

Continuing Education For the Fire Fighter



Ropes, Webbing, and Knots

Module 1

Chapter 8



LEARNING OBJECTIVES

Compare and contrast the characteristics of life safety rope and utility rope.

Explain reasons for placing rope out of service.

Describe parts of a rope and considerations in tying a knot.

Describe characteristics of knots commonly used in the fire service.



Summarize basic guidelines for rope maintenance.

Describe webbing and webbing construction.

Describe knot characteristics and knot elements.



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LEARNING OBJECTIVES

Select commonly
used rope hardware
for specific
applications.

Inspect, clean, and
store a rope.

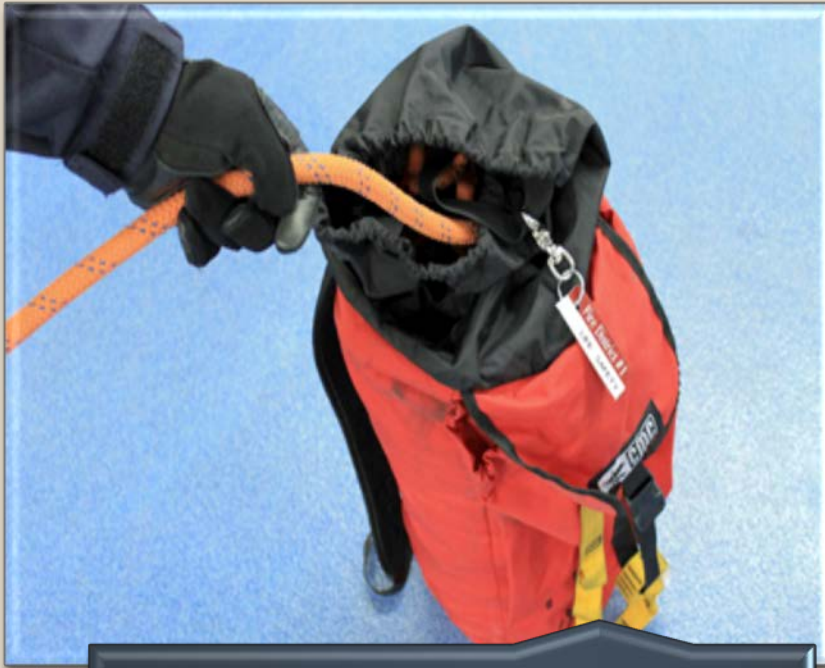
Summarize hoisting
safety
considerations.



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FIRE SERVICE ROPE IS DIVIDED INTO TWO CLASSIFICATIONS.



Life safety rope



Utility rope

*Courtesy of Shad Cooper/Wyoming
State Fire Marshal's Office*



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NFPA® 1983 CLASSIFIES TWO ADDITIONAL TYPES OF ROPES USED IN RESCUE.



Escape rope



Water rescue throw line



NFPA® 1983 SETS REQUIREMENTS AND REGULATIONS FOR LIFE SAFETY ROPE.

Block creel
construction

Continuous
filament
virgin fiber

For load-
bearing
elements

Required
manufacturer
information



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NFPA® 1983 SETS REQUIREMENTS AND REGULATIONS FOR LIFE SAFETY ROPE.

Criteria for re-use

Requires rope log

Designates options for rope removed from service

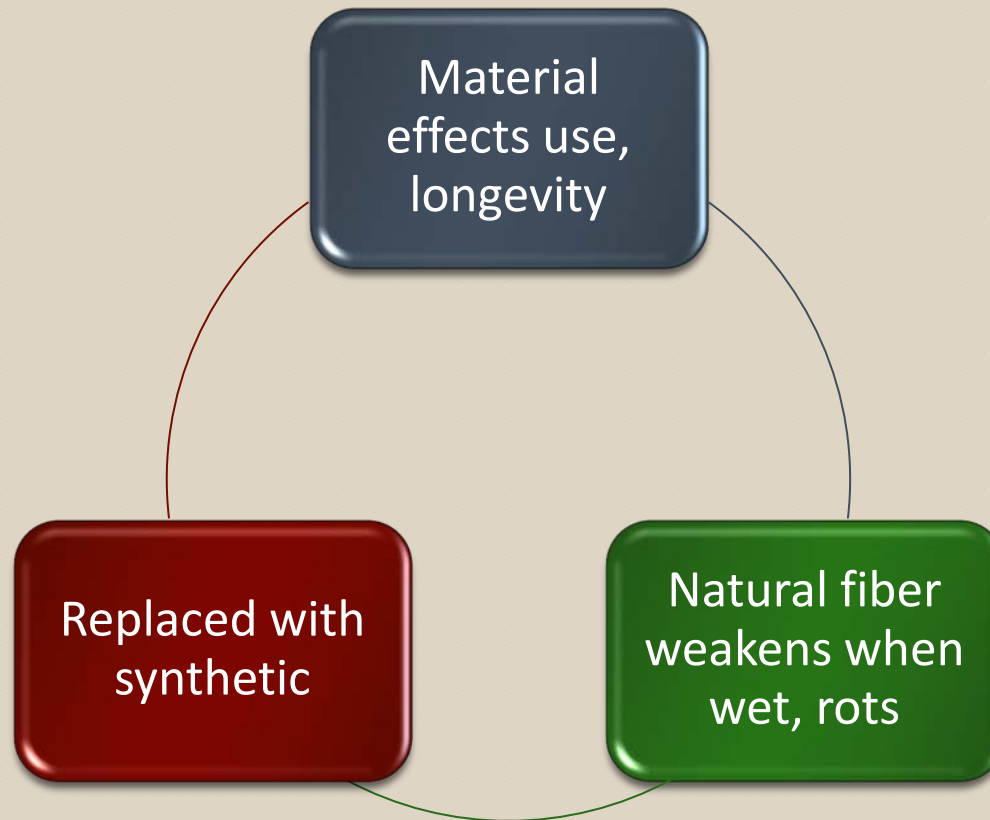


WHILE NFPA® DOES NOT REGULATE UTILITY ROPE
IT SHOULD BE INSPECTED REGULARLY.

