

# TWO-TENSIONED ROPE LOWERS – CENTRALLY FOCUSED BRIDLE ATTACHMENTS

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**Presented by:**

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Many rescue teams operate their rope rescue stretcher operations with either:

a single tensioned mainline coupled with a separately managed belay line

*or*

two tensioned mainlines without a separate belay line - often referred to as ‘Two-Tensioned Rope Lowers’.

Two-Tensioned Rope Lower configurations generally include two separate lines attached to the rescue package (patient, attendant(s), and stretcher), each supporting approximately half of the total mass. These configurations are rigged with a variety of stretcher bridle attachments, friction devices to manage the descent, attendant and patient tie-in methods, as well as rope types.

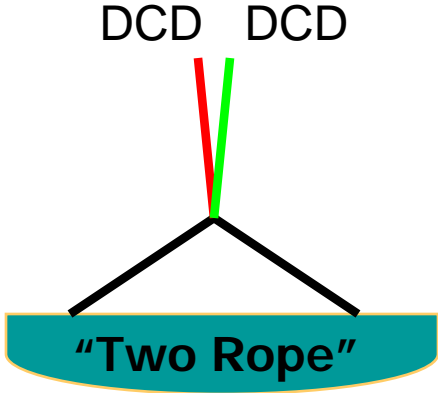
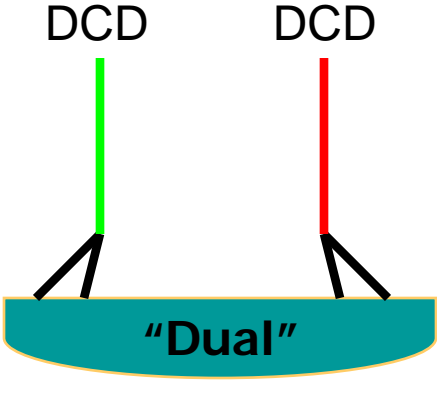
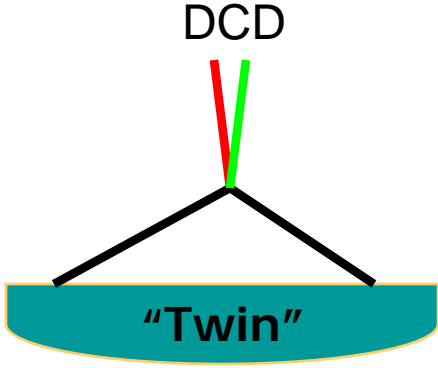
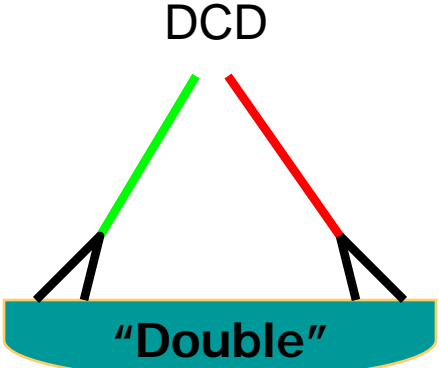
In 2003, we conducted a series of drop tests that focused on certain stretcher bridle attachment methods in a selection of Two-Tensioned Rope Lower configurations. The 2003 drop test series looked exclusively at stretcher bridle configurations that included two separate bridles and respective mainline attachments. The findings of that drop test series were presented at the ITRS 2003 in Salt Lake City.

The primary focus of this presentation is on Two-Tensioned Rope Lower configurations that incorporate a centrally focused stretcher bridle attachment method. This presentation will share the results of some failure analysis drop testing whereby we simulated a variety of modes of failure. The testing was conducted in order to examine the outcome to the rescue package using certain combinations of rope type and size, rescue mass, fall factor, descent control device, gripping ability, mode of failure and Two-Tensioned Rope Lower method. The material presented seeks to offer some direction in answering the question, “Can a given Two-Tensioned Rope Lower system arrest the fall of the rescue mass given certain system failure circumstances?”

## About the Presenter

**Mike Gibbs**, together with his partner Joanie Gibbs, own and operate Rigging for Rescue (technical ropework seminars and consulting) located in Ouray, Colorado. Mike is an active climbing guide as well as a member of the Ouray Mountain Rescue team.

