NFPA 1983  
Standard for fire service life safety rope, harnesses and hardware  
(2012 edition)  
Chapter 4 – certification  
Chapter 5 – labeling and information  
Chapter 6 – design and construction requirements  
Chapter 7 – performance requirements  
Chapter 8 – test methods  

NFPA 1670  
Standard on operations and training for technical search and rescue incidents (2014 edition)  

4.1.4 (1) — ____________________________________________________________________  
This level represents the minimum capability of organizations that provide  
response to technical search and rescue incidents  

4.1.4 (2) — ____________________________________________________________________  
This level represents the capability of organizations to respond to technical  
search and rescue incidents and to identify hazards, use equipment, and  
apply limited techniques specified in this standard to support and  
participate in technical search and rescue incidents  

4.1.4 (3) - ____________________________________________________________________  
This level represents the capability of organizations to respond to technical  
search and rescue incidents, and to identify hazards, use equipment, and  
apply advanced techniques specified in this standard necessary to  
coordinate, perform and supervise technical search and rescue incidents  

NFPA 1006  
Standard for rescue technician professional qualifications (2013 edition)  
Chapter 5 – Job Performance Requirements  
– 5.1 – General Requirements  
– 5.2 – Site Operations  
– 5.3 – Victim Management  
– 5.4 – Maintenance  
– 5.5 – Ropes/Rigging  
Chapter 6 – Rope Rescue  
6.1 – Level I General requirements  
  6.1.1 Direct a team in the operation of a simple MA system in high-  
angle environment  
  6.1.2 Direct a lowering operation in a high-angle environment  
  6.1.3 Construct a multiple-point anchor system  
  6.1.4 Construct a compound rope mechanical advantage system  
  6.1.5 Construct a fixed rope system  
  6.1.6 Direct the operation of a compound rope mechanical advantage  
system in a high-angle  
  6.1.7 Ascend a fixed rope in a high-angle environment  
  6.1.8 Descend a fixed rope in a high-angle environment,  
Rope is often used as a tool in many technical rescue disciplines including;  
– High Angle
– Water Rescue
– Low Angle or Slope Evacuation
– Confined Space
– Search an area (in wilderness)
– Trench Rescue

**Identify Needed Support Resources**
– Equipment cache
– Scene lighting
– Environmental concerns
– Personnel rehab

**Size Up**
– Distinction between rescue and recovery
– Scope and Magnitude
– Additional Resources
– Location and Number of Victims
– Risk benefit analysis
– Hazards- utilities, mechanical, hazmat
– Access to Scene
– Environmental Factors
– Separation, isolation, interviewing, security of witnesses

**Risk vs. Benefit Analysis**
- High frequency/high risk
- High frequency/low risk
- Low frequency/high risk
- Low frequency/low risk

**Rescue vs. Recovery**
– Based on Risk/Benefit Analysis
– Duration of the operations
– Mechanism of Injury
– Environmental conditions
– Victim access

**Managing Incident Hazards**
– Scene control barriers
– PPE
– Specialized equipment and resources

**Conducting a Search**
– Search specific PPE - hearing protection, fall protection, PFD
– Pertinent search equipment - GPS, helicopters, ATV’s
– Victim information - Age, last seen point, Number of victims,
– Accountability - Personnel assignments match their expertise

**Helicopter – ground support operations**
– 100’ X 100’ Landing Zone
– Slope of ground & type of ground
– Obstructions/Hazards – Trees, wires, light poles, and antennas.
– Hazardous Materials
– Crowds
– Communication

**Termination of the Operations**
– Most Dangerous Point
– Accountability
– Demobilization Plan
– Documentation
– Consider CISD

**Time Constraints**
– Is EMS with you?
– Do you have firefighter/paramedics?
– Consider – “suspension trauma”
– We are still dealing with the “golden hour”

**EMS**
– Access the victim - “given tool kits, personal protective equipment and other equipment designed to allow for physical approach to the victim…..”
– Assess and Stabilize – “given personal protective equipment to include protection from airborne and blood borne pathogens and a basic first aid kit…..treatment priorities are established.”
– Triage the victim – “given triage tags and local protocol, so that rescue versus recovery factors are assessed…..”
– Package the victim – “an ill or injured victim, given basic first aid kit and other specialized equipment…illness or injuries are managed, and potential for further injury is minimized.”
– Transfer patient to EMS – “to EMS, given local medical protocols, so all pertinent information is passed from rescuer to EMS, and the victim can be transported to a medical care facility”

