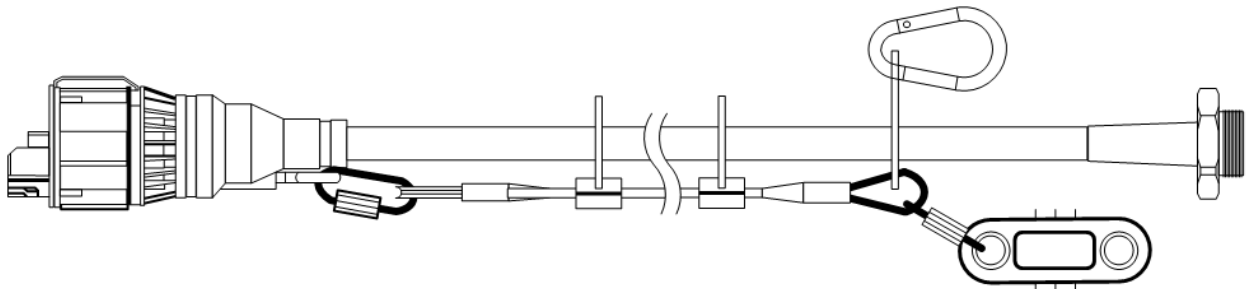


Wabtec Railway Electronics TwistLink™ Intercar Cable Operations Manual



Revision Table

Rev	Date	Author	Updates Summary
A	2/16/16	M. Gordon	First release for customer use. Same content as Revision 04 for internal use.
B	12/20/18	M. Gordon	Added tables and diagrams to identify different cable models and to update document to conform to the Intercar Cable Maintenance Manual. Changed names to TwistLink™ Intercar Cable and TwistLink™ Connector. Added cable removal and replacement procedure and soft jaw pliers description. Same content as Rev B Draft 02.

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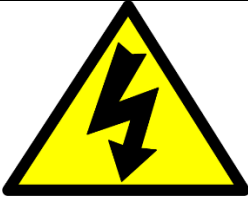



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1. Important Safety Information

This section introduces the various types of warnings used in this manual to alert the installer to possible safety hazards and to provide additional information pertinent to the installation.

For your safety and protection, read this entire manual before you attempt to install components of the Wabtec Electronically Controlled Pneumatic 4200 (ECP-4200) brake system. In particular, read this safety section carefully. Keep this safety information where you can refer to it if necessary.

Symbol	Meaning
	The high voltage symbol identifies a location on the equipment that may have high voltage or high electrical current present and as such may present a risk of injury to the installer if not handled in accordance with procedures stated in this document.
	The warning symbol identifies tasks or steps that may result in bodily injury to the installer should the installation procedure not be performed as presented in this document.
	The caution symbol identifies tasks or steps that may result in equipment damage if the installation procedure is not performed as described.
	The torque specification symbol notifies the installer that a tightening specification is being presented
NOTE:	A note highlights essential procedure steps, important conditions, or statements that convey additional information to the installer.

2. Product Overview

The Wabtec TwistLink™ Intercar Cable provides ECP system electrical connectivity on a train having an ECP system. TwistLink™ Cables can be installed between adjacent railcars, between adjacent locomotives, or between a locomotive and a railcar. One end of the TwistLink™ Cable mates with the existing EOC Receptacle, while the other end mates with a second TwistLink™ Cable, meaning that each railcar to railcar, locomotive to locomotive, or locomotive to railcar connection uses two TwistLink™ Cables. Other versions of the TwistLink™ Cable mate with a FreightMate®-compatible connector or another TwistLink™ Cable; see section 2.6 Wabtec Part Number for Each TwistLink™ Cable Configuration for more details.

Intercar Cable features include the following (see Figure 2, Figure 4 and Figure 5 for component names):

- A low contact force outer Lip Seal provides environmental sealing and ensures ease of Inline Connector mating under all conditions.
- A Face Seal provides a watertight barrier, keeping electrical contacts dry even under water immersion conditions.
- Reflective Indicators provide visual confirmation that a TwistLink™ Connector pair is mated and locked, even at night.

