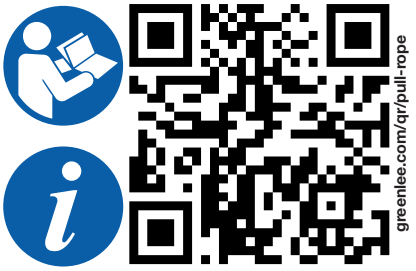
Inspection and Care for Pulling Rope



Safety Information

⚠WARNING

Safety is essential in the use and maintenance of Greenlee tools and equipment. This inspection document and any markings on the rope and spool provide information for avoiding hazards and unsafe practices related to the use of this tool.

SAVE ALL WARNINGS AND INSTRUCTIONS FOR FUTURE REFERENCE.

- **Rope can break and whip violently with great force, increasing the risk of severe injury or death.**
  - Only use properly sized pulling rope in good condition and with a Maximum Rated Capacity equal to or greater than the puller's Maximum Rated Load. .
  - Inspect entire rope before each use. Do not use rope if there is any doubts about the rope's strength.
  - Do not stand in line or allow others to stand in line with tensioned rope
  - Do not pull rope across edges or surfaces that could cut or damage the rope. .
  - Do not maintain a stationary rope on a rotating capstan to minimize damage from wear and heat.
  - Do not knot pulling rope or use rope with knots, knots weaken and damage rope.
  - Minimize the amount of rope exiting the conduit.
- **System components can break and fly away with great force, increasing the risk of severe injury or death.**
  - Only use pulling accessories in good condition in good condition and with a Maximum Rated Capacity equal to or greater than the puller's Maximum Rated Load.
  - Do not allow anything other than the rope to contact the capstan.
  - Keep unnecessary personnel away from the area during the pull.
- **Rope and capstan can entangle and crush with great force, increasing the risk of severe injury or death.**
  - Keep hands and body away from tensioned rope and moving capstan.
  - Do not wrap rope around hands or body. Hold rope so it can be quickly released.
  - Do not stand in spent coils of tailing rope. Manage the rope to keep it from coiling near the operator's feet.
  - Do not add wraps to puller capstan when capstan is moving. Stop the puller before adding or removing wraps.
  - Do not allow rope to overlap on the capstan. Stop the puller if overlap occurs, resolve overlap before continuing pull.
- **Read & understand these instructions for pulling rope and all other warnings and instructions for the puller & pulling accessories before use.**
- **Only use Greenlee recommended pulling rope for Greenlee pullers.**

Greenlee® Contact Information

If you have any questions concerning this GREENLEE Product:

- Contact your local GREENLEE distributor.
- Visit GREENLEE.com to find your local GREENLEE Tool contact point and additional copies of this manual.
- Contact Professional Tools Technical Service Department at ProToolsTechService@Emerson.com or in the USA and Canada call 1-844-789-8665

Description

This document is to provide information about the selection, inspection, and maintenance of Greenlee pulling rope used with Greenlee pullers. The contents of this document is to be used as a supplement to your employer's and the industry's best practices and procedures regarding the care and inspection of pulling rope.

Greenlee pulling rope is white with a green tracer with factory spliced eyes at both ends. Read the puller manual and consult the charts in the Greenlee product catalog to help choose the correct rope and accessories for the puller.

GREENLEE PULLING ROPE FEATURES	
DOUBLE BRAIDED PULLING ROPE	**HIGH PERFORMANCE PULLING ROPE**
Construction: Braided Core Encased in Braided Cover **Material:** Polyethylene/ Nylon Composite **Storage Temp:** Up to 350 °F (176.7 °C) **Melting Point:** 460 °F (237.8 °C)	**Construction:** 12 Strand Single Braided Rope **Material:** High-Modulus Polyethylene **Storage Temp:** -125°F to 160 °F (-87°C to 71°C) **Melting Point:** 275 °F (135 °C)
	
High Strength Minimal Elongation Under Tension Protective Outer Sleeve of Rope Core Low Coefficient of Friction for Smoother Pulling and to Reduce Cable Damage. 8" Lock Stitched Pulling Eyes on Both Ends Flexible And Easy to Handle	Ultra-High Strength Minimal Elongation Under Tension UV Resistant Coating Lower Coefficient of Friction than Double Braided Rope for Faster Pulling. 8" Lock Stitched Pulling Eyes on Both Ends Flexible And Easy to Handle 50 Ft. Orange Dyed Rope at Each End Compressible On Capstans for Maximum Wraps

