CARLISLE FIRE COMPANY

ROPES AND KNOTS

RESOURCE; IFSTA ESSENTIALS OF FIREFIGHTING 4TH AND 5TH EDITION
ROPE AND KNOTS

WHAT WE WILL DISCUSS

- DIFFERENT TYPES OF ROPE CONSTRUCTION / CLASSIFICATIONS
- PROPER CARE OF YOUR ROPE
- RECORD KEEPING AND STORAGE OF ROPE
- SEVERAL KNOTS USED IN THE FIRE SERVICE
- METHODS OF HOISTING TOOLS AND EQUIPMENT
FIRE SERVICE ROPE FALLS INTO TWO CLASSIFICATIONS

- **Life Safety**
  - Used solely to support rescuers/victims
  - Must be synthetic, block creel, virgin fiber
  - May not be reused unless meets all reuse criteria

- **Utility**
  - Used for any but life safety applications
  - May be synthetic or natural fiber
  - May be reused
LIFE SAFETY ROPES (STANDARD FOR REUSE)

- Has no visible damage
- Has never been exposed to heat, flame, or abrasion
- Has never been subjected to any impact load
- Has never been exposed to harmful chemical liquids, solids, gases, mists, or vapors
- Passes inspection before and after each use
UTILITY ROPE

• USED IN ANY INSTANCE, EXCLUDING LIFE SAFETY

• HOIST EQUIPMENT

• SECURE UNSTABLE OBJECTS

• CORDON OFF AN AREA

• THERE ARE INDUSTRY STANDARDS FOR PHYSICAL PROPERTIES

• THERE ARE NO STANDARDS FOR APPLICATIONS
THERE ARE TWO TYPES OF ROPE USED IN LIFE SAFETY SITUATIONS
• Used when long falls are a possibility

• Designed for high stretch without breaking

• Not considered practical for hauling applications
• Preferred for rescues requiring raising and lowering heavy loads

• Designed for low stretch without breaking

• Used for hauling, rescue, rappelling, and where no falls are likely to occur or only very short falls are possible
ROPE CONSTRUCTION

Laid (Twisted)

Braided

Braid-on-Braid

Static Kernmantle

Dynamic Kernmantle
ROPE TERMINOLOGY

- Strand
- Yarns
- Fibers
- Sheath or Jacket
- Core
- Mantle
- Kern
LAID (TWISTED) ROPE CONSTRUCTION

• Constructed by twisting yarns together to form strands; three strands twisted together make final rope

• Susceptible to abrasion and other types of physical damage
BRAIDED ROPE CONSTRUCTION

- Is constructed of uniformly intertwined strands
- Reduces or eliminates twisting common to laid ropes
- Is subject to direct abrasion and damage
• Is constructed of uniformly intertwined strands

• Reduces or eliminates twisting common to laid ropes

• Is subject to direct abrasion and damage
• Has braided covering or sheath over main load-bearing strands

• Comes in both dynamic and static types
PROPER CARE AND MAINTNANCE OF YOUR ROPE
GUIDELINES FOR INSPECTING ROPE

• Inspect visually and tactiley after each use.

• Remove damaged rope from service.

• Inspect for flaws and damage specific to rope type.
• Number or otherwise identify all ropes.

• Inspect after each use.

• Make periodic inspections.

• Use approved inspection methods.

• Immediately red-label rope damaged on scene.

• Keep a rope logbook.

• Remove used life safety rope from service per manufacturer’s criteria.
REASONS TO REMOVE ROPE FROM SERVICE

• Excessive sheath wear
• Severely shock loaded
• Overloaded
• Chemically contaminated
• Old
  • Lacks uniform diameter
• Lacks uniform texture
• Does not meet manufacturer’s criteria for reuse as life safety rope
CLEANING SYNTHETIC ROPE BY HAND

• Use cool water and mild soap (no detergents, bleaches, or solvent-based cleaners).

• Wipe with damp cloth that has been dipped in cool soapy water and then wrung out, or scrub gently with brush.

• Rinse thoroughly.

• Dry out of direct sunlight.
• Use cool water.

• Feed through washer to remove larger particles of dirt.

• Remove stubborn dirt by hand with cloth or scrub brush.

• Dry thoroughly out of direct sunlight.
CLEANING SYNTHETIC ROPE ON CLOTHS WASHER

- Use a front-loading, tumbling-type machine without a plastic window.

- Place rope in cloth bag in bird's-nest coil.

- Wash and rinse in cool water for recommended period of time.

- Use mild soaps (no detergents, bleaches, or solvent-based cleaners), and follow mfgr.’s directions.

- Dry thoroughly out of direct sunlight.

- Contact the rope mfg. for special cleaning problems.
• Spread out on a hose rack out of sunlight

• Suspended in a hose tower

• Loosely coiled in a hose dryer
RECORD KEEPING AND STORAGE OFropes
• Start record with purchase of each piece of rescue rope.

• Keep track of each use and the inspection/maintenance records of the rope.

