TOPPING OUT

A BSA Climbing/Rappelling Manual

BOY SCOUTS OF AMERICA®

Contents

Introduction

Young people today seek challenges. Climbing and rappelling offer them worthy opportunities to learn new skills, test themselves, and have a terrific time. It's hard to top the satisfaction of climbing a rock face and rappelling down a steep pitch. The introduction of the Climbing merit badge in the spring of 1997 spurred interest in these activities throughout the Boy Scouts of America. The proliferation of climbing areas in Scout camps and the development of artificial walls and alpine gyms across the United States have made the chance to climb and rappel available to Scouts almost everywhere.

Topping Out details the Boy Scouts of America's recommended procedure for conducting climbing and rappelling activities at district and council sites such as summer camps, and at council high-adventure bases. In addition to explaining appropriate equipment and techniques, this manual describes the qualifications and training of the directors and instructors who conduct BSA climbing/rappelling programs at the district and council levels. It also lays out a sample daylong program. (Readers should be aware that this manual provides an orientation only, and by itself does not constitute training in how to climb or rappel.)

There is inherent risk in climbing and rappelling. With proper leadership and adherence to high standards, however, the risk is minimized. Many factors play roles in the BSA's history of safely operating climbing/rappelling activities. Among the most important are these.

- The BSA limits district and council activities to *bouldering, top-roping,* and *belayed rappelling.* The National Project COPE and Climbing/Rappelling Standards (No. 430-008) apply to district and council activities. Units that elect to participate in snow and ice climbing and lead climbing without a top-rope belay should receive training from a nationally recognized organization that trains climbing instructors.
- BSA units that want to conduct their own bouldering, climbing, rappelling, or other related climbing activities should follow the guidelines put forth in Climb On Safely.

ALTHOUGH THE BSA HAS AN EXCELLENT SAFETY RECORD, THERE IS INHERENT RISK IN CLIMBING AND RAPPELLING. TO MANAGE THAT RISK, SCOUTING USES THE PROCEDURES SET FORTH IN TWO CLOSELY RELATED PUBLICATIONS—CLIMB ON SAFELY (FOR UNITS) AND THIS *TOPPING OUT: A BSA CLIMBING/RAPPELLING MANUAL* (FOR DISTRICTS AND COUNCILS).

CLIMB ON SAFELY: THE EIGHT POINTS

1. Qualified Supervision
2. Qualified Instructors
3. Physical Fitness
4. Safe Area
5. Equipment
6. Planning
7. Environmental Conditions
8. Discipline

Climb On Safely and *Topping Out*

To better assure the safety of participants and to standardize the qualifications expected of adults leading climbing and rappelling activities, the Boy Scouts of America has developed Climb On Safely as its recommended procedure for Scouting units conducting BSA climbing and rappelling activities at a natural site or a specifically designed facility such as a climbing wall or tower. Patterned after the successes of the BSA's Safe Swim Defense plan and Safety Afloat, Climb On Safely establishes the guidelines by which BSA unit climbing and rappelling activities are to be directed, and lays out the standards for equipment, sites, methods, supervision, and safety.

By comparison, the BSA's *Topping Out* manual addresses the needs of district, council, and unit climbing and rappelling activities. It is the BSA's most comprehensive publication on relevant aspects of climbing and rappelling. The manual may be a valuable resource for unit leaders in complying with Climb On Safely guidelines.

This manual is not intended to address every climbing/rappelling situation. For climbing and rappelling, the recommended reference is the seventh edition of *Mountaineering: The Freedom of the Hills*, edited by Don Graydon and Kurt Hanson. For caving, the recommended reference is *On Rope*, by Bruce Smith and Allen Padgett.

Climb On Safely establishes the guidelines for effectively and safely managing BSA unit climbing and rappelling activities.

Chapter 1

Standards and Inspections

The National Council of the Boy Scouts of America has developed the standards and inspection procedures detailed in this chapter to help ensure the highest degree of health and safety for participants and staff members engaged in climbing and rappelling activities conducted by BSA districts and councils.

THE COPE/CLIMBING VISITATION TEAM IS EMPOWERED TO INSPECT THE FACILITIES AND ACTIVITIES OF CLIMBING AND RAPPELLING PROGRAMS AND OF PROJECT COPE COURSES.

Frequency of Inspections

- National standards are revised annually, and the frequency and type of inspections must follow the current climbing national standards.
- All council or district climbing/rappelling activities—whether or not they are a part of a district activity, a summer camp, or a council high-adventure operation—must follow these standards and will be inspected accordingly.
- Climbing/rappelling activities may be inspected at times other than scheduled national resident-camp visitations.

Chapter 2

Safety and Leadership

High-adventure activities such as climbing and rappelling involve an element of risk. Because hazardous elements cannot be completely eliminated, the directors and instructors of BSA climbing/rappelling programs must take positive steps to manage that risk. The process includes

- Identifying the true nature of the risks at any given moment,
- Understanding ways participants can minimize or avoid those dangers, and
- Knowing when risk reaches a level at which activities should be postponed, halted, or canceled.

Climbers, rappellers, directors, and instructors manage risk by identifying its causes and tailoring their behavior to minimize the danger. Some risk is inherent in everything we do. As children, we are taught to look both ways (for automobiles) before crossing the street. In climbing and rappelling, checking knots, belays, solid anchor systems, and other methods are used to provide for safety.

Lead Climbing

Lead climbing is beyond the scope of the BSA director/instructor training. In lead climbing, climbers are tied to belay ropes that extend below them. As they climb, they insert chocks or other mountaineering hardware into cracks in the rock, then use carabiners to attach the rope to establish points of protection. Lead climbing requires extensive training and experience. A lead climber is exposed to the risk of falling a considerable distance (as much as 25 feet), so lead climbing may be practiced during BSA council and district activities only if participants are protected with a top-rope belay.

Experienced climbers know that static ropes must never be used to belay lead climbers. A static rope will cause a falling lead climber to absorb instantly the full force of the tumble, greatly increasing the chances of injury and the failure of anchors or other system components.

Identifying Hazards

Possible hazards commonly associated with climbing and rappelling include the following.

Potential Environmental Hazards

- Rain, wind, heat, cold
- Poor condition of the rock face or artificial structure upon which climbing/rappelling will be practiced
- Failure of equipment or anchoring points
- Animals and insects

Potential Human Hazards

- Participants physically or mentally unprepared for the challenge
- Faulty judgment, improper training, or ignorance on the part of participants, directors, or instructors
- Unreasonable expectations by participants, directors, instructors, parents, group leaders, and/or others

When human hazards and environmental hazards overlap, they compound one another and increase the likelihood that an accident will occur. Such an "accident equation" might look like this:

Subjective		Objective		
Human Hazards	+	*Environmental Hazards*	=	*Accident Potential*
Lack of knowledge		Inclement weather		
Poor physical fitness		Damaged equipment		
Emotional distress		Animals and insects		
		Loose rock		

However, when people combine the right attitude and awareness with proper action, the result is a "safety equation" that looks like this:

Attitude	+	*Awareness*	+	*Action*	=	*Safety*
Positive		Knowing what can go wrong		Planning		
Caring		Supervising activities		Training		
Safety first		Teaching others		Intervention		

Responding to Risks

Most climbing accidents result from a combination of circumstances rather than a single factor or event. A director, instructor, or group of participants making one error in judgment may commit other errors as well. The probability of an accident increases as the number of safe alternatives decreases.

Breaking the Chain of Poor Judgment

A key to safety in the field is breaking the chain of poor judgment. The following steps can be helpful in viewing a situation from a fresh—often safer—perspective.

1. Be willing to recognize your own poor judgment.
2. Be aware that a moderate level of stress may sharpen your thinking and judgment.
3. Use problem-solving strengths that optimize choices.
4. Be alert for "groups" of poor judgments, one building on top of another.
5. To help avoid repeating errors, review your original poor judgment as soon as you have "broken the chain."

Accident Prevention

Everyone shares the responsibility for safety—directors, instructors, group leaders, and participants—in climbing and rappelling activities. Help prevent accidents by making sure that

- Everyone takes ownership in having a safe experience.
- Everyone knows and follows the rules.
- Everyone completes a safety orientation or training for each stage of an activity.
- Hazards are discussed and ways of managing them are understood.

Personal Gear Checklist

Preparing for a climbing/rappelling activity begins well before people arrive at a program area. Their comfort and their ability to take care of themselves depend in part on what they carry with them. Each participant and instructor should be advised ahead of time to bring the following items.

- ☐ Clothing, including rain gear, appropriate for weather conditions. It is generally a good idea for beginning climbers to wear trousers to help avoid scrapes and abrasions. (See *Passport to High Adventure*, No. 34245.)
- ☐ At least two 2-quart containers of water (much more in hot weather or at elevation)

Depending upon the duration of the proposed program and upon conditions specific to the site, the following items may also be required.

- ☐ Lunch and/or trail snacks
- ☐ Sun protection, including a broad-brimmed hat, sunglasses, and sunscreen
- ☐ Insect repellent

Everything can easily be stowed in a day pack. Participants may use their own climbing harnesses, helmets, and shoes if they are inspected and approved by a climbing director or lead instructor.

MANY SAFETY ISSUES THAT APPLY TO OTHER OUTDOOR SCOUTING ACTIVITIES ALSO PERTAIN WHEN SCOUTS ARE CLIMBING AND RAPPELLING. DRINK ENOUGH WATER. WATCH OUT FOR POISONOUS PLANTS, BITING INSECTS, AND SNAKES. DRESS FOR THE CONDITIONS—WARM CLOTHING IN COOL WEATHER, LIGHT CLOTHING IF THE DAY IS HOT. KEEP A CLOSE EYE ON THE WEATHER AND BE READY TO LEAVE IF THE SKIES TURN STORMY OR THERE IS LIGHTNING IN THE AREA.

Instructors and Supervision

During BSA climbing and rappelling activities, instructors are the first line of defense against accidents. They will make dozens of decisions throughout the course of a day that may have significant consequences for participants and for themselves. They are often charged with setting up anchors, ropes, and belays; with assessing the needs and abilities of participants; with teaching basic climbing, rappelling, and belaying skills; and with providing participants with thoughtful support, encouragement, and guidance. Through it all, instructors must manage a day's climbing and rappelling in ways that keep events running smoothly, without compromising safety.

Unit leaders should be trained in the principles of Climb On Safely. Councils should comply with the current Project COPE and Climbing/Rappelling National Standards, No. 430-008. A qualified climbing instructor is essential for any BSA climbing/rappelling activity.

Who's Who in BSA Climbing/Rappelling Programs

BSA Council Climbing Chairman

Councils may have separate climbing and Project COPE committees or they may combine the two. The chairman of a standalone committee must possess a valid National Camping School certificate of training for the respective committee. If the committees are combined, there must be both a COPE director and a climbing director on the committee, and one of them must be the chairman. The chairman is responsible for the overall operation of the council's climbing and rappelling program, serves on the council camping committee, and manages the council's climbing staff to provide guidance to all district and council climbing events. The chairman also coordinates all council inspections, maintenance, and record-keeping tasks.

BSA Climbing Director

The director has ultimate responsibility and final approval for all that occurs at a council or district climbing/rappelling site. This person must be at least 21 years of age, have extensive training and experience in climbing and rappelling, have successfully completed a Climbing section of BSA National Camping School within the last five years, and be recognized by the local council as a mature leader and skilled teacher. The certificate of training issued to climbing directors is in effect for five camping seasons. The director need not be on-site for climbing/rappelling activities to proceed as long as a lead instructor is present.

BSA Climbing Lead Instructor

A climbing instructor 21 years of age or older who supervises the climbing/rappelling site in the director's absence is referred to as a lead instructor.

BSA Climbing Instructors

Instructors operate with the supervision of a climbing director or lead instructor. They often manage the day-to-day activities of a climbing/rappelling program. Instructors must be at least 18 years of age. They are proficient in teaching the techniques of climbing, rappelling, and belaying, and have completed a three-day instructor training course. The certificate of training issued to climbing instructors is in effect for two years.

Climbing Instructors-in-Training (IITs)

Instructors-in-training must be at least 16 years of age and may have completed a three-day instructor training course.

For a full list of requirements for directors, instructors, and instructors-in-training, and for information on instructor training courses, see chapter 13, "Staffing and Instructor Training."

Maintaining High Instructor Standards

A climbing director should ensure that candidates seeking positions as instructors are mature, responsible, and able to lead. An instructor's prior experience in Scouting and willingness to be accountable in other areas of life should give some indication as to how the individual might respond to duties as an instructor.

Districts and councils should make every effort to provide instructors who have been thoroughly trained. The three-day course described in chapter 13 of this manual can establish a good foundation of information and a thorough grounding in the methods and standards of BSA climbing and rappelling.

Beyond that, directors should take advantage of opportunities to observe instructors in action, and then to meet with each instructor to review individual performance. In many cases, a director can simply reinforce all that an instructor is doing correctly and provide praise for a job well done. The director may sometimes be able to help an instructor fine-tune certain teaching techniques or ways of interacting with participants, or can suggest alternative methods of dealing with ropes, hardware, and other technical aspects of the program.

Exercising Good Judgment With Instructors

On rare occasions, a director may determine that an instructor is not acting in a manner fully in keeping with the precepts of BSA climbing and rappelling. It might be a matter of insufficient technical skill, an inability to relate well with participants, a desire to show off at the expense of others, or an unwillingness to comply with the standards of safe climbing and rappelling.

Whatever the cause for concern, the director must deal with the situation immediately, basing a response upon the particulars of each case. Certainly it is appropriate for a director and another adult member of the district, council, or council high-adventure base to speak with the instructor in order to better understand the issues. However, a director who has concerns about an instructor's ability to manage climbing and rappelling activities should remove that instructor from the program pending further discussions and a plan for added training, greater supervision by more experienced instructors, or the decision that the person should no longer instruct.

Removing an instructor from a program can be distressing for a director, especially if friendships are involved or the absence of the instructor will limit the program that can be offered by the rest of a climbing/rappelling staff. However, directors must be objective when making decisions about who will be given responsibility for the safety of young people climbing and rappelling. No director would allow a program to continue knowing that a rope was badly frayed or an anchor was suspect.

Instructors are every bit as vital to the safety of participants as are ropes and hardware. Directors should never allow a program to proceed unless they have full confidence in the instructors they have put in charge.

Physical Fitness

Climbing and rappelling can be most fully enjoyed by youth and adults who are in good physical condition. Flexibility, strength, and endurance are all important. Those planning to take part in climbing and rappelling should get in condition through regular exercise and good health habits. The minimum evidence of a person's fitness for any climbing or rappelling activity is Parts A and C of the current BSA Annual Health and Medical Record, No. 34605, plus screening by a licensed health-care practitioner.

Directors and instructors should always be ready to adapt their teaching methods, group supervision, and experiential opportunities to anticipate potential risks associated with the health conditions of individuals under their direction. Anyone with a health condition that could significantly impair

safety may be required to undergo a further examination by a physician before being allowed to take part in climbing and rappelling activities. The BSA climbing director should also ensure that all instructors are informed about medical conditions that may affect the behavior, safety, or experience of any participant.

Be Prepared

Know what to do in the event of an accident by having a written emergency response plan. (For details on developing such a plan, see chapter 12, "Incident Resolution, First Aid, and Emergency Response.")

Rules of Safety

All participants and group leaders must follow safety guidelines presented by BSA climbing directors and instructors. Among those rules are the following.

General Safety

- Whenever participants are climbing or rappelling, there must be a suitable first-aid kit on-site and a means of emergency communications (radio, portable telephone, etc.).
- Helmets that are UIAA- or CEN-approved must be worn during climbing or rappelling activities, including while setting up and taking down anchors and ropes.
- District and council climbing and rappelling activities must operate with a BSA climbing lead instructor or director present.

Clothing

- Clothing should permit a full range of motion but must not be so baggy that it could catch on rock outcroppings or tangle in belay or rappel systems.
- Clothing should be appropriate for the weather. Layering is important for adapting to changing atmospheric conditions and for the mix of exertion and inactivity common at climbing areas.

Shoes

- Athletic shoes or light hiking boots are acceptable for most outdoor climbing/rappelling activities. Sandals and open-toe footwear are not acceptable.
- Climbing shoes can be worn in most climbing/rappelling areas, especially by more advanced participants. Special shoes may be required for wear at commercial indoor climbing gyms. (They are usually available for rental.)

Hair

Tie back long hair and tuck it under the helmet or shirt.

Jewelry and Accessories

- Remove all sharp objects (pens, combs, etc.) and any items that could fall out of pockets.
- Remove all jewelry, including necklaces, watches, bracelets, earrings, and rings.
- Remove belt buckles and scarves.

Safety Rules for Directors and Instructors

- Directors and instructors must follow all safety rules expected of climbing/rappelling participants and should at all times set a good example. Make no assumptions when it comes to safety.
- Give participants a safety briefing before activities begin, and be sure everyone understands the message being conveyed.
- Keep a constant eye on environmental and area conditions.
- Inspect anchors and hardware in the belay system before beginning each belay.
- Double-check harnesses, helmets, carabiners, knots, and clothing before allowing any participant to take part in belaying, climbing, or rappelling.
- Position an instructor near each belayer to assist in case of emergency.
- Continuously supervise participants while they are engaged in rappelling, climbing, and belaying.
- Terminate climbing/rappelling activities in the event of unsafe weather, including lightning, high winds, darkness, or any other condition that may present a hazard to participants, instructors, or the director.
- In case of emergency, follow the established written emergency plan.

Safety While Belaying, Climbing, and Rappelling

- Use only commercially made belay and rappel devices: a slotted plate (Sticht belay plate), a tube belay device, or a specialized belay device such as the Grigri. A Just-Right descender or Münter hitch also are acceptable.
- Use a figure eight follow-through knot with a safety knot to tie a belay rope to a climber's or rappeller's harness.
- Rappellers may wear leather-palmed gloves that fit well so that their hands are protected and they can feel the rope.
- Participants use the correct verbal signals whenever they are climbing, rappelling, or belaying.
- Monitor each belay rope to discourage anyone from stepping on it and to keep it from tangling.
- The belayer must keep the brake hand on the belay rope throughout the time a participant is on belay.
- The use of backup belayers is recommended.

Safety While Bouldering

- At least two properly trained spotters must be in position whenever a participant is bouldering.
- Anyone who climbs higher than shoulder height should have a top-rope belay.

Safe Supervision and Instruction

- A BSA climbing director must be available during climbing or rappelling activities to respond to any emergencies, or must assign a qualified, responsible adult to fill that role.
- A minimum of two instructors must be on-site to supervise any climbing or rappelling activity. The ratio of participants to instructors must not exceed 6-to-1. (**Note:** This maximum ratio assumes that conditions are

ideal. An instructor or director may determine that activities require a higher ratio of instructors to participants if, for example, participants are especially inexperienced.)

- At least one staff member at the program site must be currently trained in first aid and cardiopulmonary resuscitation (CPR), and physically present whenever the program is in operation. Program sites located on BSA property must allow for emergency evacuation in a reasonable length of time. If emergency evacuation is more than 30 minutes by ground transportation, then a staff member trained to a minimum level of Wilderness First Aid (16 hours) must be present on the program site.
- Instructors must never leave participants unattended during climbing or rappelling activities.
- Instructors and directors are the final judges of whether safety is being jeopardized by environmental conditions, group behavior, or any other factor. Instructors and directors may suspend activities at any time to ensure that safety is not compromised.
- Participants must never be coerced or pressured into attempting any activity. Encouragement and recognition of accomplishment may be offered, but the final decision to take part in an activity is up to each participant.

Youth Protection in the Climbing Environment

❶ As with any Scouting activity, leaders of groups engaged in climbing and rappelling should have completed BSA Youth Protection training. Each local council has materials about this important training.

❷ Two-deep adult leadership must be present at all times during BSA climbing/rappelling activities. (For more on two-deep leadership, see the *Scoutmaster Handbook*.)

❸ Participants in climbing/rappelling activities are to be paired with one another so that they can use the buddy system to help ensure their safety. Buddies offer each other encouragement and assistance; double-check their partner's harnesses, knots, and belay or rappel devices; and watch out for the best interest of others.

❹ Hazing, ridicule, and inappropriate teasing are prohibited. Group leaders and instructors must take strong steps to discourage these actions as soon as they appear.

Universal Access

BSA policy states that access to climbing sites and facilities suitable for universal access should be provided to persons with disabilities. Adult leaders sensitive to the needs of and familiar with the condition of any individual with a disability should accompany the group.

Challenge by Choice

"Challenge by choice" is a key principle of both Project COPE and BSA climbing/rappelling. Each person may choose which activities to participate in without being pressured or coerced by the group and without having to justify a choice. The group must accept each individual's choice.

Before a group participates in any climbing/rappelling activity, it is crucial that instructors give an orientation that is honest, is to the point, and encourages participants to be willing to share any concerns or needs. Such an orientation might sound something like this:

"This climbing site (or facility) offers a variety of challenges. You may participate in any or all of these challenges, or you may decide not to take part in any or all of them. The decision is yours alone.

"Climbing and rappelling can be exciting and challenging. These activities might seem frightening at first. You may be anxious about how well you will do or about what others will think of you. At times you may be outside your comfort zone. While climbing and rappelling will challenge you and encourage you to explore your abilities, you can say no to any activity at any time. No one will pressure you to do anything you do not want to do.

"Please ask yourself, 'What do I need to feel safe mentally and physically?' Before beginning any activities, we will practice how to spot and belay one another so that we can climb and rappel as safely as possible. If you have any questions about how you will be protected while climbing and rappelling, be sure to ask. By understanding the safety systems and techniques, you can better decide if you wish to participate.

"The instructors are familiar with your medical forms and have found no conditions that should limit your involvement in climbing and rappelling. However, if you have any health concerns or if there is anything we can do to further ensure your health and safety during climbing and rappelling, let an instructor know, either now or privately before the activities begin."

Setting Goals

Before engaging in climbing or rappelling activities, instructors should ask each participant to decide on a level of challenge, ranging from 0 (no challenge) to 10 (highest level of challenge). Goals should be desirable (consistent with the ideals and values of the Boy Scouts of America), realistic (not too difficult or too easy), achievable (capable of being accomplished by this participant), and measurable (it can be decided whether and to what degree the goal has been met).

Sometimes the goal may be imposed by an instructor acting as a facilitator, or it may be implied by the structure of the climbing facility. In many cases it may be more effective to have each participant determine a personal goal and level of challenge. Even though some participants might not have taken part in climbing/rappelling activities before, encourage each participant to estimate what he or she can do. Before engaging in a group discussion about doing either a high-challenge or a low-challenge activity, each individual in the group should complete these sentences:

1. Today I can easily _____.
2. It will be a risk or challenge to _____.
3. I cannot imagine doing _____.
4. The support I need from each of you is _____.

These questions have no wrong answers. All participants should be valued for their individual choices. The group should not impose its goals on anyone without that person's consent.

Debriefing

Debriefing following each activity can help participants and groups reinforce what they have learned and apply that knowledge to future performance. An instructor can facilitate debriefing with questions such as these.

- What was your goal for this activity?
- Who set the goal? (An individual? A leader? Part or all of the group?)
- How realistic was your goal?
- What was your plan for accomplishing the activity?

- How did you come up with the plan?
- Did everyone participate actively? Why or why not? (Participation can be in the form of belaying, spotting, rope handling, etc.)
- What did you learn from this activity?
- What would you do differently next time?
- How does what you learned in this activity apply to what you do in school or work, in your group, or in your community?

Open-ended questions rather than those answerable with a simple yes or no will help group members express their own ideas. If participants are shy about responding, the facilitator may encourage sharing ideas by telling participants: "This is what I saw and heard, and these are some of my impressions of your group climbing and rappelling. I wonder how you feel about... "

While simply completing a climbing/rappelling activity can be exciting for participants, the real benefit comes as group members reflect upon what just happened, how they responded, what went well, and how they could more effectively work together.