- A Lanyard Eyebolt that attaches to the Lanyard to provide strain relief during pull-apart operations.
- A braided steel Lanyard of pre-set length prevents Intercar Cable damage on pull-apart operations during train separation.
- A TwistLink™ Connector that can be disconnected from its TwistLink™ mate using only the lateral force present during train pull-apart operations.
- An optional Lanyard Electrical Isolator prevents conductivity through the Lanyard between railcars, between locomotives, or between a railcar and a locomotive, thereby providing additional lightning protection.
- A hermaphroditic bayonet-style connector that is easy to mate and unmate manually when rotated 22.5 degrees, is glove friendly, and provides positive locking.
- An optional Extended Hexnut that eases cable installation and removal.

2.1. Terminology

Terms used in this manual are defined in Table 1.

Table 1: Terms Used in this Manual

Term	Definition
EOC Plug	End of Car Connectors form part of the continuous electrical connection path used by an ECP system through all locomotives and cars in a train. The term EOC Plug is used in this document to refer to the plug on one end of a TwistLink™ Cable, while the term EOC Receptacle refers to the connector mounted on each end of a railcar or locomotive. The EOC Plug is mated to the EOC Receptacle when a TwistLink™ Cable is installed.
EOC Receptacle	See the definition for EOC Plug.
pull-apart	Separation of train vehicles (locomotives and/or rail wagons) from one another.
Trainline	The ECP power and signal distribution cabling routed through every locomotive and railcar in a train on which an ECP system is installed.

2.2. Acronyms

Table 2: List of Acronyms

Acronym	Definition
ECP	Electronically Controlled Pneumatic braking system on a train
EOC	End of Car
NPSM	National Pipe Straight Mechanical
PPE	Personal Protective Equipment
WPN	Wabtec Part Number
WRE	Wabtec Railway Electronics

2.3. Related Documents

This *TwistLink™ Intercar Cable Maintenance Manual – Customer Version, WPN 31460P*, should be used in conjunction with the *TwistLink™ Intercar Cable Operations Manual, WPN 31434P*. Individuals or facilities performing maintenance on the TwistLink™ Cable should have both of these documents.

2.4. Product Identification Label

All TwistLink™ Cables have a label whose content is defined in Figure 1.

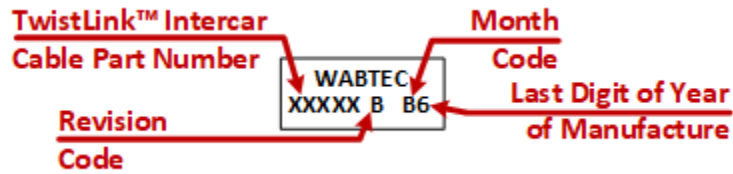


Figure 1: Content of a Sample TwistLink™ Cable Part Number Label

2.5. TwistLink™ Intercar Cable Component Names

Figure 2 (TwistLink™ Cable with Lanyard, Hexnut and Electrical Isolator) and Figure 3 (TwistLink™ Cable with Lanyard, Extended Hexnut, and without Electrical Isolator) identify the key components of the TwistLink™ Intercar Cable with Lanyard attached, which is how this product is supplied to customers. The names in this figure will be used in procedures later in this manual.

