SELF-LOCKING TERMINATION

ASSEMBLY GUIDE

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Version: 1.2

Contents

1 Intro

This document shows the assembly process for the EIVA **Self-locking Termination**.

The design incorporates an internal cone and core design – not seen in any other public systems before. This locking mechanism will ease the process of assembling the termination and make it possible to reuse components in case of a necessary re-termination.

Figure 1 – EIVA Self-locking Termination – with cable running through

The termination is based around a 7-piece design. The two layers of wire strands are wound around an internal **Termination double cone**. This geometry ensures optimal lay between the individual wires and equally sharing of the tension forces between the individual wire strands.

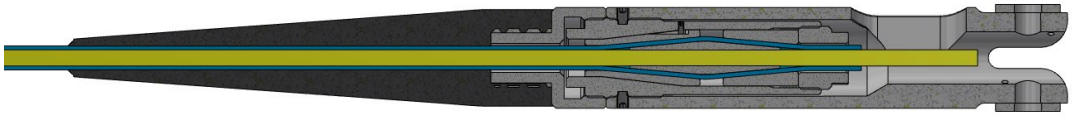


Figure 2 – Cut-through view – with coloured tow-cable

The termination is rated at 1200 kg SWL. Testing results show that even close to the breaking limit of the cable, the locking mechanism still holds and does not fail. The termination has been tested up to 6500 kg. The rated breaking limit for the Ø11.43 wire is 7200 kg.

2 Installation guidelines

Be sure to read and fully understand the procedure before starting the assembly procedure.

The internal parts are precision-made and must be handled with care. You must minimize damage, contamination from other metals or distortions of the parts – both through proper handling and storage, as described in this guide, until mounted on the desired cable.

The internal parts of the termination are designed to work with specific steel armoured cables. The termination will therefore NOT work on any other type of cable or wire unless tested and approved by EIVA – reach out if you would like to use the termination on another type of cable.

The EIVA **Self-locking Termination** may be removed and re-installed. If removal of the termination is necessary, before second use the parts must be inspected for damages and possible deformities. In case the internals are damaged, re-termination-kits (spare parts) are available.

It is strongly recommended to use a workspace which is well ventilated and lit. When making the pigtail-mould connection, fresh air is needed.

When completing this assembly, a strong vise is necessary, and a clean work area is recommended. The vise must be able to withstand 200 Nm of torque in the assembly process.

2.1 Safety considerations

To obtain the expected strength and function from the termination, be sure to use the correct sized products for your cable.

Gloves and eye protection should be worn during the installation of the **Self-locking Termination**.

This guide illustrates a safe application of the termination. Failure to follow the guide may result in personal injuries or failure of function.

2.2 Assembly – Parts list

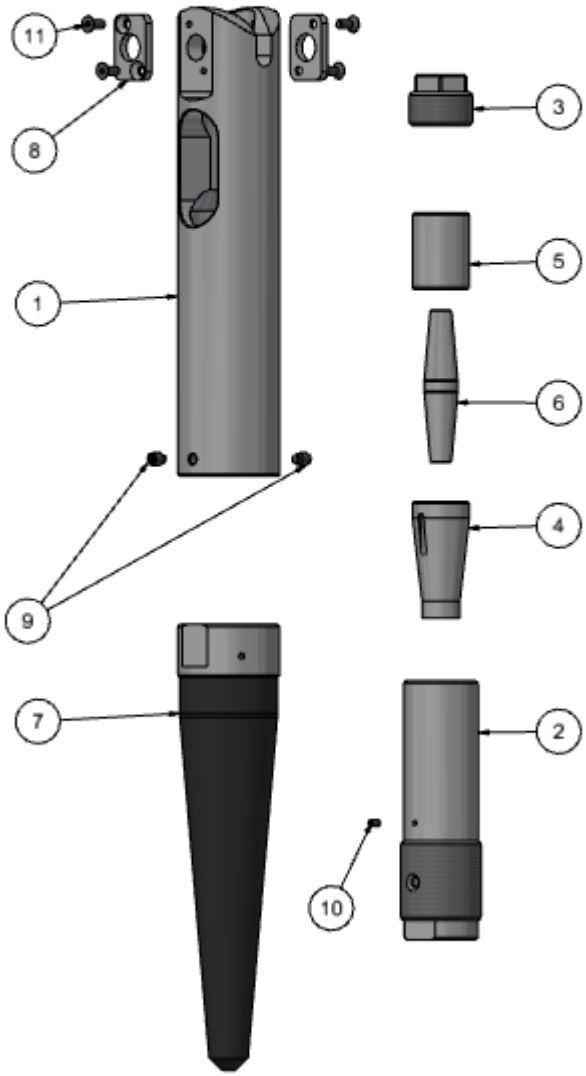
Self-locking Termination Kit

EIVA No.	Description	Qty.
0121167	Termination shell	1
0121168	Termination core	1
0121172	Termination lock	1
0121169	Termination cone 1 (shape: internal and external cone)	1
0121170	Termination cone 2 (shape: internal cone, external cylinder)	1
0121171	Termination double cone	1
0121435	Moulded strain relief	1
0121411	Termination tow point spacer	2
	DIN 915 - M6x8 Hex socket set screws full dog	2
	DIN 4026 - M3x6 Hex socket set screws flat	1
	DIN 7991 - M4x10 Countersunk head bolt	4
500000076	SubConn pigtails female MCIL-2-FS	1
500000094	SubConn dummy connector male MCDC-2-MP	1
500000100	SubConn locking sleeves female MCDLS/FS	1
500000101	SubConn locking sleeves male MCDLS/MP	1
500000683	Power cable splicing kit	1
0121424	24 mm wrench tool	1
0121423	24 mm crow foot wrench (alternative to 0121424)	(1)