Getting There Safely

The risks associated with climbing and rappelling can help a group focus on safety issues during its time at a climbing area. Just as important is traveling safely to and from the area, whether on foot or by motor vehicle. The BSA publication *Passport to High Adventure*, No. 34245, discusses issues and considerations for Scouting units traveling to and from events of all sorts.

Leave No Trace

Always practice the principles of Leave No Trace when climbing/rappelling, especially when using a natural site. These principles frequently come into play when climbing, rappelling, or bouldering. Make sure your group is prepared to practice outdoor ethics before you go.

Plan Ahead and Prepare

- Find out the allowable group size specified by the land manager or owner, and stay within the prescribed limits.
- Where necessary, obtain permits and check regulations for the area.
- Take clothing appropriate for the time of year and the area. Be prepared for windy, shady, and sunny rock faces, as well as inclement weather.
- Carry small plastic bags for packing out litter and refuse.
- Take removable protection or use natural anchors whenever possible.

Travel and Camp on Durable Surfaces

- Drive on designated roads and use established parking areas.
- Help keep natural sites intact by staying on durable surfaces such as rock, gravel, sand, compacted soil, hard-packed snow, and previously used sites.
- Use care when accessing a climbing site to avoid trampling plants, causing erosion by ascending steep routes, and breaking limbs or shrubs. Whenever possible, use existing trails or routes.

Dispose of Waste Properly (Pack It In, Pack It Out)

- Carry out food waste, scraps, and litter.
- Dig catholes at least 200 feet from trails, bases of climbs, water sources, and campsites. Dig catholes in areas exposed to the sunlight.
- Where there is no place to dig a cathole, carry out human waste in a pack-it-out kit or plastic waste-disposal bag.
- Carry a knife to remove old, unsafe slings you find.
- Avoid using chalk whenever possible, or use chalk that blends with the rock.

Leave What You Find

- Stay away from petroglyphs and pictographs, and leave artifacts for others to see.
- Do not touch rock art. Federal regulations protect all archaeological sites and artifacts, and touching them tends to hasten deterioration.
- Leave antlers, fossils, and plants for others to enjoy.

Minimize Campfire Impacts

- Whenever possible, use a lightweight stove instead of a fire. Warm clothes and hot food can keep you warmer than a fire.
- If a fire is necessary, use an existing fire lay.
- Use dead and downed wood that can be easily broken by hand.
- Make sure the fire is cold out before you leave.

Respect Wildlife

- Stay well away from nesting sites on or near crags in the spring and early summer.
- If you encounter a nest on a climb, don't touch it. Human contact may cause adult birds to abandon the nest, eggs, or young.
- If wildlife alter their habits when you approach, you are too close. Back away slowly.
- Store food and garbage where animals cannot get it so they will not acquire bad habits.

Be Considerate of Other Visitors

- Thoughtful climbers respect other visitors and give them plenty of space.
- If your intended climbing site is being used, find another site or return when that group is finished.
- Keep noise down and leave pets at home.
- Make sure the colors of your clothing blend with the environment.
- Be considerate of other climbers and respect their privacy.

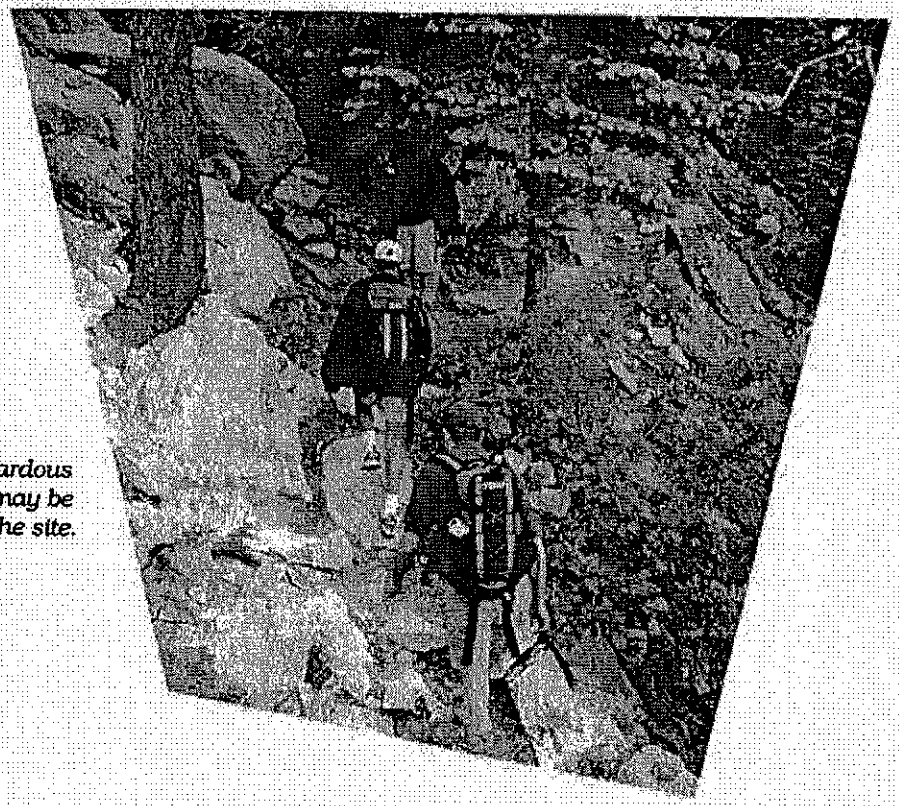
In Conclusion

Those new to challenging activities such as climbing and rappelling may find these exercises daunting at first, and perhaps even frightening. Many participants may be anxious about how they will respond to the vertical environment and whether their safety can be assured.

An important role of instructors and directors is to provide support and information for all participants at levels appropriate to their needs. Understanding how anchors are set and belays are secured can help participants enjoy climbing and rappelling without unreasonable concern. Directors and instructors who teach the correct methods of climbing, rappelling, and belaying are helping Scouts develop technical expertise and self-confidence that will increase their sense of achievement and well-being.

Ultimately, the goal of climbing and rappelling activities is not for every person to reach the top of a climb or for everyone to rappel successfully down a face, but rather to provide participants with opportunities to explore their skills, expand their abilities, and feel an increased pride in their accomplishments. For some, that may involve simply roping up and managing to climb a few feet above the ground. For others, it can mean completing complicated routes and perhaps meeting the requirements for the Climbing merit badge.

It is up to each person to determine how far he or she is willing to go. Instructors and directors provide opportunities for Scouting youth to achieve more than they think they can; from then on, the choice to proceed is always up to the individual.



One of the most hazardous aspects of climbing may be getting to and from the site.

Chapter 3

Equipment

The gear used for climbing, rappelling, and belaying has been developed over more than 150 years of serious mountaineering. The UIAA (Union Internationale des Associations d'Alpinisme) is a group of mountain travel experts who set standards and testing procedures for climbing equipment. The European Committee for Standardization (known as the CEN) serves as a similar standard for excellence. All ropes and hardware used by Scouts or Venturers for climbing, rappelling, and belaying must be designed for climbing and/or have UIAA, CEN, or National Fire Protection Association (NFPA) approval. Almost all climbing equipment sold by reputable dealers has that approval, but insist upon seeing proof, usually in the form of a brochure accompanying a new piece of gear or the UIAA or CEN stamp somewhere on an item. Unless participants can demonstrate adequate knowledge in proper equipment use, climbing instructors should always ensure participants receive proper instruction.

PERSONAL HELMETS, HARNESSES, AND SHOES MAY BE USED WITH THE APPROVAL OF THE CLIMBING DIRECTOR OR LEAD INSTRUCTOR. PERSONAL ROPE AND HARDWARE MAY NOT BE USED BECAUSE THE HISTORY OF ITS USE IS UNKNOWN.

Procurement

All equipment for climbing and rappelling must be made specifically for these activities and must be acquired new from reputable suppliers.

These sources of equipment **ARE *NOT* ACCEPTABLE:**

- **Army surplus.** Military gear has specifications different from equipment for climbing and rappelling. The history of individual items may be unknown. **Do not use army surplus equipment.**
- **Fire and rescue equipment.** Firefighters and rescue teams sometimes give away used equipment. However, a single hard use under the extreme conditions of fire fighting or rescue operations can make an item unsafe. **Never accept this type of equipment, even if it has been used only once.**

Visual and Formal Inspections of Gear

Determining the condition of gear to be used for BSA climbing/rappelling requires two levels of safety inspection—visual and formal. The two levels give maximum opportunities for discovering problems with gear that may have arisen since its last use and for observing any long-term wear or deterioration caused by use or exposure to stresses such as weather.

Never modify or alter a climbing harness or any other item of climbing equipment because this may render it unsafe and remove the manufacturer's warranty.

Visual Inspection

A climbing instructor or director must visually inspect all climbing/rappelling equipment just before it is put into use. No one may climb or rappel until every item of equipment that will be used has been found to be in satisfactory condition.

Instructors and directors conducting visual inspections should look for anything that could indicate a problem with a piece of equipment—frayed webbing or harnesses, damaged hardware, etc. Give every rope an inch-by-inch hand and eye examination. (For more on ensuring that rope is safe, see chapter 4, "Rope and Rope Handling.") Any piece of gear that arouses suspicion must be put aside pending a more thorough inspection to determine whether the item in question should be removed from the inventory for proper disposal.

Formal Inspection

Equipment, facilities, staff qualifications, and training, as well as operation of the program, should be reviewed during the annual summer camp visitation. This inspection must be conducted by a trained regional climbing/rappelling inspector or Project COPE inspector. The Project COPE visitation team is empowered to inspect both climbing/rappelling and Project COPE facilities and activities. The climbing/rappelling site is also inspected annually by a climbing director and members of the council climbing committee. Climbing/rappelling program sites or facilities on council property that are not part of a summer camp operation must be inspected at least once a year by a trained climbing director or inspector from outside the BSA local council. A BSA regional visitation team submits written recommendations to the council identifying facilities, procedures, and instruction techniques that need to be changed.

In addition to examining climbing and rappelling equipment, the semiannual inspection may also consider the appropriateness and safety of the following:

- Program sites
- Program equipment
- Program administration
- Staff qualifications and training
- Participant prerequisites
- Program safety procedures
- Instruction techniques
- First-aid and emergency procedures

Record Keeping

Records must be maintained on all aspects of all BSA climbing/rappelling activities. These records can provide valuable information for future program planning, for accurate management of equipment, and for assessing the appropriateness of climbing areas. Each piece of climbing equipment should be marked so that its history can be tracked, and an accurate record must be kept from the time of its procurement, through its daily use, and to its eventual retirement. The record includes a description of the piece of equipment and describes any unusual incidents in which it has been involved.

The most detailed records should be kept for ropes, helmets, and harnesses. Forms for tracking the histories of helmets, hardware, and harnesses are in this chapter. The form for documenting the history of a rope is located in chapter 4, "Rope and Rope Handling."

Helmet and Hardware Record

Photocopy this form and use it to maintain a record throughout the life of each helmet and hardware item used in BSA climbing/rappelling activities.

Item No. ______________________ Purchase date ________________ Put in service (date) ____________________

Size __________________________ Color _______________________ Brand ____________________________

Supplier ____

Date Used	**Where Used**	**Circumstances of Note**

Harness Record

Photocopy this form and use it to maintain a record throughout the life of each harness used in BSA climbing/rappelling activities.

Harness No. ____________ Purchase date ____________ Put in service (date) ____________

Size ____________ Color ____________ Distinguishing markings ____________

Brand ____________ Supplier ____________

Date Used	**Where Used**	**No. of Users**	**Circumstances of Note (hard falls, bad weather, etc.)**

Hints for Marking Equipment

- **Helmets.** Write identifying numbers and the date of purchase inside with a permanent marker.
- **Hardware.** *Never* scratch or file marks on carabiners, belay or rappel devices, or other hardware. Instead, place colored tape on a part of the hardware that will not interfere with its function. The color can be keyed to the item's year of purchase. (Hardware can sometimes be purchased in various colors, which may aid in tracking its history.)
- **Harnesses.** Mark a number and the date of purchase on the label of each harness but not on the waist belt itself, where the ink might affect the integrity of the harness.

Organizing Equipment Records

A useful format for keeping climbing/rappelling records is a loose-leaf binder divided into sections for various types of information. Pages can be added over time. Districts and councils may also be able to draw upon the skills of computer-literate volunteers to set up computer programs for their record keeping.

Equipment records usually have three major sections.

- The first section contains the usage records for helmets, harnesses, and ropes. It also contains information on other items in the climbing/rappelling cache—carabiners, webbing, rappel devices, etc. For each item, write down the size, type, brand name, supplier, date of original purchase or initial service, and descriptions of any significant stresses the item has sustained.
- The second section contains the outcome of each semiannual inspection, noting results, recommendations, and the verification that any recommended maintenance or replacement has been completed.
- The third section contains records relevant to participants and staff members. It is made up of rosters and dates of participation, records of accidents or close calls, medical information/informed consent forms, participant evaluations and suggestions, and staff debriefing records.

Record-keeping procedures should be reviewed by council and area inspection teams.

Retiring Equipment

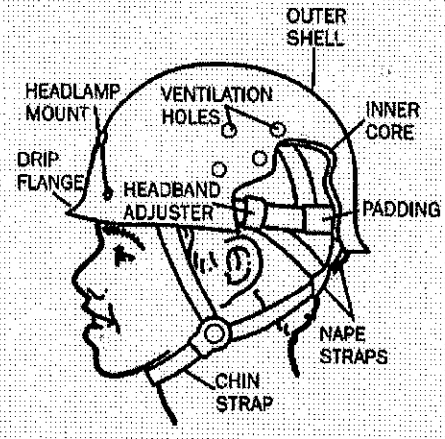
Equipment that has been damaged or has reached the end of its safe lifetime must be rendered useless by altering it in such a way that it can never be accidentally used for any climbing, rappelling, or belaying activities. Never give away retired equipment; that leaves open the possibility of its being put back into service.

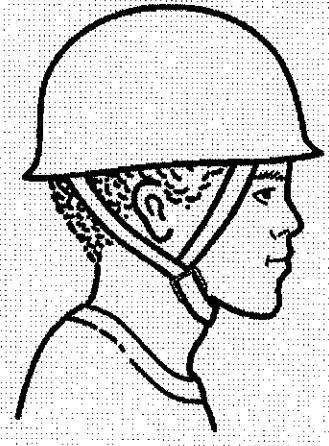
- **Carabiners**—Retire by breaking off the gates to render them unusable.
- **Harnesses**—Retire by cutting apart with scissors.
- **Ropes**—Retire by cutting into 15-foot or shorter lengths.
- **Helmets**—Retire by snipping edges with a cutter, then smashing them and cutting out the webbing.

Helmets

Every participant in any BSA climbing/rappelling activity must wear a helmet that is UIAA- or CEN-approved for climbing. Other kinds of helmets such as those intended for bicyclists, cavers, or football players are not specifically designed for climbing and are not acceptable.

FIG. 1. CLIMBING HELMET FEATURES





The helmet should be properly fitted and adjusted.

Climbing helmets protect heads from falling rocks and gear, and from contact with the climbing surface. Participants may complain at times that helmets feel hot or uncomfortable, but the assurance of increased safety far outweighs any minor discomfort. Instructors should see that every participant's helmet is adjusted to fit well. Never allow a helmet to be worn tipped back to expose the forehead.

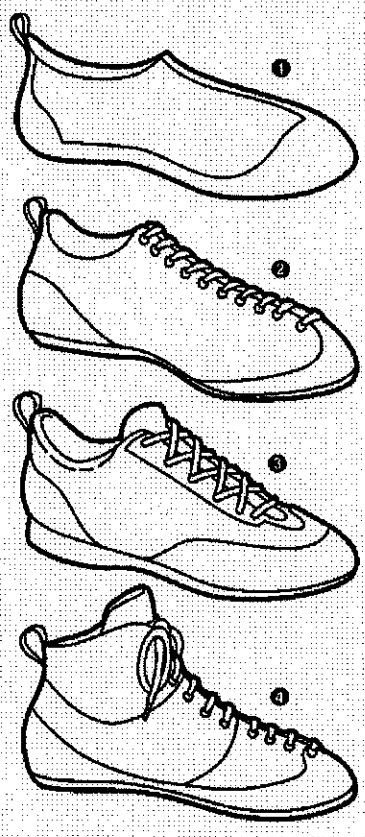
When selecting helmets, consider ventilation, ease of adjustability, and color (dark colors absorb heat; light colors reflect it). A distinctive color used for the helmets of climbing instructors can help provide immediate identification.

All climbing helmets must be retired according to the manufacturer's recommendations, or sooner if one shows signs of wear or if it has sustained significant impact. Follow any additional manufacturer's guidelines for retiring helmets.

Gloves

Some climbers and most rappellers prefer to wear gloves. If worn, gloves must be properly fitted with leather palms. Gloves help protect hands from nature's cold and friction's heat. Some gloves have reinforced palms that will provide additional protection against the heat caused by friction. The climbing director will decide the appropriate use of gloves at the site.

FIG. 2. ROCK SHOES



1. *Climbing slipper*
2. *Friction shoe*
3. *Edging shoe*
4. *General-purpose shoe*

Shoes

Beginners may climb and rappel in athletic shoes, lightweight hiking boots, or other fully enclosing shoes. Avoid shoes with slick soles. Sandals and thongs are not acceptable, as they provide no lateral support. Due to the risk of injury, do not let participants climb barefooted.

Serious climbers may want to purchase shoes made especially for climbing. Commercial climbing gyms often require that special climbing shoes be worn, and likely will have appropriate footwear available for rent.

The world of climbing shoes is understood by a few proficient climbers. For avid climbers, different kinds of climbing surfaces require different kinds of shoes. Fit is as important as function, and climbers usually opt for tight shoes worn without socks, sacrificing comfort to maximize the ability of their feet to "feel" holds on the rock and help maintain footholds.

Among the choices of shoes available to climbers are the following.

Climbing Slippers. Slippers are very thin, are often held in place by elastic tops, and are popular at indoor climbing areas. However, they provide little support, depending instead upon the muscles of a climber's feet to do most of the work. Beginners should avoid using slippers.

Friction Shoes. Friction shoes are highly flexible so that the sole of the shoe can smear against the rock. Smearing increases the friction between the shoe and the rock, allowing a climber to adhere better to steep pitches.

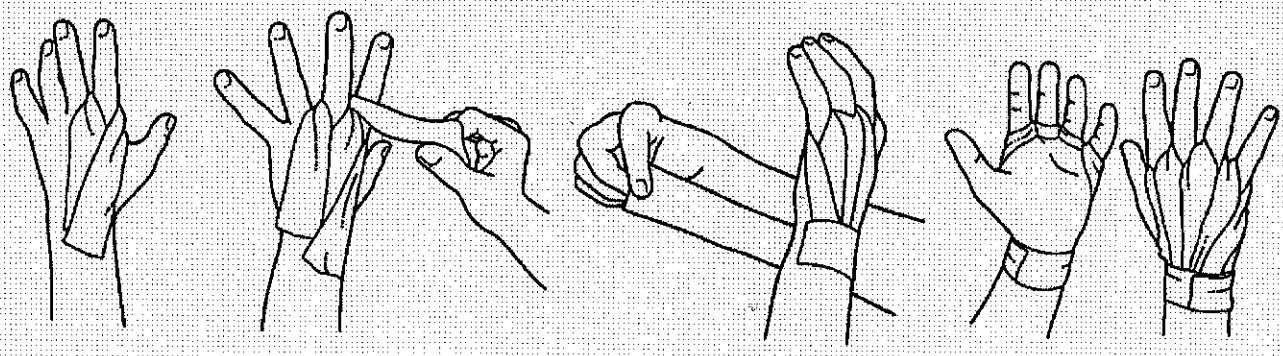
Edging Shoes. Good edging shoes should enable a climber to stand on a hold no wider than the thickness of a quarter. Since their feet may not have the strength required to hold their weight, beginning climbers can benefit from stiff footwear such as edging shoes.

General-Purpose Shoes. No shoe matches all the situations a climber may encounter, but general-purpose shoes try to offer a little of everything. The stiff sides of the soles can be used for edging, while the soles themselves work well for smearing during friction climbing.

Tape

Many climbers use athletic tape to shield their hands from abrasions, especially if they expect to use jam holds. There are a variety of taping techniques, but the basic idea is to cover knuckles and other parts of the hand that could be injured by grinding against rough surfaces. The tape should not be applied too tightly, but should be secure enough not to come loose at inopportune moments.

FIG. 3. HAND TAPED FOR CLIMBING



Back of hand and knuckles are protected; palm is mostly left open.

Chalk

Some climbers use gymnastic chalk (magnesium carbonate) to remove moisture or sweat from their hands and give them a more secure grip on holds. Attached to waist belts or climbing harnesses, chalk bags containing loose chalk or chalk balls (a fine mesh ball with chalk inside) are common ways of carrying chalk. (A homemade version of a chalk ball can be made from the cutoff toe of a nylon stocking.)

A drawback to chalk is that climbers using it leave traces on the holds they grip. Because it is visible on the rocks, chalk use conflicts with Leave No Trace principles. Not only does it look unnatural, it also marks the handholds of popular climbing routes and removes the challenge of guesswork for subsequent climbers. Whatever the case, climbers should always follow local regulations concerning chalk use.

Carabiners

Carabiners are the essential connectors of belay and rappel systems. Most carabiners are made of aluminum alloy or high-grade steel. A spring-loaded gate allows a carabiner to be snapped onto a rope or piece of webbing.

Carabiners are either *locking* or *nonlocking*. They are further distinguished by their shape—oval-shaped, D-shaped, or pear-shaped.

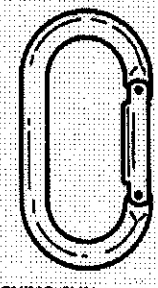
Locking Carabiners

Locking carabiners have mechanisms for guarding the gate when it is closed. The lock can vary from a simple threaded collar that screws down over the gate, to spring-loaded, automatic-locking devices securing the gate in such a way that there is less chance of it accidentally opening. Use locking carabiners for joining belayers to anchors and belay devices, and rappellers to rappel devices. Before anyone begins a climb, rappel, or belay, double-check to be sure that each locking carabiner is, indeed, locked.

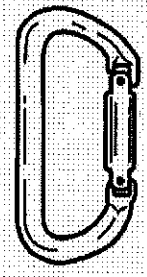
Double-Locking Carabiners

A double-locking carabiner requires two actions to unlock its gate. A visual and physical check is required to be sure the gate is closed.

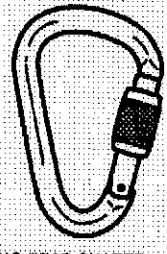
FIG. 4. CARABINERS



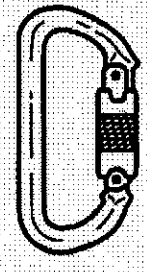
NONLOCKING OVAL



NONLOCKING D-SHAPED

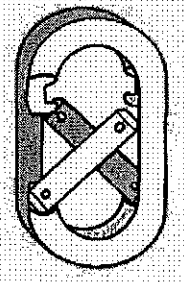


LOCKING PEAR-SHAPED



LOCKING D-SHAPED

FIG. 5. NONLOCKING CARABINERS, WITH GATES REVERSED



Nonlocking Carabiners

Unlike a correctly closed locking carabiner, the gate of a nonlocking carabiner may accidentally open if it pushes against a rock, a rope, or even a climber's clothing. The dynamics of a hard fall arrested by a rope running through a carabiner can cause *gate lash*—the momentary opening of a carabiner's gate due to the gate's inertia overcoming the spring tension, or collision of the carabiner against another object, or the vibration of the rope over the carabiner.