GREENLEE PULLING ROPE SPECIFICATIONS*									
ROPE TYPE	CAT. NO.	UPC NO.	LENGTH (ft)	DIAMETER (in)	MAX. RATED CAPACITY		AVG. BREAKING STRENGTH		COMPATIBLE PULLER(S)
					lbf	kN	lbf	kN	
DOUBLE BRAIDED PULLING ROPE	450	783310237730	300	3/8	1,375	6.1	5,500	24.5	805
	451	783310237754	600						
	452	783310237761	1,200						
	455	783310237747	300	1/2	2,450	10.9	9,800	43.6	G3, UT2
	456	783310237778	600						
	35285G	783310352839	300	9/16	4,000	17.8	16,000	71.2	UT6 640
	35284	783310352846	600						
	35285G	783310352853	1,200						
	35098	783310350989	300	3/4	6,500	28.9	26,000	115.7	G6 6001
	35100	783310351009	600						
	35101	783310351016	1,200						
	34136G	783310341369	300	7/8	8,000	35.6	32,000	142.3	UT-8
	34137	783310341376	600						
	34138	783310341383	1,200						
HIGH PERFORMANCE PULLING ROPE	HPR600	78331006671	600	19/32Δ	10,000	44.5	44,500	197.9	UT10 GX10
	HPR1200	783310007340	1,200						

** All information for new, unused, and properly stored Greenlee Pulling Ropes*
Δ Can be used in place of 7/8 in. or 3/4 in. ropes on appropriate Greenlee Pullers

General Pulling Rope Information

Selecting pulling rope requires understanding of the following concepts related to rope/puller design and general pulling principles:

- Pulling ropes are specifically designed for cable pulling and should not be used for any other applications.
- Pulling ropes are subjected to two primary types of loading that can weaken ropes over time:
  - Cyclic Loading: This is repeated cycles of tension and release on the rope.
  - Static Loading: This is a constant, sustained load that can continually stretch the rope over a long time.
- Pulling rope capabilities are commonly stated as:
  - Safety Factor: This is a design margin used to ensure the rope is significantly stronger than the maximum expected load. Greenlee ropes have a 4:1 safety factor, meaning the rope's average breaking strength is four times greater than the maximum load it is expected to handle. This reduces the risk of failure during use.
  - Average Breaking Strength: This is an average of amount of force needed to break the rope based on tensile testing of multiple samples by the manufacturer.
  - Maximum Rated Capacity: This is the pulling force that must not be exceeded to reduce wear and maintain the safety factor of the rope. These values come from the average breaking strength of a cord or rope divided by a safety factor.
- The primary control for a capstan pull is the tailing force.
  - Maintaining consistent tailing force is crucial. Changes in tailing force directly impact the pulling force. The ideal tailing force should be comfortable to maintain throughout the pull, requiring only minor adjustments.
  - Insufficient tailing force: Can lead to inadequate wrap engagement, causing excessive friction and heat buildup on the rope.
  - Excessive tailing force: Increases the risk of rope overlap, wear, and operator fatigue. If the operator struggles to maintain sufficient pulling force, it may indicate insufficient wraps on the capstan.
  - When using a capstan, the resulting pulling force is controlled by the tailing force, the number of rope wraps, and the friction between the rope and capstan. The number of wraps needed to achieve the desired pulling force can only be approximated. For a starting reference, Table 1 contains the approximate pulling force per capstan warps of new Greenlee pulling rope on a GX10.

TABLE 1: APPROXIMATE PULLING FORCE WITH 20 LBF TAILING FORCE

# of wraps	Approximate Pulling Force Generated			
	Double Braid Rope		High Performance Rope	
	lbf	kN	lbf	kN
2	131	0.6	100	0.4
4	475	2.1	395	1.8
6	1,413	6.3	1,050	4.7
8	3,175	14.1	2,000	8.9
10			3,625	16.1
12			6,000	26.7
13			6,425	28.6

The High-Performance rope requires more wraps due to its lower coefficient of friction. However, its compressibility allows for this increased number of wraps.