Tools and misc (not included)

	Description	
	Safety glasses	
	Gloves	
	Vise mounted to table	
	Torque bar (1/4 inch square, minimum 200 Nm)	
	Tape/zip-ties	
	1.5, 2.5 & 3 mm Allen key	
	Plier with cutting edges	
	Hammer	
	Loctite 2400 (or similar)	

PARTS LIST (Components)			
No.	Qty	Part Number	Title
1	1	0121167-rev3	Termination Shell
2	1	0121168-rev3	Termination Core
3	1	0121172-rev3	Termination Lock
4	1	0121169-rev4-D	Termination Cone 1
5	1	0121170-rev4-D	Termination Cone 2
6	1	0121171-rev3-D	Termination Double Cone
7	1	0121435-rev1	Molded strain relief
8	2	0121411-rev1	Termination towpoint spacer
9	2	DIN 915 - M6 x 8	Hex socket set screws full dog
10	1	DIN 4026 - M3 x 6	Hex socket set screws flat
11	4	DIN 7991 - M4x10	Countersunk head bolt



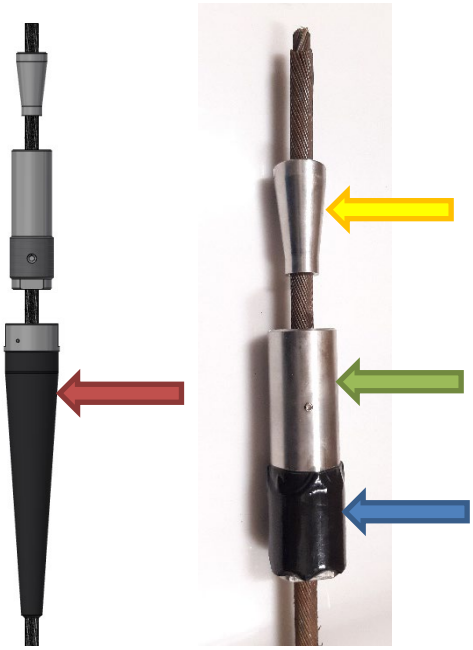
Variation D shown – For *Ø11.43* coax cable.

2.3 Assembly – Mechanical

Step 1

Ensure correct insulation and continuity in the tow cable wires.

If the end of the tow cable is damaged or deformed, cut away the damaged section.



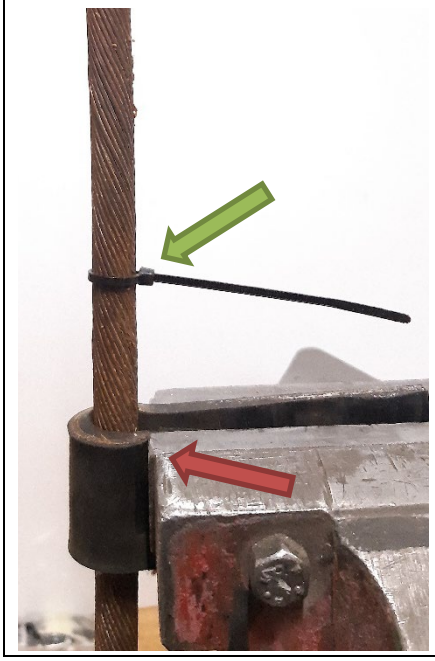
Step 2

First, slide on the **Moulded strain relief**, with the moulded, non-threaded, end first (red arrow).

On the **Termination core** (green arrow) wrap tape or similar easily removable protection around the external thread (blue arrow) to protect the thread during the assembly process. Then slide the termination core onto the cable, externally threaded end first.

Then mount slide the **Termination cone 1** on with the pointy end first (yellow arrow) after checking to ensure that it is the correct size for the cable.

With all three parts on the cable, slide them further up the cable and out of the way.



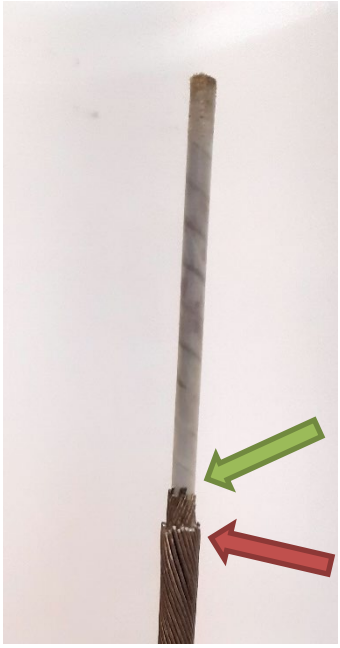
Step 3

With the cut end up, set the cable into a vise with rubber jaws or a similarly soft grip (red arrow) to protect the wire strands – only clamp enough to keep it from falling away.

