



Rescue North Carolina
Presents...

NC Technical Rescuer;
General; Ropes



**So, what can we expect from
this course?**



So, what can we expect from this course?



So, what can we expect from this course?



TRR Compliments:

- Confined Space Rescue
- Trench Rescue
- Water & Ice Rescue
- Low/High Angle Rescue
- Helo Operations
- Large Animal Rescues
- USAR/ Structural Collapse
- Dive Rescue
- Sub-Terrain Rescue
- Firefighter Survival Techniques

Terminology

Terminology Handout

Rope



Webbing



Software

Accessory Cordage



Harnesses



Harnesses

- Class II – designed for rescue operations, design load is 600 lbf. A “Swiss seat” is an improvised Class II harness. b. Class III – designed for rescue operations. The design load is 600 lbf. c. The rescue knot is used for raising or lowering individuals and should be constructed using lifeline rated rope.

HARNESSES

- CLASS II
- CLASS III
- IMPROVISED HARNESSES
- *Ladder belts are not classified as a life safety harness.*

Escape Belts

- Designed for emergency escape for Technical use, design load of 300 lbf.



Class II

- Designed for rescue operations, design load is 600 lbf.
- *(A “Swiss seat” is an improvised Class II harness.)*
- A ladder belt is not classified as a life safety harness.



Class III



- Class III – designed for rescue operations. The design load is 600 lbf.
- Utilized for the potential for inversion
- Multiple lifting points

Chest Harness



- Used in conjunction with Class II harness.
- Can be connected using a tri-link to join both.



Patient Class II



- Color-coded harness for quick connection

Improvised Harnesses

- Webbing used for constructing any improvised harness, used to support a human, shall be a minimum of **1 3/4" inch width** and have a **breaking strength of 6000 lbf.**
- **Rescue knot is used for raising or lowering individuals and should be constructed using lifeline rated rope.**
- Seat harness w/ Chest harnesses
- Seat Harness
- Rescue Knot

Harness Checks & Safety

- Harness Check
- Class I, II, and III rescue harness straps and buckles.
- Check for frayed stitching and damaged metal
- Follow the manufacturer's guidelines for use, inspection, and maintenance.
- Importance of labeling and warning labels.

Harness-Induced Pathology

“30-minute Rule”

- **Suspension Trauma/Orthostatic Intolerance**
- An accumulation of blood in the legs reduces the amount of blood in circulation. Resulting in increased pulse rate.
- The body reacts in an attempt to maintain sufficient blood flow to the brain.
- If the blood supply is significantly reduced, the body will abruptly slow the heart rate and blood pressure will diminish in the arteries.
- During severe venous pooling, the reduction in quantity and/or quality (oxygen content) of blood flowing to the brain causes fainting.
- This reduction also can have an effect on other vital organs, such as the kidneys. The kidneys are very sensitive to blood oxygen, and renal failure can occur with excessive venous pooling. If these conditions continue, they potentially may be fatal.

Signs & Symptoms Of Orthostatic Intolerance:

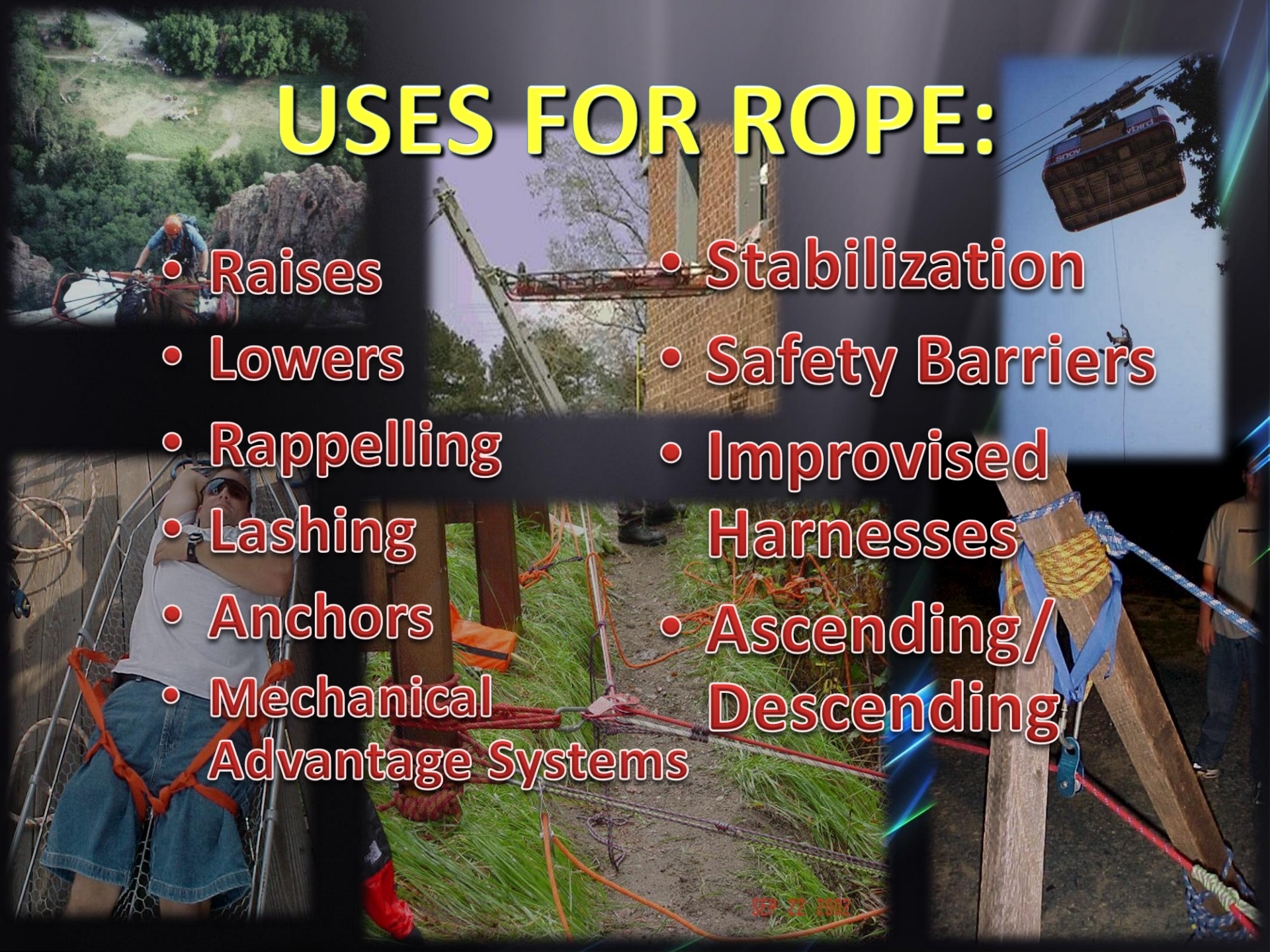
- Faintness
- Nausea
- Breathlessness
- Dizziness
- Sweating
- Unusually Low Heart Rate
- Paleness
- Hypothermia
- Shock
- Unusually Low Blood Pressure
- Loss of Vision
- Increased Heart Rate
- Inability to move legs
- Pain
- Injuries during fall
- Fatigue
- Blood Loss

Life Safety Ropes

The background features a dark gradient from black to grey, with several bright, glowing light streaks in shades of blue and green that curve across the right side of the image.

USES FOR ROPE:

- Raises
- Lowers
- Rappelling
- Lashing
- Anchors
- Mechanical Advantage Systems
- Stabilization
- Safety Barriers
- Improvised Harnesses
- Ascending/Descending





ROPE CONSTRUCTION

TYPES OF ROPES

- NATURAL

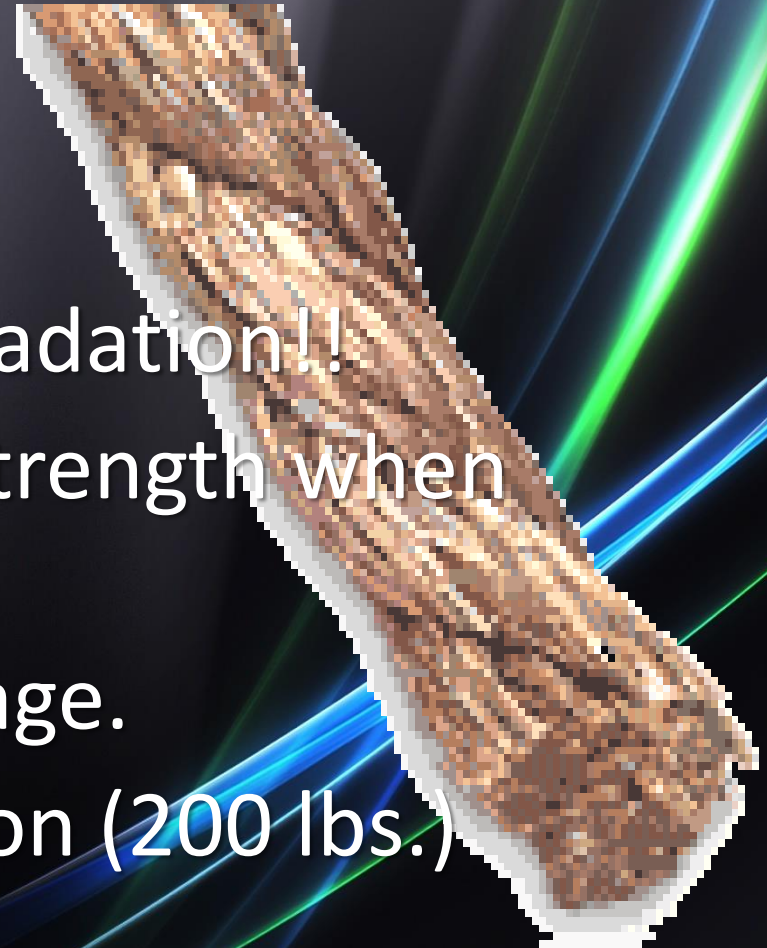


- SYNTHETIC FIBER



NATURAL FIBER

- 1st ropes were made from hair, cotton, wool, plant fibers such as:



- Manila
- Sisal
- Hemp
- All are subject to degradation!!
- Loses 1/2 it's tensile strength when subjected to water.
- Becomes brittle with age.
- Low energy absorption (200 lbs.)
- No continuous fiber



UTILITY ROPE ONLY !!