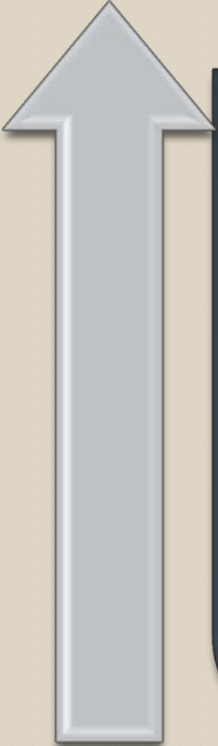


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SYNTHETIC AND NATURAL FIBER ROPE ARE CONSTRUCTED FROM DIFFERENT MATERIALS.



SYNTHETIC FIBER ROPES ARE MADE FROM A VARIETY OF MATERIALS AND HAVE MANY ADVANTAGES AND DISADVANTAGES.



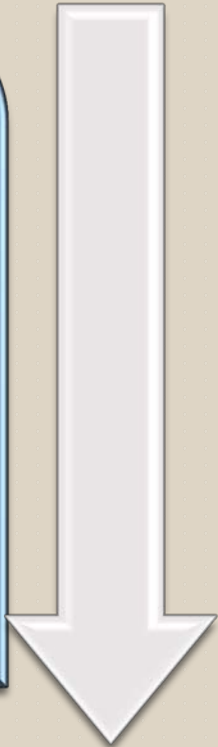
- Resistance to water, mildew, mold, rotting, shrinkage, ultraviolet (UV) light

- Long lifespan

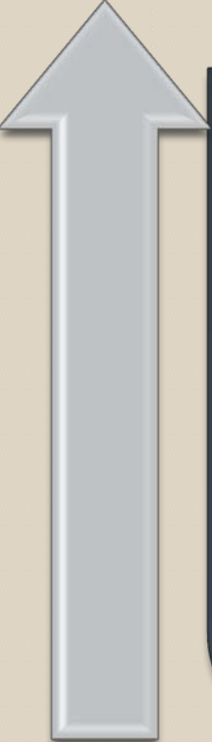
- Strong/lightweight

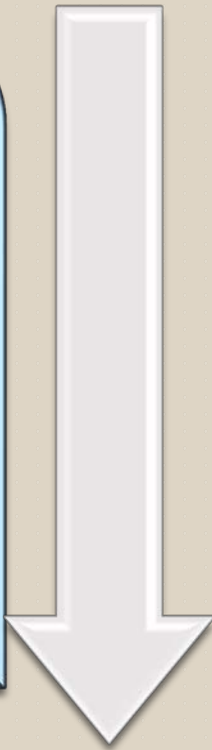
- Easy maintenance

- Melts when exposed to heat



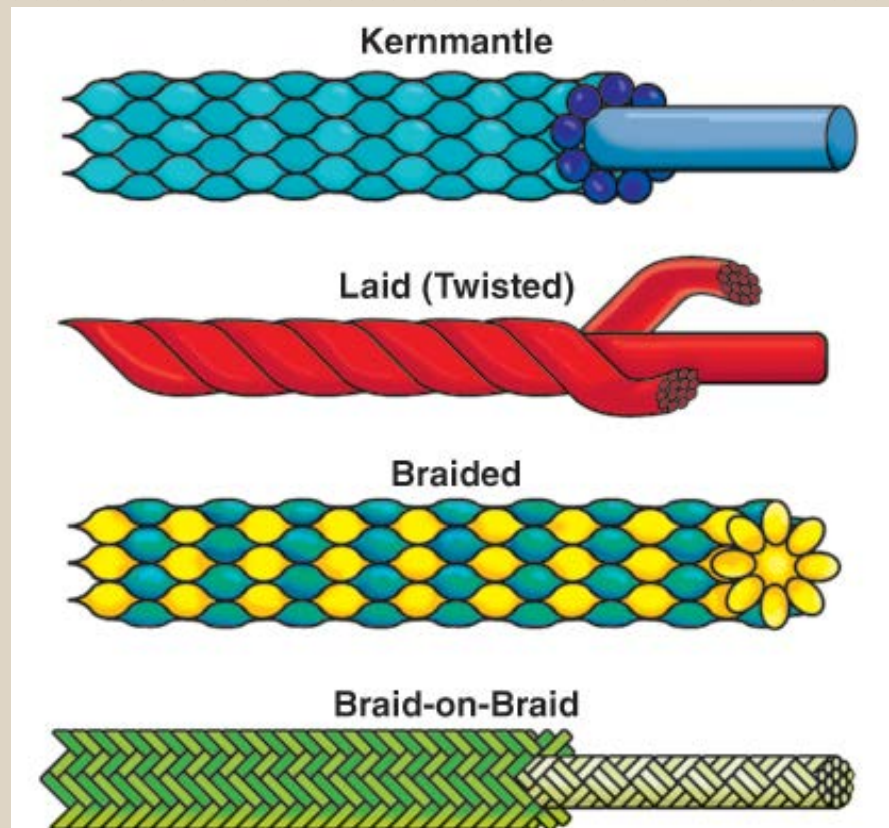
NATURAL FIBER ROPES HAVE DISTINCT ADVANTAGES AND DISADVANTAGES.

