

INSTALLATION AND

 **TOKYO ROPE USA, INC.**

USER INSTRUCTIONS



**0.6" ϕ CFCC HANDLING, ANCHOR
INSTALLATION AND
MAINTENANCE MANUAL**

MARCH 2023 | VERSION 1.00

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PREFACE

1.1 Introduction and Description of User

Thank you for purchasing and using CFCC and the CFCC anchorage system. CFCC and the CFCC anchorage system is designed and manufactured to the highest quality standards and is backed by the Tokyo Rope USA commitment to service and parts support.

<http://www.tokyoropeco.jp/english/>

This document is intended for precast fabrication managers, foremen and installers that use CFCC and the CFCC anchorage system. Use of CFCC and the CFCC anchorage system shall only be carried out by properly trained personnel.

Your safety and the safety of others depend on the proper handling, installation, operation, maintenance, and understanding in the use of this equipment.

All personnel managing and/or using CFCC must read and understand this manual prior to using CFCC and the CFCC anchorage system. Follow all instructions, warnings, and precautions in the manual. Failure to follow instructions can cause injury or death.

It is the responsibility of the precast fabrication managers, foremen and installers to ensure CFCC and the CFCC anchorage system is used and maintained in a safe and appropriate manner that will not cause damage to or make unsafe in any way the operation of CFCC and the CFCC anchorage system being used.

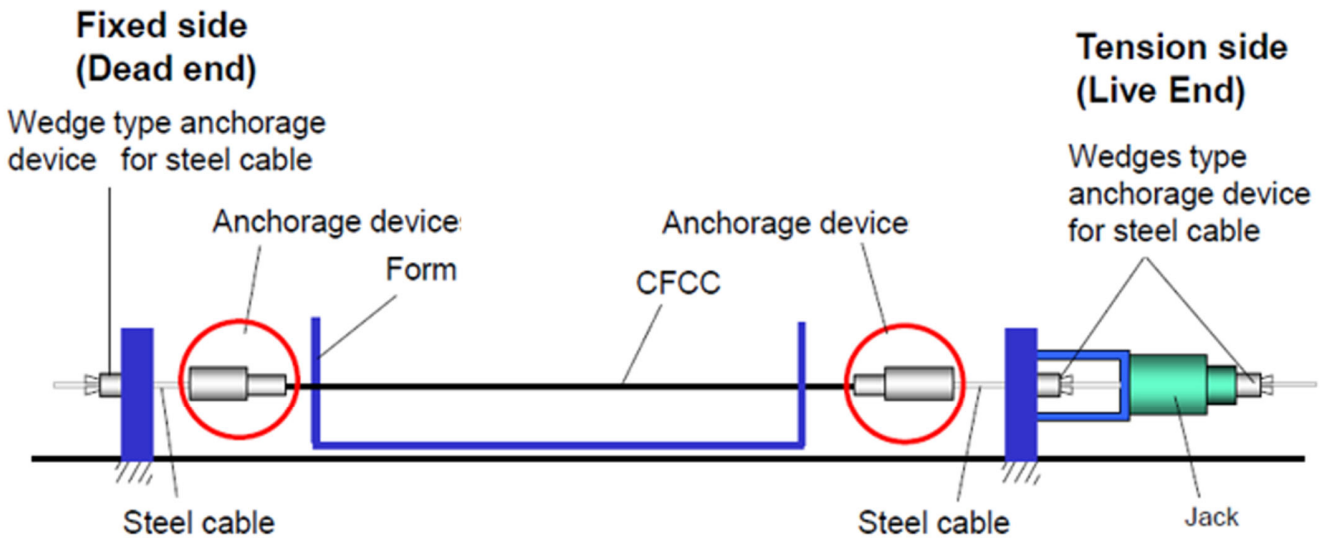
Continuing improvements and advancements of this product may occur at any time.

If any nonconformances are found in the product, do not use that portion of the product and notify Tokyo Rope.

If any questions arise during installation or maintenance of this product, please consult your sales representative, or contact Tokyo Rope USA's corporate office.

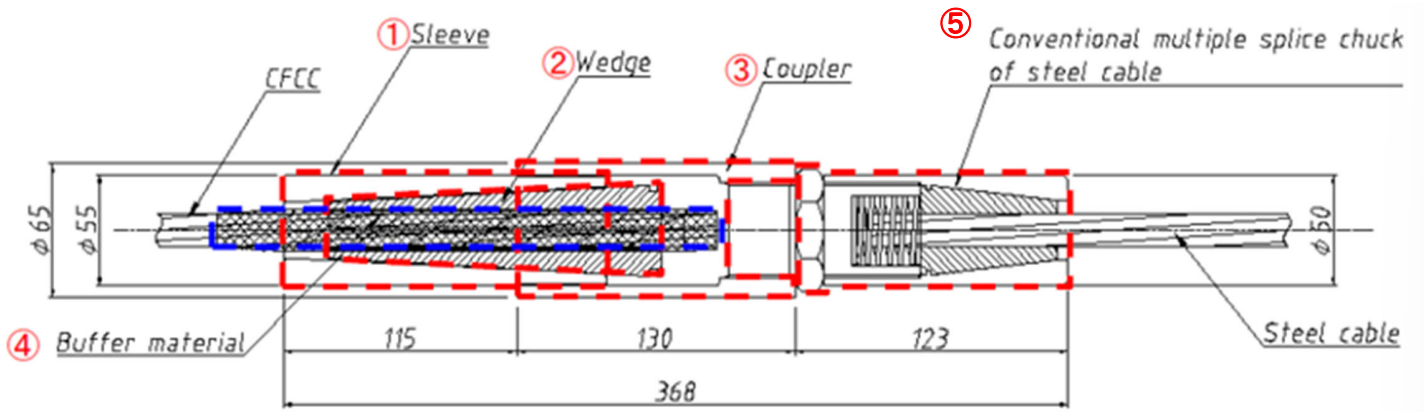
DESCRIPTION OF THE PRODUCT

2.1 System Overview



DESCRIPTION OF THE PRODUCT

2.2 Components of Anchorage System



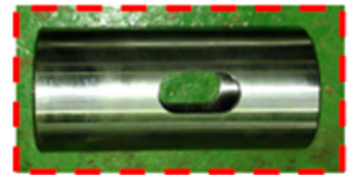
① Sleeve for CFCC



② Wedges for CFCC



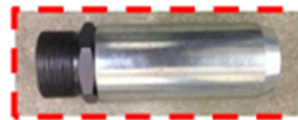
③ Coupler for CFCC



④ Buffer material

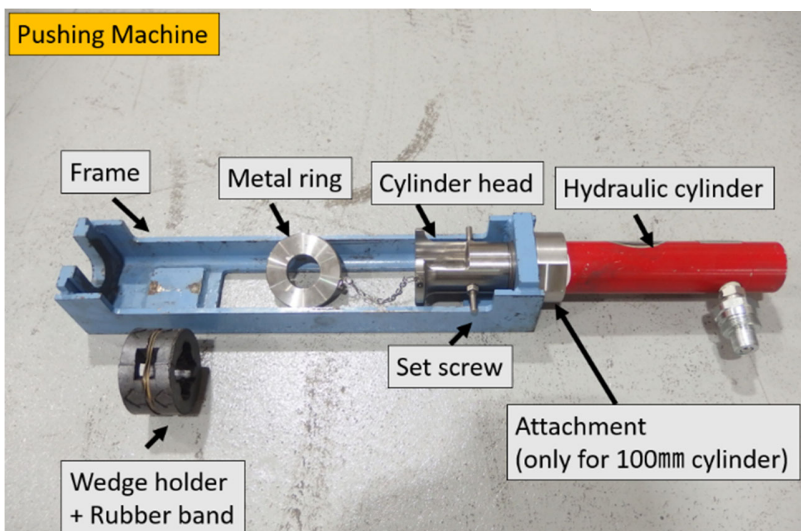
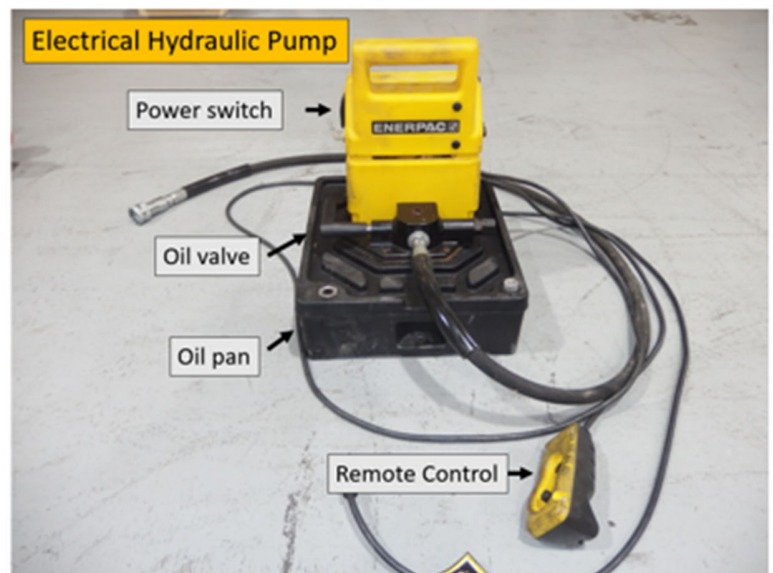
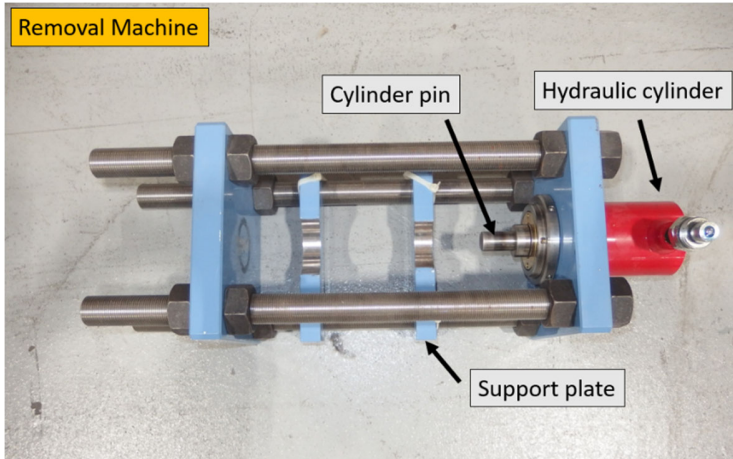


⑤ Conventional multiple splice chuck



DESCRIPTION OF THE PRODUCT

2.3 Installation Tools and Equipment



SAFETY

3.1 Explanation of Safety Warnings

The following safety warnings are used throughout the manual:



This symbol is used to call attention to instruction concerning personal safety. Be sure to observe and follow these instructions.