**NOT FOR LIFE SAFETY OR RESCUE
WORK !!!**



SYNTHETIC FIBER

- Nylon
- Polyester
- Poly-propylene
- Poly ethylene
- Kevlar
- Spectra

NYLON

- 10-15% loss when wet
- Stronger than natural fiber
- Higher energy absorption
- Higher abrasion resistance



NYLON

- One continuous fiber
- Developed during WWII.
- Does not float
- Good resistance to uv rays.

TYPE CONSTRUCTION

- Laid (twisted)
 - Manila, goldline..
- Kernmantle
 - Climbing rope

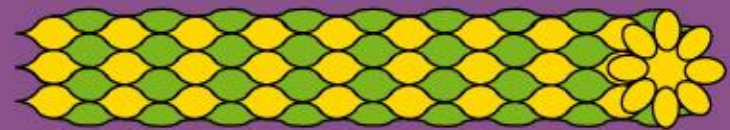
ROPE CONSTRUCTION

6-2

Laid (Twisted)



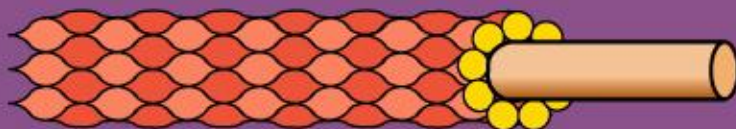
Braided



Braid-on-Braid



Static Kernmantle



Dynamic Kernmantle



LAID ROPE

- Constructed by twisting small bundles of fibers together and then combining them into large bundles which are twisted around one another.
- Each step is opposite direction of others
- 3 strands

Laid (Twisted)



Disadvantages of LAID ROPE

- Surface fibers are susceptible to abrasion.
- They tend to be very stretchy.
- Tends to kink.
- Used for utility work.

LAI D ROPE

- Will untwist when load is applied
- Low abrasion resistance,
- 3 strands exposed
- Not for life safety

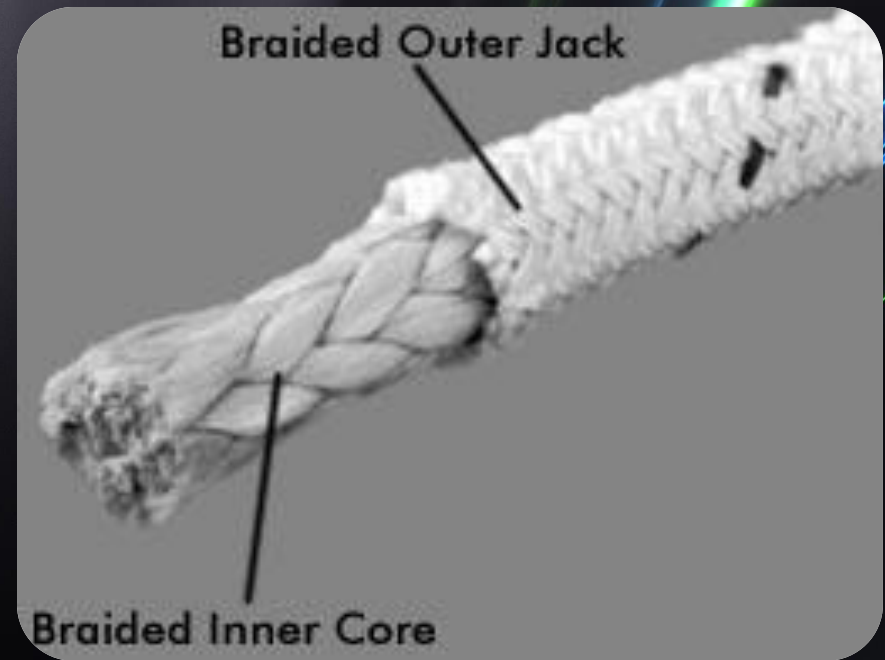
Plaited Rope

- Plaited rope has bundles of fibers plaited together.
- It is soft and pliable.
- Prone to picking.
- **Not used for life safety applications.**



Braided Rope

- The exterior of the braid on rope can be mistaken for Kernmantle rope.
- These ropes are not designed for life loads but for utility applications.



Solid Braided Rope

- **Solid braid** is referred to as clothesline braid.
- Single weave of three or more bundles of fibers.
- Not for life safety operations.



Hollow Braided Rope

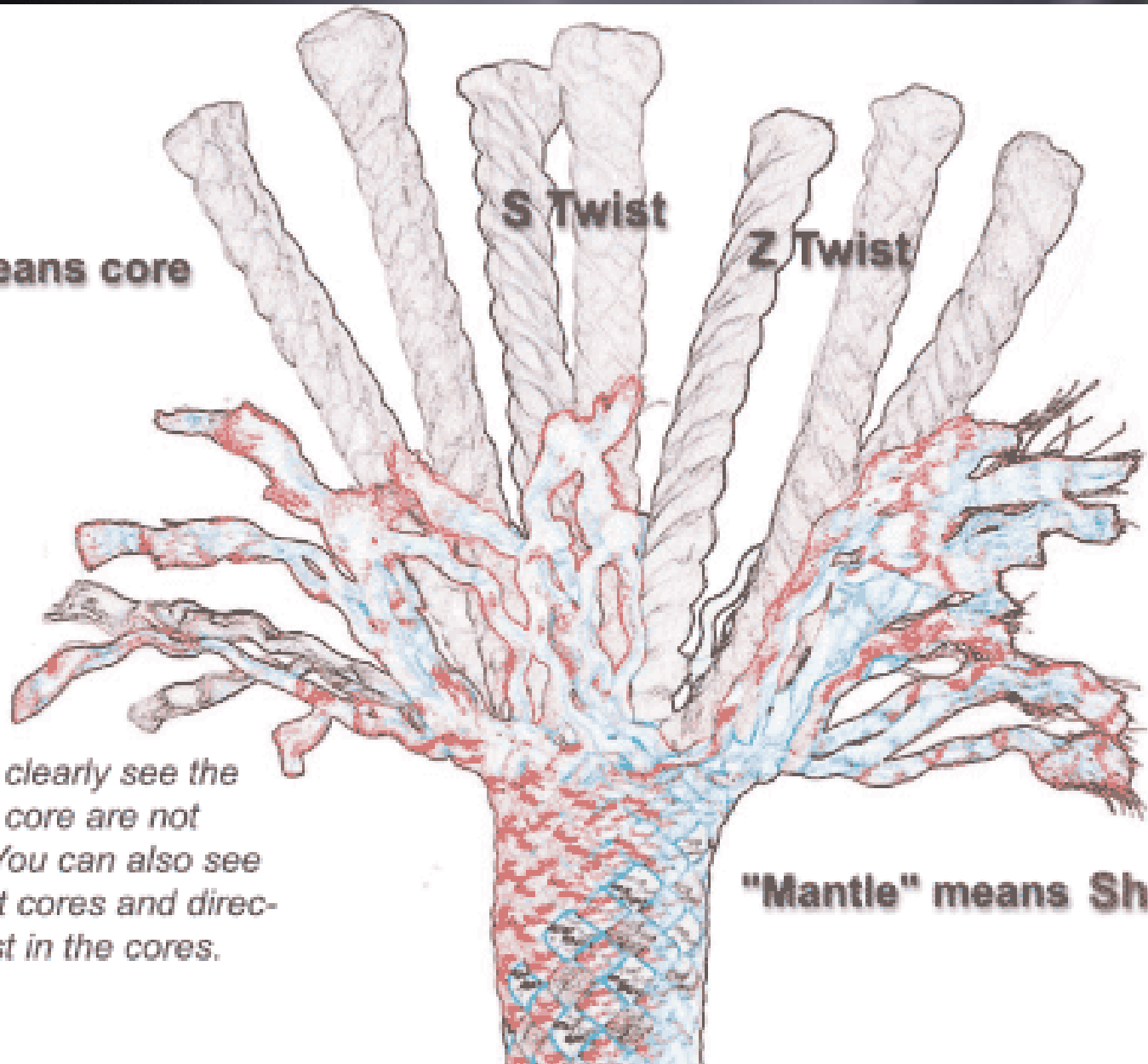
- Hollow braid is a very thick sheath found with filler such as scrap yarn or filament plastic.
- Commonly found in hardware stores.
- It is not for life safety operations.





Kernmantle Construction

"Kern" means core



As you can clearly see the sheath and core are not attached. You can also see the different cores and directions of twist in the cores.

"Mantle" means Sheath

HOW IS KERNMANTLE ROPE IS MADE?



KERNMANTLE

- German word describing construction of rope.
- Kern=core (supports majority of load)
- Mantle= outer sheath
- The construction design produces a rope that is strong and easy to handle
- Doesn't tend to twist or kink under load.
- 75% of the strength is in the core
- 25% in the sheath
- **15 to 1 safety ratio**

KERNMANTLE

- Sheath protects the core.
- High abrasion resistance
- High energy absorption

TYPES OF KERNMANTLE ROPES



KERNMANTLE

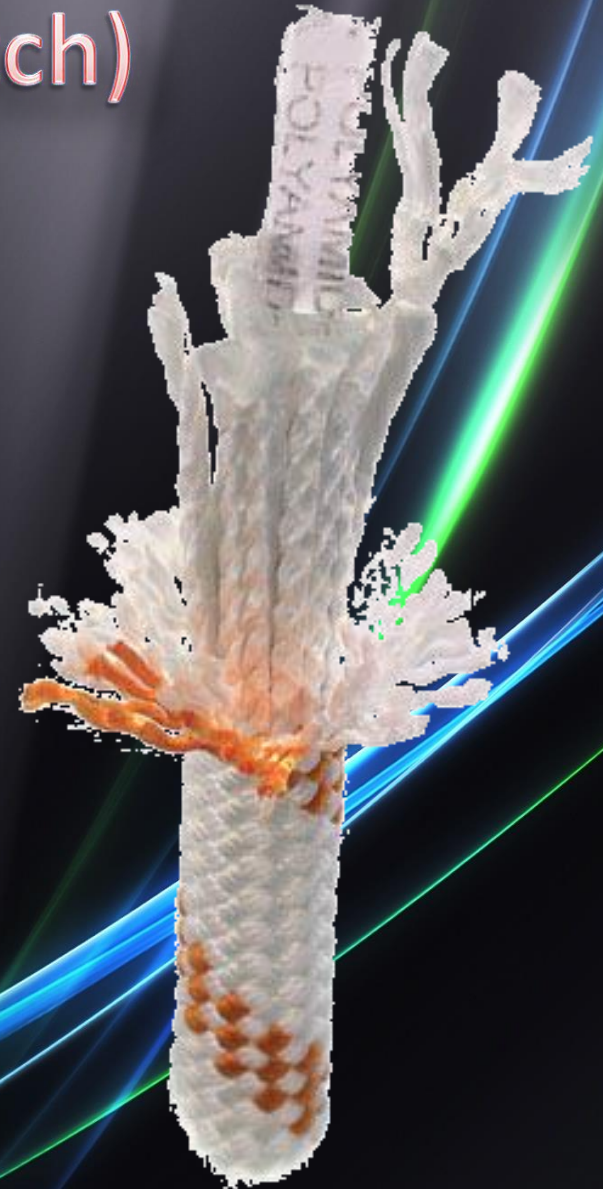
- Static (low stretch)
- Dynamic (high stretch)



