

Tool Operating Manual

Cat® Synthetic Rope Machine Recovery
Cable Assemblies

- Installation
- Safe Use
- Inspection Guidelines
- Removal from Service Guidelines

Cat® synthetic rope assemblies— recovery/towing

This usage guideline provides information intended for the safe use of the Cat® synthetic fiber rope recovery and tow lines. Synthetic rope tow lines are designed to meet the strength and durability needs of recovering disabled equipment and machines in mining and off-road operations.

These assemblies are designed for light-weight, durability and personnel safety. Careful routine inspections must be made on all component ropes and slings, as well as all assembly hardware prior to use. To ensure the safety of all personnel using these recovery assemblies or in the immediate area of their use, please thoroughly read the following instructions. Also review all Cat safe towing instructions for the machines involved in any recovery or towing operation.

Note: The information contained in this document is for general use and any site specific regulations need to be taken into consideration in conjunction with this document.

Recovery



Towing



Introduction

There are three Cat® synthetic rope machine recovery assemblies (Large, Medium or Small) for replacement of wire rope, chain or other commonly used towing devices for disabled machines.

These multi-component assemblies are designed to provide:

- Light-weight, easy and rapid transit, installation, use and storage
- Safe Use
- Meet Cat LMT towing standards for
 - Rated Strength Capacities
 - Safe Work Load Limits (WLL)
 - Load Equalization on front frame structure for disabled machines when recovered or towed

If the intention is to TOW as well as RECOVER, Cat synthetic rope towing extensions are an option to the Recovery Kit. These light-weight extensions extend the overall length of the assemblies to provide additional distance between the towing and towed machines. They are installed in place of the Ripper Blade Connecting Sling (Component D) and attach to single or dual tow points on the towing machine.

- Assembly still provides load equalization (machine being towed)
- If attaching to two points on the towing machine – two (2) tow extension lines will be needed
 - There are braided rope tow-extension slings listed on the parts list for each category: Large, Medium or Small. Please assure to choose and use the correct tow-extension sling for your assembly.
- Please follow all instructions in this guide to achieve maximum performance and safety results.

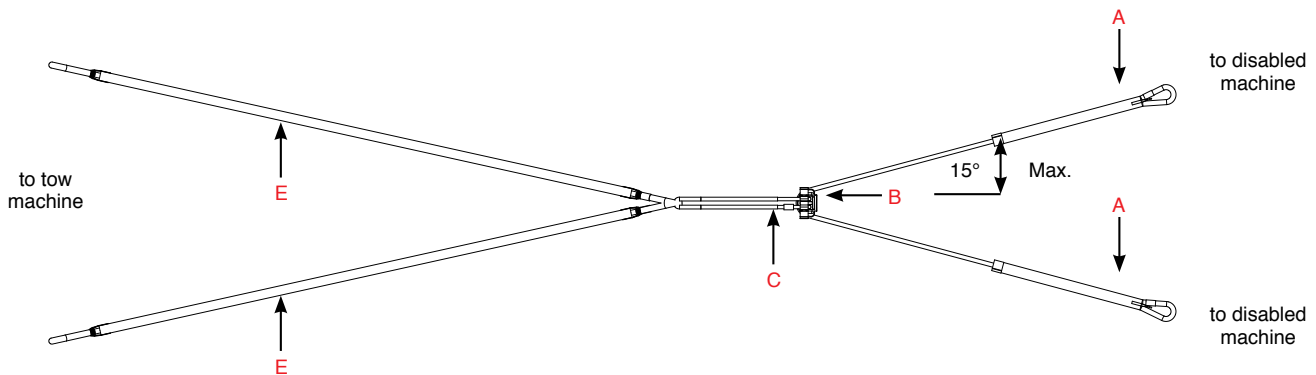
Package components (shipped in storage tote container with lid)

1. Component **A** – (1) Rope slider sling (lime-green rope)
2. Component **B** – (1) Load equalizer hardware
3. Component **C** – (1) Center link sling
4. Component **D** – (1) Ripper blade connector sling
5. Component **E** – (1) Optional towing line

Dual tow line configuration:

Uses synthetic rope towing extensions (optional accessories to the Recovery Kit)

Remove Component D from recovery setup and attach two Component E Optional Towing Slings.

