Salt Lake Climbers Alliance
Professional Anchor Replacement Initiative

saltlakeclimbers.org

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Many of the technical information and graphics used in this handbook are available in the product and technical resources found at Petzl.com.

2020.07.22JW

SLCA
SALT LAKE CLIMBERS ALLIANCE

Professional Anchor Replacement Initiative
Fall Protection Handbook and Assessment

CONTENTS

The SLCA Anchor Replacement Program protects workers from hazards by: identifying general health & safety hazards, performing Job Hazard Analysis and Work Safety Plans, and providing the administrative, training, work practices and Personal Protective Equipment controls to manage the hazards.

JOB HAZARD ANALYSIS FOR ALL ANCHOR REPLACEMENT OPERATIONS

DESCRIPTION OF WORK:

The removal of unreliable, failing or failed mechanical and 'glue-in' bolt anchors used for rock climbing, and the placement of reliable replacement anchors. This includes secure work positioning, and tool & material handling 'at height.'

Hiking and scrambling are used to access anchors whenever possible, on terrain not exposed to a fall hazard.

On terrain requiring exposure to a fall hazard: belayed climbing, temporary lifelines, and rope ascent/descent systems are used as fall protection to access and position for the work.

REQUIRED PERSONAL PROTECTIVE EQUIPMENT:

General Health & Safety	Fall & Falling Object Protection
❑ Gloves (work) ❑ Impact resistant & UV protection 'safety glasses' ❑ Ear plugs ❑ Mask (particulate)	❑ Helmet ❑ Harness (waist/sit + chest) ❑ Belay +/or Descent device ❑ Ascender ❑ Personal adjustable lanyards ❑ Backup device / secondary rope clamp w/ lanyard ❑ Progress-capture pulley ❑ Connectors (simple + locking) ❑ Dynamic climbing ropes ❑ Low-stretch ascent/descent ropes ❑ Tool & material lanyards ❑ 'CAUTION' tape/signage

HAZARD ANALYSIS by task

TASK	HAZARDS	CONTROLS
Unload vehicles	• Back injury • Vehicular collision	• Avoid heavy lifting, get help • Park off the road, in designated areas • Unload vehicle on opposite side of road
Hike to crag carrying equipment	• Slips, trips, falls	• Wear appropriate, closed-toe footwear • Don't carry materials in hand
Working outdoors	• Hypothermia • Hyperthermia • Dehydration • Sunburn • Exhaustion	• Planning / timing • Wear appropriate clothing • Drink & eat • Wear sunscreen and sunglasses • Communicate needs with partners • Physical preparation
Working at dusk/dawn	• Difficult visibility	• Use headlamps
Working above/below others	• Falling tools or materials	• Use tool lanyards • Use material handling bags • Wear helmet • Mark an exclusion zone with "CAUTION" tape • PR/ Communication

ACCESS & FALL PROTECTION HAZARDS

TASK	HAZARDS	CONTROLS
Working 'at-height' on rope	• Anchor failure • Rope failure • Connection failure • Belay failure • User failure	• Use redundant anchors • Use rope protection • Use 'captive' rope devices • Use secondary systems • Continuous connection • Double-check safety systems • Review and communicate plan • Skills training assessment
Climb routes via lead climbing	• Falling • User error	• Alternative access? • Use reach pole • Use both aid and free climbing techniques • Review plan & belay commands • Both climbers tied in • Skills training assessment

TASK	HAZARDS	CONTROLS
Descend ropes	• Falling • Rope abrasion • Disconnection from rope • User error	• Use rope protection • Use re-belay anchors • Use secondary systems • Use 'captive' rope devices • Use adjustable lanyard to connect to anchors • Use a backup rope grab for 'hands-free' work • Secure rope ends • Continuous connection • Double-check safety systems prior to use • Skills training assessment
Ascend ropes	• Falling • Rope abrasion • Disconnection from rope • User error	• Use rope protection • Use re-belay anchors • Use 'captive' rope devices • Use lanyard on ascender • Use adjustable lanyard to connect to anchors • Continuous connection • NO slack in rope or lanyards • Double-check safety systems prior to use • Skills training assessment

WORK HAZARDS

TASK	HAZARDS	CONTROLS
Remove bolts with hand tools / hammer	• Eye injury • Hearing injury • Hand injury	• Wear gloves • Wear safety glasses • Wear ear plugs
Remove bolts with drill or grinder	• Cut rope • Eye injury • Hearing injury • Hand injury • Respiratory Injury	• Use secondary safety system • Wear safety glasses + face visor • Wear ear plugs • Wear gloves • Wear dust mask
Drill & clean hole for new bolt	• Eye injury • Hearing injury • Hand injury • Respiratory injury	• Use secondary safety system • Wear safety glasses • Wear ear plugs • Wear gloves • Wear dust mask
Placement of new expansion bolt	• Eye injury • Hand injury	• Wear safety glasses • Wear gloves
Placement of new adhesive bolt	• Eye injury • Chemical contact	• safety glasses • Wear latex/nitrile gloves • Use holster for applicator • Bring paper towels & trash disposal bags

EMERGENCY RESPONSE

- Confirm scene is secure.
- Contact injured (if possible).
- Access injured via rope system indicated in Work Safety Plan
- Hasty survey for immediate life threats: airway, breathing, circulation (bleeding), disability (neck/back) and environmental exposure.
- Stabilize immediate life threats (to the extent of training).
- If injuries are serious, and emergency services are needed, **contact 911**:
- Salt Lake County Sheriff Search & Rescue, NON-emergency dispatch only assistance= (801) 743-7000,
- If cell service is unavailable, use the Garmin InReach GPS with Satellite Text.
- Stabilize and protect the patient. Use field First Aid kit.
- Identify possible evacuation route or possible hoist or landing zone(s).
- Maintain communications with 911 Dispatch.
- Guide responders to the injured's location.

PERSONNEL EMERGENCY INFORMATION

Name	Phone	Emergency Contact + Phone	Medical Alert?
example	*xxx-xxx-xxxx*	*Ex., xxx-xxx-xxxx*	

BASIC HEALTH & SAFETY MEASURES

All workers should implement regular health, hygiene and infection control practices, including:

- ❑ Personal preparation for physically demanding work in an outdoor environment
- ❑ Not working if sick or unhealthy
- ❑ Frequent and thorough hand washing and/or sanitizing
- ❑ Good respiratory and sanitary etiquette around other workers
- ❑ Minimizing shared use of equipment
- ❑ Regular cleaning of shared equipment
- ❑ Limiting close contact between workers
- ❑ Use of Personal Protective Equipment

HEALTH & SAFETY PERSONAL PROTECTIVE EQUIPMENT

PPE is used to protect workers against the general hazards associated with anchor replacement operations, as well as for good hygiene, and to limit infectious disease transmission:

- ❑ gloves for hand protection
- ❑ ear protection for drilling/grinding/hammering operations
- ❑ eye protection for drilling/grinding/hammering, and for UV light protection
- ❑ respiratory protection from particulate matter (drilling/grinding operations) and infectious disease transmission (when working in close proximity)

FALL PROTECTION PPE INDIVIDUAL KIT

Item	Application
Helmet	Falling objects, Falling
Sit + Chest harness	Climbing + Secondary or Fall Protection attachments
Adj. 'Y lanyard' + auto-lock connectors	Fall Restraint & positioning, direct anchor connection, aid climb, ascender tether
ABD w/ auto-lock connector	Climbing belay, sport RAD
DCD w/ auto-lock connector	Rope Ascent / Descent (RAD)
Ascender + foot loop + connector	RAD, secondary or rescue Rope Grab
Secondary / 'Backup' device + lanyard + connectors	Redundant Fall Protection for RAD systems, training
Slot belay device + connector	Retrievable rappel systems, secondary multi-device
Simple pulley + connector	Rope ascent efficiency
Progress pulley + connector	Material handling, self-belay
Long anchor sling/ cord (23kN) + 2 HMS connectors	Anchor equalization, improvised rescue
2 Connectors (simple)	Anchor equalization
Cord loop + connector	Simple rope grab, backup

FALL PROTECTION & EQUIPMENT TEAM ISSUE

Item	Application
(Dynamic) Climbing ropes	Climbing belays, improvised RAD systems
(Low-Stretch) Work ropes	Ascent / Descent systems, secondary/backup rope system
Releasable, Adjustable Rope Lanyard (w/ device)	Work positioning, aid climbing & weighted transitions
Tag Line (Climbing 'half-rope')	Material hauling, improvised descent / self-rescue
Sewn (23kN MBS) slings	Anchor construction & equalization
Temporary removable anchors	Lead climbing protection & anchors, temporary anchors
Connectors (23kN MBS)	Anchor construction, connection & equalization
Removable bolts	Directional anchors
Rope protection sleeve(s)	Protect RAD & secondary ropes & lanyards, natural anchors
Work seat + connectors	Work positioning & support
Work bucket bag	Tool & Material handling
Swivel + connectors	Material hauling & handling
Headlamp	Visibility in dark conditions

PPE CARE & MAINTENANCE

Appropriate PPE is issued from the SLCA managed, traceable and regularly inspected inventory.

*Any 'Personal Use' PPE (provided by workers) must be inspected before use. (Personal Use PPE Inspection GoogleForm)

INSPECTION

***Workers should conduct regular pre- and post-use inspections* of all PPE**:

- ❑ Unique identification and/or known history
- ❑ Visual Check for defects
- ❑ Touch & Feel for defects
- ❑ Function Check (ground level, full load) for defects
- ❑ Quarantine all unfit PPE for inspection & destruction

CLEANING

- Cleaned and rinsed in warm water only.
- Dilute Woolite in cool water may be used to clean harnesses, helmets and textile items.
- Items should be rinsed thoroughly and air-dried, out of sunlight.
- A dry (non-aerosol) graphite or wax lube may be used to lubricate moving metallic components.