**STATIC KERNMANTLE
CONSTRUCTION (LOW STRETCH)**

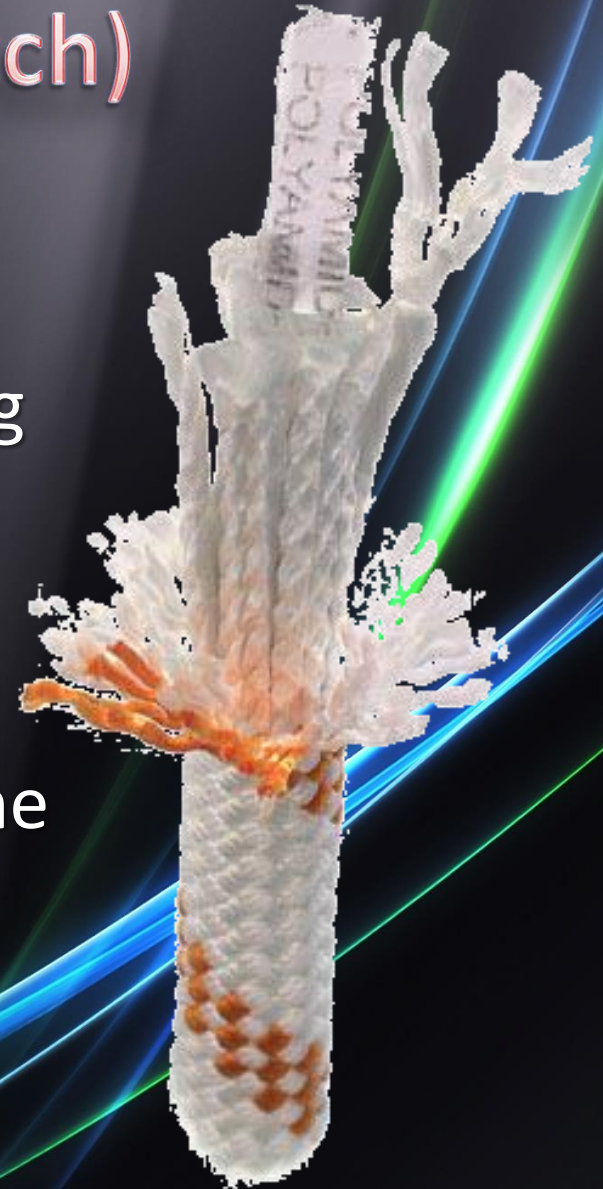
Static (low stretch)

- Rope of choice for rescue operations in which human life will be in direct contact with the rope.



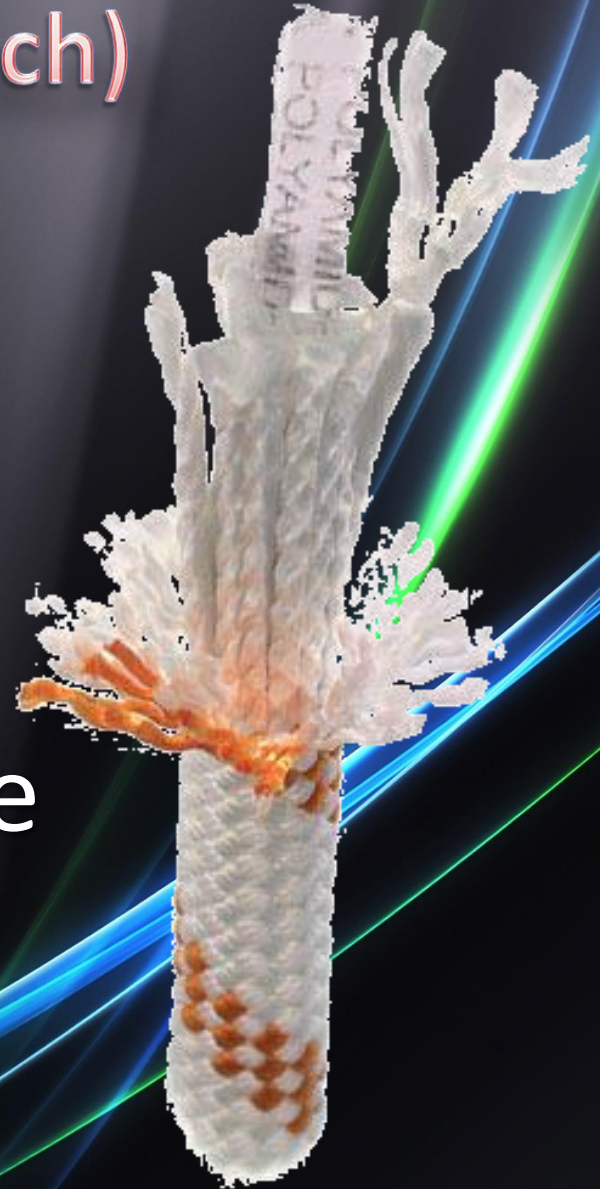
Static (low stretch)

- Considered as a low stretch rope designed to:
 - Absorb low impact loads reducing the risk of rope failure.
 - Have a thicker and tighter sheath providing greater resistance to abrasion reducing the ability of dirt and grit from penetrating the core.
 - Absorption factor of 1,450 lbs. Per sq. Ft.



Static (low stretch)

- The core bundles are parallel to each other creating a low stretch rope.
- Use Static Rope for use with Mechanical Advantage Systems

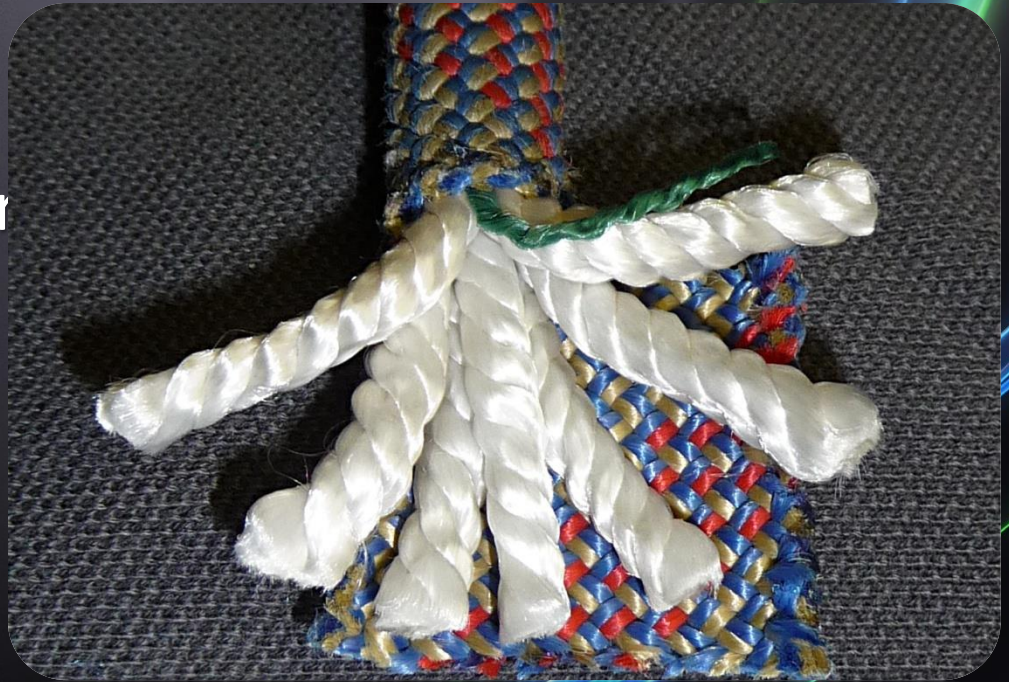




**DYNAMIC KERNMANTLE
CONSTRUCTION (HIGH STRETCH)**

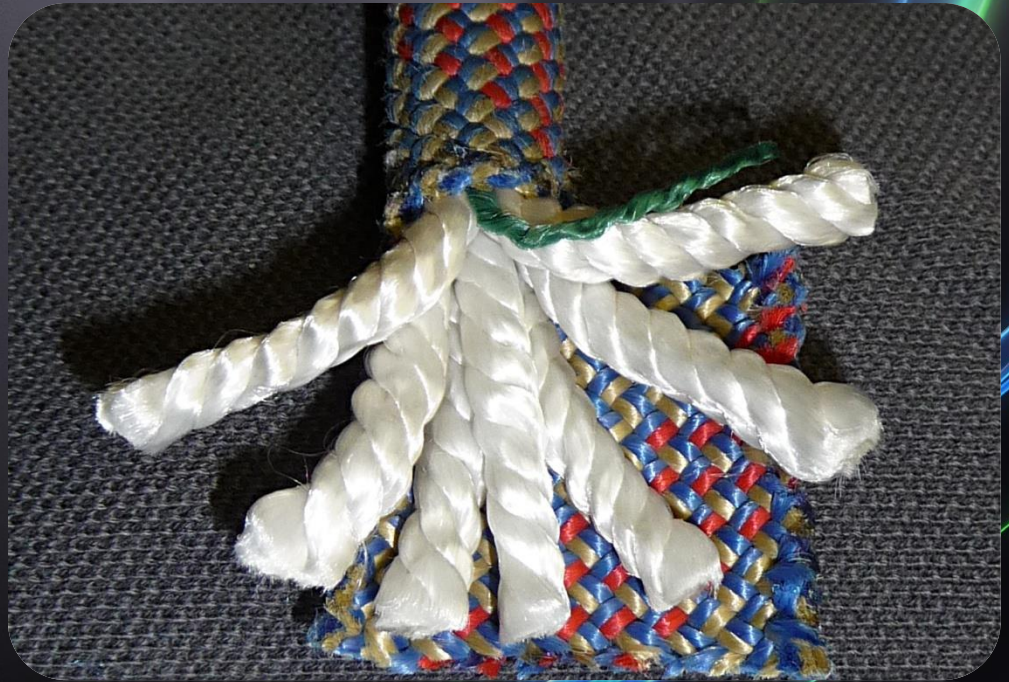
DYNAMIC (high stretch)

- Braided sheath woven over a twisted strand shock absorber core.
- Considered high stretch rope because it is designed to absorb high impact loads reducing the risk of rope failure.