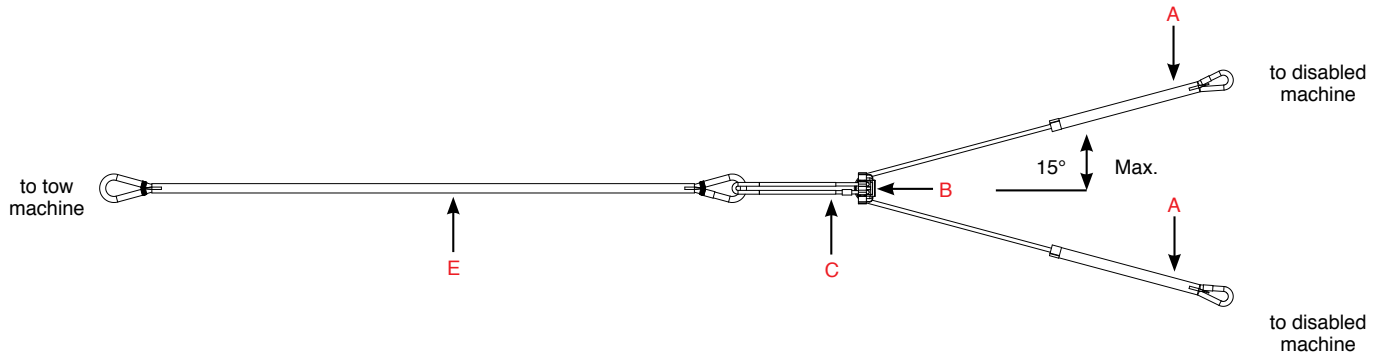


Introduction

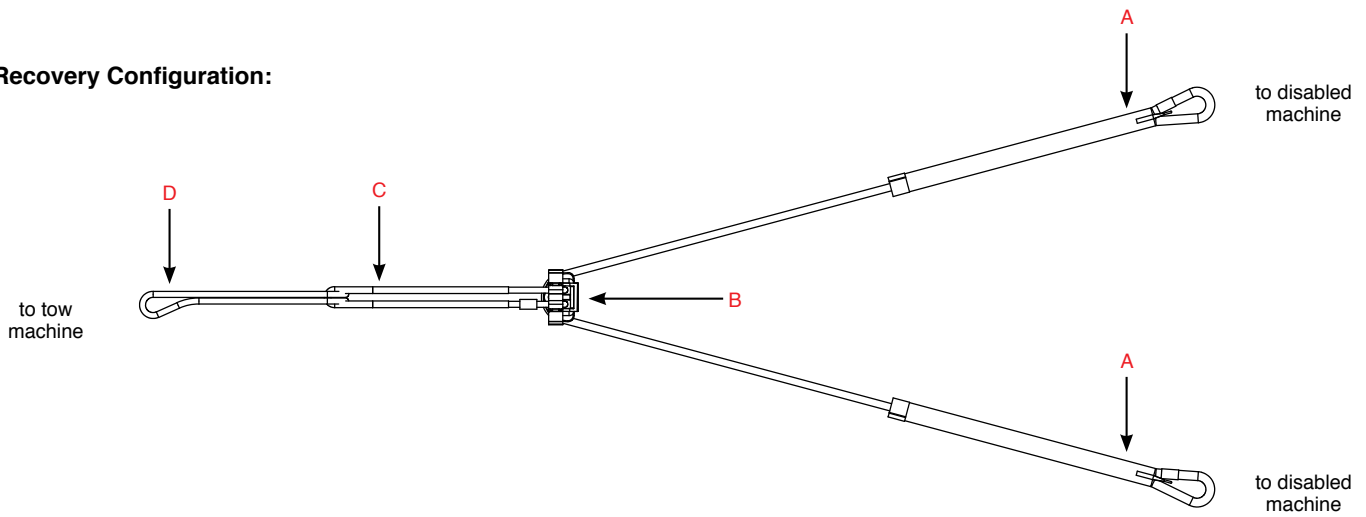
Single tow line configuration:

