

Rope and Hardware Equipment Standards

These standards are applicable to all divisions, units, or teams of the San Bernardino County Sheriff's Department performing rope rescue, or using ropes and devices addressed in this document for personal access at any level of operation, effective immediately. Check the date at the bottom of the page with the Volunteer Forces Unit for the most current version.

Direct all questions to the Rope Rescue Oversight Committee via the Volunteer Forces Unit. If you cannot find information on a particular piece of equipment or practice, contact RROC via Volunteer Forces Unit.

Software

General

- All software in the following categories (rope, webbing, harnesses, and other software) will be retired prior to the listed retirements dates if subjected to severe shock forces, exposed to harmful substances, or if excessive wear is present.
- All software (rope, webbing, harnesses, etc.) will be plainly marked with the date it is placed in service.
- Allowable uses are based on rope size rather than manufacturer's rated strength since these numbers vary widely.
- All software applications require a 10:1 static system safety factor (SSSF).
- Know your cordage strength.
- Full fingered gloves REQUIRED, synthetic or leather, with abrasion resistant palms.
- Eye protection recommended.

Rope

<u>Size (diameter)</u>	<u>Allowable uses</u>
6 mm	Personal Prusik use only
7mm	Mountaineering cordelette and Personal Prusik use
8 mm	Prusiks for tandem Prusik use (suitable for 11.1 and 12.5 mm), pre-tensioned back-ties (PTBT), Prusik by-pass (PBP), Load-releasing Hitches (LRH), and travel restricts
9 mm	LRH, PTBT, and personal access line
10 mm	Personal access line, PTBT
11.1 mm	Personal access line, 2-person rescue, PTBT. 3-person rescue with Prusik by-passes. [High angle allowable uses listed here. Low angle use restrictions are set by the "Resultant Force (KN) for Given Slope Angle and Mass" chart in the TRBC text.]
12.5 mm	Personal access line, 2-person rescue, 3-person rescue. [High angle allowable uses listed here. Low angle use restrictions are set by the "Resultant Force (KN) for Given Slope Angle and Mass" chart in the TRBC text.]

- Rope will be retired in the 7 to 10 year range. (Shelf storage may extend this range, but should be verified by testing conducted by the manufacturer to ensure rope is still serviceable.)
- Ropes referred to here are nylon, low-stretch kernmantle rope.
- PMI Impact™ Rope is acceptable for use as a main line, two-person rescue (pick-off), or for single person ascending and rappel (per manufacturer's recommendation). **Not to be used for belay!**
- High stretch rope, e.g., climbing rope, is for personal use/single person loads only and will not be used in rescue systems where it might be subjected to shock forces involving two or more person loads. Appropriate uses for high stretch rope in rescue is belay of a lead climber, roped-up walking on ice/snow, and specialized alpine rescue applications. The manufacturer's guidelines will be followed as to single rope, twin rope or double rope use in each case.
- New rope classifications will be addressed as needed by the Rope Rescue Oversight Committee (RROC).

Webbing

- Webbing should be purchased that meets a 4,000 lb. minimum breaking strength.
- Webbing will be retired in the 5 to 7 year range. (Shelf storage may extend this range, but should be verified by testing conducted by the manufacturer to ensure webbing is still good.)

Other Software

- Any seat harness used shall be commercially manufactured/sewn, except for expedient harnesses tied out of webbing by the individual. Harnesses that have been in service will be retired at no more than 10 years, unless manufacturer’s standards specify a shorter period, in which case the shorter period will apply. Harnesses will be carefully inspected for wear and damage regularly.
- When placed in service, the date will plainly marked on the harness.
- No home-sewn nylon accessories will be permitted, such as slings, pick-off straps, or runners. Only commercially manufactured accessories of this nature are allowed. Nylon accessories of this nature shall be retired at 7-10 years. Runners, slings, etriers and similar accessories can be hand-tied using accepted technique for field expedients. All nylon accessories will be carefully inspected for wear and damage regularly.
- Spectra, Kevlar, and other slings made of extremely low-stretch, high-strength materials are not approved for use in personal vertical systems (ascending, traverse, and rappel). This software will not be used with out prior approval from RROC.
- Chest harnesses required in the High Angle Environment accept for Single Rope Technique (SRT).