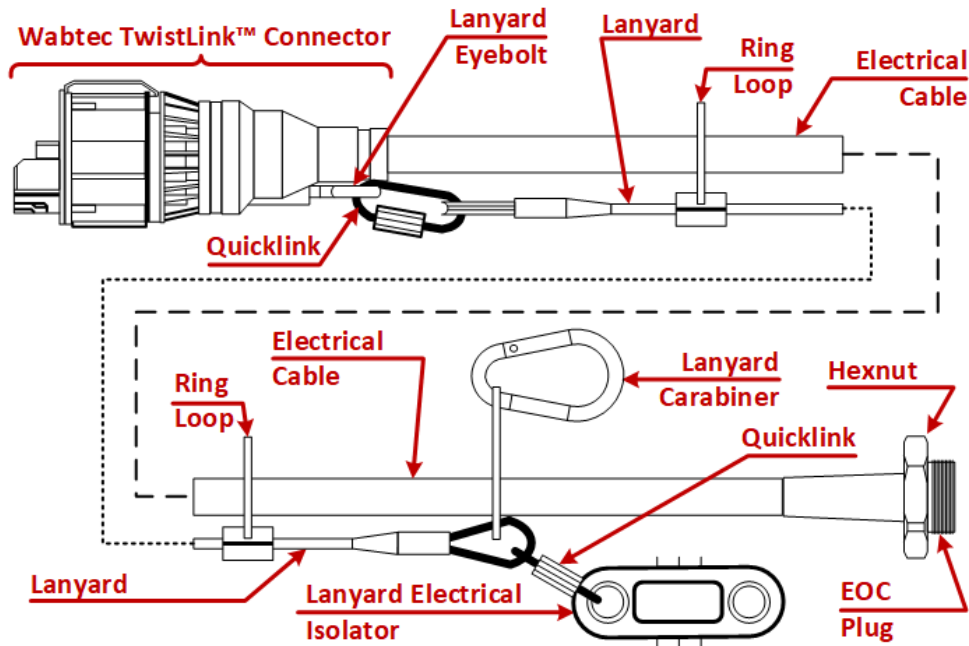


Figure 2: Components of TwistLink™ Cable with Lanyard & Electrical Isolator

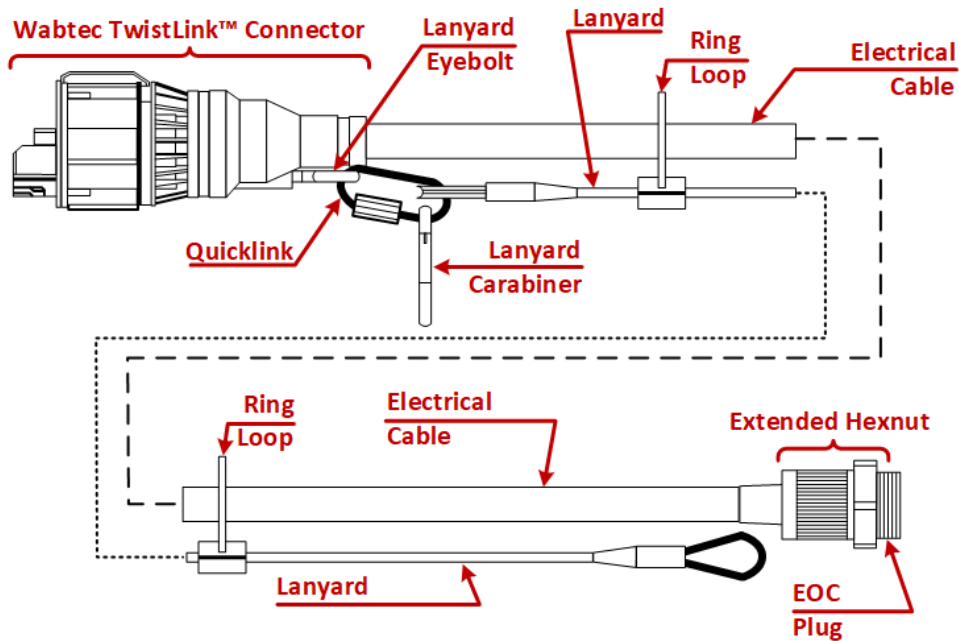


Figure 3: Components of TwistLink™ Cable with Lanyard & Extended Hexnut

Figure 4 identifies TwistLink™ Connector components on the Indicator side. Note the Indicators – Reflective, Rotating and Stationary – whose position relative to one another is important when mating or unmating two TwistLink™ Cables.