Uses synthetic rope towing extensions (optional accessories to the Recovery Kit)

Remove Component D from recovery setup and attach Component E Optional Towing Sling.



Recovery Configuration:



Introduction

Parts List

Part Number	Component	Description	qty	Rope Size/Type	Nominal Length (mm)	Weight each (kg)	Notes
Large Recovery Assembly							
453-7268		Large Recovery Assembly in Tote	1		9900	179	Includes all components except optional topline
453-7270	A	Rope Slider Sling	1	64 mm dia. UHMWPE 12x12 Braided Rope	12400	50	Rope is Lime Green coated color. Grey UHMWPE braided chafe gear fixed in place on eyes
502-1414	B	Load Equalizer Assembly	1			30	
453-7271	C	Center Link Sling	1	52 mm dia. UHMWPE 12x12 Braided Rope	4900	26	Grey UHMWPE braided chafe gear fixed in place on eyes
453-7272	D	Ripper Blade Connector Sling	1	52 mm dia. UHMWPE 12x12 Braided Rope	4100	26	Entire rope covered with Grey UHMWPE braided chafe gear
453-7273	E	Optional Accessory Towing Line	1	80 mm dia. UHMWPE 12x12 Braided Rope	8500	62	Not incl. in Large Assembly – Order separately. Formed eye terminations with Grey UHMWPE chafe gear on each end. Body covered with orange Velcro® clasp Nylon chafe sleeve.
453-7274		Storage Tote—Large		49" x 41" x 30"	—	59	Blue
Medium Recovery Assembly							
453-7275		Medium Recovery Assembly in Tote	1		9900	124	Includes all components except optional topline
453-7277	A	Rope Slider Sling	1	48 mm dia. UHMWPE 12x12 Braided Rope	11000	24	Rope is Lime Green coated color. Red UHMWPE braided chafe gear fixed in place on eyes
549-3527	B	Load Equalizer Assembly	1			30	
453-7278	C	Center Link Sling	1	40 mm dia. UHMWPE 12/S Braided Rope	6700	19	Red UHMWPE braided chafe gear fixed in place on eyes
453-7279	D	Ripper Blade Connector Sling	1	40 mm dia. UHMWPE 12/S Braided Rope	3500	13	Entire rope covered with Red UHMWPE braided chafe gear
453-7280	E	Optional Accessory Towing Line	1	60 mm dia. UHMWPE 12x12 Braided Rope	5500	26	Not incl. in Medium Assembly – Order separately. Formed eye terminations with Red UHMWPE chafe gear on each end. Body covered with orange Velcro® clasp Nylon chafe sleeve.
453-7281		Storage Tote—Small/Medium		48" x 28" x 32"	—	49	Blue
Small Recovery Assembly							
453-7282		Small Recovery Assembly in Tote	1		10000	98	Includes all components except optional topline
453-7284	A	Rope Slider Sling	1	36 mm dia. UHMWPE 12/S Braided Rope	8300	10	Rope is Lime Green coated color. Yellow UHMWPE braided chafe gear fixed in place on eyes
549-3527	B	Load Equalizer Assembly	1			30	
453-7285	C	Center Link Sling	1	30 mm dia. UHMWPE 12/S Braided Rope	9400	13	Yellow UHMWPE braided chafe gear fixed in place on eyes
453-7286	D	Ripper Blade Connector Sling	1	30 mm dia. UHMWPE 12/S Braided Rope	3500	7	Entire rope covered with Yellow UHMWPE braided rope chafe gear
453-7287	E	Optional Accessory Towing Line	1	48 mm dia. UHMWPE 12x12 Braided Rope	5500	15	Not incl. in Small Assembly – Order separately. Formed eye terminations with Yellow UHMWPE chafe gear on each end. Body covered with orange Velcro® clasp Nylon chafe sleeve.
453-7281		Storage Tote—Small/Medium		48" x 28" x 32"	—	49	Blue

