustability and other qualities. At the conclusion of our 2005 study, we recommended that a lanyard should ideally be able to meet the following performance guidelines:

(1) Acceptable MAF at a fall factor of 1 – less than or equal to 8 kN.

(2) Lanyard integrity OK at a fall factor of 1

Our testing was geared towards examining the Purcell Prusik against those performance guidelines.

Test Method:

Rather than attempt to duplicate the test method of any particular standard or regulatory agency, we chose instead to test the various lanyards in a manner that:

(1) was representative of what could take place in the field of use.

(2) would provide some indications as to the capabilities and/or limitations.

The purpose of this study was twofold:

(1) to examine the magnitude of peak forces on Purcell Prusiks in a dynamic event at various fall factors.

(2) to examine the integrity of the connection on Purcell Prusiks in a dynamic event at various fall factors.

All of the drop tests conducted included a free fall of the test mass. This was done in order to simulate a climber or rescuer falling from a stance in which they had some slack in their primary lanyard attachment. Scenarios could include standing up to adjust some rigging while at a belay station, lanyard climbing a ladder on a tower rescue or a litter attendant scrambling up on to the side of the litter to adjust some rigging during a vertical lower/raise operation.

The parameters we examined were:

(1) lanyard make, model & construction
(2) lanyard material & size
(3) mass
(4) fall factor

All of the drop tests were conducted using a rigid test mass and a rigid anchor beam. The lanyards tested were new and unused.

All of the Purcell Prusiks were tied using 350cm (per Purcell) of 6mm cord from two different manufacturers – Sterling and PMI. The Purcells were all tied with a 3-wrap prusik hitch. The knots were all set by the same person using body weight to cinch them tight.

The drops were conducted with a 100 kg mass (≈ 224 lbs.). The 100 kg mass was selected to represent a rescuer. This amount is on par with that used in testing by the British Columbia Council of Technical Rescue to represent a ‘mountain rescuer’.

The log sheets (included in this proceedings paper-12 pages in total) from the drop test series outline the individual parameters and data points for each of the respective drop tests.

Null Hypothesis:

A Purcell Prusik is incapable of being an appropriate positioning lanyard for rescue and climbing due to:

(1) unacceptable peak force values in a shock loading scenario (dynamic event) at a fall factor of 1

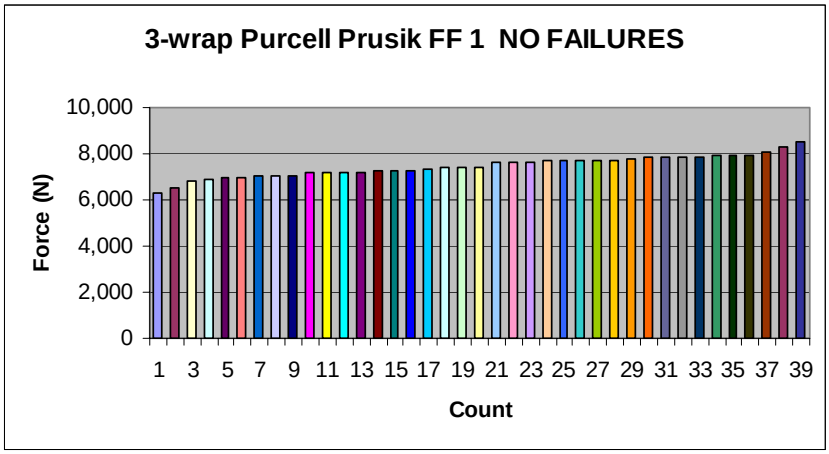
and/or

(2) inability to maintain its integrity (e.g. it breaks) in a shock loading scenario (dynamic event) at a fall factor of 1