• Keep rope’s log book in waterproof envelope.

• The rope log is usually placed in a pocket sewn on the side of the rope’s storage bag.
LIFE SAFETY ROPE STORAGE

• In clean, dry spaces that have adequate ventilation

• Coiled

• In bag
  
  o Best for kernmantle rope and other life safety rope

  o Allows easy carrying; keeps dirt and grime from rope
BAGGING ROPE
The ability to tie knots is a vital part of fire and rescue operations.

IT COULD SAVE YOUR LIFE
Easy to tie

Easy to identify

Easy to untie

Secure under load (not subject to slippage)

Tied with few abrupt bends

Strong enough for required job
ELEMENTS OF THE KNOT

Bight

Underhand Loop

Round Turn

Loop

Overhand Loop
KNOTS ARE USED TO CONNECT OR JOIN OBJECTS AND FORM LOOPS

- Vital part of Fire and Rescue Operations
- Improperly tied knots are extremely hazardous
SINGLE AND DOUBLE OVERHAND KNOT

• USED AS A SAFETY FOR ALL KNOTS

• ELIMINATES DANGER OF END OF ROPE SLIPPING THROUGH THE KNOT
KNOTS

**BOWLINE**

- IMPORTANT KNOT IN THE FIRE SERVICE
- EASILY TIED AND UNTIED
- GOOD FOR FORMING A LOOP THAT WILL NOT CONSTRING THE OBJECT
- FIREFIGHTERS SHOULD BE ABLE TO TIE IN THE OPEN AS WELL AS AROUND AN OBJECT
BOWLINE
ANCHOR BEND

• USED FOR ATTACHING A ROPE TO A RING OR SIMILAR TERMINATION
ANCHOR BEND
CLEAT HITCH
CLOVE HITCH

- Consists of 2 half hitches
- Used to attach a rope to an object
- Not suitable for anchoring life safety rope
- Can be formed anywhere in the rope
- Withstands pull in either direction
- Easily slips

![Clove Hitch Diagram](image)
CLOVE HITCH
BECKET BEND (SHEET BEND)

- USED FOR JOINING TWO ROPES OF UNEQUAL SIZE
- UNLIKELY TO SLIP WHEN WET
- NOT SUITABLE FOR LIFE SAFETY APPLICATIONS
• GAINED INCREASED ACCEPTANCE AND POPULARITY FOR FIRE AND RESCUE

• SEVERAL VARIATIONS OF THE FIGURE-EIGHT
FIGURE-EIGHT
FIGURE EIGHT FOLLOW THROUGH

1. 
2. 
3.
HOISTING SAFETY CONSIDERATIONS

• Have Solid Footing and Make Necessary Preparations

• Use Hand-Over-Hand Method

• Always Use a Safety Knot

• Protect Rope from Physical Damage

• Work in Teams
Secure Charged Hose line’s Handle to Prevent Accidental Discharge

Do Not Hoist Pressurized Cylinders, such as Fire Extinguishers and SCBA Bottles

Ensure All Personnel are Clear of Hoisting Area

Avoid Electrical Hazards
  If Not Possible, Use Extreme Caution
ALMOST ANY PIECE OF EQUIPMENT CAN BE HAULED WITH ROPE

- THE KNOTS OR HITCHES USED MAY VERY
- CONSIDER A TAG LINE OR TYING THE EQUIPMENT IN MIDDLE OF ROPE
- KEEP SAFETY IN MIND AT ALL TIMES

WE WILL DISCUSS HOW TO HOIST THE FOLLOWING

- AXE
- PIKE POLE
- LADDER
- HOSELINES
- FANS
• Tie a Clove Hitch Near the Head of the Axe

• Loop the Working End of the Rope Around the Head of the Axe and Back up the Handle

• Tie a Half Hitch on the Handle a Few Inches Above the Clove Hitch

• Tie Another Half Hitch at the Butt End of the Handle
• Face the Pike Pole Head Up

• Tie a Clove Hitch Toward the End of the Handle

• Tie a Half Hitch in the Middle of the Handle

• Tie Another Half Hitch Around the Head
• Tie a Bowline or Figure-Eight on a Bight

• Slip the Knot Through the First Two Rungs of the Ladder, About \( \frac{1}{3} \) of the Way from the Top

• After Pulling the Loop Through, Slip it Over the Top of the Ladder
Fold the Nozzle End of the Hose line Back Over the Rest of the Hose so that an Overlap of 4 to 5 Feet is Formed

Tie a Clove Hitch Around the Tip of the Nozzle and Hose

Place a Half Hitch on the Doubled Hose About 12 From the Loop End
• Tie a Clove Hitch Around the Hose About 1 foot Below the Coupling and Nozzle

• Tie a Half Hitch Through the Nozzle Handle and Around the Nozzle Itself in a Manner that Allows the Rope to Hold the Nozzle Shut While it is Being Hoisted
• Tie a bowline or figure-eight follow through around the upper supports.
• Tie a knot Around One of the Legs to Form the Tag Line