- 
- Resistant to sunlight
 - Does not melt
 - Holds knot firmly

- Mildew/mold
 - Exposure to chemicals
 - Burns in contact with flame, embers
- 



USE ONLY KERNMANTLE ROPE CONSTRUCTION FOR LIFE SAFETY OPERATIONS.



KERNMANTLE ROPE IS MADE OF SYNTHETIC MATERIAL AND CONSISTS OF TWO MAIN COMPONENTS.

Braided covering or sheath (mantle)



Core (kern) of main load-bearing strands



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KERNMANTLE ROPE CAN BE EITHER DYNAMIC OR
STATIC AND SHOULD BE USED IN DIFFERENT
CIRCUMSTANCES.

Dynamic rope



Static rope

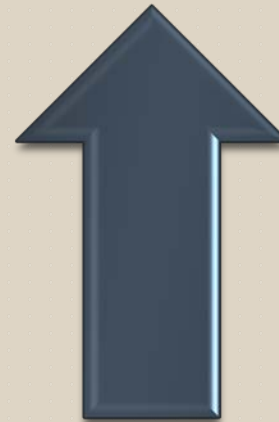


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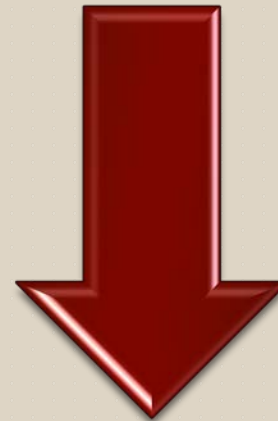
LAID (TWISTED) ROPE CAN BE EITHER SYNTHETIC OR NATURAL AND IS USED ONLY FOR UTILITY ROPE.



*Courtesy of Shad Cooper/Wyoming
State Fire Marshal's Office*



Easy to inspect



- Abrasion, physical damage
- Damage affects strength



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BRAIDED ROPE IS LESS LIKELY TO TWIST THAN LAID ROPE, BUT IS STILL VULNERABLE.



*Courtesy of Shad Cooper/Wyoming
State Fire Marshal's Office*



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BRAID-ON-BRAID (DOUBLE BRAIDED) IS
OFTEN CONFUSED WITH KERNMANTLE.



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FOUR ASPECTS OF MAINTENANCE HELP KEEP ROPE READY TO USE WHEN NEEDED.



ALL ROPE MUST BE INSPECTED AFTER USE OR
AT LEAST ONCE A YEAR.

Document in rope log

Inspect visually, by touch

Glass
shards

Metal
shavings

Splinters

Foreign
objects



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INSPECT KERNMANTLE ROPE BY APPLYING SLIGHT TENSION AND FEELING FOR IRREGULARITIES.

Soft spots

May signal core damage

If sheath damaged, core likely as well

If in doubt, remove from service

Other signs

Shape, weave

Smells

Discoloration

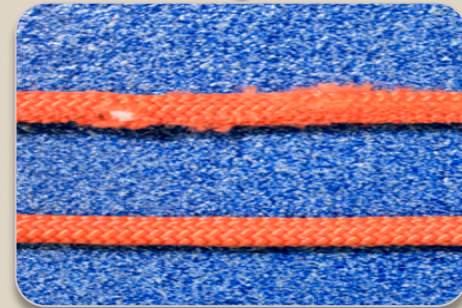
Roughness

Abrasions

Fuzziness

Some is normal

Remove from service if excessive



Courtesy of Shad Cooper/Wyoming State Fire Marshal's Office



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UNTWIST SYNTHETIC LAID ROPE SO EACH STRAND CAN BE INSPECTED.