If a load comes onto a carabiner at the instant the gate is open, carabiner failure may occur. (A carabiner with its gate open typically has less than 50 percent of its rated, gate-closed strength.) Using carabiners with locking gates or using pairs of carabiners will significantly reduce this type of carabiner failure. When two nonlocking carabiners are used together, the gates should be reversed so that when they are pressed open the gates form an X. That orientation will prevent both carabiners from being accidentally opened at the same time.

Bent-Gate Carabiners

Bent-gate carabiners have a concave gate that makes them easy to clip onto ropes and slings. They are used primarily for lead climbing and sport climbing, and are not appropriate for most BSA climbing/rappelling activities.

BEWARE OF LOOK-ALIKES

Be aware that some carabiner-like items are designed for uses other than climbing—key rings, accessory holders, etc. Allow no carabiners or carabiner-like items on a climbing/rappelling site except those of known history, strength, and appropriateness for use by climbers, rappellers, and belayers.

Carabiner Care

Keep carabiners dry and clean, and protect them from corrosion. Do not store carabiners in humid or salty air, with damp gear or clothing, or near corrosive chemicals. Do not file carabiners for any reason. Surface burrs may be removed with 220–400 grade sandpaper, but if that does not remove a burr, retire the carabiner. The sleeves of locking carabiners can become difficult to operate due to grit or damage to threads, springs, or hinges. If a carabiner sticks, wash it in warm soapy water, rinse and dry thoroughly, then lubricate with dry graphite around the hinge area, inside the spring hole, and in the locking mechanism.

Accessory Cord

High-strength accessory cord, 7 to 9 millimeters in diameter, may be helpful as a self-locking Prusik to provide a backup system for newly trained rappellers. A 20- to 25-foot length of 7-millimeter accessory cord can be used to tie a cordelette to equalize the load among anchor points. A short piece also may be helpful for rescues where one or both hands may be needed to assist a student or accident victim. At no time should accessory cord be used as a substitute for a climbing rope. Most accessory cord is static in that it has a minimal stretch. Accessory cord requires the same care as rope.

Harnesses

Harnesses give climbers, rappellers, and belayers a secure way to attach themselves to ropes and belay anchors. In case of a fall, the loops and waist belt distribute a person's weight in several directions, making a harness more comfortable and much safer than a tied harness.

Climbing harnesses have evolved over the years to become as comfortable as they are safe. They are constructed of a waistband and leg loops, which absorb some of the load when a person is suspended. Many harnesses simplify belaying and rappelling by virtue of having a belay/rappel loop permanently fixed to the harness.

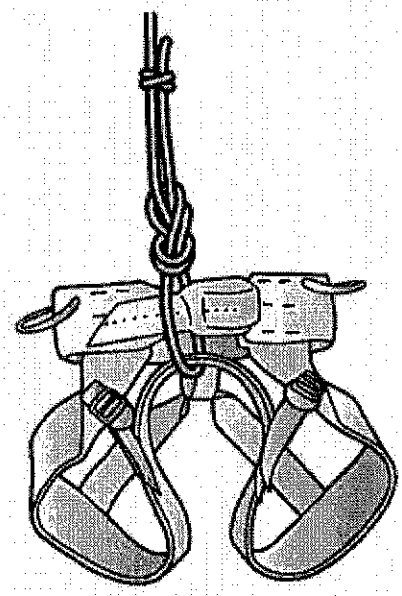
Kinds of Harnesses. Commercially made harnesses are available in a variety of designs, most notably the waist-belt/leg-loop style (sometimes called "sit" or "seat" harnesses), diaper style, chest, fully adjustable, and full body style.

Waist-Belt/Leg-Loop Style Harnesses (Commercially Made Harnesses)

These are the most common commercially made harnesses and are often the most comfortable. A waist belt with a buckle closure and the leg loops are held together by a belay loop made of strong webbing. The leg loops may be adjustable and, like the waist belt, padded for comfort.

The belay loop serves as an attachment point for rappel and belay devices. Follow the manufacturer's recommendation for attaching to a harness.

FIG. 6. COMMERCIALLY MADE HARNESS



Chest Harnesses

A chest harness can provide additional support to a leg-loop harness in special situations—for example, when ascending or rappelling while wearing a pack. Chest harnesses must always be used in combination with a tied-seat harness or commercial harness.

Fully Adjustable Harnesses

Adaptable to a wide range of body sizes, the fully adjustable harness is made from a single piece of webbing that wraps around the legs and continues to the waist. Leg loops must be adjusted snugly to prevent slack from migrating to the waist.

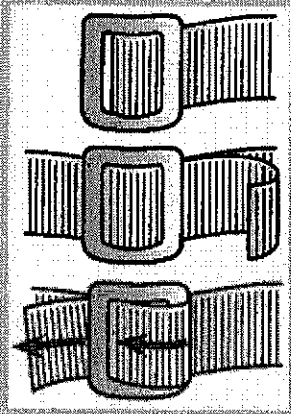
Full-Body Harnesses

Full-body harnesses incorporate chest, back, and shoulder support. Young participants whose hips are not developed enough to hold a normal harness in place should use a full-body harness, as should any individual whose waist is too large for proper positioning of a harness waist belt.

BUCKLE UP!

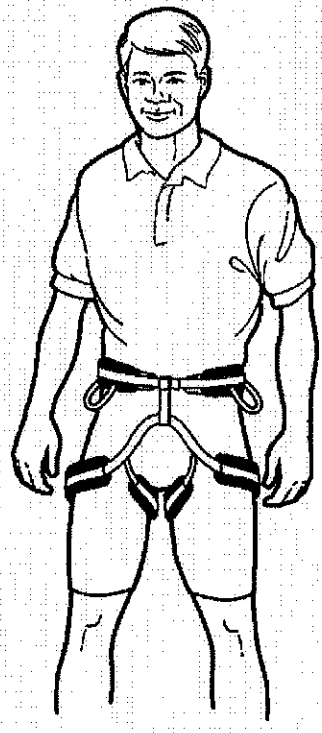
Before allowing a person to climb, rappel, or belay, double-check to be certain that the end of the harness belt has been properly secured according to the manufacturer's specifications. In most cases, that involves threading the belt back through the buckle. More than a few experienced climbers have become fatalities because they overlooked this essential safety principle.

FIG. 7. BUCKLING A HARNESS



Secure the end of the harness belt by doubling it back through the buckle.

FIG. 8. CORRECTLY FITTED HARNESS



Fitting Commercially Made Harnesses

Even the most carefully designed and cushioned harness will not be secure if it is too big or too small, nor will it be comfortable. If a harness is too tight, it will restrict movement and can pinch. A loose harness may slip and chafe; in an inverted fall, a climber or rappeller could slide out of it.

Climbing directors and instructors should be diligent in ensuring that every participant is matched with a harness of the correct size, and that it is properly adjusted. Each participant should be trained to put on and adjust his or her own harness.

Fitting Waist-Belt/Leg-Loop Harnesses

A waist-belt harness should sit snugly above the hip bones and be impossible to pull down. A harness that is too large may slide up onto the ribs, compress the diaphragm, and interfere with breathing. A harness that is too small can compress the hips and legs, reducing mobility. When in doubt, however, err on the small side. Be thorough when testing the security of harness fit. If the harness will not stay above a participant's hip bones, it may not hold that person in an inverted fall. Instead, use a full-body harness or a chest harness in combination with a seat harness.

Safety Concerns for Harnesses

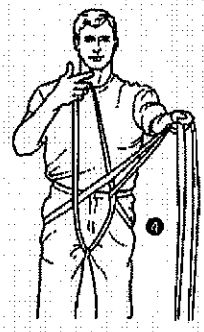
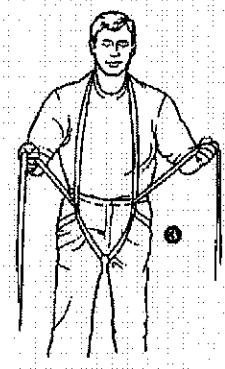
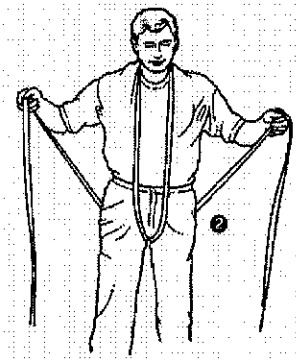
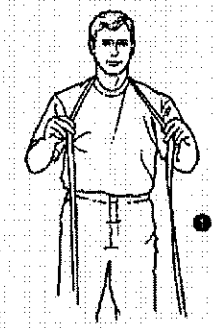
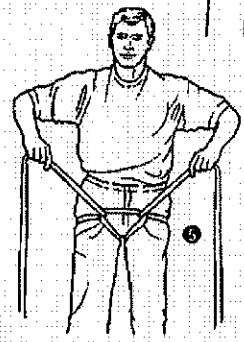
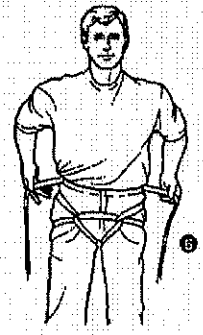
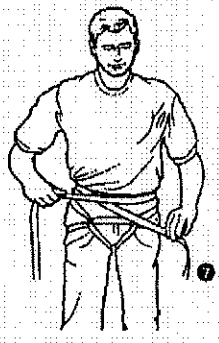
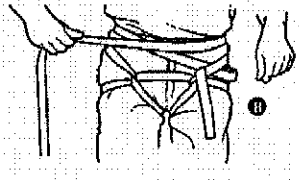
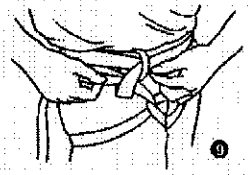
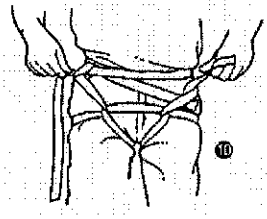
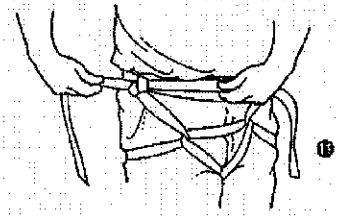
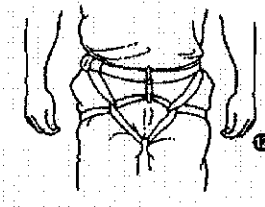
- A properly sized commercial climbing harness or a tied-seat harness made from at least 1-inch-wide webbing is required for all belayed events.
- Before use, inspect visually and by touch the condition of each harness, paying close attention to belay loops, stitching, and buckles.
- Most harnesses use buckles to secure the waist belt. Harnesses must be buckled in a specific way, a process that usually requires doubling the webbing back through a buckle and leaving a tail at least 3 inches in length. If the buckle and the harness are not correctly secured they may come apart, a potentially fatal occurrence. Review the manufacturer's recommendations and follow those instructions every time you buckle a harness.
- Pay special attention when using harnesses that include hook-and-loop fasteners. Considered by some climbers to be a convenience, a hook-and-loop fastener may increase the possibility of a participant forgetting to buckle a harness properly.
- Protect harnesses from excessive direct sunlight and heat, and from nylon-damaging substances such as acids, alkalis, sunscreen, oxidizing agents, insect repellent, dirt, and bleach.
- Shield harnesses from contact with sharp objects that could cut or abrade the material.
- Wash a dirty harness by hand in cool water with mild soap. Rinse thoroughly and allow to air-dry in a shaded area.
- All climbing harnesses must be retired according to the manufacturer's recommendations or no more than seven years from the date of purchase, or sooner if conditions warrant. Retire a harness when it shows obvious signs of wear such as fading or abrasion. Over time, the webbing will get fuzzy at the tie-in points. Although that is not a matter of great concern, be very suspicious when tie-in points are excessively worn, or if stitching is in any way damaged.
- Instruct each participant on the proper methods of fitting and buckling the harness.

For general guidelines on tying in to a harness with a belay rope, climbing rope, or rappel device, see the chapters on belaying, climbing, and rappelling in this manual. For specific instructions, refer to the manufacturer's tag sewn into the harness in question.

Tied Harnesses

A 30-foot length of 1-inch webbing can be used to tie a reliable and comfortable seat harness. A tied harness, such as the Swiss seat, and the knotted leg-loop harness are commonly used in BSA climbing/rappelling activities.

FIG. 9. TYING A TIED-SEAT HARNESS

How to Tie a Seat Harness

Tie the seat harness using a piece of webbing 24 to 30 feet long.

❶ Drape the center of the webbing behind your neck.

❷ Step over the ends of the webbing and bring them around the sides of your hips, taking care not to allow any portions of the webbing to twist. Pull the webbing snug.

❸ Pass the webbing ends behind and then through the lengths of webbing lying against your lower torso.

❹ Slip the webbing off your neck.

❺ As you pull out the slack, the bend that had been around your neck will become the horizontal band between the loops of webbing that have formed around your legs.

❻ Going first behind your back, wrap the remaining lengths of webbing around your waist in this fashion:

a. The piece originally in your right hand goes clockwise.

b. The piece originally in your left hand goes counterclockwise.

❼ Continue wrapping until only about 3 feet remains at each end of webbing. Keep the webbing flat and snug against your body.

❽ Tuck the end of the counterclockwise webbing beneath the sling on your left hip. (You will need it in a moment to finish tying a water knot.)

❾ With the end of the clockwise webbing, tie a loose overhand knot (½ of a water knot) around the wraps of webbing on your right hip.

❿ Retrieve the other end of the webbing and use it to trace back through the loose overhand knot, thus completing a water knot.

⓫ Tighten the water knot. Check the harness to be sure it fits securely and that there are no unnecessary twists in the webbing. Wrap any remaining length of webbing around your waist and tuck the end under the previous wraps.

⓬ Use a locking carabiner to clip together all the webbing between the knots in front of your body.

How to Tie a Knotted Leg-Loop Harness

Form the knotted leg-loop harness using a piece of webbing 24 to 30 feet long.

❶ a. Holding one end of the webbing, measure off a length that stretches from your nose to your outstretched hand. Keep that length marked with one hand while you tie the first leg loop.

b. Form the first leg loop. Just beyond the measured piece, wrap the webbing around your thigh to size it to your leg. Add another 4 to 6 inches to allow for a knot, and form a leg loop with an overhand-on-a-bight knot.

c. Move about 6 inches further along the webbing and repeat step 1b to form a second leg loop.

❷ With the shorter, measured piece of webbing on your left side, put on the leg loops as you would a pair of pants. Pull the loops all the way to your crotch with the knots toward the front. For the sake of comfort, be sure there are no twists in the webbing. Each loop must be snug, but not tight enough to restrict circulation. You should be able to easily slip two fingers between a leg loop and your leg.

❸ Let the shorter, measured piece of webbing hang down on your left side. Bring the longer piece of webbing clockwise, behind your back, and wrap it several times around your waist. Bring the end of it across your belly to your right side.

❹ Tuck the webbing end up and behind the wraps of webbing on your right hip, leaving enough slack to form a bend.

❺ Pass the webbing end through the bend to form an overhand knot. Work any slack out of the webbing so that the harness fits snugly around your waist and the overhand knot is secure.

❻ Wrap the remainder of the longer piece of webbing a final time around your waist, going clockwise, as before. To keep it out of the way, tuck the end behind the webbing above the right leg loop. (You will need it in a moment to finish tying a water knot.)

❼ Turn your attention to the shorter, measured length of webbing on your left side.

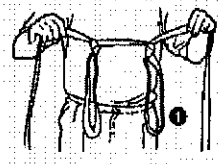
❽ With the measured length of webbing, tie a loose overhand knot (½ of a water knot) around the wraps of webbing on your left hip.

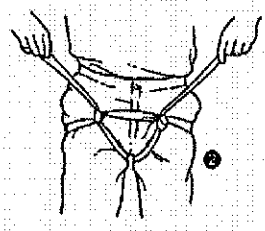
❾ Retrieve the other end of the webbing and use it to trace back through the loose overhand knot, thus completing a water knot.

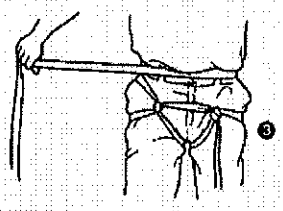
❿ Tighten the water knot. Check the harness to be sure it fits securely and that there are no unnecessary twists in the webbing. Wrap any remaining length of webbing around your waist and tuck the end under the previous wraps.

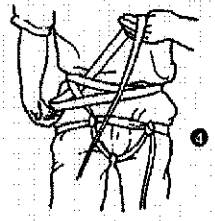
⓫ Use a locking carabiner to clip together all the webbing between the knots in front of your body.

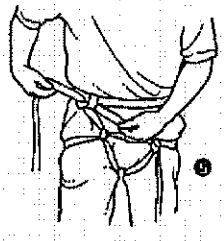
FIG. 10. TYING A KNOTTED LEG-LOOP HARNESS

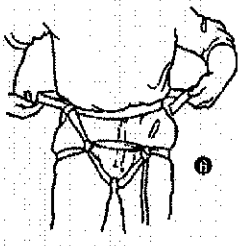


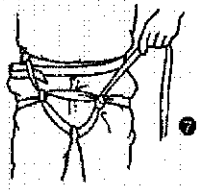


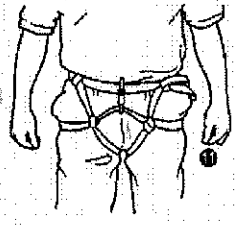


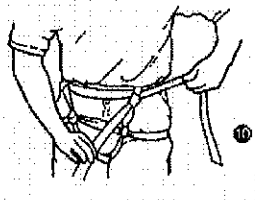


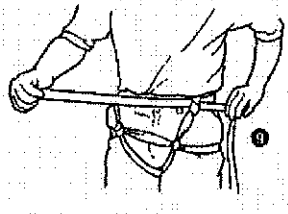


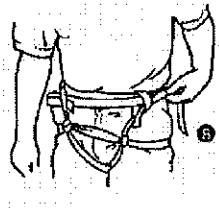












Belay/Rappel Devices

Belay and rappel devices apply friction to a rope, allowing its speed to be controlled. Commercially made devices approved for BSA activities include the following.

For belaying:
- Slotted plate (Sticht plate)
- Tube device
- Specialized belay devices such as the Grigri

For rappelling:
- Slotted plate
- Tube device
- A figure eight used in a rappel mode
- Rappel rack (more appropriate for advanced rappellers; primarily used for caving)

Slotted Plate

A slotted plate is also called a *Sticht plate.* It is available with or without a spring. The spring version may be easier to use.

Tube Device

Tube devices are similar in operation to a springless slotted plate, although tubes feature greater surface area to dissipate heat.

Specialized Belay Devices

Some specialized devices are appropriate for BSA activities. Among them is the Petzl Grigri, a belaying mechanism often used at indoor climbing gyms. Using the same principle employed by automobile seat belts, a camming device inside the Grigri locks up whenever the rope is loaded with sufficient tension. As a result, the Grigri is seen by many to be a belay device that requires minimal input from a belayer. However, it requires the same amount of belay technique as any other belay device.

Storing Equipment

Careful storage and handling of climbing and rappelling equipment can substantially increase its life span and help protect it against loss or misuse. Except for bolts used as anchors, all hardware, ropes, and webbing must be removed from climbing areas at the end of each day and stored in an orderly fashion.

At district and council climbing facilities, establish a separate area for storing climbing and rappelling equipment in a building where access can be controlled. Tubs, tote boxes, or plastic garbage cans for sorting and transporting equipment will help prevent loss of gear and keep the equipment in the best possible condition.

A permanent display of worn equipment (ropes, carabiners, webbing, etc.) will help climbers and rappellers know what to look for as they inspect equipment for daily wear. Any equipment in the same or worse condition as that in the display must be retired and properly disposed of.

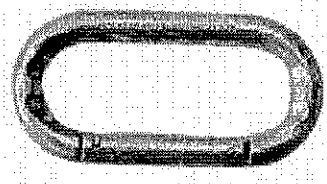


FIG. 15. WORN NONLOCKING CARABINER

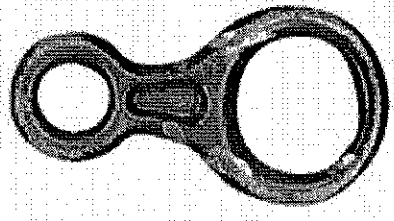


FIG. 16. WORN FIGURE EIGHT RAPPEL DEVICE

Excessively worn items of climbing hardware should be retired.

BEFORE EACH USE, CAREFULLY EXAMINE BELAY AND RAPPEL DEVICES. CHECK CLOSELY FOR GROOVES WORN INTO THE METAL BY THE PASSAGE OF THE ROPE, AND RETIRE ANY HARDWARE THAT APPEARS TO BE BENT OR SHOWS INDICATIONS OF EXCESSIVE WEAR.

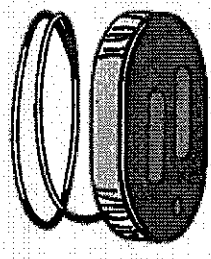


FIG. 11. STICHT PLATE

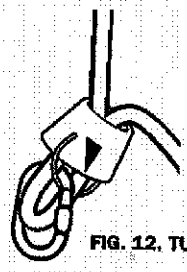


FIG. 12. TUBE DEVICE

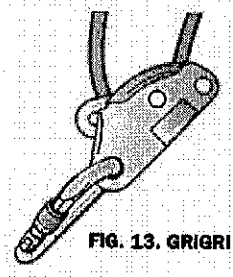


FIG. 13. GRIGRI

The Grigri is a specialized belay device.

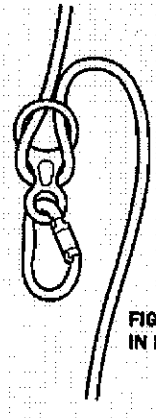


FIG. 14. FIGURE EIGHT IN RAPPEL MODE

Chapter 4

Rope and Rope Handling

Rope is the lifeline of climbing and rappelling. It is vital for stopping the falls that inevitably occur as participants learn and practice the arts of climbing and rappelling. The quality of a rope and the way in which it is handled can mean the difference between life and death.

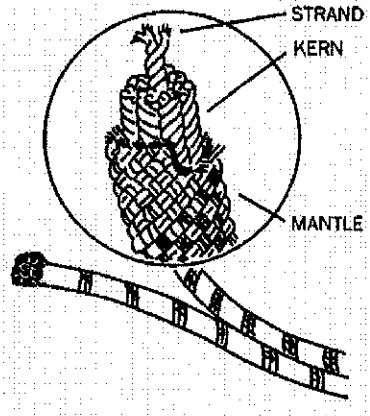
In the 1800s when people began recreational climbing in earnest, it was a commonly held hope that a climber simply would not fall. The thinking stemmed in part from the reality that the ropes of the time were likely to break when suddenly put under strain. Those ropes were constructed of natural fibers such as manila or sisal that were twisted or *laid* into lengths. They were prone to rot if allowed to remain wet for long periods. Natural fibers make ropes that are *static*, meaning they have little ability to stretch; they must absorb all at once, rather than gradually, the impact of a falling body.

By the 1950s, modern materials had made possible the development of rope described as *dynamic*, meaning it has a significant amount of stretch. Because of its elastic properties, a dynamic rope will stop a falling climber gradually rather than all at once. That reduces the shock load on the rope, on the anchors, and on the climber. Dynamic rope revolutionized the sport of climbing by making it possible for climbers to survive uninjured the sorts of falls that a century before could have been serious and even fatal.

Today, ropes that stretch little—static ropes—may be used for top-rope climbing or rappelling. Static ropes may also be used in situations requiring the use of ascenders or hauling, such as in caving and rescue work.