The signal word DANGER in the manual identifies a hazardous situation which, if not avoided, WILL result in death or serious injury.



The signal word WARNING on the machine and in the manual indicates a potentially hazardous situation which, if not avoided, COULD result in death or serious injury. If CFCC gets damaged, DO NOT use damaged portion of CFCC.



The signal word CAUTION in the manual indicates a potentially hazardous situation which, if not avoided, MAY result in minor or moderate injury. It may also be used to alert against unsafe practices.



This notice identifies procedures which must be followed to avoid damage to the machine.

Instructions are necessary before installing or operating the equipment. All personnel must read and understand this installation and maintenance manual. Follow warnings and instructions in the manual when installing. Failure to follow instructions can cause injury or death.

CFCC HANDLING

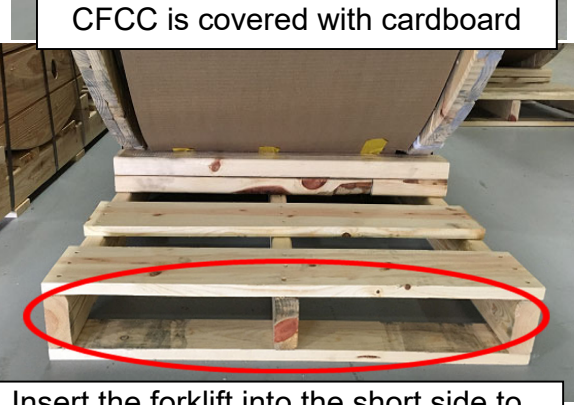
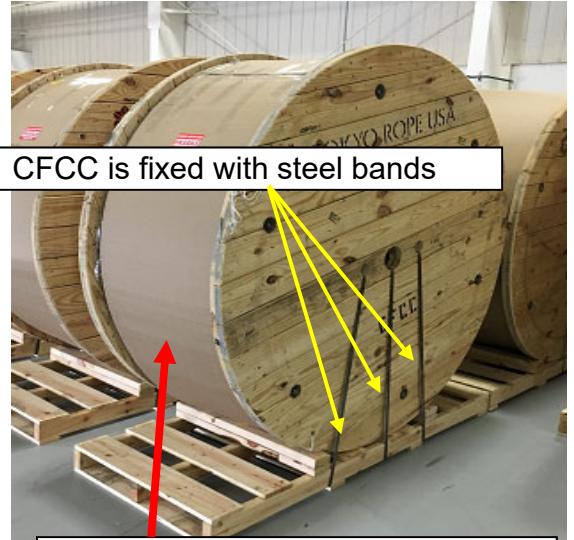
4.1 Unloading and Storage of CFCC

4.1a

CFCC is delivered on a wooden reel and packaged as shown. The wooden pallet is longer than a typical pallet with dimensions of 31" long x 6' high and needs unloaded/transported/moved with a forklift. If a loading dock is not available and the reels are inaccessible by a forklift, a hand truck with 6LF forks is needed to move the reels to the back of the truck so accessible by a forklift. Do not remove the outer cardboard layer until using CFCC and reel is transported to the fabrication site.



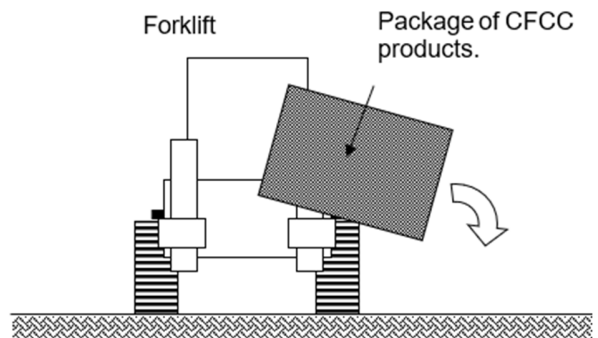
Upon arrival, check the Cardboard Covering for punctures and/or rips. If there are punctures or rips, the outer layer of CFCC could have been damaged during shipping or unloading. Contact Tokyo Rope for further instruction if punctures and/or rips are present.



Do NOT drop CFCC products off a forklift. Dropping CFCC products CAN damage CFCC. Damaged CFCC CAN break during tensioning and cause serious injury or death.

4.1b

If the forklift forks are less than 6 LF in length, the wooden pallet CAN break and the CFCC CAN be damaged by the broken wood (see picture below). Use extension forks if the fork length is less than 6 LF.



CFCC HANDLING



Wooden pallet broken by fork resulting in damage to CFCC.



Extension forks to be used if the fork length is less than 6 LF.

4.1c

Store CFCC in a dry flat location out of direct sunlight. Long periods of sunlight exposure of 2 weeks or more will not affect the strength of CFCC, but it may provide the strand with memory of the round reel shape therefore making it difficult to work with. The wooden reel and pallet can rot and soften if exposed to rain/water.

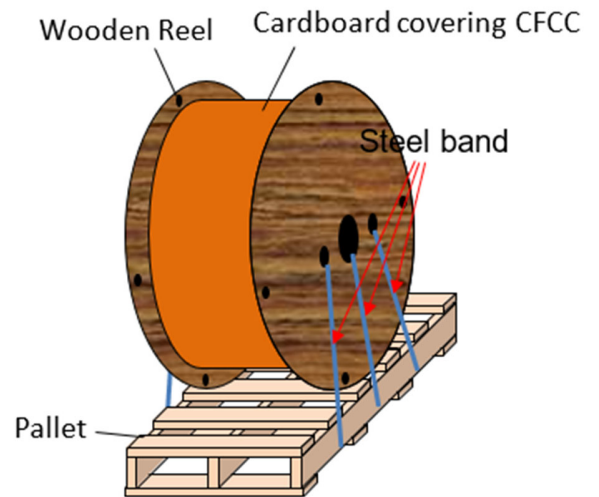


Store CFCC reels such that the reels are stable, will not fall over and/or roll and will not be struck by anything that could potentially damage the CFCC. Store anchorage components in a dry location prior to use to prevent rusting.

CFCC HANDLING

4.2 Unpacking CFCC

Unpack CFCC directly before using. Cut the steel bands that fix the reel to the pallet. Remove the outer cardboard layer and plastic layer below the cardboard.

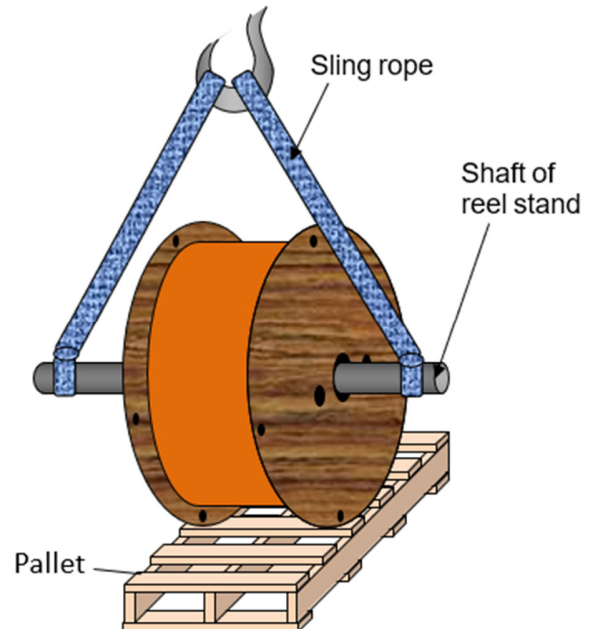



CFCC HANDLING

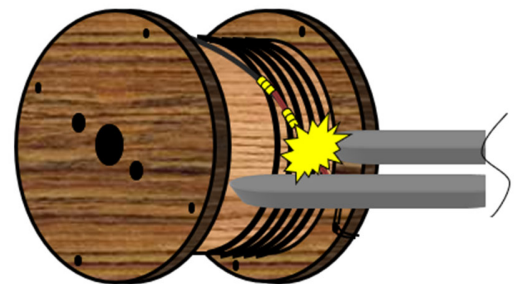
4.3 Transporting CFCC to Fabrication Site

4.3a

Transport the reel to the fabrication site by crane or forklift by Inserting the reel stand shaft into the hole in the reel and hooking the sling rope to the shaft.

