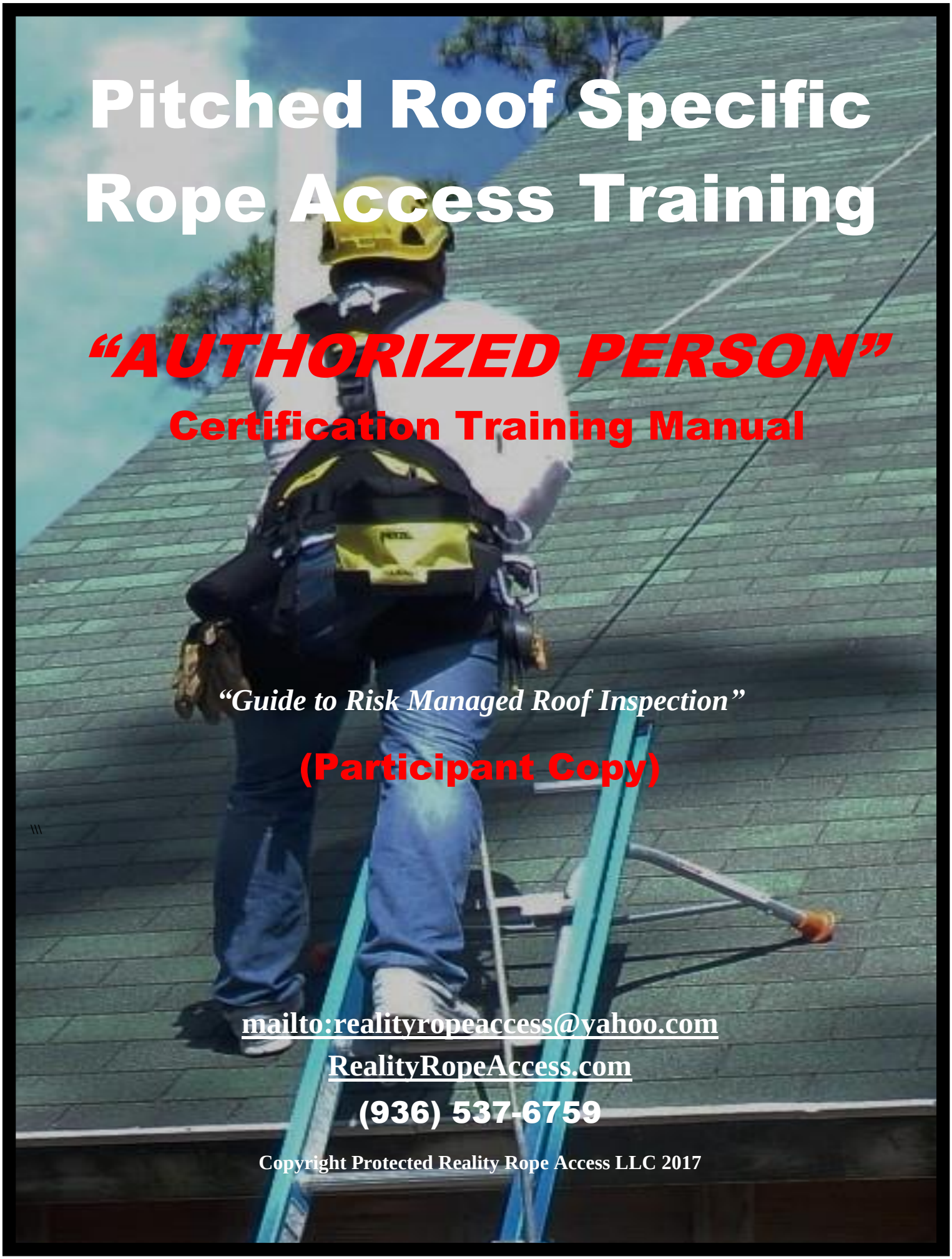

Pitched Roof Specific Rope Access Training

"AUTHORIZED PERSON"

Certification Training Manual

"Guide to Risk Managed Roof Inspection"

(Participant Copy)

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Introduction

Class participation does not guarantee certification. Successful course completion requires that every participant demonstrates technical skill proficiency consistent with professional association (ACRABAT) standards that can be viewed at *www.acrabat.org*.

