North Carolina
Rope Rescue Technician
Fixed Rope Systems

RAPPELLING

Purposes Of Rappelling

- The controlled descent of a rope using friction of a rope through a descender as a means of control.
- A required skill for operating in a high angle environment.
- Learning safe rappelling skills greatly enhances the rescuer's confidence and comfort while working from heights.
- Always remain in control of the rappel.
- Avoid rapid bouncing rappels.

Purposes Of Rappelling

- The use of a top belay is recommended and is the only true belay.
- A belay line should be mandatory for any rescue operation where a person is attached to the line and the mainline cannot be totally protected from potential damage or entrapment.
- Rappelling should be taught by a qualified and experienced instructor.
- For new personnel or learning new techniques should be practiced in ground school first before moving to gradual elevations in vertical height; and shallow to steep angles that require a top belay.

Low Angle/Slope Rappelling
Arm & Body Rappelling

- Used for short, low-angle slopes.
- Potential injury from abrasions to the arms and hands.
- Do more harm than good

Principles of Rappelling

- Arm rappels and body rappels are recommended for use in the low angle environment only.
- They require continuous training or they can do more harm than good for the rescuers.
- For steep & high angle work, the use of a descent control device is the preferred and safest method.
- Many brands of descent control devices available on the market.
- The AHJ should make the final decision as to what type of device is best suited for operations in their jurisdiction.


Harnesses

Class I Harness

- Class I harness has been deleted from NFPA 1983.

Class II Harness

- Harness that fastens around the waist and around thighs or under buttocks and is designed for rescue with a design load of 600 lbf.

Wilderness Harnesses are NOT rated for 600 lbs SWL.!!

Class III Harness

- A harness that fastens around the waist, thighs or under buttocks, and over shoulders
- Designed for rescue with a design load of (600 lbf) shall be designated as Class III life safety harness.
- It is designed for rescue operations where the potential for inversion may occur

Industrial Class III Harness

- These are NOT RATED FOR RESCUE
- 485 lbs SWL
- Used For Fall Arrest or Positioning
- Dorsal Attachment Point

Modified Seat Harnesses

- Hand constructed class II or class III improvised seat.
- Should meets the design criteria and approved material of NFPA 1983.
- Material used for improvised body harnesses must be constructed 1 ¾ inch width webbing .
- Minimum tensile strength 6000 lbs..

Modified harness

- Swiss Seat
- Hasty hitch
- Hanson Hitch
- Chest hitch
- Rescue Knots

Modified Harnesses

Modified Harnesses (Swiss Seat)

- Using a 12’ piece of webbing
- Attach the 2 ends with a water knot soured with an overhand safety knot on each side to form a loop.
- Pass the loop behind the legs and buttocks.
- Reach between the legs and bring the webbing under the section that is around the waist and dress it down snugly.

Modified Harnesses (Chest Hitch)

- Take a 12’ piece of webbing
- Attach the two ends with a water knot secured with an overhand safety knot on each side to form a loop.
- Form a twist in the webbing, creating a figure eight in the loop.
- Slip your arms through the ends of the figure 8 so that the crossover point rests in the middle of the rescuer’s upper back.
- Connect the ends of the chest hitch with a locking carabiner.
- Connect the chest harness to the seat harness using two carabiners between a short webbing tether creating a modified Class III harness.

NFPA Descent Control Devices

Rescue 8

Harken/ CMC Clutch

SCARAB

Petzl Gri-Gri

CMC MPD

Petzl Maestro

Brake Bar

Petzl ID

ATC

SCARAB

Petzl Gri-Gri

Brake Bar

Wilderness Descent Control Devices


ATC-XP Settings
"0"
"1"
"2"
"3"