Allow enough cable to extend beyond the vise for both the electrical connection and the mechanical lock. We will go through a standard example: 25 cm is needed for the mechanical lock and an additional 25 cm for the pigtail. This means a total of ~50 cm cable is needed from the vise and up.

Note: Add extra length if needed/wanted on the outside of the termination, depending on application. This moves the electrical connection point further away from the termination.

Tie a small zip tie around the lower end of the cable by the vise (green arrow) as a lower stop for the next steps.



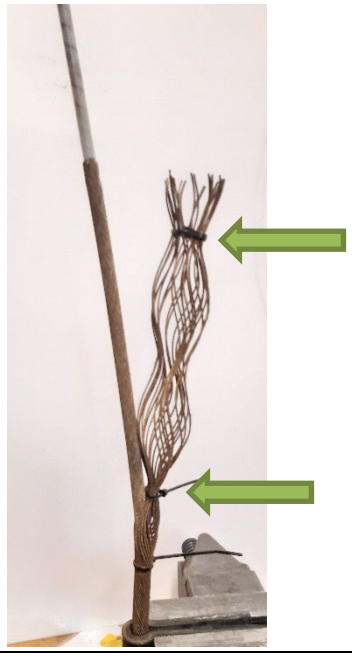
Step 4

With a marker, draw a line around the cable 25 cm from the cable end (if needed, add the extra length here). This will be the rough length of cable on the outside of the mechanical lock, when completed.

Start unwinding the outer layer of wires. While unwinding, cut each wire strand at the marked line (red arrow). When the last wire of the outer layer is cut, mark the internal layer 1 cm higher than the cut made on the outside layer. Use that as a guide for cutting the internal layer (green arrow).

Cutting the excess wire-length can alternatively be done by Dremel with a cutting wheel or similar.

NOTE:
Any damage to the internal core, will compromise the function of the completed termination.

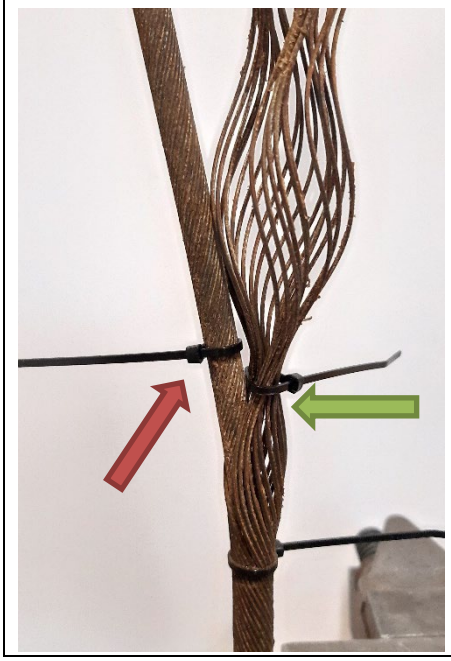


Step 5

Taking one strand at a time, unwind the outer layer to the zip-tie (red arrow) – This should be about 25 cm from the now cut end of the wire strands.

Note:
Make sure not to plasticly bend the individual wire strands.

With the outer layer opened, use zip-ties to hold the strands away (green arrow), leaving space to unwind the internal layer.



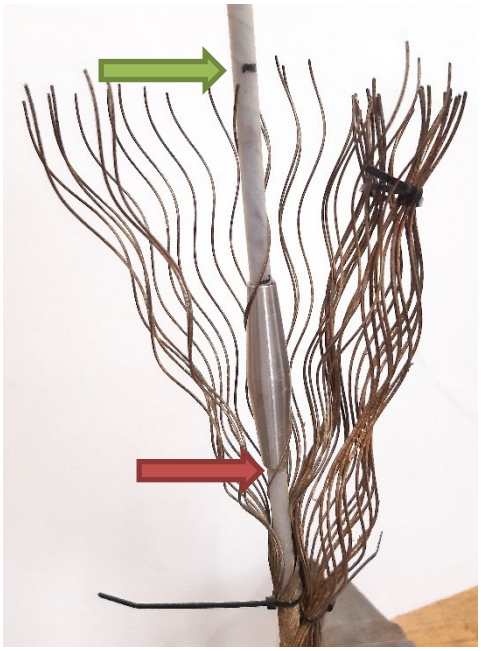
Step 6

Place another zip-tie around the internal wires to function as a lower stop (red arrow) – Place it just above the curve of the first outer layer (green arrow) ~5 cm above the zip-tie mounted in Step 3.

Step 7

With a pen or piece of tape, mark the height/position of the internal layer (red arrow) before unwinding the strands.