# Two-Tensioned Rope Lower Methods

	1 Point of Attachment (Typically 1 Attendant)	2 Points of Attachment (Typically 2 Attendants)
<b>Two Brakes</b> On top	 <p>DCD DCD</p> <p>"Two Rope"</p>	 <p>DCD DCD</p> <p>"Dual"</p>
<b>One Brake</b> On top	 <p>DCD</p> <p>"Twin"</p>	 <p>DCD</p> <p>"Double"</p>

# Modes of Failure Tested

<b>Failure Mode</b>	<b>Style Tested</b>	<b>Possible Reason(s)</b>
1m drop on 3m of rope – both lines intact	“Two Rope” “Twin”	✓ Poor Edge Transition  ✓ High Directional Failure
1m drop on 3m of rope – one line intact	“Two Rope”	✓ Rigging error revealed during edge transition w/o a high directional
0m drop on $\approx$ 2.5m of rope while lowering– one line intact	“Two Rope” “Twin”	✓ Rock fall ✓ Poor Edge Protection ✓ Pendulum of the load

## Two-Tensioned Rope Lowerers

## Drop Test Log Sheet

Test #	(Belay) Device(s)	Rope Type: size,model, elongation & construction	Initial Rope Length (cm)	Mass (kg)	Drop Height (cm)	FAS Extension pre-rebound (cm)	Slide Distance @ Belay (cm)	Maximum Arrest Force (N) {@ anchor}
1	SMC Brakerack (aluminum)	7/16" Sterling Superstatic NLSK Orange/Yellow (new)	300	200	100	N/A Grounded	N/A Grounded	2824
TTRL Method: "Two Rope"								
Mechanical Hand Setting (N): 50								
# of bars on Brakerack: 5								
Rope entry angle (interior) between MH and DCD: $\approx 70^\circ$								
Rope in service between MH and DCD: 55cm								
2	SMC Brakerack (aluminum)	7/16" Sterling Superstatic NLSK Orange/Yellow (new)	300	200	100	230.8	184.5	5626
TTRL Method: "Two Rope"								
Mechanical Hand Setting (N): 210								
# of bars on Brakerack: 5								
Rope entry angle (interior) between MH and DCD: $\approx 70^\circ$								
Rope in service between MH and DCD: 55cm								
3	BMS Microrack (steel)	7/16" Sterling Superstatic NLSK Orange/Yellow (new)	300	200	100	N/A Grounded	N/A Grounded	3215
TTRL Method: "Two Rope"								
Mechanical Hand Setting (N): 210								
# of bars on Brakerack: 4 plus the hyperbar								
Rope entry angle (interior) between HD and DCD: $\approx 32^\circ$								
Rope in service between MH and DCD: 120 cm								
4	BMS Microrack (steel)	7/16" Sterling Superstatic NLSK Orange/Yellow (new)	300	200	100	N/A Grounded	N/A Grounded	4345
TTRL Method: "Two Rope"								
Mechanical Hand Setting (N): 210								
# of bars on Brakerack: 4 plus the hyperbar								
Rope entry angle (interior) between HD and DCD: $\approx 32^\circ$								
Rope in service between MH and DCD: 120 cm								
5	BMS Microrack (steel)	7/16" Sterling Superstatic NLSK Orange/Yellow (new)	300	200	100	155.3	110	5062
TTRL Method: "Two Rope"								
Mechanical Hand Setting (N): 425								
# of bars on Brakerack: 4 plus the hyperbar								
Rope entry angle (interior) between HD and DCD: $\approx 24^\circ$								
Rope in service between MH and DCD: 120 cm								
6	CMI Rescue 8 (aluminum)	7/16" Sterling Superstatic NLSK White/Black (new)	300	200	100	N/A Grounded	N/A Grounded	1695
TTRL Method: "Two Rope"								
Mechanical Hand Setting (N): 210								
DCD set-up method for friction: 'Lowering mode' sometimes referred to as 'Rappelling mode'								
Rope entry angle (interior) between HD and DCD: $\approx 0^\circ$								
Rope in service between MH and DCD: 104 cm								
7	CMI Rescue 8 (aluminum)	7/16" Sterling Superstatic NLSK White/Black (new)	300	200	100	147.6	100	6017
TTRL Method: "Two Rope"								
Mechanical Hand Setting (N): 210								
DCD set-up method for friction: Double Wrap in 'Lowering mode' sometimes referred to as 'Rappelling mode'								
Rope entry angle (interior) between HD and DCD: $\approx 0^\circ$								
Rope in service between MH and DCD: 104 cm								