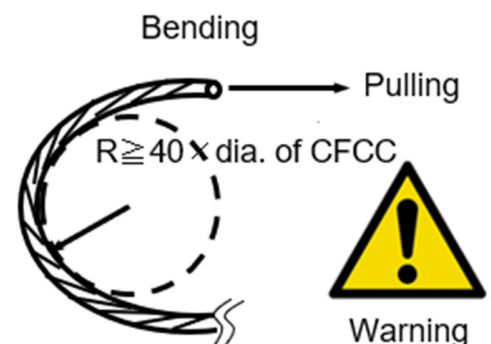


 Take care not to strike and damage the CFCC with the forklift or equipment during transport.



4.3b

Place the reel on the reel stand such that the CFCC can be drawn into the bed from the bottom of the reel. The reel stand MUST be such that the CFCC can be drawn from the reel and pulled through the bed without bending the CFCC more than it's bending limit. Best practice is to construct the reel stand such that CFCC is pulled from the reel into the bed without bends.



The radius (R) must be greater than 40 times the CFCC diameter.

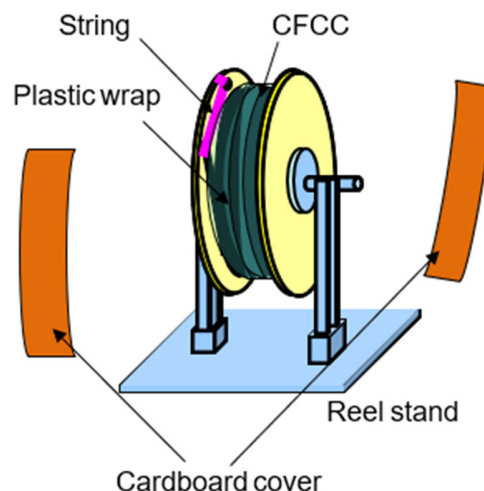
CFCC HANDLING

4.3c

Check again for tears and/or punctures in the cardboard cover. If there are tears and/or punctures, the outer layer of CFCC needs inspected for damage. Any damaged CFCC MUST BE discarded. Remove the cardboard cover from the CFCC.

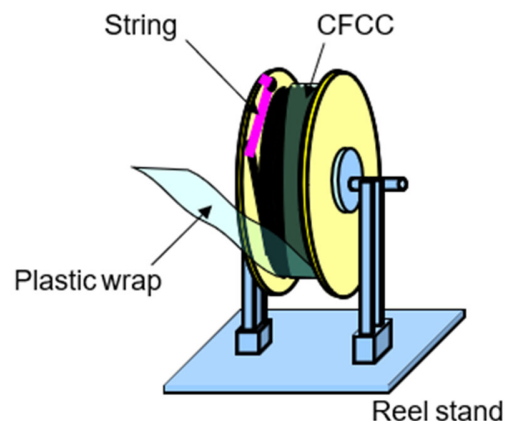


Remove any damaged CFCC prior to use.



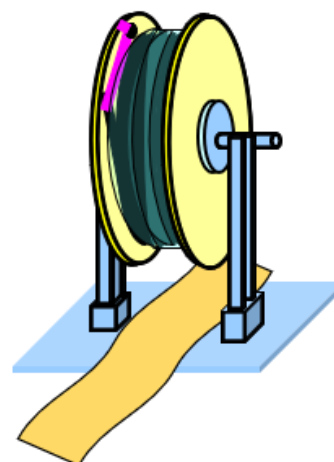
4.3d

Check for tears and/or punctures in the plastic wrap located under the cardboard cover. If there are tears and/or punctures, the outer layer of CFCC needs inspected for damage. Any damaged CFCC MUST be discarded. Remove the plastic wrap from the CFCC.



4.3e

Before withdrawing CFCC, set a protection sheet (cardboard, etc.) under the reel to prevent CFCC from being scratched by any obstructions on the ground.



CFCC HANDLING

4.4 Method to Pull Out CFCC from the Reel

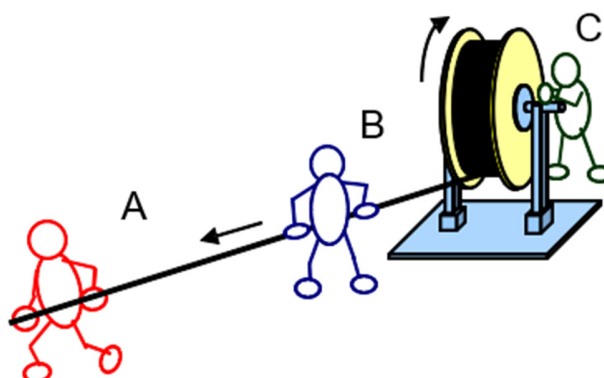


Personal Protective Equipment should be worn when installing the CFCC anchorage system. Carbon fibers can transfer from CFCC to the skin during installation of the anchorage system causing skin irritation. The metal anchors can heat up from the sunlight and be too hot to handle without gloves. Shards of carbon fiber can spray from the CFCC during cutting of the strand and enter the eyes causing irritation and/or serious eye injury.

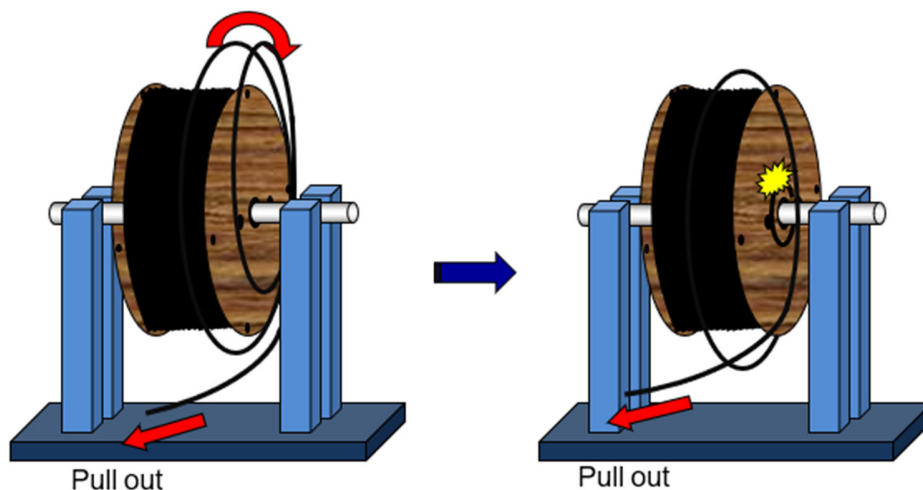


4.4a

Pull out CFCC from the bottom of the reel into the bed or alongside of the bed. While CFCC is being drawn from the reel, a worker must hold the outside reel flanges to control the rotation speed of the reel to prevent the CFCC from unwinding too quickly and becoming loose during this process.



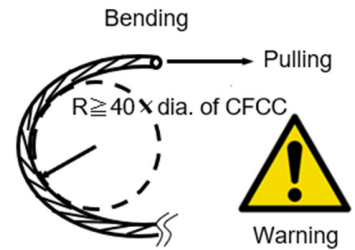
If the CFCC becomes loose as it's being drawn from the reel, the CFCC may potentially move outside the reel flange and wrap around the shaft damaging the CFCC due to the tight bend.



CFCC HANDLING

WARNING

Do NOT bend CFCC such that the radius becomes less than 40 times the diameter of CFCC. CFCC WILL lose strength at the local bend location and experience internal and external damage.



If the CFCC becomes loose as it's being drawn from the reel, proceed as follows:

If the CFCC becomes slightly loose, but does not loosen more than the outer rim of the flange (distance H), increase the braking pressure to remove looseness.



If the CFCC becomes loose such that it sags outside of the rim of the flange (distance H), STOP pulling out the CFCC and correct the condition. Correct the condition by pulling out the CFCC very slowly while increasing the braking pressure until the loose CFCC is removed, rewinding afterwards as necessary. When rewinding the CFCC, ensure the CFCC rewinds evenly without looseness on the reel and does not overlap.



Overlapping the CFCC during rewinding may damage the CFCC when pulling it back out due to bending. Once corrected, continue pulling out the CFCC slowly with increased braking pressure.

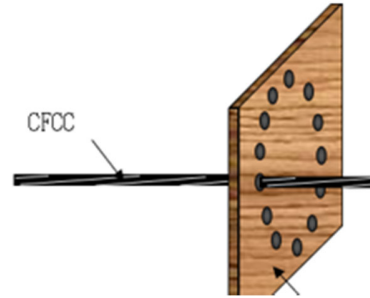
Ensure there is no looseness in CFCC while rewinding.



CFCC HANDLING

4.4b

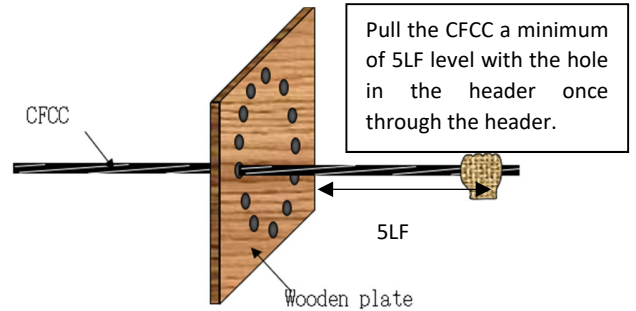
Wooden headers **MUST** be used to prevent damage to the CFCC from the sharp metal holes. If wooden headers are not used, the metal holes **MUST** be chamfered so that contact between the CFCC and steel is with a smooth rounded steel surface.