Pulling Rope Selection

Ropes should be selected based on the following critieria:

1. **Maximum Rated Load of Puller to Maximum Rated Capacity of Pulling Rope:** All accessories, including pulling rope, must have a Maximum Rated Capacity that meet or exceed the Puller's Maximum Rated Load. See your puller manual specifications for the Maximum Rated Load of the puller.
2. **Condition:** Pulling rope should be in good repair and inspected regularly to reduce the risk of failure.
3. **Construction:** Always use the appropriate rope for your application to minimize the risk of injury. Greenlee pulling ropes are engineered to withstand high tensile forces while minimizing elongation or stretch to reduce the risk of dangerous whipping action in case of rope failure. Additionally, they have a low coefficient of friction for a smoother pull and reduced wear from conduit walls and sheaves.

   The following ropes are not recommended for cable pulling:

   i. Kernmantle: A rope made of a braided outer sleeve and straight fiber core.

   ii. Twisted Rope: Multiple fibers twisted together into strands that are then twisted in the oppositedirection with multiple strands into rope.

   iii. Ropes made from organic materials (hemp, cotton, etc.), polypropylene, or nylon.

   These ropes can all present hazards and dangers due to not being strong enough to withstand the pulling forces or may stretch excessively. Additionally, some ropes may have different surface finishes that do not work well on capstans or increase the risk of rope overlap.
4. **Diameter:** Greenlee pulling ropes are offered in various diameters. The diameter of the pulling rope is crucial for strength, optimal performance and safety. The rope diameter and capstan size must be compatible to achieve sufficient wraps. See your puller manual for the recommended diameter of pulling rope. NOTICE: The High-Performance Rope can be used in place of 7/8" and ¾" Double Braided Rope, the lack of solid core allows the High-Performance Rope to compress and achieve more wraps on the capstan.
5. **Safety Factor:** Choosing a rope with a higher safety factor offers several advantages:
   - Protection against overloading due to excessive load.
   - Accommodation for wear and tear over time.
   - Mitigation of unexpected forces such as sudden jerks or impacts.

Training & Qualifications

Pulling rope inspections should be carried out by an individual who holds appropriate specialized training, such as a recognized degree or certification, and has extensive knowledge, and experience, and a proven ability to address issues related to cable pulling. If you are not knowledgeable about pullers, pulling ropes, and the pulling process, you should not conduct the rope inspections.

Pre-Operation Inspection

⚠WARNING

Before each use, inspect your pulling rope and correct any issues to reduce the risk of severe injury from rope breakage, whipping and striking.

Inspect the entire length of rope.

- Perform inspection on a clean smooth surface under good lighting.
- Lay the rope in a straight line under a light tension or pass sections hand over hand to straighten rope and allow focus on the condition of the rope.
- See General Inspection Notes and Tables 3A-C for suggested inspection criteria and procedures.

1. Inspect any other equipment (puller, connectors, sheaves etc.) in the pulling system according to their instructions.
2. Optional, it is good practice to keep a log about the rope and inspection findings. This helps to track the current condition of the rope to aid the inspector's decision about the rope.
   - This log should include information such as:
     - Greenlee rope description, size, and rating
     - Date of manufacture
     - Date of first use and each use
     - Inspection results (observations of rope condition), including date and who performed the inspection.
     - Dates of cleaning or repairs with description and who performed them.
     - Unusual or out of ordinary uses or exposures for the rope such as:

       a. Shock loads (Catching falling objects, etc.)

       b. Overload (loads greater than rope rating)

       c. Exposure to liquids, solids, gases, mists, or vapors of any chemical or other material that can deteriorate the rope.

       d. Exposure to excessive heat or direct flame, and

       e. Other modes of concern (Table 3A-C)

To differentiate between ropes, add markings or tags on the rope, reel or storage container to allow distinction between specific ropes. If keeping a log, make sure to match the rope to the description in the log before starting inspection.