**Two-Tensioned Rope Lowerers  
Drop Test Log Sheet**

Test #	(Belay) Device(s)	Rope Type: size, model, elongation & construction	Initial Rope Length (cm)	Mass (kg)	Drop Height (cm)	FAS Extension pre-rebound (cm)	Slide Distance @ Belay (cm)	Maximum Arrest Force (N) {@ anchor}
8	CMI Rescue 8 (aluminum)	7/16" Sterling Superstatic NLSK White/Black (new)	300	200	100	N/A Grounded	N/A Grounded	2542
TTRL Method: "Two Rope"								
Mechanical Hand Setting (N): 425								
DCD set-up method for friction: 'Lowering mode' sometimes referred to as 'Rappelling mode'								
Rope entry angle (interior) between HD and DCD: $\approx 0^\circ$								
Rope in service between MH and DCD: 104 cm								
9	CMI Rescue 8 (aluminum)	7/16" Sterling Superstatic NLSK White/Black (new)	300	200	100	N/A Grounded	N/A Grounded	3172
TTRL Method: "Two Rope"								
Mechanical Hand Setting (N): 50								
DCD set-up method for friction: Double Wrap in 'Lowering mode' sometimes referred to as 'Rappelling mode'								
Rope entry angle (interior) between HD and DCD: $\approx 0^\circ$								
Rope in service between MH and DCD: 104 cm								
10	BMS Belay Spool	7/16" Sterling Superstatic NLSK White/Black (new)	300	200	100	108.1	58.5	8146
TTRL Method: "Two Rope"								
Mechanical Hand Setting (N): 210								
DCD set-up method for friction: 3 complete wraps (fully loaded)								
Rope entry angle (interior) between MH and DCD: $\approx 0^\circ$								
Rope in service between MH and DCD: 65 cm								
11	BMS Belay Spool	7/16" Sterling Superstatic NLSK White/Black (new)	300	200	100	N/A Grounded	N/A Grounded	3433
TTRL Method: "Two Rope"								
Mechanical Hand Setting (N): 50								
DCD set-up method for friction: 3 complete wraps (fully loaded)								
Rope entry angle (interior) between MH and DCD: $\approx 0^\circ$								
Rope in service between MH and DCD: 65 cm								
12	BMS Belay Spool	1/2" Sterling Superstatic NLSK Blue/Red (new)	300	280	100	184	126	8124
TTRL Method: "Two Rope"								
Mechanical Hand Setting (N): 210								
DCD set-up method for friction: 3 complete wraps (fully loaded)								
Rope entry angle (interior) between MH and DCD: $\approx 0^\circ$								
Rope in service between MH and DCD: 65 cm								
13	BMS Microrack (steel)	1/2" Sterling Superstatic NLSK Blue/Red (new)	300	280	100	N/A Grounded	N/A Grounded	4714
TTRL Method: "Two Rope"								
Mechanical Hand Setting (N): 210								
# of bars on Brakerack: 4 plus the hyperbar								
Rope entry angle (interior) between HD and DCD: $\approx 32^\circ$								
Rope in service between MH and DCD: 120 cm								
14	BMS Microrack (steel)	1/2" Sterling Superstatic NLSK Blue/Red (new)	300	280	100	N/A Grounded	N/A Grounded	5691
TTRL Method: "Two Rope"								
Mechanical Hand Setting (N): 425								
# of bars on Brakerack: 4 plus the hyperbar								
Rope entry angle (interior) between HD and DCD: $\approx 32^\circ$								
Rope in service between MH and DCD: 120 cm								