Service Replacement Parts

Part Number	Description	qty	Type	Color
464-8309	Slider Chafe Sleeve – Large	2	Closeable Chafe Sleeve	Black
566-7476	Center Link Chafe Sleeve – Large	2	Closeable Chafe Sleeve	Black
464-8310	Towing Line Chafe Sleeve – Large	1	Closeable Chafe Sleeve	Orange
464-8311	Slider Chafe Sleeve – Medium	2	Closeable Chafe Sleeve	Black
570-4833	Center Link Chafe Sleeve – Medium	2	Closeable Chafe Sleeve	Black
464-8312	Towing Line Chafe Sleeve – Medium	1	Closeable Chafe Sleeve	Orange
464-8340	Slider Chafe Sleeve – Small	1	Closeable Chafe Sleeve	Black
570-4832	Center Link Chafe Sleeve – Small	2	Closeable Chafe Sleeve	Black
464-8341	Towing Line Chafe Sleeve – Small	1	Closeable Chafe Sleeve	Orange
515-4641	Load Equalizer Bottom Block – Large	1	Machined part	
576-6153	Load Equalizer Wedge Bottom Block – Small/Medium	1	Machined part	
541-9337	Load Equalizer Straps Kit – Large	1	Straps, bolts, washers	
576-6152	Load Equalizer Straps Kit – Small/Medium	1	Straps, bolts, washers	

Installation overview

Step 1	Remove Synthetic Rope Recovery and/or Tow Assembly from storage tote
Step 2	Lay out component slings and connecting hardware between the disabled machine and the recovery/tow machine
Step 3	Inspect synthetic rope sling components and connecting hardware (refer to pages 12–18 in this document)
Step 4	Assemble Components C center link sling and A rope slider sling in Component B Load Equalizer Hardware
Step 5	Connect other end of Component A rope slings to front frame tow point on disabled machine using suitable hardware
Step 6	Connect Step #4 assembled components to Component D ripper blade connector sling
Step 7	Attach completed assembly to tow or recovery point of tow machine
Step 8	Slowly position the towing machine for best alignment with disabled machine while removing slack in the recovery assembly

Note: Use optional component(s) E when further reach is required or tow machine utilizes two tow points.

Installation step detail

Steps #1 & 2 - Remove Recovery Assembly components out of storage tote and lay out between the towing/recovery machine and the disabled machine.

- Machine Positioning
 - Position the recovery machine in front of the disabled machine such that the ripper blade (or tow points) of the recovery machine and the front connection points of the disabled machine are approximately 10 m from each other.
- Note – Recovery Assembly is not supplied with truck connection hardware; e.g. wide body shackles.



Installation

Step 3 - Inspect assembly components for wear or damage before installation (refer to pages 12–18 in this document).

Step 4 - Assemble and connect Component A (rope slider sling) with Component B (load equalizer hardware) and Component C (center link sling).

- Note – this 3 component assembly arrives complete, in originally supplied Assembly Kit (in tote). Instructions are offered on “re-rigging” the two rope component slings into Component B load equalizer hardware.
- Note – pink Velcro straps removed from some photos for clarity



Assemble the 3-part assembly (from bottom up in picture):
a. Component A rope slider sling (lime-green rope)
b. Component B load equalizer hardware
c. Component C center link sling



Rigging method of assembly:
First slip Component A rope slider sling (lime-green rope) through Component C center link sling 'eyes'



Next, rig one of the eyes of Component C center link into one of the grey channels of Component B load equalizer hardware.