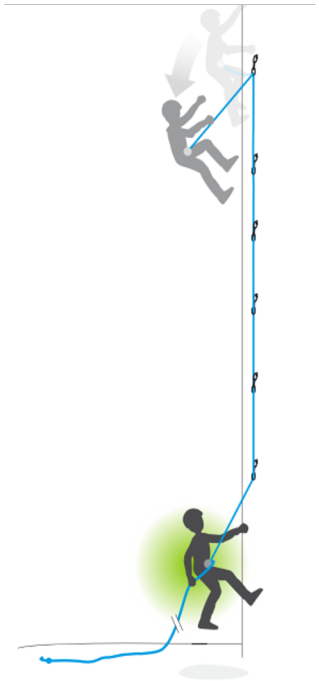
HANDLING

- SLCA PPE used for SLCA work ONLY.
- Protected from UV exposure, high temperatures and chemicals
- ANY questionable PPE immediately quarantined from service, to be inspected by Coordinator

ACCESS METHODS

Use (possibly in combination) to get into position for anchor replacement work:

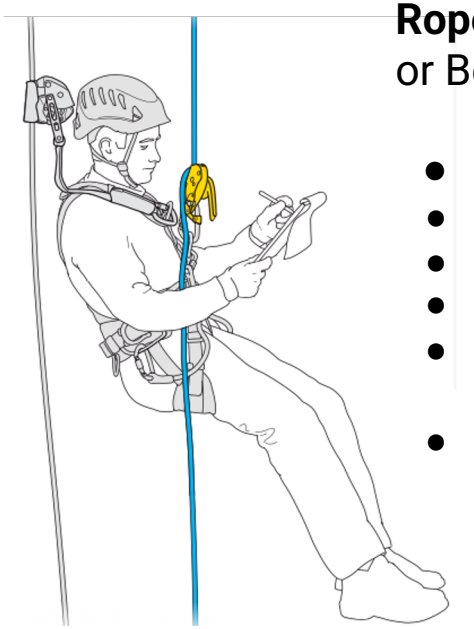
- ❑ Alternative access to top via hiking or scrambling, not exposed to fall hazard
- ❑ Lead climbing (free & aid) with an attended belay up the work route or an adjacent route
- ❑ Rope or lanyard descent from another anchor above
- ❑ Rope ascent of a previously installed rope system



Lead Climbing with an **'Attended Belay'**:

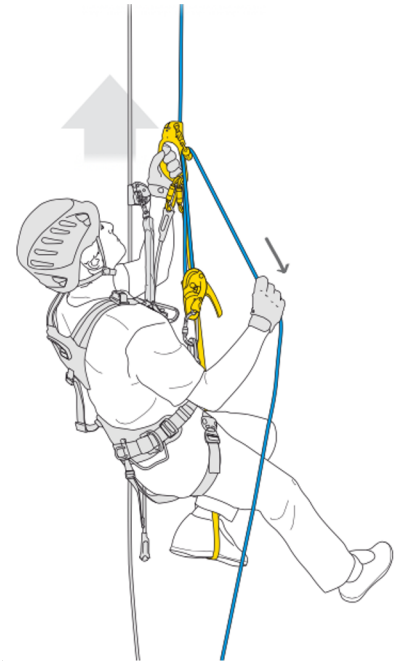
- dynamic rope= energy absorber
- compatible belay device
- waist harness attachment
- intermediate protection anchors
- Clear, clean rope path

Images: Petzl.com



Rope Descent w/ Descender or Belay Device:

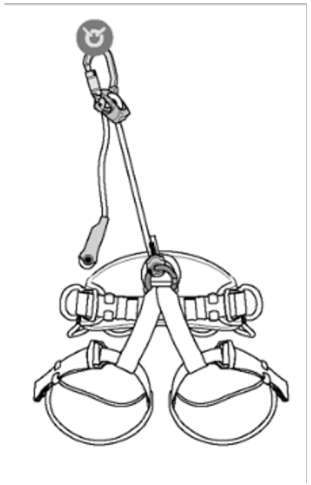
- low-stretch or dynamic rope
- rope protection sleeve
- compatible device
- device on waist belay loop
- redirected brake strand for additional friction
- + chest harness + secondary rope + backup device for sustained work positioning and tool use



Rope Ascent w/ Descender or Belay Device, Ascender(s), Pulleys

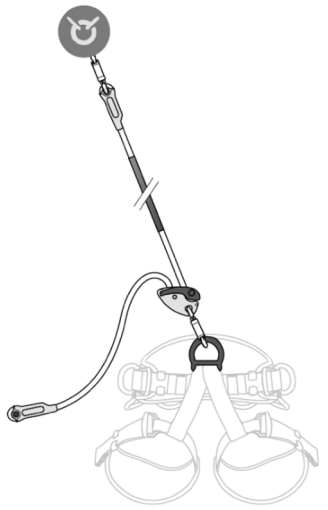
- low-stretch or dynamic rope
- rope protection sleeve
- compatible device
- device on waist belay loop
- ascender + footloop (+ lanyard / tether)
- brake strand may be redirected through pulley
- + chest harness, secondary rope + backup device for sustained work positioning and tool use

ADJUSTABLE LANYARDS:
FALL RESTRAINT



Use Adjustable rope ‘Y Lanyards’ (*not releasable under load*) to:

- Connect to an anchor
- Connect to, or ‘drop-proof’ a device
- Connect to a horizontal lifeline
- Position for ‘hands-free’ work while suspended or belayed on a rope system.



A longer rope lanyard w/ an integral descender or belay device *that can be released under load,* is used for:

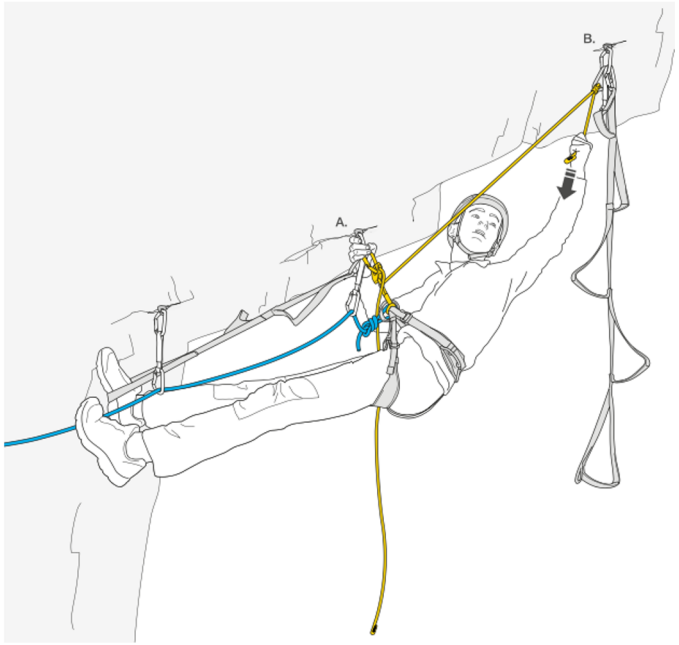
- Aid climbing and weighted transitions on overhanging terrain
- Extended positioning (w/ long rope lanyard) from the anchor

Images: Petzl.com

ADJUSTABLE LANYARDS:
AID PROGRESSION and
WORK POSITIONING

Use a ‘Y” lanyard (or compatible assembly of 2 lanyards on a shared locking connector) to:

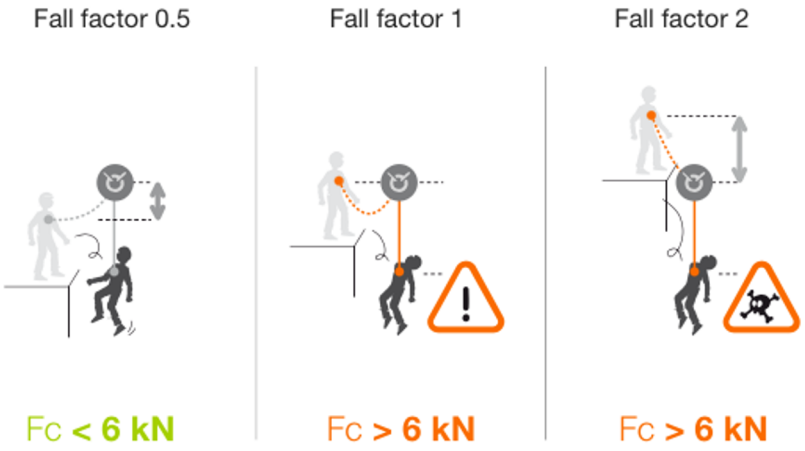
- Maintain continuous or direct connection to anchor when transitioning between systems
- Aid climb from anchor point to anchor point while belayed climbing or on rope ascent/descent
- Re-position for work or for a redundant connection

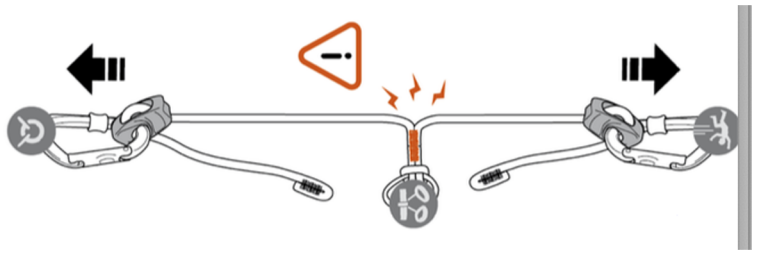


ADJUSTABLE LANYARDS:
PRECAUTIONS FOR USE

Adjustable lanyards - with a sewn terminal or secured blocking knot- are used for positioning or aid climbing, in addition to a rope system, or for a direct anchor connection.