**Two-Tensioned Rope Lowerers**  
**Drop Test Log Sheet**

Test #	(Belay) Device(s)	Rope Type: size, model, elongation & construction	Initial Rope Length (cm)	Mass (kg)	Drop Height (cm)	FAS Extension pre-rebound (cm)	Slide Distance @ Belay (cm)	Maximum Arrest Force (N) {@ anchor}
15	SMC Brakerack (aluminum)	1/2" Sterling Superstatic NLSK Blue/Red (new)	300	280	100	N/A Grounded	N/A Grounded	5300
TTRL Method: "Two Rope"								
Mechanical Hand Setting (N): 210								
# of bars on Brakerack: 5								
Rope entry angle (interior) between MH and DCD: $\approx 70^\circ$								
Rope in service between MH and DCD: 56 cm								
16	SMC Brakerack (aluminum)	1/2" Sterling Superstatic NLSK Blue/Red (new)	300	280	100	N/A Grounded	N/A Grounded	7342
TTRL Method: "Two Rope"								
Mechanical Hand Setting (N): 425								
# of bars on Brakerack: 5								
Rope entry angle (interior) between MH and DCD: $\approx 70^\circ$								
Rope in service between MH and DCD: 56 cm								
17	CMI Rescue 8 (aluminum)	1/2" Sterling Superstatic NLSK Blue/Red (new)	300	280	100	N/A Grounded	N/A Grounded	2694
TTRL Method: "Two Rope"								
Mechanical Hand Setting (N): 425								
DCD set-up method for friction: 'Lowering mode' sometimes referred to as 'Rappelling mode'								
Rope entry angle (interior) between HD and DCD: $\approx 0^\circ$								
Rope in service between MH and DCD: 104 cm								
18	CMI Rescue 8 (aluminum)	1/2" Sterling Superstatic NLSK Blue/Red (new)	300	280	100	144.3	84.5	8863
TTRL Method: "Two Rope"								
Mechanical Hand Setting (N): 425								
DCD set-up method for friction: Double Wrap in 'Lowering mode' sometimes referred to as 'Rappelling mode'								
Rope entry angle (interior) between HD and DCD: $\approx 0^\circ$								
Rope in service between MH and DCD: 104 cm								
19	Pro Allp	7/16" Sterling Superstatic NLSK White/Black (new)	300	200	100	N/A Grounded	N/A Grounded	2976
TTRL Method: "Two Rope"								
Mechanical Hand Setting (N): 210								
DCD set-up method for friction: 50N of 'Tail tension' with 200kg mass								
Rope entry angle (interior) between HD and DCD: $\approx 0^\circ$								
Rope in service between MH and DCD: 105 cm								
20	Pro Allp	7/16" Sterling Superstatic NLSK White/Black (new)	300	200	0	N/A Grounded	N/A Grounded	1565
TTRL Method: "Two Rope"								
Mechanical Hand Setting (N): 210								
DCD set-up method for friction: 50N of 'Tail tension' with 100kg mass								
Rope entry angle (interior) between HD and DCD: $\approx 0^\circ$								
Rope in service between MH and DCD: 105 cm								
21	Pro Allp	7/16" Sterling Superstatic NLSK White/Black (new)	110*	200**	0	N/A Grounded	N/A Grounded	1651
TTRL Method: "Two Rope"								
Mechanical Hand Setting (N): 210								
DCD set-up method for friction: 50N of 'Tail tension' with 100kg mass								
Rope entry angle (interior) between HD and DCD: $\approx 0^\circ$								
Rope in service between MH and DCD: 105 cm								
* starting RIS and then $\approx 50$ cm added during lowering before DC								
** Rescue Randy; Stretcher; Timbers comprised test mass								