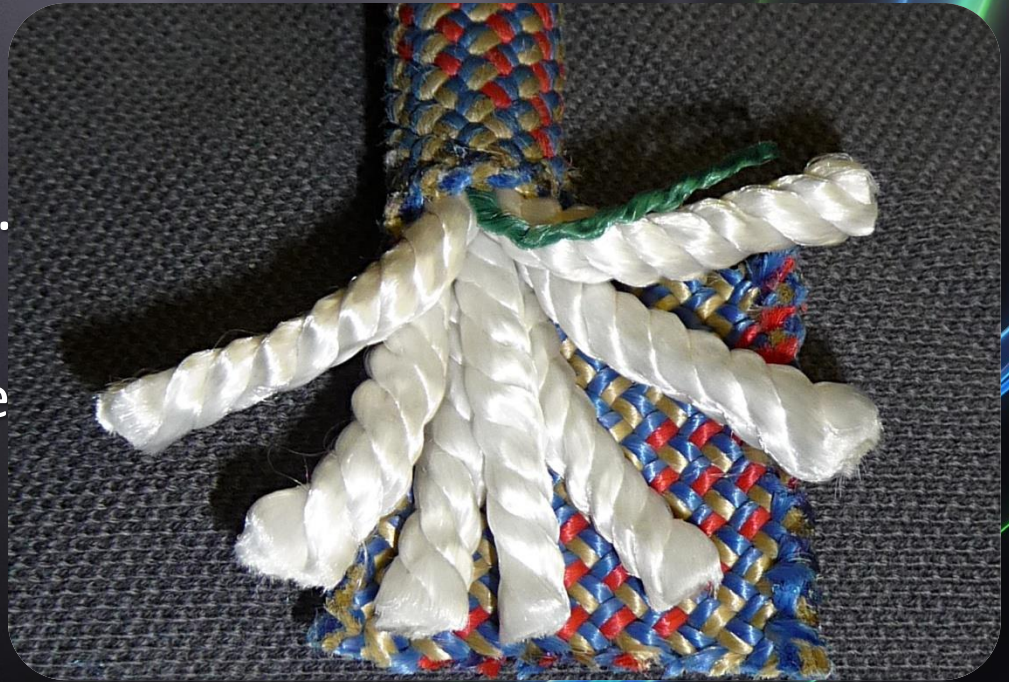
DYNAMIC (high stretch)

- The inner core is constructed of twisted bundles that allow the rope to stretch under a load allowing the rope to absorb a lot of energy.



DYNAMIC (high stretch)

- Best suited for applications where long falls are possible.
 - Lead Climbing
 - Mountain/Cliff Rescue
 - Tower Rescue



DYNAMIC (high stretch)

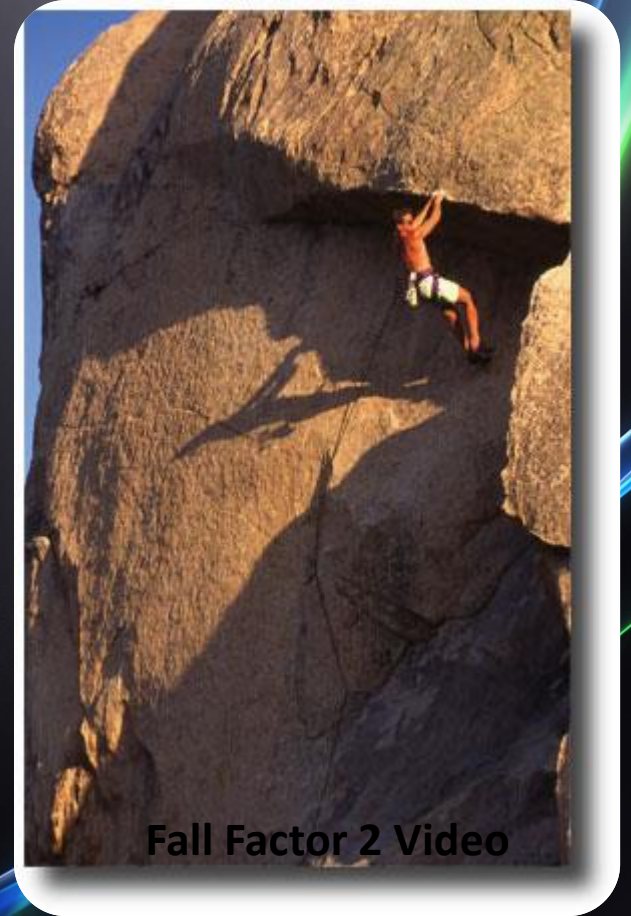
- Absorption factor of 2500 lbs per sq. Ft.
- Used when fall factor greater than 1.



Fall Factor Videos



Fall Factor 1 Video



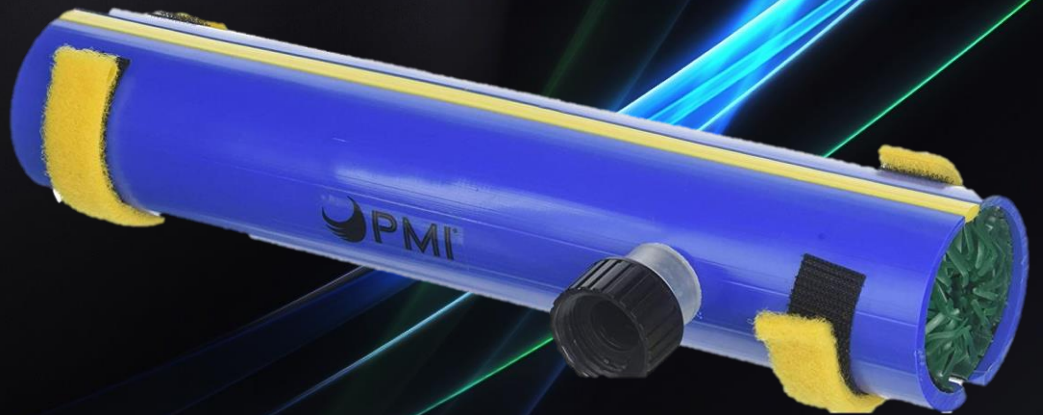
Fall Factor 2 Video

N.F.P.A. 1983

- Maintenance
 - Individuals responsible for care and maintenance should have a thorough knowledge of lifeline construction and characteristics associated with NFPA 1983.
 - Inventory after every use
 - Bags vs. Coiling
 - Storage Considerations
- Protect Rope From:
 - Excessive Exposure To Sun
 - Technical
 - Exposure To Acid
 - Exposure To Dirt And Grit
 - Exposure To Hydrocarbons
 - Exposure To High Temperatures



INSPECTION , CARE, MAINTENANCE



N.F.P.A. 1983

- Rope Identification
 - Year of mfg. or date put in service
 - Length
 - Diameter
 - Number of rope (1-3)
 - Color Varieties

N.F.P.A. 1983

- Inspecting Rope:
 - visible damage
 - Cut sheath or core, or soft spots on the sheath.
 - Check for irregular shape, foul smell, and discoloration.
 - Mild abrasion after multiple uses is normal.
- Ensure;
 - Rope has not been exposed to heat, direct flame impingement, or abrasion.
 - **DO NOT STEP , SMOKE, SPIT, OR MISTREAT ROPE!!!**
- Rope has not been subjected to any shock load.
- Rope has not been exposed to liquids, solids, gases, mist or vapors of any chemicals or other products that can deteriorate the rope.

Inspecting Rope:

- Rope passes inspection when inspected by a qualified person following the manufacturer's procedure both before and after each use.
- **Rope not passing inspection should be discarded or cut into short lengths and used as utility rope.**
- Rope logs should be maintained for each lifeline for the duration of its in-service life.
- **Many rope rescue experts recommend a shelf life for lifeline of 5-7 years and not to exceed 10 years.**
- A rope log should reflect types of usage and maintenance.

Care and Maintenance

Washing the Rope

- Methods of washing and drying rope vary from manufacturer to manufacturer.
- Cool water and mild soap are least likely to damage rope.
- Rope can be cleaned by hand, commercial rope washer or front load washer without a plastic window.
- Do not use a top-loading washer.

Care and Maintenance

Washing the Rope

- Rope should be placed in a cloth or mesh bag or coiled like an electrical cord (Bird's Nest).
- Rope can be dried on a hose rack, a hose tower or loosely coiled in a hose dryer.
- Keep rope from extended exposure to direct sunTechnical.
- Once cleaned, rope should be stuffed into rope bag.
- Rope should be kept in a clean dry compartment
- void of any contaminants.
- Other software materials are washed similar.