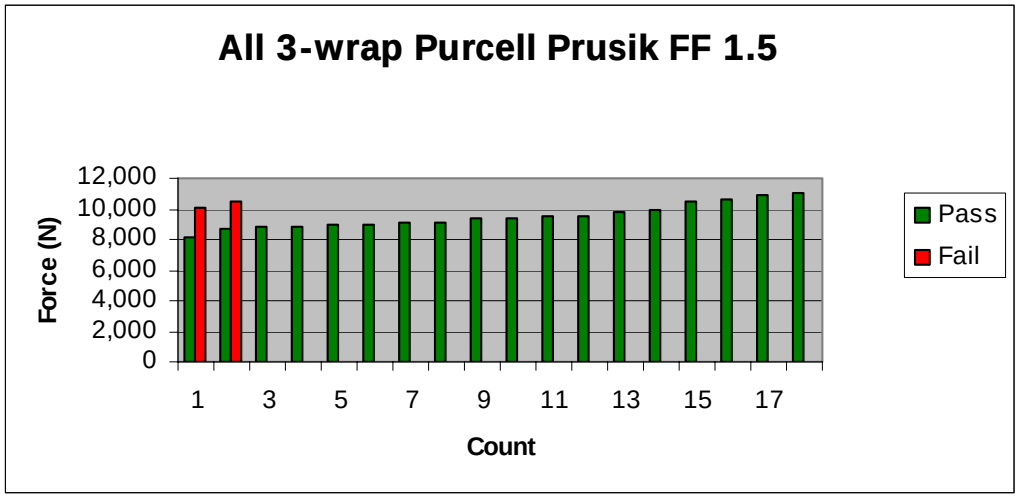
Data Summary:

The following are a number of charts and summary spreadsheets that are a compilation of the data from the 12 log sheets for the drop test series.

All of the force values in the right hand columns of the spreadsheets are expressed in Newtons. For example, the mean value of 7459.1 Newtons for the 39 drop tests at fall factor 1 is approximately equivalent to 7.46 kN or around 1676 lbs. force.



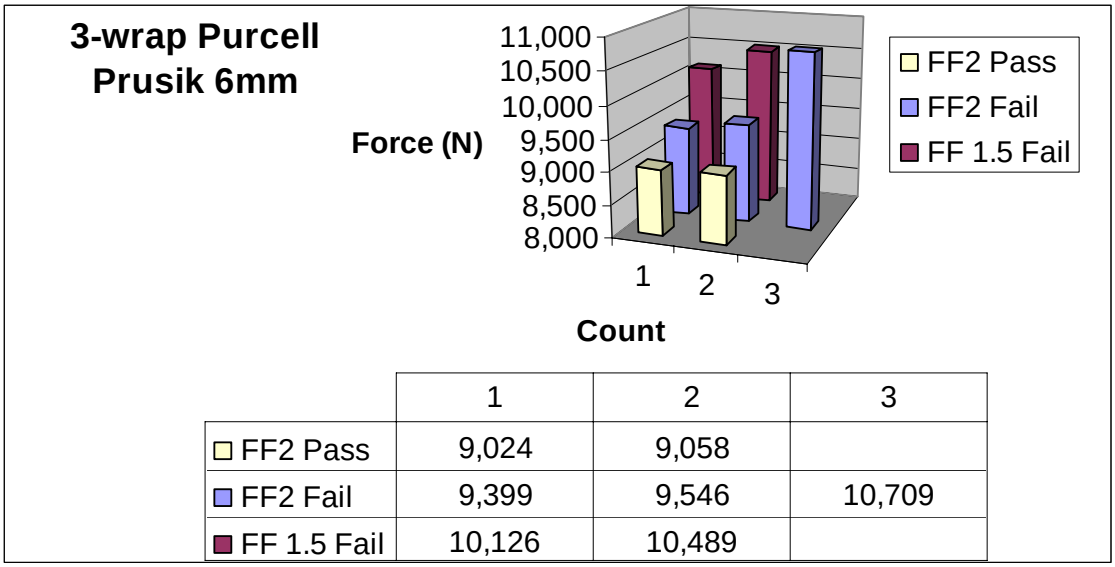
3-wrap Purcell Prusik FF1 {force in Newtons}	
Mean	7459.1
Standard Error	74.7
Median	7428.0
Standard Deviation	466.6
Minimum	6321.0
Maximum	8488.0
Count	39.0
Largest(1)	8488.0
Smallest(1)	6321.0
Confidence Level(95.0%)	151.2



3-wrap Purcell Prusik FF 1.5 PASS *{force in Newtons}*	
Mean	9505.5
Standard Error	188.4
Median	9376.0
Standard Deviation	799.2
Minimum	8196.0
Maximum	11100.0
Count	18.0
Largest(1)	11100.0
Smallest(1)	8196.0
Confidence Level(95.0%)	397.5

3-wrap Purcell Prusik FF 1.5 FAIL *{force in Newtons}*	
Mean	10307.5
Standard Error	181.5
Median	10307.5
Standard Deviation	256.7
Minimum	10126.0
Maximum	10489.0
Count	2.0
Largest(1)	10489.0
Smallest(1)	10126.0
Confidence Level(95.0%)	2306.2

All totaled there were 64 drop tests conducted on Purcell Prusiks – 39 at fall factor 1; 20 at fall factor 1.5; and 5 at fall factor 2. All of the lanyard failures occurred at either fall factor 2 or fall factor 1.5. The smallest recorded MAF that produced a lanyard failure was 9399 N at fall factor 2.