Hardware

Pulleys

- Pulleys shall meet a minimum strength rating to maintain at least a 10:1 SSSF.
- As a general rule, in order to maximize pulley efficiency, pulley tread diameter should be at least 4 times the diameter of the rope, in order to maintain full rope strength. Users should be aware that there is often a substantial difference between catalog size and actual tread size.
- Plastic sheaves are banned on any pulley that might be used in a rescue system. (Synthetic polymers such as Delrin, which are used to make sheaves for pulleys such as the Kootenay Carriage and Russ Anderson KPP are acceptable.)

Carabiners

Breaking strength

Allowable uses

Less than 20 KN	Banned for rescue team use in any application
20 KN	Minimum acceptable 1- or 2-person load
30 KN	Minimum acceptable 3-person load. <u>Strongly recommend all carabiners purchased, both personal and team, meet this strength rating.</u> Carabiners that are at least 30 KN breaking strength provide flexibility in the midst of operations that is not provided by less strong models.
40 KN	Acceptable for any application

- No distinction is made between aluminum and steel carabiners. Suitability for use shall be determined by breaking strength. Users should be aware that steel generally would resist scratches and dents better than aluminum.
- RROC strongly recommends that all carabiners be rated at least 30 KN breaking strength. Carabiners that are at least 30 KN breaking strength provide flexibility in the midst of operations that is not provided by less strong models.
- All quick-links must be rescue rated, e.g., the Mallion Rapide. Hardware store, non-rescue grade quick links are banned.
- Carabiners must be the standard locking variety. “Backward” locking carabiners and all “auto-locking” carabiners are banned in all rescue systems and personal use where they might become employed in a rescue system. (Auto-locking carabiners will be reviewed again in 2007.)
- Non-Locking carabiners can be used consistent with accepted mountaineering practices. Minimum breaking strength rating 20 KN.

Rope grabs

- Prusiks are the preferred rope system interface. 3-wrap Prusiks will be used for all rescue applications. 2-wrap Prusiks will be used only for personal applications such as ascending or attaching to a personal travel restrict. Whenever a rescue subject is involved, a 3-wrap Prusik will be utilized.
- Gibbs Ascenders™ are banned in rescue systems. Gibbs Ascenders™ may be used in personal climbing systems only.
- No handled ascenders may be used as a rope grab in a rescue system at any time. These devices are for personal use only. This applies to the Wild Country “Hand™”, “Ropeman™” and Petzl Tibloc™ as well.
- Rescucenders™ are acceptable under limited applications only as a rope grab device in a rescue system. The Rescucender™ is never to be used as a part of a belay system. When used as a haul cam, the progress capture device (PCD) should be located between the haul cam and the load. When used as a PCD, there must be absolutely no possibility of a shock force to the system. Use of the Rescucender™ in the PCD role is restricted to expert ^{note1} use only.

Helmets

- Helmets shall meet the ANSI and/or CE standard and be sold for use as a rescue helmet by the manufacturer. Examples of commonly accepted rescue helmets in this classification are the Bullard Advent™, Petzl Ecrin™ series, and the Joe Brown Super Helmet™. (There are others – these are the most common in this county.)
- The following helmets are banned: Petzl Meteor™, all bike helmets, all construction-style hardhats. Others may be added to this list if improper use of inappropriate helmets becomes evident.
- Three- or four-point chinstraps are required. Chinstraps with the capability of releasing under load are strongly recommended.
- Helmets should fit the user properly and the chinstrap should be kept fastened.
- Helmets should be retired in the 5-7 year age range.

