



# KNOTS AND HITCHES

ELEMENTS OF ROPE



## DISCLAIMER

This manual is not to be considered as an all-inclusive or stand alone training aid. This manual are designed to help guide you through the evolution of common topics and practices found throughout the United States. Climbing is inherently dangerous and you must be trained under the supervision and instruction of skilled workers before attempting to replicate any of the following situations alone.

**This is no substitute for thorough professional instruction and expert supervision.**

## PREFACE

Knot tying and rigging is an essential aspect of the Line construction trade. You will need to proficiently perform / demonstrate these knots to successfully complete First Year at Camp Rilea. Additionally you will be required to perform these knots throughout the remainder of your apprenticeship. Therefore, you will be tested throughout your apprenticeship on various knots and hitches. This manual is an in-depth review and instruction on knots and hitches used by most professionals in the industry. Some knots are used for rigging, while others are used for life support. Be sure to first read the description of each knot thoroughly; then tie, dress, and set each knot and hitch; and, finally, test each of your knots and hitches prior to use.

Throughout your career, you will use ropes and proper rope handling to save your life or rescue a coworker's, complete a job with damaging property, and generally increase job site safety.

In this manual, you will become acquainted with various types of rope, proper uses, and multiple knots and hitches commonly used in the industry, as well as rope construction, care, and inspection.

# ROPE TERMINOLOGY

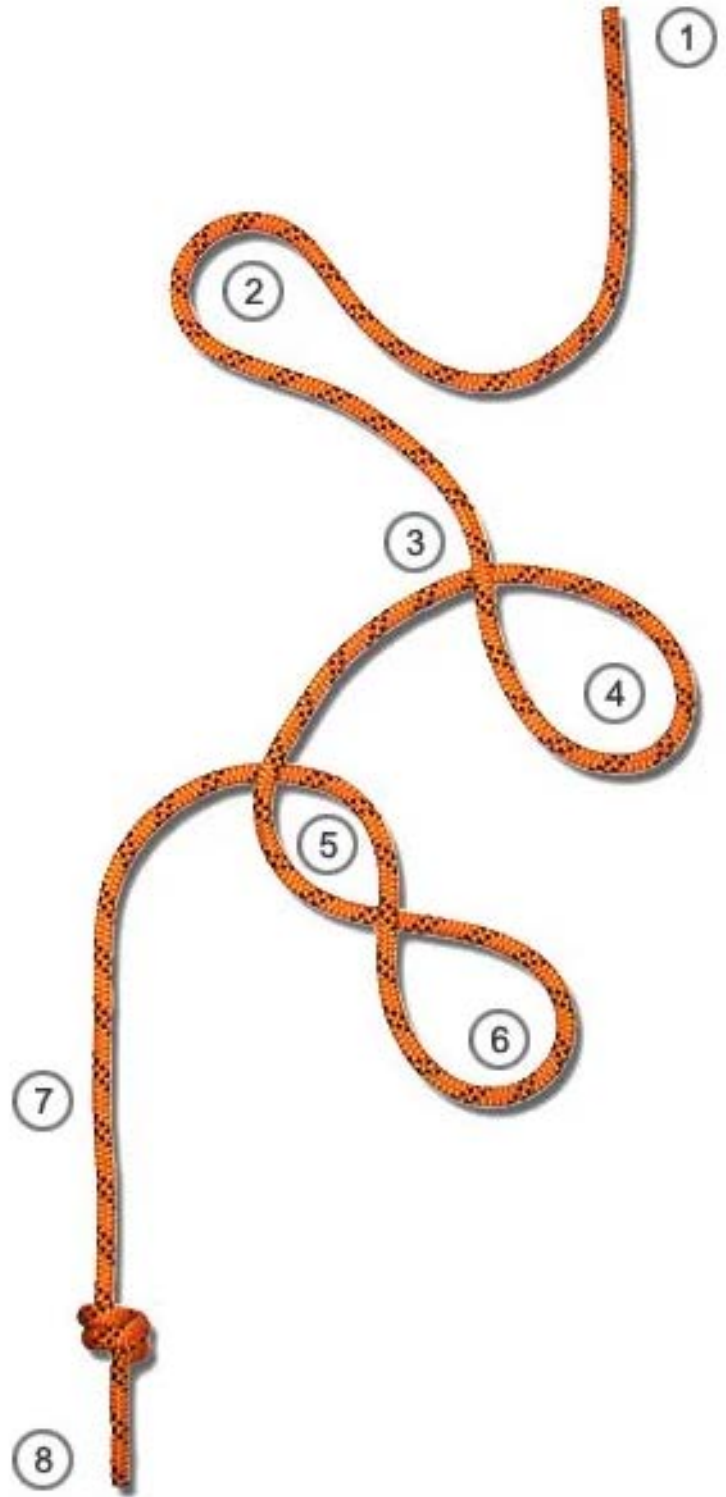
- ▶ **BEND:** a type of knot that joins two ropes together