General Rope Inspection Notes

- Verify suitability by confirming the rope type and rated capacity align with the planned use.
- Understand the rope's nominal specifications (diameter, rating, etc.) to use as comparison while inspecting.
- Regular inspections should be made along the whole length of the rope before and after use to aid in detecting new damage.
- Consider the age of the rope based on the date of manufacture, older and well used rope may have degraded, and the strength compromised. Do not use rope that is older than 5-7 years, depending on the frequency of use and the inspector's discretion. Unused rope greater than 10 years old should also not be used as time may have degraded the fibers and compromised the strength.
- Have a general knowledge of the rope's history or consult the rope's log to aid in identifying potential types and locations of damage. Some issues can be easily identified visually or with minimal handling, such as feeling or gently parting strands.
- Inspect the pulling eyes for any damage or loose strands. The pulling eyes may wear out faster than other areas due to continuously rubbing against the connector or swivel for the cable grips.
- If any issue are found, do not use the rope until the issue is resolved and the rope is approved for use by a qualified person. Rope inspection is subjective and based on the experience of the inspector and information available. If there is any question as to the integrity of the rope do not use it.

Table 2A-2C further explains the most common issues that may be seen by the inspector, what it looks like, how to inspect, how it is caused, and how to mitigate these conditions.

Specific Inspection Notes for Double Braided Pulling Rope

- While inspecting, measure the rope diameter periodically using string or a measuring tape and compare that measurement to the nominal diameter. Changes in diameter greater than 10% of the nominal diameter may indicate an area on the rope to inspect more closely for issues.
- Inspect the core by gently pushing the outer sleeve apart, the strands should part easily and fall back into place when released. Check core for any powdered fiber, broken yarns, wear, or kinks in the core. Repeat this inspection at different places along the rope, especially when a change in diameter is present.

Specific Inspection Notes for High Performance Pulling Rope

- This rope is coreless but the interior between strands should be inspected for damage. Gently separate strands without pulling out the braid to inspect.
- The rope will flatten on the capstan allowing for more wraps.
- The color on the ends may fade or be rubbed off, but loss of color doesn't necessarily mean there is damage present.
- While the rope is UV-resistant, minimizing sun exposure is still encouraged to extend its lifespan.

TABLE 2A: ROPE CONDITIONS			
Condition	**Cut Strands**	**Abrasions/Wear**	**Protruding Strands**
Picture Example			
Inspection Notes	Take note if the cuts are on the core or the casing. Damage to the core is more serious that to the outer casing. The rope strength is severely compromised each time a strand is cut. Cut strands cannot be repaired or rewoven.	Inspect both inner and outer fibers. Make note of the frequency, spacing, depth and length of wear. Lots of wear, close together or over a long stretch of rope weakens the entire length.	Make note of the condition of the strand. Damage to the strand may impact the overall strength. Consider the frequency of protruding strands along the length of the rope and how close they are. Most protruding strands can be rewoven into the line with minimal impact on strength.
Retirement Notes	Do not use rope with cut strands.	Do not use a rope significant wear is present or if more than 50% of the strands are affected in that area.	If multiple strands cannot be rewoven then consider downgrading or retiring rope. Do not use rope with more than four protruding strands over several feet cannot be rewoven.
Cause	Sharp edges or debris, poor storage.	Contact with sharp edges and rough surfaces.	Pulling or snagging of strands on equipment or surfaces.
Prevention	Inspect storage and any surfaces that the rope will encounter for sharp edges or elements. Use sheaves, in good condition to direct rope around corners and minimize contact of rope around sharp corners or rough surfaces.	Keep surfaces of sheaves and capstans clean and free of burrs or rust to reduce wear on the rope strands. Avoid passing rope through small sheave grooves or over sharp edges. Use properly sized sheaves, diameter of sheave grooves should be no smaller than 4 times the diameter of the rope, to prolong rope life. Do not drag rope over dirt, sand, gravel, rust or corroded surfaces. Debris could be picked up in the rope fibers.	Use sheaves and padding to direct rope over surfaces and around corners. Pack rope in a closed container or on a reel to reduce the risk of it snagging on other equipment during transport.