With the internal layer marked, follow the same process for unwinding the outer layer, for the internal layer.



Step 8

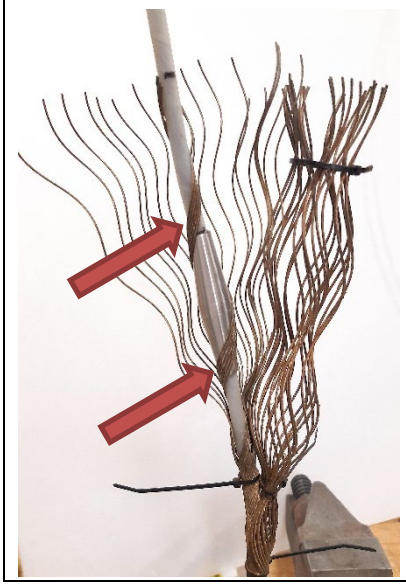
Position the internal **Termination double cone**, on the cable with the lowest point (red arrow) 15-18cm from the end (green arrow).

The **Termination double cone** is symmetrical – Both ends can be used as the load bearing area.

In case of re-terminating the unit, turn the double cone around and use the other end as load bearing.

Winding the core:

From the lowest point on the single strand, following its natural curve, push it around the core. Be careful during the handling not to permanently bend the individual wire strands (do not plasticly bend away from their natural helical routing). If some of the wires gets bent, affecting the lay of the individual wires, the function of the entire lock might be compromised.

	Step 9 Wind each wire strand back onto the internal cable and the **Termination double cone** (red arrows). Apply the wire strands, one at a time. Do not allow them to cross over each other – make sure they lay next to each other, just as they did before they were unwound. In case wires are overlapping: With the side of a screwdriver and using your thumb, it is possible to generate light pressure on the wire, moving it back in place.

	Step 10 Finishing the internal layer, make sure all wire strands are snapped into place laying on the internal cable (red arrow). If necessary, push the individual strands to help them lie flat and equally spaced around the widest part of the cone. If the cone is not completely in line with the cable (slightly pointing to the side), realign the cone by grabbing it gently, moving it in the opposite direction.

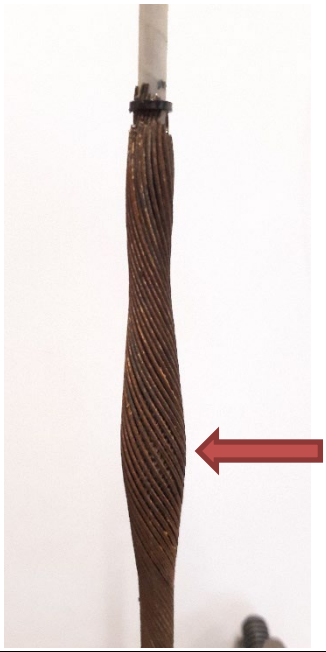
Step 11

Temporarily secure the inner layer with a zip-tie.

With the internal layer cut 1 cm longer than the outer (Step 4), enough space is left for the zip-tie not to interfere when mounting the outer layer.

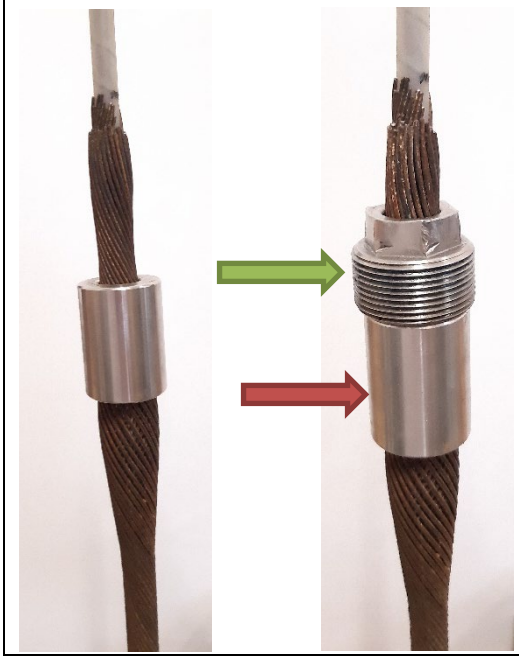
Step 12

Following the same procedure, wind the outer layer of wires, such that the **Termination double cone** is completely covered, and no wires are overlapping.



Step 13

Internal **Termination double cone** now positioned and secured within the cable.



