

## 6.2 KNOTS and HITCHES ☺

There are many different types of knots available for use in mountain rescue situations. Our Emphasis is SIMPLICITY. The Knots listed in this section have been selected for use in AMRG systems.

- **KEEP IT SIMPLE & SAFE (KISS)**
- The fewer types of knots that are used in the system, the easier it is to set up and check.
- Group familiarity & recognition with each knot/hitch or system used is essential to operate efficiently in a rescue.

### 6.2.1 **FIGURE 8** A.K.A. (follow through 8, rewoven figure 8)

- Principal use: End of rope knot for tying directly into harness loops.
- Always back up this knot with a 1/2 of double fishermen's knot See (6.2.7).
- Only used on NON-Rescue loads (i.e.: 1 person belayed or climbing) except on the Apex ring of the litter spider rig for attendant lines or similar situation.
- This knot should be uniform and lie well when properly tied.

### 6.2.2 **FIGURE 8 ON A BIGHT**

- Principal use: End or mid rope knot for clipping a rope to a RESCUE load for hauling, lowering, belay or an anchor.
- When tied in the end of the rope as primary rescue knot, must be backed up with ½ of a double fisherman knot.
- This knot is the ONLY one that shall be used on the rescue rope with a rescue load except when tying two or more ropes together. (See 6.2.3 DOUBLE SHEET BEND)
- If tied in the middle of rope, no back up is necessary for this knot.

### 6.2.3 **DOUBLE SHEET BEND**

- Principal use: Tying two or more rescue ropes together to increase the length.
- Both tails should be on the same side of the knot when finished
- This knot should be well-dressed and loaded after tying.
- Knot should be backed up with a split double fisherman

### 6.2.4 **CLOVE HITCH**

- Principal use: An adjustable tie off at the middle or end of rope.
- The clove hitch SHALL be backed up with a FIGURE 8 ON A BIGHT to the anchor on the standing end
- A clove hitch may be used in anchor systems or as an attachment point on a hauling line that is being piggybacked, in lieu of a second soft hauling cam.
- Be sure to remove all slack rope between the hitch and the anchor.
- The load line from the hitch shall be proximal to the spine of the carabiner.

### 6.2.5 **MUNTER HITCH** A.K.A. (Italian Hitch)

- Principal use: For lowering or rappelling with a standard load (NON-RESCUE). Also used in the making of a TRD.
- This is an acceptable alternative for the use of a standard belay (friction) device for non-rescue loads.
- The use of this hitch creates a substantial amount of twisting in the rope.



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### 6.2.6 **DOUBLE FISHERMAN KNOT** A.K.A. (Grapevine)

- Principal use: To tie the ends of a piece of cord into a closed loop, also 1/2 is used as a backup on a figure 8-knot tail.
- A (3") Three-inch tail shall be left on each end after the knot is tied and dressed.
- When tying on a closed loop both halves of the knot shall be parallel and lie uniformly.

### 6.2.7 **WATER KNOT** A.K.A. (Ring Bend, Overhand-Follow Through, Gut knot)

- Principal use: To tie the end of webbing together, either to extend a length or in a closed loop.
- A (3") Three-inch tail shall be left on each end after the knot is tied and dressed.
- This is the preferred knot in webbing for ease of knot removal after loaded heavily.
- When tying the knot both ends shall be flat and lie uniformly.

### 6.2.8 **BLOCKING KNOT** A.K.A. (safety lock off)

- Principal use: To "Safety " off a belay device or a TRD.
- When releasing the knot, be prepared to begin belaying as soon as the slip bight is pulled free.
- Always "dimmer off" clip the last bight back to the anchor.

### 6.2.9 **KLEMHEIST**

- Principal use: To provide a backup safety (autobelay) during individual rappelling or ascending.
- Shall be clipped into a dedicated locking carabiner on the harness.
- The loop shall be wrapped downwards a minimum of three (3) times around the rope before returning back through the open bight at the top.
- This knot shall be dressed properly and "Tended" so it will function smoothly and efficiently.
- Construct a loop for use as a Klemheist using 5-7 feet of 7mm accessory cord, tied into a loop with a double fisherman's knot.