TABLE 1B: ROPE CONDITIONS CONTINUED			
Condition	**Changes to Rope Diameter: Flat Spots or Bumps***	**Knots & Hockles**	**Glazing & Stiffness**
Picture			
Inspection Notes	Inspect the flexibility of the rope, feel for any stiffness or bumps. Inspect the core by gently parting the outer casing or untwisting strands. Flexing the rope and massage fibers may help to loosen the weave. Rope should be supple, bend easily and flatten slightly when compressed.	Inspect for knots, hockles and twists in the rope. Pulling without unknoting or straightening rope creates stress concentrations that can damage pulling rope and increase risk of rope failure. Even when unknotted, the location of the knot has a higher risk of breaking from potential damage created by the knot. Pulling rope should lay flat with no twisting. Gently straighten out hockles and twists before using.	Inspect for glazing, glossy marks, hard/ stiff areas, or fused strands. Areas where glazing or fused fibers are present are brittle and can break under high loads. Not all stiffness indicates damage and can be gently massaged out. If stiffness cannot be fixed then the inspector should consider it when evaluating the state of the rope.
Retirement Notes	Do not use rope if the core is exposed, broken, powdered, or parted.	Do not use pulling rope with knots in it or if it has been used for other applications such as lifting or as a tie down. Do not use pulling rope where twists and hockles cannot be straightened.	Do not use rope if glazing is found.
Cause	Flat Spots: Broken strands in the core of the rope are likely due to overloading or shock loads. Bumps: This is caused by compression forces squeezing the fibers of the rope affecting the flexibility of the rope.	Hockles form when the rope twists on itself, often due to the improper removal of rope from coils or spools.	Heat or chemicals can cause the strands to melt together creating a glossy spot. Heat can build up between the rope and capstan if the rope is not feeding off the capstan.
Prevention	Pay attention to the Maximum Rated Capacity of the rope and the maximum rated load of the puller. Avoid wedging rope or passing rope through a small opening. Regulate the amount of tailing force applied to be just enough to remain engaged on the capstan. Do not use an underrated rope, the rope can break and start whipping around causing injury or death.	Do not use pulling rope for lifting applications. Pulling rope should only be used for pulling. Do not tie rope to other rope or use for tying down objects. Minimize twisting and hockles by storing and removing rope properly from spools or coils. Gently straighten out kinks or hockles before pulling.	Pay attention to the rope as is passes over surfaces. Set up the puller with the appropriate number of wraps according to its instructions. Do not keep a stationary rope on a rotating capstan, the heat could build up from the friction and damage the rope. Do not store rope in the same place as harsh chemicals or where extreme heat is possible.

*Only on double braided composite rope

TABLE 1C: ROPE CONDITIONS CONTINUED			
Condition	**Worn Out Eye**	**Dirt & Moisture**	**Discoloration**
Picture			
Inspection Notes	Note any worn spots and broken strands. Look at the connection to the main rope length and make sure there are no broken or protruding strands. Inspect the stitching for any damage.	Inspect for dirt, debris, and moisture along the surface and among the strands. Debris can wear down the rope fibers over time, weakening and increasing the risk of the rope failing.	Look for discoloration in the rope not made by dirt, this can be a sign of damage from chemicals or heat. Make note of the storage location and if any harsh chemicals are present. Inspect discolored fibers for char, stiffness, brittleness and flaking. This is evidence of damage to the fibers. Rope fibers should be flexible and not fused together.
Retirement Notes	Do not use rope if the pulling eye is in poor condition.	Do not use rope if excessively dirty, moldy or has metal slivers, rust, or gravel embedded in it.	Do not use rope if discoloration is linked to chemical or heat damage.
Cause	Over time the eye will become frayed and worn down from contact with conduit surfaces, grips, and connectors.	Dragging rope across the ground or over dirty/wet surfaces will cause the rope to pick up particles and moisture that over time can affect the integrity of the rope.	Harsh chemicals, such as for cleaning, can emit vapor into the air that can be absorbed by the rope strands if stored together. Heat can build up between the rope and capstan if the rope is not feeding off the capstan.
Prevention	Use clevis and swivel connectors to distribute the load from the cable grips. Minimize rubbing of the connector on the pulling eye material. Alternate the eye that the cable connector is attached to.	Keep rope clean by storing in a cool dry place, away from direct sunlight, and on a reel off the ground or in clean container. During use, deposit rope off the capstan in a clean container. Keep sheave and capstan surfaces clean.	Do not store rope in the same place as harsh chemicals. Work in a clean area and avoid getting oil or other chemicals on the strands. While pulling, lubricants may be used and could get on the rope. Only use approved pulling lubricants to reduce the risk of introducing harmful chemicals to the rope.

Service Life

The risk involved with using pulling rope varies over time and it is impossible to know the exact strength of the rope unless through destructive testing. It is therefore recommended to retire potentially worn rope earlier than later if in doubt. When a rope is no longer suitable for pulling destroy rope by cutting into lengths too short for further use.