- ▶ **BEND RATIO:** the size or diameter of the device or limb a rope is placed over/through creating a bend ratio
- ▶ **BIGHT:** a loop of rope that does not cross over itself; it can also refer to where a knot cinches down onto itself when loaded
- ▶ **COIL:** a method of rope storing where a person starts at one end of the rope and makes continuous overhand turns, stacking the rope back on itself
- ▶ **DIAMETER:** refers to a rope's cross-sectional width
- ▶ **DOUBLE BRAID:** rope with braided outer sleeve and braided inner core
- ▶ **DYNAMIC:** opposite of static, is a load or weight load (under tension) then unloaded (not under tension)
- ▶ **FLAT SPOT:** area of the rope where the internal fibers have broken or separated leaving a flattened area
- ▶ **FRICTION:** heat caused by rubbing, can cause damage and rope glazing
- ▶ **GLAZING:** sections of a rope where it was exposed to excessive amounts of friction that melted the fibers
- ▶ **HITCH:** knot consisting in wraps and braids that allows it to move in both directions when no weight is applied but then grips the rope and holds when weight is applied
- ▶ **HOLLOW BRAID:** rope with one or two carrier strands but has no core
- ▶ **NON-WORKING END:** the end of the rope not active during application
- ▶ **OVERHAND TURN:** a loop made in the rope by placing the working end over the non-working end
- ▶ **STATIC:** a load or applied weight that is constant and non-changing
- ▶ **STOPPER KNOT:** inline knot tied near the tail to prevent another knot or hitch from moving or rolling off the tail
- ▶ **THREE STRAND:** three separate ropes braided together to form a larger diameter rope
- ▶ **TIE, DRESS, & SET (TSD):** after you tie a knot, perform this method to get the knot ready for use
- ▶ **WORKING END:** the end of the rope you are currently working with