**Two-Tensioned Rope Lowerers  
Drop Test Log Sheet**

Test #	(Belay) Device(s)	Rope Type: size,model, elongation & construction	Initial Rope Length (cm)	Mass (kg)	Drop Height (cm)	FAS Extension pre-rebound (cm)	Slide Distance @ Belay (cm)	Maximum Arrest Force (N) {@ anchor}
22-26								
Five drop tests conducted using Tandem Prusik Belay as well as 540° Rescue Belay								
Drop testing results not included as they are not germane to this presentation subject matter								
27	BMS Brakerack (steel)	7/16" Sterling HTP Yellow/Blue (new)	300	200	100	82.6	58.5	10024
TTRL Method: "Twin"								
2-Rope Mechanical Hand Setting (N): 210				<b>Note:</b> Both ropes being held by '2-rope MH'				
# of bars on Brakerack: 6								
Rope entry angle (interior) between MH and DCD: ≈67°								
Rope in service between MH and DCD: 94 cm								
28	BMS Brakerack (steel)	7/16" Sterling HTP Yellow/Blue (new)	300	200	100	206.9	185	8374
TTRL Method: "Twin"								
2-Rope Mechanical Hand Setting (N): 50				<b>Note:</b> Both ropes being held by '2-rope MH'				
# of bars on Brakerack: 6								
Rope entry angle (interior) between MH and DCD: ≈67°								
Rope in service between MH and DCD: 94 cm								
29	HB Brakerack with Dual/Double Hyperbars	7/16" Sterling HTP Yellow/Blue (new)	300	200	100	238.1	221.5	7592
TTRL Method: "Twin"								
2-Rope Mechanical Hand Setting (N): 50				<b>Note:</b> Both ropes being held by '2-rope MH'				
# of bars on Brakerack: 4 plus 1 Hyperbar (per rope)								
Rope entry angle (interior) between HD and DCD: ≈33°								
Rope in service between MH and DCD: 154 cm								
30	Rock Exotica Tuba	7/16" Sterling HTP Yellow/Blue (new)	300	200	100	69	43.5	12283
TTRL Method: "Twin"								
2-Rope Mechanical Hand Setting (N): 50				<b>Note:</b> Both ropes being held by '2-rope MH'				
DCD set-up method for friction: 50N of 'Tail tension' using 3 wraps around main tube (6 strands of rope)								
Rope entry angle (interior) between HD and DCD: ≈17°								
Rope in service between MH and DCD: 145 cm								
31	Rock Exotica Tuba	7/16" Sterling HTP Yellow/Blue (new)	300	280	100	MNT	52	12470
TTRL Method: "Twin"								
2-Rope Mechanical Hand Setting (N): 50				<b>Note:</b> Both ropes being held by '2-rope MH'				
DCD set-up method for friction: 62N of 'Tail tension' using 3 wraps around main tube (6 strands of rope)								
Rope entry angle (interior) between HD and DCD: ≈17°								
Rope in service between MH and DCD: 145 cm								
32	CMI Rescue 8 (aluminum)	7/16" Sterling HTP Yellow/Blue (new)	300	200	100	N/A Grounded	N/A Grounded	3845
TTRL Method: "Twin"								
2-Rope Mechanical Hand Setting (N): 210				<b>Note:</b> Both ropes being held by '2-rope MH'				
DCD set-up method for friction: 'Lowering mode' sometimes referred to as 'Rappelling mode' with both ropes reeved through DCD								
Rope entry angle (interior) between HD and DCD: ≈0°								
Rope in service between MH and DCD: 139 cm								