	1	2	3
FF2 Pass	9,024	9,058	
FF2 Fail	9,399	9,546	10,709
FF 1.5 Fail	10,126	10,489	

Recommendations:

No different than our conclusion generated from our previous drop test study completed in 2005: at a minimum, a primary attachment lanyard should be able to withstand a fall factor of 1.0 with acceptable levels of peak force and stopping distance, while maintaining its functionality.

The testing conducted on Purcell Prusiks was by no means a comprehensive examination. However, the testing conducted certainly suggests that a Purcell Prusik constructed out of 6mm cord with a 3-wrap prusik hitch meets the recommended lanyard performance guidelines of being able to withstand a fall factor 1 event with acceptable levels of MAF and no observable degradation of the lanyard. The testing also demonstrates that the margin over and above that minimum performance criteria is *approaching* the 50% level at fall factor 1.5.

The Purcell Prusik used as a lanyard can certainly be considered a worthwhile alternative to the traditional daisy chains and other personal restraint lanyards available in the marketplace.

The introduction of high performance fibers into climbing and rope rescue equipment has some worthwhile applications. However, the use of HMPE like Spectra ® or Dyneema ® in the construction of daisy chains or similar lanyards is simply a poor application of the materials.

The very low elongation at break and the low melting point are likely the key contributing factors to:

(1) the high peak force values observed in our testing of lanyards constructed out of these materials.

(2) the breaking of these same lanyard types on certain drops.

When selecting a lanyard either to purchase or to construct:

(1) avoid the use of low-elongation high performance fibers.

(2) choose one that limits MAF to a reasonable level - at least at fall factor 1. (not to exceed 8 kN)

(3) select one that retains functionality even after a severe drop.

When using a lanyard as the only means of attachment to an anchor:

(1) keep unnecessary slack out of the lanyard, thereby keeping the potential fall factor low.

Lanyard Testing
Drop Test Log Sheet
Date: 7-20-06

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Test #	Lanyard Type: model, make, color	Lanyard Type: size, material & construction	Initial Unit Length (cm)	Mass (kg)	Drop Height (cm)	Fall Factor	Slide Distance (cm)	Final Unit Length (cm)	Maximum Arrest Force (N)
1	3-wrap Purcell Prusik; PMI; purple/yellow	6mm Cord; Nylon; tied	70	100	140	2	28.5	101	9024
Comments: Light chafing on the two standing parts of cord between figure 8 knot and prusik. Light fusing on the girth hitch where it is attached to the shackle of the test mass.									
2	3-wrap Purcell Prusik; PMI; purple/yellow	6mm Cord; Nylon; tied	70	100	140	2	31	102.5	9058
Comments: Light chafing on the two standing parts of cord between figure 8 knot and prusik.									
3	3-wrap Purcell Prusik; PMI; purple/yellow	6mm Cord; Nylon; tied	68.5	100	137	2	17	102	10709
Comments: Failure on one standing part @ entrance point of figure 8 knot on the shackle side.									
4	3-wrap Purcell Prusik; PMI; purple/yellow	6mm Cord; Nylon; tied	70	100	140	2	38.5	111.5	9399
Comments: Failure on one standing part @ entrance point of figure 8 knot on the prusik side.									
5	3-wrap Purcell Prusik; PMI; purple/yellow	6mm Cord; Nylon; tied	69	100	138	2	17	110.5	9546
Comments: Failure on one standing part @ entrance point of figure 8 knot on the shackle side.									
6	3-wrap Purcell Prusik; PMI; purple/yellow	6mm Cord; Nylon; tied	68.5	100	68.5	1	10	89	7913
Comments: Very light chafing on the two standing parts of cord between figure 8 knot and prusik.									
7	3-wrap Purcell Prusik; PMI; purple/yellow	6mm Cord; Nylon; tied	67.5	100	67.5	1	10.5	90.5	7939
Comments: Very light chafing on the two standing parts of cord between figure 8 knot and prusik.									