Auto Block Self-Belaying

- Fall Arrest is placed BELOW the Descender

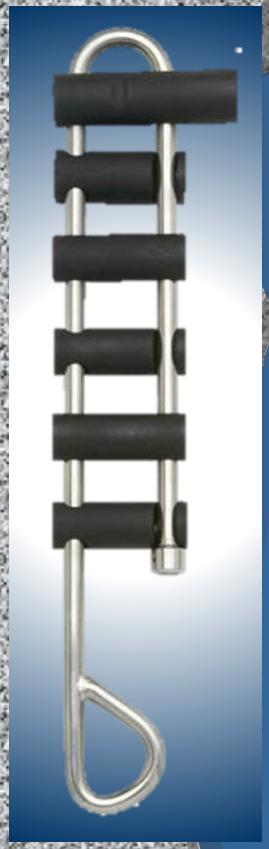
Coventional Figure Eight Descenders

- Molded to form a large ring stacked on top of a small ring constructed from aluminum or steel.
- The larger ring creates friction on the rope and the smaller ring is attached to a seat harness carabiner.
- Drawbacks:
  - Large rope won't thread through the smaller designs.
  - Ropes can slip over the large ring causing a girth hitch.

Rescue 8 Descenders

- Rescue 8 descender twists the rope.
- Large rope won't thread through the smaller designs
- Rescue 8 is choice for most rescue operations including rappelling.
- Rabbit ear design allows for extra friction to be applied and the ears prevent girth hitch .
- Manufacturers do not recommend using these devices for rappels exceeding 75'-100' feet due to excessive heat buildup and potential damage to lifelines.
- Causes excessive twisting of rope.

Brake Bar Rack



- Weave the lifeline under and over each bar until desired friction is obtained.
- Lay lifeline across the top of the training groove on the rack.
- Running end should come out the bottom of the rack.
- Braking hand should be centered between back and hip.
- Gates are in up position.

Brake Bar Rack

- Speed of descent is controlled by manipulating the slack in the rope, and by adding or subtracting bars from the system.
- Each bar generates 50 lbs. of force.
- Humans can only grip about 30 lbs.
- Slowed by pulling the running end of the rope up towards the top of the rack and loosing one's grip.

Rigging the Brake Bar Rack

- Lay lifeline across training groove on the rack.
- Weave the lifeline under and over each bar (Number of bars varies depending on the weight of the load.)
- The running end coming out the bottom of the rack is held in the rescuer's brake hand and positioned between the center of the rescuers back and hip.
- Connect the rack to the rescuer's harness with a carabiner, with the gate in the up position.
- Speed is controlled by manipulating the friction in the rope, and by adding or subtracting bars from the system.
- Descent is slowed by pulling the running end of the rope up towards the top of the rack.
- The descent speed can be increased by slacking the running end of the rope and loosening one's grip.

Brake Bar Rack

- Locking off:
  - Round turn around the rack with the running end
  - Securing two half hitches to the standing part
  - Extends above the top of the rack.

Rappelling Methods

- “Butt Thrust Method”
- “Knees over the edge Method”
- Above anchor point
- Even with Anchor
- Below anchor

Rappelling Methods

"Butt Thrust Method"

- Used when rappelling out of a window and off the top of a building.
  1. Face the anchor.
  2. Slowly thrust your butt out over the edge and slowly begin to lower yourself.
  3. When the standing part of the rope reaches the edge
  4. Begin to ease yourself over the edge keeping your feet shoulder width apart and begin a controlled descent.

Rappelling Methods

"Knees over the Edge Method"

1. Walk up to the edge with no slack in the rope.
2. Get down on your knees.
3. Lean back, thrusting your butt over the edge.
4. ON your knees… slide over the edge until your toes touch the edge.
5. Continue lowering yourself until you can push your legs away from the edge and position your body so your legs are perpendicular to the edge and begin a controlled descent.

Belaying

- Belays lines should be on separate point on harness.
- Lines should have separate D-ring.

Belaying

- “To secure (a person) by attaching to one end of a rope.”
- “to secure (a rope) by attaching to a person or to an object offering stable support.”