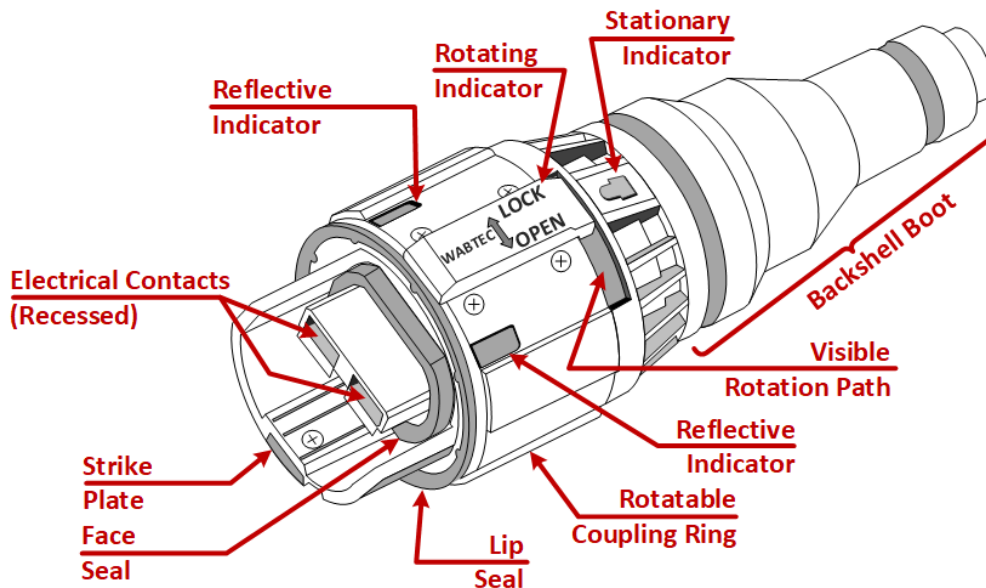


Figure 4: TwistLink™ Cable Inline Connector Perspective View – Indicator Side

Figure 5 identifies TwistLink™ Connector components on the Strike Plate side. The Rotatable Coupling Ring – visible on both Figure 4 and Figure 5 – is used to lock and open the TwistLink™ Connector

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respectively during installation and removal. The Latch Pin on one TwistLink™ Connector contacts the Strike Plate on the TwistLink™ Connector to which it mates.