Adjustable lanyards do NOT have an impact energy absorber. **The User should remain in tension or suspension on the lanyard, below the anchor point. A fall from above the anchor will result in very high impact forces!** Care must also be taken not to load the sewn or shared connection in opposite directions.





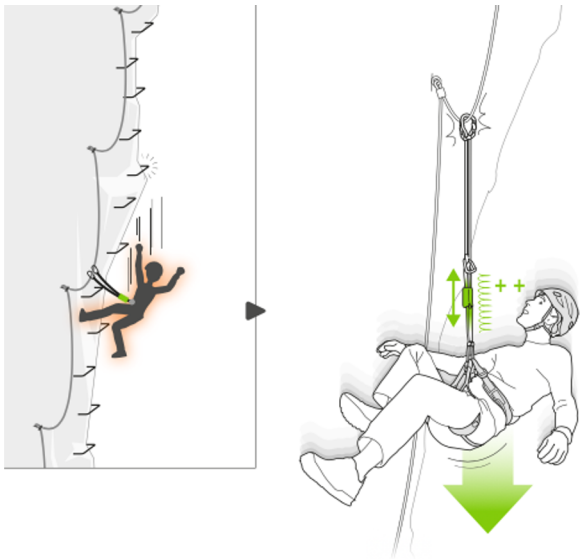
Images: Petzl.com

FALL ARREST LANYARDS:
ENERGY ABSORBING

If access or progression involves a risk of falling from above, directly onto an anchor or lifeline, use a Fall Arrest Lanyard with an integral energy absorber.

Maintain the lanyard connections on the highest anchor available. The impact force of a fall is reduced by the extension of the absorber. This adds to the length of fall, so there is still a risk of impacting the ground or surface.

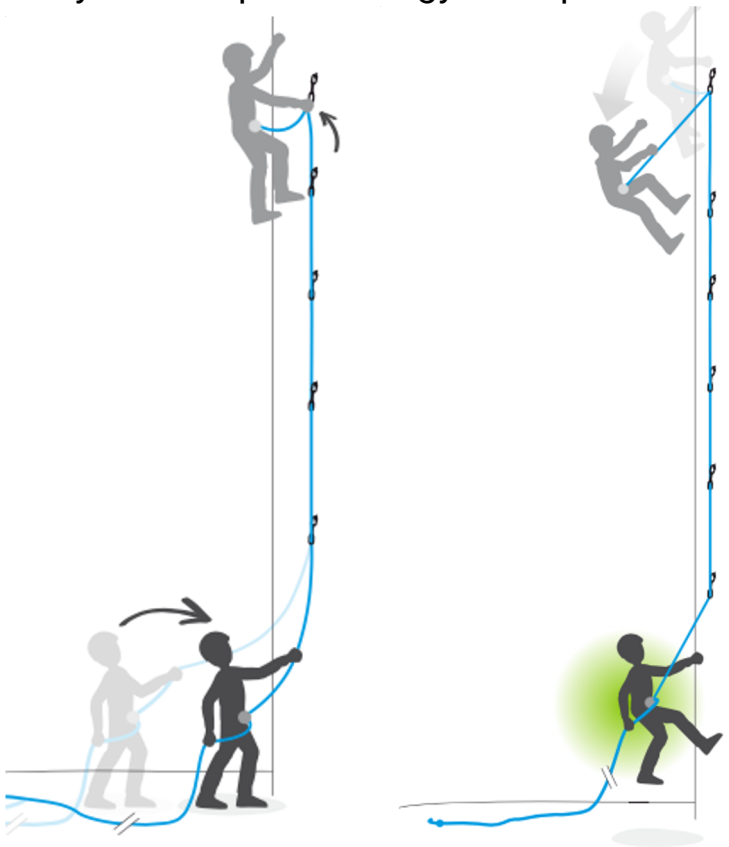
- Sport ‘Via Ferrata’ Y Lanyards may be connected to waist or chest attachments, provided the User is within the specified weight/mass limit (+/- 80kg)
- Industrial “Fall Arrest’ Y Lanyards must be connected to the chest,, and are specified for larger users (+/- 100kg) and longer fall distances, (requiring more clearance.)



LEAD CLIMBING:
FALL PROTECTION with an ATTENDED BELAY for ACCESS & FALL PROTECTION

Use free and aid climbing techniques for progression, and the belay system for protection in case of a fall:

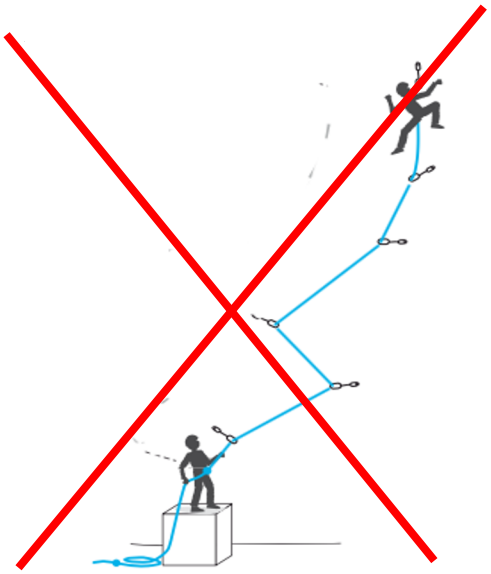
- Fall distance, clearance and impact forces are managed by a positioned and attentive belayer with compatible belay device
- Belayer may be anchored or unanchored, or use a direct anchor belay
- Use intermediate existing or removable protection anchors
- Dynamic rope for energy absorption.



Use all available intermediate protection anchors to minimize the fall distance, including:

- Tree Anchors
- Geologic structures: boulder, horn or constriction
- Removable metallic wedge or expansion anchors
- Existing, 'in place' wedge, sleeve, adhesive and piton anchors
- Documented, replaced sleeve & adhesive anchors

Use variable length slings and connectors on intermediate anchors to minimize rope drag, and allow rope to extend freely throughout it's full length, reducing the impact force in the event of a fall.



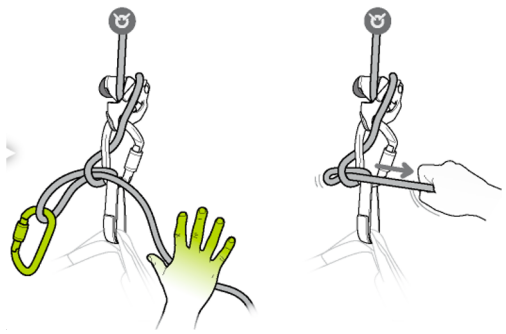
SECURE all **ROPE ENDS** with bocking knots or attachment to an anchor or user.

Images: Petzl.com

ROPE ASCENT / DESCENT SYSTEM for:
Access, Fall Protection, Positioning, Rescue

Attachment to primary rope with a (compatible) Assisted Braking Belay Device (ABD) or an industrial Descent Control Device (DCD) allows for easy movement and positioning both up and down an anchored rope:

- Low-stretch rope preferred (to minimize stretch and abrasion)
- Rope protection installed on any wear points
- Compatible ABD / DCD installed on waist / belay loop with auto-locking connector
- Work seat attached to ABD/DCD connector or loop
- Allows for self- or assisted- descent/ lower/escape
- Redirect brake strand for additional friction for lowering/descending.
- For **'hands-free work' - use an auto- locking DCD, or an ABD with a backup hitch on the brake strand**:

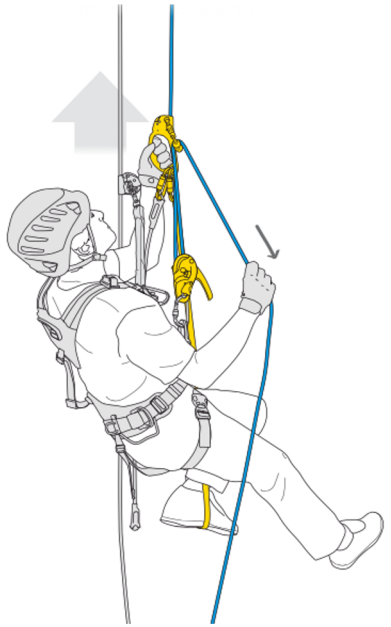


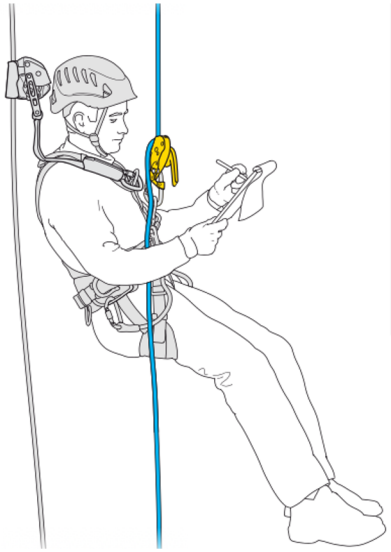
SECURE all **ROPE ENDS** with bocking knots or direct attachment to an anchor or user.