1. Remove
mildew

2. Clean
Rope

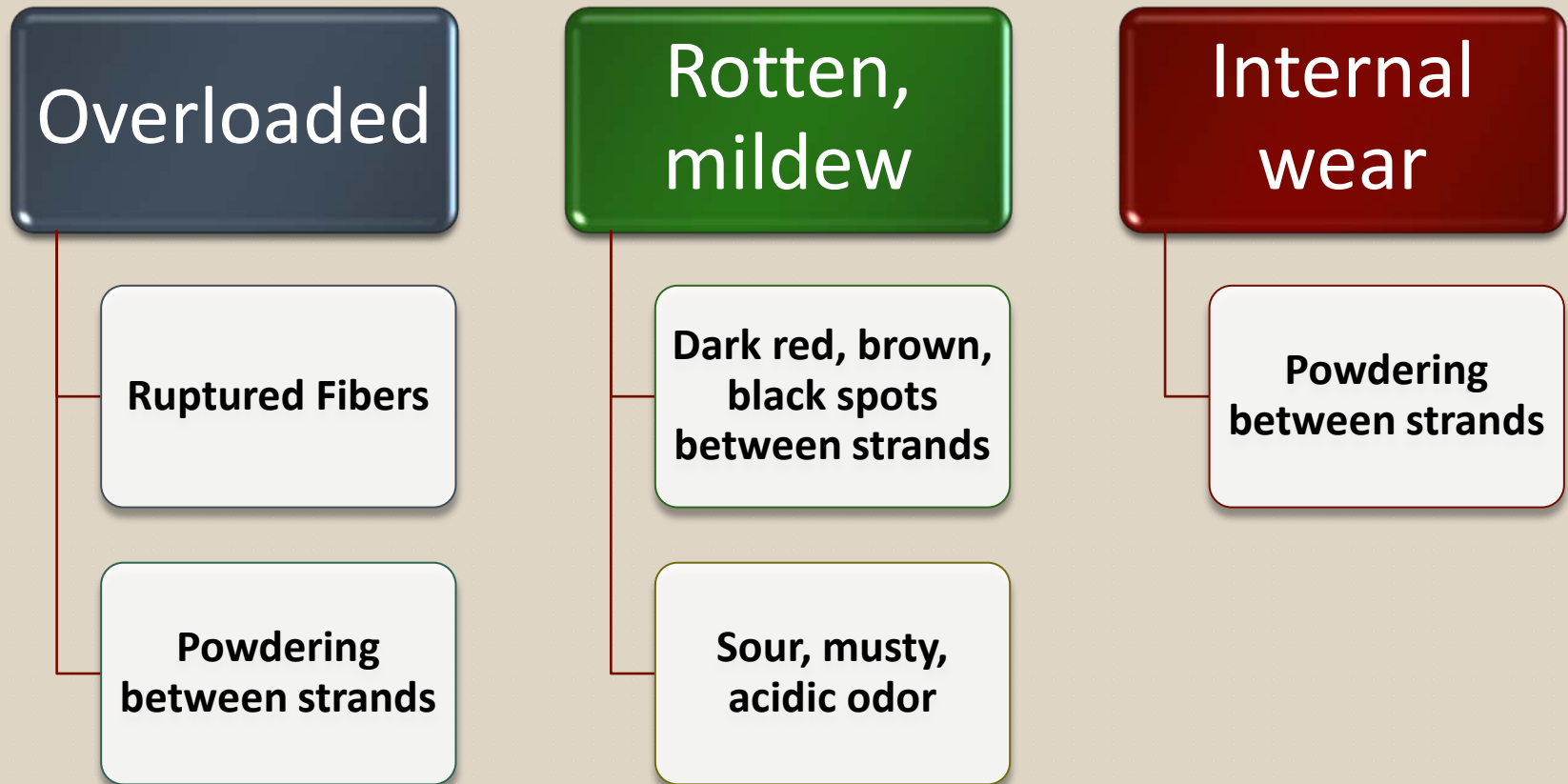
3. Re-
inspect

Look for:

- Soft, crust, brittle spots
- Stretching
- Cuts, nicks, abrasions
- Chemical abrasions
- Dirt, grease, other flaws



REMOVE NATURAL FIBER LAID ROPE AT MANUFACTURER'S END OF SERVICE PERIOD.



REMOVE NATURAL FIBER LAID ROPE AT MANUFACTURER'S END OF SERVICE PERIOD.

**Chemical
damage**

**Brittle, ruptured
fibers; dark red,
brown spots**

**Salt
incrustation;
swollen areas**

**Pulley, metallic
devices**

Rust spots

**Reduced
holding power**

**Heavy, greasy
material**



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ENSURE THAT ROT DOES NOT SPREAD TO NEW ROPE.

1. Remove rope
from service

2. Clean

3. Re-inspect

4. Dry, ventilate
storage area
before
returning



INSPECT BRAIDED ROPE VISUALLY AND BY TOUCH.

Exterior

Nicks, cuts, heat
sears

Excessive, unusual
fuzziness

Interior

Permanent mushy
spots, deformities

Feel, squeeze
surface



INSPECT BRAID-ON-BRAID ROPE VISUALLY AND BY TOUCH.

Heat sears, nicks,
cuts

Lumps indicate
core damage

Shrinking diameter
may indicate break

Examine sheath
for wear

If sheath slides on
core:

- Cut off end, remove excess, seal end



AVOID ABRASION AND UNNECESSARY WEAR WHILE USING ANY TYPE OF ROPE.