Certification is valid for a period of three years from successful class completion date.

WARNING:

The information contained within this document is intended for use as a supplement to actual hands-on / experiential training conducted by a Competent Trainer. Improper interpretation and / or misuse of this information may result in incident, injury or fatality. No liability for loss or damage, direct or consequential, to readers or others from the use of information contained herein will be assumed by Reality Rope Access LLC, its administration, members, partners, or contributors.

Document Purpose:

Establish minimum standards of managed fall protection practice consistent with federal OSHA regulation, ANSI recommendations and international rope access standards as it applies to the Pitched Roof Access trades industries.

Class Objectives:

Eliminate the risk of fall related injury for the diverse spectrum of trades who must access pitched roofing systems to deliver an effective, accurate and complete work product.

Safe Access Philosophy:

Most roof structure access accidents can be prevented with:

- Acknowledgement that the highest priority for any industry is the health, safety, and wellbeing of their human resource.
- Understanding the inherent risks associated with pitched roofing system access.
- Careful selection of workers with the appropriate equipment, attitude, physical attributes, inherent abilities, and developed skills.
- Completion of a comprehensive pitched roof specific fall protection training class.
- Active participation within a site specific managed fall protection program.
- Appropriate selection, use, inspection, and maintenance of all rope access gear and personal protection equipment.
- **Workers taking responsibility for their own wellbeing by exercising their right to refuse work related duties that they believe to be unsafe**

Knots

Correctly tied and properly dressed knots are an essential part of any lifeline assisted roof inspection. The knots used for this training have been carefully selected by the world-wide rope access community based on the application for which they are to be applied:

- **direction of force to be applied to the knot**
- **tensile breaking strength of the knot**
- **knot's resistance to the forces of shear**
- **degree of effort required to untie once subjected to the forces of a working load**

Knots w/ Roof Climbing / Inspection Applications:

1) **Super 8** ***(Anchor Knot)*** **–** used to secure a lifeline to an anchor or to anchor webbing.

Reduces residual rope strength by 35%.

2) **Double Overhand or Locking Knot** **(Redundant Knot) –** A redundant knot used to secure primary knot (Figure 8 follow through or Bowline on a bight). A double oppositional Overhand locking knot can also be used to connect two lengths of rope.

Reduces residual rope strength by 30%.

3) **Water Knot** **w/ Locking Knots** ***(Tape Knot / Flat Cordage Knot)*** **–** Used to create no slip anchor lines.

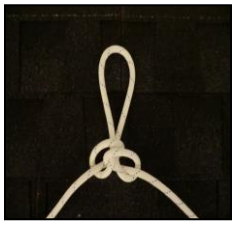
Reduces residual rope strength by 30%.

4) **Prusik Knot** **–** used to secure a prusik cord to a lifeline.

Residual rope strength will vary based on diameter ratio of prusik cord to rope.

5) **Butterfly Knot** ***(Pivot Line Knot)*** **–** Used to form a loop in the middle of a lifeline where the knot will be subjected to loading in three different directions.

Reduces residual rope strength by 35%.



6) **Figure 8 Follow Through** – Used to secure a lifeline directly to a human anchor's seat harness or to secure a pivot line directly to a pivot point (butterfly loop) without the use of a carabiner.

Reduces residual rope strength by 30%.

Ladder Safety

The majority of all roof access injuries are ladder related therefore, ladder safety is undeniably the most important topic addressed in this program. Please take time to review the following ladder safety information**:**

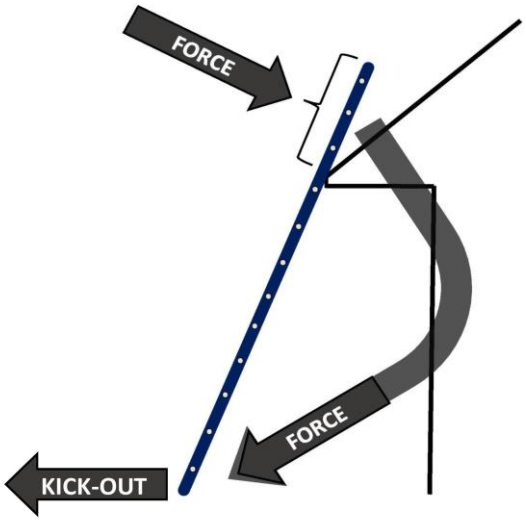
Avoiding Little Known Ladder Mistakes:

1. Choose roof access points carefully. Walk around entire house or building prior to setting up your ladder. **Remember: the best choice for ladder placement is not always at the front of the risk!**
2. Avoid double pulls (pulling a ladder up onto a roofing surface to access a higher roofing surface). Ladders of appropriate length should be used from ground level to access all roofing slopes.
3. Ladder stabilizers can greatly increase a ladder's resistance to the forces of lateral slippage and leverage kick-out.
4. Ladders do not have an indefinite life span. Make sure you inspect your ladder on a regular basis and retire it when appropriate.
5. Do not allow a raised ladder to be unattended w/o securing it to the eave line or incorporating the use of a ladder stabilizer.
6. Metal ladders conduct electricity. Always complete a visual inspection for power lines prior to removing your ladder from your vehicle.

Points to Consider:

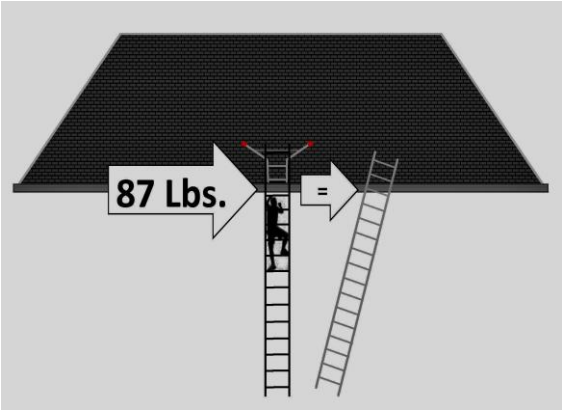
- The use of ladders are the leading cause of fall related injuries and fatalities for those who are required to access pitched roofing systems for their professions.
- Appropriate ladder selection and use are the most critical components of any risk managed roof inspection plan.
- All portable ladders are multi-use ladders! There is NO such thing as a pitched roof specific ladder.
- Extension ladders represent the overall best choice for pitched roof specific access:

Types of Ladders	Available in Lengths of 12' to 60'	Adjustable in Increments of One Foot	Adjustable Footing w/ Rubber Pads & Cleats	Compatible for Use w/ Ladder-Max Stabilizer	Compatible for Use w/ Walk-Through Safety Rails
Articulated Ladder	NO	SOME	NO	MOST	NO
Extension Ladder	YES	YES	YES	YES	YES
Telescoping Ladder	NO	YES	NO	MOST	NO



Ladder Kick-Out – is the leading cause of ladder access related injuries that occurs when the dynamic forces applied to the ladder exceed the traction of the ladder's base footing. The application of climber's weight to any rung located above the rail contact points at the eave of the roof can cause catastrophic ladder failure.

Lateral Slippage is the second most common cause of ladder related failure. It can take place with as little as 9 lbs of lateral pressure during the climber's transition from ladder to roof or roof to ladder. Both kick-out and lateral slippage can be greatly reduced with the implementation of ladder stabilizing accessories.

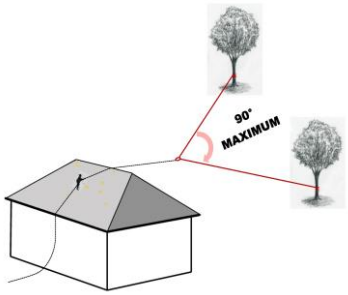


Roof Specific Rope Access Tools

- **ANCHORS** – represent a critical component of a personal fall arrest system used as a secure point to attach a lifeline or lanyard.

Fixed Anchors – Suitable anchor points that exist in place at the site where the roof inspection is to take place. The most appropriate form of lifeline anchors consists of heavy vegetation such as trees and shrubs or manmade structures such as decks, fences and outbuildings.