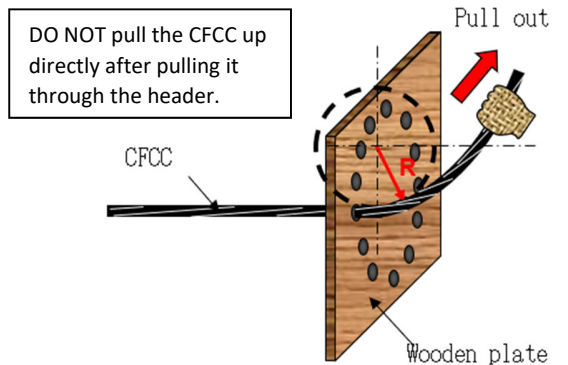
Wooden headers **MUST** be used.

4.4c

When walking the CFCC down the bed, keep the CFCC straight (at the same height as the hole in the header) for a minimum of 5 LF once the CFCC is through the header before continuing to walk the CFCC down the bed at a higher height.



DO NOT pull the CFCC up at an angle directly after pulling it through the header.

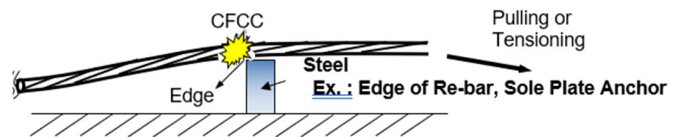
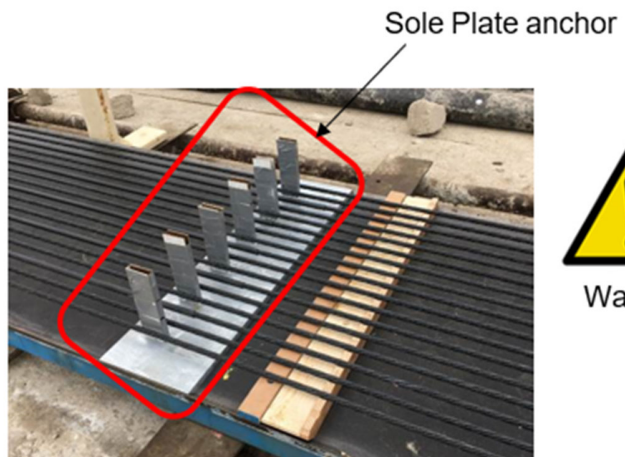
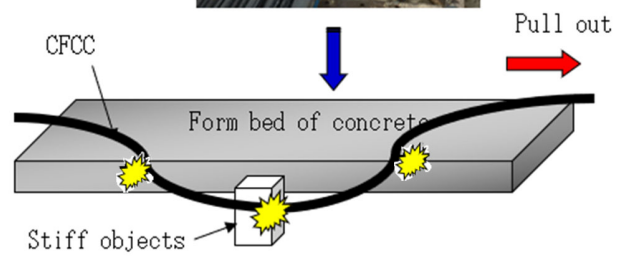
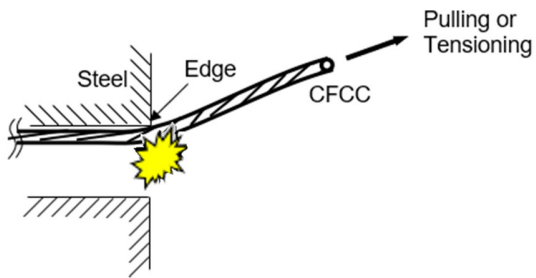


CFCC HANDLING

⚠ WARNING

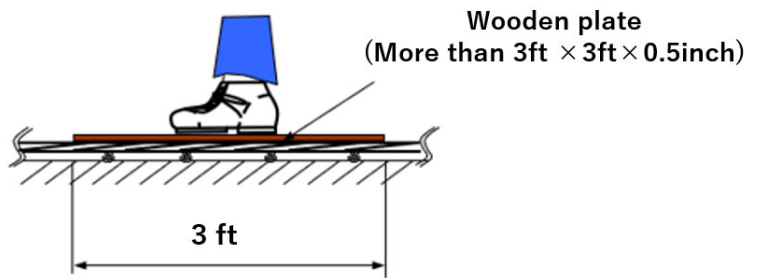
Do not pull CFCC forcefully against metal edges.

CFCC CAN be damaged from metal edges. Protect edges as necessary before pulling CFCC from the reel.

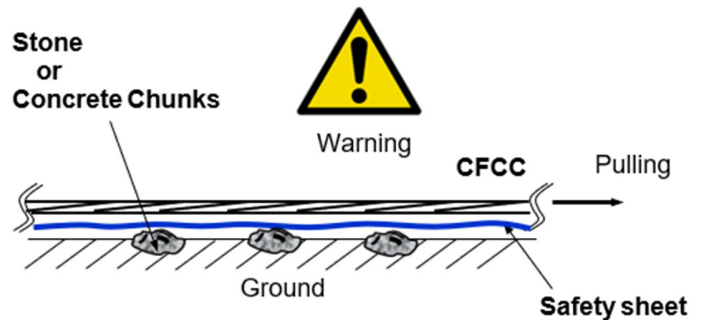


CFCC HANDLING

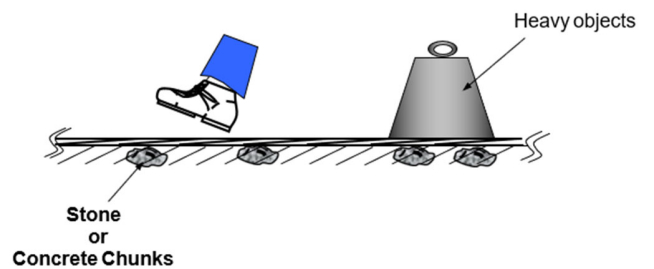
⚠ WARNING Do NOT step on elevated CFCC without distributing the load. Place a wooden board with a minimum area of 9ft² on top of CFCC before stepping on CFCC to spread the force evenly.



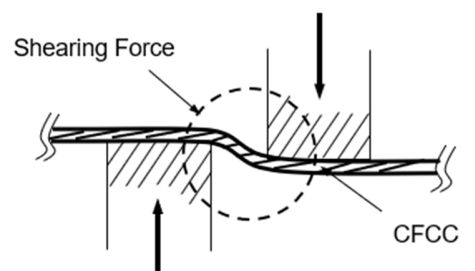
⚠ WARNING Do NOT drag CFCC over concrete chunks or stone on the ground when pulling out or moving CFCC. This CAN damage CFCC. Spread a safety sheet over the ground if CFCC must be pulled in these conditions.



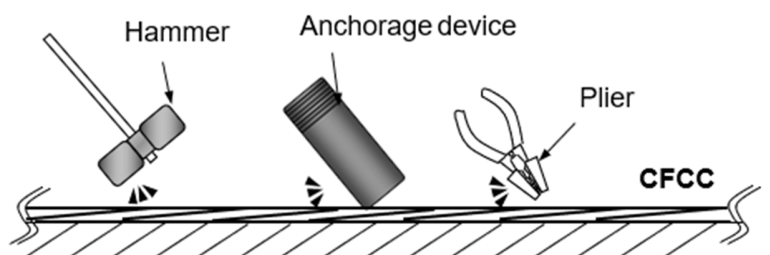
⚠ WARNING Do NOT step on or place heavy objects on CFCC on uneven ground. This WILL result in shear force damage and/or damage from hard edges.



⚠ WARNING Do NOT apply shear force to CFCC. CFCC is weak against forces applied at right angles to its axis.



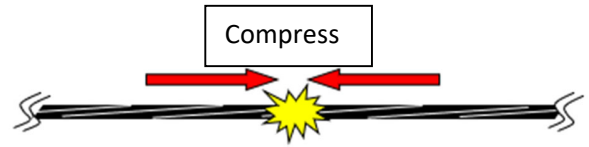
⚠ WARNING Do NOT drop hard objects such as tools on CFCC.



CFCC HANDLING

⚠ WARNING

Do NOT compress CFCC. CFCC is vulnerable to compressive force in the axial direction and CAN easily damage if compressed.



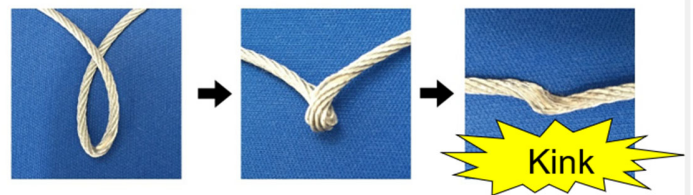
⚠ WARNING

Do NOT kink CFCC. CFCC can become kinked if pulled while twisting or looped. Kinked CFCC has significantly reduced strength and WILL be damaged internally and externally.



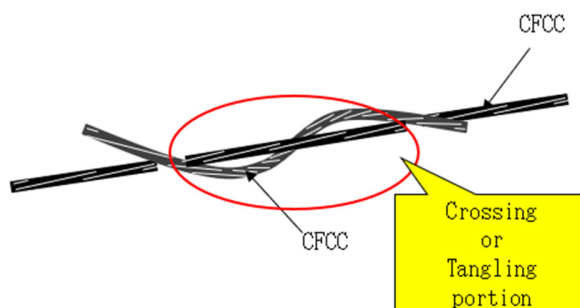
Twisting of CFCC

Looping of CFCC



⚠ WARNING

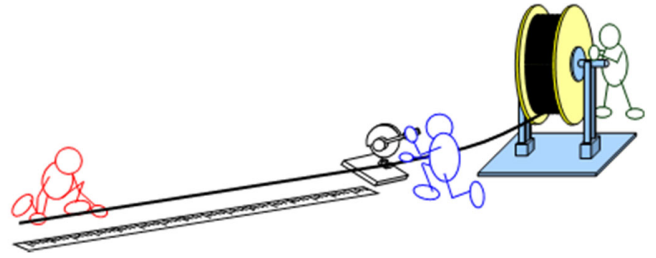
Do NOT apply tension to CFCC when CFCC is crossed or tangled.