Chafing, dragging over rough surfaces



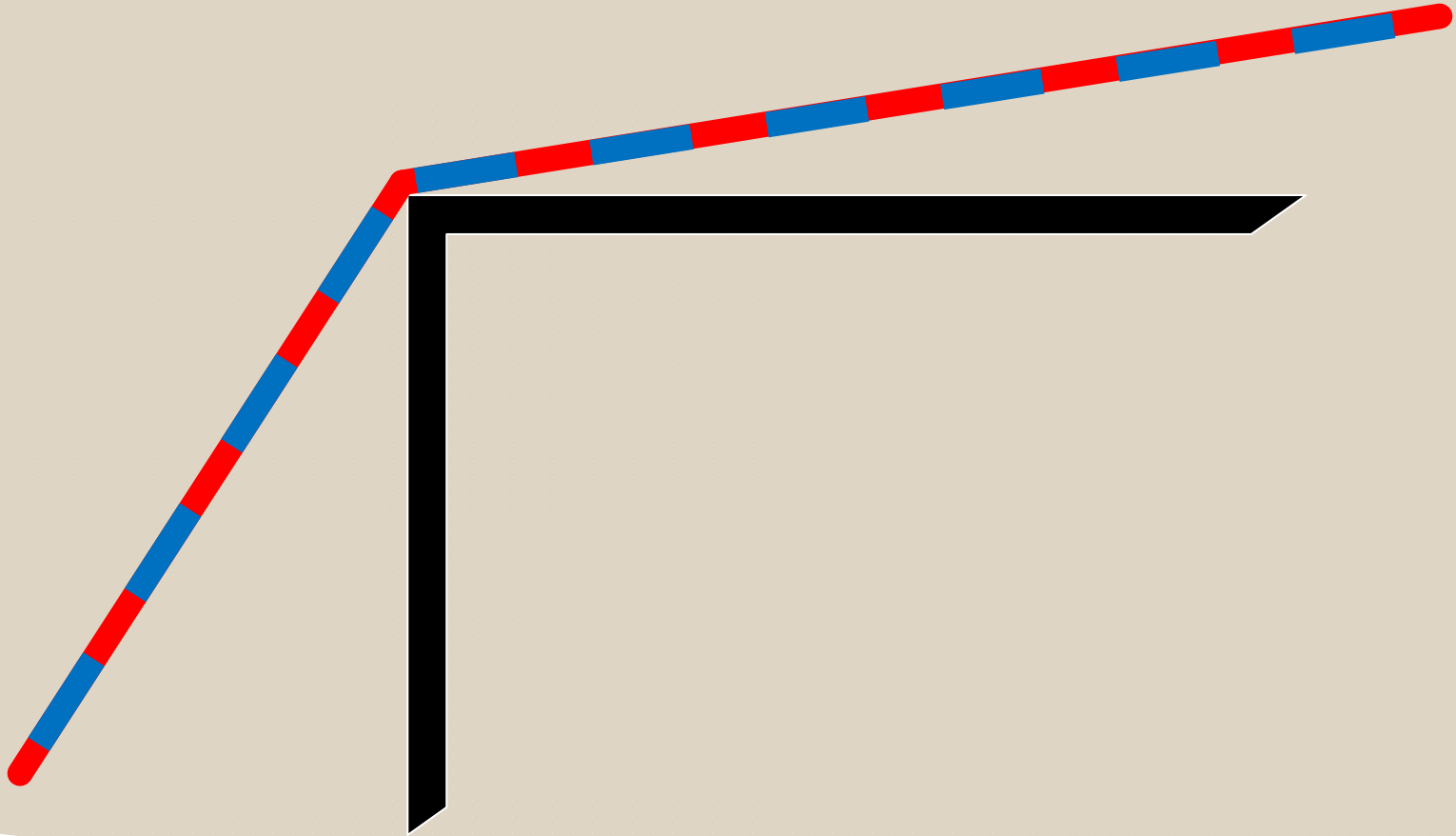
Constant vibration while in storage



Compression when stored tightly



AVOID SHARP ANGLES AND BENDS, WHICH
CAN REDUCE ROPE STRENGTH UP TO 50%.



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PROTECT ROPE ENDS FROM DAMAGE BY TAPING OR WHIPPING THEM.



AVOID EXPOSING ROPE TO SUSTAINED LOADS.



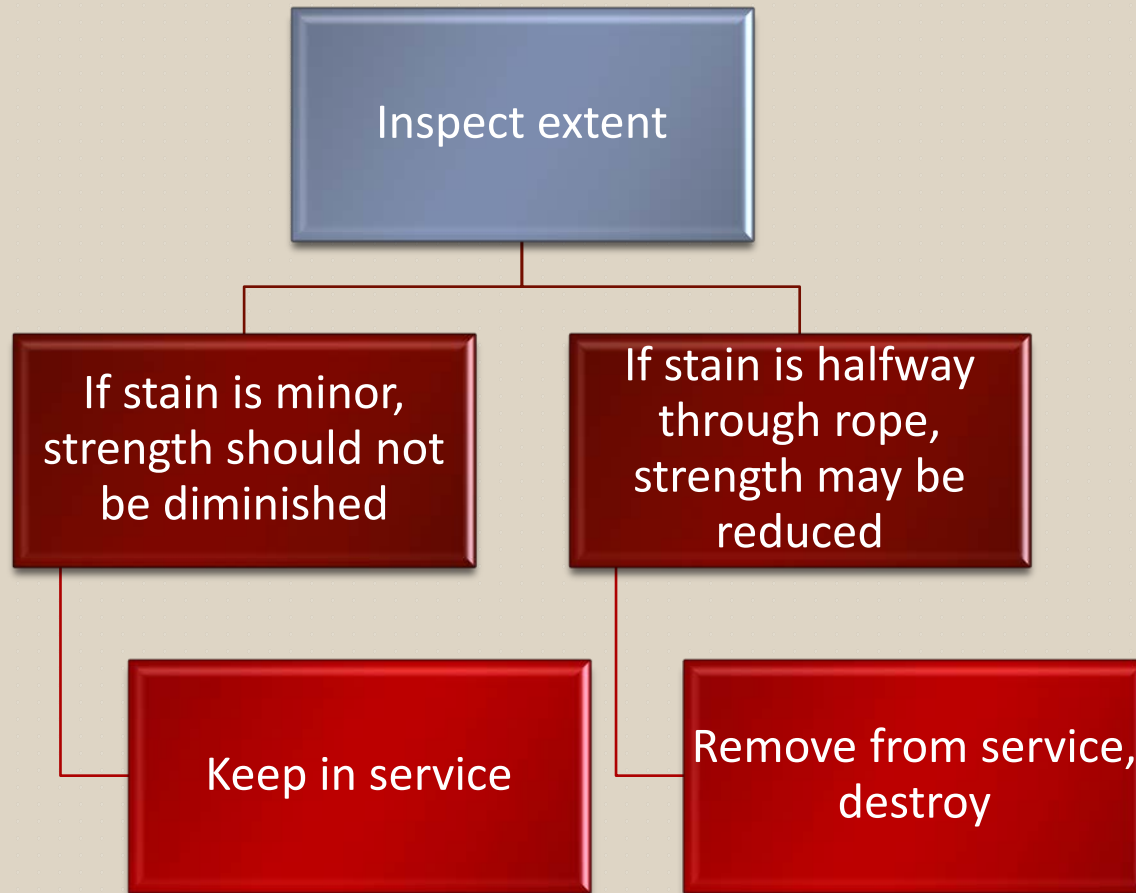
Synthetic fiber holds better than natural fiber