Load Sharing Anchors – the combination of several anchors to provide a structure centered connection point and / or enough foot pounds of resisting force to secure a primary lifeline.



Weight Based Anchors- utilized only in situations where no suitable fixed anchors are present. Should be appropriately placed directly under the opposing eave of the roof slope to be inspected and consist of a weight approximately equal or greater to that of the roof climber.

Human Anchors

NOTE: weight based anchors attached to a lifeline positioned across a composition based roof's ridge cap are capable of sustaining three to four times their own static weight when situated directly beneath the eave of an opposing slope.

Anchor Barrel w/ Webbing Cage – 55 gallon plastic drum encased in a 1" tubular webbing cage that can easily be moved into position on a flat surface, filled with water from a garden hose and connected to a lifeline with carabiners.

Portable Anchors:

Examples of Appropriate Fixed Anchors: Trees, fence posts, deck posts, heavy shrubs, fire hydrants, anchor barrels and vehicles.

1) Appropriate working loads will need to be approximated however, all lifeline anchors should at least adhere to the following:

   I) Fixed anchors should be attached to the earth in a manner that would require a force of greater than 5000 lbs. to compromise it.
   II) Weight based anchors should have equal or greater weight to that of the roof climber.
   III) When using a vehicle for an anchor make sure:
   - it is parked on a clean, dry surface (not on gravel).
   - it is locked with the keys secured so that it cannot be accidently moved.
   - it is connected to a structural member attached securely to the frame.
   - it is positioned so force is applied is at a right angle to the drive train.
   - lifeline extending to climber does not cross a driveway or any other open travel ways.

2) Some belay set-up situations may require the use of load sharing, a process where multiple anchor points are combined to achieve a desired tensile strength or structure connection point.

This anchor point demonstrates the concept of load sharing by attaching several deck posts to anchor webbings clipped into a single, split looped Super 8 knot.

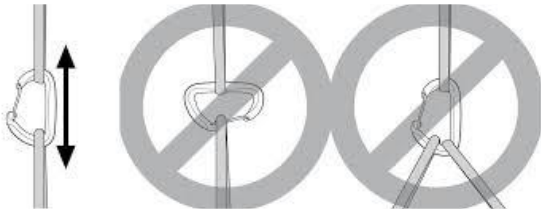
3) Appropriate anchor selection will incorporate consideration for selection based on minimizing shear (i.e. sharp edge damage to cordage).

4) Some anchors will require the use of tubular webbing to prevent damage to lifeline.

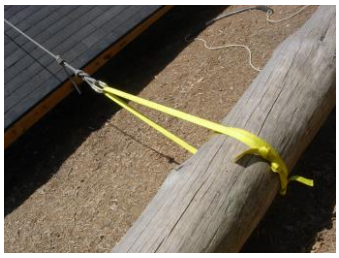
Establishing an anchor point around an axle or tire rim is an effective means of securing a lifeline however, should incorporate the use of tubular webbing to prevent shear damage to a rope.

5) All anchor lines should be placed low to the ground and make at least two full loops around anchor structure to prevent vertical or horizontal movement.
6) All anchors should be located directly in line with the climbers intended access path.
7) Vertical lifelines should incorporate two lifelines with two independent anchors.

8) Use care to prevent cross loading of anchor connectors. Remember to apply all loads across the carabiner's major axis / spine.



- **Anchor Webbing -** Flat braided tubular Nylon typically used in a rope access system to secure rope to anchors. Tensile breaking strength: 1" = 4000 lbs., 1" Loop w/Water knot = 6800lbs.



- **Anchor Slings –** Heavy duty braided nylon of varying lengths with stitched looped ends used to expedite the set-up of an anchor connection point. Tensile breaking strength: End to End = 9,000 lbs., Basket loop = 18,000 lbs.

- **ASCENDERS -** a belay device best suited for climbing up a rope.

Petzl Hand- Held Ascender ***(Jumar)*** – (Aluminum) Tensile breaking strength = 1,240 lbs. when attached to 10.5 mm rope (available in both right and left handed models). Hand held rope gripping device used to ascend a Lifeline.

WARNING: Ascenders can fail with as little as 600 lbs of load force therefore are not approved by manufacturers to use alone as a primary belay device!