CFCC HANDLING

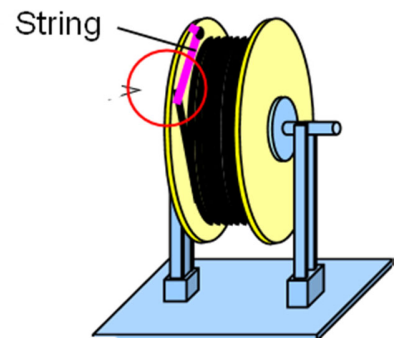
4.4d

Measure and mark the portion of CFCC to be cut.
Cut the CFCC cable with a grinder.

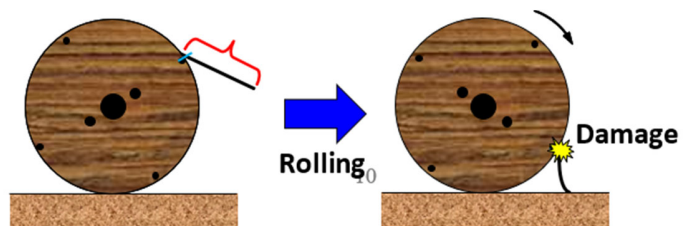


4.4e

Fasten the end of the CFCC to the reel with a string any time the CFCC is not being used.



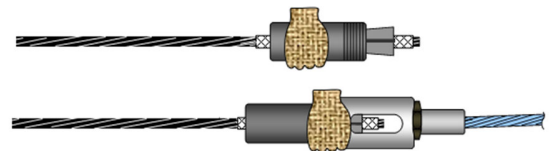
⚠ Ensure the CFCC is not protruding outside the edge of the reel flange to avoid damage to the end of the CFCC from being hit and/or rotation of the wheel.



4.4f

Transfer anchorage components to fabrication site at time of fabrication to avoid rusting while not in use. Install anchorage system – See Chapter 5 and Chapter 6 for anchorage system installation and anchor staggering instructions, respectively. Anchor staggering is not always required as explained in Chapter 6.

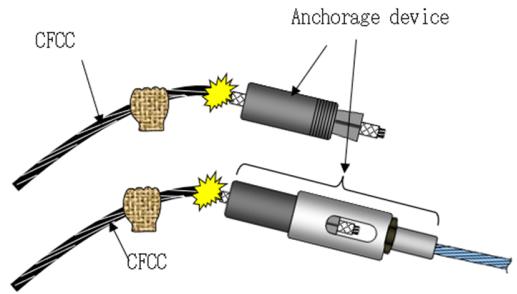
When lifting/moving CFCC and the anchors after the anchors are installed, make sure to hold the anchors and NOT the CFCC.



CFCC HANDLING

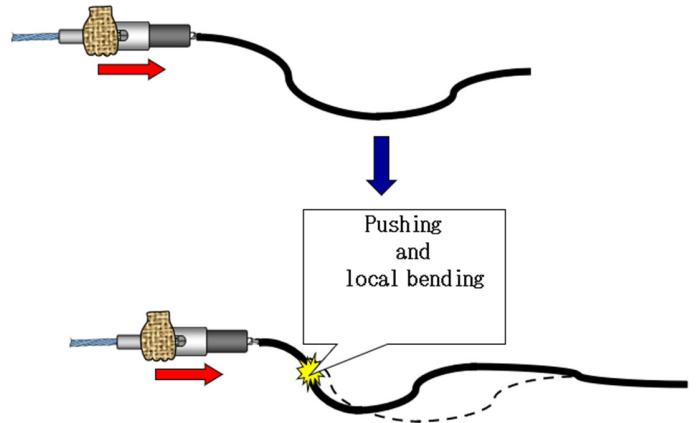
⚠ WARNING

Do NOT lift/move the anchors/CFCC after the anchors are installed by holding the CFCC. This can reduce the strength of the CFCC near the anchor and/or damage the CFCC.



⚠ WARNING

Do NOT hold the anchor and compress the CFCC from one side. This will cause local bending which CAN reduce the strength of CFCC and/or damage the CFCC at the bend.



CFCC HANDLING

4.5 Initial and Final Tensioning

4.5a

Once the anchorage devices are installed, perform the initial tensioning work.

4.5b

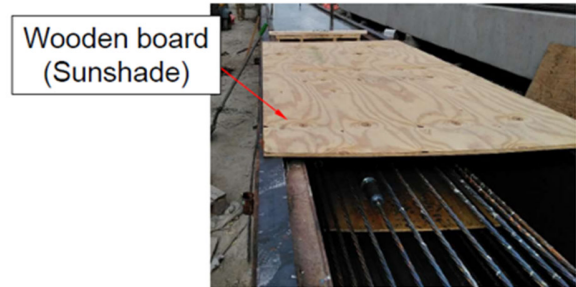
Check to ensure the CFCC and steel cables are not crossing and the CFCC anchor locations will accommodate the anchor movement due to elongation during final tensioning.

4.5c

After the initial tensioning and verification in Step 4.5b, perform the final tensioning. If the anchors are staggered, the tensioning order **MUST** be such that the anchors do not hit each other during tensioning.

4.5d

Cover the anchorage devices with wooden boards, tarps, or other methods to provide protection from the sunlight. Position the cover to ensure the anchorage devices are always shaded as the sun changes position.

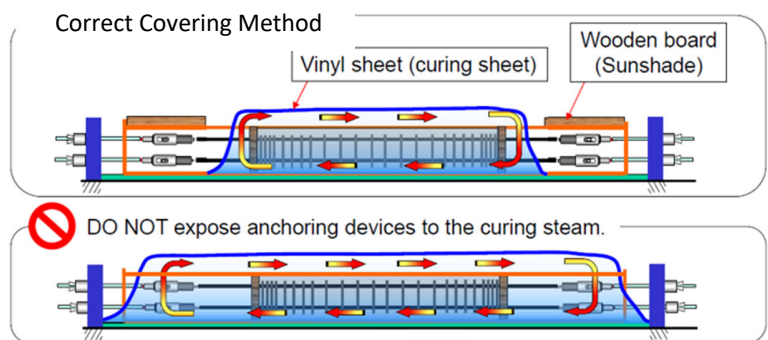


The anchors **MUST be managed so that their temperature does not exceed 122°F (50°C).**

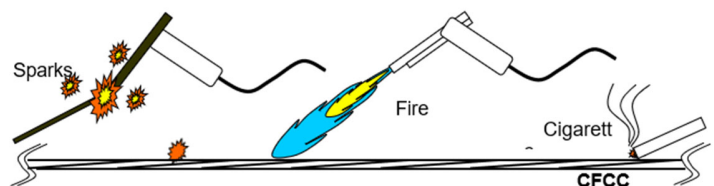


DO NOT expose

the anchorage devices to the heat from steam produced during curing of the concrete. The anchorage devices **MUST be covered separately from the curing concrete.**



Do NOT expose CFCC to fire and/or extreme heat. CFCC is solidified with epoxy resin and vulnerable to fire. The quality of resin **WILL change and the strength of CFCC **WILL** be seriously lowered when in contact with extreme heat, such as welding sparks, flame, cigarette fire, etc.**



ANCHOR STAGGERING

5.1 Secure Buffer Material on CFCC Strand

5.1a

Undo the blue and red Velcro from each other.

5.1b

Insert the end of the CFCC through the buffer material making sure the red Velcro is at the end of the CFCC. Leave 1" of CFCC protruding from the end of the buffer material.

5.1c

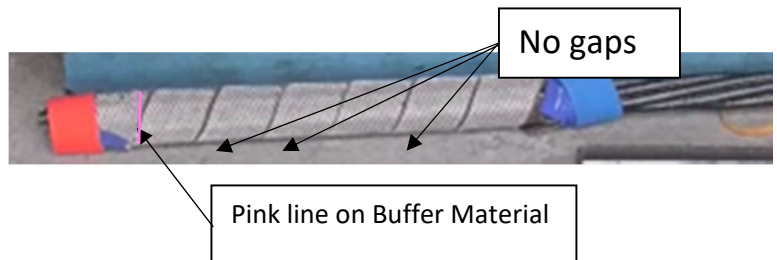
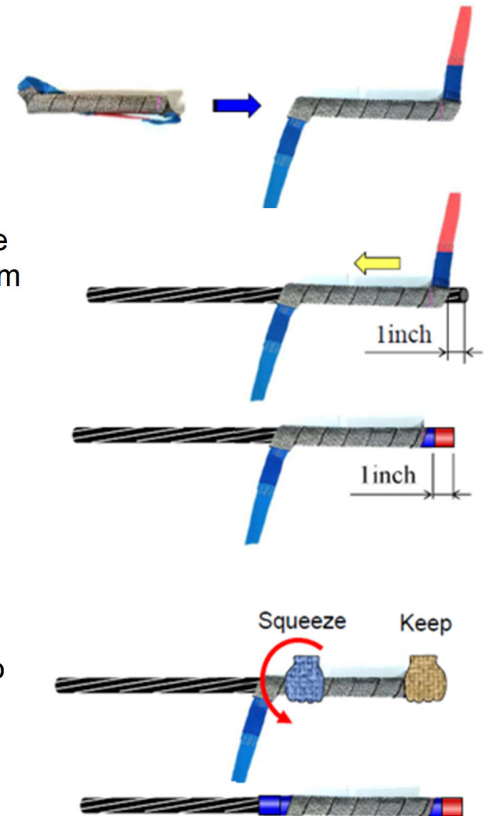
Starting with the red Velcro, tightly wind the Velcro around the 1" protruding portion of CFCC.