Descending Devices

- Figure 8 rappel devices are banned from rescue systems.
- Brake bar racks (also known as rappel racks) that have an open frame should have a welded eye for the attachment point. The coiled, “pigtail” style is not permitted.
- Closed style rappel racks that have a minimum frame strength in excess of 40 KN may be used for all rescue systems. Micro racks must have stainless steel bars, a minimum of 4 bars (one of which is a hyperbar) to qualify. These devices are fine for pick-offs, variable length deviations and short lowers (less than approx. 50 ft.), but they should be used with caution for long drops due to their small mass to absorb friction heat. For general system usage, full-sized, 6-bar racks are recommended and preferred. (A 4-bar/hyperbar full width rappel rack was recently introduced by BMS and will be tested by RROC.)
- The following devices are banned for use in rescue systems and are permitted for personal use and use in pick-off's only: the Petzl 5-bar (open frame) rack, and any other descent device with a rated strength of less than 20 KN.
 - **Note:** For clarification, a pick-off is an emergency expedient with short time constraints and is not considered a “2-person rescue load” for that reason.
- All bobbin descenders, such as the Petzl Stop™ and the SRT Stop™ are banned for use in rescue systems at this time and are for personal use only. They may, however, be used for emergency pick-off.
- The carabiner wrap, carabiner brake bars, and arrangements of carabiners to act as brake bars are banned for use as expedient descent devices. The only permitted field expedient rappel technique using a carabiner only is the Munter Hitch, and the doubled Munter Hitch is preferred and recommended. The Munter Hitch is an emergency rappel technique and is not acceptable as a routine practice.
- Sticht plates, Figure 8 with Ears, and “ATC™” style devices (also known as ‘tubers’, Trango towers, etc.) are approved for personal rappel only. It is strongly recommended that these devices NOT be used for pick-offs.
- “Whale tails” and rappel racks with only 3 bars (or less) are banned as rappel devices.
- The Rock Exotica Alpine Brake Tube is acceptable for lowering loads but is not considered a rappel device.
- Any descent device not covered here must be cleared by RROC prior to use.

Ascending Systems

- The desirable design criteria for any ascending system are:
 - It must grab the rope and allow for upward movement.
 - It should enable the climber to stop and rest while on rope.
 - It should use applied energy efficiently.
 - It must be safe by having strength and back-ups to prevent catastrophic failure.
 - It should never allow a climber to fall or invert.
 - It should use the climber's major muscles for most of the effort.
- Additional ascending system requirements are:
 - 2 gripping points of attachment to the rope must be maintained at all times above the center of gravity.
 - The presence of "Chicken Loops" on a foot sling, although recommended (particularly for inexperienced climbers), does not constitute a gripping point of attachment.
 - If one of the points of attachment is connected to a chest harness, the chest harness must be connected to the seat harness by a tether.

Litters

- Litters and their accessories (e.g., litter wheels, litter shields) must be commercially manufactured. ^{note2}
- Any of the commercially manufactured rescue litters on the market are acceptable, with the strong recommendation that only litters with stainless steel or titanium components be purchased.
- The SKED/OSS II combination is recommended for confined space rescue and Alpine rescue. The Half-SKED/OSS II is acceptable for short duration, horizontal applications only.
- Some "Break-apart" litters must be backed up with webbing or 8 mm accessory cord (minimum) when in use. Any questions contact RROC.

Specialized Equipment

- Climbing "Pro", due to the wide variation in the strength of equipment, is reserved for expert use only^{Note 1} when used in a rescue system. RROC strongly urges proper supervision and training in the use of climbing pro prior to use by rescuers acting in the role of lead climbers.
- The use of hypothermia bags such as the Wiggy's Hypothermia Bag™ is strongly encouraged for patient packaging in extreme cold conditions. Down bags are appropriate only if they can be kept completely dry.
- The Norwegian-made HeatPac™ is recommended for additional warming of patients in cold conditions. Care must be taken in lighting this device in confined spaces due to the amount of smoke that it generates for the first two-three minutes of operation.
- Any specialized equipment not mentioned here must be referred to RROC for consideration.

General Remarks

- All hardware designated for general system usage must be rated to maintain a minimum 10:1 SSSF for the intended load, e.g., a three-person load will require all components to be rated at 30 KN. A 2-person load requires all components to be rated no less than 20 KN.
- Equipment designated for use in a highline main line and tag lines (which function as the belay) must be rated at 40 KN for a highline using 12.5 mm rope and 30 KN for a highline using 11.1 mm rope.
- If a team is using SRT (Single Rope Technique) a 15:1 SSSF is required.
- Training films produced for the purpose of teaching rope rescue should be reviewed by Volunteer Forces prior to distribution and use by SAR teams in order to prevent erroneous and/or obsolete techniques from being promoted.