Repeat for the second eye of Component C center link, and position Component A rope slider sling (lime-green rope) in the white channel of Component B load equalizer hardware.

Installation

Step 4 - Continued



Install the load equalizer bottom block and secure with the bolt, washer, and lock washer.



Close the pink Velcro straps to secure the rope slings to Component B load equalizer hardware. The straps around Component A rope slider sling (lime-green rope) should not be tight against the rope. Component A rope slider sling (lime-green rope) should be free to slide in the white channel.

Step 5 - Connect each eye of Component A rope slider sling (lime-green rope) to front tow point of disabled machine using suitable hardware (e.g. widebody shackles).

Installation

Step 6 - Connect Component D ripper blade (connection sling) to Components A, B and C; and attach to towing or recovery (pulling) machine.



Recovery Loop both eyes of Component D ripper blade connector sling over the ripper blade. Care should be taken to position the eyes of rope sling as high as possible on ripper blade to prevent cutting. NOTE: image above shows the braided chafe gear eyes as gray, however standard color will depend on Recovery Assembly size: grey=large, red=medium, yellow=small.



Towing When towing, replace Component D ripper blade connector sling with one or two Component E optional towlines and attach to one (1) or two (2) rear connection points on tow machine. NOTE: Each tow leg will take almost 100% of the load if turns happen during tow; assure connection uses proper size (and strength) of rope tow slings.

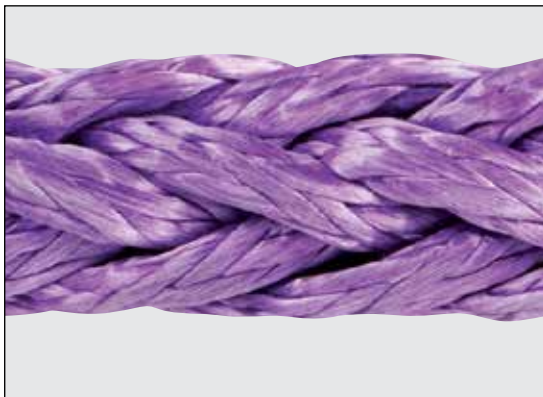
Step 7 - Slowly position towing machine (attached to Cat® Recovery Assembly and disabled machine) taking out slack in system before recovery or tow procedure begins.



Safe use, storage and general care

UHMWPE (Ultra High Modulus PolyEthylene) synthetic rope

To properly inspect the UHMWPE synthetic rope component slings in the Cat[®] Recovery Assemblies, it is important to understand the rope construction. The synthetic rope sling components are manufactured in a braided and balanced torque-free construction. Each rope is made up of yarns twisted and braided into strands and then finished into a round rope construction: either 12 strand or 12 x 12 strand.



New section of 12x12 synthetic rope



Rope yarn



Rope strand (12 strand construction)

Rope Chafe Protection

The braided synthetic rope used in the assembly components and slings may have full or partial coverage by chafe gear; preventing abrasion wear and cutting. The three types of chafe gear in the Cat assemblies are:

- Replaceable – Orange Velcro-clasp nylon sleeves
- Fixed in place – braided UHMWPE color-coated chafe sleeves; on body or in eye terminations
 - Grey color, for Large assembly sling components
 - Red color, for Medium assembly sling components
 - Yellow color, for Small assembly sling components
- Fixed in place – tubular nylon body chafe sleeves – typically black in color

Note: Do not mix sling components (e.g. Large and Small) in your recovery assembly as the mixture will not produce published rated strength capacities. The cut and abrasion resistance of the braided UHMWPE rope is far greater than the protective chafe sleeves. Ripped or cut chafe gear will not affect the performance of the recovery assembly unless the braided UHMWPE rope core inside the chafe sleeve is damaged. Therefore, if the Nylon or UHMWPE chafe gear is cut or damaged, careful inspection of the UHMWPE rope must be conducted immediately.