5.1d

While tightly holding the end of the buffer material over the red Velcro, twist the opposite end of the buffer material adjacent to the blue Velcro to secure the buffer material to the CFCC. Once the buffer material is twisted as tightly as possible to the CFCC, tightly wind the blue Velcro around the CFCC adjacent to the buffer material to keep the buffer material tightly in place.

5.1e

Check the buffer material for fit. The buffer material should be tight to the CFCC so that there is NO movement of the buffer material on the strand and there should be NO gaps in the buffer material.



CAUTION No loose or gapped Buffer Material

ANCHOR STAGGERING

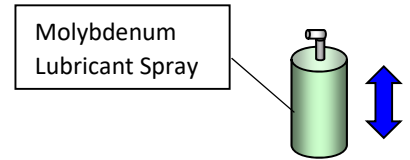
5.2 CFCC Sleeve Preparation

5.2a

Shake spray can vigorously until you hear a rattling sound.

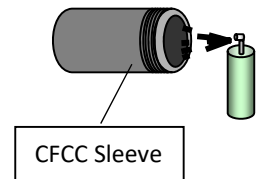


Rattling sound **MUST** be heard before spraying to ensure the Molybdenum is consistently mixed with thinner.



5.2b

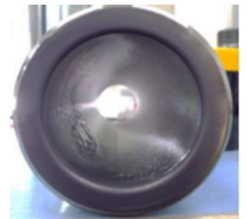
Spray the molybdenum lubricant inside the CFCC sleeve making sure to cover the inside of the sleeve completely. Spray the entire inside of the sleeve for about 2 seconds (2 turns around the inner circumference can be used as a guide).



5.2c

Check the molybdenum spray coating. The inner surface of each sleeve **MUST** be visually inspected after being sprayed to ensure none of the steel surface is visible and is entirely coated with molybdenum. Check both ends of sleeve. The entire inside of the sleeve should be dark grey in color due to the coloring of the molybdenum spray. CFCC sleeve needs to be properly coated with molybdenum allowing the wedges to move into place securing the CFCC during tensioning.

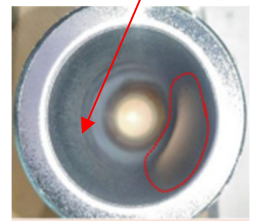
ACCEPTABLE – steel surface is entirely coated.



WARNING

Do not use CFCC sleeve if insufficiently coated with spray. Insufficient molybdenum coverage CAN cause slippage. Slippage WILL make CFCC and anchorage system break/fly at high speed and CAN cause serious injury or death.

NOT ACCEPTABLE – steel surface is visible.



5.2d

Slide CFCC sleeve onto the CFCC until it passes the buffer material.

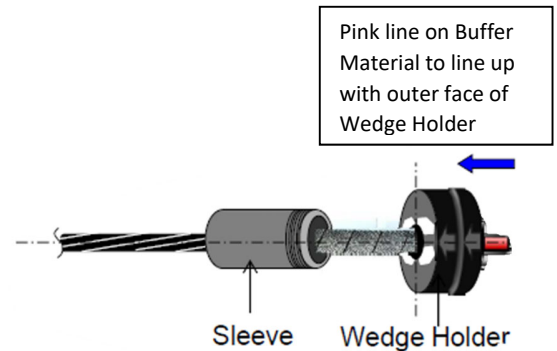



ANCHOR STAGGERING

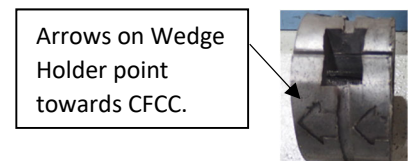
5.3 Secure Wedges and CFCC Sleeve to CFCC

5.3a

Slide the Wedge Holder onto the Buffer Material so that the outside face of the Wedge Holder is in line with the pink line on the Buffer Material (near red Velcro).
 Note: The rubber band around the Wedge Holder keeps it closed to prevent the Wedges from falling out.

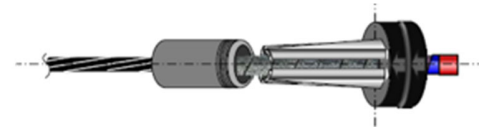


 Arrows on Wedge Holder to point towards CFCC.



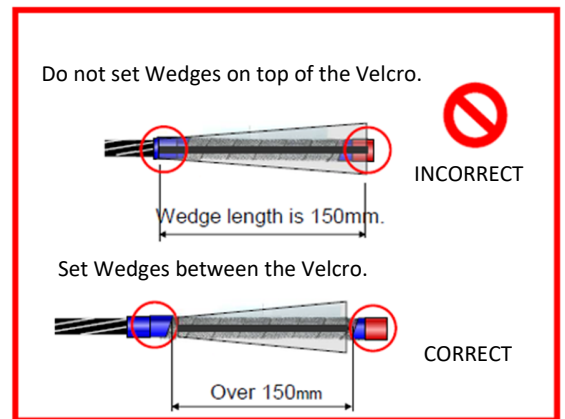
5.3b

Slide each of the (4) wedges into the (4) holes in the Wedge Holder until the top of the Wedges are flush with the outside face of the Wedge Holder.



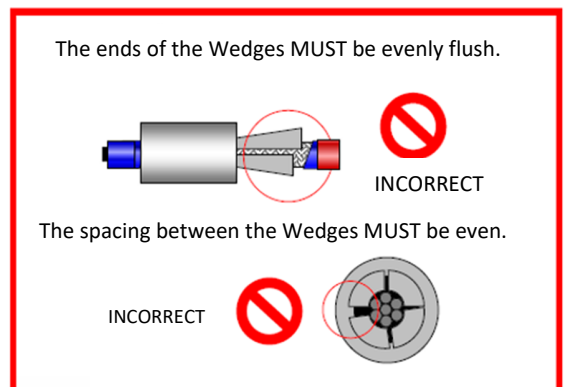
5.3c

Check to ensure Wedges are sitting between blue and red Velcro and NOT on top of the Velcro.
 The Wedges MUST be fully supported by Buffer Material.



5.3d

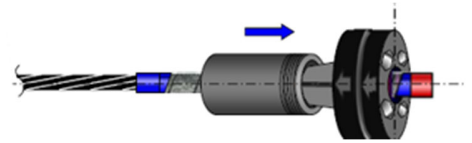
Check to ensure Wedges are flush and even at end.



ANCHOR STAGGERING

5.3e

Slide the CFCC Sleeve over the Wedges until it stops sliding, ensuring the Wedges stay in place.



⚠ WARNING

Do not proceed to next step until Wedges are fully seated on Buffer Material, evenly flush at ends and evenly spaced. Improper seating of wedges CAN cause slippage. Slippage WILL make CFCC and anchorage system break/fly at high speed and CAN cause serious injury or death.

5.3f

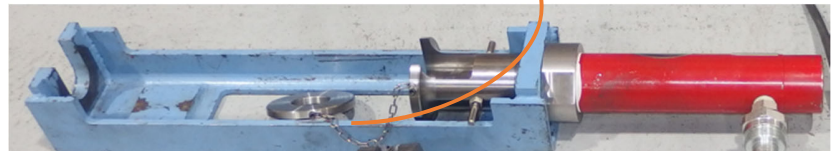
Prepare Pushing Machine by fully rotating cylinder clockwise until fully seated. Once seated, set the set screw to keep the cylinder at this position and prevent it from rotating counterclockwise.

5.3g

Place Metal Ring around end of CFCC against Wedge Holder. Then place the Sleeve / Wedges / Wedge Holder unit into the Pushing Machine.



Place Metal Ring around end of CFCC against Wedge Holder before setting unit into the Pushing Machine.



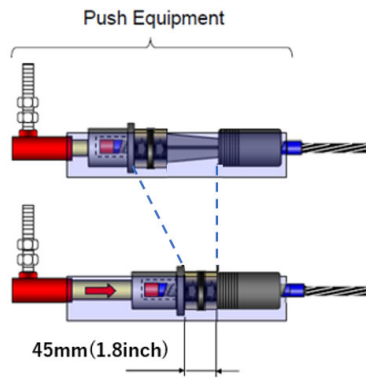
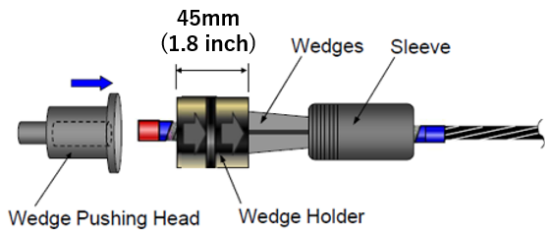
⚠ CAUTION

Metal Ring MUST be used for Wedges to be pushed into the CFCC Sleeve evenly.

5.3h

Push the Wedges into CFCC Sleeve by pressing the remote control button on the Pushing Machine until the cylinder head stops and reaches its limit position. Once the header stops, take thumb off button to stop machine and remove wedge holder.