Belay

- The "540 Rescue Belay" device is provisionally approved for use by teams trained in its use.
- Some type of belay is preferred in personal rappel is required wherever possible. Circumstances may dictate a belay using a separate, untensioned line tended by a belayer. The decision to mandate a belay is left to the judgment of the Operations Officer, the Safety Officer and/or the rescuer on scene. A rescuer who requests a belay will be accommodated if at all possible.
- The tandem triple-wrap prusik hitch with a Load-Releasing Hitch (LRH) system is the preferred rescue belay system.

(Continued)

Belay (continued)

- Mechanical rope grabs such as Gibbs ascenders, Rescuescenders and all handled ascenders are banned in belay systems.
- The following devices are permitted for belay of a lead climber/single person load only: ATC™, Sticht plate, MÜNTER Hitch, Petzl Grigri™.
- Where a standard belay is not possible, a conditional self-belay is strongly recommended and shall be by one of the following methods/devices: An 'autostop' descent device such as the Petzl Stop™, Petzl ID™, SRT Stop™, etc.; Wild Country Hand™, Petzl Shunt™, Guide's Rappel Backup (GRB), Prusik. A bottom belay will provide conditional belay and reduces the necessity for a conditional self belay.

Standards

- A single person load is defined as 225 lbs. or 100 kg. The kiloNewton equivalent is 1 kiloNewton (1 KN)
- A two-person load is defined as 450 lbs. or 200 kg. The kiloNewton equivalent is 2 KN.
- A two-rope pick-off is an emergency field technique that has time constraints, which may preclude the setup of elaborate rescue systems. For that reason, there is a short list of descent devices that may be used for that purpose, which are not allowable in a rescue system under any other circumstances. (See the section on descent devices, above.)
- A three-person load is defined as 600 lbs. The kiloNewton equivalent, for field purposes, is 3 KN. This is also referred to as an "extreme" rescue load.
- A kiloNewton is defined as the force generated by a 100 kilogram mass accelerating at approximately 10 meters per second squared. This is defined by the industry as 224.8 pounds force, and is often rounded off to 225 pounds force.
- The accepted test in the industry for devices in belay is the "Belay Confidence Drop Test", developed by the British Columbia Council of Technical Rescue.

Banned Equipment

This section consolidates all banned equipment and/or practices listed above.

- Mechanical rope grabs such as Gibbs ascenders, Rescuescenders and all handled ascenders are banned in belay systems.
- No home-sewn nylon accessories will be permitted, such as harnesses, slings, pick-off straps, or runners. Only commercially manufactured accessories of this nature are allowed.
- Plastic sheaves are banned on any pulley that might be used in a rescue system. (Synthetic polymers such as Delrin, which are used to make sheaves for pulleys such as the Kootenay Carriage and Russ Anderson KPP are acceptable.)
- Carabiners must be the standard locking variety. "Backward" locking carabiners and all "auto-locking" carabiners are banned in all rescue systems and personal use.
- Gibbs Ascenders™ are banned in rescue systems. Gibbs Ascenders™ may be used in personal climbing systems only.
- No handled ascenders may be used as a rope grab in a rescue system at any time. These devices are for personal use only. This also applies to the Wild Country "Hand™", the Petzl "Tibloc™" and the "Ropeman™" (both versions).
- The following devices are banned for use in rescue systems and are permitted for personal use and use in pick-off's only: the Petzl 5-bar (open frame) rack, and any other descent device with a rated strength of less than 20 KN.
- Mechanical rope grabs such as Gibbs ascenders, Rescuescenders and all handled ascenders are banned in belay systems.

Notes:

1. **Expert use:** is defined for the purpose of these standards to mean under the supervision of a fully accredited Sheriff's Technical Rescue Instructor or SAR member holding at least "Intermediate" rope rescue status.
2. **Exceptions:** will be granted only on a case-by-case basis. Requests for exceptions will be made in writing to the RROC via Volunteer Forces, and must be accompanied by supporting documentation that justifies the request. Examples of appropriate documentation would include third-party test result paperwork, certificates, etc. with phone numbers and addresses where the originator can be contacted. The item in question will be evaluated by RROC and a decision rendered. Until such time as the item in question is approved, it is not to be used for any purpose including missions *or* training.
3. **Modifications:** to these standards may be suggested at any time. Suggestions must be submitted in writing to the RROC via Volunteer Forces and include:
 1. The item to be added, deleted, or changed
 2. Justification for the change
 3. Test data with complete documentation to support the change.