Images: Petzl.com

Rope Ascent w/ ascender + connector + footloop

- Pulley on redirect at ascender for more efficiency
- \+ Backup rope for sustained use





Rope Descent with locking descender

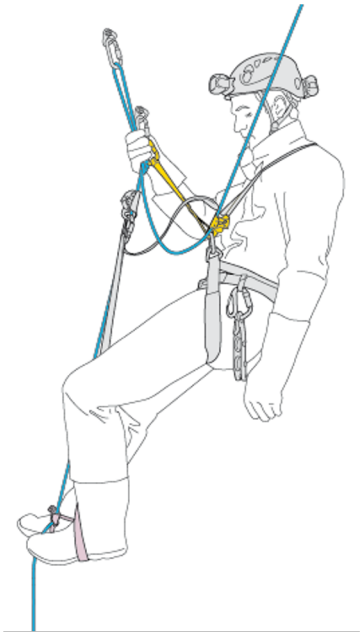
- Handle position in lock, or auto-lock
- Backup rope for sustained use

RESCUE: The RAD system allows for easy self- and assisted rescue:

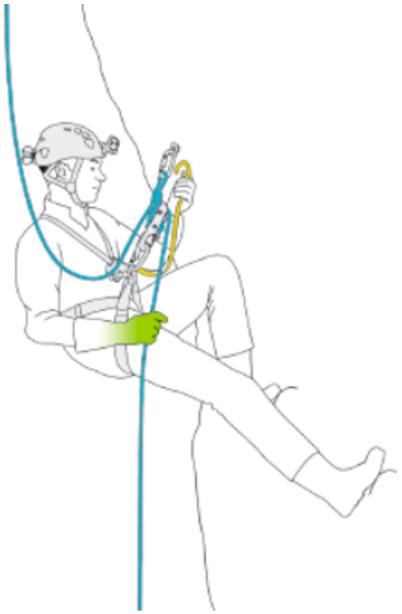
- Assisted operation of the injured's descender, or
- Controlled transfer onto a rescue system, rescuer's device, or anchor.

ANCHOR & SYSTEM TRANSITIONS
WITH ADJUSTABLE LANYARDS

Use an ADJUSTABLE LANYARD connected to the highest anchor focal point and tensioned into fall restraint, to maintain continuous protection when passing anchors, and allow for primary security and easier unweighting & removal or reinstallation of devices, or transitions between weighted systems.



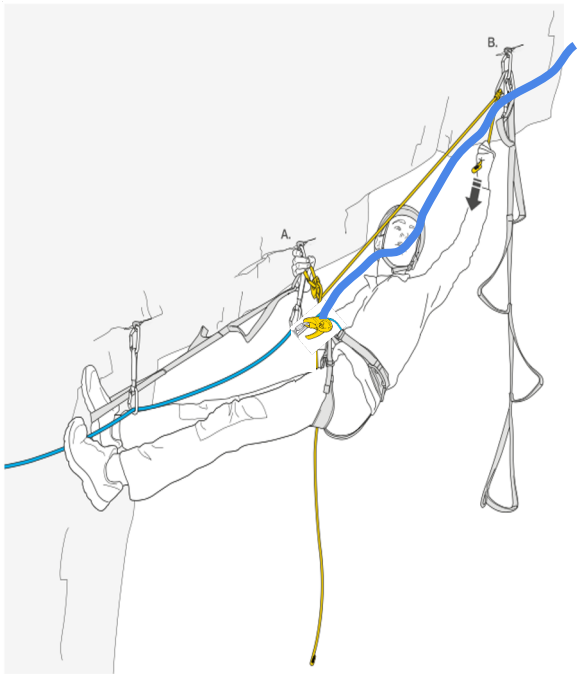
ALWAYS TEST LOAD with lanyard as BACKUP: After installation or transition to a new ascent or descent system, FIRST-SLACK THE LANYARD adjuster, BUT STAY CONNECTED to anchor, and LOAD THE NEW SYSTEM. After setup is verified, remove or release the lanyard and progress.



AID CLIMBING ASCENT
WITH RELEASABLE LANYARDS

On steep terrain with anchors in close proximity, use adjustable lanyards for aid progression via suspension & release on alternating lanyard legs

- Releasable rope lanyards (with integral DCD adjusters) are easier to release if weighted
- Connect foot loop(s) separately on anchor points (NOT on rope adjuster) to assist weighting & unweighting
- Tend ABD/DCD as primary connection to RAD rope, maintain < 2ft slack with auto-locking handle or blocking hitch/knot

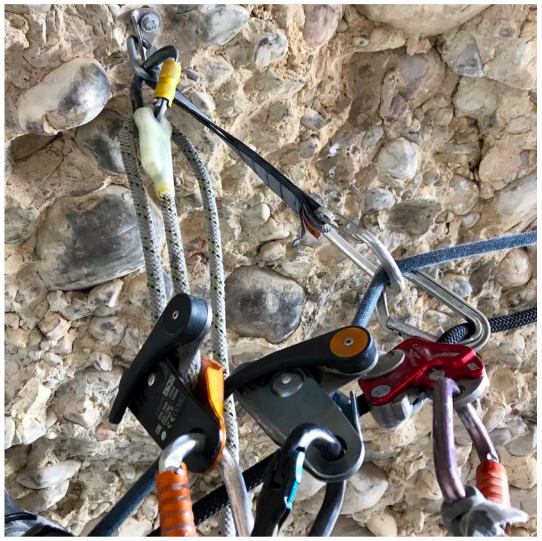


Images: Petzl.com

STEEP ROPE RAD ASCENT
W/ DIRECTIONAL ANCHORS

Rope ascent/descent and positioning method for work on steep or traversing routes requiring passing directional anchors with controlled ‘lower-outs’

Main and backup ropes connected separately on steep terrain.



Tail of adjustable lanyard may be redirected through the terminal connector for advantage when tensioning.

- ➔ Ascend with RAD system as close as possible until ascender is ~ 6” from directional anchor, and descender is as high as possible. *Maintain weight on descender.*
- ➔ Remove ascender from below directional carabiner and replace on main rope above
- ➔ Attach to anchor as high as possible with releasable lanyard. Tension with body weight.
- ➔ Pass backup device above directional anchor
- ➔ Release the main descender and slack main rope (or both if clipped together)
- ➔ Reconnect both main and backup ropes to the directional anchor, below the descender.
- ➔ Advance descender upward until tensioned
- ➔ Secure the tail end of the ropes below the descender with one hand
- ➔ Release adjustable lanyard from anchor, transferring load to hand grip
- ➔ Use hand grip to ‘ lower out’ to plumb
- ➔ Repeat for each directional

RAD LANYARDS for AID CLIMBING

On very steep and/or difficult terrain, for initial access to install work ropes, an improvised (dynamic) rope lanyard can be used for the lead aid climbing progression and to minimize potential fall distance if a progression anchor fails.

- ➔ An improvised RAD lanyard is constructed using a 3-5M section of 10mm dynamic rope, installed on a compatible DCD or ABD.
- ➔ A loop or barrel hitch is tied at the upper terminal end, and a connector installed. The connector with rope end should be held securely on the end of a (tethered) stick clip.
- ➔ While secured with an adjustable lanyard, or help by an attentive belayer at a protection anchor, the connector end of the RAD lanyard is extended with stick clip and attached either directly to the next bolt hanger, or (if unreachable) connector end of a fixed sling.
- ➔ Once attached, the climber is lowered out to 'plumb' by belayer, and then ascends the lanyard using RAD progression. Repeat for each protection anchor.
- ➔ Can be used on ascent or descent to install working ropes. Working on ascent may be easier on very steep terrain.

RAD LANYARDS for RETRIEVABLE LOWER OUTS

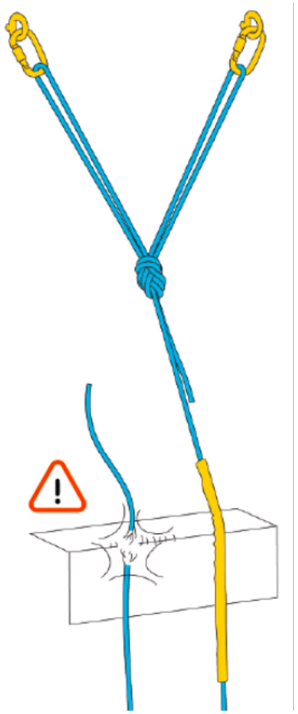
On very steep terrain- on ascent of the working ropes, an improvised RAD lanyard- with NO knot or termination on one end, is used to 'lower-out' with control, from each anchor, before RAD ascending the working line to the next anchor.

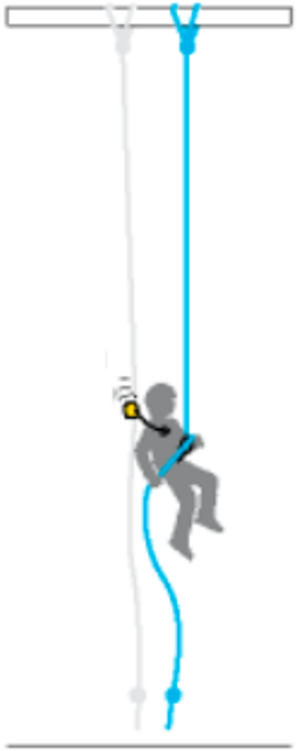
- ➔ An improvised RAD lanyard is constructed using a 3-5M section of 10mm dynamic rope, installed on a compatible DCD (for drop-resistant installation of the rope.)
- ➔ One end of the lanyard is tied with a figure eight to the worker.
- ➔ To lower out, a loop of rope is extended from the tie-in, and either clipped through a fixed connector, or threaded directly through the anchor hanger, and installed on the DCD at the worker's waist.
- ➔ This counterbalanced loop is tensioned, and all other connections released.
- ➔ The descender is used to counterbalance 'lower-out' rope until the worker is plumb
- ➔ Free end of lanyard is retrieved by pulling through DCD and anchor point.
- ➔ RAD ascent of working ropes to next anchor

SECONDARY / ‘BACKUP’ ROPE SYSTEM:
Redundant fall protection for work

Use a secondary rope system to control the risk of rope abrasion in sustained suspension, the risk of rope damage during ANY cutting / grinding / drilling operations, and user error during training exercises:

- Install a low-stretch rope or strand in parallel to the ascent/descent rope and through shared directional anchors.
- Install a compatible Backup Device onto the rope, and connect to the chest attachment with a compatible lanyard





Images: Petzl.com

PROGRESSION

- Excess backup rope may be coiled and hung to lightly tension the rope for easier device handling.
- Tend backup device to minimize slack, and **MAINTAIN DEVICE EVEN OR ABOVE USER** at all times to minimize higher fall factors.
- Reposition device with each progression up or down the RAD system. *Pace appropriately*.
- If the device is unintentionally loaded, tension rope by hand below the device and depress the clamp to release.
- If device is heavily loaded- ascend on RAD line, place ascender above backup device and weight to create slack, and release the clamp.
- **SECURE** all **ROPE ENDS** with bocking knots or direct attachment to an anchor or user.