Can break below load limit after long periods of time

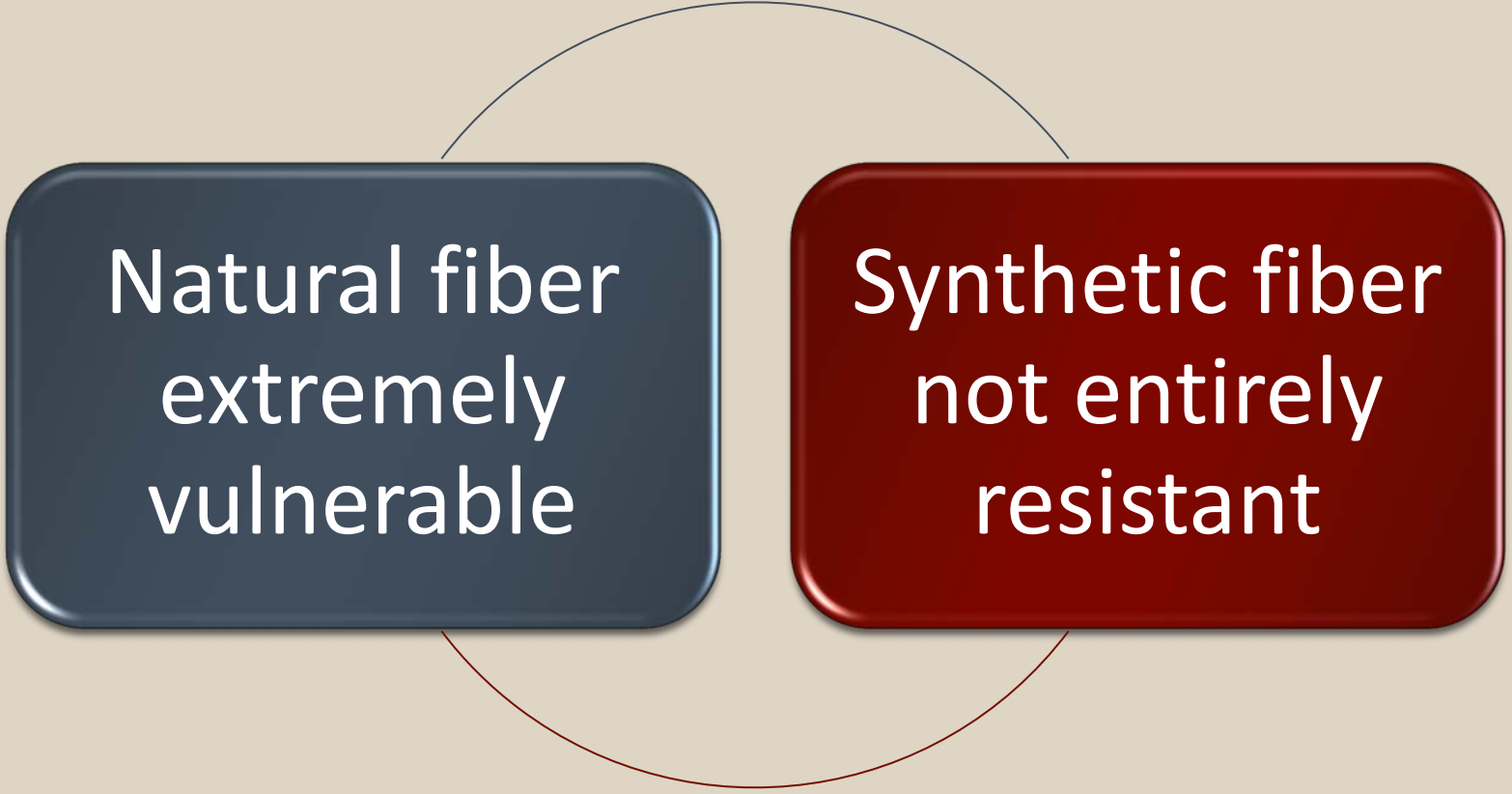
Never exceed load limit and never more than two days



AVOID EXPOSING ROPE TO RUST, WHICH CAN WEAKEN ROPE WITHIN ONE OR TWO WEEKS.



PREVENT CHEMICALS FROM COMING INTO CONTACT WITH ANY ROPE.