Prussik Hitches

- The diameter of prusik, should be 2/3 to ¾ the diameter of the lifeline.
  - 8mm prussik on 7/16 “
  - 9 mm on ½” & 5/8”
  - 7mm prusik is the smallest diameter for use in rescue operations.
  - Kevlar; fibers break when knots are tied in it and the cord is loaded

New Technology

VT Prussik 7mm or 8mm

100% Technora construction

Hollow Core Block

Prusik Hitches

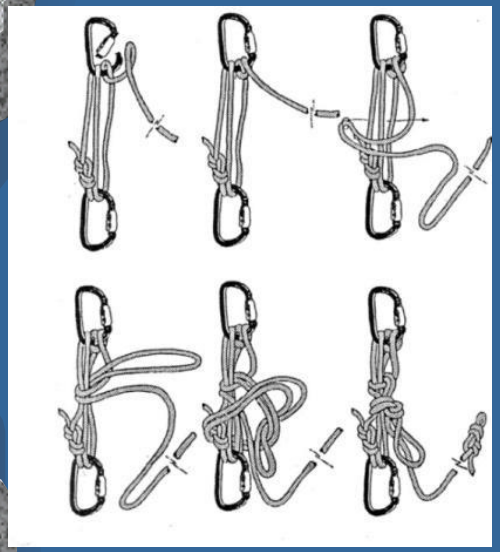
- **65 inch and 53 inch length** of 6-8mm of accessory cord.
- 65 inch prusik sling tie a **double wrap** prusik hitch **for light loads**, or a **triple wrap** prusik **for rescue loads** onto the lifeline.
- Repeat with 53”inch prusik; **place behind 65” prusik** (closet to the anchor sling carabiner.

Load Releasing Hitches

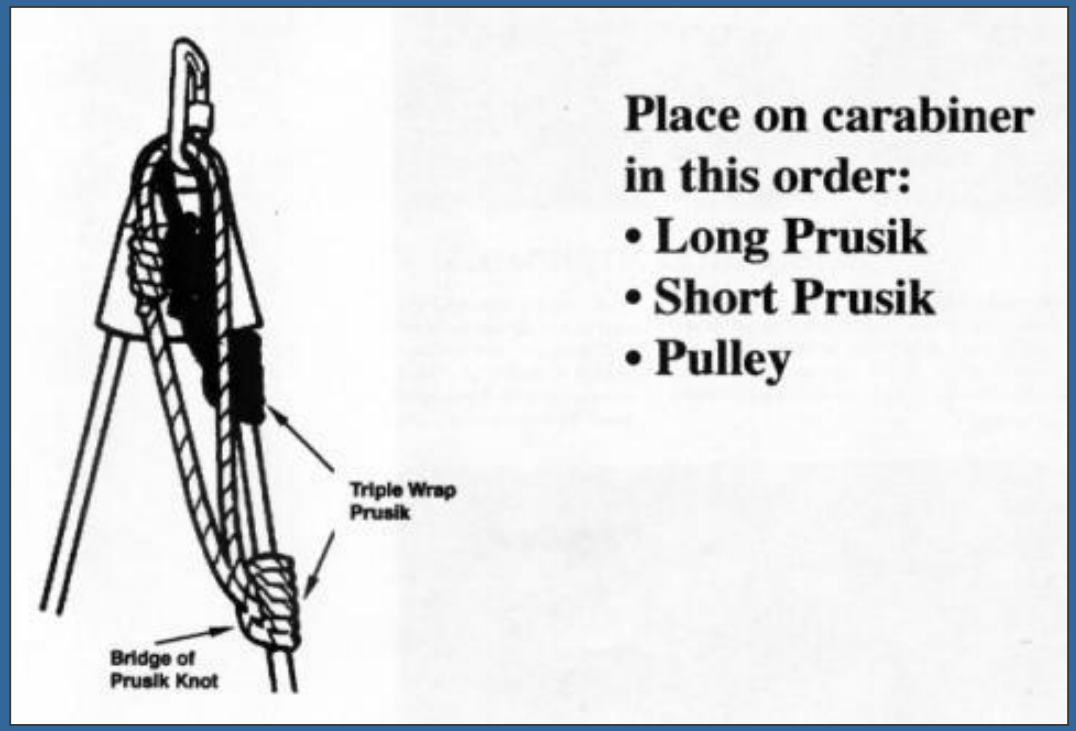
- Why?
  - Prevent stuck prusiks
  - Passing knot while under load.
  - Transition between descending and ascending systems.
  - Attaches to Progress Capturing Device. (PCD)