### 6.2.10 **PRUSIK**

- Principal use(s): As a bi-directional safety cam (autobelay) for attachment to either a fixed line or rappel line. Also used in sets as a rescue belay in a hauling system, as a hauling cam, and belay back-up in a lowering system (attached above friction device).
- When used in rescue system (as autobelay, belay backup, and hauling cam) must be made from 8mm cord with a minimum breaking strength of 15KN
- This knot shall be dressed properly and "Tended" so it will function smoothly and efficiently.
- The loop shall be wrapped inwards a minimum of three (3) times around the rope before pulling the anchor end tight.
- Smaller diameter cord can be used for NON-RESCUE loads, such as rappel backup or in ascending devices.
- Shall be clipped into a dedicated locking carabiner on the harness when used in a rappel as an auto belay.
- Tandem Prusiks (used as a rescue belay or autobelay in a hauling system) shall be made of 8mm kernmantle cord with a min. breaking strength of 15KN and sized according to the following specifications:

"Long" = 65" (165 cm) tied into a loop with a double fisherman (2.5" tails)\*

"Short" = 53" (135 cm) tied into a loop with a double fisherman (2.5" tails)\*

\*Tighten the knot with body weight.

### 6.2.11 FRENCH BAUDRIER (Pronounced: Bo-Dree-A)

- Principal use: To create an improvised shoulder loop chest harness.
- Always load in both directions to ensure that the knot does not slip and is correctly tied.
- Use remaining bight to integrate the chest harness to the seat harness if long enough.

### 6.2.12 RADIUM RELEASE HITCH (Tension Release Device-TRD)

- Principle use: as a tension release device allowing lowering of a connected rope system a short distance while that system is under rescue load
- Radium release hitch was developed by Rigging for Rescue (RFR) after extensive comparative analyses of release devices undertaken 1997-1999.
- Created from 10 meters of 8mm nylon low stretch cord and 2 locking pear-shaped carabiners.
- Tie a figure-of-8 on a bight and clip it into the load-side carabiner on its spine side. Clip the standing part of the cord up through the anchor carabiner, back down through the load carabiner; bring back up to the anchor and tie a Munter Hitch onto that anchor carabiner on its gate side. Ensure that the Munter Hitch is in the release position with the in-feed rope towards the gate side of the carabiner. A reasonable length for the hitch (distance between 2 carabiners) is 10 to 15 cm.
- Secure the Radium Release Hitch using a bight to tie a half hitch around the entire stem below the Munter Hitch , and then back it up with an overhand-on-a-bight knot, again around the entire stem (all strands).

## 6.3 HARNESSES AND HOOK-UPS §

### **Both a seat and chest harness shall be worn during all technical operations.**

- The seat harness shall be of commercial construction, designed for climbing or rescue work, and meeting the UIAA or NFPA standards. Improvised chest harnesses may be used, but commercially produced chest harnesses are strongly encouraged.
- The Seat harness and chest harness shall be fully integrated together with webbing or kernmantle cord. This is essential in order to provide shock absorbency and strength in the event of a fall.
- Improvised harnesses should only be used if a commercial harness is not readily available or impractical to apply on a stranded climber. Exception: An improvised chest harness is an acceptable alternative to a commercial harness.
- When attaching the rescue rope to a harness system, a figure 8 on a bight and locking carabiner shall be used. The rope should be attached (via carabiner) to the integration loop between the chest and waist harness so that a comfortable, head-up position is maintained in the event that a rescuer becomes incapacitated or unconscious. The main line should NOT be attached to the waist harness and then clipped through a carabiner on the chest harness as this could lead to serious back compression and torso constriction in the event of a fall.
- Any device or system attached to a harness shall be clipped separately into the harness loops or master LOCKING carabiner with an independent locking carabiner or multiple dedicated locking master carabiners may be used. Thus, any device or system can be easily disconnected without inadvertently exposing other systems to failure.

### 6.3.1 **Improved sit harness shall be a modified diaper sling that can be applied/tied from a 10' loop of 1" tubular from behind the subject .**

### 6.3.2 **Improved chest harness shall be a shoulder loop tied with a French Baudier.**