Storage and general care

- Recommended storage is in plastic container or box
 - If on pallet, make sure other items which may damage or cut the sling are not stacked on top of the slings.
- Washing care
 - Synthetic rope tow slings can be washed to remove dirt and grime; power washing is acceptable—allow to air dry before use or storage. If dirt and particulate are somehow getting beneath the chafe sleeves and into the core rope, some internal abrasion may be happening. Inspection procedures for rope can be reviewed on our website at cortlandcompany.com.
- Environmental
 - UV and sunlight resistance on synthetic rope tow slings are excellent and should not erode the strength of the core rope in the sling over its service life.
 - Water does not affect the strength of synthetic rope tow slings. However liquids which contain high Ph or acidic values can degrade the strength of the sling.
 - Synthetic rope tow slings can be repaired at factory or factory-authorized distribution centers. Repair requires inspection of rope and fiber integrity, possible re-splice terminations and addition of new chafe gear. A program of repair can be set up if needed.

Inspection / removal from service guidelines

Properly installed and used within Cat® LMT recovery and towing guidelines, the Synthetic Rope Machine Recovery Assemblies should provide many jobs with safety and high performance. However, the key to long service life and high performance is constant visual inspection of the rope assembly and components; both slings and hardware.

It is important to inspect all components before and after use, before storing the assemblies back into the weather-resistant tote. Please follow these guidelines below.

5-step inspection guide before use

Steps	Description
#1	Choose correct Cat® Recovery Assembly for the job
#2	Inspect eye terminations of each sling component for damage
#3	Inspect chafe sleeves of each sling component
#4	Inspect synthetic rope slings
	a. Broken or excessively damaged rope; e.g. complete cuts on (1) or more strands
	b. Excessive abrasion or shape deterioration
	c. Excessive heat or environmental damage
#5	Inspect load equalizer hardware for excessive wear or damage

Inspection steps details

The braided synthetic ropes in these assemblies are light-weight and durable. Primary inspection methods are visual and “by hand”. When the rope components are not under tension-load, and when you see an area on the ropes which concerns you or does not look like the new version of the rope, the primary inspection method is as follows:

- “Hand-compress” the braid at the affected area to open up the construction. This allows close visual inspection of the yarn and strand wear (e.g. mass volume loss to abrasion, cutting or heat damage). This “flexing” of the rope at the affected area does not damage the strength-integrity of the sling.
- Note: if you cannot “Hand-compress” or flex the rope at the area of concern—this rope needs to be removed from service.



Inspection

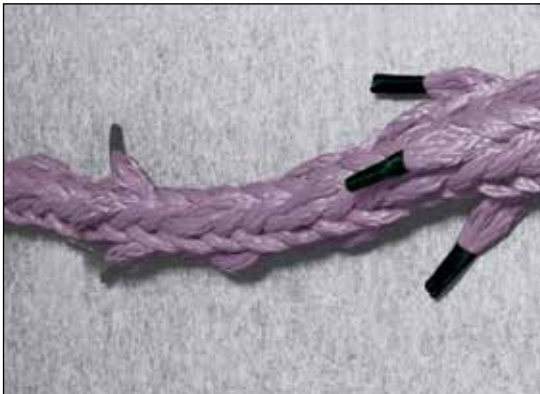
Step 1 – Choose correct assembly for the job

Recovery Assemblies

Specifications	UOM	Large	Medium	Small
		Part No. 453-7268	Part No. 453-7275	Part No. 453-7282
Assembly rated capacity	tons	452	316	162
	MT	410	287	147
Recommended min. WLL	tons	170	116	62
	MT	154	105	56
Recommended Cat® machine class		795-797 trucks; D11 dozers	785-793 trucks; D10 dozers	777 or < trucks; D8 and D9 dozers
Assembly weight without storage tote	lbs	289	166	109
	kg	131	75	49
Color coating on SX eyes		Grey	Red	Yellow

Step 2 – Inspect eye terminations of each sling component.