Dynamic and static ropes approved for BSA climbing and rappelling are *kernmantle* ropes. Each is composed of a woven sheath (the *mantle*) over a braided core (the *kern*). The core bears the brunt of the load placed on the rope, while the sheath protects the core from damage. A 50-meter (165-foot) kernmantle rope with a diameter of 11 millimeters (7/16-inch) weighs from 6 to 9 pounds. Its core is woven from 50,000 filaments and the sheath from 30,000, each filament running the full length of the rope.

FIG. 17. CONSTRUCTION OF A KERNMANTLE ROPE



Kernmantle rope with its woven sheath (the mantle*) over a braided core (the* kern*)*

BSA Rope Standards

All cordage used for climbing (climbing ropes, accessory cord, and webbing) must be designed for climbing and used according to the manufacturer's recommendations. All dynamic climbing ropes must be UIAA- or CEN-approved.

All static ropes used for rappelling must have a tensile strength (breaking strength) of at least 22.2 kiloNewtons (5,000 pounds) when new. A diameter of 7/16 inch or 11 millimeters is recommended for static rappelling ropes; every climbing rope must have a minimum diameter of 10.5 millimeters.

All ropes and nylon webbing must be new when procured. Use of three-strand rope for climbing or rappelling is prohibited. Three-strand (multiline) rope ½ inch or larger in diameter may be used for lobster claws and hand lines on low- or high-course elements. Webbing must be designed for climbing and must have a minimum breaking strength of 17.5 kiloNewtons (4,000 pounds) when new.

A written log of the history of each rope used in the program must be kept, indicating: (1) the date the rope was purchased, (2) the date the rope was placed in service, and (3) any environmental or severe stresses that were placed on the rope. Each rope must be uniquely marked and permanently identified. All webbing must be marked with the date of purchase. All cordage (climbing ropes, accessory cord, and webbing) must be retired according to the manufacturer's recommendations, or when the condition warrants or five years from the date placed into service or 10 years from the date of purchase, whichever comes first.

Purchasing New Rope

Rope for BSA climbing/rappelling activities must have a clearly documented history. Rope entering a climbing program must be new, have UIAA, NFPA, or CEN approval, and be procured from a reliable vendor. In most cases, that means buying rope of the standard length and diameter (50 meters or 165 feet in length with a diameter of 10.5 millimeters for dynamic rope, 7/16-inch for static rope), or purchasing spools of rope of up to 1,000 feet in length and cutting the rope into appropriate lengths. Buying by the spool may afford some economy, but it also means a climbing area will have a great deal of rope aging at the same rate. Unless BSA climbing directors are certain the rope will be used in such large volume, it may be wiser to purchase rope in pre-cut lengths, and then only as the need arises.

Numbers printed on a band at each end of a new rope provide information about its intended uses.

① The number "1" in a circle indicates that the rope is rated for use as a single line—that is, as a belay rope for climbing or rappelling, or as a single line for rappelling.

½ The fraction "½" in a circle means a rope is rated for use with another "½" rope. The emblem appears on ropes of 9 millimeters or less. A rope marked with ½ in a circle is not allowed for Scouting climbing.

When shopping for rope, you may have the option of buying either *standard* rope or *dry* rope. The mantle of dry rope is impregnated with a chemical treatment that makes the rope water resistant. Dry rope may cost more than standard rope, but for climbing areas where frequent rain or afternoon thunderstorms are a factor, not having to dry out soaked ropes can more than make up for the added expense.

Cutting Climbing Rope

There are several ways to cut a climbing rope. Retail outlets usually have a hot wire that will sever a climbing rope and fuse the ends at the same time. You can duplicate that action with a soldering iron fitted with a tip designed for cutting linoleum, or you can heat a butter knife over a flame until it is hot enough to melt through the rope (wear leather gloves to protect your hands).

If you must cut a rope in the field, begin by placing a wrap of duct tape around it at the point of the intended separation. Use a sharp knife to cut through the tape and the rope. Before removing the tape, hold each end of the fresh cut over the flame of a butane lighter to melt the filaments and fuse them together.

Some climbing directors buy rope 10 feet longer than necessary. After each year of use, they cut off 2 feet of length from one end so that the center of the rope—the portion most prone to wear—migrates a little and is thus less likely to become damaged.

Marking Rope

Tracking a rope requires that it be identified throughout the span of its useful life. One option is to purchase rope of a different color each year. All ropes with sheaths of the same color can thus be identified as having been bought at the same time.

To mark ropes further, dip the last 2 inches of each end of a rope into a jar of *rope dip*, available at hardware stores, and allow to dry thoroughly. Create a multicolored coding scheme by dipping the dried ends into rope dip of a second color, leaving a band of the original hue exposed. Rope retailers may also sell special shrink-wraps that can be slipped over the ends of a rope and then secured in place by applying heat. By noting the color of the rope's sheath and the unique set of colored bands or wraps at its ends, instructors and directors should be able to differentiate each rope from all others.

Maintaining Records

An accurate written history of a rope is of vital importance to those deciding whether that rope is safe to use. Enter information about a rope in an equipment history logbook, including: 1) date of purchase; 2) date placed in service; and 3) any environmental, severe, or unusual stresses that were placed on the rope.

Rope Care and Maintenance

General Rope Care

- Use rope **only** for the purposes for which it was designed—climbing, rappelling, or belaying. Do not use climbing ropes for setting up tents or other camp shelters, towing vehicles, dragging logs, or any other activities outside the specific arena of climbing, rappelling, and belaying.
- To prevent them from fraying, fuse the raw ends of a rope by holding them above a flame. Take care not to apply heat to any other portion of the rope.
- Avoid stepping on a rope.
- Never drag a rope along the ground. Rock crystals can work into a rope and slowly damage the fibers.
- Never allow a rope to run over any sharp edge, especially if the rope is bearing a load. Sharp edges are extremely dangerous to ropes and are a major cause of rope failure. Place a burlap pad, a canvas shield, or other protective barrier under a rope whenever it must cross a sharp or dirty area.
- Never allow a moving rope to run across a standing rope or webbing, or through a loop made of webbing or rope. Friction created by rope movement may generate enough heat to melt the sheath and damage core fibers, or to weaken webbing.
- Never leave a rope stretched or under tension for an extended period of time.
- When it is not in use, keep rope coiled or stowed in a rope bag.
- Belayers can pile uncoiled rope on a tarp to protect it from dirt and grit.
- Keep rope dry, if possible, and air-dry wet rope (away from direct sunlight) before putting it into storage. A rope has a lower minimum breaking strength when it is wet than when it is dry, and may be more difficult
  to handle. Nylon itself will not mildew, but organic materials such as lichen and moss may become attached to a rope and produce mildew.
- Prolonged exposure to ultraviolet rays will cause a rope to deteriorate. While normal use in sunlight will cause negligible harm, ropes should not be stored in direct sunlight or allowed to hang on sunny climbing routes longer than necessary.
- Keep rope away from petroleum products (including sunscreen), pesticides (including insect repellent), and chemicals with the potential to destroy rope fibers. Ropes can be severely damaged by battery acid or rodent urine.
- Do not leave ropes hanging unsupervised; their use cannot be monitored, nor can their history be accurately recorded.
- Thoroughly examine a rope immediately after any of the following:
  — It has been hit by a falling rock, branch, or other object.
  — It has been subjected to a load while passing over a sharp edge such as a cliff or a nub of rock.

Washing Rope

A dirty rope can be washed to remove grime and rock crystals that may otherwise shorten its useful life. Wash soiled rope in a mesh bag in tepid water with a mild soap such as Woolite or Ivory, either by hand or in a front-loading machine that has no agitator to entangle the rope. A commercial rope washer also may be used with a rope-washing soap. Rinse the rope well and air-dry it away from direct sunlight before storing it or using it again. Complete drying may take several days. **Do not dry rope in a dryer or expose it to excessive heat, bleach, or other chemicals.**

Hard Fall

Hard falls are usually associated with lead climbing; a lead climber may fall 10 or 20 feet or more before the rope stops the descent. Rope manufacturers provide guidelines indicating that a rope should be retired after stopping a given number of hard falls.

Hard falls are impossible for climbers protected by top-rope belays, because an alert belayer will never allow more than a couple of feet of slack to form in the rope. For more on top-roping, see chapter 7, "Belaying and Belay Signals." For more climbing terminology, see the glossary.

Rope Inspection and Retirement

Before each day's use, perform an inch-by-inch hand and eye inspection of every rope. Check a kernmantle rope for damage by slowly running a bare hand along the entire length of the rope, feeling for defects such as soft, hollow, or lumpy spots that are indicative of damage to the core. While running a hand along the rope, look for cuts, protruding puffs of core fibers, excessive stiffness, and discoloration or glazing of the sheath. Tie a figure eight knot in the end of the rope to indicate that it has been inspected.

If any damage is identified, retire the rope. Some fraying or fuzzing of the sheath may not necessitate rope retirement; however, ropes with excessive sheath abrasion (many of the outer sheath yarns are broken or the core is exposed) should be retired. If there are doubts of any sort about the safety of a rope, retire it. Regardless of its appearance, every rope should be retired according to BSA standards. A climbing rope should be retired by cutting it into 15-foot or shorter lengths. These rope sections can be used for knot-tying practice.

Coiling a Rope

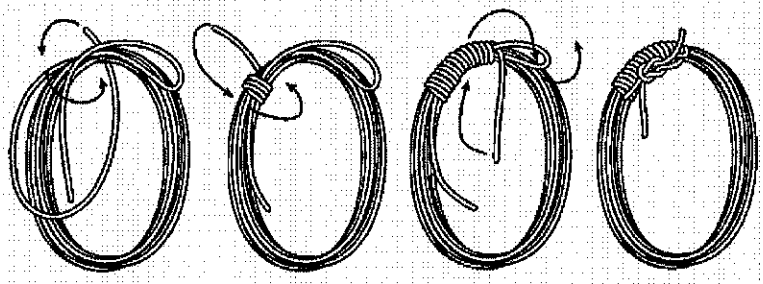
Coiling a rope keeps it in a neat package that is easy to carry and store. A good coil can also be loosened without tangling. This is especially important when a rope is being tossed down a cliff for a belay or rappel.

Two coiling techniques can be used—the *butterfly coil* and the *mountaineer's coil.* Each method has its advantages, so it is best to learn how to form both coils and be proficient in applying each to appropriate situations. The mountaineer's coil is a series of rope loops that forms a convenient package for carrying over a shoulder or securing to a pack. For a butterfly coil, the rope is laid back and forth in a U-shape that is unlikely to kink the line. Once formed, the butterfly coil can be tied quickly and neatly to a climber's back.

Begin every coil by removing any knots and hardware from the rope.

ROPES ARE FREQUENTLY RETIRED BECAUSE THEY HAVE SUFFERED ABRASIONS. SHIELD ROPES FROM ANYTHING THAT COULD CUT OR FRAY THEM DURING CLIMBING/RAPPELLING ACTIVITIES, DURING TRANSPORT TO AND FROM THE FIELD, AND WHILE IN STORAGE.

FIG. 18. MOUNTAINEER'S COIL



Mountaineer's Coil

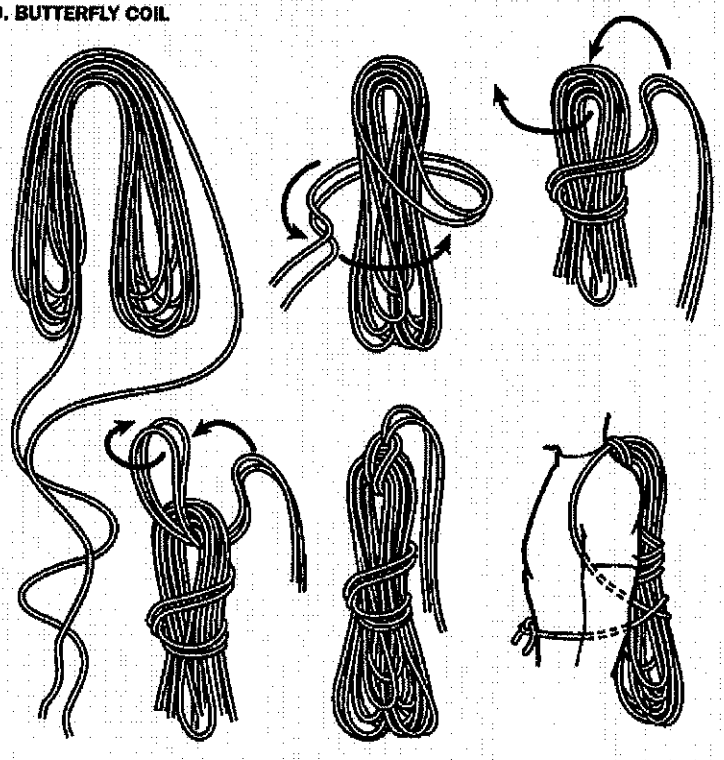
Sit, and begin wrapping the rope around your feet and knees. If the rope is long, you may want to coil half of it and lay that coil aside, then coil the second half and lay the second coil atop the first.

With about 10 feet of rope left, make a bend in the rope. Lay the bend on the coil, then wrap the remainder of the rope around the strands, working toward the bend. Pass the end of the rope through the bend and pull the bend snug.

Butterfly Coil

Starting about 10 feet in from one end, drape lengths of the rope over the back of your neck so that the loops hang below your waist. When you are about 10 feet from the other end, lift the loops from your neck, then grasp the two ends of the rope and wrap them several times around the coil. Thread a bend of the remaining lengths of rope through the coil, pass the ends through the bend, and pull the bend snug.

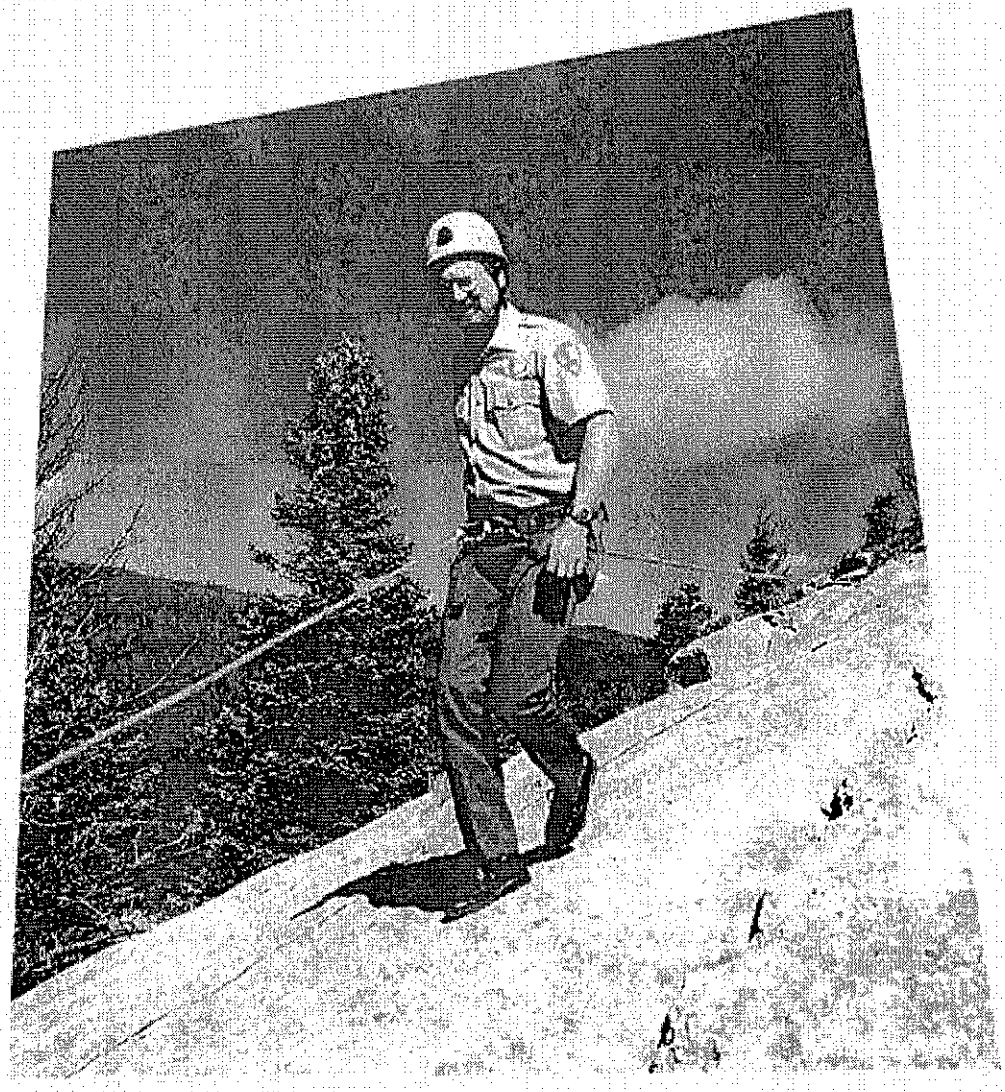
FIG. 19. BUTTERFLY COIL



Bagging a Rope

A practical way of organizing a rope is with a rope bag. Any stuff sack can be used as long as it is large enough to contain the rope. Commercially made rope bags may have a nylon loop sewn inside. A climber can begin storing a rope by tying one end of it to the loop. (Don't use a carabiner to attach the rope to the loop; the carabiner could be damaged if the bag is thrown over a cliff.) Simply stuff the rope into the bag for carrying or for storage.

To deploy a bagged rope, secure the free end to an anchor, make sure the area beneath you is free of climbers or bystanders, then toss the rope-filled bag down the climbing face. As the bag drops, the rope will extend itself.



When there is danger of falling, clip into a safety line with a carabiner. Always wear a helmet while in the climbing area.

Stacking a Rope

Stacking a rope simply means tossing one coil at a time on top of each other so that the rope will play out freely as it is being used for belaying or rappelling. A little care taken to stack a rope can help prevent a lot of problems with knotting or snarling of the rope.

Each time you are stacking a rope, pay attention to the line as it passes through your hands. Check it for hard spots, puffs, fraying, and any other indications that it should be retired from use.

Tossing a Rope Down a Cliff

It may seem a simple thing to throw a rope down a cliff. However, climbers can waste a remarkable amount of time untangling improperly thrown ropes. Consider the following steps that will contribute to orderly rope handling and subsequent mental health.

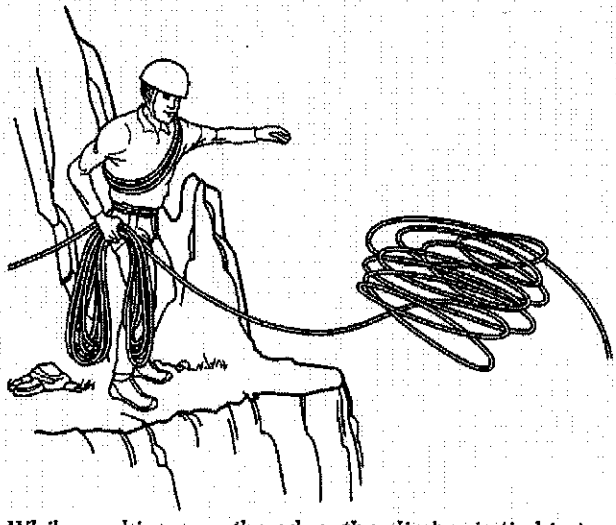
- If the rope has been coiled, loosen any loops used to tie the coils together. Divide the coil in half.
- Secure one end of the rope to an anchor. Be careful not to step into a loop of the rope.
- Shout, "Rope!" and then wait a moment. This standard signal used throughout the climbing community warns anyone below to be alert for falling rope. If there is some reason the rope should not be thrown, that information must immediately be shouted up to the person managing the rope by signalling "no."
- If the response "clear" is heard, then it is safe to throw the rope down.
- After waiting a few seconds for a reply to the shout and hearing none, toss the half nearest the anchor down the cliff and, once the rope has straightened itself, toss the other half.
- If the rope has been stowed in a rope bag, toss the bag over the edge of the cliff. The rope should pay out neatly as the bag descends.

Storing Ropes

Update the written record documenting the history of the rope's condition and use.

Remove any knots and locking wraps. Loosely hang wet rope and allow it to air-dry. Do not hang a rope over nails. To store a rope overnight or for a few days, loosely coil it or bag it and then put it in a safe place that is dry, clean, cool, and not exposed to sunlight. For longer storage, be sure that the rope is dry and stowed away from sunlight, sources of heat, petroleum products, chemicals, or dirty areas. Do not store a rope in the trunk of a car.

FIG. 20. THROWING DOWN A ROPE



While working near the edge, the climber is tied in to an anchor for safety.

Chapter 5

Knots and Knot Tying

"A NOT NEAT KNOT NEED NOT BE KNOTTED."

Knowing a variety of knots and their proper uses is of paramount importance for anyone interested in climbing and rappelling. Climbing instructors and directors must be able to tie knots with ease, and should know which ones to use when setting up safe systems for climbing, rappelling, and belaying. In an emergency, the ability to tie the correct knots quickly and with certainty can spell the difference between an effective rescue and one that is fraught with difficulty.

Becoming expert with knots is a matter of repetition. The more you tie them, the more deeply they will become ingrained in your fingers. Instruction is helpful, either from printed resources or from a good teacher, but mastery comes only with practice.

In addition to tying a knot correctly, climbers should also make it a habit to *dress* each knot—adjusting it so that the knot is neatly arranged and snug. That will align the strands of the knot in such a way that it will have the greatest possible strength. A good ritual to follow when tying knots is

- Tie it.
- Dress it.
- Load it.
- Check it.
- Double-check it.

Know Your Knot's Strength

A rope is strongest when it is straight—free of knots, hardware, and bights. Adding any of these elements reduces a rope's strength, although some knots are stronger than others.

Type of Knot	Percent of Relative Strength
Straight rope	100
Figure eight	70 to 75
Double bowline	70 to 75
Double fisherman's	65 to 70
Water	60 to 70
Overhand	60 to 65
Clove hitch	60 to 65
Square	45

Parts of a Rope

The following terms are useful for describing how to tie knots.

- **Running end,** also known as the *working end* or simply the *end.* This is the free end of a rope, most often used for tying a knot, for securing a rope to a climber or anchor, for reeving (passing) a rope through a rescue pulley, or for some other active use.
- **Standing part.** The portion of the rope that is not the running end is the *standing part.*
- **Bight** or **bend.** A *bight* in a rope (also known as a *bend)* is a simple turn that *does not* cross itself.
- **Loop.** A loop in a rope is a simple turn that *does* cross itself.
- **Tail.** The end of the rope left over after a knot has been made is the *tail.* Climbers often use the tail for tying a *safety knot.*

Safety Knots

A safety knot (also known as a backup or *stopper knot*) added to the primary knot such as a figure eight follow-through will help prevent the free end of the rope from working itself loose. The most effective safety knot goes by several names—*barrel knot, one-sided grapevine knot,* and *half a double fisherman's knot.* Form it by loosely looping the tail of the rope twice around the standing part, then passing the end through the two loops thus formed. (This is the same method as is used to tie the first portion of the double fisherman's knot, described later in this chapter.)

Work any slack out of the safety knot so that it lies snug against the knot it is protecting. Safety knots can also be used to protect knots tied in webbing. The overhand or half hitch is used as a safety knot in webbing.

Knots for Anchoring, Climbing, Rappelling, and Belaying

The knots listed here have applications during BSA climbing/rappelling activities. Every BSA climbing director and instructor should master them.