Two-Tensioned Rope Lowerers  
Drop Test Log Sheet

Test #	(Belay) Device(s)	Rope Type: size,model, elongation & construction	Initial Rope Length (cm)	Mass (kg)	Drop Height (cm)	FAS Extension pre-rebound (cm)	Slide Distance @ Belay (cm)	Maximum Arrest Force (N) {@ anchor}
33	BMS Brakerack (steel)	11mm Petzl Vector NLSK Blue (new) *	≈150	200	0**	MNT***	MNT***	MNT***
TTRL Method: "Twin"								
2-Rope Mechanical Hand Setting (N): 210			<b>Note:</b> Both ropes being held by '2-rope MH'					
# of bars on Brakerack: 6			* 11mm PMI EZ Bend NLSK Yellow (new) was DC rope					
Rope entry angle (interior) between MH and DCD: ≈67°			** A sudden transfer of tension with no free fall {fall factor =0}					
Rope in service between MH and DCD: 94 cm			*** Faulty test set-up with no data recorded					
34	BMS Brakerack (steel)	11mm Petzl Vector NLSK Blue (new) *	≈150**	200	0***	NA	0	3182
TTRL Method: "Twin"								
2-Rope Mechanical Hand Setting (N): 210			<b>Note:</b> Both ropes being held by '2-rope MH'					
# of bars on Brakerack: 6			* 11mm PMI EZ Bend NLSK Yellow (new) was DC rope					
Rope entry angle (interior) between MH and DCD: ≈67°			** starting RIS and then ≈100 cm added during lowering before DC					
Rope in service between MH and DCD: 94 cm			*** A sudden transfer of tension with no free fall {fall factor =0}					
35	BMS Brakerack (steel)	11mm Petzl Vector NLSK Blue (new) *	≈150**	200	0***	N/A Grounded	N/A Grounded	3009
TTRL Method: "Twin"								
2-Rope Mechanical Hand Setting (N): 71			<b>Note:</b> Both ropes being held by '2-rope MH'					
# of bars on Brakerack: 6			* 11mm PMI EZ Bend NLSK White (new) was DC rope					
Rope entry angle (interior) between MH and DCD: ≈67°			** starting RIS and then ≈100 cm added during lowering before DC					
Rope in service between MH and DCD: 94 cm			*** A sudden transfer of tension with no free fall {fall factor =0}					
36	Rock Exotica Tuba	11mm Petzl Vector NLSK Blue (new)	≈150*	200	0**	N/A Grounded	N/A Grounded	3476
TTRL Method: "Twin"								
2-Rope Mechanical Hand Setting (N): 50			<b>Note:</b> Both ropes being held by '2-rope MH'					
DCD set-up method for friction: 50N of 'Tail tension' using 3 wraps around main tube (6 strands of rope)								
Rope entry angle (interior) between HD and DCD: ≈17°			* starting RIS and then ≈100 cm added during lowering before DC					
Rope in service between MH and DCD: 145 cm			** A sudden transfer of tension with no free fall {fall factor =0}					
37	SMC Brakerack (aluminum)	11mm Petzl Vector NLSK White (new)	≈150*	200	0**	N/A Held Load	N/A Held Load	MNT
TTRL Method: "Two Rope"								
Mechanical Hand Setting (N): 210								
# of bars on Brakerack(s): 5								
Rope entry angle (interior) between MH and DCD: ≈70°			* starting RIS and then ≈100 cm added during lowering before DC					
Rope in service between MH and DCD: 55cm			** A sudden transfer of tension with no free fall {fall factor =0}					
38	SMC Brakerack (aluminum)	11mm Petzl Vector NLSK White (new)	≈150*	200	0**	N/A	200	2498
TTRL Method: "Two Rope"								
Mechanical Hand Setting (N): 50								
# of bars on Brakerack(s): 5								
Rope entry angle (interior) between MH and DCD: ≈70°			* starting RIS and then ≈100 cm added during lowering before DC					
Rope in service between MH and DCD: 55 cm			** A sudden transfer of tension with no free fall {fall factor =0}					
39	BMS Microrack (steel)	11mm Petzl Vector NLSK White (new)	≈150*	200	0**	N/A Grounded	N/A Grounded	MNT
TTRL Method: "Two Rope"								
Mechanical Hand Setting (N): 50								
# of bars on Brakerack: 4 plus the hyperbar								
Rope entry angle (interior) between HD and DCD: ≈24°			* starting RIS and then ≈100 cm added during lowering before DC					
Rope in service between MH and DCD: 120 cm			** A sudden transfer of tension with no free fall {fall factor =0}					