Test #	Lanyard Type: model, make, color	Lanyard Type: size, material & construction	Initial Unit Length (cm)	Mass (kg)	Drop Height (cm)	Fall Factor	Slide Distance (cm)	Final Unit Length (cm)	Maximum Arrest Force (N)
8	3-wrap Purcell Prusik; PMI; purple/yellow	6mm Cord; Nylon; tied	70	100	70	1	12	92	7422
Comments: Very light chafing on the two standing parts of cord between figure 8 knot and prusik.									
9	3-wrap Purcell Prusik; PMI; purple/yellow	6mm Cord; Nylon; tied	69.5	100	69.5	1	12.5	91.5	6524
Comments: Light chafing on the two standing parts of cord between figure 8 knot and prusik.									
10	3-wrap Purcell Prusik; PMI; purple/yellow	6mm Cord; Nylon; tied	68.5	100	68.5	1	6.5	88	7869
Comments: Very light chafing on the two standing parts of cord between figure 8 knot and prusik. Light chafing at the girth hitch location where the lanyard attaches to the test shackle.									
11	3-wrap Purcell Prusik; PMI; purple/yellow	6mm Cord; Nylon; tied							
Comments: Bad test. Test mass fall was arrested such that the girth hitch on the shackle slipped to the side of the shackle causing uneven loading.									
12	3-wrap Purcell Prusik; PMI; purple/yellow	6mm Cord; Nylon; tied	69	100	69	1	13.5	91.5	7161
Comments: Light chafing on the two standing parts of cord between figure 8 knot and prusik.									
13	3-wrap Purcell Prusik; PMI; purple/yellow	6mm Cord; Nylon; tied							
Comments: Bad test. Test mass fall was arrested such that the girth hitch on the shackle slipped to the side of the shackle causing uneven loading. Same as Drop #11.									
14	3-wrap Purcell Prusik; PMI; purple/yellow	6mm Cord; Nylon; tied	68	100	68	1	11	90.5	7815
Comments: Light chafing on the two standing parts of cord between figure 8 knot and prusik. Light chafing at the girth hitch location where the lanyard attaches to the test shackle.									

Test #	Lanyard Type: model, make, color	Lanyard Type: size, material & construction	Initial Unit Length (cm)	Mass (kg)	Drop Height (cm)	Fall Factor	Slide Distance (cm)	Final Unit Length (cm)	Maximum Arrest Force (N)
15	3-wrap Purcell Prusik; PMI; purple/yellow	6mm Cord; Nylon; tied	68	100	68	1	13	90.5	7277
Comments: Very light chafing on the two standing parts of cord between figure 8 knot and prusik.									
16	3-wrap Purcell Prusik; PMI; purple/yellow	6mm Cord; Nylon; tied	70	100	70	1	11.5	92	7671
Comments: Very light chafing on the two standing parts of cord between figure 8 knot and prusik. Light chafing at the girth hitch location where the lanyard attaches to the test shackle.									
17	3-wrap Purcell Prusik; PMI; purple/yellow	6mm Cord; Nylon; tied	66.5	100	66.5	1	12	88	7428
Comments: Very light chafing on the two standing parts of cord between figure 8 knot and prusik.									
18	3-wrap Purcell Prusik; Sterling; yellow/black	6mm Cord; Nylon; tied	68	100	68	1	12	89.5	7737
Comments: Light chafing on the two standing parts of cord between figure 8 knot and prusik.									
19	3-wrap Purcell Prusik; Sterling; yellow/black	6mm Cord; Nylon; tied	72	100	72	1	23	98	8488
Comments: Moderate to heavy chafing on the two standing parts of cord between figure 8 knot and prusik.									
20	3-wrap Purcell Prusik; Sterling; yellow/black	6mm Cord; Nylon; tied	70	100	70	1	20	93.5	7064
Comments: Moderate chafing on the two standing parts of cord between figure 8 knot and prusik.									
21	3-wrap Purcell Prusik; Sterling; yellow/black	6mm Cord; Nylon; tied	71.5	100	71.5	1	25	97.5	6321
Comments: Moderate chafing on the two standing parts of cord between figure 8 knot and prusik.									