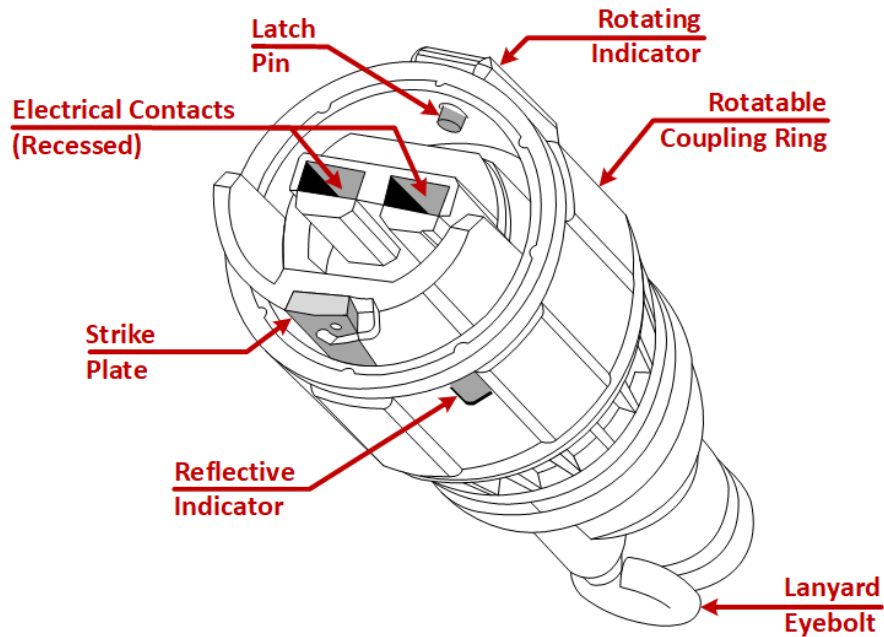


Figure 5: Intercar Cable TwistLink™ Connector Perspective View - Strike Plate Side

2.6. Wabtec Part Number for Each TwistLink™ Cable Configuration

All TwistLink™ Intercar Cables have a TwistLink™ Connector on at least one end. Other characteristics of the cable – the presence or absence of an integral Lanyard, the presence or absence of a Lanyard Electrical Isolator, the absence of a connector on one end, the type of Hexnut, etc. – are variable. Table 3 summarizes the different versions of TwistLink™ Cables. A drawing of each style of cable listed in Table 3 is provided in section 2.7. Use the number in the “Cable Type” column of Table 3 to match a cable version with a drawing in section 2.7.

Table 3: TwistLink™ Cable Versions and Part Numbers

Cable Type	Connector 1	Connector 2	Lanyard	Electrical Isolator	Hexnut	Chain	WPN	ID Drawing
1.	Wabtec TwistLink™	EOC Plug	No	No	Regular	No	34412P, 34412-2, 34412-3	Figure 6
2.	Wabtec TwistLink™	EOC Plug	Yes	Yes	Regular	No	34797P, 34797-2, 34797-3	Figure 7
3.	Wabtec TwistLink™	EOC Plug	Yes	No	Extended	No	35800P	Figure 8
4.	Wabtec TwistLink™	EOC Plug	Yes	No	Extended	Yes	35761P	Figure 9
5.	Wabtec TwistLink™	None	No	No	None	No	35757P, 35757-2	Figure 10

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Cable Type	Connector 1	Connector 2	Lanyard	Electrical Isolator	Hexnut	Chain	WPN	ID Drawing
6.	Wabtec TwistLink™	FreightMate®	No	No	None	No	34968P	Figure 11
7.	Wabtec TwistLink™	None	No	No	No	No	35612P	Figure 12
8.	Wabtec TwistLink™	None	No	No	No	No	36254P	Figure 13
9.	Wabtec TwistLink™	Wabtec TwistLink™	No	No	Regular	No	35758P	Figure 14
10.	Wabtec TwistLink™	EOC Plug	No	No	Extended	No	36250P, 36250-2, 36250-3, 36250-4	Figure 15

The details of each TwistLink™ Cable version and its Wabtec part number are enumerated in Table 4. These versions are distinguished by differing lengths, differing connectors on each end, the presence or absence of a Lanyard, etc.