Care and Maintenance

- Drying the rope
- Nylon rope loses approximately 15% strength when wet
- Follow manufacturers' recommendations
 - Air dry nylon rope
 - Do not lay the rope on concrete floor
 - Once dry return to storage container

Care and Maintenance

- Retiring rope
 - Sheath penetration is present
 - Shock loading has occurred
 - A fall of five or more feet with one-person load equals shock load
 - Degraded due to age, use or storage conditions
 - 3 to 5 years for industry
 - Up to 10 year for municipalities

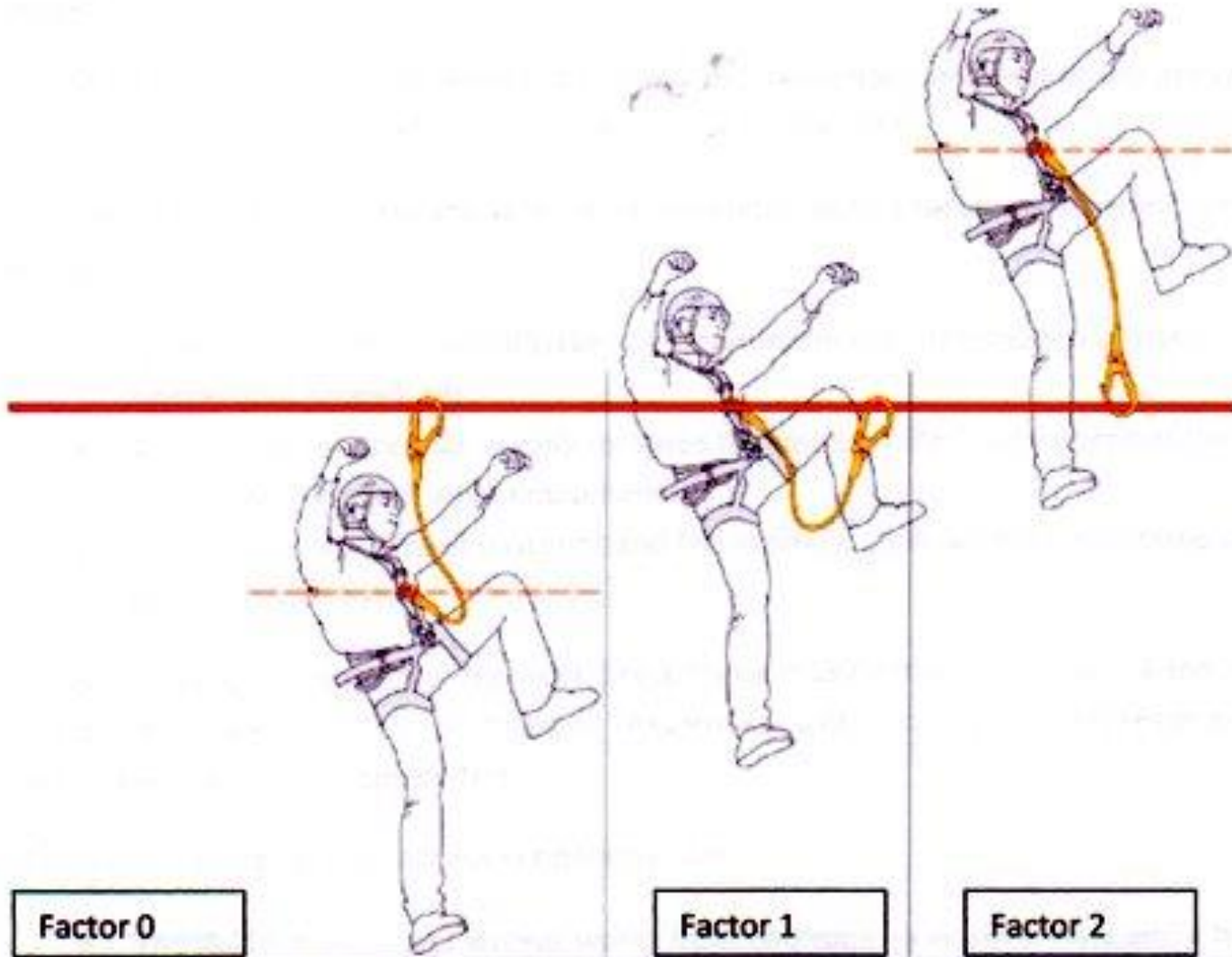
Care and Maintenance

- Retiring Rope
 - Severe overload
 - Used to tow vehicles etc.
 - Contaminated by chemicals
 - Acids, chlorine and bleach
 - Soft, mushy or hard spots
 - Not recoverable by “popping”
- **WHEN IN DOUBT, THROW IT OUT!!**

Care and Maintenance

- Deploying
 - Feed the rope out
 - Do not drop the rope bag to the ground from heights
 - Dropping may cause damage due to shock

What is the Fall Factor?





N.F.P.A. 1983

Standard on Fire
Service Life Safety
Rope, Harnesses
and Hardware

N.F.P. A. 1983

- Addresses safety guidelines regarding the use of rope and related equipment that effect various fire and rescue activity.
- Establishes minimum performance requirements to ensure the safety of the rescuers and the general public that may be affected by the operational use of the equipment.

N.F.P. A. 1983

- Does not apply to:
 - Utility rope
 - Special rescue operations;
 - Wilderness rescue
 - Water
 - Caving
 - Lead climbing
 - Recreational
 - Industrial fall situations

“Rope Dedicated Solely for the Purpose of Constructing Lines for Supporting People During Rescue, Firefighting, or Other Emergency Operations or During Training Evolutions.”

LIFE SAFETY ROPE

Training ropes are used under controlled conditions in which impact loading and other damaging situations would be observed.

“Ropes used in this manner should be inspected and cleaned before and after every use and carefully stored between training sessions.”

“Records should provide a history of each rope, and training ropes should be scheduled for replacement at regular intervals.”



DEFINITIONS

WORKING ELONGATION

“The initial stretch of the rope that occurs when a load is first applied.”

- 200 Lb Load Working Elongation Is 1.2-2.0% of the Rope's Length for Static Rope

200' Length



205' Elongation
Length

MAXIMUM SAFE WORKING LOAD

- Weight That Is Supported By The Rope That Shall Not Be Exceeded In Use.



TENSILE STRENGTH

- Certified Minimum Breaking Strength Of Each Rope Tested When Sold.



NFPA Life Safety Rope Specifications

NFPA Strength Ratings:

- When Sir Isaac Newton was hit on the head by an apple, we have learned that the force with which an object (load) either hits the ground or end of the rope after a free fall, it is a **combination of the load's weight and the acceleration caused by gravity.** (9.81 m per sec.)
- Expressed in Maximum Impact Force called Newtons.
- So, **A Newton is a Unit of Force**

Newton's:

- Calculated as: Measurement of Force
- Force= Mass x Acceleration
- 1 Newton= .225 lbs. Units of Force
- 1 Kilo= 1000
- **1 kilo Newton= 1000 x .225 = 225 lbs. of Units of Force**

NFPA Usage Categories:

- **“T”- Technical Use**
- Diameter is 3/8” (9.5 mm) up to 1/2” (12.5 mm)
- Minimum breaking strength (MBS):
 - 4496 pounds
- Maximum safe working load (SWL):
 - 300 pounds.

NFPA Usage Categories:

- “G” - General Use

- Diameter is 7/16” (11 mm) - not more than 5/8” (16 mm)
- Minimum breaking strength (MBS)
 - 8892 pounds
- Maximum safe working load (SWL)
 - 600 pounds.

NFPA Usage Categories:

- **“E”-Escape**
- Diameter is 1-9/64” (7.5 mm) - less than 3/8” (9.5 mm)
- *Minimum breaking strength (MBS)*
 - 3034 lbs.
- *Maximum safe working load (SWL)*
 - 300 pounds
 - Intended only for emergency self-rescue situations.

NFPA Usage Categories:

- **Throw line** – diameter criteria is the same as escape rope
- Minimum breaking strength(**MBS**)
 - **3000 pounds**

NFPA RATINGS

BASED UPON 15:1 SAFETY RATIO PER NFPA 1983

1 Person (Technical Use)		2 Person (General Use)	
US	Metric	US	Metric
300 Lbs.	1.33 KN	600 Lbs.	2.66 KN
4500Lbs.	20 KN	9000Lbs.	40 KN

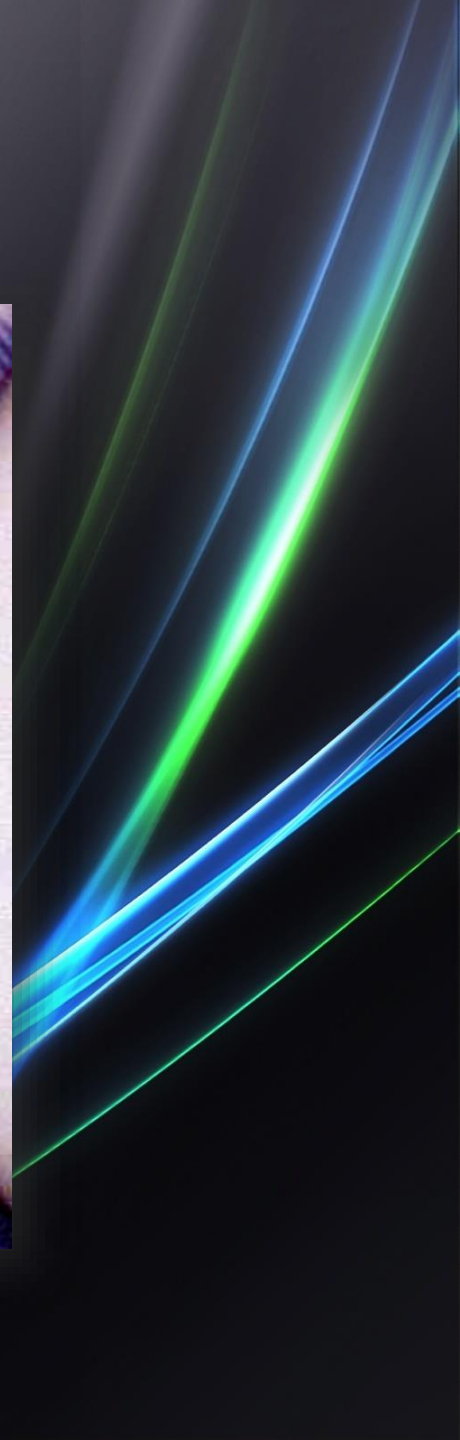
Ropes Specifications Per N.F.P.A. 1983

Based Upon 15:1 Safety Ratio per NFPA 1983

Load on Rope:	Diameter of Rope:	Safe Working Load		Minimum Breaking Strength	
		US	Metric	US	Metric
One Rescuer	7/16"	300 lbs.	1.33 kn.	4,500lbs.	20 kn.
Two Rescuers	1/2"	600 lbs.	2.66 kn.	9,000lbs.	40 kn.
Two Rescuers	5/8"	865 lbs.	3.99kn	13,000lbs	60 kn.

System-wide Safety Ratio Should be 10:1

WEBBING



Standardized Color-Code for Webbing Lengths

- 5 feet 
- 12 feet 
- 15 feet 
- 20 feet 
- 25 feet 

WEBBING STRENGTHS

- 1" *TUBULAR* = 4000 LBS.
- 1" *FLAT* = 6000 LBS.
- 2" *TUBULAR* = 6000 LBS.
- 2" *FLAT* = 9000 LBS.
- SAFETY FACTOR 10:1
- 300LB. LOAD 3000 TENSILE
- NFPA 1983 recommends that any webbing that makes contact with a body shall be at 1 3/4" width with a breaking strength of 6000 pounds



Accessory Cord

- Constructed Of Synthetic Fiber
- Ranges In Size From 6 - 8mm
- Constructs Prussik Slings.
- Prussik Slings Are Formed Using A Length Of Accessory Cord Tied With A Double Fisherman Knot.