**Personal Protective Equipment**
– Helmet
– Gloves
– Eye Protection
– Ear Protection
  – For both Rescuer and Victim
– Footwear

**Personal Protective Equipment – Inspection and Maintenance**
– Cleaning
– Inspection
– Maintenance
– Sanitization
– *Follow Manufacturer Recommendations*

**Equipment – Inspection and Maintenance**
– Clean
– Wash or dry equipment
– Proper inspection after each use - identify wear and damage
– Log equipment use
– Record time and date of usage
– Replace equipment when needed
– Proper disposal methods

**Rope – Care and Maintenance**

**DO NOT**
– Step on the rope
– Drag rope on ground
– Leave rope under tension
– Smoke around ropes
– Store a rope in a poorly vented area
– Store in direct sunlight
– Expose a rope to high temperature
– Run nylon over nylon
– Subject rope to chemicals, oils, acids, etc.
– Use life safety rope for towing
– Cause undo abrasion to rope
– Do not shock load the rope

DO
– Inspect a rope for damage
– Clean a rope after each use if necessary
– Use edge protection
– Bag rope, ready for use
– Remove knot as soon as possible

**Anchor Point** - A single, structural component used either alone or in combination with other components to create an anchor system capable of sustaining the actual and potential load on the rope rescue system (*NFPA 1006 3.3.3*)

Anchors Points –
Solid
Bomb proof
Critical angle
– Less than 120°
– Under 90° preferred

SeRENE –
S - solid (bomb proof)
R - redundant
E – equalized
NE - non-expanding

Examples of good anchors:

a. ___________________________________________

b. ___________________________________________

c. ___________________________________________

d. ___________________________________________
Examples of bad anchors:
   a. __________________________________________
   b. __________________________________________
   c. __________________________________________

Edge Protection
   – Used to protect rope and webbing from sharp or abrasive edges
   – Types of edge protection
     - Software when rope is not moving under load
     - Hardware when rope is moving under load

Two Important Causes of Rope Failure:
   – unprotected Edges
     • __________________________________________
     • __________________________________________
   – Shock Load

Belay a Falling Load:
   – Only have 8-12” of slack in system at a time
   – Use the “Z” system of pulling slack out of the tandem prusik belay
   – IF A SHOCK LOAD SHOULD HAPPEN:
     • Let go and set the second prusik!

Conducting a Systems Safety Check
   – Start at one end, work your way through the entire system
   – Never safety check something that you built

The Rescuer Must be Capable of:
   The ability to move up and down the rope
   To move side to side on rope
   Engineer lowering systems
   Descend
   Ascend

Life safety rope is made in accordance with NFPA 1983, 2012 edition. This standard considers the following to be appropriate working loads:
1 – Person Working Load equals __________ lbs.

2 – Person Working Load equals __________ lbs.

Minimum breaking strength for 1 person load ______________ lbs

Minimum breaking strength for 2 person load ______________ lbs

Another NFPA requirement is that the fibers be of ________________ material and ________________ in length.

The two main types of rope used in the technical rescue are ________________ Kernmantle and ________________ Kernmantle.

Static Kernmantle has an elongation (stretch) less than 6% with a 10% load. Static Kernmantle (low stretch) has an elongation of 10% or less with a 10% load. Both will stretch approximately 20% at their break point. This is the preferred rope in most areas of rope rescue.

Dynamic Kernmantle has an elongation of 8-12% and breaks at approximately 60%. This is the type of rope used by rock climbers and in tower rescue where the rescuer climbs ABOVE their anchor point.

________________ rope is used in water rescue. It floats and is made in bright colors to increase visibility. This rope must NOT be used when committing weight to gravity.

Accessory cord is usually 9mm or less in diameter with strength of approximately 3000lbs. It is used in situations requiring a “rope grab”. It is also used when building systems to introduce adjustability into the system.

Webbing – lightweight and inexpensive
   1 inch tubular, military specification has a load rating of 4000lbs.
   1 inch flat webbing has a rating of 6000lbs but is slightly more difficult to tie knots with.