RESCUE:

If the injured is suspended by a loaded backup device, an improvised ‘raise, transfer and release’ will be required:

- Injured may be ASSISTED- raised, released and lowered on RAD or other rescue system
- The injured may be raised onto rescuer’s shared descender (‘in tandem’), released and ACCOMPANIED on descent

REDUNDANT ASCENT SYSTEM:
(with SPORT PPE) for free climbing terrain

Sport PPE may occasionally be used to provide redundant fall protection for climbing terrain, or to 'fore-run' a relocated anchor placement on a route, based on:

- Terrain characteristics and access to work site
- Compatibility with other PPE and systems in use
- Worker size and weight < or = 80kg
- Worker training and experience
- Ergonomics and required athletic performance

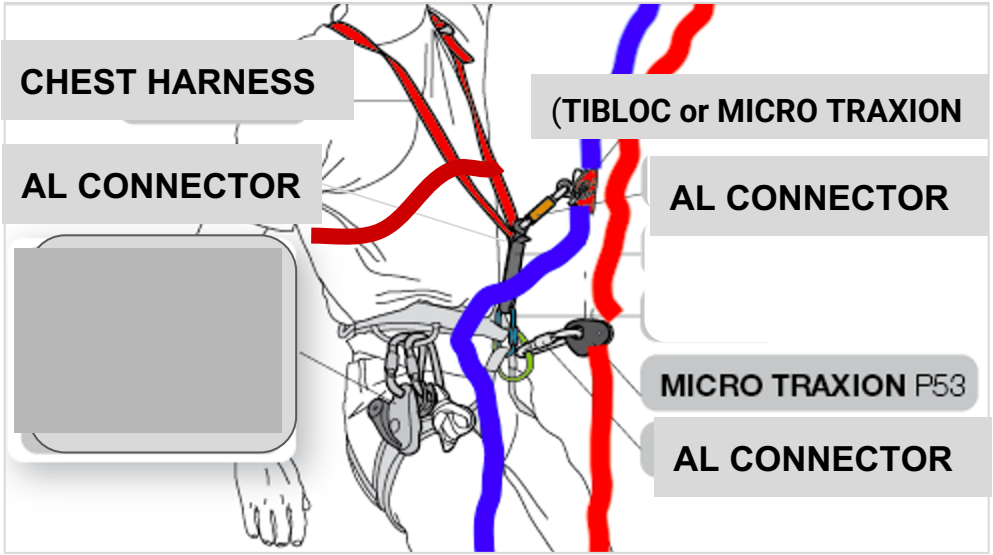
INSTALLATION:

- 2 parallel strands of dynamic or low-stretch rope, both connected through all directional anchors
- If ascent via climbing- install progress capture pulley on the primary rope and belay loop OR
- If ascent via RAD system, install the ABD/DVD on belay loop with an Autolock (AL) Connector
- Put on a modular chest harness (w/ full-strength sit harness connection) and chest attachment.
- Install a small progress capture pulley or simple/emergency rope grab in a direct connection (ONLY) to the chest attachment
- Excess secondary rope (only) may be coiled and hung to tension the strand for easier device handling.

Images: Petzl.com

CARE must be taken at all times to REMOVE SLACK from the system (< 2 ft) with each upward progression.

SECURE all **ROPE ENDS** with bocking knots or direct attachment to an anchor or user.



RESCUE:

If the injured is suspended by either or both devices, an improvised 'raise, transfer and release' will be required:

- Injured may be ASSISTED- raised, released from both ascenders, and lowered on separate system
- The injured may be raised onto a rescuer's shared descender ('in tandem'), released and ACCOMPANIED on descent

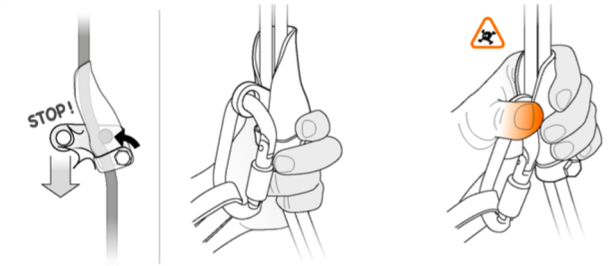
REDUNDANT DESCENT SYSTEM:
(with SPORT PPE)

Sport PPE may occasionally be used to provide redundant fall protection and positioning, based on:

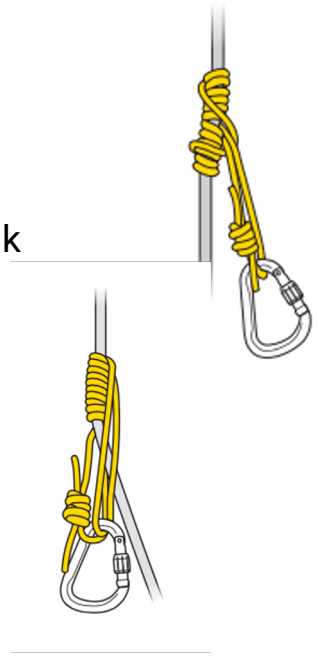
- Terrain characteristics and access to work site
- Compatibility with other PPE and systems in use
- Worker size and weight < or = 80kg
- Worker training and experience
- Ergonomics and required athletic performance

INSTALLATION:

- Redundant ('twin') system for fall protection and work positioning for *descent only, with a sit harness*
- 2 parallel strands of dynamic or low-stretch rope installed on anchor
- Alternatively - a 50-70M dynamic rappel or low-stretch rope, connected to top anchor at middle with a figure eight bight, isolating two strands
- Ropes/strands in parallel through all directional anchors
- Extend a slot rappel device on a lanyard from belay loop. Beware positioning near the face.
- Install both ropes through dual- rope clamp (Petzl Shunt) with locking connector, onto the belay loop.
- **SECURE** all **ROPE ENDS** with bocking knots or direct attachment to anchor or user.



- DO NOT GRAB THE DEVICE and release the clamp unless you have control of both brake strands.
- Alternate: Use a cord sling and prussik hitch or autoblock with locking connector for backup. Test first for adequate friction.



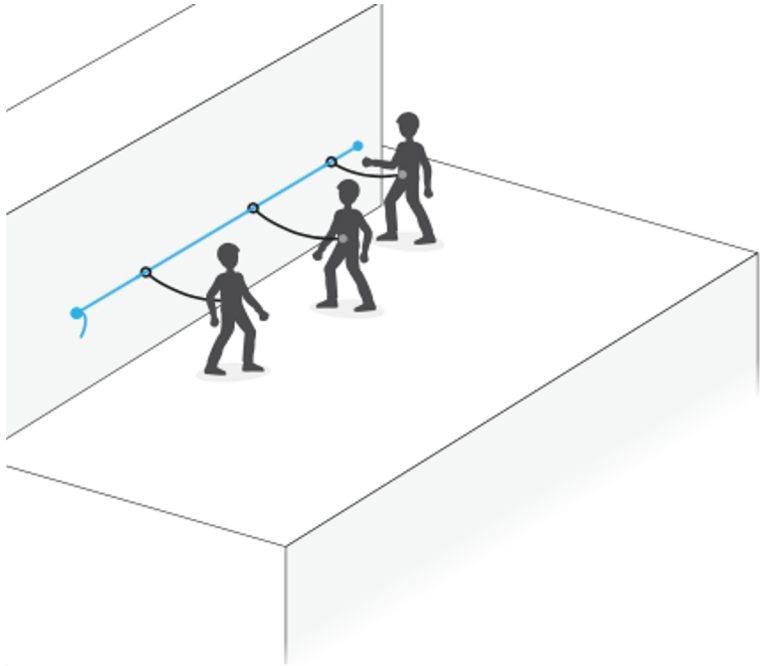
For SUSTAINED 'HANDS-FREE' positioning, install a **BLOCKING KNOT** below the rappel backup device or friction hitch.

Images: Petzl.com

LIFELINES:
Travel Restraint & Fall Protection for Access

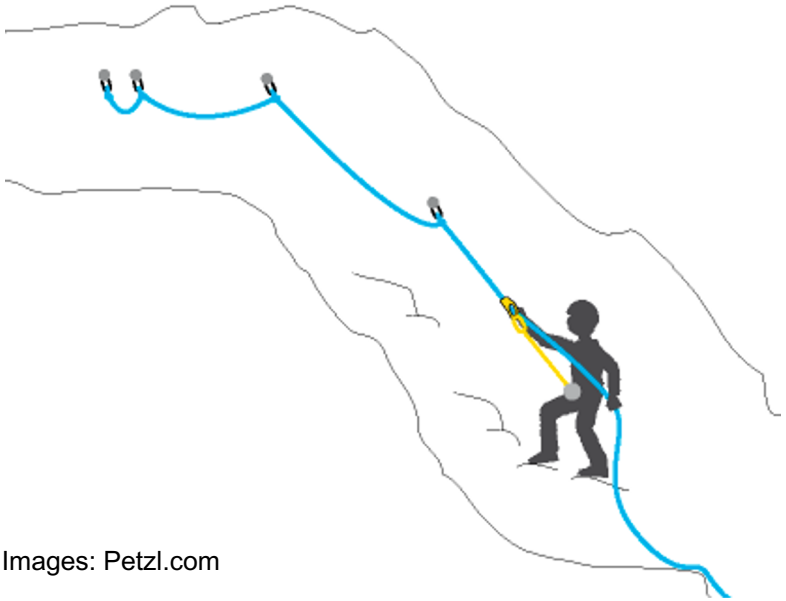
HORIZONTAL LIFELINES

- Travel restraint only- not to be fully loaded. Wide angle on anchors= potentially high forces
- Protect horizontal access to anchors with fall exposure, or the regular movement of materials and/or workers
- Adjustable lanyard used for RESTRAINT to prevent entering actual fall zone
- NOT for suspension or work positioning. Use a dedicated anchor and rope system for positioning below the lifeline.