- Safety knot
- Figure eight on a bight
- Figure eight follow-through
- Double-loop figure eight (super eight or Canadian eight)
- Water knot (ring bend) (used for webbing)
- Double fisherman's knot (grapevine knot)
- Basket hitch
- Bowline
- Bowline on a bight
- Girth hitch
- Clove hitch
- Prusik knot
- Münter hitch (Italian hitch)
- Mule knot
- Mariners hitch

FIG. 21. FIGURE EIGHT ON A BIGHT

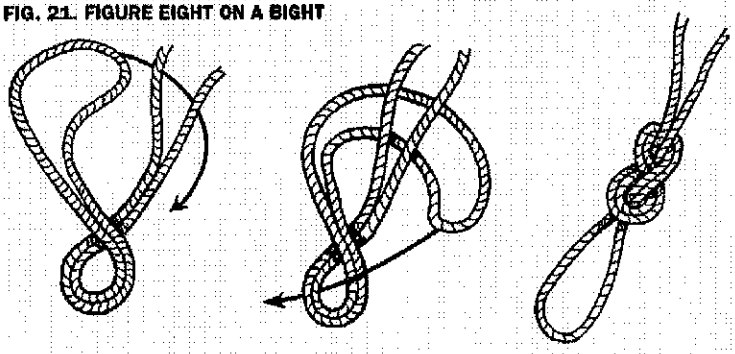


Figure Eight on a Bight

Making a bight in a rope and then tying a figure eight knot with it results in a loop that will not slip or come loose. Clip a carabiner into the loop, and the rope can be attached to an anchor sling. When this knot is tied in the end of a rope, back it up with a safety knot.

Figure Eight Follow-Through

The figure eight follow-through is similar to the figure eight on a bight, differing only in the way in which it is tied. The figure eight on a bight must be tied in a rope *before* it is attached to a carabiner, while the figure eight follow-through is tied directly to a harness. The end of the rope can be passed through an anchor sling or a harness before the knot is tied.

Begin by tying a simple figure eight knot in a rope (steps 1–4 in the illustration). Run the end of the rope through the climbing harness or the hardware to which you want to attach the rope (step 5), then trace the end of the rope back through the figure eight knot to form a figure eight follow-through (the "follow-through," steps 6–8). Leave enough tail for a safety knot (step 9).

FIG. 22. FIGURE EIGHT FOLLOW-THROUGH

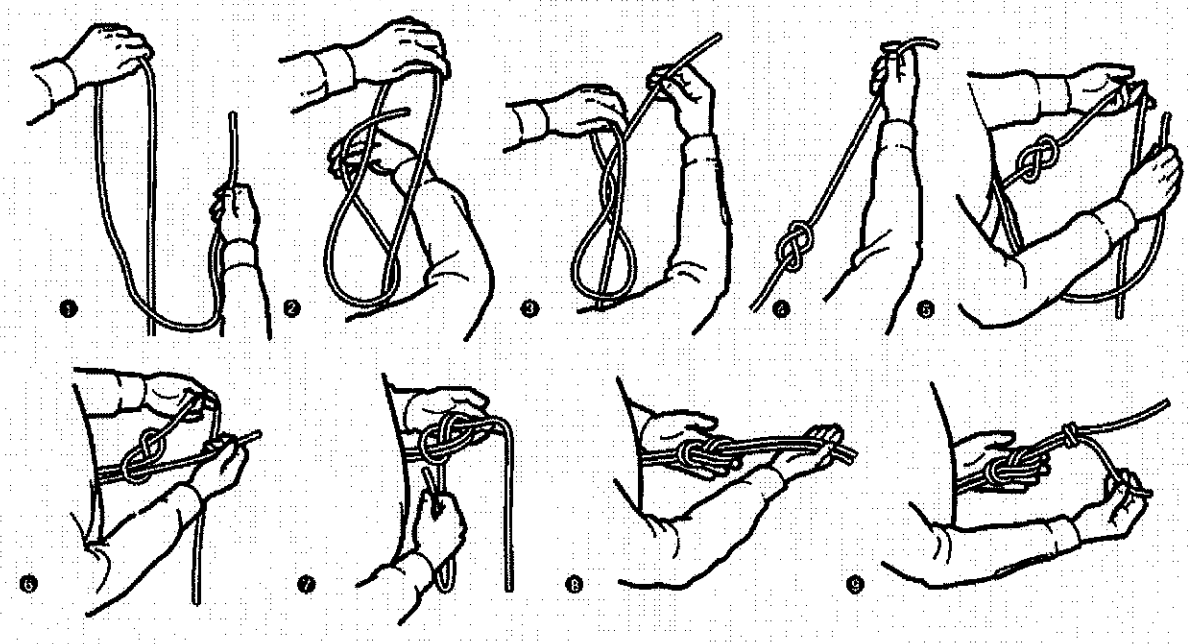
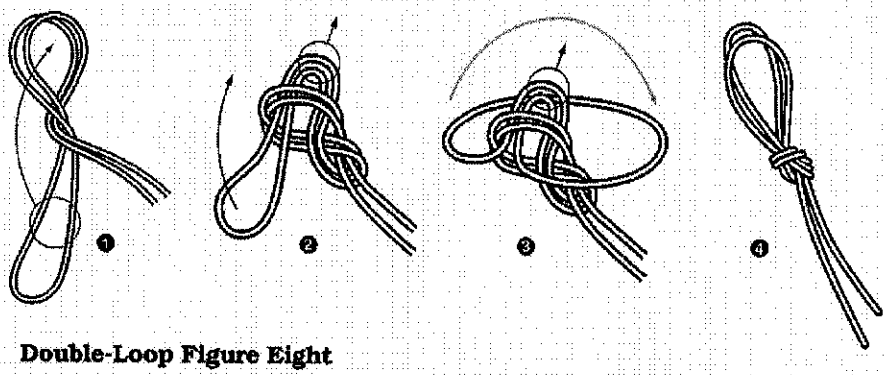


FIG. 23. DOUBLE-LOOP FIGURE EIGHT



Double-Loop Figure Eight

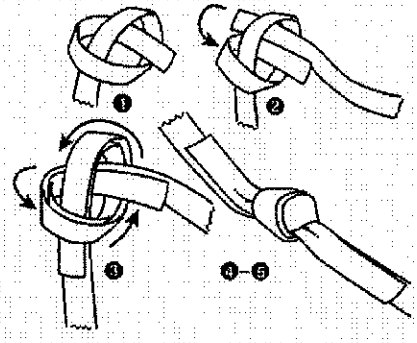
The double-loop figure eight is also known as the super eight and the Canadian eight. It is useful in climbing situations because the second loop acts as a backup to the first loop and it is easy to untie after being loaded. Clip into both loops for security, but do not use the loop to take the place of a figure eight follow-through, which is the preferred method of securing a belay rope to a person's harness. Use this loop to secure a rope to an anchor.

With the rope doubled, begin the knot as if tying a figure eight on a bight, leaving a generous length (18 to 24 inches) of rope for the end loop. Insert the center of the end loop through the loop formed for the figure eight.

Hold onto the two loops while you flip the remaining end loop over the entire knot.

Dress the bight and tighten it. The completed figure eight on a bight will have two loops instead of one, hence the "double-loop" in its name.

FIG. 24. WATER KNOT IN 1-INCH WEBBING



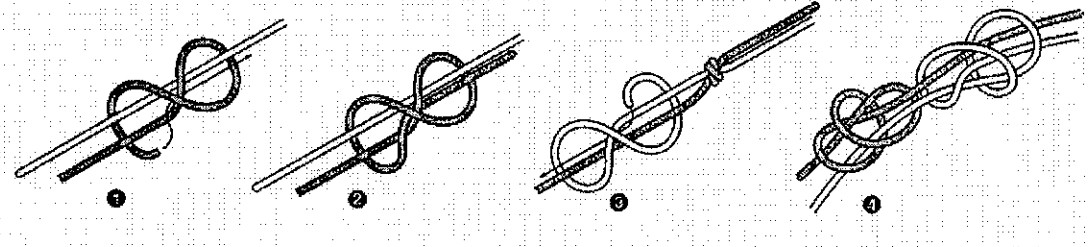
Water Knot (Ring Bend)

Use a water knot to tie together the ends of a piece of 1" seamless tubular webbing to make a loop sling for use as a runner in an anchor system, or when tying a harness. Once it has been tightened, the water knot seldom slips and can be difficult to untie.

(Also known as an *overhand bend* or a *sling knot*, the water knot should be used only with webbing. To form loops in rope, use the *double fisherman's knot.*)

Begin tying a water knot by forming an overhand knot in one end of the webbing, leaving a tail at least 6 inches long. With the other end of the webbing, trace the first end all the way back through the overhand knot (steps 2 and 3), again leaving at least a 6-inch tail. Dress the knot (step 4) so that the webbing lies flat, then cinch it tight (step 5). Back it up with safety knots.

FIG. 25. DOUBLE FISHERMAN'S KNOT

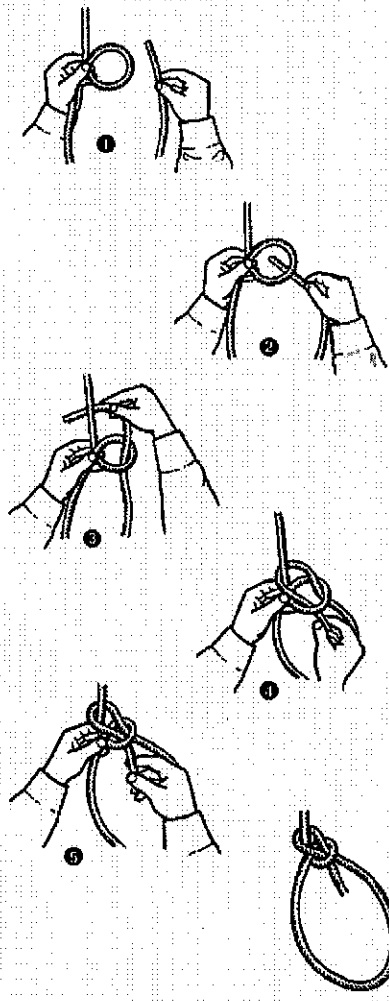


Double Fisherman's Knot (Grapevine Knot)

This knot is used for joining together two ropes of similar or dissimilar materials. It is also used to tie together the two ends of a shorter piece of rope or accessory cord to form a runner, or loop. Half of a double fisherman's knot (also known as a barrel knot) can be used as a safety knot to back up a primary knot such as a figure eight on a bight.

Lay about 2 feet of the ends of two ropes alongside each other, ends opposite. Loosely loop one rope end twice around the other, then thread the end of that rope through the loops. Repeat the procedure with the second rope end. Carefully tighten the two parts of the knot and slide them together so that the flat sides lie parallel against each other. If they don't fit together neatly, the knot is incorrectly tied. Always secure the tails with safety knots.

FIG. 26. BOWLINE

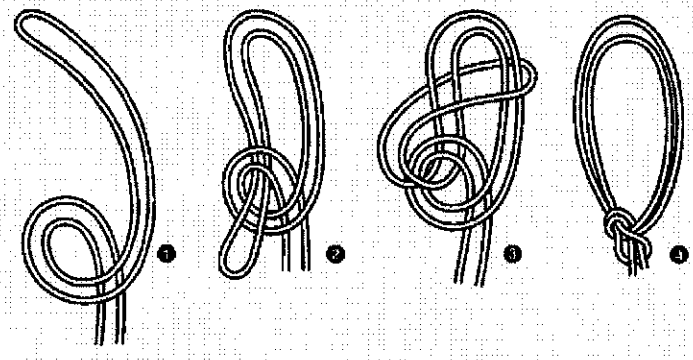


Bowline

The bowline allows a climber to make a reliable loop around a tree or other anchor. The loop will not slip or cinch down and is easy to untie. Always tie off the tail.

Begin by making a small overhand loop in the standing part of a rope. Bring the rope end up through the loop, around behind the standing part, and back down into the loop. Tighten the bowline by pulling the standing part away from the loop.

FIG. 27. BOWLINE ON A BIGHT



Bowline on a Bight

The bowline on a bight is a variation of a bowline. It is a high-strength knot. The completed bowline on a bight will have two loops.

Begin with a small overhand loop over the standing part of a doubled rope. Pass the free end up through the small loop, leaving a generous length of rope for the second loop. Open the bight where the rope is doubled and pull the main doubled loop through. Slide down the bight, then tighten the knot.

Girth Hitch

A girth hitch has use where the webbing may move from its desired location. A more appropriate knot might be a basket hitch: Loop a tied piece of webbing around the anchor point and secure both end loops with a locking carabiner.

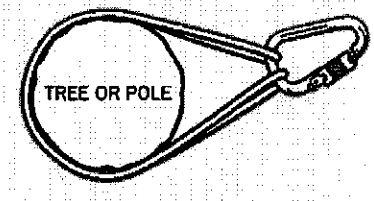
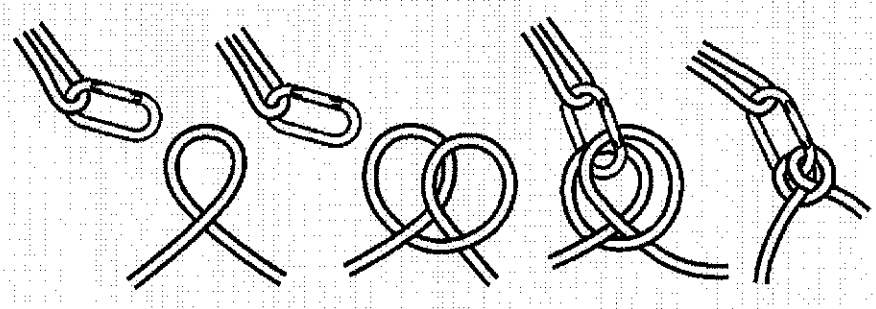


FIG. 28. BASKET HITCH

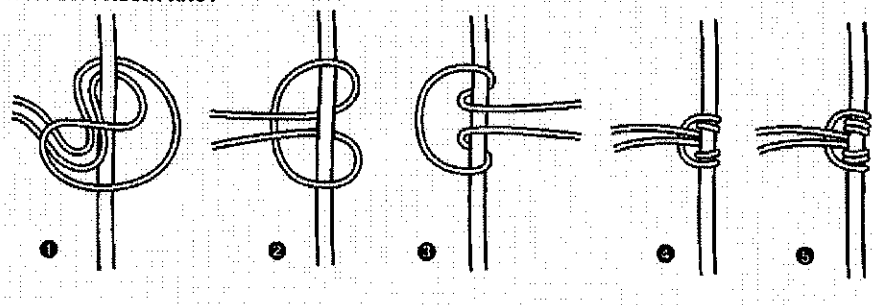
FIG. 29. CLOVE HITCH



Clove Hitch

A clove hitch can be used in anchoring and belay systems to secure a rope to a carabiner. Its advantages are that it is easy to install and to adjust. However, the system should also include at least one additional knot that will not adjust, such as a figure eight follow-through, to provide the fail-safe security not available with a clove hitch alone.

FIG. 30. PRUSIK KNOT



Follow steps 1–4 for tying a Prusik knot. Additional wraps can be added to increase friction (step 5).

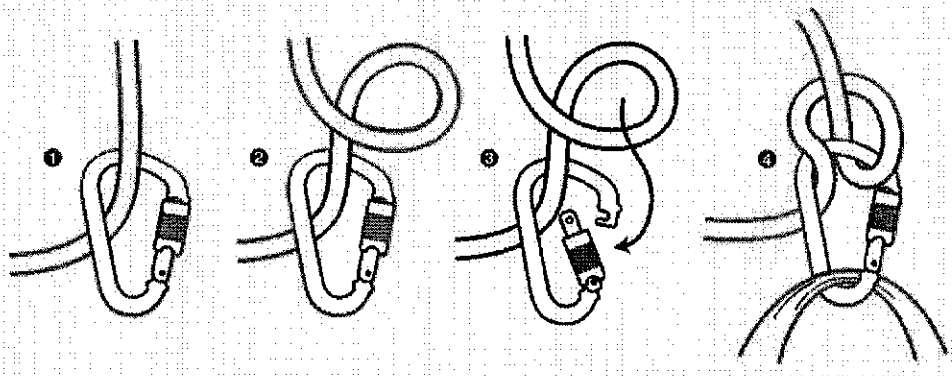
Prusik Knot

The Prusik knot secures a loop of smaller rope or accessory cord to a climbing rope in such a way that it can be slid along the rope, but when it is loaded will bend the rope and hold securely. The knot is commonly tied with accessory cord by a climber to ascend a rope or to secure a belay system in order to release the belayer. A Prusik cord should be 3 millimeters smaller or 70 percent smaller than the rope to which it is secured.

To tie a Prusik knot, use the loop of smaller rope to form a girth hitch around the larger rope, then bring the free bend of the loop around the larger rope a second time and pass it back through the other bend. Dress the knot so that it lies neatly on the larger rope, and remove any slack.

To use the Prusik knot to ascend a climbing rope anchored at the top of a route, clip a carabiner to the free bend of the Prusik and attach it to a runner that will serve as a stirrup. Clip the climber's harness to a second Prusik. A climber can stand in the stirrup and push the harness Prusik up the rope, then put weight on the harness and slide the stirrup Prusik higher. Repeating the process will carry the climber up the rope. (For information on using a Prusik to release a belayer in an emergency situation, see chapter 7, "Belaying and Belay Signals.")

FIG. 31. MÜNTER HITCH

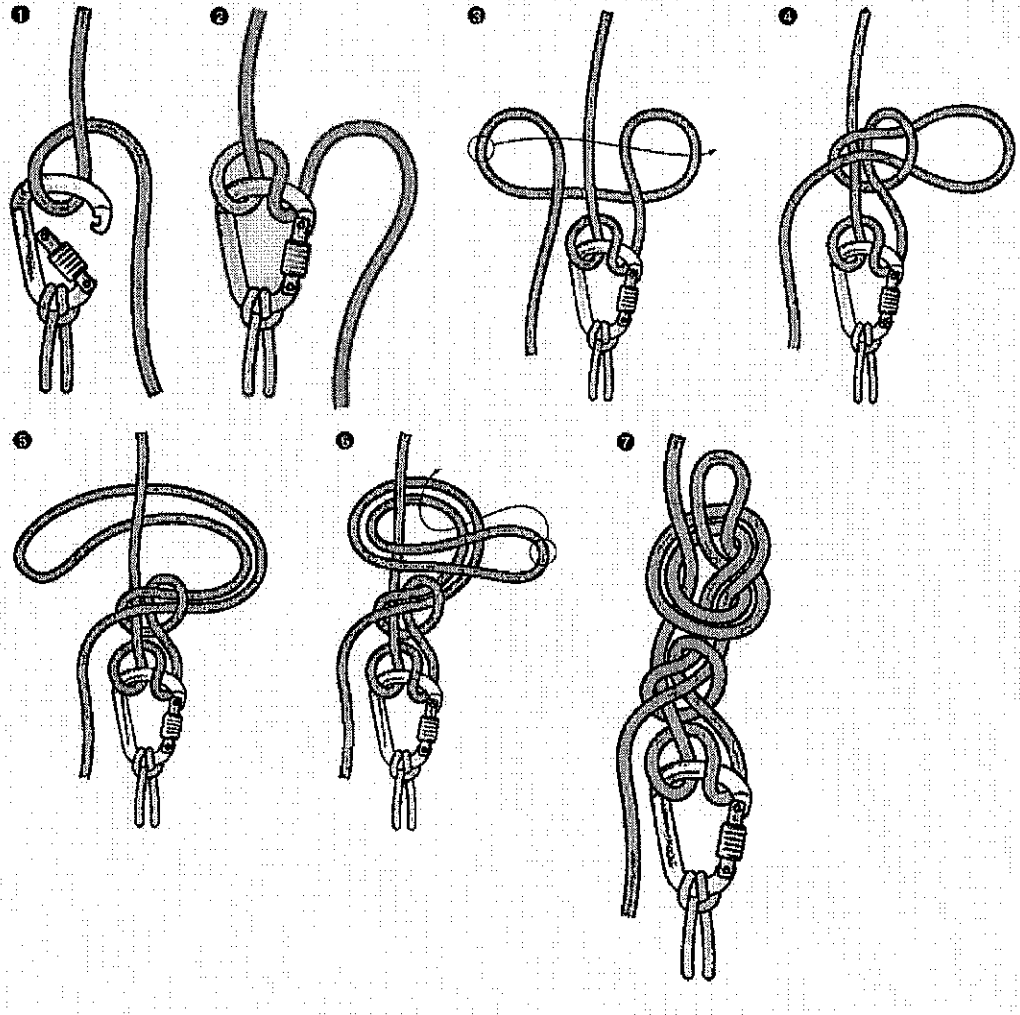


Münter Hitch (Italian Hitch)

The Münter hitch is the knot to rely upon for emergency belaying when a belay device is not available. Used with a locking carabiner (a large, steel pear-shaped carabiner works best), the hitch allows the rope to be fed through the carabiner or pulled back. The Münter hitch can also be used by a rappeller to control the rate of descent. However, it tends to twist the rope. For these reasons, a rappel device, if available, is the better choice.

To form the Münter hitch, clip the carabiner to your harness and to the rope. Form a loop in the rope and clip that loop into the carabiner. Lock the carabiner.

FIG. 32. MÜNTER/MULE KNOT (STEPS 1-2, MÜNTER; STEPS 3-7, MULE KNOT)



Münter/Mule Knot

The mule knot is a useful knot if you want to lock off a belay device or a Münter hitch.

- For locking off a belay device:

While maintaining a lock-off with your brake hand, use your guide hand to pass a bight of rope through the belay carabiner. Once through, you can hold onto this portion of the rope to maintain the lock-off while you tie the rest of the knot.

Create a small loop close to the belay device and then a second small loop or bight on the other side of the device.

Pass the second loop or bight through the first loop, making sure to enclose the load side of the rope. Pull the knot tight and slide it against the belay device.

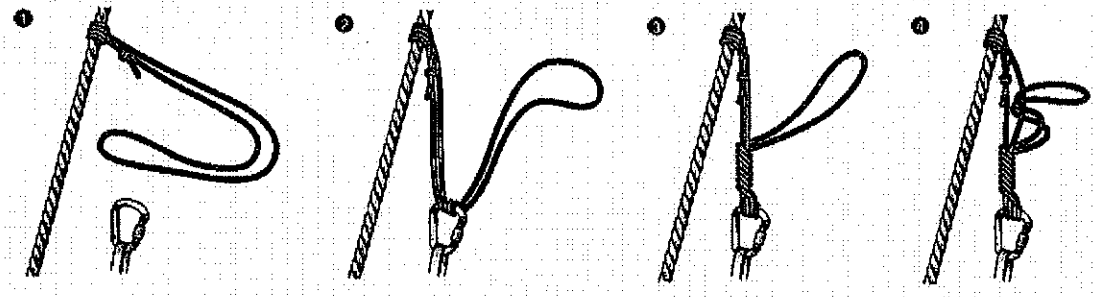
Pull enough slack through to have a bight roughly 18 inches in length. Using this bight, tie an overhand around the load side of the rope. This will ensure that the mule knot will not come untied. For extra safety, you can clip the end of the bight to the load strand using a carabiner.

- For locking off a Münter hitch (See Figure 32.):

Use the same method as above, except **do not** pass a bight through the carabiner. Tie the mule directly in front of the Münter hitch on the load strand as shown. Make sure to include the overhand backup knot.

For either system, it is important to remember to never lose control of the brake side of the rope until the mule knot is completely tied.

FIG. 33. MARINERS HITCH



Mariners Hitch

This hitch uses a sling or accessory cord and a carabiner to create a load-releasable system, a technique that may be useful in special situations such as needing to escape a loaded belay.

Pass the looped sling or cord through the carabiner twice to make a full wrap around the end of the carabiner. Wrap the working end around the loaded strand four or five times (more wraps is more friction), and then tuck the end between the two loaded strands.

For extra safety, you can clip a carabiner to the end of this bight.

Chapter 6

Anchor Points and Anchoring Systems

"When in doubt, overcompensate."

—Adage for anchoring and for life

A BSA climbing program must have fail-safe anchors securing every belayer and the ropes used for climbing and rappelling. Climbing directors and instructors should spare no effort to ensure that all anchor points are reliable and that the anchoring systems attached to them are put together with gear and techniques that meet the highest standards of safety. Lives will depend on it.