CHARACTERISTICS OF SOFTWARE:

Static Kernmantle Low Stretch	Nylon	1/2"	9000 lb/40 kn
		5/8"	12,500lbs./ 55 kn
Dynamic Kernmantle High Stretch	Nylon	7/16"	5,000 lb/ 22 kn.
Water Rescue Rope	Polypropylene	10mm	3,600 lb/ 8.45 kn.
Tubular webbing	Nylon	1"	4000 lbs./ 17 kn.
Tubular Webbing	Nylon	2"	6000 lbs./ 26 kn.
Prusik Cordage	Nylon	8mm	2,875 lbs./ 12 kns.

Hardware



Carabiners



Pulleys



Ascenders



Stokes Baskets



Descenders

CARABINERS

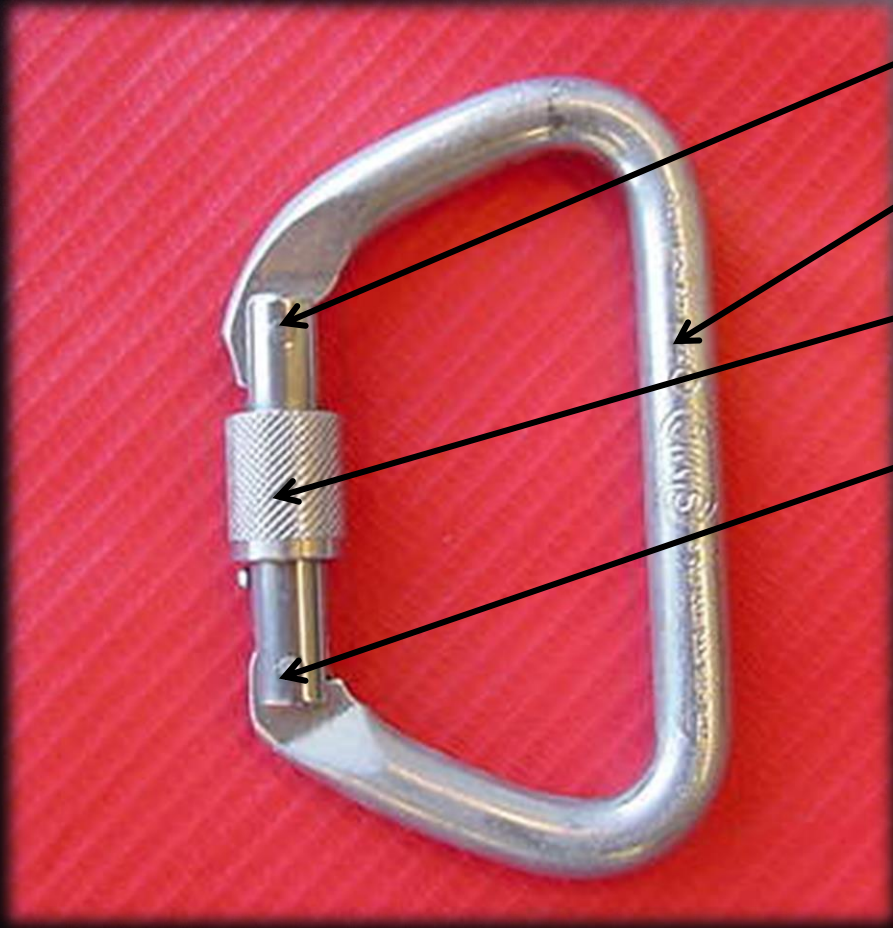


Carabiners

- Steel
- Aluminum
- Various Strengths
- Various Shapes
- Locking/ Non-Locking
- Screw Gates/ Auto Locking

Carabiners

- Made from hollow and solid aluminum alloy solid steel, and stainless steel.
- Some use anodized coating for aluminum carabiners to reduce friction.
- The basic parts of a carabiner include
 - Spine,
 - Gate (include knurls nut)
 - Latch
 - Hinge.



Gate

Spine

Screw Gate or Knurl Nut

Hinge

Carabiners

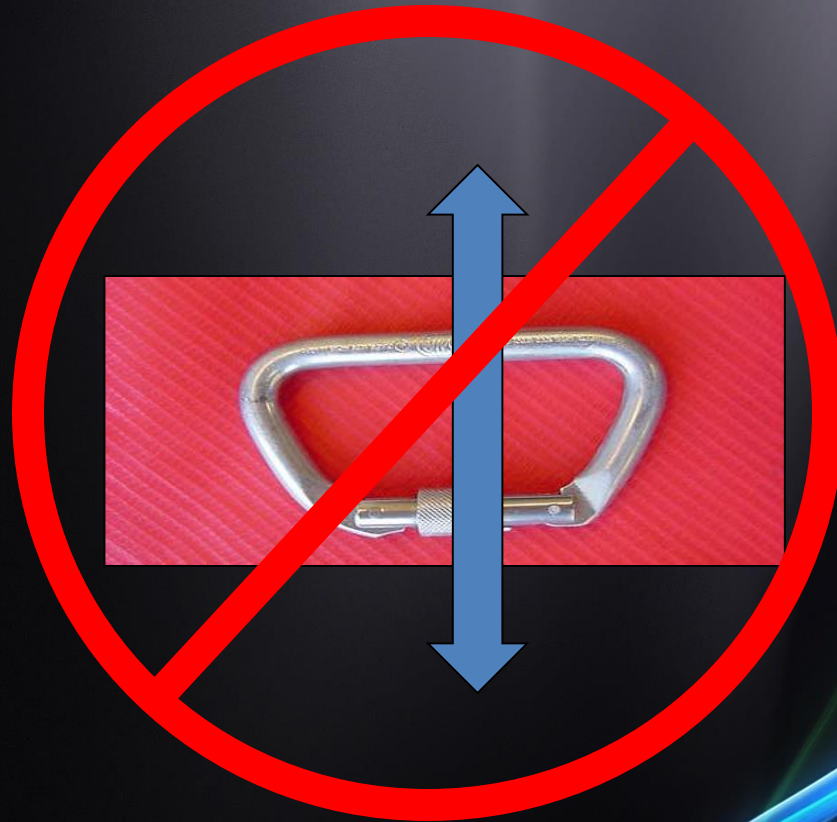
- Shapes include;
- Oval
- D-shaped
- Modified D-shape knurls with dry silicone
- The D-shaped carabiner tends to take the most advantage of the strength of the spine of the carabiner.

Carabiners



- Are designed to be loaded along the long axis only.
- The latching mechanism may be a pin and slot design, a claw on the gate and slot design, or a keyhole and slot design.

Cross Loading



Carabiners

- Carabiners designated for Light or **Technical use** shall have a minimum major axis breaking strength with the gate closed of 6000 pounds.
- Carabiners designated for **general use** shall have a minimum major axis breaking strength with the gate closed of 9000 pounds.
- “P” for Personal use (1995 - 2001)
- “L” for light duty use (2001)
- “E” for Escape use
- “T” for Technical duty
- “G” for General duty

Carabiners

- When attaching carabiners to a vertical hauling system, the gate of the carabiner should point down to reduce the chance of the gate unlocking as a result of vibration.
- When attaching carabiners to a horizontal hauling system, the gate of the carabiner should point towards the load to reduce the chance of the gate unlocking as a result of vibration.

Carabiners

- Tri-links and semi-circle design links are nonhinged screw links recommended for multidirectional loads.
- Inspect carabiners for wear grooves, deep gouges, sticking gate or hinges.
- Dropping carabiners, particularly aluminum, onto a hard surface may result in damage.
- Lubricate hinges and gate with dry silicone.

Screw Type



VARIOUS SIZES



AUTO LOCKING



TWISTED D- RINGS



Rigging Rings

- Steel rings are used for various load bearing applications.
- They are also rated as a multi-directional anchors.
- Tensile Strength of 10,000lbf.

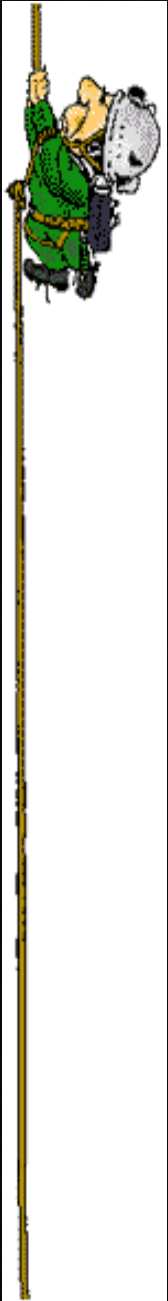


Swivels



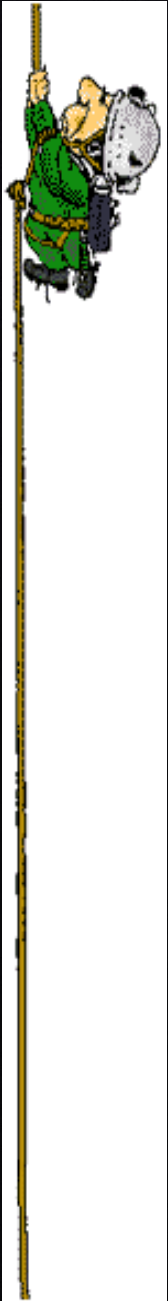
- Swivels are applied at the anchor attachment point.
- They must be rated for life safety loads. (G Rating)
- Prevent ropes in a mechanical advantage system from twisting.
- Used in litter tending operations.





ASCENDERS

- Compliments Rappelling Skills
- Allows The Rescuer To Self- Extricate Themselves From A Jammed Rappelling Device.
- Used Extensively In Confined Space
- Follow the manufacturer's guidelines and safety precautions when incorporating these devices into a mechanical advantage system



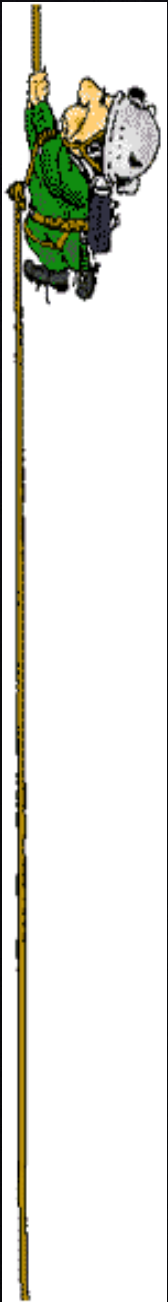
ASCENDERS

- Used for single load ascensions and hauling systems.
- Are not for arresting dynamic falls.
- Free running cams activate only when a load is applied to the opposite end of the lever.
- Spring loaded cams maintain light contact with the rope at all times regardless whether or not a load is applied.

