**Chapter 10: Ropes and Knots**

**Chief Concepts**

* The three primary types of rope in the fire service are
  + *Life safety rope*. Used to support people during a rescue. This type of rope is used only for life-saving purposes.
  + *Escape rope*. Used as a single-purpose emergency self-escape rope
  + *Utility rope.* Used to perform all other tasks, such as hoisting equipment.
* Life safety ropes are rated as either technical use life safety rope or general use life safety rope.
* An escape rope is designed to be used once by one fire fighter.
* Ropes can be made of natural or synthetic fibres. Natural fibres can be weakened by mildew and age, so they cannot be used to make life safety ropes. Synthetic fibres are generally stronger than natural fibres and are used in life safety ropes.
* Synthetic fibres can be damaged by ultraviolet light.
* Nylon is the most common synthetic fibre used in life safety ropes, followed by polyester and polypropylene. Polypropylene does not absorb water, so it is often used for water rescues.
* Common rope construction includes the following types:
  + *Twisted ropes.* Individual fibres twisted into strands that are twisted together to form the rope.
  + *Braided ropes.* Constructed by weaving or intertwining strands together in the same way that hair is braided.
  + *Kernmantle ropes*. Consists of the kern and the mantle. The kern is the core of the rope and the mantle is the braided covering that protects the core. These ropes can be either dynamic or static.
* During technical rescue incidents, several hardware components are used in addition to rope to rescue victims:
  + *Carabiner.* Connects one rope to another rope or a harness
  + *Harness.* Webbing that secures a person to a rope or solid object
* Most rope rescue incidents involve people who are trapped in normally inaccessible locations such as trenches, confined spaces, and open water.
* All ropes need proper care to perform in an optimal manner. The four parts to the rope maintenance formula are the following:
  + Care
  + Clean
  + Inspect
  + Store
* The principles of caring for a rope include the following:
  + Protect the rope from sharp and abrasive surfaces.
  + Protect the rope from rubbing against another rope or webbing.
  + Protect the rope from heat, chemicals, and flames.
  + Protect the rope from prolonged exposure to sunlight.
* When inspecting life safety rope, consider these questions:
  + Has the rope been exposed to heat or flame?
  + Has the rope been exposed to abrasion?
  + Has the rope been exposed to chemicals?
  + Has the rope been exposed to shock loads?
  + Are there any depressions, discolourations, or lumps in the rope?
* A rope record for a life safety rope includes a history of when the rope was purchased, when it was used, how it was used, each inspection, and what kinds of loads were applied to it.
* Ropes should be stored away from temperature extremes, out of sunlight, and in areas with good air circulation. Rope bags can be used to protect and store ropes.
* Knots can be used for one or more particular purposes. Hitches, such as the clove hitch, are used to attach a rope around an object. Knots, such as the figure eight and the bowline, are used to form loops. Bends, such as the sheet bend or Becket bend, are used to join two ropes together. Safety knots, such as the overhand knot, are used to secure the ends of ropes to prevent them from coming untied.
* Specific terminology is used to refer to the parts of a rope in describing how to tie knots:
  + The working end is the part of the rope used for forming the knot.
  + The running end is the part of the rope used for lifting or hoisting.
  + The standing part is the rope between the working end and the running end.
  + A bight is formed by reversing the direction of the rope to form a U bend with two parallel ends.
  + A loop is formed by making a circle in the rope.
  + A round turn is formed by making a loop, and then bringing the two ends of the rope parallel to each other.
* The knots that a fire fighter should know how to tie are as follows:
  + *Safety knot.* Used to finish other basic knots
  + *Half hitch.* Knots that wrap around an object
  + *Clove hitch.* Used to attach a rope to a round object
  + *Figure eight.* Basic knot used to produce a family of other knots
  + *Figure eight on a bight*. Used to create a secure loop at the working end of a rope
  + *Figure eight follow-through*. Used to create a secure loop at the end of the rope when the working end must be wrapped around an object or passed through an opening before the loop can be formed
  + *Bowline.* Used to create a loop
  + *Water Knot.* Used to join the ends of webbing together
* The bends that a fire fighter should know how to create in order to join two ropes together are the sheet bend and the Becket bend.