VERTICAL LIFELINES

- Fall protection for exposed hiking & scrambling access, and to protect regular movement of materials and/or workers through exposed terrain
- One worker at a time on rope system, or between intermediate anchors
- Rope protection or re-belay anchors at wear points
- Rope clamp + waist lanyard used for progression, or tended to minimize slack
- Load on rope clamp not to exceed 4kN (+/- 900 lbs), or RISK OF ROPE DAMAGE.



Images: Petzl.com

TEMPORARY / REMOVABLE ANCHORS:
CONSTRUCTION & EQUALIZATION

SPORT & INDUSTRIAL SYSTEMS

Access, fall protection and positioning require a combination of both industrial and sport systems and techniques. **ALL fall protection systems control and limit potential fall distance and impact force on the worker (below 6kN) in the event of a 'worst-case' fall:**

- Dynamic rope and belay technique for climbing
- Energy absorbing lanyard if working above anchors
- Remaining always in tension below anchor if using adjustable restraint or aid climbing lanyard
- Remaining in tension/suspension on RAD system
- More rope in systems between load and anchor absorbs forces. (Take care on lanyards, and when close to anchor.)

ANCHOR TYPES:

- ❑ Trees
- ❑ Geologic structures: boulder, horn or constriction
- ❑ Removable metallic wedge, expansion or piton anchors
- ❑ Existing, 'in place' wedge, sleeve, adhesive and piton anchors
- ❑ Documented, replaced sleeve or adhesive anchors

STRENGTH

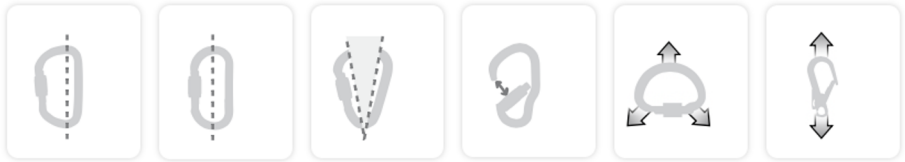
Workers use 'training and knowledge' to estimate the relative strength of anchors. To account for a safety margin, and the use of temporary, removable and existing anchors, multiple anchors may be equalized with PPE to a shared attachment point, for maximum strength.

SYSTEM	ANCHOR STRENGTH
Belayed Climbing	22kN / 5000 lbs, or Estimated 22x bodyweight
Rope Ascent / Descent (RAD) System	22kN / 5000 lbs, or Estimated 22x bodyweight
Secondary / Backup System	22kN / 5000 lbs, or Estimated 22x bodyweight
Rescue System	8kN / 1800 lbs, or Estimated 8x bodyweight
Directional / Intermediate Anchors	2- 14kN / 550 - 3,150 lbs, or 2x - 14x bodyweight
Fall Restraint (in tension)	8kN / 1800 lbs, or Estimated 8x bodyweight

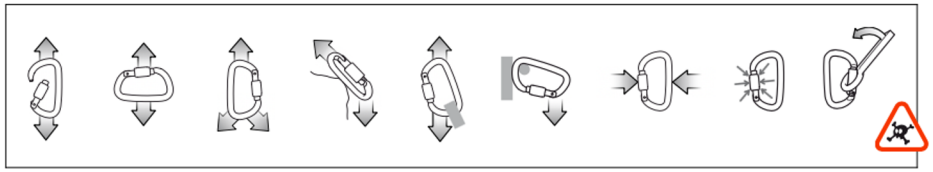
* ''Bodyweight' = worker + gear + safety factor = 1 kN = 225 lbs.

CONNECTORS / ‘CARABINERS’

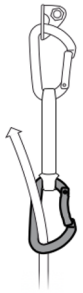
Use appropriate SHAPE connector for the application:



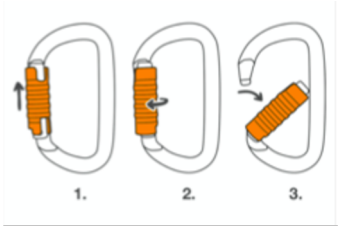
Make sure connector is not IMPROPERLY LOADED:

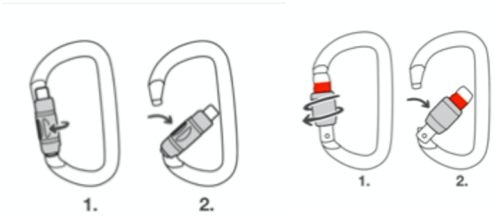


Use simple connectors for directional and intermediate anchors



Use Locking connectors for all system attachments:





- Tri-Act (Auto Lock) for maximum security

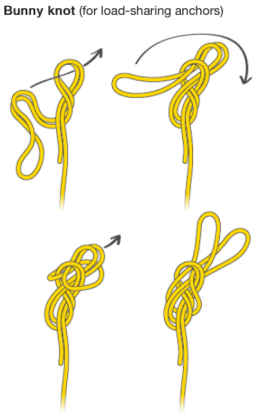
- Twist-Lock for frequent handling

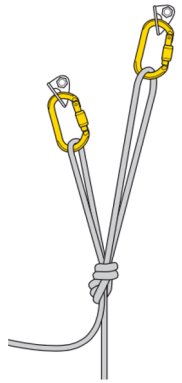
- Screw-Lock for easy install, occasional handling, dirt/ice

Images: Petzl.com

ROPE-BASED ANCHOR ATTACHMENT

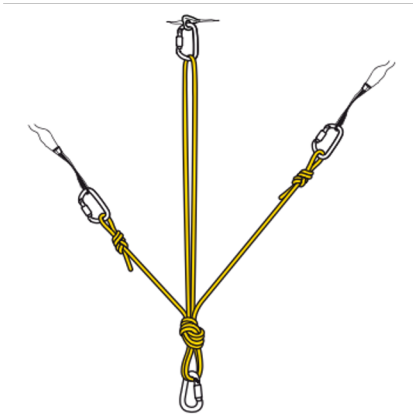
Use locking connectors and a ‘Figure Eight with Double Bight’ knot to attach ropes directly to established bolt anchors that have been inspected in good condition.

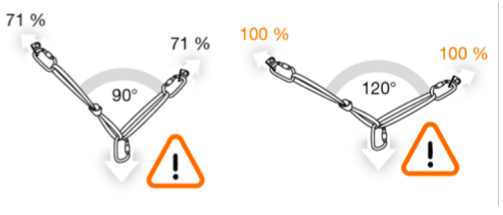




EQUALIZED ANCHOR ATTACHMENT

Use connectors, sling(s) or rope, and 2+ anchors to create knotted loop, in direction of anticipated loading, as shared attachment point.





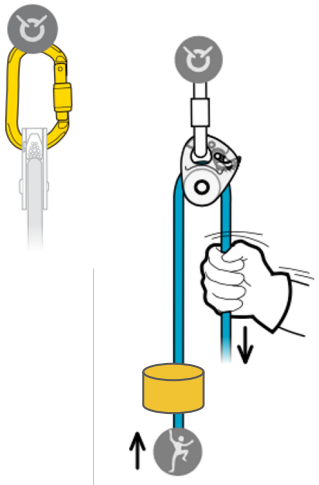
Do not exceed 90 degrees with equalized sling angles.
Extend the slings to reduce the angle.

TOOL & MATERIAL HANDLING:
Positioning and Drop/Loss Prevention

Position and control the work bucket with tools & materials *at all times*, using:

- Direct haul through a progress-capture pulley
- Direct haul / lower with a belay device
- Lanyard to anchor
- Lanyard to belay/descent device connector, or to belay loop
- Worn in a backpack

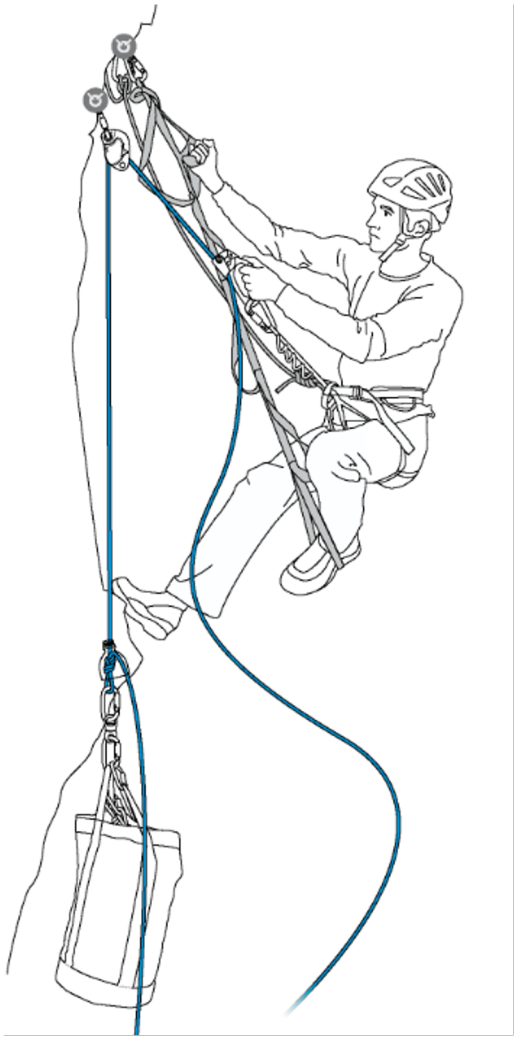
HAULING
Use a tag-line or bottom end of secondary rope system for haul line. Install the haul pulley on an anchor, or install a temporary knotted loop below the backup device. Install a rope protector and swivel to protect the bag attachment if necessary.