**Two-Tensioned Rope Lowerers**  
**Drop Test Log Sheet**

Test #	(Belay) Device(s)	Rope Type: size, model, elongation & construction	Initial Rope Length (cm)	Mass (kg)	Drop Height (cm)	FAS Extension pre-rebound (cm)	Slide Distance @ Belay (cm)	Maximum Arrest Force (N) {@ anchor}
40	BMS Microrack (steel)	11mm Petzl Vector NLSK White (new)	≈150*	200	0**	N/A Held Load	MNT Held Load	3237
TTRL Method: "Two Rope"								
Mechanical Hand Setting (N): 210								
# of bars on Brakerack: 4 plus the hyperbar								
Rope entry angle (interior) between HD and DCD: ≈24°			* starting RIS and then ≈100 cm added during lowering before DC					
Rope in service between MH and DCD: 120 cm			** A sudden transfer of tension with no free fall {fall factor =0}					
41	BMS Belay Spool	11mm Petzl Vector NLSK White (new)	≈150*	200	0**	N/A Held Load	MNT Held Load	2813
TTRL Method: "Two Rope"								
Mechanical Hand Setting (N): 210								
DCD set-up method for friction: 3 complete wraps (fully loaded)								
Rope entry angle (interior) between MH and DCD: ≈65°			* starting RIS and then ≈100 cm added during lowering before DC					
Rope in service between MH and DCD: 65 cm			** A sudden transfer of tension with no free fall {fall factor =0}					
42	BMS Belay Spool	11mm Petzl Vector NLSK White (new)	≈150*	200	0**	N/A Grounded	N/A Grounded	2650
TTRL Method: "Two Rope"								
Mechanical Hand Setting (N): 50								
DCD set-up method for friction: 3 complete wraps (fully loaded)								
Rope entry angle (interior) between MH and DCD: ≈65°			* starting RIS and then ≈100 cm added during lowering before DC					
Rope in service between MH and DCD: 65 cm			** A sudden transfer of tension with no free fall {fall factor =0}					
43	Pro Allp & Allp	11mm Petzl Vector NLSK White & Blue (new)	300	200	100	N/A Grounded	N/A Grounded	3921
TTRL Method: "Two Rope"								
Mechanical Hand Setting(s) (N): 50 on each MH								
DCD set-up method for friction: 50N of 'Tail tension' with 100kg mass on each DCD								
Rope entry angle (interior) between HD(s) and DCD(s): ≈0°								
Rope in service between MH(s) and DCD(s): 105 cm on each								
44	Pro Allp & Allp	11mm Petzl Vector NLSK White & Blue (new)	300	200	100	MNT	77	4605
TTRL Method: "Two Rope"								
Mechanical Hand Setting(s) (N): 210 on each MH								
DCD set-up method for friction: 50N of 'Tail tension' with 100kg mass on each DCD								
Rope entry angle (interior) between HD(s) and DCD(s): ≈0°								
Rope in service between MH(s) and DCD(s): 105 cm on each								
45	BMS Belay Spool(s) (1 old / 1 new )*	11mm Petzl Vector NLSK White & Blue (new)	300	200	100	MNT	67 (new)* 82.5 (old)*	6256
TTRL Method: "Two Rope"								
Mechanical Hand Setting(s) (N): 50 on each MH			* referring to the version or style of BMS Belay Spool					
DCD(s) set-up method for friction: 3 complete wraps (fully loaded)								
Rope entry angle (interior) between MH(s) and DCD(s): ≈0°								
Rope in service between MH(s) and DCD(s): 65 cm on each								
46	SMC Brakerack(s) (aluminum)	11mm Petzl Vector NLSK White & Blue (new)	300	200	100	137.5	113 (white) 110 (blue)	5995
TTRL Method: "Two Rope"								
Mechanical Hand Setting(s) (N): 50 on each MH								
# of bars on Brakerack(s): 5 on each								
Rope entry angle (interior) between MH(s) and DCD(s): ≈58°								
Rope in service between MH(s) and DCD(s): 55 cm on each								

**Two-Tensioned Rope Lower  
Drop Test Log Sheet**

Test #	(Belay) Device(s)	Rope Type: size,model, elongation & construction	Initial Rope Length (cm)	Mass (kg)	Drop Height (cm)	FAS Extension pre-rebound (cm)	Slide Distance @ Belay (cm)	Maximum Arrest Force (N) {@ anchor}
47	BMS Microrack(s) (steel)	11mm Petzl Vector NLSK White & Blue (new)	300	200	100	140.1	111 (white) 114.5 (blue)	5159

TTRL Method: "Two Rope"

Mechanical Hand Setting(s) (N): 50 on each MH

# of bars on Brakerack(s): 4 plus hyperbar on each

Rope entry angle (interior) between HD(s) and DCD(s): ≈26°

Rope in service between MH(s) and DCD(s): 201 cm on each

**Key to Acronyms and Abbreviations**

Item	Description
TTRL	Two-Tensioned Rope Lower
m	Metre
cm	Centimetre
kg	Kilogram
N	Newton
NLSK	Nylon Low Stretch Kernmantle
FAS	Fall Arrest System
MH	Mechanical Hand
MAF	Maximum Arrest Force
DCD	Descent Control Device
HD	High Directional
RIS	Rope in Service
HTP	High Tenacity Polyester
DC	Disconnect