ANCHOR STAGGERING

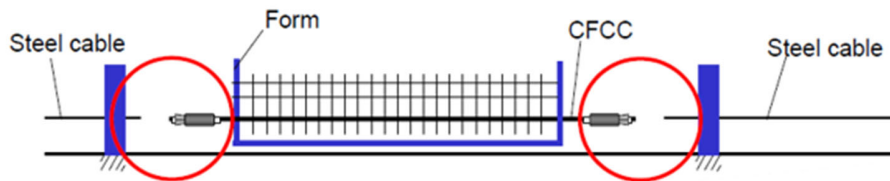


ANCHOR STAGGERING

5.4 Connect CFCC to Steel Strand

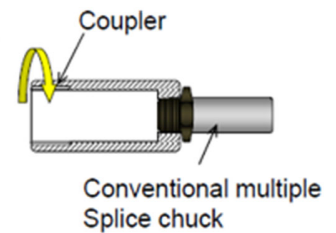
⚠ WARNING

Ensure the lay direction (twisting direction) is the same as that of CFCC to prevent the CFCC from untwisting. It is also advised that the diameter of the steel cable is the same as that of CFCC. CFCC loses strength when untwisted and CAN break during tensioning causing the anchorage system break/fly at high speed and CAN cause serious injury or death.



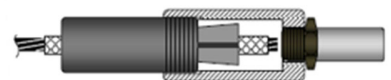
5.4a

Connect Coupler to Conventional Splice Chuck. Spray the inside of Conventional Multiple Splice Chuck with Molybdenum Spray and assemble chuck using the same method as a typical steel chuck. Fully thread the Coupler onto the Conventional Multiple Splice Chuck, turning a half-turn back in opposite direction once fully threaded. Turning a half turn back in opposite direction makes it easier to remove the Splice Chuck from the Coupler.



5.4b

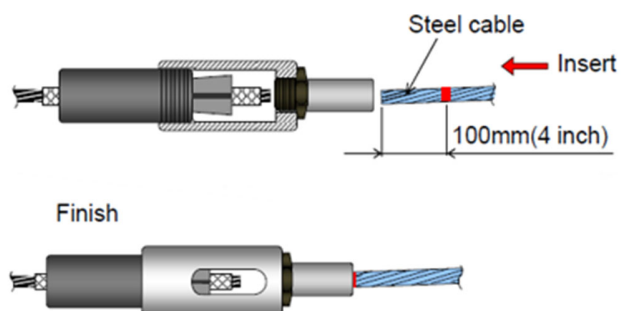
Connect Coupler to the Sleeve / Wedges unit. Fully thread the opposite end of the Coupler to the Sleeve / Wedges unit by turning the Coupler, turning a half-turn back in opposite direction once fully threaded. Turning a half turn back in opposite direction makes it easier to remove the CFCC Sleeve from the Coupler.



Do not turn the CFCC Sleeve to thread the sleeve to the coupler. This will untwist the CFCC.

5.4c

Mark the Steel Cable to be connected to the CFCC 4" from the end and insert into the Conventional Multiple Splice Chuck, making sure the entire 4" portion of steel cable is inserted.

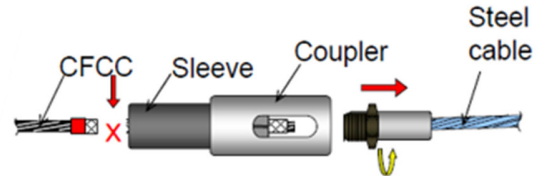


ANCHOR STAGGERING

5.5 Remove Wedges from CFCC Sleeve [After Detentioning]

5.5a

Cut off CFCC from CFCC Sleeve flush with Sleeve (if CFCC is not cut flush with Sleeve, the Sleeve / Wedges unit may not fit in the Removal Machine).

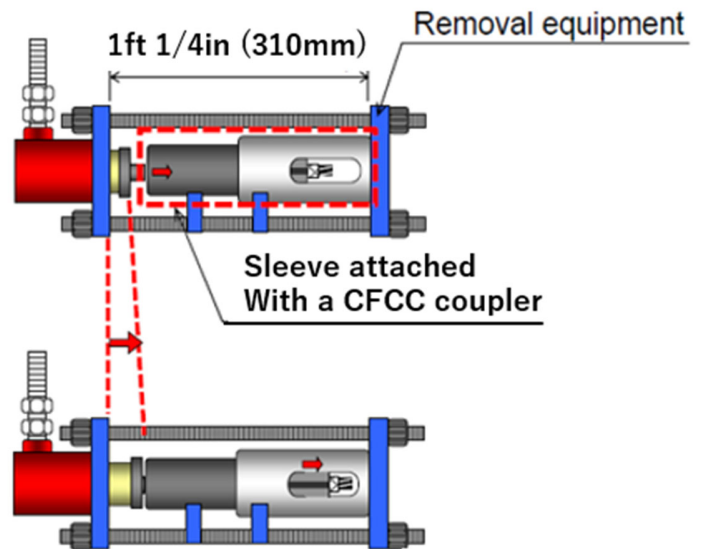


5.5b

Detach Coupler from Conventional Multiple Splice Chuck.

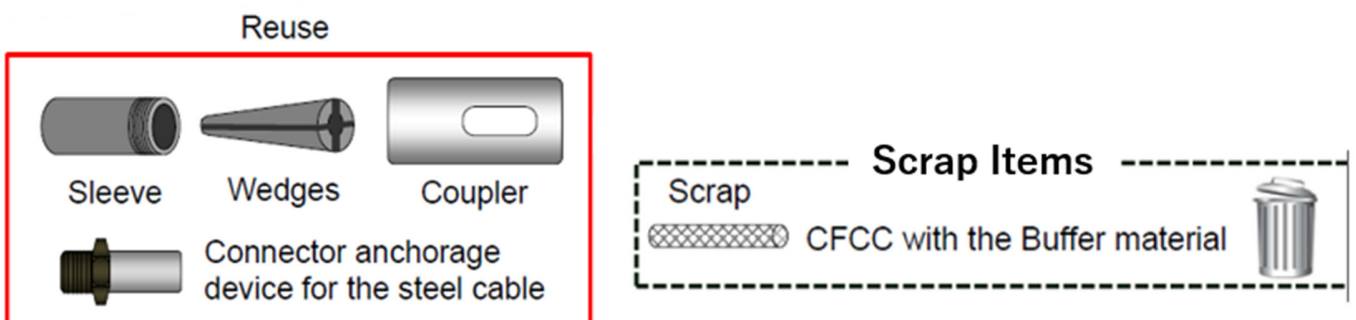
5.5c

Set the Sleeve / Wedges unit into the Removal Machine and Press the button on the Removal Machine until the Wedges are removed.



5.5d

Save and reuse the Reuse Items and return to Tokyo Rope at completion of project. Discard the Scrap items.



5.6 CFCC Anchor Installation and Removal Videos

Installation video : [0.6" φ CFCC Anchor Installation Video](#)

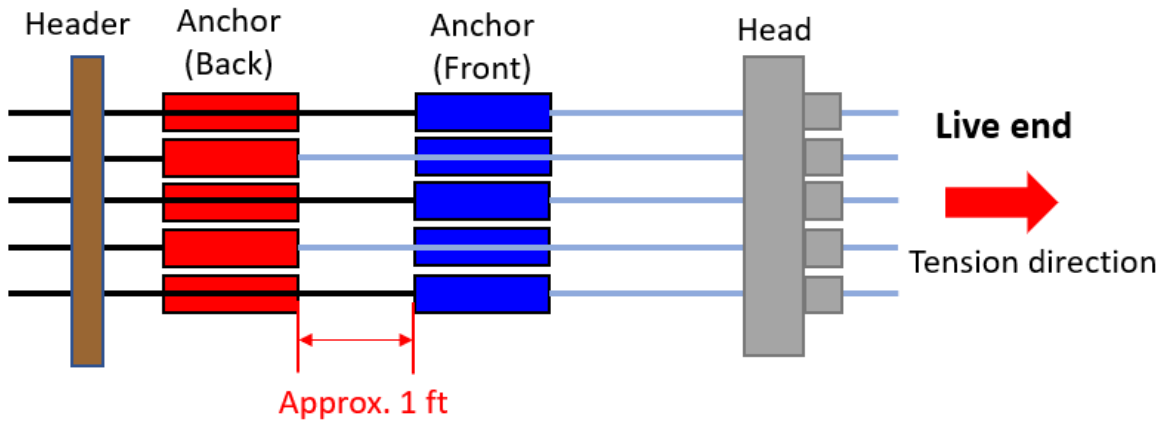
Removal video : [0.6" φ CFCC Anchor Removal Video](#)

ANCHOR STAGGERING

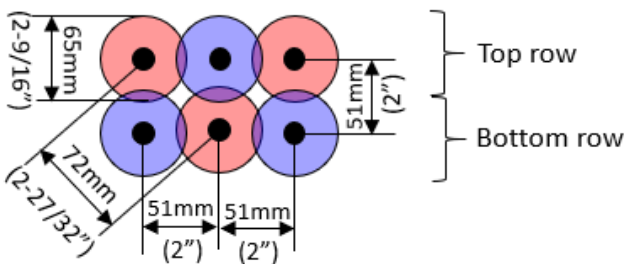
6.1 Anchor Staggering

The width of a CFCC anchor is 2.56 inch (65mm). If the spacing between strands is less than 2.56 inches, staggering is required. Stagger the anchors and tension the CFCC per the positioning and tensioning order below.