Lanyard Testing
Drop Test Log Sheet
Date: 7-20-06

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Test #	Lanyard Type: model, make, color	Lanyard Type: size, material & construction	Initial Unit Length (cm)	Mass (kg)	Drop Height (cm)	Fall Factor	Slide Distance (cm)	Final Unit Length (cm)	Maximum Arrest Force (N)
22	3-wrap Purcell Prusik; Sterling; yellow/black	6mm Cord; Nylon; tied	71	100	71	1	20.5	94.5	6825
Comments: Moderate chafing on the two standing parts of cord between figure 8 knot and prusik.									
23	3-wrap Purcell Prusik; Sterling; yellow/black	6mm Cord; Nylon; tied	70.5	100	70.5	1	23.5	95	7231
Comments: Light **/** Moderate chafing on the two standing parts of cord between figure 8 knot and prusik.									
24	3-wrap Purcell Prusik; Sterling; yellow/black	6mm Cord; Nylon; tied	70.5	100	70.5	1	19.5	93	7211
Comments: Light **/** Moderate chafing on the two standing parts of cord between figure 8 knot and prusik.									
25	3-wrap Purcell Prusik; Sterling; yellow/black	6mm Cord; Nylon; tied	70	100	70	1	12.5	88.5	8080
Comments: Light chafing on the two standing parts of cord between figure 8 knot and prusik. Light chafing at the girth hitch location where the lanyard attaches to the test shackle.									
26	3-wrap Purcell Prusik; Sterling; yellow/black	6mm Cord; Nylon; tied	70.5	100	70.5	1	23	95.5	7642
Comments: Light **/** Moderate chafing on the two standing parts of cord between figure 8 knot and prusik.									
27	3-wrap Purcell Prusik; Sterling; yellow/black	6mm Cord; Nylon; tied	71.5	100	71.5	1	20.5	94.5	7613
Comments: Light **/** Moderate chafing on the two standing parts of cord between figure 8 knot and prusik.									
28	PAS; Metolius; Black	"Monster Webbing"; Dyneema/Nylon Blend	94	100	94	1	NA	107	20219
Comments: Fusing on the first and second chain links (proximal to the test mass side).									

Test #	Lanyard Type: model, make, color	Lanyard Type: size, material & construction	Initial Unit Length (cm)	Mass (kg)	Drop Height (cm)	Fall Factor	Slide Distance (cm)	Final Unit Length (cm)	Maximum Arrest Force (N)
29	PAS; Metolius; Black	"Monster Webbing"; Dyneema/Nylon Blend	94	100	117.5	1.25	NA	Failure	17068
Comments: Failure of lanyard.									
30	PAS; Metolius; Black	"Monster Webbing"; Dyneema/Nylon Blend	94	100	94	1	NA	106.5	19578
Comments: No visible damage.									
31	PAS; Metolius; Black	"Monster Webbing"; Dyneema/Nylon Blend	94	100	105.75	1.125	NA		
Comments: Bad test. Not a clean release of the test mass. Test mass got twisted during release; likely due to ring on quick release mechanism getting hung up on something during the drop.									
32	Monster Daisy; Metolius; Blue	Dyneema	127	100	63.5	0.5	NA	149.5	11885
Comments: Fall arrested. One blown pocket mid-lanyard. Two other blown pockets near anchor side.									
33	Monster Daisy; Metolius; Gray	Dyneema	127	100	95	0.75	NA	146.5	10625
Comments: Three blown pockets proximal to anchor side.									
34	Monster Daisy; Metolius; Blue	Dyneema	127	100	127	1	NA	164	12100
Comments: Multiple blown pockets. Only one pocket failure away from catastrophic failure of the lanyard.									
35	Monster Daisy; Metolius; Blue	Dyneema	127	100	127	1	NA	166	11698
Comments: Multiple blown pockets. Only one pocket failure away from catastrophic failure of the lanyard. Almost an identical result to Drop Test #34.									

Test #	Lanyard Type: model, make, color	Lanyard Type: size, material & construction	Initial Unit Length (cm)	Mass (kg)	Drop Height (cm)	Fall Factor	Slide Distance (cm)	Final Unit Length (cm)	Maximum Arrest Force (N)
36	Monster Daisy; Metolius; Blue	Dyneema	127	100	127	1	NA	Failure	12148
Comments: Failure of lanyard.									
37	Monster Daisy; Metolius; Gray	Dyneema	127	100	95	0.75	NA		
Comments: Bad test. Test mass fall was arrested such that the girth hitch on the shackle slipped to the side of the shackle causing uneven loading. Similar to Drop Tests # 11,13.									
NOTE: This was the last drop test on 7-20-06. Drop tests #38 and on were conducted on 8-01-06.									
38	3-wrap Purcell Prusik; Sterling; yellow/black	6mm Cord; Nylon; tied	71.5	100	71.5	1	20	94	7776
Comments: Light chafing on the two standing parts of cord between figure 8 knot and prusik.									
39	3-wrap Purcell Prusik; Sterling; yellow/black	6mm Cord; Nylon; tied	69.5	100	69.5	1			
Comments: Bad test. Test mass fall was arrested such that the girth hitch on the shackle slipped to the side of the shackle causing uneven loading. Similar to Drop Tests # 11,13,37.									
40	3-wrap Purcell Prusik; Sterling; yellow/black	6mm Cord; Nylon; tied	69.5	100	69.5	1	21.5	94.5	7851
Comments: Light chafing on the two standing parts of cord between figure 8 knot and prusik.									
41	3-wrap Purcell Prusik; Sterling; yellow/black	6mm Cord; Nylon; tied	69.5	100	69.5	1	26.5	96	7887
Comments: Light chafing on the two standing parts of cord between figure 8 knot and prusik.									
42	3-wrap Purcell Prusik; Sterling; yellow/black	6mm Cord; Nylon; tied	72.5	100	72.5	1	25	96	6998
Comments: Light chafing on the two standing parts of cord between figure 8 knot and prusik.									