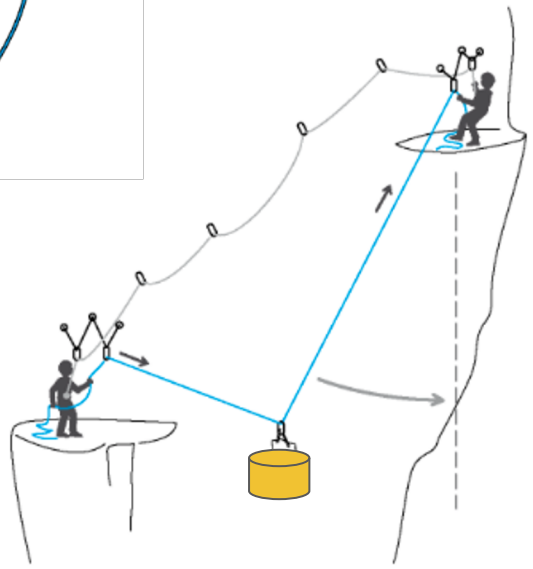
DROP / LOSS PREVENTION
All tools have a dedicated tether and/or tether attachment.

An INCIDENT REPORT is required for any dropped objects!

Images: Petzl.com



Use ascender + footloop to haul with legs and bodyweight



Use a separate tag-line, or excess tail end of rope to control pendulum swings while hauling.

PARTNER RESCUE:

Self- Rescue, Assisted & Accompanied

RESPONSE

- CONTACT the injured.
- ASSESS immediate LIFE THREATS
- STABILIZE the injured (if accessible)
- CONTACT 911: (if needed)
  - Location
  - Nature of Injury
  - Evacuation= SAR? Heli Hoist?
- ACCESS the injured
- STABILIZE the injured
- RESCUE the injured to ground
- STABILIZE the injured
- COMMUNICATE with Responders
- Prepare for EVACUATION of injured

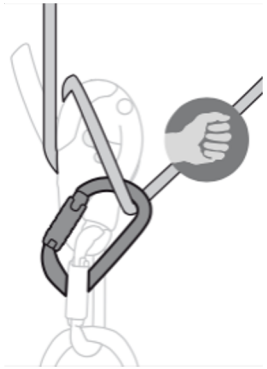
STRATEGY

- Can inured SELF_RESCUE?
- Can injured be ASSISTED with rescue?
- Can injured be lowered UNACCOMPANIED to ground or anchor?
- ACCOMPANY the injured to ground or anchor.

Images: Petzl.com

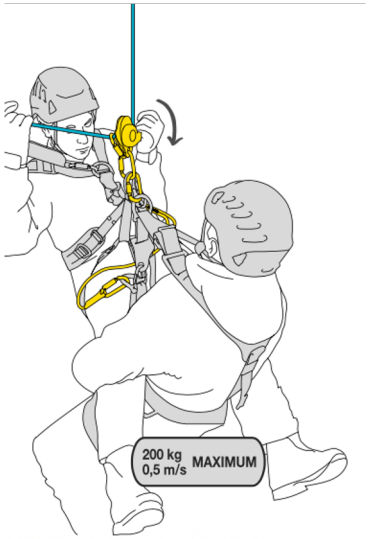
PRINCIPLES

- Use 'hands-free' and/or 'backup' methods/devices
- Use releasable / reversible systems
- Use higher friction to control two-person loads
- Stationary ropes < abrasion than moving ropes
- Single rope system may be OK if low hazard and urgent priority



TECHNICAL SKILLS

- Efficient Belay Management
- Raise, Lower & Descent Systems
- Assists & Rescue from above
- Leader Rescue (from below)



Accompanied Descent - in tandem on rescuer's DCD.

Note- Do NOT use sport ABD ('GriGri') with 2 person loads!

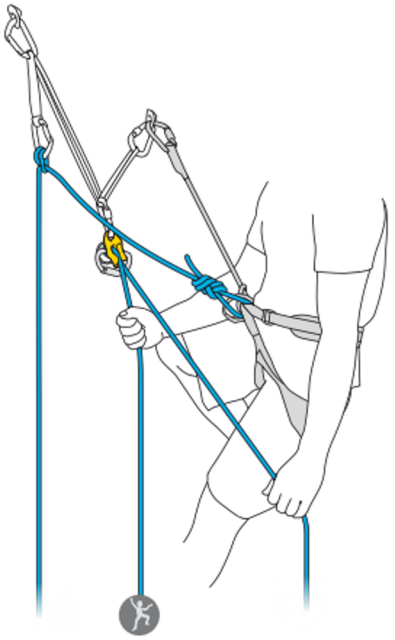
EFFICIENT BELAY MANAGEMENT

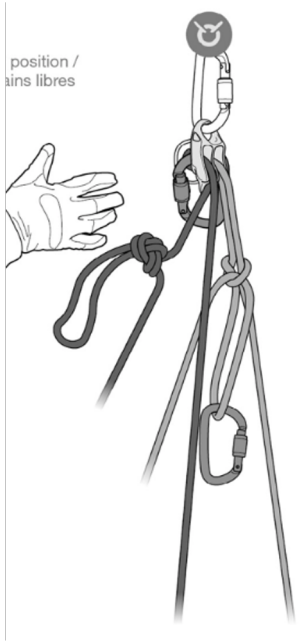
SKILLS

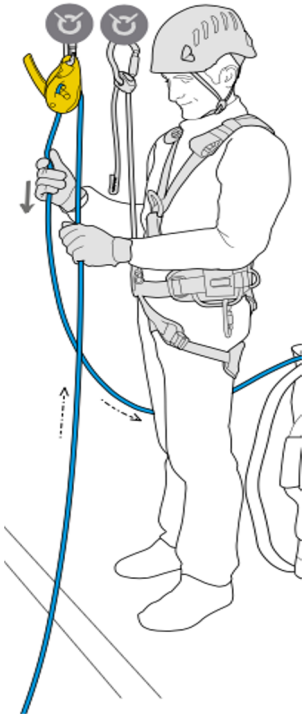
- ❏ Construct a full-strength focal point anchor (estimated > 23kN / 5000lb)
- ❏ Secure belay device for ‘hands free’ work
- ❏ Use ascender (+ lanyard) as rope grab
- ❏ Use a friction hitch (prussik, autoblock, klemheist) as improvised rope-grab
- ❏ Direct anchor belay with munter hitch. Use mule hitch to secure & release
- ❏ Release a self-blocking belay device

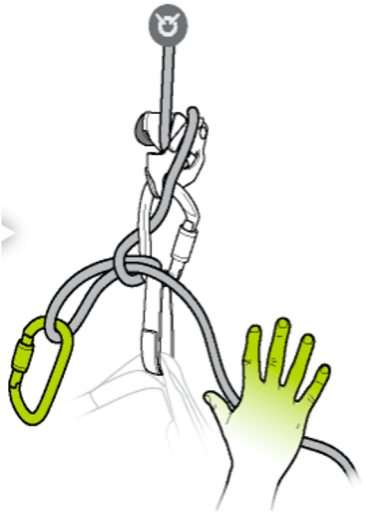
PRACTICAL SCENARIOS

- ❏ ‘Take over’ a loaded, attended belay from other user (on ground)
- ❏ Escape attended belay (on waist) and transfer to direct anchor belay
- ❏ Transfer load from self-blocking belay device to releasable hitch (munter-mule).









Images: Petzl.com

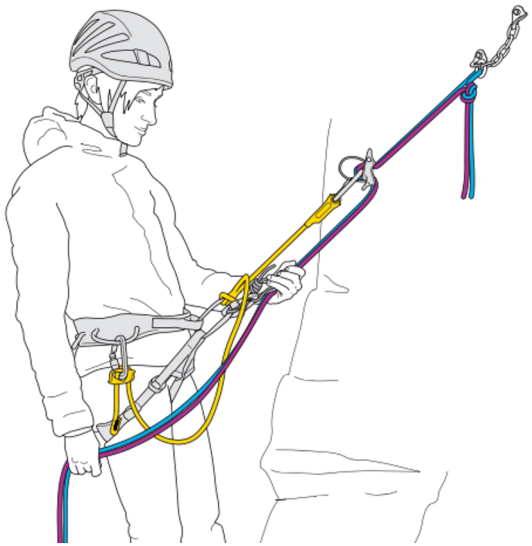
LOWER, RAPPEL & HAUL SYSTEMS

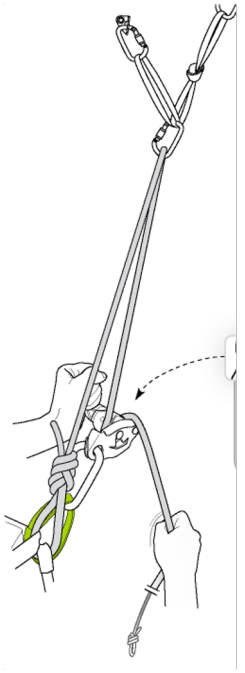
SKILLS

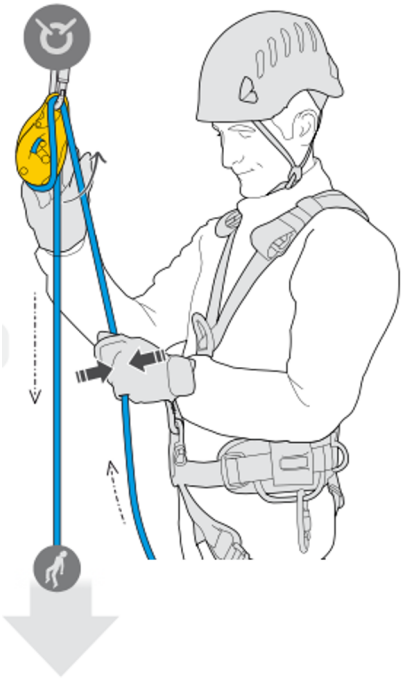
- ❏ Install belay device in ‘self-blocking’ mode
- ❏ Install a rope grab and pulley for mechanical advantage and improvised hauling
- ❏ Install belay device in lowering mode. Redirect brake strand through connector for additional friction
- ❏ Extend rappel device with lanyard connection and use backup hitch or rope clamp for hands-free positioning
- ❏ Counterbalance rappel
- ❏ Construct improvised ‘Block & Tackle’