An *anchor point* is a boulder, a living tree, an installed bolt, or other fixed point located at the top of a climbing or rappel route or near a belay position. The *anchoring system* consists of the webbing or rope and the hardware secured to the anchor points in such a way that they can be attached to the harnesses and/or ropes protecting belayers, climbers, or rappellers.

At new climbing areas and when establishing new routes, experienced climbing directors should select the anchor points to be used for each climb, rappel, and belay, and oversee the design and use of the anchors attached to them.

Check Every Time

Never assume that an anchor point is safe simply because it has been used in the past. Even if you set it yourself, check every anchor point and every anchor each time you intend to use it. Slings and rope left on an anchor point by previous climbing/rappelling parties may have been damaged by heavy use or exposure to the elements. Remove any rope, webbing, or hardware you find attached to an anchor point and replace it with gear that you know to be in top condition.

Anyone who will be involved in teaching or supervising climbing and rappelling must be versed in the theory, placement, and use of anchors. Establishing anchors is left to experienced climbing directors, but instructors will often reinstall previously approved anchoring systems at the beginning of a day's activities. Instructors will certainly be expected to check the security of anchors before participants use them and also while participants are using them, and must call a halt to all events if they

suspect something has gone awry with any part of an anchoring system. At the end of a day's activities, instructors remove webbing, ropes, and hardware from anchor points and store everything in such a way that those who will next put up the anchors will find the materials in order and ready to go.

How to set anchors can be learned through courses taught by nationally recognized outdoor organizations. Experience is a great teacher, too, but this is one subject that allows no room for error. Seeing to it that anchors are absolutely reliable is the first priority of every director and instructor.

Safety Lines

Protect yourself whenever you are working with anchors at the top of a climbing or rappelling route. If working within a body-length of the edge of a cliff (6 feet or less), tie in to an anchor or a safety line before you begin setting anchors. Securing yourself may involve setting an anchor in a location where you can do so without danger (6 to 10 feet back from the edge of the cliff), then attaching a safety line to that anchor and to your climbing harness.

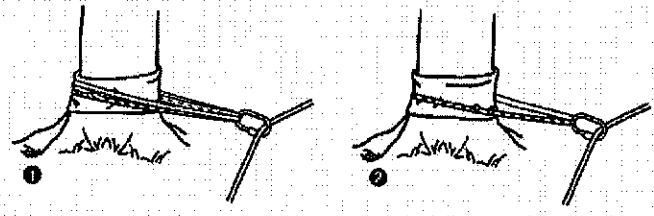
A safety line may be required each day when instructors are setting anchors, and for participants moving from the top of a climb to the top of a rappel. Determine the traffic patterns participants will follow and protect any exposed sites with safety lines. Consider also how participants will clip into the safety line, release themselves from the climbing belay, and then clip into the rappel system. They must be tied in to a belay rope or a safety line that will protect them if they fall.

BSA Climbing/Rappelling Anchors

The basic principles guiding placement and use are the same for each of the following kinds of anchors common to BSA climbing/rappelling activities:

- Top-rope anchors for belaying climbers
- Rappel anchors
- Belay anchors to tie in belayers protecting rappellers

FIG. 34. METHODS OF ATTACHING A RUNNER TO A TREE TRUNK



❶ *Basket hitch, looped around the trunk and clipped together with a carabiner.*

❷ *Retied around the trunk.*

Anchor Points

Anchor points may be divided into two categories—natural and artificial.

ANCHORS SHOULD BE PLACED ONLY BY QUALIFIED PERSONNEL.

Natural Anchor Points

Trees, rock outcroppings, boulders, and other immovable objects in the right locations at a climbing site are natural anchors that can be used simply by placing around them a sling of webbing or, in some cases, a climbing rope. Natural anchor points have three distinct advantages over other forms of anchors.

- Anchors using natural anchor points are often easy to rig before a climbing session and to dismantle when a group is done.
- A natural anchor is often highly reliable regardless of the direction in which it is loaded.
- Natural anchors are the least environmentally disruptive means of protection, increasing a group's ability to climb and rappel without leaving a trace.

Trees as Anchor Points

Anchoring to a solid, sizable tree is usually straightforward. The tree must be healthy, securely rooted, and at least 6 inches in diameter at the point of attachment.

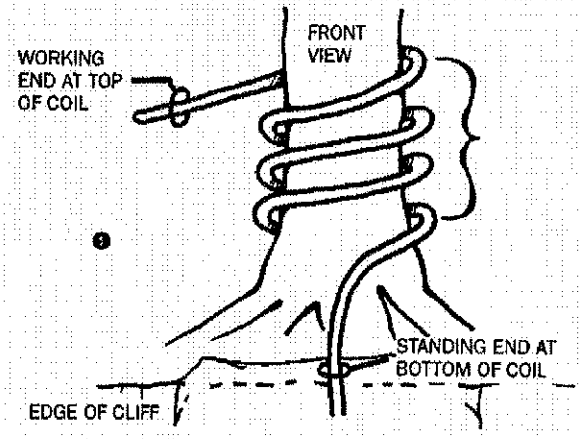
To set an anchor with webbing, use a commercially sewn runner or tie a sling, and encircle the tree using a basket hitch. Keep the webbing close to the ground where the tree is strongest. Placing anchor webbing higher on a tree trunk will create undesirable stress on the anchor point.

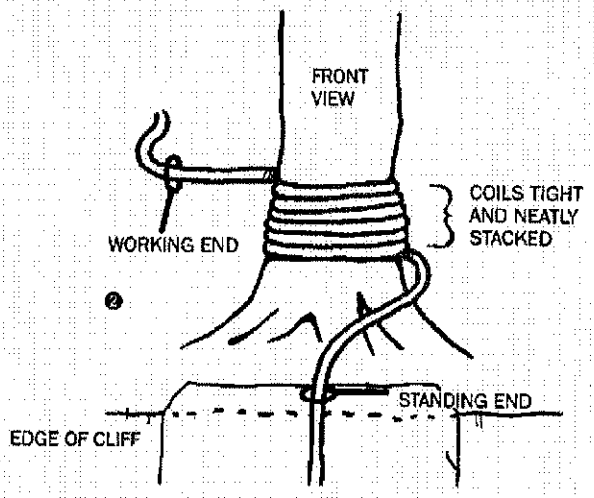
Webbing should not abrade or otherwise harm a tree. If you suspect your anchor might cause damage, shield the bark by placing padding between the bark and the anchoring material. (Burlap, carpet scraps, or strips of old fire hose work well.) **Never tie off a tree with a string of linked carabiners—they are not designed for this use.**

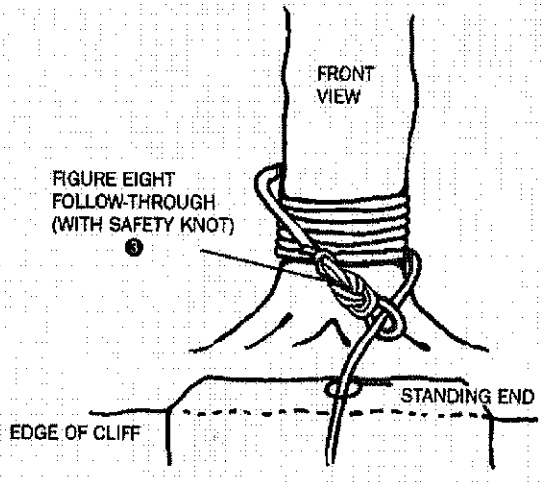
To anchor a climbing rope directly to a tree, use *tensionless rigging*, also known as a *coil wrap*. Tensionless rigging comes by its name because the system requires no knots on which stress can be placed. With the coil wrap in place, the tree absorbs the maximum amount of a load while the rope receives the minimum.

Before anchoring a climbing rope directly to a tree, carefully inspect the tree. Some trees ooze pitch that can be difficult to remove from the sheath of a rope. If you are not convinced that you can attach a rope to a tree without causing harm either to the tree or to the rope, design an anchor using a webbing runner instead.

FIG. 35. COIL WRAP/TENSIONLESS RIGGING







Rock Anchor Points

A boulder can serve as an anchor point if it has sufficient mass and is situated so that no amount of load placed upon it by climbers or rappellers will jar it loose. A rock outcropping has potential, too, if it is a continuous part of a cliff. Another common anchor point is a *chockstone*—a rock jammed into a crack in such a way that it cannot be dislodged. Study any boulder, outcropping, chockstone, or other likely rock formation before relying on it as an anchor point. Is the quality of the rock good? If not, it may crumble or break under the stress of a load.

FIG. 36. SECURING A RUNNER TO A ROCK HORN WITH A CLOVE HITCH

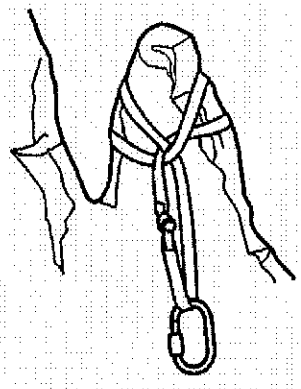


FIG. 37. ANCHORING TO A ROCK OUTCROPPING WITH A WEBBING RUNNER

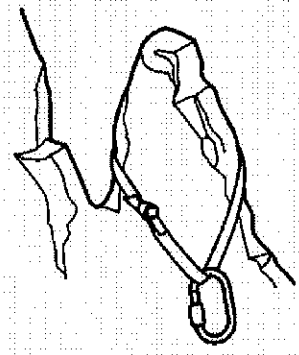
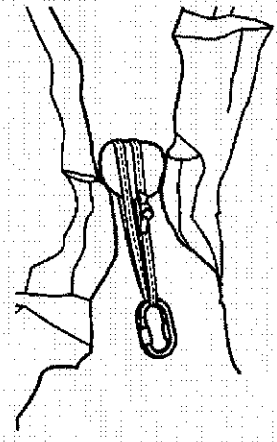


FIG. 38. ATTACHING A RUNNER TO A CHOCKSTONE



These would be locations for using a multi-point anchor system.

Artificial Anchor Points

Artificial anchor points include bolts installed in solid rock, and passive or active protection. *Passive protection* consists of carefully shaped pieces of metal that can be jammed into cracks in the rock. These metal pieces have no moving parts. *Active protection* incorporates hardware featuring camming devices and other moving parts.

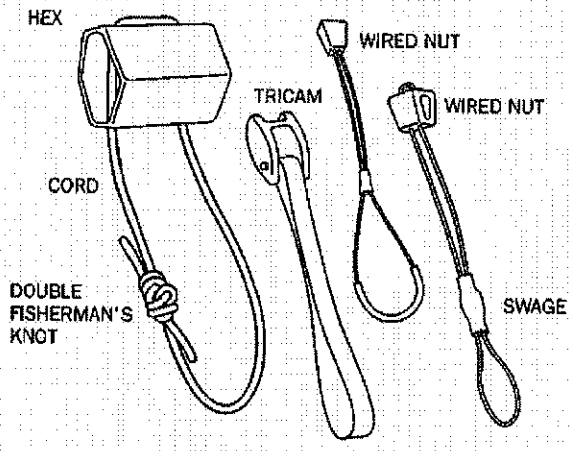
Webbing vs. Rope to Set an Anchor

It's usually better to use webbing rather than rope to set an anchor around a rock because the rough surface of rock may abrade rope or create small cuts in the sheath. Situate the webbing so that it will not slip off or come into contact with sharp edges; take advantage of notches or other irregularities to help secure the anchor in place. Padding the rock with burlap, sections of old fire hose, or carpet scraps can help shield webbing from damage.

Passive Protection

The sport of climbing has, in the last quarter of a century, developed an assortment of hardware that can be used for setting reliable anchors in cracks. Chief among these are chocks (nuts). In many cases, all trace of chocks can be removed at the end of a climbing session.

FIG. 39. CHOCKS



Chocks are available in a wide variety of shapes and sizes.

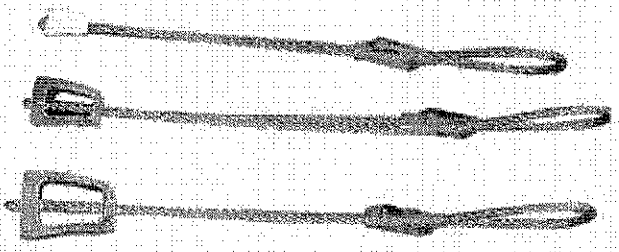
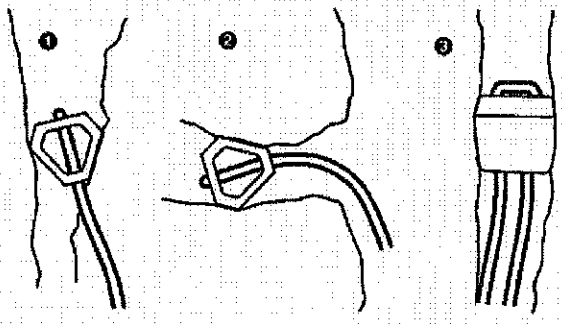


FIG. 40. PLACEMENTS OF THE HEXENTRIC CHOCK



❶ *In a vertical crack, as a passive cam—good contact with the rock gives greater holding power.* ❷ *In a horizontal crack, as a passive cam—the sling exits near the roof of the crack for proper camming action.* ❸ *Sideways in a crack, as a passive cam.*

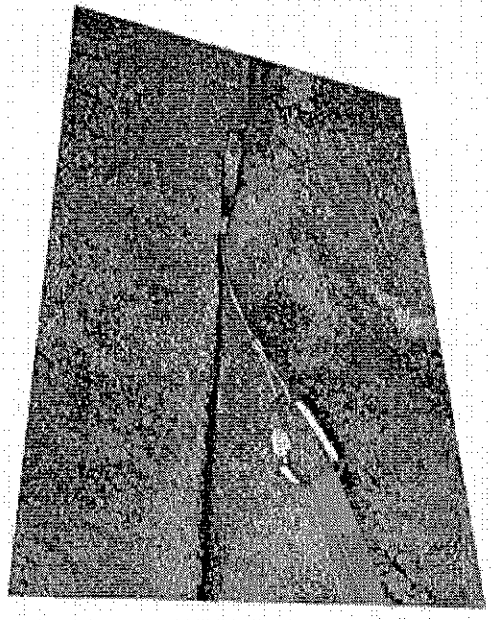
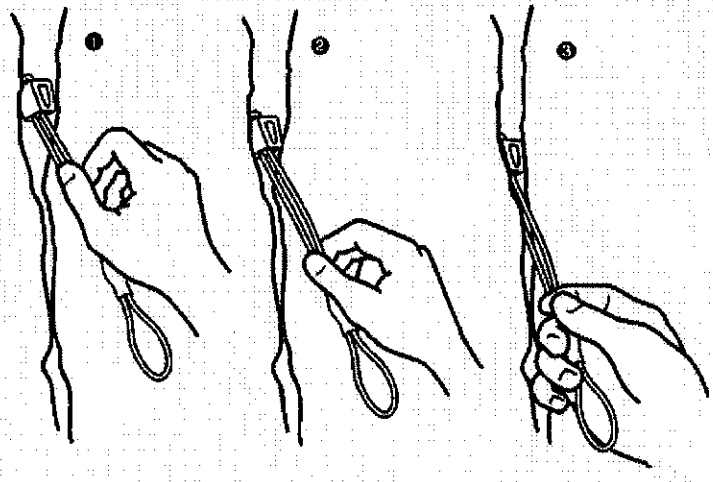


FIG. 41. PLACING A WIRED NUT

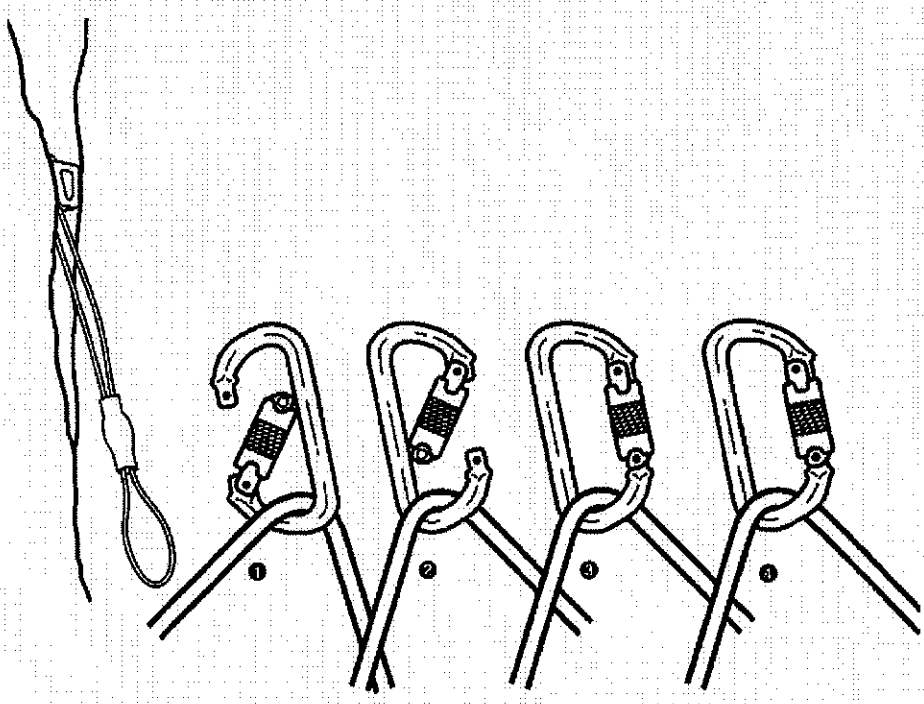


❶ *Placing a wedge into a crack above the constriction.*
❷ *Sliding it into place.* ❸ *Tugging on the chock sling to set it.*

Chocks come in a wide range of sizes, as small as ¼ inch across and as large as several inches. Their shapes vary, too, from tapered rectangles to hexagons of irregular dimensions. Whatever their size and shape, each is outfitted with a loop of wire or drilled holes to accommodate an accessory cord.

A chock must be matched in size to the crack in which it will be placed. A carabiner or webbing runner can be secured through the loop attached to a chock, and that, in turn, connected to the rest of the anchoring system. When a load is placed on the chock in an expected direction, it will jam more tightly into the crack. Removing a chock is a matter of pulling it in the opposite direction. A nut tool is handy for popping loose chocks that have become stuck in cracks.

FIG. 42. CORRECT DOWN-AND-OUT POSITIONING OF A CARABINER



❶ Clip a locking carabiner in a downward direction. ❷ Rotate it out and away from the rock. ❸ The gate opening is now down and facing out from the rock. ❹ Make sure the rope runs freely through the carabiner in the direction of travel without twisting the carabiner around.

Active Protection

A spring-loaded camming device (SLCD) placed in a crack of a width for which it was designed can provide a very solid anchor point. The cams of the device should not be fully retracted when they are released inside the crack. That allows the device to achieve maximum grip while still being easy to extract. Orient the stem of an SLCD in line with the pull of any potential falls.

FIG. 43. EXAMPLES OF SPRING-LOADED CAMMING DEVICES (SLCDs)

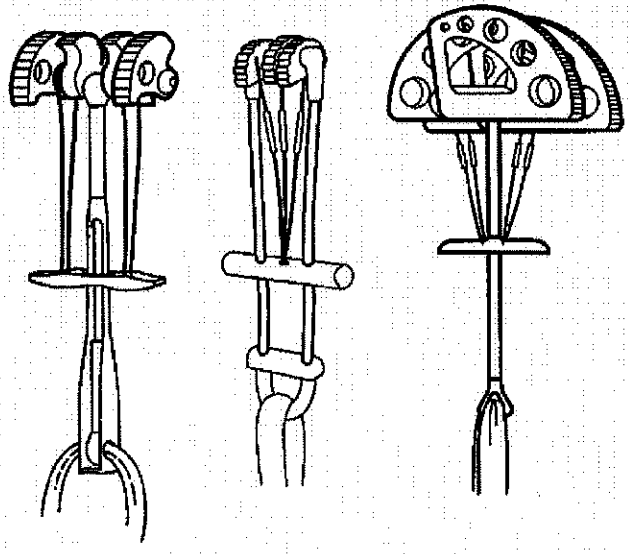
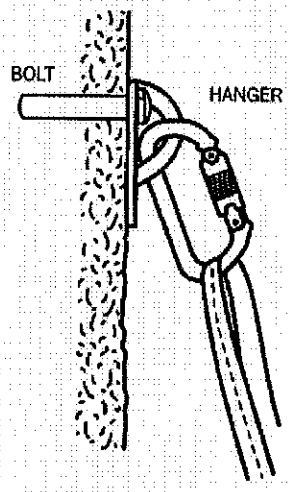


FIG. 44. BOLT AND HANGER



Bolts and Hangers

While chocks and camming devices are usually removed at the end of a climbing session, bolts are secured in holes drilled into the rock, and are permanent. Likewise, the bolt hanger (a bent strip of metal secured by a nut screwed onto the bolt) also stays in place, providing the means to connect a locking carabiner of an anchoring system to the bolt.

Bolt Placement

Only qualified experts should place bolts. Bolt placement is beyond the scope of this manual, and should not be attempted by BSA leaders without specialized training and extensive experience. Bolts may be installed at climbing sites on BSA property only with permission of the council's climbing/rappelling committee.

Types and Sizes of Bolts

Of the several types of bolts in common use today, only a UIAA- or CEN-approved bolt meets BSA standards.

- **Contraction bolt.** Has a split shaft that compresses as it is driven into a hole. This type of bolt is not allowed for anchor points.
- **Expansion bolt.** Expands an attached sleeve as it is driven into the rock or tightened with a wrench.
- **Glue-in bolts.** The bolt's shaft is glued into a predrilled hole.

Bolts used in climbing areas must have a diameter of at least ⅜ inch and be designed specifically for climbing.

A new generation of ⅜-inch bolts is made especially for use on climbing routes. Hangers attached to the bolts may be colored to match the hues of the rock, thus reducing their visual impact.

Bolt and Hanger Standards

Always observe these prohibitions when engaged in BSA climbing/rappelling activities.

- Use no bolts less than ⅜-inch in diameter. Quarter-inch bolts are no longer placed as anchors. Avoid them if they are found on any climbing routes.
- Use no aluminum hangers.
- Use no homemade bolts, hangers, or other improvised anchoring hardware. New bolts should be designed specifically for use as protection for climbers, rappellers, and belayers.
- A single bolt may not be used as the only anchor point. It should be one of the anchor points in a multi-point anchor system.
- Use only one carabiner per hanger unless the hanger is designed for more than one carabiner.

Where bolts have been placed for use as anchors for top-roping, for rappelling, or for belaying rappellers, directors and instructors of BSA climbing/rappelling activities must determine the reliability of those bolts before allowing participants to trust their lives to them. There is no absolute method to test the security of bolts embedded in rock, although the following suggestions will provide clues.