Table 4: Intercar Cable Part Numbers, Lengths, and Attributes

WPN	Length	Description
34412P	36 inches	ASY INTERCAR CABLE Wabtec TwistLink™ Connector on one end, EOC Plug Connector with Hexnut on the other end. No Lanyard.
34412-2	41 inches	ASY INTERCAR CABLE Wabtec TwistLink™ Connector on one end, EOC Plug Connector with Hexnut on the other end. No Lanyard.
34412-3	51 inches	ASY INTERCAR CABLE Wabtec TwistLink™ Connector on one end, EOC Plug Connector with Hexnut on the other end. No Lanyard.
34797P	36 inches	ASY INTERCAR CABLE W/LANYARD Wabtec TwistLink™ Connector on one end, EOC Plug Connector with Hexnut on the other end. Integral Lanyard with electrical isolator.
34797-2	41 inches	ASY INTERCAR CABLE W/LANYARD Wabtec TwistLink™ Connector on one end, EOC Plug Connector with Hexnut on the other end. Integral Lanyard with electrical isolator.
34797-3	51 inches	ASY INTERCAR CABLE W/LANYARD Wabtec TwistLink™ Connector on one end, EOC Plug Connector with Hexnut on the other end. Integral Lanyard with electrical isolator.
34968P	22 inches	ASY CABLE INTERCAR ADAPTER. Wabtec TwistLink™ Connector on one end, FreightMate®-compatible connector on the other end.
35612P	NA	ASY CABLE TL 5 OHM TERMINATOR TWIST. Wabtec TwistLink™ Connector on one end, no connector on the other end. No Lanyard. No Electrical Cable. A 5 Ohm terminating resistor is jumpered across the two electrical wires.
36254P	NA	ASY CABLE TL DUST COVER. Wabtec TwistLink™ Connector on one end, no connector on the other end. No Lanyard. No Electrical Cable. No internal electrical connections. The Backshell Boot is sealed to prevent water and dust entry.
35757P	30.75 inches	ASY INTERCAR CABLE OPEN END. Wabtec TwistLink™ Connector on one end, unterminated wires (no connector) on the other end. No Lanyard.

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WPN	Length	Description
35757-2	20.25 inches	ASY INTERCAR CABLE OPEN END. Wabtec TwistLink™ Connector on one end, unterminated wires (no connector) on the other end. No Lanyard.
35758P	532 inches	ASY INTERCAR CABLE DUAL ENDED CONN. Wabtec TwistLink™ Connector on both ends. No Lanyard. Long enough to jumper around a wagon.
35761P	51 inches	ASY INTERCAR CABLE LOCO W/LANYARD. Wabtec TwistLink™ Connector on one end, EOC Plug Connector with Extended Hexnut on the other end. Integral Lanyard with no Electrical Isolator and a Quicklink on each end. A galvanized steel Chain (34 inches long) is attached to the same Quicklink as the Lanyard on the TwistLink™ Connector-end of the cable.
35800P	36 inches	ASY INTERCAR CABLE W/LANYARD Wabtec TwistLink™ Connector on one end, EOC Plug Connector with Extended Hexnut on the other end. Integral Lanyard with no Lanyard Electrical Isolator.
36250P	36 inches	ASY INTERCAR CABLE EXT NUT Wabtec TwistLink™ Connector on one end, EOC Plug Connector with Extended Hexnut on the other end. No Lanyard.
36250-2	41 inches	ASY INTERCAR CABLE EXT NUT Wabtec TwistLink™ Connector on one end, EOC Plug Connector with Extended Hexnut on the other end. No Lanyard.
36250-3	51 inches	ASY INTERCAR CABLE EXT NUT Wabtec TwistLink™ Connector on one end, EOC Plug Connector with Extended Hexnut on the other end. No Lanyard.
36250-4	540 inches	ASY INTERCAR CABLE EXT NUT Wabtec TwistLink™ Connector on one end, EOC Plug Connector with Extended Hexnut on the other end. No Lanyard.

2.7. Identification Drawings for TwistLink™ Intercar Cable Versions

A drawing depicting the mechanical outline of each TwistLink™ Intercar Cable in Table 3 is provided in this section to promote easy visual identification. These drawings are for reference only and not to scale; for example, the length of the cable in each drawing is not representative of the cable’s actual length.