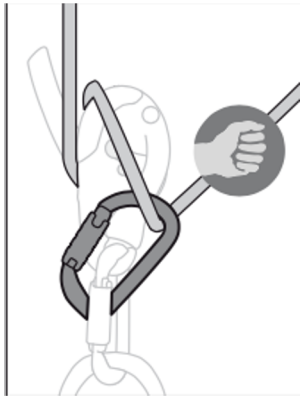
PRACTICAL SCENARIOS

- ❏ Haul passive, suspended partner
- ❏ Lower passive, suspended partner
- ❏ Lower passive partner with knot pass
- ❏ Perform a tandem rappel (2 person, ‘accompanied’)
- ❏ Use improvised ‘Block & Tackle’ to raise passive partner onto or off belay anchor.









Images: Petzl.com

COUNTERBALANCE RETRIEVAL (from below)

SKILLS

- ❏ Ascend a counter-balanced rope- with secure progress capture by RAD with an ABD, or with belay device and friction hitch
- ❏ Attach a lanyard to partner as secondary rescue connection
- ❏ Counterbalance rappel opposite partner, rebalancing as necessary.

PRACTICAL SCENARIOS

- ❏ Retrieve top-rope climber who cannot be lowered
- ❏ Retrieve fallen leader who cannot be lowered (due to injury, positioning, or > ½ rope length)

COUNTERBALANCE RETREAT (from above)

SKILLS

- ❏ Direct anchor belay
- ❏ Use a load release hitch
- ❏ Install a ‘fixed’ rappel anchor connector
- ❏ Rig and manage a counterbalance rappel
- ❏ Attach lanyard to partner as secondary connection
- ❏ Use improvised ‘Block & Tackle’ to raise and release a passive partner from anchor

PRACTICAL SCENARIO

- ❏ Transition from direct anchor belay to counterbalance retreat / rappel

ASSISTED & UNACCOMPANIED RESCUE:

'Pick-Off' + Lower

An injured Partner, unable to operate their descender, or held in suspension, requires:

ACCESS

- Via ascent or descent of a separate, adjacent and/or redirected rope system, OR
- Via partner's backup rope, taking care to connect before removing their devices, OR
- Via partner's primary climbing rope and counterbalance, with rope grabs or hitches

ASSIST

➢ IF injured is on releasable device, ASSIST and lower them on their own device. Confirm enough rope and secure end.

'PICK-OFF' & LOWER

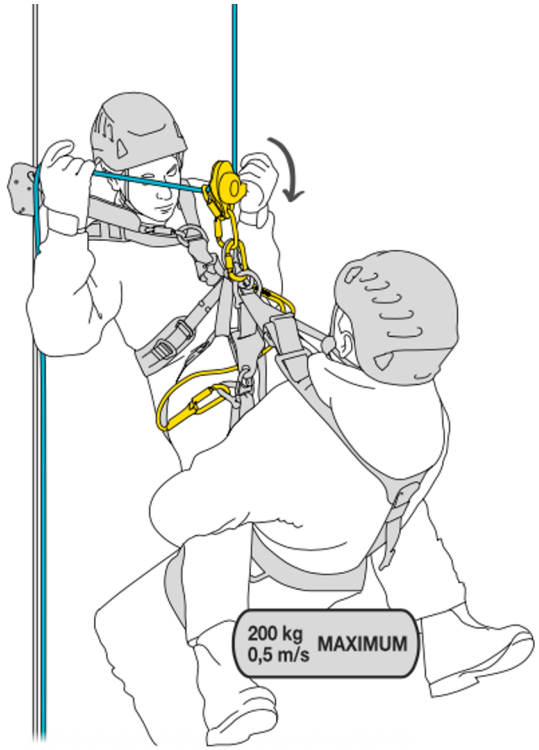
➢ Confirm enough rope and secure end
➢ If raise & release, first attach backup rope or lanyard to injured
➢ Use Block & Tackle, RAD or Counter- Balance Hoist off anchor, knot or device
➢ Lower injured unaccompanied on rope system (default if using sport ABD- GriGri)

ACCOMPANIED RESCUE:

'Pick-Off ' + Tandem Descent

ACCOMPANIED

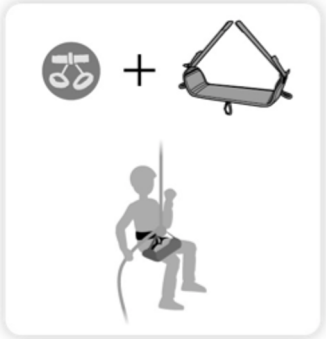
➢ POSITION 'hands-free' slightly above injured's attachment point
➢ Attach backup lanyard to injured
➢ Use Block & Tackle, improvised RAD or a Counterbalance Hoist off anchor, device or rope knot to raise & release
➢ Onto a shared descender or rappel device with redirect +/- friction for 2 persons



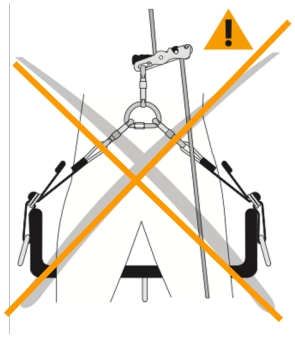
Images: Petzl.com

WORK SEATS

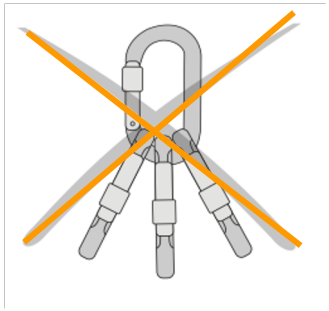
For sustained work in suspension, use a work seat for more support:



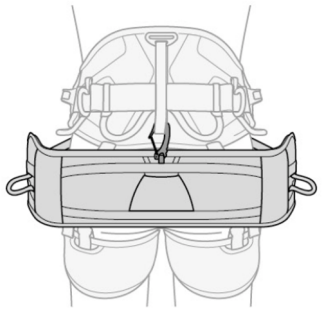
- Use seat in addition to harness. Seat does NOT replace a harness.
- Install small connectors or shackles on the seat attachment points



- Attach seat connectors to omnidirectional ring installed on belay loop, OR to belay loop, OR



- Attach seat connectors to large radius ABD/DCD connector, on each side of belay loop.
- Tension seat against backside for support.
- To position seat out of way, loosen adjusters, and clip seat to connector on waist belt. Redeploy when needed.



WORK SAFETY PLAN

Developed by the Anchor Replacement Coordinator specifically for the job.

WORK SAFETY PLAN PDF

WORK SAFETY PLAN GOOGLE FORM

INCLUDES:

- ❑ Site Survey and forecasted conditions
- ❑ Work Survey
- ❑ Tools & Materials needed
- ❑ Personnel
- ❑ Review Job Hazards
- ❑ **Fall Protection to be used**
- ❑ **Work Processes & Progression to be used**
- ❑ Rescue Plan if injury
- ❑ Workers' signatures
- ❑ Notes/Debrief
- ❑ Complete Incident Report Form or PDF (if applicable)

PRACTICAL SKILLS ASSESSMENT

WORKER: _____

DATE: _____

TRAINER: _____

BASICS

- ❑ Explain the job hazards in anchor replacement, and the controls used to limit them.
- ❑ Put on and adjust each item of Worker Issue PPE, and explain what each is used for.
- ❑ Explain how to conduct a user inspection, and what to do with questionable equipment.

SYSTEMS

- ❑ Demonstrate proper use of adjustable lanyard for fall restraint, positioning and anchor transitions.
- ❑ Demonstrate proper use of an energy absorbing lanyard for fall protection.
- ❑ Demonstrate proper use of lead climbing equipment and intermediate anchors (existing and removable) for access and fall protection.
- ❑ Demonstrate proper climbing belay (fall protection) for lead climber.
- ❑ Demonstrate proper climbing belay (fall protection) for following climber.
- ❑ Install and demonstrate proper use of Rope Ascent/Descent (RAD) system, with directionals, for access & fall protection.
- ❑ Demonstrate proper ‘hands-free’ use of a RAD system for fall protection and positioning.
- ❑ Demonstrate proper use of ascenders for steep positioning, with RAD backup connection.
- ❑ Demonstrate proper use of lanyards for steep positioning, with RAD backup connection.
- ❑ Install and demonstrate proper use of secondary /backup system for fall protection.
- ❑ Demonstrate release of loaded backup device.
- ❑ Install and demonstrate use of vertical lifelines with rope clamps for fall restraint.
- ❑ Install and demonstrate use of horizontal lifeline and adjustable lanyards for fall restraint.
- ❑ Construct a full-strength (estimated) equalized anchor with removeable, temporary anchors.
- ❑ Install and demonstrate proper use of a progress-capture pulley for material handling.
- ❑ Perform a multi-pitch, Leader Rescue scenario.
- ❑ Perform a partner rescue from loaded backup device or anchor.