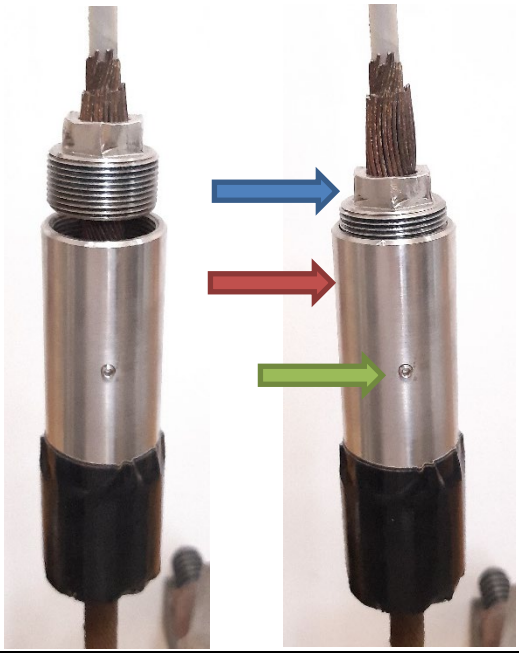
Step 14

Remove the zip-tie from the inner layer and position the **Termination cone 2** unto the cable (red arrow). Ensure it is oriented correctly.

Then position on the **Termination lock**, with the threaded section towards the cone (green arrow).

Step 15

Slide the **Internal core 1** back from up the cable and onto the wound core – Pull until firmly seated over the core (red arrow).

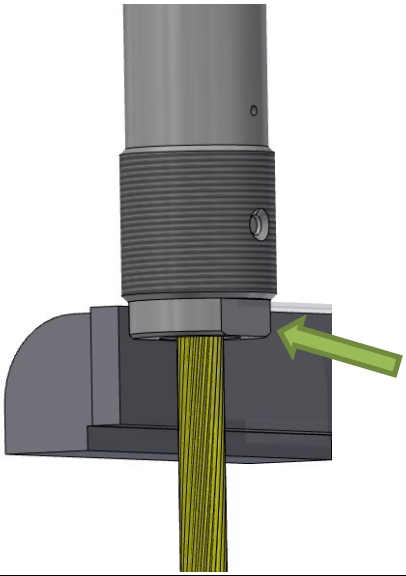


Step 16

Slide the **Termination core** back and over the **Internal core 1** (red arrow) – Align the cut-out int the **Internal core 1** with the threaded hole in the **Termination core** and mount the 1 x m3x6 socket set screw (green arrow).

Firmly pull until the **Termination core** is seated over the insert.

Screw in the **Termination lock** by hand (blue arrow).

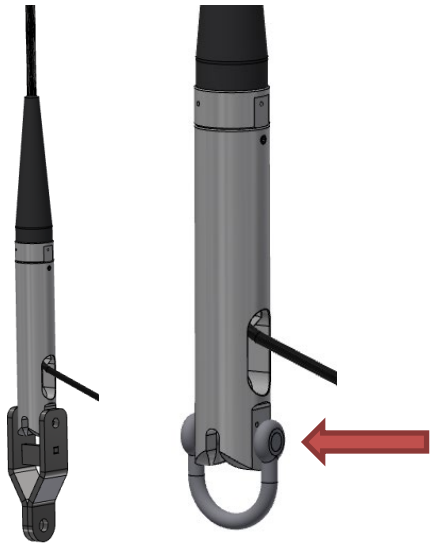


Step 17

Clamp the assembled termination core in the vise using the two flats in front of the threaded part (red & green arrows).

Initially just tighten the **Termination lock** lightly [~10 Nm] with the tightening-tool – It should not be tightened completely before the termination have been preloaded (next section). Preloading the termination seats the cones and ensures optimal function.

Note: If an initial preload of the termination is not possible, then go to Step 19 and fully torque the core at this point, skipping the part guiding through the preload process.



Step 18

For an initial preload pull, mount the **Termination Shell** on the **Termination core** with two **M6x8 Hexagon socket set screws with full dog point (DIN 915)**. Followed by the **Moulded strain relief**, mounted onto the **Termination core** by hand.

Lock it to a fixed point on the ship or a heavy load.

Example: Shackle; width: >43mm with Ø12 pin (red arrow) or similar tooling.

Make sure all parts; winch, sheave, fix point and tooling are up for the task.

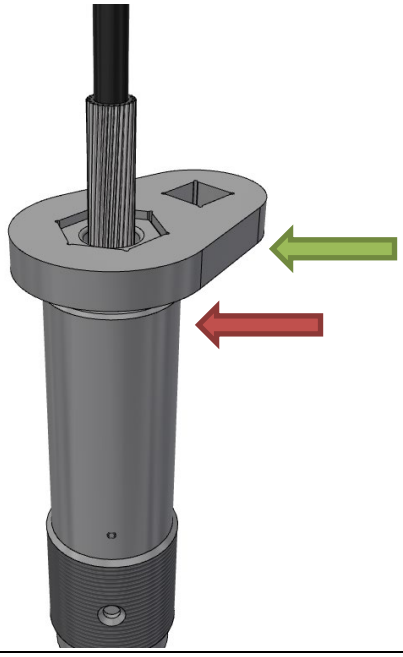
With a pen, piece of tape, zip-tie or similar, place a marker on the tow cable. Use this as reference for 'before pull' vs 'after pull'.