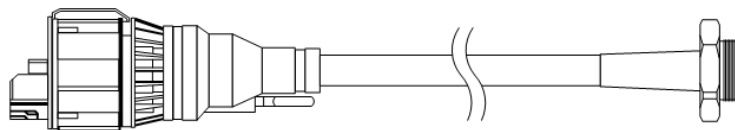


Figure 6: TwistLink™ Cable Type 1 (See Table 3)

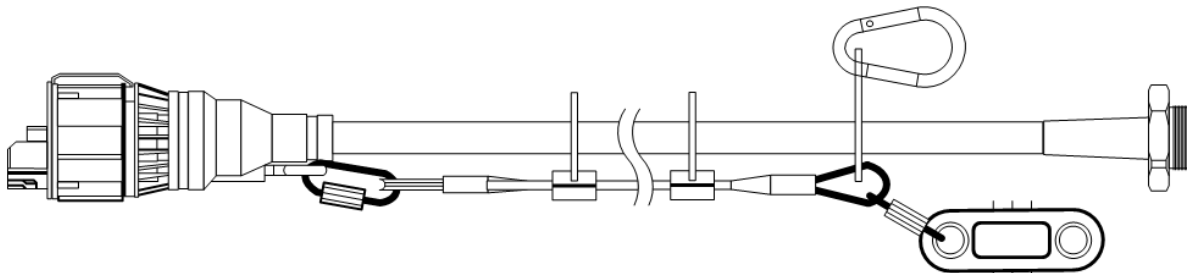


Figure 7: TwistLink™ Cable Type 2 (See Table 3)

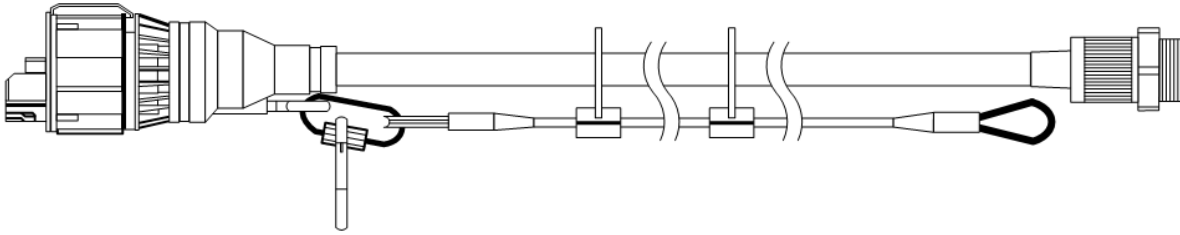


Figure 8: TwistLink™ Cable Type 3 (See Table 3)

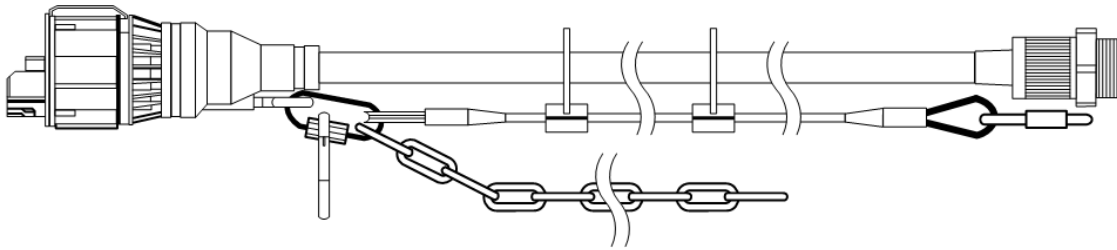


Figure 9: TwistLink™ Cable Type 4 (See Table 3)

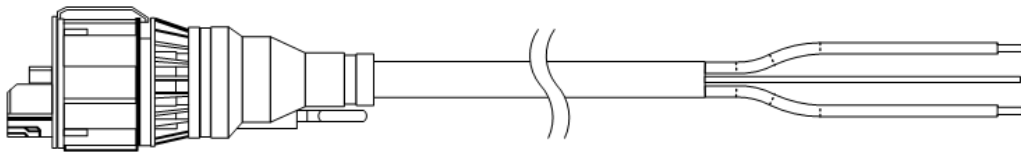


Figure 10: TwistLink™ Cable Type 5 (See Table 3)