Test #	Lanyard Type: model, make, color	Lanyard Type: size, material & construction	Initial Unit Length (cm)	Mass (kg)	Drop Height (cm)	Fall Factor	Slide Distance (cm)	Final Unit Length (cm)	Maximum Arrest Force (N)
43	3-wrap Purcell Prusik; Sterling; yellow/black	6mm Cord; Nylon; tied	70.5	100	70.5	1	18.5	92.5	7679
Comments: Light chafing on the two standing parts of cord between figure 8 knot and prusik.									
44	3-wrap Purcell Prusik; Sterling; yellow/black	6mm Cord; Nylon; tied	71.5	100	71.5	1	16.5	93	6853
Comments: Light chafing on the two standing parts of cord between figure 8 knot and prusik.									
45	3-wrap Purcell Prusik; Sterling; yellow/black	6mm Cord; Nylon; tied	70.5	100	70.5	1	19.5	93.5	7601
Comments: Light chafing on the two standing parts of cord between figure 8 knot and prusik.									
46	3-wrap Purcell Prusik; Sterling; yellow/black	6mm Cord; Nylon; tied	70	100	70	1	17.5	90.5	7065
Comments: Light chafing on the two standing parts of cord between figure 8 knot and prusik.									
47	3-wrap Purcell Prusik; Sterling; yellow/black	6mm Cord; Nylon; tied	70.5	100	70.5	1	20.5	93.5	7208
Comments: Light chafing on the two standing parts of cord between figure 8 knot and prusik.									
48	3-wrap Purcell Prusik; Sterling; yellow/black	6mm Cord; Nylon; tied	70.5	100	70.5	1	19.5	92	7357
Comments: Light chafing on the two standing parts of cord between figure 8 knot and prusik.									
49	3-wrap Purcell Prusik; Sterling; yellow/black	6mm Cord; Nylon; tied	71.5	100	71.5	1	30	99	6939
Comments: Light chafing on the two standing parts of cord between figure 8 knot and prusik.									

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Test #	Lanyard Type: model, make, color	Lanyard Type: size, material & construction	Initial Unit Length (cm)	Mass (kg)	Drop Height (cm)	Fall Factor	Slide Distance (cm)	Final Unit Length (cm)	Maximum Arrest Force (N)
50	3-wrap Purcell Prusik; Sterling; yellow/black	6mm Cord; Nylon; tied	70.5	100	70.5	1	18.5	93.5	7917
Comments: Light chafing on the two standing parts of cord between figure 8 knot and prusik.									
51	3-wrap Purcell Prusik; Sterling; yellow/black	6mm Cord; Nylon; tied	69.5	100	69.5	1	20	93.5	7190
Comments: Light chafing on the two standing parts of cord between figure 8 knot and prusik.									
52	3-wrap Purcell Prusik; Sterling; yellow/black	6mm Cord; Nylon; tied	69	100	69	1	18	91	7680
Comments: Light **/** Moderate chafing on the two standing parts of cord between figure 8 knot and prusik.									
53	3-wrap Purcell Prusik; Sterling; yellow/black	6mm Cord; Nylon; tied	69.5	100	69.5	1	18.5	93	7011
Comments: Light chafing on the two standing parts of cord between figure 8 knot and prusik.									
54	3-wrap Purcell Prusik; Sterling; yellow/black	6mm Cord; Nylon; tied	71	100	71	1	21.5	96	7397
Comments: Light chafing on the two standing parts of cord between figure 8 knot and prusik.									
55	3-wrap Purcell Prusik; Sterling; yellow/black	6mm Cord; Nylon; tied	70	100	70	1	11	89	8325
Comments: Very light chafing on the two standing parts of cord between figure 8 knot and prusik.									
56	3-wrap Purcell Prusik; Sterling; yellow/black	6mm Cord; Nylon; tied	70.5	100	70.5	1	19.5	93	7268
Comments: Light chafing on the two standing parts of cord between figure 8 knot and prusik.									