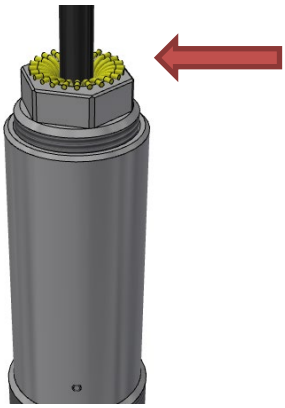
Pull and hold the termination at up to 800 kg maximum, for 4 minutes. Remove the load, let it rest for a few minutes and then pull it again at the same tension for another 4 minutes.

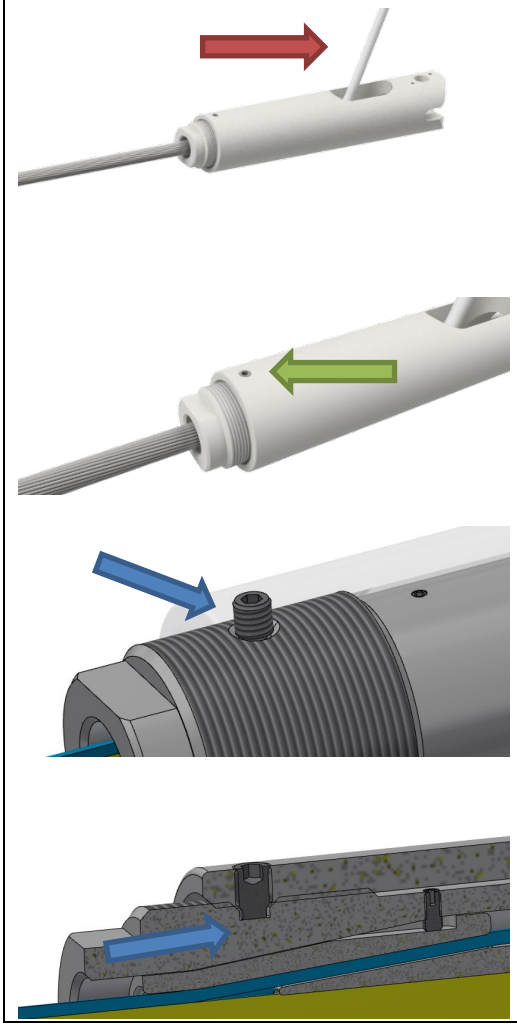
It must be noted that the wire might move a few mm out of the locking mechanism while preloading the unit. This is normal, it is the mechanism locking into place, obtaining a secure grip! This will only happen during preload when not fully torqued.

If the cores slip more than a centimetre, something is wrong, and it must be taken apart and inspected for faults.

These initial loadings of the cores ensures that the termination is gripping the cable as intended.

	Step 19 Bring the termination back to the vise: Clamp the **Termination core** into the vise and remove the **Termination shell** (as in Step 17). Remove the **Termination lock** to put **Loctite 2400** on the thread (red arrow; on the inside). Torque the **Termination lock** to 180–200 Nm with the tightening-tool and a 0.5 inch-socket torque-wrench (green arrow).

	Step 20 Bend each strand of the wire out into a fan and cut them at a length of roughly 0.5 cm from behind the lock (red arrow) – This reduces the chance of the strands working their way into the internal cable over time. Wire strands are shown in yellow for a better view.



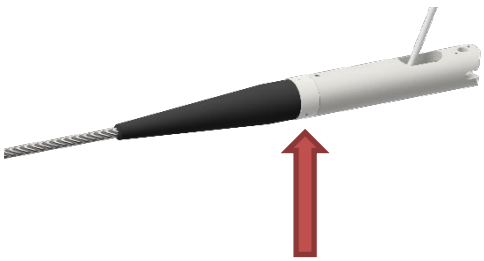
Step 21

With a few drops of **Loctite 2400**, mount the **Termination Shell**. Make sure the internal core of the cable is coming out of the opening of the termination shell (red arrow)

Lock it in place with two **M6x8 Hexagon socket set screws with full dog point (DIN 915)** and use **Loctite 2400** on these (green arrow).

The **socket set screws** sets into the pockets on the **Termination core** (blue arrows).

Note: Ensure that the **socket set screws** are located properly on the flat areas in the **Termination core** and at the same time do not hit the threaded outer part of the **Termination core** – Extra rotations of the **Termination shell** will shift it closer or further away from lining up with the **Termination core**.



Step 22

Slide the **Moulded strain relief** back up to the termination and with a few drops of **Loctite 2400** on the remaining thread, screw and tighten it onto the termination (red arrow) – Use a 45 mm key or wrench.

The mechanical part of the termination is at this point complete.

2.4 Assembly – Electrical

This next step is best done in a well-ventilated area with fresh air.

Open the inner core of the cable and the end of the pigtail, preparing the individual wires for soldering between the two ends.

Place shrink tube (with glue) on one set of each of the connections. Make sure each wire, after soldering, is the same length.

For optimal function of the moulding material, coat the exposed surfaces which will be inside the casting, with resin primer: around the exposed wires, heat shrink, short section of the pigtail and a short section of the cable core.

Coat the inside of the mould with a release spray, making sure the moulding material will not stick to the mould. Let it sit for a few minutes before placing the cable within.