# PARTS OF A KNOT

## Glossary of Common Knot Terms

- ▶ **1. WORKING END:** This is the end of the rope actively being used to tie and form the knot
- ▶ **2. BIGHT:** a u-shaped section of rope usually used to tie knots onto, typically it will cinch down on itself when loaded
- ▶ **3. CROSSING POINT:** any point where the rope crosses back over itself
- ▶ **4. OVERHAND LOOP:** created when the working end is placed over the standing end
- ▶ **5. INTERLOCKING ELBOWS:** occurs when the bight is twisted twice resulting in two crossing points
- ▶ **6. UNDERHAND LOOP:** created when the working end is placed under the standing end, opposite of the overhand loop
- ▶ **7. STANDING END:** the portion of rope not actively in use
- ▶ **8. STOPPER KNOT:** the knot placed on the tail of the standing end to prevent it from pulling through a device or hitch



The first step in tying knots/hitches is to learn what the rope terminology is and where to apply it. Be sure to familiarize yourself with the terminology on this page. You may find yourself using an end of the rope or you may be tying a knot in the middle such as a Bowline on a Bight which is a temporary eye in the middle of a line that will not slip, jam, or fail.

# TYPES OF LINE CONSTRUCTION KNOTS

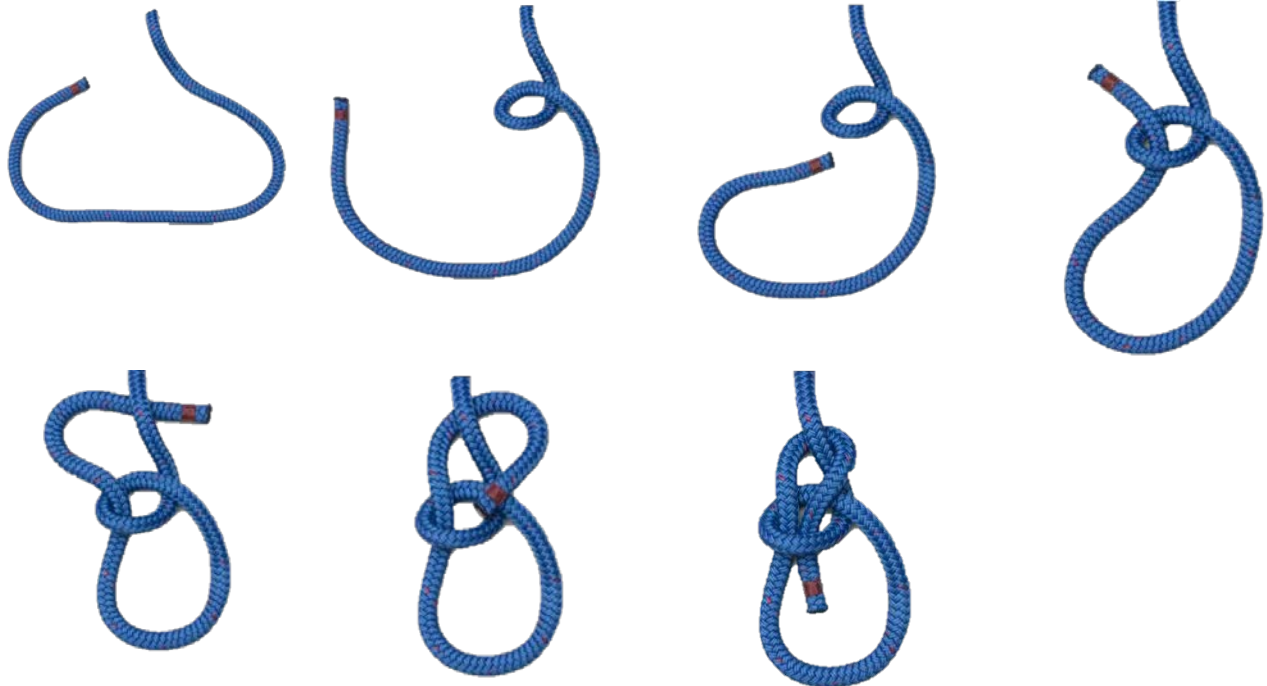
## Glossary of Knot Names and How-To Guide

The following list covers essential knot tying and rigging used within the Line construction trade today. Some require a lot of rope while other require very little. Some require two ropes instead of just one. Be sure to read each description to understand the elements of each knot/hitch and the included example of its' respective application.

- ▶ BOWLINE
- ▶ RUNNING BOWLINE
- ▶ BOWLINE ON A BIGHT
- ▶ CLOVE HITCH
- ▶ SQUARE KNOT
- ▶ TIMBER HITCH
- ▶ SHEET BEND
- ▶ MUNTER HITCH
- ▶ BOWLINE IN A BIGHT
- ▶ GRAPEVINE HITCH