Natural fiber
extremely
vulnerable

Synthetic fiber
not entirely
resistant



REVERSE ENDS OF THE ROPE PERIODICALLY
TO ENSURE AN EVEN WEAR.



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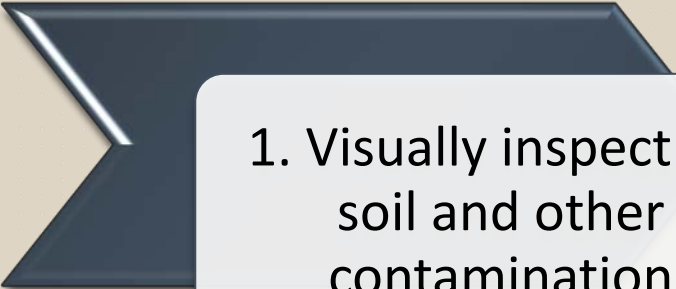
DO NOT WALK ON ROPE, WHICH CAN WEAKEN IT
BY BRUISING AND GRINDING DIRT INTO THE
STRANDS.



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CLEANING ROPE INVOLVES TWO BASIC STEPS.



1. Visually inspect for
soil and other
contamination



2. Use stiff brush to
remove



DO NOT USE BLEACHES OR STRONG CLEANERS ON
SYNTHETIC FIBER ROPE; WASH IN WARM WATER AND
MILD DETERGENT.



By hand



Rope washing device



Washing machine

Courtesy of Shad Cooper/Wyoming State Fire Marshal's Office



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DRY SYNTHETIC FIBER ROPE IMMEDIATELY AFTER WASHING AND RINSING.



Do:

- Spread on hose drying rack
- Suspend in hose tower
- Coil loosely in hose dryer



Do Not:

- Place near heat source
- Let dry in direct sunlight



WIPE OR GENTLY BRUSH NATURAL FIBER ROPE, BUT DO NOT USE WATER.



Courtesy of Shad Cooper/Wyoming State Fire Marshal's Office



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ALL LIFE SAFETY ROPE MUST BE PERMANENTLY IDENTIFIED WITH A ROPE LOG ONCE PURCHASED.

Rappel Rope Log — A rope log is used to ensure that rope usage is maintained in accordance with the standards established in the rope grading table. Inspect rope for damage and excessive wear each time it is deployed and again after each use. Immediately retire all suspect ropes.

[illegible]

Mark ends

- With unit number and service start date
- Print on label, seal to ends with liquid compound

Log is kept for working life



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[illegible]

Records dates every use,
maintenance, inspection

Info helps determine when to remove from service

Log is kept in waterproof envelope in pocket on side of bag



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FOLLOW THESE GENERAL GUIDELINES FOR STORING ROPE.

- Clean, dry, unheated area
- Freely circulating air

- Protect from weather, direct sunlight, chemicals, fumes, vapors
- Keep in separate compartment from fuels



STORING ROPES IN A BAG PROVIDES SEVERAL ADVANTAGES.



Easy to transport

Protects against contamination, abrasion

Can be easily marked, with rope log attached

May be dropped, thrown to be deployed quickly



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WEBBING COMES AS EITHER FLAT OR TUBULAR IN
EITHER SPIRAL OR CHAIN WEAVE.



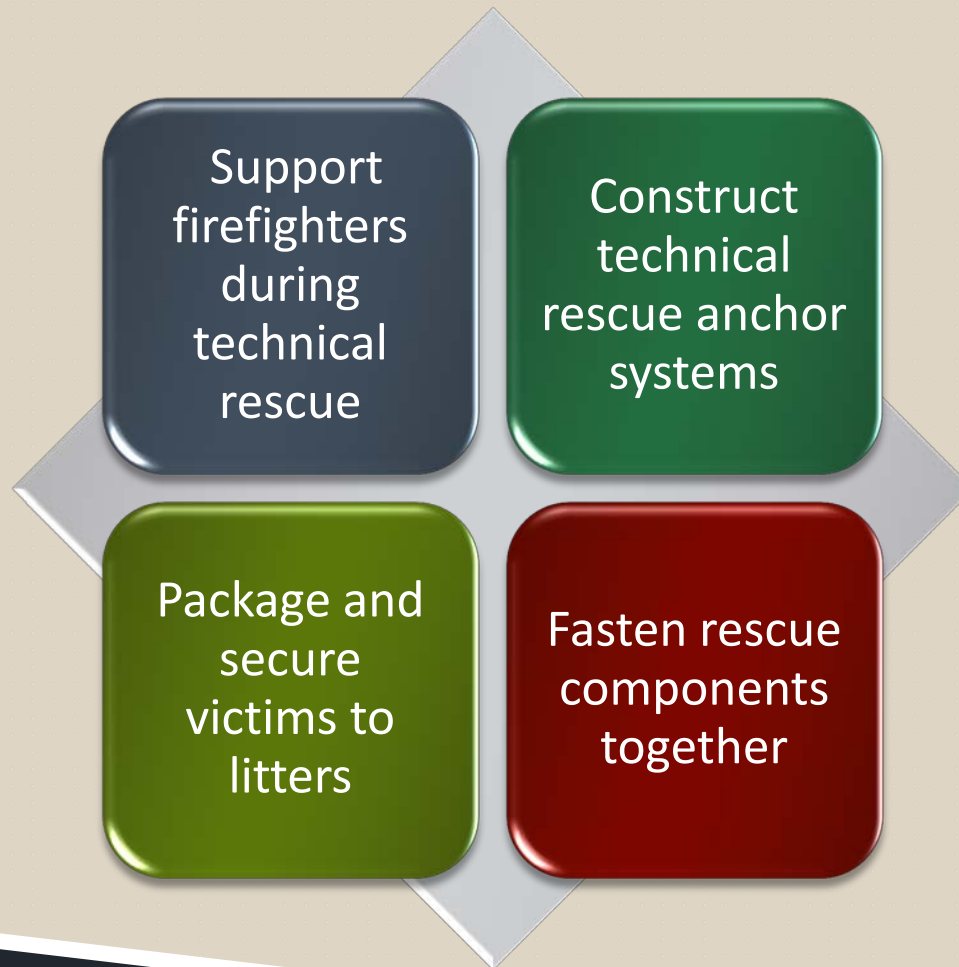
Made from same
material as
synthetic rope