Place the cable in a horizontal position inside the mould, and clamp together the mould. Pour in the moulding material. If possible, vibrate the mould or tip it from side to side, letting possible air bubbles get out – thereby ensuring the best possible result.

Let it sit until it has hardened.

Remove the mould and check the casting for air pockets or unwanted defects. If the moulding process was successful, the termination is now ready to use.

2.5 Disassembly

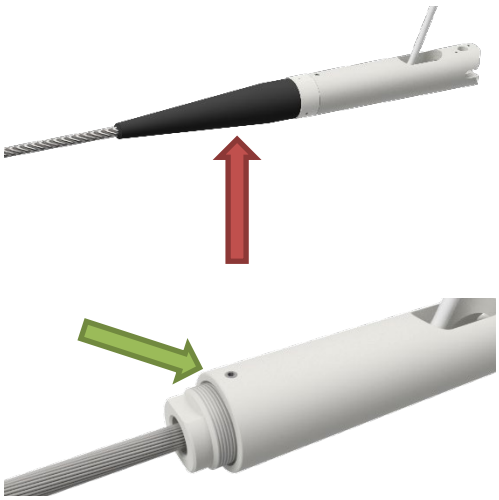
The design of the termination allows for disassembly and reuse of the internal parts.

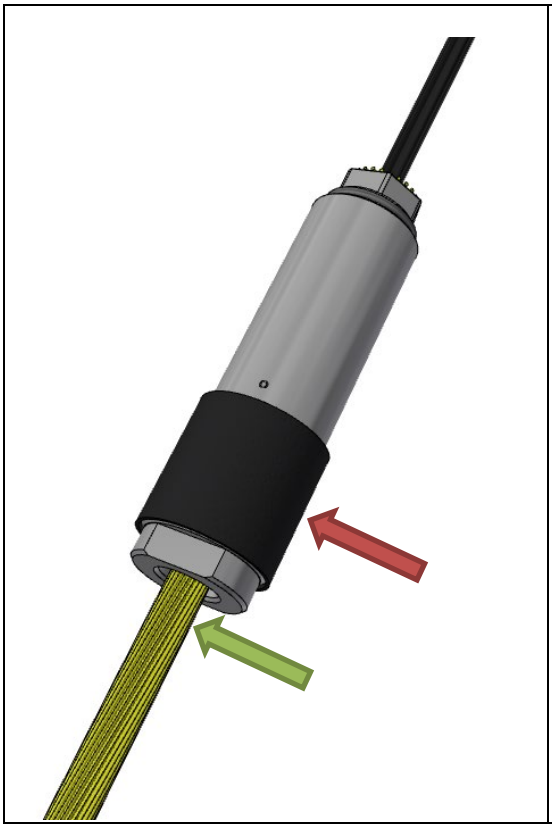
If the tow cable gets damaged, either mechanically, electrically or both, re-terminating the unit should solve the on-hand problem.

The following shows how the disassembly process can be done – mostly it is the assembly process backwards.

Locate the damaged part of the tow cable and cut it away.

Most parts of the termination should be directly reusable. If parts have been damaged or need a replacement, EIVA can supply any needed parts.

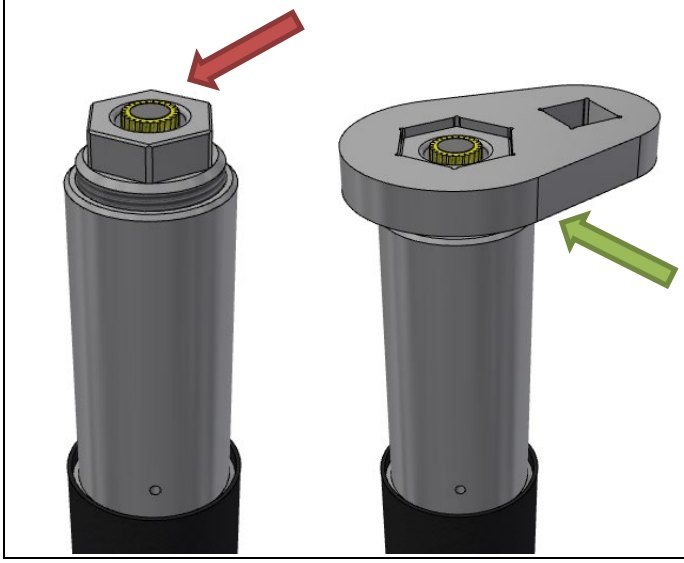
	Step 1 Cut the electrical connection (pigtail) close to the **Termination shell**, saving as much length as possible. Open the termination by removing the strain-relief (red arrow), followed by removing the two **M6x8 Hexagon socket set screws** and the **Termination shell** (green arrow). Wrap tape around the now exposed thread on the **Termination core**. Store all parts safely.



Step 2

Cut the tow cable just in front of the **Termination core** (green arrow) with an angle grinder or hacksaw – as close as possible to the **Termination core** without damaging it.