ASCENDERS



- Handled ascenders teeth are designed for single load ascensions only.
- They are not used in a hauling system
- Attaching an ascender to a rope.



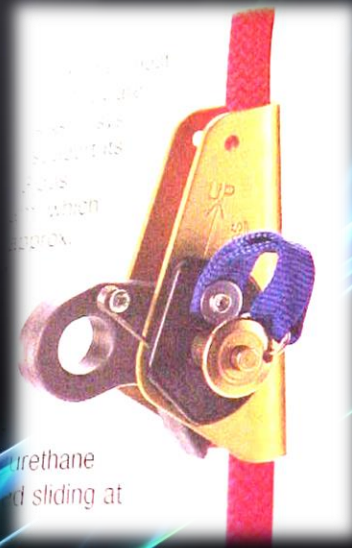
Ascenders

- Verify whether or not the device is designed for use in a mechanical advantage system and identify the limitations of its use.
- Ascenders should not be used as a load capturing device.

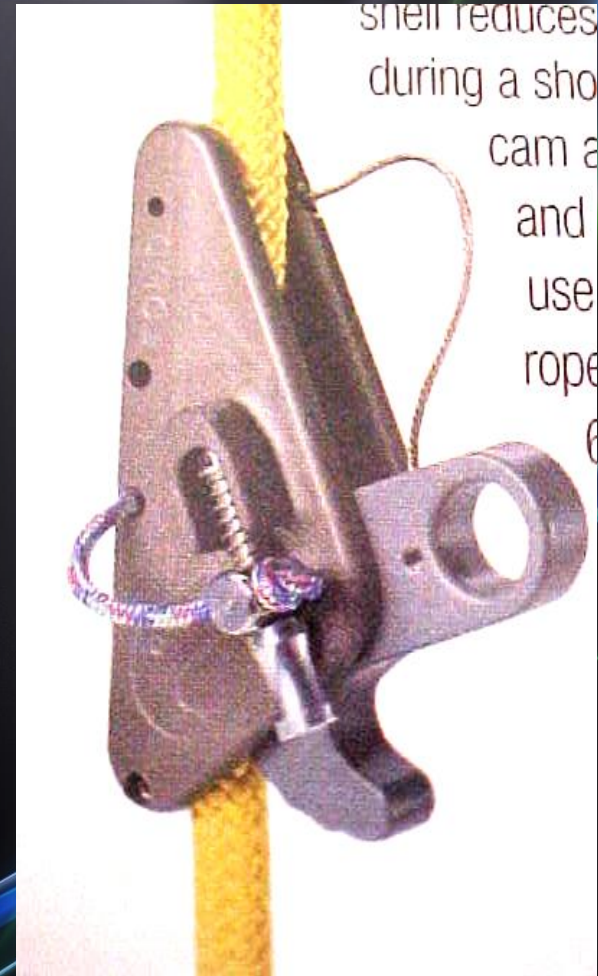
TYPES OF ASCENDERS



Gibbs



MICRO ASCENDERS



JUMARS OR ULTRA ASCENDERS



ASCENDERS/ Cams

- Used for single load ascensions and limited hauling systems.
- Are not for arresting dynamic falls.
- Free running cams activate only when a load is applied to the opposite end of the lever.
- Spring loaded cams maintain Technical contact with the rope at all times regardless whether or not a load is applied
- Handled ascenders teeth are designed for single load ascensions only.
- They must not be used in a hauling system.

RESCUE 8 DESCENDERS



Not to Be Used As a Multi-directional Anchor

Rescue 8 Descenders

- Double ring unit made of steel or anodized aluminum.
- Used primarily as a descending device for rappelling.
- **Figure of eight plates with appendages (ears) on a larger ring are commonly called Rescue 8s.**
- **The ears prevent the rope from slipping out of place and forming a girth hitch.**



Not to Be Used As a Multi-directional Anchor

Rescue 8 Descenders

- Will accommodate up to a 5/8" single rope or a two 7/16" ropes.
- Descent distance should be limited to 75' to 100' when using a figure of 8 plate.
- **NOTE: Most manufacturers advise rescuers not to use a figure of eight plate or rescue eight plates as a multidirectional load bearing device.**



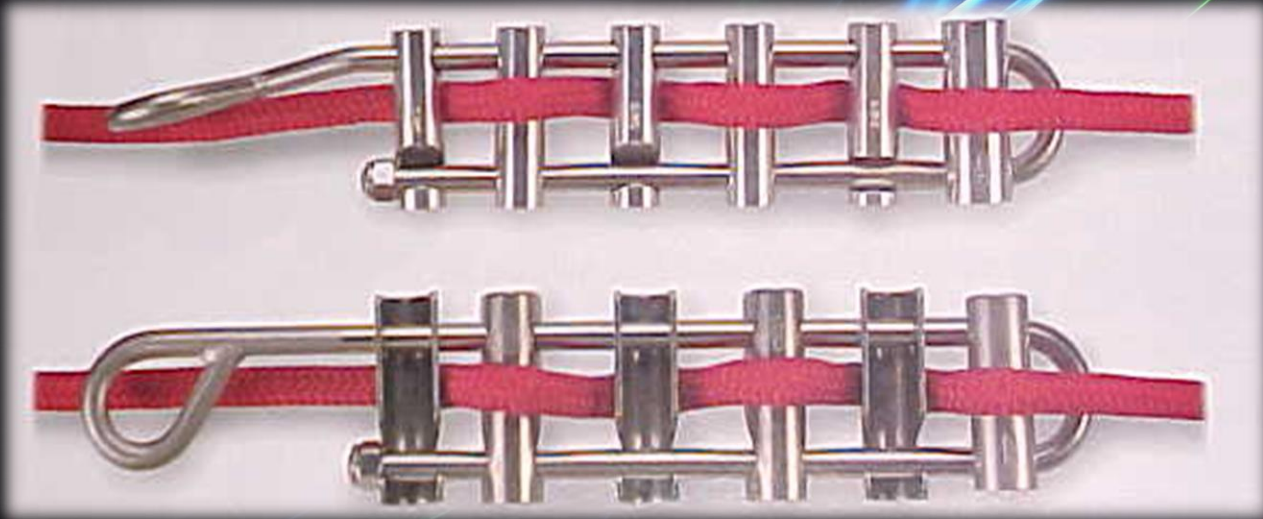
DESCENDERS

- RESCUE 8'S
- BRAKE BARS
- USES & STRENGTHS





BRAKE BAR RACK



Rappel or Brake-bar Racks

- Elongated “U” shaped steel rod with an eye on one side and a threaded nut on the other side.
- Across the rod are the friction bars.
- The bar closest to the “U” is the largest and has a guide groove cut into it.
- Bars can be steel or aluminum, and solid, hollow, or half moon shaped.

Rappel or Brake-bar Racks

- Used as a rappelling device or a load control descending device.
- Friction can be changed under load by adding or subtracting friction bars.
- Rescue 8's do not have this capability.
- Recommended when the need for adjusting the amount of friction to control descent.
- Use when the descent exceeds 100' because it creates less friction.

Brake Tube

- Large aluminum alloy tube with a right angle vertical post and a screw locking gate designed to function as an oversized friction device.
- Rope is wrapped around the tube 3 – 4 times, and it can accommodate single or double ropes, and has the capability of passing a knot.





Pulleys



PULLEYS

- Used to reduce rope friction
- Reposition a rope to a safe area
- Change the direction of a running rope around an object.
- **The sheave or wheel should have a diameter of 4 times the diameter of the rope being used.**
 - $12.5\text{mm} \times 4 = 50\text{mm}$
 - $1/2'' \times 4 = 2''$ diameter
 - $5/8''$ would require $4''$ diameter pulleys
- Side plates are the weakest link of the pulley, for high tensile strength rope (diameters above $1/2''$) should be constructed of steel.
- Some Pulleys have pulleys with swivels built in

PULLEYS

- Two Types of Bearings:
- **Bronze bushings**
 - Very strong
 - Can be accessed for cleaning
 - Less expensive.
 - **Disadvantages:**
 - » They can be contaminated by dirt and grit.
- **Ball Bearings**
 - turn more freely than bronze bushings
 - Some are sealed
 - **Disadvantages:**
 - » They do not take sudden blows as well as bronze bushings.

TYPES OF PULLEYS



Single Sheaved

DOUBLE SHEAVED



TRIPLE SHEAVED



HAUL SAFE



STEEL PULLEYS



PRUSSIK MINDING PULLEY



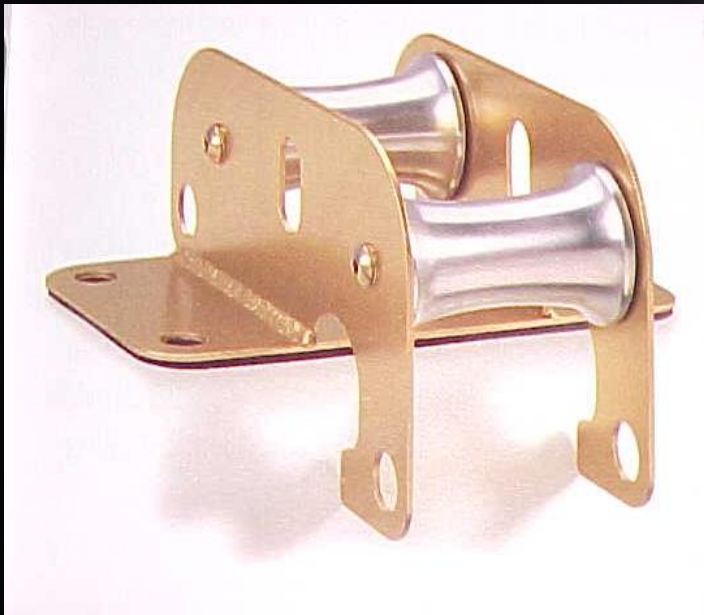
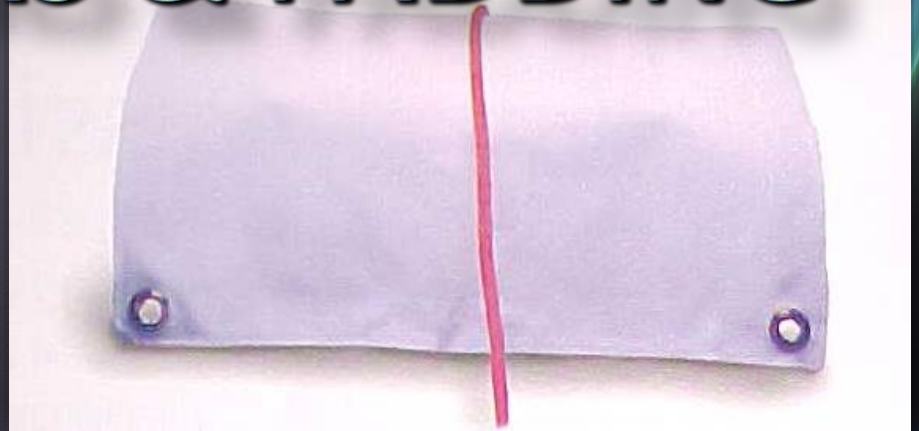
KOOTENEY CARRIAGE "KNOT PASSING PULLEY")