Test #	Lanyard Type: model, make, color	Lanyard Type: size, material & construction	Initial Unit Length (cm)	Mass (kg)	Drop Height (cm)	Fall Factor	Slide Distance (cm)	Final Unit Length (cm)	Maximum Arrest Force (N)
57	3-wrap Purcell Prusik; Sterling; yellow/black	6mm Cord; Nylon; tied	70.5	100	70.5	1	25.5	96	7672
Comments: Light chafing on the two standing parts of cord between figure 8 knot and prusik.									
58	Daisy Chain (used); Black Diamond; Green	Spectra; 13mm	127	100	127	1	NA	NA	9135
Comments: Failure. Snapped lanyard @ the anchor side.									
59	3-wrap Purcell Prusik; Sterling; yellow/black	6mm Cord; Nylon; tied	70.5	100	105.75	1.5	26	99.5	8794
Comments: Light **/** Moderate chafing on the two standing parts of cord between figure 8 knot and prusik.									
60	3-wrap Purcell Prusik; Sterling; yellow/black	6mm Cord; Nylon; tied	72	100	108	1.5			
Comments: Bad test. Shackle misalignment during fall arrest. Similar to drops # 11,13,37,39									
61	3-wrap Purcell Prusik; Sterling; yellow/black	6mm Cord; Nylon; tied	69	100	103.5	1.5	34.5	101	9165
Comments: Moderate chafing on the two standing parts of cord between figure 8 knot and prusik.									
62	3-wrap Purcell Prusik; Sterling; yellow/black	6mm Cord; Nylon; tied	70.5	100	105.75	1.5			
Comments: Bad test. Shackle misalignment during fall arrest. Similar to drops # 11,13,37,39,60									
63	3-wrap Purcell Prusik; Sterling; yellow/black	6mm Cord; Nylon; tied	71	100	106.5	1.5	22	97.5	9516
Comments: Light **/** Moderate chafing on the two standing parts of cord between figure 8 knot and prusik. Some glazing of the Nylon in the prusik coils.									

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Test #	Lanyard Type: model, make, color	Lanyard Type: size, material & construction	Initial Unit Length (cm)	Mass (kg)	Drop Height (cm)	Fall Factor	Slide Distance (cm)	Final Unit Length (cm)	Maximum Arrest Force (N)
64	3-wrap Purcell Prusik; Sterling; yellow/black	6mm Cord; Nylon; tied	71	100	106.5	1.5	23	97.5	9413
Comments: Light **/** Moderate chafing on the two standing parts of cord between figure 8 knot and prusik. Some glazing of the Nylon in the prusik coils. Some fusing of the sheath on to itself within the prusik coils									
65	3-wrap Purcell Prusik; Sterling; yellow/black	6mm Cord; Nylon; tied	70	100	105	1.5	32	101.5	10831
Comments: Light **/** Moderate chafing on the two standing parts of cord between figure 8 knot and prusik. Some glazing of the Nylon in the prusik coils. Some fusing of the sheath on to itself within the prusik coils									
66	3-wrap Purcell Prusik; Sterling; yellow/black	6mm Cord; Nylon; tied	72	100	108	1.5	35	104	10580
Comments: Light **/** Moderate chafing on the two standing parts of cord between figure 8 knot and prusik. Some glazing of the Nylon in the prusik coils. Some fusing of the sheath on to itself within the prusik coils									
67	3-wrap Purcell Prusik; Sterling; yellow/black	6mm Cord; Nylon; tied	70	100	105	1.5	26.5	98	9339
Comments: Light **/** Moderate chafing on the two standing parts of cord between figure 8 knot and prusik. Some glazing of the Nylon in the prusik coils. Some fusing of the sheath on to itself within the prusik coils									
68	3-wrap Purcell Prusik; Sterling; yellow/black	6mm Cord; Nylon; tied	71	100	106.5	1.5	24.5	97.5	8669
Comments: Light **/** Moderate chafing on the two standing parts of cord between figure 8 knot and prusik. Some glazing of the Nylon in the prusik coils. Some fusing of the sheath on to itself within the prusik coils									
69	3-wrap Purcell Prusik; Sterling; yellow/black	6mm Cord; Nylon; tied	69.5	100	104.25	1.5	29.5	99	8962
Comments: Light **/** Moderate chafing on the two standing parts of cord between figure 8 knot and prusik. Some glazing of the Nylon in the prusik coils. Some fusing of the sheath on to itself within the prusik coils									
70	3-wrap Purcell Prusik; Sterling; yellow/black	6mm Cord; Nylon; tied	70	100	105	1.5	30	100	8196
Comments: Light **/** Moderate chafing on the two standing parts of cord between figure 8 knot and prusik. Some glazing of the Nylon in the prusik coils. Some fusing of the sheath on to itself within the prusik coils									