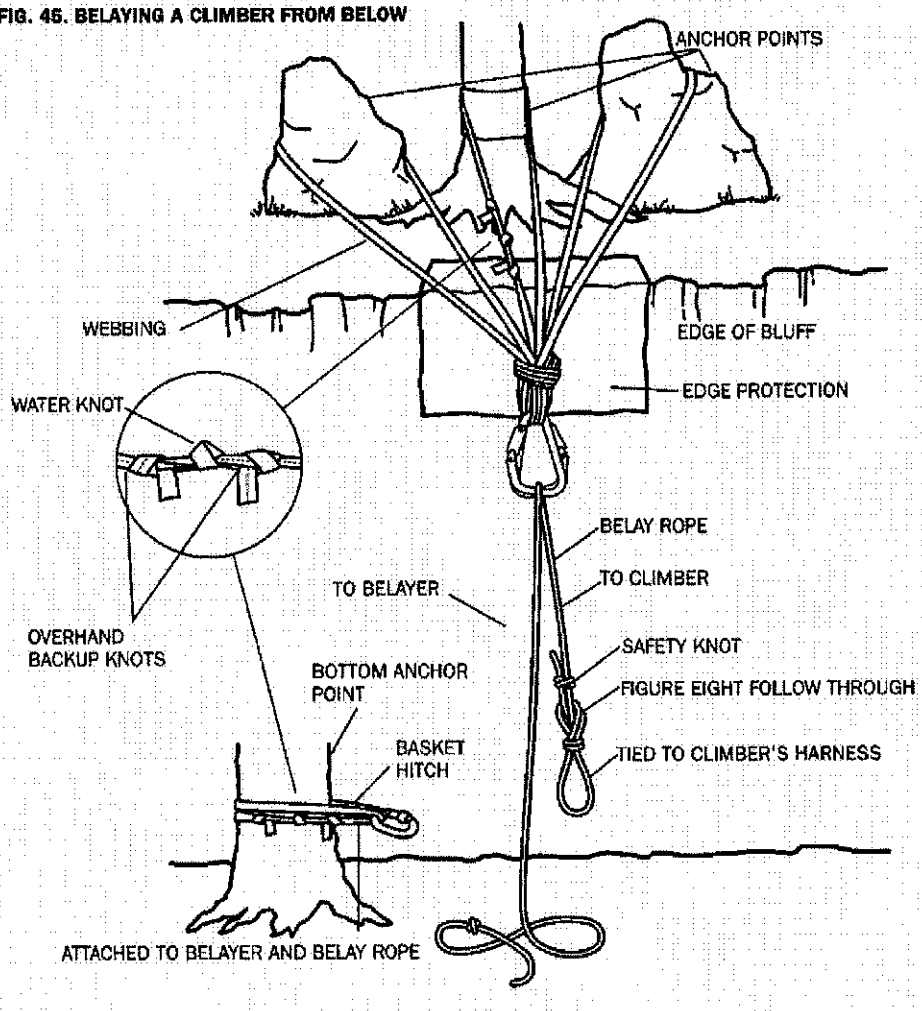
- The bolt must be fully inserted into the hole and the hanger fairly snug against the rock.
- The bolt and hanger must not be damaged, or rusted.
- The rock around the bolt should be intact, not beaten out by poor drilling or excessive pounding.
- Never test a bolt by pounding on the bolt or the hanger.
- Bolts should be installed at least 6 inches apart and at least 6 inches from fractures in the rock.
- If a bolt is loose, it must be tightened, removed, or disabled.

PITONS

The Boy Scouts of America does not permit the placement of pitons or the use of previously installed pitons. Pitons you may find in a climbing area cannot be considered reliable.

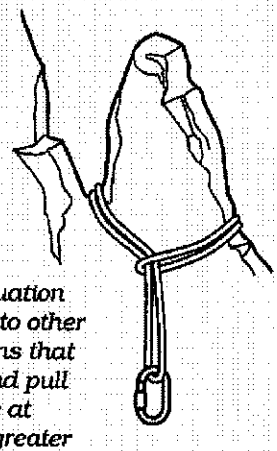
Because they can scar rock and widen cracks, pitons are rarely used today. Instead, climbers use nuts, chocks, camming devices, and other pieces of protection that are easy to remove and will not mar the faces of climbing areas.

FIG. 45. BELAYING A CLIMBER FROM BELOW

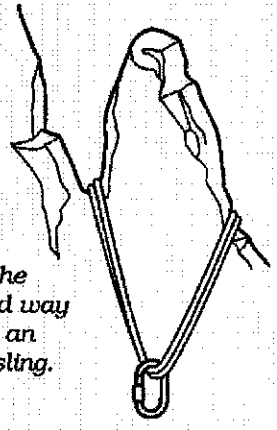


How to set up a belay system using a tree and rocks. Note that the system is extended to allow the carabiners securing the belay rope to hang freely over the edge of the cliff. That helps prevent the rope from being abraded.

FIG. 46. ANCHOR SLINGS

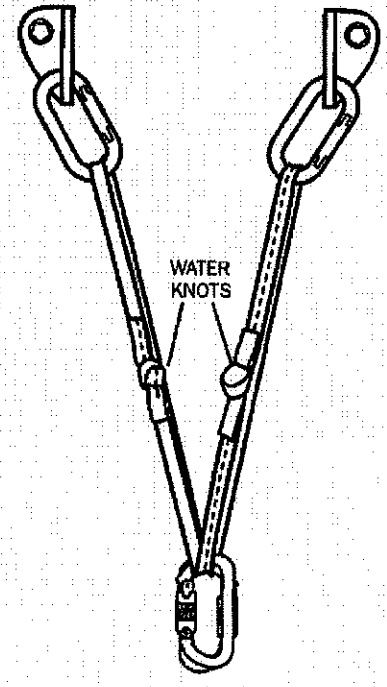


This situation applies to other situations that bend and pull the rope at angles greater than 120 degrees.



This is the preferred way of using an anchor sling.

FIG. 47. SIMPLE STATIC EQUALIZATION



Anchoring Systems

Use multiple anchor points and design each anchor to be failproof so that the entire system has redundancy (backup). Different types of anchors should be used for each anchoring system, such as a large tree or boulder, a climbing nut or chock, a bolt, or a spring-loaded camming device.

Redundancy is a key concept in anchoring. Securing belayers, climbers, and rappellers to systems attached to several anchor points provides backups that could prove to be lifesaving if one anchor pops loose. *Never rely on a single anchor point to ensure the safety of a climber or rappeller.*

For practicality in running a BSA climbing/rappelling program, keep anchoring systems as simple as possible. Instructors must be able, without difficulty, to set up the systems before a session begins and to remove the equipment at the conclusion of the day's activities. The layout of each system must be clear so that, while the system is in use, instructors can be certain of its security.

Of course, an anchoring system is adequate only if it is fail-safe. Each anchor should be placed so that it provides the most effective protection for anyone who will be using it. An anchor system must not be loaded in any direction other than the intended direction of force.

Equalized, Angle, Redundant, No Extension, Solid, Timely

Every anchoring system must exhibit the five essential qualities that spell EARNEST: **E**qualized, **A**ngle, **R**edundant, **N**o **E**xtension, **S**olid, and **T**imely.

- **Equalized.** Develop each anchoring system so the load is distributed as equally as possible among all the anchor points. That will reduce the strain on a given point and reduce the chances of any of the points failing.
- **Angle.** Keep the angle less than 90 degrees between the legs of the anchor system.
- **Redundant.** All anchors must be fail-safe or backed up. If you have even the slightest suspicion that an anchor is anything but completely reliable, build enough redundancy into the system so that the failure of an anchor will not imperil a climber, rappeller, or belayer.
- **No extension.** If an anchor point fails, the anchor system will not extend and be *shock loaded.*
- **Solid.** Anchors must be utterly reliable. There is no room for compromise. Take all the time you need to do the job right. If you are unsure of your expertise, find someone who is qualified to provide guidance.
- **Timely.** Use your time wisely and efficiently. Send staff ahead to set up so that the program is ready to go when the Scouts arrive.

Equalized Anchors

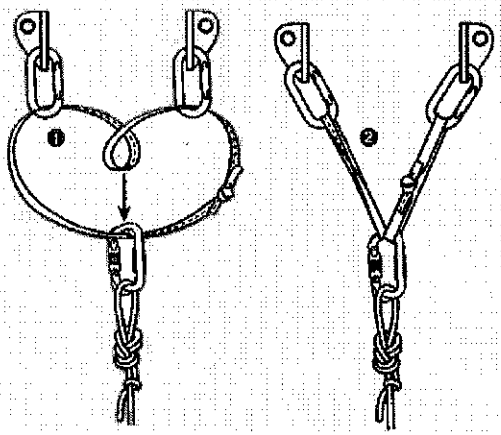
A properly equalized anchor distributes forces to all points of the anchor system. The points may be a combination of bolts, trees, rocks, cables, or pieces of artificial protection.

There are two types of equalized systems: self-equalized and pre-equalized.

- *A self-equalized anchor* may also be called self-adjusting. A loop of webbing or cordelette is attached with carabiners to several anchor points. The webbing from each leg of the anchor system is brought together as shown in Figures 48 or 49. This will allow the anchor system to adjust itself if a climber were to traverse sideways. The half twists in the upper portions of the webbing or cordelette must be used to limit the extension since a self-equalized system would have some extension if one point of the system were to fail.

- *A pre-equalized anchor* is designed to work in only one direction of pull. A loop of webbing or cordelette is attached with carabiners to several anchor points. The webbing from each leg of the anchor system is brought together as shown in Figure 50. Clip a carabiner into all of the loops. Pull the carabiner in the direction of pull. Tie an overhand knot or figure-eight knot with all of the loops.
- If the overall angle between the legs approaches 120 degrees, the forces applied to the anchor are greater than the weight of the climber.

FIG. 48. TWO-POINT SELF-EQUALIZATION



❶ *Clip a single runner to the anchor carabiners and form a loop at the top.*
❷ *Clip into the loop and the bottom part of the runner.*

FIG. 49. THREE-POINT SELF-EQUALIZATION

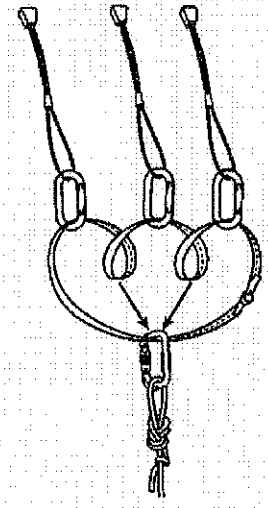
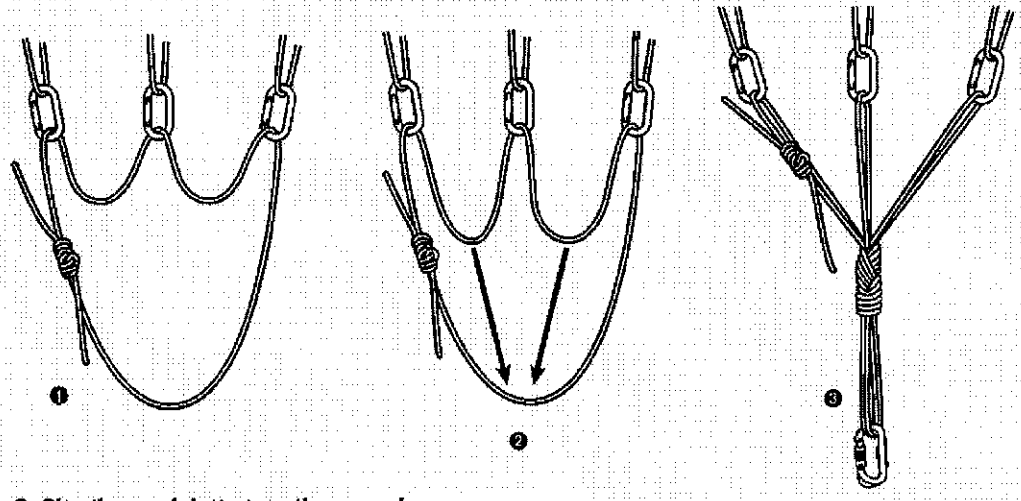
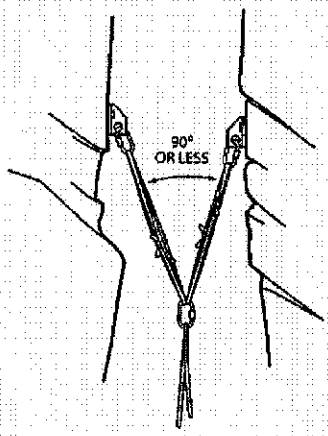


FIG. 50. PRE-EQUALIZATION WITH CORDELETTE



❶ *Clip the cordelette into three anchors.*
❷ *Pull the segments between the anchors down.*
❸ *Clip a locking carabiner into the loops, grasp all three loops together, and tie an overhand or figure-eight knot.*

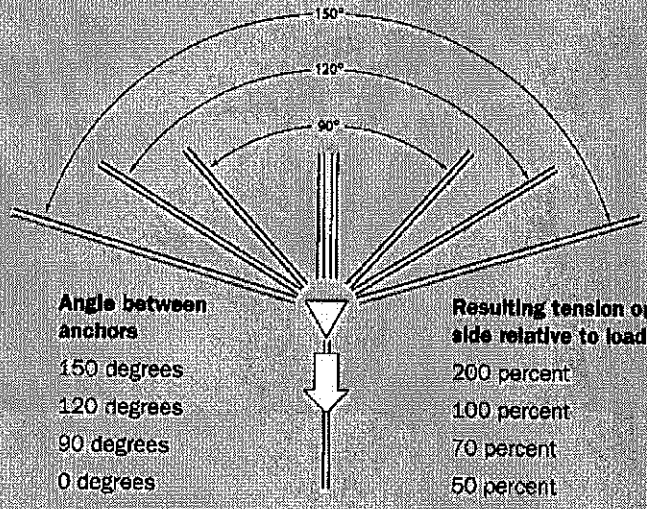
FIG. 51. OPTIMUM ANGLE BETWEEN ANCHORS



An angle of 90 degrees or less between anchors is good.

The forces on the individual points of the anchor system increase as the angle between the anchor points increases.

FIG. 52. FORCE EXERTED ON A ROPE



Angle between anchors	Resulting tension on each side relative to load
150 degrees	200 percent
120 degrees	100 percent
90 degrees	70 percent
0 degrees	50 percent

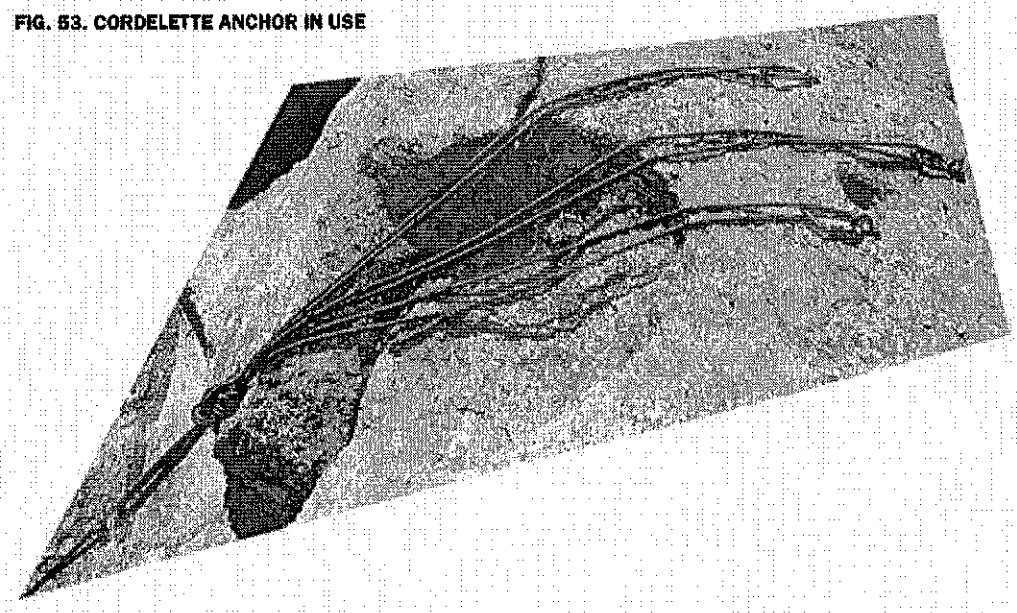
Two Anchors

Using two anchors to tie off requires special attention. The angle the rope makes between the two anchors can place stresses upon the rope that far exceed its working load. Even though it seems that the twin anchors are sharing the load, situations might arise that cause each anchor to sustain more than the actual weight of the load. When the two ropes form a 120-degree angle, each leg of the anchor is supporting 100 percent of the load. Angles greater than 120 degrees cause the tension to increase dramatically. At 150 degrees, the load is 200 percent of the original load on each leg. In actual field work, 90 degrees is a safe relationship between two legs.

Cordelette

With a minimum of equipment, a *cordelette* can divide the force of a load among several anchor points. Begin the cordelette by forming a loop with a double fisherman's knot in about 20 to 24 feet of accessory cord with a minimum diameter of 7 millimeters. Connect the loop to each anchor using a carabiner. Draw the slack from the cord to form a separate bend between each anchor, then gather the bends together and secure them with an overhand knot or figure eight knot. Clip a carabiner into the loop of the knot and use it to secure a belayer, a climbing rope, or a rappel rope.

FIG. 53. CORDELETTE ANCHOR IN USE

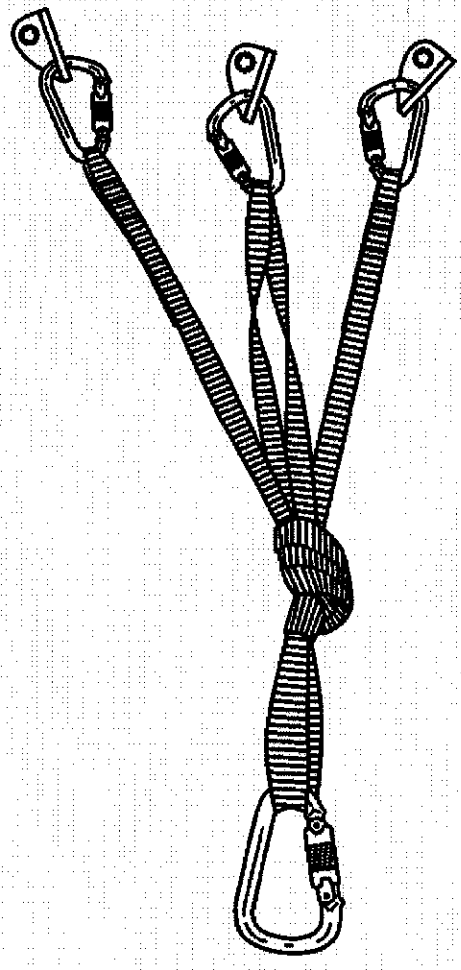


Reminders for Safe Anchoring Systems

- Each anchor must be failproof or backed up and the load equalized.
- Examine every anchor before using it, even if at first glance everything appears to be in order. Before trusting it, understand an anchor's strengths and weaknesses.
- Do not allow a rope to run over nylon webbing. Friction created by the motion of the rope may melt the webbing and lead to system failure.
- Set and rig anchors in such a way that the system is set up with the direction of pull.

- Keep the system simple so that it is convenient to set up and easy to monitor.
- During periods of use, anchoring systems should be periodically checked to make sure they are secure.
- Use the minimum amount of hardware to do the job safely and efficiently. Each component introduced into an anchoring system is one more piece that could fail.

FIG. 54. WEBOLETTE ANCHOR



Chapter 7

Belaying and Belay Signals

Managing the ropes protecting climbers and being always ready to arrest a fall, competent belayers are vital to the safe operation of a climbing/rappelling program. In fact, belaying may be the most important skill in climbing. A belayer can safeguard inexperienced climbers and rappellers, and can make it possible for skilled climbers to attempt routes that would otherwise be too dangerous. There is no way to compensate for a belayer who does not have sound skills and good judgment. Climbing/rappelling activities cannot begin until a climbing director or lead instructor is confident that all belayers are well trained and highly responsible.

The techniques of belaying have evolved dramatically through the decades. The earliest belayers simply grabbed a rope with their hands, braced themselves as best they could, and hoped that the climber tied to the other end would not fall. Over time, belayers learned the importance of tying themselves to an immovable object so that they would not be pulled down the mountain during the tumble of a climber they had been entrusted to protect. They also discovered ways to wrap the rope around their bodies and manage it to give anyone tied to the other end the best chance of surviving a fall. More recently, the development of belay devices has revolutionized belaying by providing belayers with simple, reliable means of maintaining maximum control over the rope with a minimum of effort.

BELAYING IN THE BSA

BSA climbing/rappelling guidelines require that any climber or rappeller more than shoulder height above the ground must be protected by a belayer. Climbers and rappellers may be belayed either from the top of the climb or from the ground. Anyone who is *bouldering*—practicing climbing moves closer to the ground or beginning a climb—does not need to be tied into a belay rope, but should be protected by *spotters* positioned to lessen the impact of a shortfall.

The ideal belaying setup is to belay off of the anchor and to have the belayer attached to the system. Belaying without an anchor puts both the belayer and the climber or rappeller at risk. If the climber or rappeller falls, an unanchored belayer may be pulled out of position, even over a cliff, and both the belayer and the climber or rappeller could be injured.

FIG. 55. BOTTOM BELAY SYSTEM SETUP

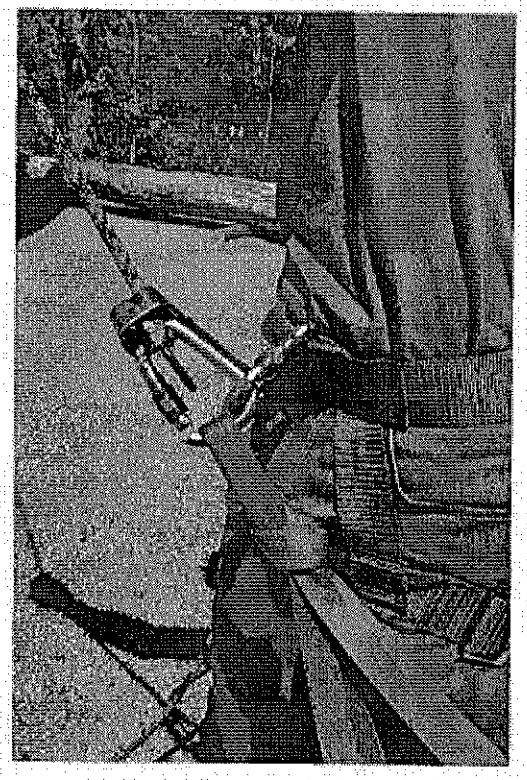
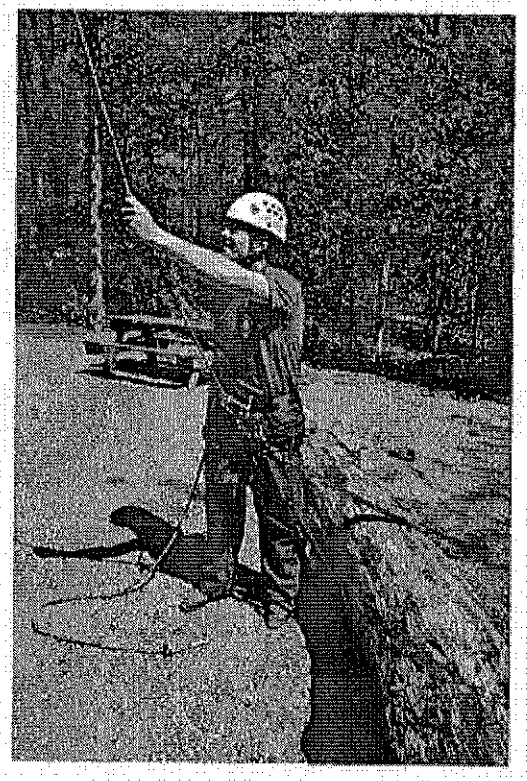


FIG. 56. BELAYER PROPERLY ANCHORED FOR A BOTTOM BELAY

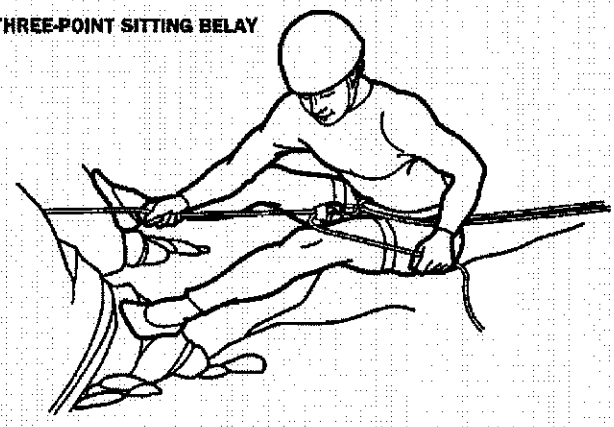


A belayer should be tied-in in such a way that there is no slack. In addition, belayers can create greater stability by bracing their feet against the ground or a rock outcropping. Belayers must at all times remain alert with their attention focused on the climbers or rappellers they are protecting.