RIGGING PLATES



EDGE ROLLERS & PADDING



Edge Rollers & Padding

- Reduce friction created by the rope going over the edge.
- They protect rope from abrasion, cuts and snags.
- Carpet
- Canvas pads
- Fire hose
- Dynamic protectors such as edge rollers



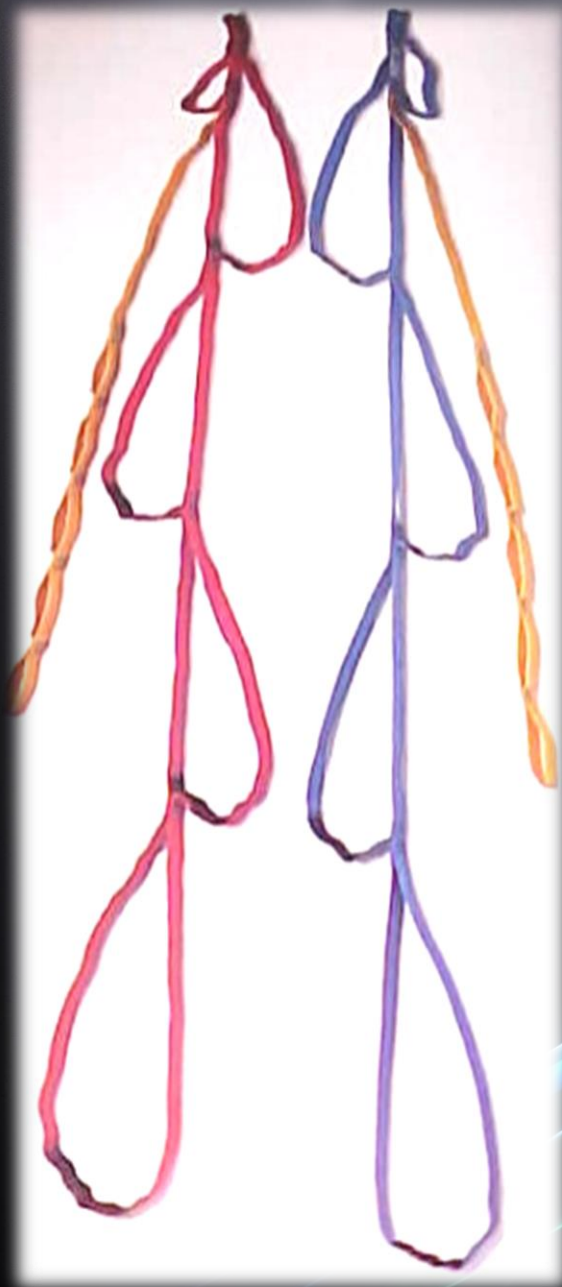
Rope Rescue Equipment



NFPA Usage Categories:

- **“G”- General Use (Steel) 2 Person Load**
 - *D-Rings: 8992 lbs. or 40 kn.*
 - *Pulleys: 4946 lbs. or 22 kn.*
 - *Ropes: 8992 lbs. or 40 kn.*
 - *Brake Bar: 10,000lbs. Or 44 kn.*
- **“L”- Technical Use (Aluminum) 1 Person Load**
 - *D-Rings: 6069 lbs. or 27 kn.*
 - *Pulleys: 2473 lbs. or 5kn.*
 - *Ropes: 4496 Lbs. or 20 kn.*
 - *Rope Grab Devices: 2473 or 11kn.*

Etriers





Bokat
Rope Washer



SMC
Rope Washer

BASKETS,IMMOBILIZATION, STRETCHERS



NEW TECHNOLOGY



Wingman



JAG



“Set of 4’s”



Aztek

NEW TECHNOLOGY



Petzl ID

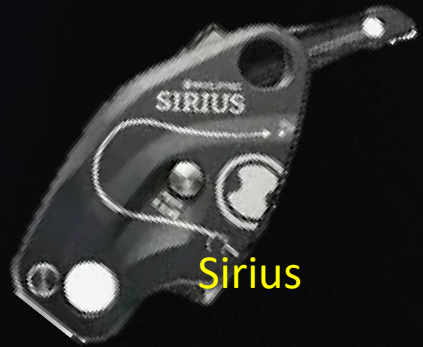


MPD



Clutch

Capto



Sirius



Maestro

Multi-Purpose Devices

New Technology

- Descending (Rappelling)
- Ascending
- Descent Control
- Fall Arrest (Progress Capture)
- Pick-Off's
- Highlines
- Technical & General Rated
- Dedicated Main & Dedicated Belay Systems DMDB)
- Twin-Tensioning Rope Systems (TTRS)

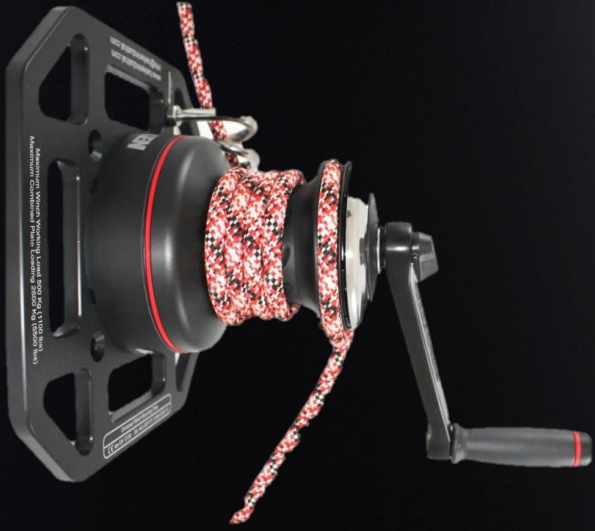
Multi-Purpose Devices

FALL ARREST

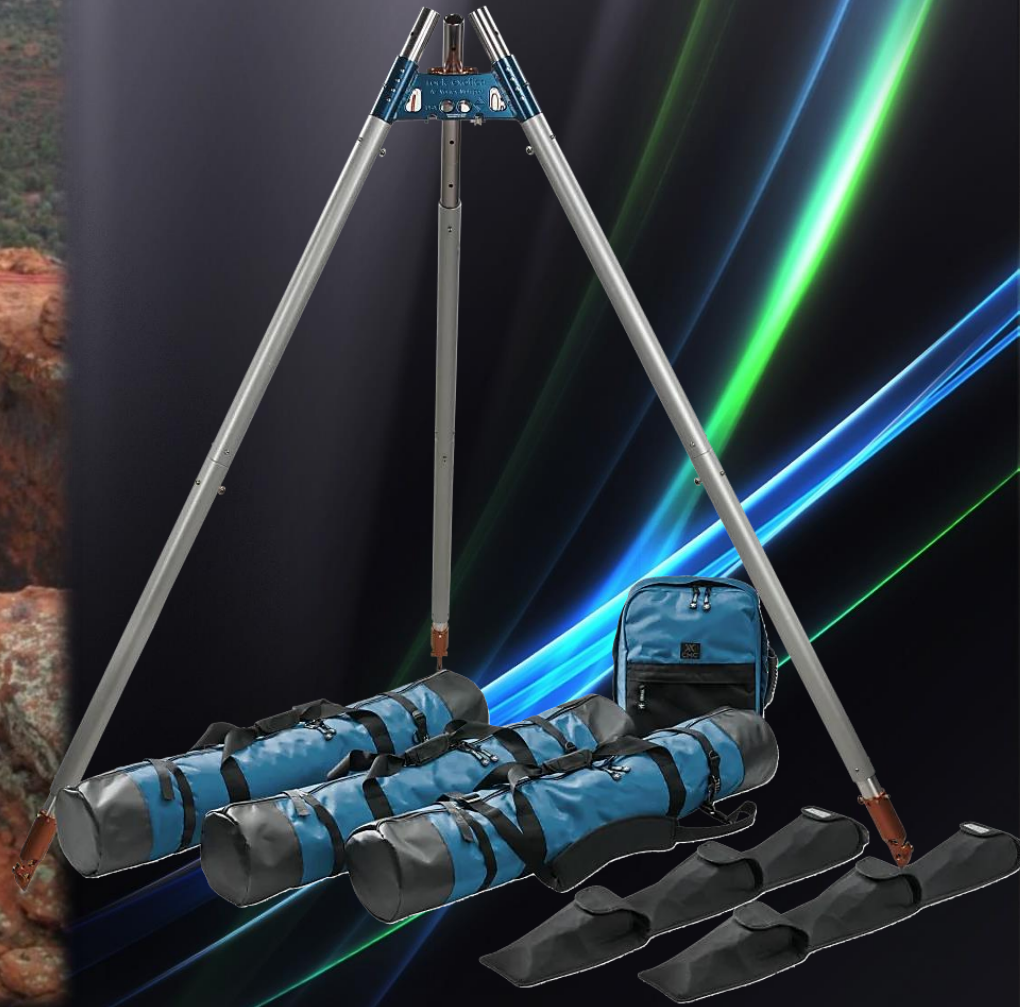
Petzl ASAP w/ Absorber



HARKEN WINCH



ARIZONA VORTEX



TERRADAPTOR



Why do I need to know the strengths of all of this stuff?

- How much is the load?
- What materials do I have to utilize?
- Do I have enough materials?
- If not, can I improvise with what I have?

Practical Exercises

The background features a dark gradient from black to grey. On the right side, there are several glowing, curved lines in shades of blue and green, creating a sense of motion and energy. The lines are layered and have a soft, ethereal glow.