Harness
Class 2 ______________________________
Class 3 ______________________________

HARDWARE
Carabiners – NFPA rated
   – “G” – general use
     ▪ MBS of 40kN (8992 lbs)
“T” – Technical use
- MBS of 27kN (6069 lbs)
MBS = minimum breaking strength

Always load along the major axis or spine

Always lock the gate and safety check BEFORE placing under any load

**Pulleys** – NFPA rated
- “G” – general use
  - MBS of 36 kN (8093 lbs)
- “T” – technical use
  - MBS of 22 kN (4946 lbs)

Types:
- Single sheath
- Double sheath becketed
- Knot passing
- Prusik minding

Must be at least 4 times the diameter of the rope

Moving pulleys provide mechanical advantage

Change of direction pulleys act as force multipliers

**Ascenders** –
- They were originally designed to travel up a rope.
- We now use them as rope grab devices, to allow movement up a rope or as a device to grab the rope to allow us to haul or pull on the rope

**Descenders** – (decent control device)
- Figure 8 with ears – NFPA rated - 22 kN (4946 lbs)
- Bar rack – NFPA rated - 22 kN (4946 lbs)

Both devices may be used for rappelling and/or lowering

**Edge protection** –
- Hardware – when moving under load
  - Edge rollers
  - Roof rollers
– Software – when line is static
  • fire hose
  • garden hose
  • salvage covers, etc.

**Reasons For Failure Of Technical Rescue Operations**

Acronym: **FAILURE**

**F** – Failure to understand or underestimating the environment

**A** – Additional medical implications not considered

**I** – Inadequate rescue skills

**L** – Lack of teamwork and experience

**U** – Underestimating the logistical needs of the operation

**R** – Rescue versus recovery mode not being considered

**E** – Equipment not mastered

_______________________- this line carries the load. It should tie directly into the rescuer’s main attachment point. Avoid having slack in this line.

_______________________- this line is the safety. It should be tied into the rescuer at some secure point other than the main attachment point. Avoid having this line under tension

**Mechanical Advantage;**

*Definition – a force created through mechanical means, including but not limited to, a system of ropes and pulleys usually creating an output force greater than the input force.*

**Simple Mechanical Advantage:**

– Single Rope Mechanical Advantage System. A rope mechanical advantage system containing a single rope and one or more moving pulleys (or similar devices), all traveling at the same speed and in the same direction, attached directly or indirectly to the load mass; and may contain one or more stationary pulleys (or similar devices), so that the force on the
system is distributed approximately evenly among its supporting rope segments.
– One or more moving pulleys
– Both traveling at the same speed and direction
– Forces are evenly distributed throughout the system
– Examples. – 2:1. 3:1. 4:1 rescuemate

**COMMANDS:**

- **SLACK** -- let out more rope, introduce slack into the system. ex. “Slack on blue line”
- **UP ROPE** -- take up the slack in the line. ex. “Up rope on red line”
- **TENSION** -- remove all slack and put some load on the line. ex. “Tension on blue belay”
- **STOP** -- this can be called out by anyone, anytime. If you see an unsafe situation or what you think is an unsafe situation call out STOP! With this everything stops immediately.
- **ON BELAY?** -- This is a question the rappeller asks the edge manager before approaching the edge/window. He is asking if everyone is ready for him to approach the edge.
- **BELAY IS ON** -- the edge manager answers him, acknowledging that they are ready.
- **ON RAPPEL?** -- Done after tensioning the system, the rappeller asking the edge manager if he’s ready for him to exit the window/edge.
- **RAPPEL AWAY** -- the edge manager’s answer that he is ready for the rappeller to exit.

**COMMANDS WHILE ON ROPE:**

- **STOP** -- the rappeller telling the edge manager he’s stopping.
- **WHY STOP?** -- The edge manager asking why the rappeller is stopping. ex. Locking off, adjusting my harness, etc.
- **UNLOCKING** -- the rappeller telling the edge manager he is unlocking.
- **UNLOCKING** -- the edge manager acknowledging the unlocking and that he’s ready for it.
- **ON RAPPEL?** -- The rappeller asking the edge manager if he’s ready for him to continue.
- **RAPPEL AWAY** -- edge manager to rappeller -- ready for you to continue
- **SAFE ON BLUE** -- rappeller to edge manager -- I am on the blue line and I’m safely on the ground, not off belay at this time.
- **OFF BLUE BELAY** -- rappeller to edge manager -- I am safely off the blue line’s belay.

**PERSONAL EQUIPMENT NEEDED FOR CLASS**

*leather work gloves -*
  - non-firefighting type
  - non-lined
  - clean

*boots –*
  - over the ankle
  - firefighting type boots are ok

*dress appropriate –*
  - cold / warm weather
  - rain / snow

*water for rehydration*

![Figure of Eight](image1)

![Figure of Eight on a Bight](image2)