The eye splice termination area from the base of the eye creates a larger outside diameter (OD) than the braided rope; approximately 1.5 times the rope OD. This is standard in all synthetic rope splices.



Close up of synthetic rope splice tails. Braided synthetic ropes in system may have eye terminations with 'exposed tails' protruding. This is normal and correct. Make sure tails are not becoming untucked; if un-tucked, replace component sling.



Lay out sling for thorough inspection of splices, cuts, excessive wear, heat damage, etc.

Inspection

Step 3 – Inspect chafe sleeves of each sling component.

A new synthetic rope recovery and tow sling consists of a braided rope strength member which may be encased in either a black or orange nylon chafe protective sleeve or a braided colored UHMWPE chafe sleeve.



New rope slings with chafe gear



Black nylon chafe sleeves have Velcro® clasps allowing both internal synthetic rope sling inspection, and replacement of sleeve



Excessive cutting or wear on braided UHMWPE chafe sleeve. **If synthetic rope sling is visible through cut chafe gear, replace sling component.**

Step 4 – Inspect synthetic rope slings

Careful visual inspection of each rope component in the assembly is critical. By compressing the braided rope area of concern, both strand and internal wear/damage can be assessed.

While an UHMWPE braided ropes is one of the most cut-resistant synthetic fiber ropes available, metal can prove stronger than the rope in long-term abrasion. Signs of excess abrasion include:

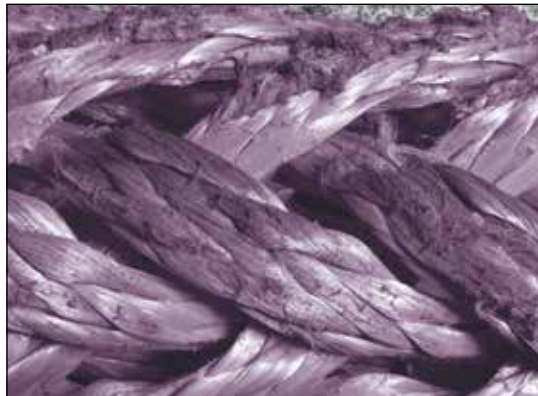
- Heavy “fuzzing” or broken surface synthetic fibers on the exterior of the rope
- Synthetic yarn or strand “pull-outs” or snags; distorting the construction of the braid
- Cut strands in a single or multiple area and
- Overall rope size and construction distortion

Note:

- Broken exterior and interior yarns are caused by normal abrasion, wear against rough or angled surfaces, and environmental exposure to caustic chemicals or sunlight (UV).
- All UHMWPE synthetic ropes experience and exhibit “fuzzing” or broken surface fibers during use. The key to inspection and use or removal from service/replacement of these ropes showing this wear is the extent of wear.
 - If the original size or volume of the braided rope strand or entire rope appears to be reduced by 25% or more, either locally or over its entire length, the rope sling must be removed from service and replaced.
- Make sure rope chafe protection is in place or replaced when needed.



New braided synthetic rope sling. No external rope strand or rope core wear or damage.



Inspect for excess surface wear on rope.



Slight external strand and synthetic fiber yarn abrasion wear and cutting. **This rope is good for continued full use.**

Yarn and strand inspection

Repeated lateral abrasion wear against sharp edges is the primary cause of damage to UHMWPE braided synthetic ropes; cut yarns or strands. Partial cutting of yarns and/or strands can create an imbalance in load-sharing leading to significantly lower strength and rope sling performance. **Visual and hand inspection for strand cuts is the key inspection method for these slings; discard or remove from service if one (1) or more strands are cut in the rope.**



Inspection of hollow core area of 12x12 Strand rope. In picture above, no internal wear is observed. **Exterior yarn abrasion is noted as 'light' and not a problem.**



Visual inspection of interior yarns shows wear from abrasion or cutting. **This should be removed from service.**



Visual inspection of yarns on rope in this sample shows heavy cutting on two adjacent strands, but only moderate surface abrasion (darker areas on the surface of the strands). **This should be removed from service.**



Worn rope surface. Strands appear braided and 'glazed'. Inspection method is visual and compressing (flexing) rope area. If worn rope area cannot "open up" by compression REMOVE FROM SERVICE and replace. If strands area volume is still 75% or more of original and not 'heat-fused' solid, then it is OK to continue to use.