SAFETY ON EDGES

Anyone in the area of a potential fall must be on belay or anchored.

FIG. 57. THREE-POINT SITTING BELAY



The three-point sitting belay is a strong belay position.

FIG. 58. BELAYING FROM BELOW

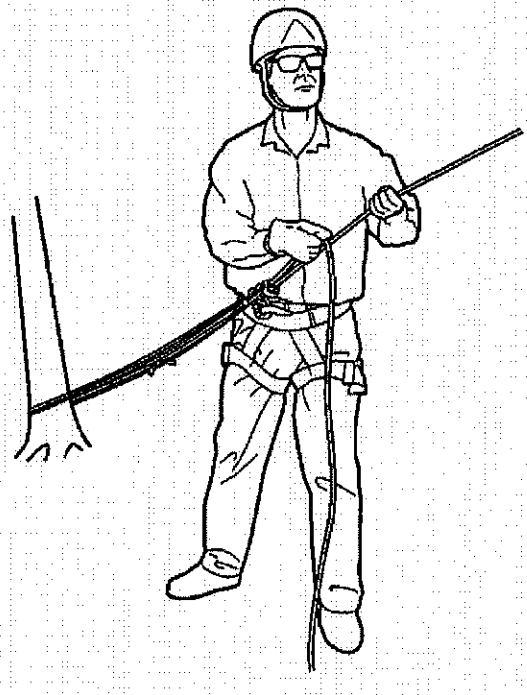
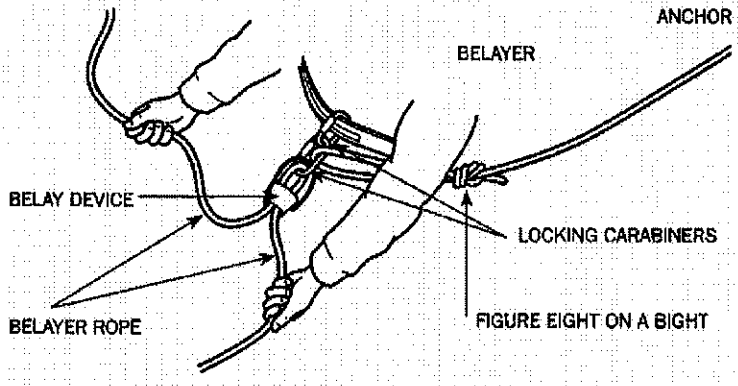


FIG. 59. ANCHORING THE BELAYER



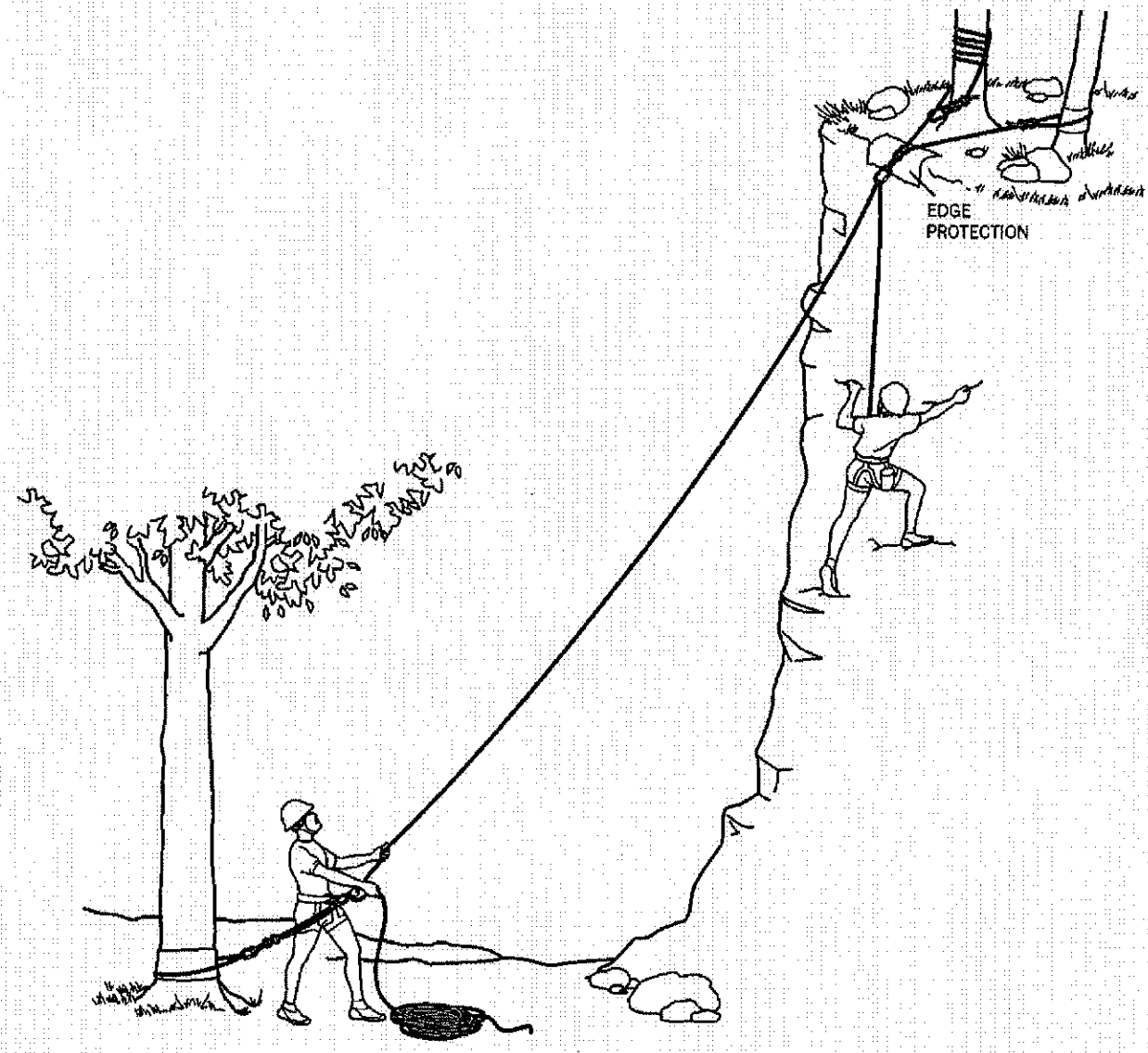
Belaying From Above

To belay from above, attach the belayer to the belay anchor with a locking carabiner (double locking carabiner preferred) clipped to the front (preferred) of the seat harness. The belayer should move forward to remove any slack between the harness and the anchor points. That will help prevent the belayer from being yanked off balance if the climber or rappeller falls. If necessary, adjust the length of the anchor sling to improve the belay position.

The belayer's location should be directly between the belay anchor system and the fall line. When the belay rope is sharply angled to one side of the fall line, a climber or rappeller who slips may pendulum across the face, increasing both the chances of injury and the strain on the belay system. Such a fall could also pull the belayer out of position if the loading force on the rope comes from a direction for which the belayer was not prepared.

Belay a climber or rappeller with a commercially manufactured belay device. (For more on belay devices, see chapter 3, "Equipment.")

FIG. 60. ANCHORING SYSTEM



Redundancy builds safety into anchoring.

Belaying From Below

While the techniques of belaying from the bottom of a route are the same as those used by belayers at the top of a climb or rappel, the methods by which a belayer is anchored may differ.

A belayer on the ground who is belaying a climber may need to be tied in to a single anchor point—one sturdy tree, for example, or a single rock outcropping—as opposed to the multiple anchor points of a belayer at the top of a climb. Belayers at the bottom of a route are usually situated so that even if they are pulled out of position, they cannot be dragged over a cliff or otherwise seriously endangered.

A belayer on the ground should be secured to anchoring systems in the same manner as for belaying from above. The belayer must be outside the fall zone. A locking carabiner connects the front of the seat harness to the anchor sling. While sitting or standing, the belayer moves forward and/or adjusts the length of the anchor system to remove any slack between the belayer and the anchor point.

Sitting vs. Standing Belay

An effective belay can be accomplished from either a sitting or a standing position. A sitting belay is generally more stable because the belayer makes three points of contact with the ground. If the belayer's feet can be braced against rocks, that provides a solid belay stance. A sitting belayer is less apt to tire when belaying a number of climbing or rappelling participants; however, it is wise to change belayers long before the belayer tires physically or mentally. A sitting belayer is easily observed by a nearby instructor.

A standing belay from the top allows an experienced belayer to peer over the edge to observe the progress of the climber or rappeller. The anchor points should be fairly high so that the belayer stays in line with the direction of pull on the rope. A standing belayer can move effectively to take in or feed out rope as the progress of the climber or rappeller is observed. One foot should be placed forward of the other to provide the most stable stance.

FIG. 61. SITTING BELAY

For a sitting belay, the belayer is off anchor and is tethered to an independent line.

A standing belay from the bottom of the climb can be easy to manage. Stay close to the face of the climb. If you back up too far from the base, you are increasing the forces, and the belayer may be yanked off his or her feet should the climber fall.

Belaying Variations

In addition to the standard belay scenarios described above, climbing directors may encounter one of several acceptable variations. In some climbing programs, a belayer anchored on the ground in the standard way is provided a backup anchor in the form of another person gripping the belayer's harness and using body weight to hold the belayer in place. An additional participant can be assigned the task of handling the loose rope, a job that keeps excess rope out of the way and helps occupy the time and attention of one more person.

Belaying With Belay Devices

A belay device will bend the rope in such a way that the belayer can smoothly take in or feed out line. The belayer can also arrest a fall by bending the rope more sharply, creating friction and locking the rope in place. The devices are especially helpful if a small belayer is protecting larger rappellers or climbers. As with other climbing and rappelling skills, handling a belay device efficiently requires instruction and practice.

Use a locking carabiner to clip a bend of rope and the keeper loop of the device directly to an anchor system to which the belayer is independently clipped. The keeper loop will prevent the device from migrating along the rope and beyond the belayer's reach.

Arrange the rope so that the belayer's stronger hand (usually the right hand for people who are right-handed) will be the *brake hand*—the hand closest to the free end of the rope. The other hand will be the *guide hand*, resting on that part of the rope leading to the climber or rappeller. (Specialized belay devices such as the Grigri are set up a little differently. Refer to the manufacturer's guidelines.)

FIG. 62. BELAYING

There are a variety of acceptable techniques for belaying. The most important requirement is that the brake hand never leaves the rope. In the past, the most commonly used technique has been called, "slip-slap-slide."

To take up slack as a climber ascends:

❶ *Grasp the rope with both hands and feed it through the belay device, pulling the guide hand toward the body and moving the brake hand away.*

❷ *Holding the rope firmly with the brake hand, slide the guide hand out along the rope, away from your body.*

❸ *Use the fingers and thumb of your guide hand to clasp both sections of the rope firmly, then slide your brake hand back toward your body. Begin the sequence again.* ***(Remember—the brake hand must never leave the rope!)***

❹ *Whether you are letting out rope or taking up slack, stop a fall by grasping the rope tightly and pulling it back toward the hip on your brake-hand side.*

The BUS (brake-under-slide) technique has become popular.

❶ ***Brake*** *or lock off the belay rope by pulling downward with the brake hand.*

❷ *Move the guide hand* ***under*** *the brake hand.*

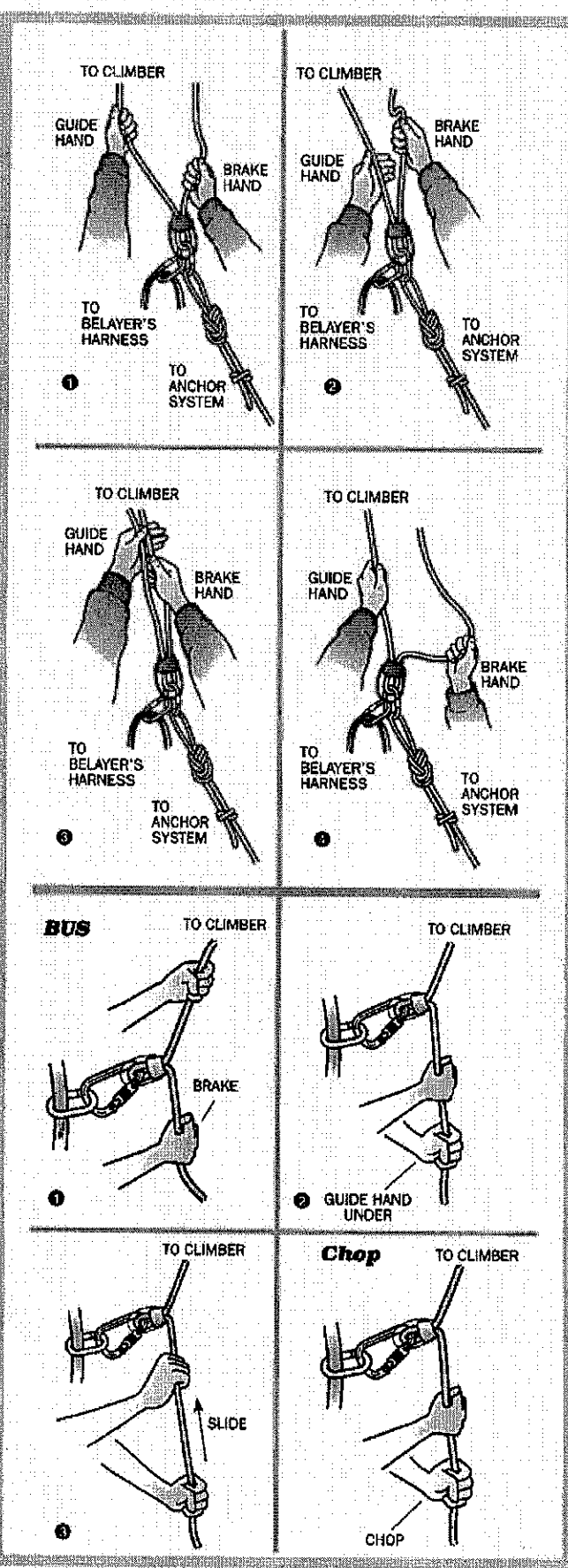
❸ ***Slide*** *the brake hand up toward the belay device.*

You are ready to repeat the procedure.

A variation of the BUS is the ***Chop*** *technique since the hand movement is similar to chopping wood.*

Both hands are brake hands. They pull the rope through the belay device and then lock off as both hands move down. Next, one hand slides up toward the belay device. The other hand slides up toward the first hand.

You are ready to repeat the procedure.



When a climber is moving, the belay process requires coordination between the guide hand and the brake hand.

- For the "slip-slap-slide" technique, the guide hand is extended down the rope away from the belay device, grasps the rope, and pulls in slack. At the same time, the brake hand pulls rope away from the belayer's body and draws the slack through the belay device.
- While the brake hand tightly holds the rope, the guide hand slides back down the live part of the rope, then reaches across beyond the brake hand and grasps both parts of the rope.
- The brake hand slides back to the belay device and again grasps the rope securely. The process is repeated each time slack forms in the rope.

The brake hand must never leave the rope. The fingers must always be curled around it, ready to arrest a fall by bending the rope across the belay device.

When a rappeller is descending, the belayer's guide hand feeds rope out through the belay device. To lock off the rope and arrest a fall, the belayer uses the brake hand to bend the rope sharply across the device.

The ability to arrest a fall with a belay device depends on smooth, practiced handling of the rope and a constant focus on the climber or rappeller. Belayers must be alert to any changes in the situation and aware of the security of anchors, equipment, and the belay stance itself.

Verbal Signals for Climbers and Belayers

Safety at climbing/rappelling areas is impossible without good communication. Climbers, rappellers, and belayers have developed a standard set of signals to exchange information with one another. Participants should be introduced to these signals and should use them throughout BSA climbing/rappelling activities.

Hearing-Impaired Participants

Climbing instructors may have opportunities to work with participants who are hearing-impaired. Instructors should meet ahead of time with the adult leaders of these participants to develop appropriate strategies for ensuring safe communications during climbing and rappelling. A climbing instructor should be willing and able to work with hearing-impaired participants in a climbing/rappelling activity.

Limit talking in climbing areas to essential exchanges of information. Noise and the distractions of casual conversations can confuse belayers and those on belay. Participants waiting their turn should curtail visiting and avoid horseplay. If chattering becomes an issue, instructors should suspend climbing and rappelling activities until the situation has been remedied. If the day is too windy or the area too noisy for climbers and belayers to hear one another clearly, climbing and rappelling should be postponed or moved to another site.

Rock!

A shout of "Rock!" is perhaps the most important of climbing's signals. It warns everyone that there is immediate danger from something falling—a rock, a carabiner, an article of clothing, etc. Yells of "Rock! Rock! Rock!" warn of more danger than a single shout. Those hearing the warning should not look up, but must immediately protect themselves in the most efficient way—taking refuge under a ledge, moving quickly to the left or right, or becoming "small" under one's climbing helmet.

The signals between a belayer and a climber or rappeller are clear commands and answers of just a word or two. Each command is always followed by a response of acknowledgment to ensure that the command was heard and correctly understood. Each word should be enunciated loudly and slowly, especially if the wind is blowing, distance is a factor, or a ledge or overhang prevents a belayer and a climber or rappeller from seeing one another. Several participants climbing or rappelling in close proximity should use names to be sure the right person is getting the message. When in doubt, repeat signals and responses.

Signals for Belaying Climbers

Generally accepted signals exchanged between a climber and a belayer include the following, listed in a normal sequence.

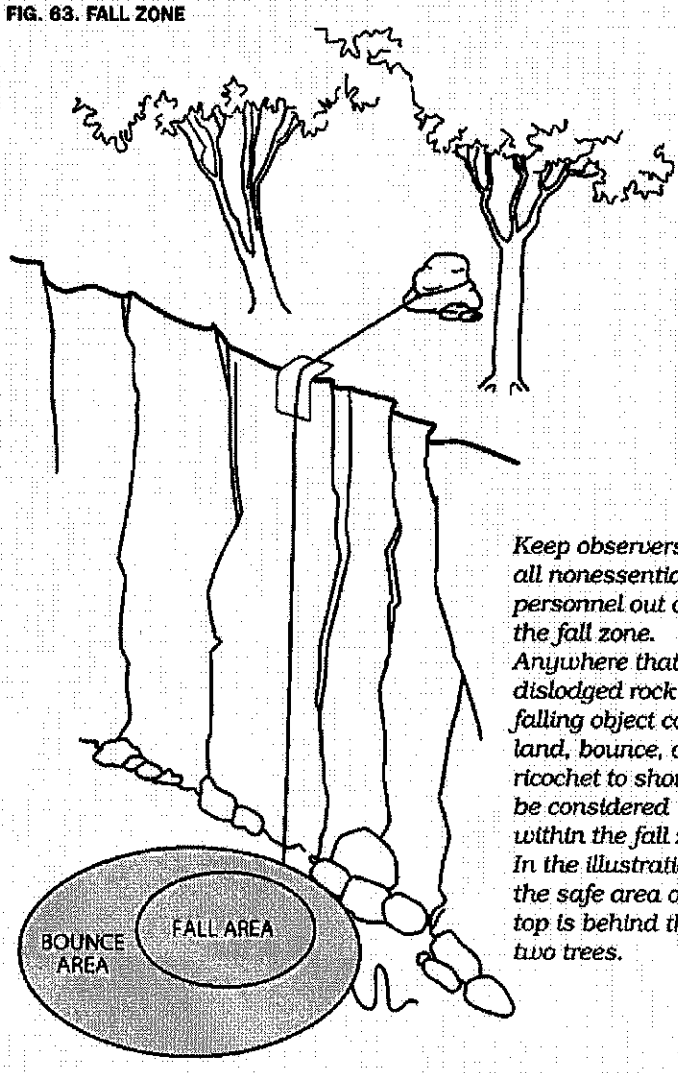
Climber	Belayer	Meaning
"On belay?"	→	"Is the belay ready?"
	"Belay on." →	"Your belay is ready."
"Climbing."	→	"Here I come."
	"Climb" or "Climb on." →	"Come ahead."
"Slack."	→	"I need some slack in the rope."
"Up rope." or "Tension."	→	"Take in the loose rope."
"Falling!"	→	"I'm falling! Brake the rope!"
"Ready to lower."	→	"Lower me down the route."
	"Lowering." →	"I'm letting you down now."
"Rock!" →	"Rock!" →	"Look out for falling objects."
"Rope!" →	"Rope!" →	"Rope being thrown down."
"Clear." →	"Clear." →	"It is safe to throw down a rope."
"Off belay."	→	"I'm in a safe place and no longer need a belay."
	"Belay off." →	"I'm no longer belaying you."

Signals for Belaying Rappellers

The verbal signals used by rappellers are a little different from those of climbers, but the basic information they share is the same.

RAPPELLER	BELAYER	MEANING
"On belay?"	→	"Is the belay ready?"
	"Belay on." →	"I'm ready to belay."
"Rappelling."	→	"Your belay is ready."
	"Rappel on." →	"Go ahead."
"Falling!"	→	"I'm falling! Brake the rope!"
"Off belay."	→	"I am done rappelling and am in a safe place."
	"Belay off." →	"I'm no longer belaying you."
"Off rappel" or "Off rope."	→	"The rope is free of hardware and is ready for the next rappeller."

FIG. 63. FALL ZONE



Keep observers and all nonessential personnel out of the fall zone. Anywhere that a dislodged rock or falling object could land, bounce, or ricochet to should be considered within the fall zone. In the illustration, the safe area on top is behind the two trees.

Getting Out of a Belay System

In extremely rare situations, it may be necessary to remove the belayer from the anchor system. If the belay rope is attached directly to the anchor system with the belayer attached independently, it is very easy to do this:

❶ Use a belay device with a mule knot (or a Münter/mule knot with an HMS carabiner) to tie off the belay rope.

❷ The belayer can now detach from the system without affecting the integrity of the belay system.

❸ Another belayer can clip into the system.

❹ Untie the mule knot.

❺ Resume belaying.

If the belay rope is attached directly to the belayer's harness and not directly to the anchor, it is much more involved.

❶ Tie off the belay device with a mule knot. (See Figure 32 in chapter 5.)

❷ Attach a cordelette or webbing sling to the belay rope above the belay device using an appropriate friction knot. Put a locking carabiner in the cordelette or sling.

❸ Attach another long cordelette or webbing sling to the anchor. Tie the other end to the carabiner in Step 2 using a Mariners hitch. (See Figure 33 in chapter 5.)

❹ To tie the Mariners hitch, do the following:

- Pass the cordelette or sling through the carabiner twice.
- Then wrap the free end around the standing part of the lines, making four or five wraps.
- Finish by passing the free end between the two strands.

❺ The belayer can now detach from the system.

❻ Another belayer can now clip into the system.

- Untie the Mariners hitch.
- Untie the mule knot.
- Resume belaying.

Pick-off and cutaway rescues add additional risk because they remove the participant from his or her primary belay system. These procedures should be reserved for professional rescue personnel and should not be taught or practiced as a part of our program.

Assess the Situation First

As in any emergency, rescuers and bystanders must be aware of their own safety so that they do not complicate an already difficult situation by becoming victims themselves. Belayers at the top of climbing or rappelling routes should assess their positions before releasing themselves from an anchor. In some cases, it will be appropriate to clip into a safety line or another anchor before giving up the security of the original position.

(For more on ensuring an appropriate environment for climbing and rappelling, see chapter 2, "Safety and Leadership." For more on responding to emergencies at climbing/rappelling sites, see chapter 12, "Incident Resolution, First Aid, and Emergency Response.")