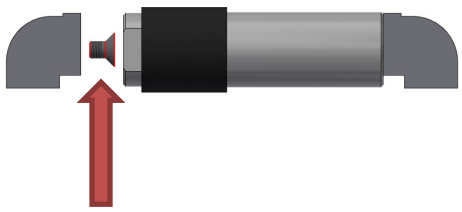
The red arrow shows several layers of tape on the thread.

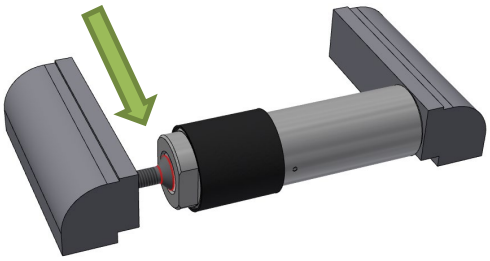


Step 3

Cut all bent wire strands away with pliers or similar (red arrow).

Use the tool or wrench to remove the **Termination lock** (as shown with the green arrow).



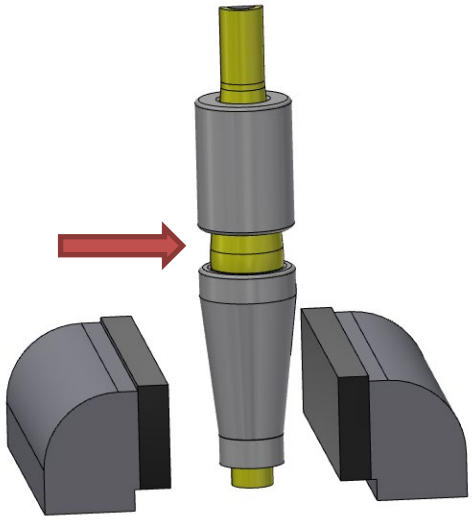


Step 4

To push the internal cones out of the **Termination core,** use a vise clamp (min 140 mm opening) and a bolt (or similar with a <Ø18 mm head) as shown with the red arrow). The bolt could for example be an m8 countersunk, m10 buttonhead or similar.

Align the **Termination core** and the bolts/plunger before pushing out the cores (green arrow).

Note: It does take a substantial amount of pressure. The cores release at once, and the **Termination core** will drop down from the vise – so be ready to catch it.

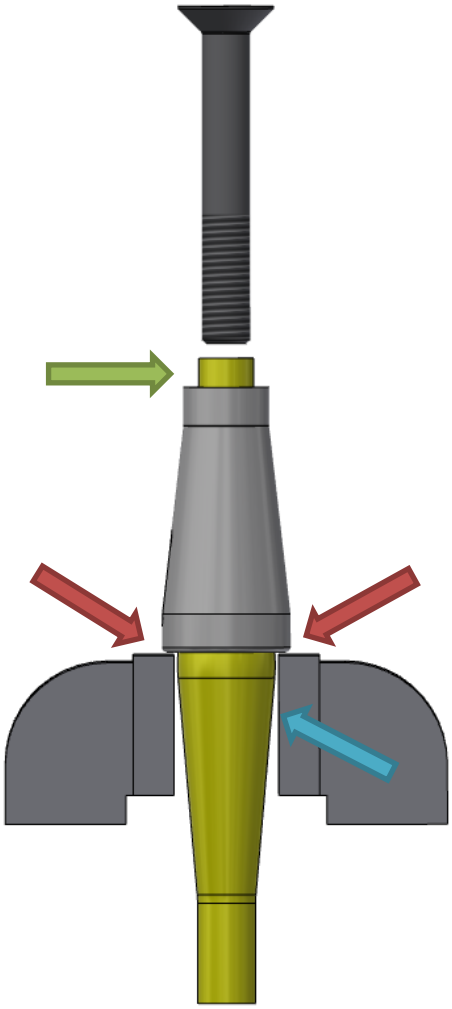


Step 5

Position the now released cones in the vise. Use rubber jaws or similar.

With two wide-head screwdrivers, pry the cores away from each other (red arrow) and remove the **Termination cone 2**.

Note: It might help the disassembly if the wires are cut between the two parts (red arrow). Use hand tools to not damage the internal **Termination double cone** when cutting!



Step 6

You will now remove the **Termination cone 1**, which can be difficult to remove from the wires and internal double cone.

Position the parts in the vise like shown. With the outer core resting on the ledge, supported as much as possible (red arrows).

Note: If the internal wire strands are not cut in Step 6, then cutting them now might help positioning the parts better on the vise. It depends on the vise, whether it is necessary.

Then, hammer a bolt through to force the remaining parts away from each other. You must use a long bolt that is able to pass into the outer core and thereby able to direct force into the internal wire strands.

Note: It will help the disassembly if the wire strands on the end are cut away as close to the end of the core as possible (green arrow).

With all parts removed from the damaged tow cable, re-assembly of the termination should be possible. First, make sure no parts of the termination are damaged.

Clean all the parts and check for defects. With all parts approved, go through the guide from the beginning.

3 Troubleshooting

If problems related to the assembly or other difficulties occur, please contact EIVA support.