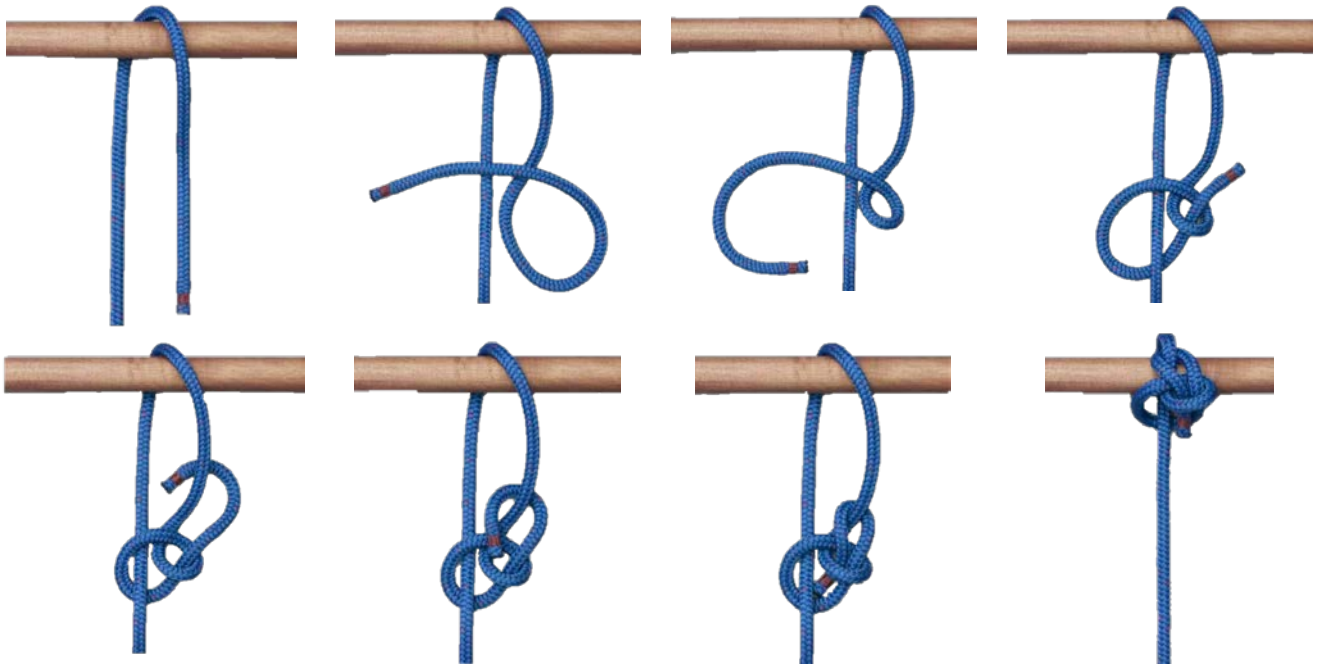
## Bowline

The bowline knot is the most common of knots used in arboriculture and has many variations. This knot can be used for lifting, lowering, pulling and tie-offs. It can be easily untied after considerable load has been applied.



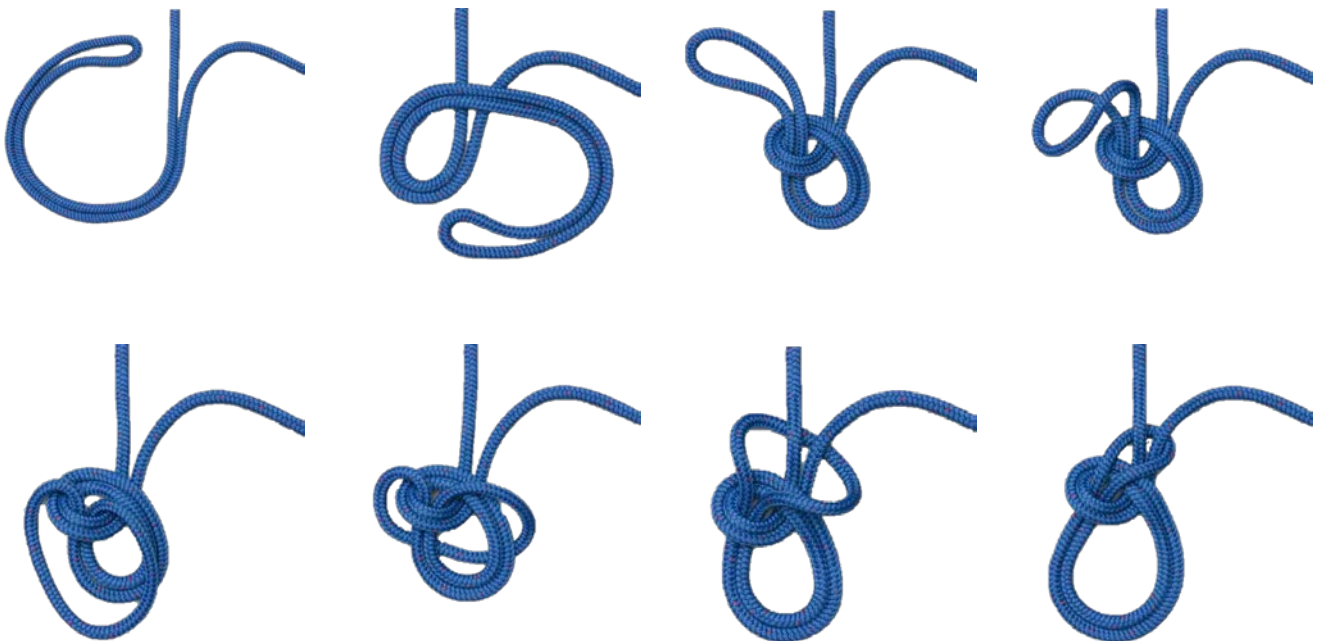
## Running Bowline

The Running Bowline is a simple Bowline that is tied around the standing end of its own rope. When finished the standing end of the rope is pulled and the Bowline chokes itself around the object your tying it to. This is common for attaching ropes around structures.