Petzl Chest Ascender ***(Croll)*** – (Aluminum) Tensile breaking strength = 1,240 lbs. when attached to 10.5 mm rope. Chest positioned rope gripping device used to ascend a lifeline. Retirement at 10 years or sooner based on condition.

- **BODY HARNESS SYSTEM –** Nylon based component system of webbing and fasteners that encapsulate both the upper and lower torso. Designed to evenly distribute weight across the chest, shoulders, waist and thighs. A rope access harness that provides a minimum of two (central / waist level and sternal / chest level) points of attachment. Must be adjusted so it fits snugly across the legs, waist and shoulders without significantly limiting rope access worker's range of movement

Falcon Seat Harness

Top Croll Chest Harness

- **CONNECTORS –** a device (ex. carabiners, snap hooks, rapid links) used to link components of a rope access system.

CARABINERS – Two & Three Stage Carabiners

Carabiners are used to secure various components from anchors to climber within a rope access system. Carabiners should be load rated to at least 5000 lbs. / 22.2 kn. (1 kn. = 224.8 lbs.) and should have at least two different locking mechanisms that require two different consecutive manual actions to open the gate. Weight loads should never be applied across the short axis / gate or to the long access with an unsecured gate! ANSI rated carabiners offer a minimum tensile strength of 3600 lbs of gate strength as an additional measure of safety should load be accidentally applied to short axis.

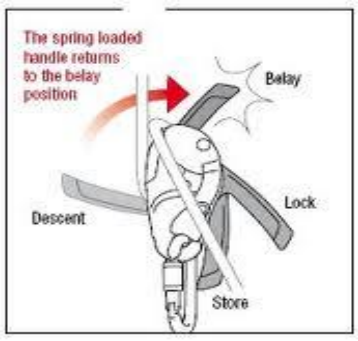
Warning: Carabiners represent a quick and easy way of establishing a rope access connection however, to avoid compromising a carabiner's greatest listed strength, they should always be loaded in a single direction along the major access with the gate securely closed.

Cross Loading – The application of any load on a carabiner other than that which is applied to the carabiner's long / major axis.

NOTE: Attaching aluminum carabiners to steel hardware or steel carabiners to aluminum hardware will accelerate wear to the piece of equipment composed of the softer metal!

- **DESCENDERS -** A belay device primarily designed to travel down a rope.

Petzl "Rig" - a friction producing device attached to a climber's seat harness and used to effect a controlled rate of descent. Intended for use with climbing rope of 10.5 – 11.5 mm in diameter only and not intended for use with loads that exceed 330 lbs. Retirement at 10 yrs. or sooner based on condition.



- **LADDERS –** Of appropriate lengths and load capacity in good working order that have been stamped with a seal from the Underwriter's Laboratory.

Type III (RED) = 200 lbs. **Type II (GREEN) = 225 lbs.** **Type I (BLUE) = 250 lbs**

Type I-A (ORANGE) = 300 lbs. **Type I-AA (YELLOW) = 375 lbs.**

NOTE: Fiberglass Ladders Are Color Specific to Load Rating:

- **LADDER STABILIZERS –** Roof access specific attachments utilized to improve extension ladder stability and secure a climber's transition from ladder to roof and roof to ladder.




- **FALL ARRESTERS** - a belay device that moves along a lifeline and engages / locks onto a lifeline in the event of a fall.

Prusik Cord (Fall Arrester) **–** small diameter nylon cord. A primary or redundant friction producing device that secures a climber to a rope.



- **GLOVES** - utilized to protect climber's hands from heat producing friction experienced with rope management (minimizes potential for rope abrasions).

- **THE HUMAN BODY –** Without question the most vulnerable component of any rope access system. Physical shock related trauma to the average human body occurs at around 1000 lbs. (when attached to central / waist level D-ring). NOTE: Static falls of as little as 5 feet can produce around 1200 lbs. of shock load to a 200 lb climber. Tensile breaking strength 2000 lbs.

- **Tag-Lines –** A collection of components assembled together and used from ground level to position a rope / lifeline over a structure. Tag-Lines should minimize the threat for friction related trauma to rope and the surfaces that they are employed over.