Test #	Lanyard Type: model, make, color	Lanyard Type: size, material & construction	Initial Unit Length (cm)	Mass (kg)	Drop Height (cm)	Fall Factor	Slide Distance (cm)	Final Unit Length (cm)	Maximum Arrest Force (N)
71	3-wrap Purcell Prusik; PMI; purple/yellow	6mm Cord; Nylon; tied	70	100	105	1.5	13	96.5	10445
Comments: Light **/** Moderate chafing on the two standing parts of cord between figure 8 knot and prusik. Some glazing of the Nylon in the prusik coils. Some fusing of the sheath on to itself within the prusik coils									
72	3-wrap Purcell Prusik; PMI; purple/yellow	6mm Cord; Nylon; tied	69	100	103.5	1.5	25	98	8845
Comments: Light **/** Moderate chafing on the two standing parts of cord between figure 8 knot and prusik. Some glazing of the Nylon in the prusik coils. Some fusing of the sheath on to itself within the prusik coils									
73	3-wrap Purcell Prusik; PMI; purple/yellow	6mm Cord; Nylon; tied	69	100	103.5	1.5	24.5	98	8918
Comments: Light **/** Moderate chafing on the two standing parts of cord between figure 8 knot and prusik. Some glazing of the Nylon in the prusik coils. Some fusing of the sheath on to itself within the prusik coils									
74	3-wrap Purcell Prusik; PMI; purple/yellow	6mm Cord; Nylon; tied	70	100	105	1.5	15.5	95	9779
Comments: Light **/** Moderate chafing on the two standing parts of cord between figure 8 knot and prusik. Some glazing of the Nylon in the prusik coils. Some fusing of the sheath on to itself within the prusik coils									
75	3-wrap Purcell Prusik; PMI; purple/yellow	6mm Cord; Nylon; tied	67	100	100.5	1.5	15.5	92	9160
Comments: Light **/** Moderate chafing on the two standing parts of cord between figure 8 knot and prusik. Some glazing of the Nylon in the prusik coils. Some fusing of the sheath on to itself within the prusik coils									
76	3-wrap Purcell Prusik; PMI; purple/yellow	6mm Cord; Nylon; tied	70	100	105	1.5	12.5	93.5	11100
Comments: Light **/** Moderate chafing on the two standing parts of cord between figure 8 knot and prusik. Some glazing of the Nylon in the prusik coils. Some fusing of the sheath on to itself within the prusik coils									
77	3-wrap Purcell Prusik; PMI; purple/yellow	6mm Cord; Nylon; tied	68	100	102	1.5	16	92.5	9904
Comments: Light **/** Moderate chafing on the two standing parts of cord between figure 8 knot and prusik. Some glazing of the Nylon in the prusik coils. Some fusing of the sheath on to itself within the prusik coils									

Lanyard Testing
Drop Test Log Sheet
Date: 8-1-06

Rigging for Rescue ®

Test #	Lanyard Type: model, make, color	Lanyard Type: size, material & construction	Initial Unit Length (cm)	Mass (kg)	Drop Height (cm)	Fall Factor	Slide Distance (cm)	Final Unit Length (cm)	Maximum Arrest Force (N)
78	3-wrap Purcell Prusik; PMI; purple/yellow	6mm Cord; Nylon; tied	71	100	106.5	1.5	NA	Failure	10489
Comments: Failure of one standing part in bight @ test mass side as it entered the figure 8 knot.									
79	3-wrap Purcell Prusik; PMI; purple/yellow	6mm Cord; Nylon; tied	69	100	103.5	1.5	NA	Failure	10126
Comments: Failure of one standing part on anchor side as it entered the figure 8 knot.									
80	3-wrap Purcell Prusik; PMI; purple/yellow	6mm Cord; Nylon; tied	69.5	100	104.25	1.5			
Comments: Bad test. Load cell attachment bolt failed due to too few threads into the load cell itself. Threads failed at 9400N.									