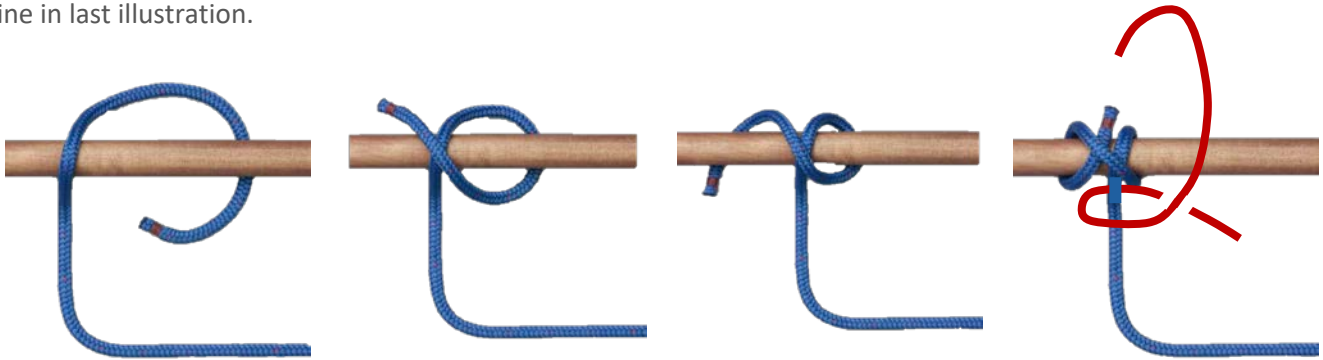
## Bowline on the Bight

This knot is a temporary eye in the middle of a line that will not slip, jam, or fail, and offers multiple anchor points because the finished product ends with two fixed eyes. It can be untied after a heavy load and is excellent for pulling. The loop sizes can be adjusted for the desired task.



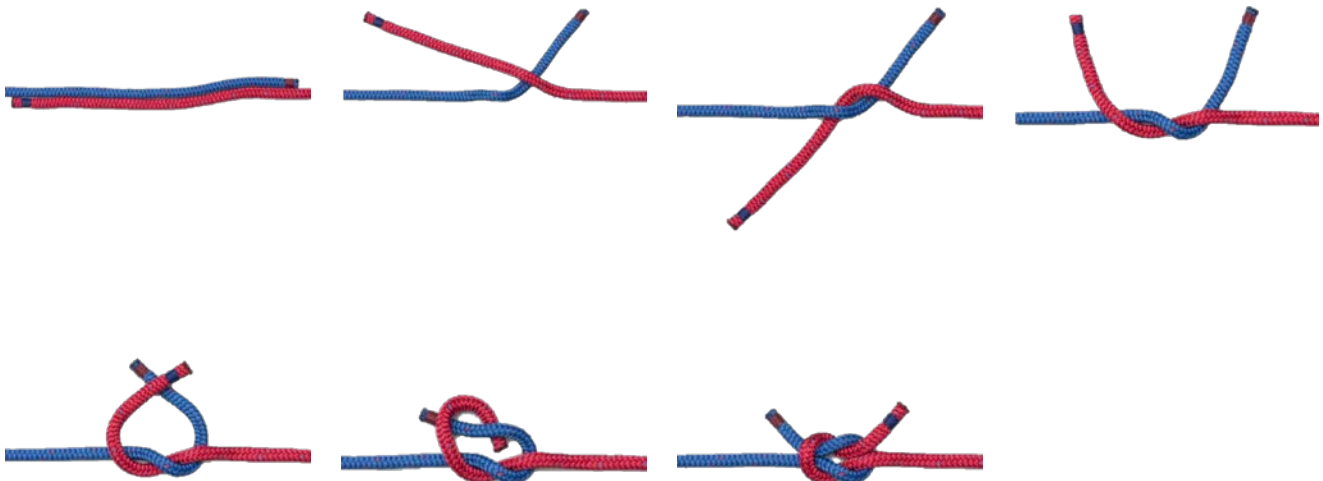
## Clove-Hitch, end of line

A clove hitch is similar to a constrictor knot and is commonly used in rigging practices for installing arms, risers, and equipment. A Clove-Hitch **MUST BE** finished with a half hitch so the knot does not roll out or untie. (See red line in last illustration.)