Life safety
webbing must be
NFPA[®] compliant



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LIFE SAFETY WEBBING IS USED FOR FOUR DIFFERENT PURPOSES.



NFPA® 1983 PROVIDES STANDARDS FOR LIFE SAFETY WEBBING AND DESCRIBES THREE SEPARATE CLASSES.



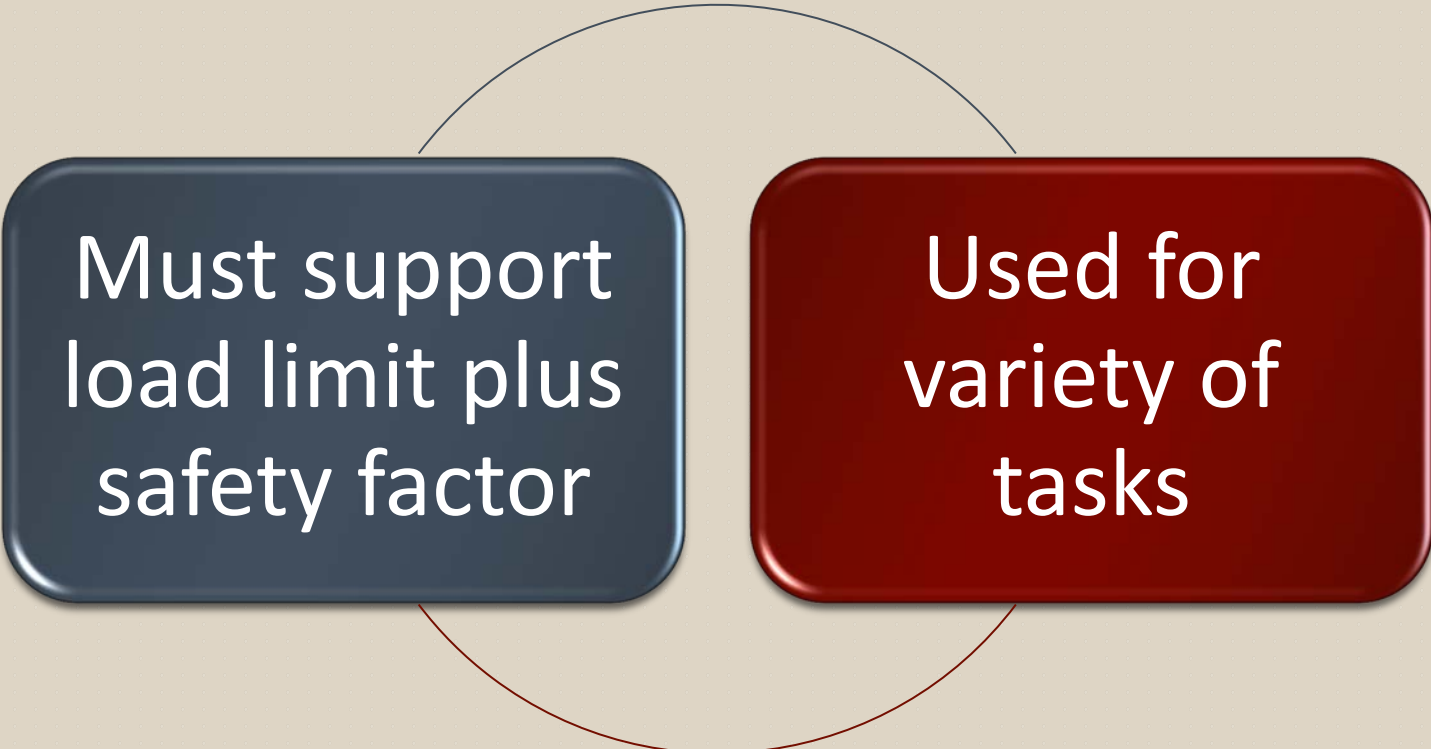
Class I and II

Class III



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UTILITY WEBBING IS NOT REGULATED BY A STANDARD.



Must support
load limit plus
safety factor

Used for
variety of
tasks



WEBBING CARE AND MAINTENANCE PROCEDURES ARE SIMILAR TO ROPE.

Follow same
guidelines as
synthetic fiber rope



Always follow
manufacturer's
instructions



WEBBING IS STORED IN SEVERAL WAYS.



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SUMMARY

Firefighters use rope and webbing to hoist tools and equipment, stabilize objects, designate control zones, perform rescues, and escape from life-threatening situations.



You must know how to inspect, clean, maintain, and store ropes and webbing so that they are ready for use when needed.