  Tag-Line System - A weighted ball (6 to 8 ounces) attached to a plastic cylindrical tube or sphere with 2-3mm tightly braided polypropylene cord (110ft. minimum length required for average residential setting).

Comet Ball Video Demonstration Line Launcher Video Demonstration

Precision Line Launcher w/Attached Rope Caddy - A Ramset / blank cartridge powered tag-line delivery device. Used to position a tag-line over structures that are either extremely tall, or present obstructions / obstacles that require a greater degree of accuracy to secure in place.

- **RIDGE PROTECTOR -** Placed over top of roof structure to protect ridge capto eliminate the threat of damage to shingles or rope.

- **LOW STRETCH ROPE -** of appropriate lengths 150' – 250' in length and 10mm / 13mm Perlon (nylon) tensile breaking strength will vary depending on the manufacturer and method of construction.

Note: Low Stretch rope typically only contains one or two colors and is firmer to the touch than Dynamic rope.

Ropes come in varying shapes, sizes, colors and strengths and are used for varying purposes. Not all rope is suitable for rope access on pitched roofing systems.

OSHA requires that all work related climbing ropes are made from synthetic fibers like Nylon.

NOTE: All ropes will elongate under the force of a load. Some ropes possess significantly greater elongation potential than others. Rope elongation represents contractible expansion under a force within the limits of a working load. Rope stretch typically represents damage from either age, or a force that exceeds that of a working load limit.

Kernmantle Climbing Rope: Most climbing rope is comprised of a twisted, white nylon core (the kern) which is surrounded by a braided nylon cover (the mantle).

Three Types of Kernmantle Rope Typically Used for Climbing:

Less Elongation Potential → **Static / Low Stretch / Dynamic.** ← More Elongation Potential

Static: This type of rope is often two toned or a solid color. Static rope produces less than less than 6% elongation at 10% of the manufacturer's listed minimum breaking strength.

Low Stretch: This type of rope is often two toned or a solid color as well. Low stretch rope produces between 6% and 10% elongation at 10% of the manufacturer's listed minimum breaking strength.

Dynamic: This type of rope is generally more multi-colored (normally three or more different colors) is brighter, more expensive and softer to the touch. It is designed to absorb the energy of a fall therefore limiting the amount of impact force transmitted to the climber. Dynamic rope produces up to 30% elongation at the manufacturer's listed minimum tensile breaking strength.

WARNING! Dynamic climbing rope has a limited safe applications for accessing a pitched roof and is capable of producing amounts of elongation that can fail to prevent a climber's stability and / or impact with the ground

Rope Care:

- Store in a cool dry place, do not store directly on top of or beside a concrete surface.
- Keep rope away from petroleum products and fumes.
- Minimize exposure to ultraviolet radiation.
- Avoid exposure to heat, e.g., fire, cigarettes, excessive friction, and hot surfaces.
- Avoid exposures to dangerous chemicals, dirt and sand.
- Rope should receive visual and tactile inspection for flat spots, fraying, or cuts both before and after use. Keep a record of use in a rope log.
- Remove knots after every use.
- Minimize shear (avoid sharp edges and objects). Shear represents the greatest threat for rope damage!
- ropes can be cleaned as needed in a washtub or front loading (not a top loading washing machine or a washing machine with an agitator) using a mild detergent like "woolite" (never bleach) in cold water. air dry by hanging outstretched in a cool, dry place with good air circulation. do not machine dry!

ropes should be retired (no longer used for climbing) if:

- ✓ shock loaded (i.e. subjected to a force that exceeds a working load limit).
- ✓ showing flat spots, excessive wear or fraying.
- ✓ exposed to excessive heat.
- ✓ over three years old or has over 300 hours of use.
- ✓ they have stretched or shrunk more than 5%.

**** IMPORTANT:*** *Equipment information provided in this manual is approximate and only provided for the purpose of comparison. Actual equipment strengths will vary depending on brands, sizes, condition, and application. Equipment specific information provided by manufacturer should always be regarded as primary / most accurate when considering the capabilities of individual rope access hardware components.*