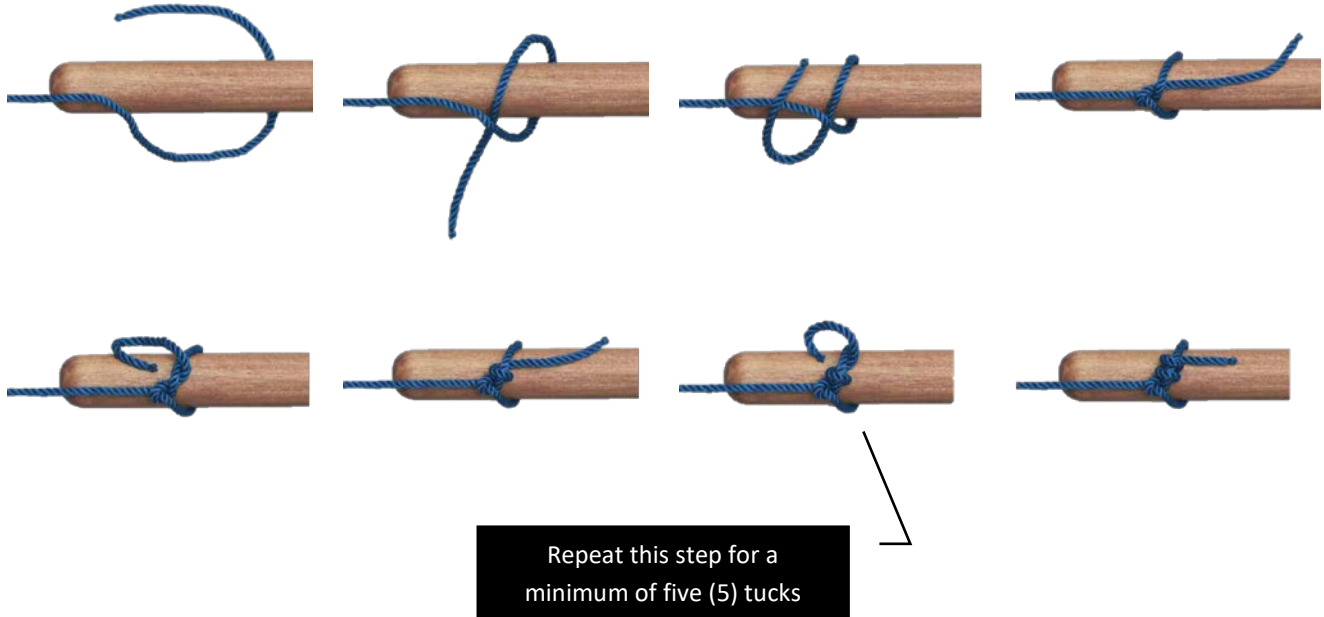
## Square Knot

A square knot is a quick and easy knot to tie for securing items, most commonly hand lines. It is not to be trusted to join ropes together. Be sure to form the square knot and avoid tying a granny knot by making sure both parts of the rope, the standing line, and the free end, exit the knot together.



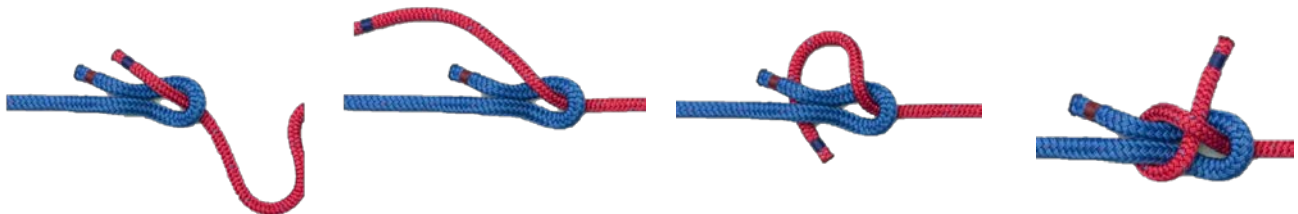
## Timber Hitch

This is an excellent hitch that can be used to secure the end of a rope to a pole as a tie off. It is made by wrapping one tail end of the rope around the tree, then taking the same tail end and crossing above or below the pole where they meet and tucking the wraps behind the rope, against the pole in the opposite direction. In the pictures below, the hitch directions have been scaled down for training purposes, the wraps to secure the rope should always be spread across the pole to produce greater friction.