Do not use rope for pulling if the integrity of the rope is in question at any time. The inspector is responsible for making decisions of the usability of the rope based on their experience with the rope's application and their familiarity with the history of the rope.

Discontinue use of a rope if:

- It is suspected of being exposed to loads close or greater than its Maximum Rated Capacity.
- It is suspected of being exposed to shock loading close or greater than its Maximum Rated Capacity.
- Cut strands are present and cannot be repaired or rewoven into the rope.
- Glazing or fusing of outside fibers from heat or chemicals is present.
- Any damage to the inner stands or core of the rope is found, such as broken/cut or powdered strands.
- Discoloration due to rust, mold, chemicals, or heat is present.
- Excessive abrasion and broken fibers on the rope either in a single spot or a long length of the rope.
- Excessively worn pulling eye(s) with broken strands or loose splicing.
- Regularly used rope that is more than 5-7 years old or new unused rope that is more than 10 years.

General Best Practices

These are various best practices to follow when using pulling rope and the Greenlee pulling system:

- Always wear safety glasses and other appropriate protective equipment.
- Set up the puller to minimize the amount of rope exiting the conduit.
- Do not stand in line or allow others to stand in line with tensioned rope.
- Keep hands and body away from tensioned rope and moving capstan.
- Manage rope to prevent piling near feet
- Hold rope for quick release in case of slipping.
- Properly align the first wrap on the capstan with rope ramp to help guide the rope and reduce the risk of overlap. Do not use High Performance Pulling Rope on tapered capstan without the use of a rope ramp.
- Work in an appropriate area. Area should be clear, level, stable, dry, and well lit. If needed, sweep the area to reduce the possibility of dirt and debris embedding in the rope during use. Do not operate rope near harsh chemicals. Chemicals could be absorbed and weaken rope.
- Thoroughly read the puller manual for detailed set-up and operation.
- Adhere to Maximum Rated Capacity: Never exceed the Maximum Rated Capacity specified for the rope. Overloading can accelerate degradation and can lead to internal damage that may not be easily detected. Document all instances where the rope may have experienced overloading to factor into later inspections.
- Avoid Shock Loads: Minimize sudden, forceful impacts on the rope. This can put significant stress on the rope and increase risk of rope failure.
- Perform Regular Inspections: Regularly inspect the rope for signs of wear, damage, or internal deterioration.
- Store Rope Properly: Store the rope in a cool, dry place, away from direct sunlight and extreme temperatures.
- Retire Rope in a Timely Manner: Retire the rope when it shows signs of significant wear or damage or experiences an event, such as overloading, that puts in doubt the strength of the rope.
- Reverse rope ends regularly to allow even wearing.
- Pull in a direction that will require the lowest amount of pulling force.
- Use pulling lubricant on the cable. This can further minimize friction between the cable and conduit. Less friction means less tension on the rope during the pull.
- Remove rope properly from coils or reels:
  - Regular right hand laid rope should be uncoiled in a counterclockwise direction from the inside. Lay the coil on the floor with the inside end at the bottom.
  - Remove the rope from a reel by pulling it off the top while the reel is free to rotate on a reel stand. Rope should never be unspooled from a reel lying on its end, in this orientation it is more likely to kink or hockle or pull yarns on the wooden reel flange. Follow reel stand instructions to secure reel and reel stand to prevent slipping or tipping during a pull.

Storage

Store pulling rope:

- In a clean, dry, and well-ventilated location inside.
- Off the ground, properly coiled on a shelf, in a clean covered container, or on a Reel Stand: Never lay coil directly on a concrete or dirt floor.
- Out of direct sunlight, synthetic rope may be severely weakened by prolonged exposure to ultraviolet (UV) rays.
- Away from extreme heat: Rope strands could melt and become brittle.
- Away from harsh chemicals: Never store rope, acid, and/or alkalis in the same area.

Cleaning

Keep rope clean. Dirt and grit picked up by the rope can work into the strands and cause damage to individual strands, reducing the integrity of the rope.

Remove dirt or abrasive particles by washing rope in cool or tepid water. Air dry on a clean surface or hanging off the ground and out of direct sunlight. Dry rope completely before using and when storing coiled or on a reel.