Worn rope surface. Strands appear braided and 'glazed'. Inspection method is visual and compressing (flexing) rope area. If worn rope area cannot "open up" by compression REMOVE FROM SERVICE and replace. **If strands area volume is still 75% or more of original and not 'heat-fused' solid, then it is OK to continue to use.**



Distortion of rope construction and heat damage

New construction UHMWPE ropes are very flexible and unlike rigid wire rope constructions, may change shape when in a relaxed state, under load or bent over or around contact surfaces. This is normal for these ropes and should not be a reason to discard the sling unless the change of shape is permanent and detrimental to the strength performance of the component sling.

Sustained or temporary overloading of a synthetic rope sling component can create heat damage to the rope fibers and construction. This heat damage may fuse exterior yarns or even strands if severe enough—causing the rope to become very hard and diameters to become smaller or irregular in shape.

- UHMWPE synthetic fiber ropes have a critical temperature, (at which the rope softens permanently) of 150 °C or 297 °F. Long term exposure above 60 °C/140 °F is not recommended.

While long-term high ambient heat can affect these ropes, especially when under sustained load or tension, friction heat can be a greater damage; caused by rope rubbing against metal surfaces.

- The size and mass of larger diameter ropes (typically 30 mm diameter and larger) may mitigate the effect of ambient heat as it is difficult to transfer the exterior surface heat into the rope interior.

Typically, UHMWPE braided ropes do not experience heat damage in normal applications and when used at recommended Work Load Limits.



Synthetic rope slings are manufactured with balanced yarn and strand construction. Distorted and/or damaged yarns and strands usually occur in most applications. **Ropes exhibiting areas of severely distorted construction or yarn damage should be repaired or removed from service.**

Inspection

Step 5 – Inspect hardware.



Inspect load equalizer hardware, looking for cracks or breaks in frame. **Remove from service or replace if seen.**



Inspect rope 'sliding channel' in load equalizer for excessive nicks or wear to coating. **Remove from service or replace if seen.**



If connecting to truck frame using properly sized screw pin shackles, it is 1) recommended to use 'wide body shackles, and 2) to inspect hardware for 'nicks' or distortion before use.

Removal from service criteria

	Condition	Remove from service	Inspection Date	Inspection Date
1	Tagging illegible or missing	✓		
2	Rope splice integrity damaged; e.g. tucks pulled out	✓		
3	Distortion of construction / Diameter inconsistency	✓		
4	Internal abrasion Melted or fused yarns and strands Powdery or brittle fibers	✓		
5	Cuts (fiber, yarn and strands) Two (2) or more adjacent yarns in the 12 strand or 12x12 rope construction; one (1) or more cut strands	✓		
6	Reduction in overall diameter of rope Localized diameter area reduction Stiff and flat areas on rope unable to be flexed back into shape	✓		
7	Heat damage Localized areas of fused and melted fibers	✓		
8	Discoloration caused by unknown source Localized areas that "cleaning" cannot repair	✓		

Cortland is a global designer, manufacturer, and supplier of technologically advanced ropes, slings, cables, and strength members. Collaborating with customers, our team uses its experience in high performance materials and market knowledge to transform ideas into proven products.

For more than 35 years, our custom-built solutions have been developed for work in the toughest environments and to overcome some of the world's greatest challenges. They consistently enable our customers to meet the demands of the aerospace, defense, medical, research, subsea, marine, and energy industries.

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