Schematic of Bed with Staggered Anchors



Cross Section Views of Staggered Anchors



Tensioning Order with Staggered Anchors

(1) **Blue** → (2) **Red**

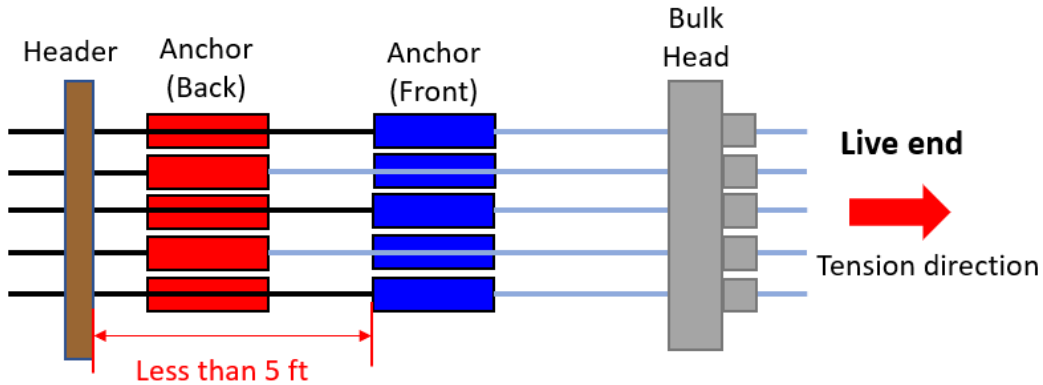
ANCHOR STAGGERING

6.2 Precautions of Anchor Staggering

6.2a



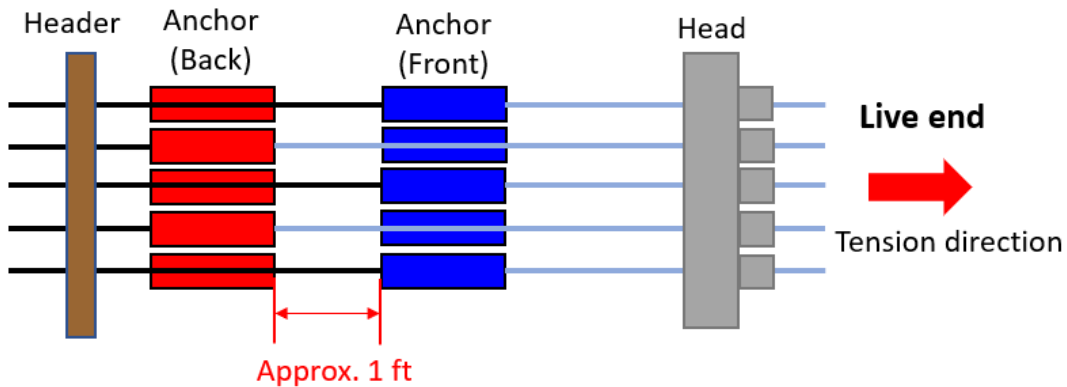
The length of CFCC from the end header to front anchor should be less than 5 ft. If this CFCC length is exceeded, the anchors may recoil during detensioning.



6.2b



The length of CFCC from the back anchor to the front anchor should be approximately 1 ft. Too short of a length CAN cause the front and back anchors to make contact during tensioning.



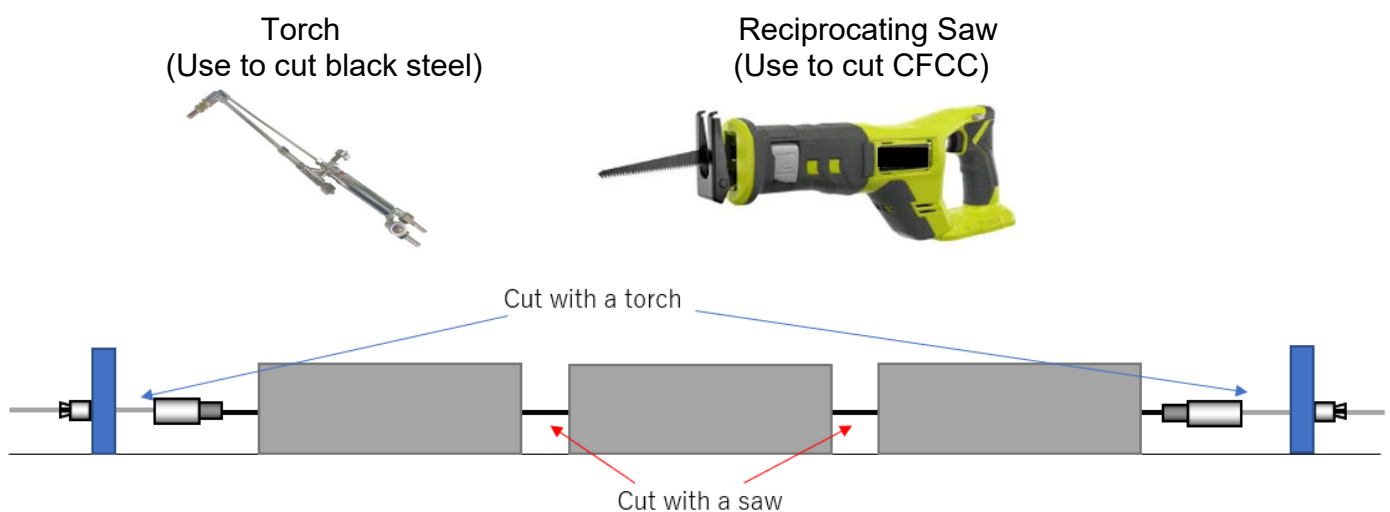
DETENSIONING

7. Detensioning

CFCC elongation is greater than the elongation of steel cable. The higher CFCC elongation may cause the anchors to recoil and fly resulting in an accident if the detensioning work is not performed correctly.

7.1 Tools

A torch CANNOT be used to cut CFCC. A blade such as a reciprocating saw or grinder must be used to cut CFCC.



7.2 Detensioning Method

⚠ WARNING

Detensioning CFCC must be done carefully to prevent anchors from recoiling.

The detensioning method is project specific. Tokyo Rope will provide the detensioning method for each project.

⚠ If the CFCC between the anchor and the beam is long, the recoiling is intense.



If length of CFCC greater than 5LF, intense recoiling MAY occur.

MAINTENANCE

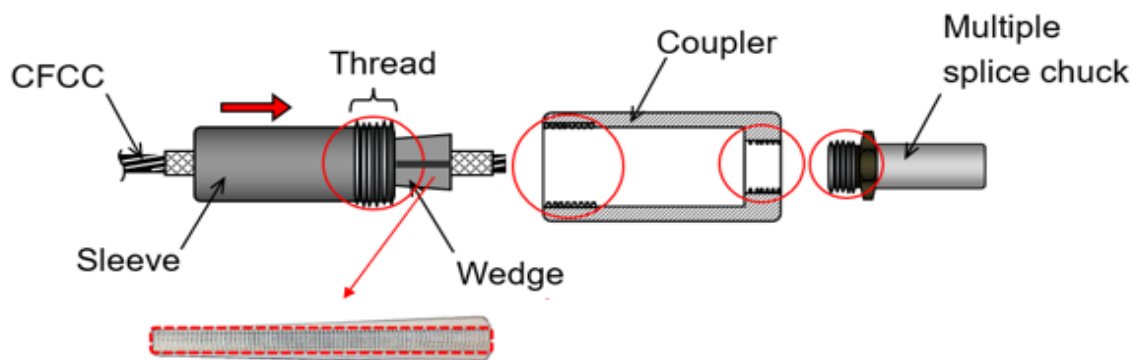
8. Maintenance

Proper maintenance is crucial to keep the anchorage devices safe and operational.

8.1 Cleaning

The figures below show the parts of each anchorage device that must be cleaned after each casting. Brush all threading with a wire brush and wipe the wedges and sleeve with a piece of cloth. Spray molybdenum on the inner sleeve surface to prevent rust from forming.

Threading to be Cleaned with Wire Brush



(Wire Brush)

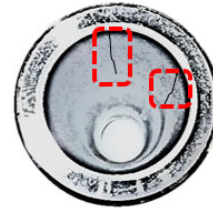
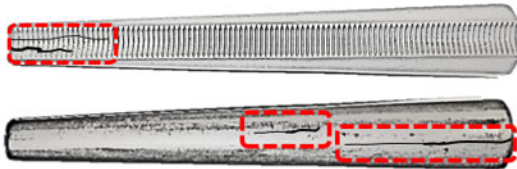


MAINTENANCE

8.2 Inspection

Check the anchorage device parts for damage (cracks, scratches, chips, bends, rust, etc.).

(Crack)



(Scratch)

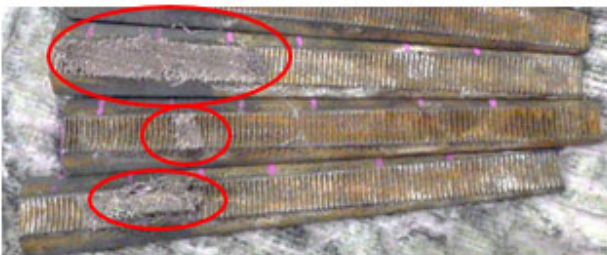
(Rust)



(Chip)



(Parts of Buffer Material Stuck to Wedge)



The following items **MUST NOT** be used:

- Damaged devices (Figures above) – Store separately to avoid using in error. If devices cannot be repaired by using the cleaning procedure several times.
- Damaged wedge holder (inside tabs are torn). Damaged wedge holders should be discarded.

 **WARNING**

CFCC may slip from anchor during tensioning if damaged devices are used. Devices **MUST be inspected before installing anchorage devices to avoid a CFCC slippage accident.**

EQUIPMENT RETURN

9.1 Equipment to Return

Return the following tools and equipment to Tokyo Rope upon completion of project:

Pushing Machines
Removal Machines
Electrical Hydraulic Pumps
Wedges
CFCC Sleeves
Couplers
Multiple Splice Chucks
Unused Buffer Material
Damaged devices described in Section 8

Ship items listed above to:

Tokyo Rope USA
8301 Ronda Drive
Canton, MI 48187