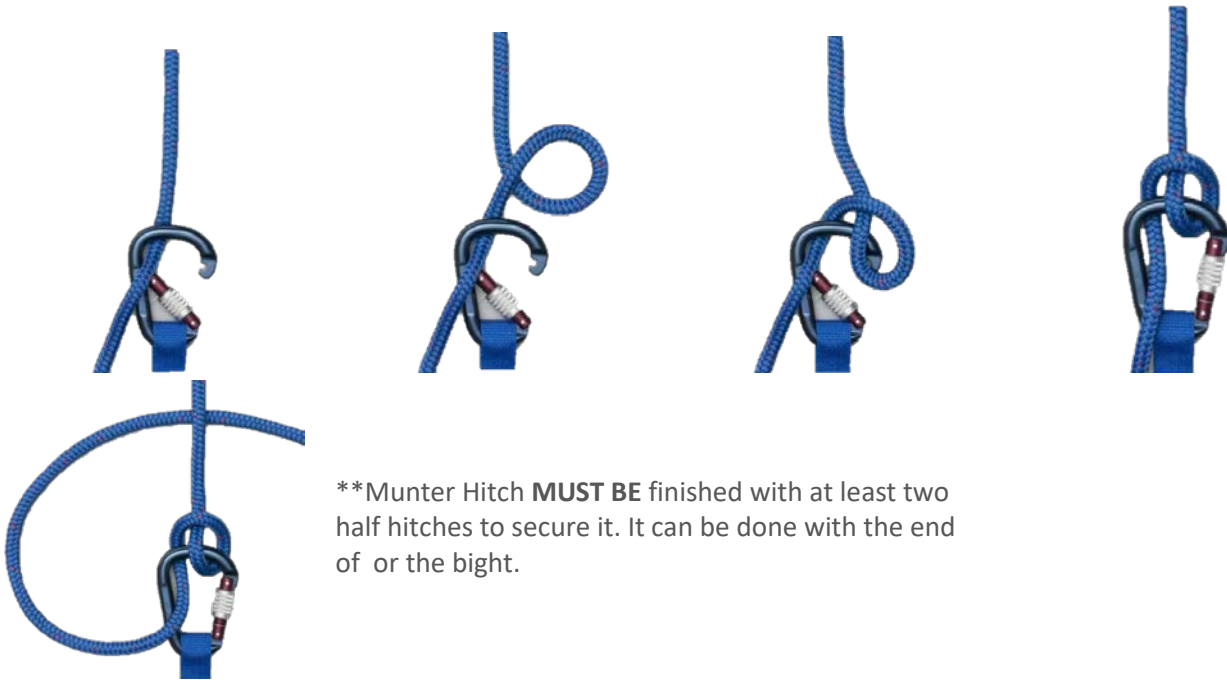
## Sheet Bend

This is a very effective bend to join two ropes of unequal, or similar size, to quickly extend the ropes length.



# Munter Hitch

The Munter Hitch creates friction by having the rope rub on itself and on the object it has been wrapped around. It is used to secure or tie a line around an object. It can be loosened under strain and slacked while the load stays under control. This is a very popular knot among linemen to ensure they can come out of their rope or rigging.



## Bowline in the Bight

Temporary eye in the middle of a line that will not slip, jam, or fail. It is also able to capture the standing part of the rope to be used in a choke configuration.



## Grapevine Hitch

This hitch is used for pulling an object. Tied properly it will grip an object or other line. It will loosen and slide to regrip the object or other line for repositioning and then grip again. Outside of our industry, this type of hitch maybe referred to as a Rolling Hitch. *\*\*The number of turns is dependent on the load weight. The heavier the load the more turns are required. Turns are always made TOWARDS the load, never away.*