Load Releasing Hitches

- Radium load releasing hitch
- Mariners hitch



Prusik-Minded Pulley Belay



Place on carabiner in this order:

- **Long Prusik**
- **Short Prusik**
- **Pulley**

Prusik-Minded Pulley Belay

- Attach the radium load release hitch to the prusik minded pulley.
- Bridge a small oval carabiner between standing and running ends.

Munter Hitch

- Emergency descents.
- Best Protection when racks or eights aren’t available.
- Single person loads.
- Low angle

Rappel Commands

- On-belay?
  - Given by rescuer asking if belayer is ready
- Belay's on!
  - Response by belayer confirming that belayer is ready.
- On rappel?
  - Command given by rescuer denoting start of descent.

Rappel Commands

- Off rappel
  - Given by rescuer denoting safe arrival on the ground
- Off belay
  - Given by rescuer denoting that the rescuer has unhooked from the lifeline.

Self-belay (pseudo or false belay)

- Used when a top belay is not available
- Or when a rope cannot be belayed from ground.
- When a rescuer's descent becomes uncontrolled, the prusik hitch locks down on the lifeline.
- Hazards:
  - *wrong size accessory cord*
  - *prusik hitch is to loose*
  - *rescuer lets go of his rappelling system and grabs the prusik hitch*
- Practice of this technique is critical

Personal Escape

- Manufacturers create emergency escape systems strong enough to meet the one person requirement
- Periodic inspection is critical.
- Pay attention to the rope construction features such as strength, and susceptibility to heat when buying.
- Escape systems are designed for one time use.

Pick-offs

- Window cleaner stranded
- FF Bailout
- Stranded rock climber
- Suicide victim
- The pick off procedure with / without harness

Pick-offs w/ harness

- Adjust for anticipated load on descent device.
- Rescuer rappels or is lowered above victim & locks off
- Attach pick-off strap to victim
- Adjust length as needed to transfer load to rescuer’s harness.
- Safety the strap
- Unlock & lower/raise

Pick-offs w/o harness

- Adjust for anticipated load on descent device.
- Rescuer rappels or is lowered BELOW victim & locks off
- Ties improvsed harness
- Attaches pick-off strap to victim
- Adjust length as needed to transfer load to rescuer’s harness.
- Secure the strap
- Unlock & lower/raise

Ascending

- Builds confidence for high angle
- Allows for flexibility for moving about on a fixed line.
- Under load, creates an offset camming action by pressing the cam against the lifeline preventing the ascender from slipping down the lifeline.

Ascending

- Types of ascenders:
  - Friction Ascenders
    - Double/triple wrapped prusiks
    - Purcells
  - Light use cams (Tooth Type)
    - Jumars
    - Tear rope unckr load at 800 lbs. General Use
    - Rock Exotica, Gibbs
    - Frames are

Purcell Pruskis

- 6-7 mm diameter nylon kernmantle for ascending
- 8-9mm diameter nylon kernmantle for all other operations incorporating a Purcell prusik hitch.

Tying Off Short

- Rescuer ties directly to the mainline to ensure added protection in the event trouble occurs during the ascent.
- Using a two point ascending system, may have to cross over a knot
- Rescuer is using a system that cannot guarantee the rescuer remains upright in the system.

Tying Off Short

- Pick up the slack out of the lifeline just below the lowest ascender and tie a figure eight-on-a-bight into it.
- Clip the knot into a spare carabiner and attach it to the rescuer's seat harness.
- Complete the move past the obstacle.
- Unclip and untie the knot and let the slack of the lifeline drop below the rescuer.