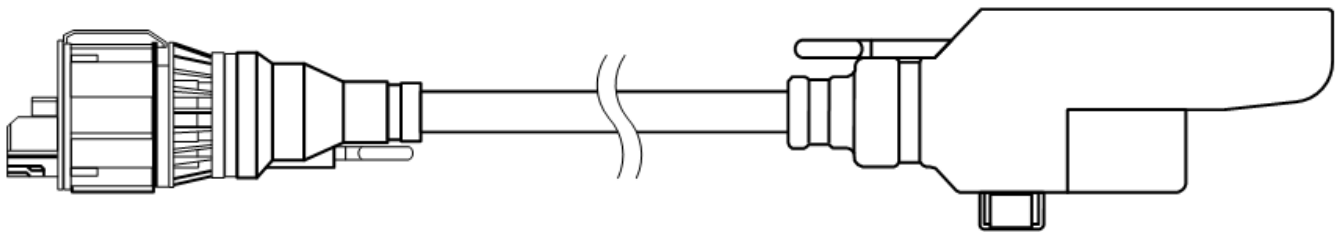


Figure 11: TwistLink™ Cable Type 6 (See Table 3)

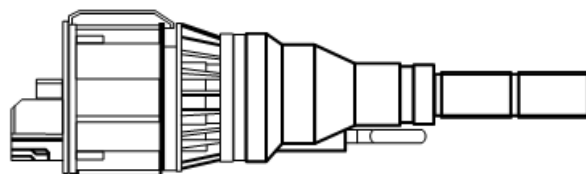


Figure 12: TwistLink™ Cable Type 7 (See Table 3)

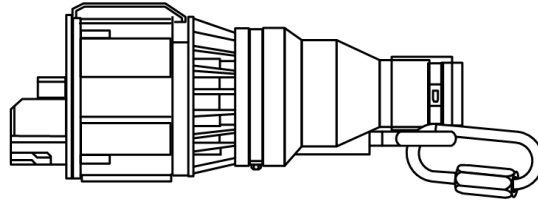


Figure 13: TwistLink™ Cable Type 8 (See Table 3)

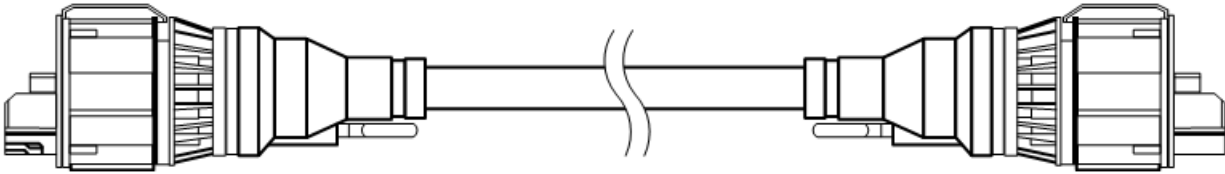


Figure 14: TwistLink™ Cable Type 9 (See Table 3)

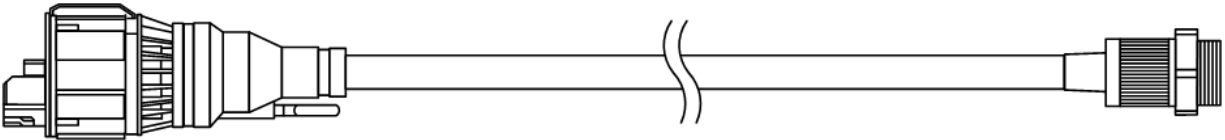


Figure 15: TwistLink™ Cable Type 10 (See Table 3)

3. Intercar Cable TwistLink™ Connector Operating Positions

The TwistLink™ Connector Rotatable Coupling Ring has two positions, Open and Lock. Turn the Rotatable Coupling Ring away from the Stationary Indicator to place the TwistLink™ Connector in the Open position. The Open position is depicted in Figure 16; note that in this position the Rotating Indicator and the Stationary Indicator are NOT aligned.

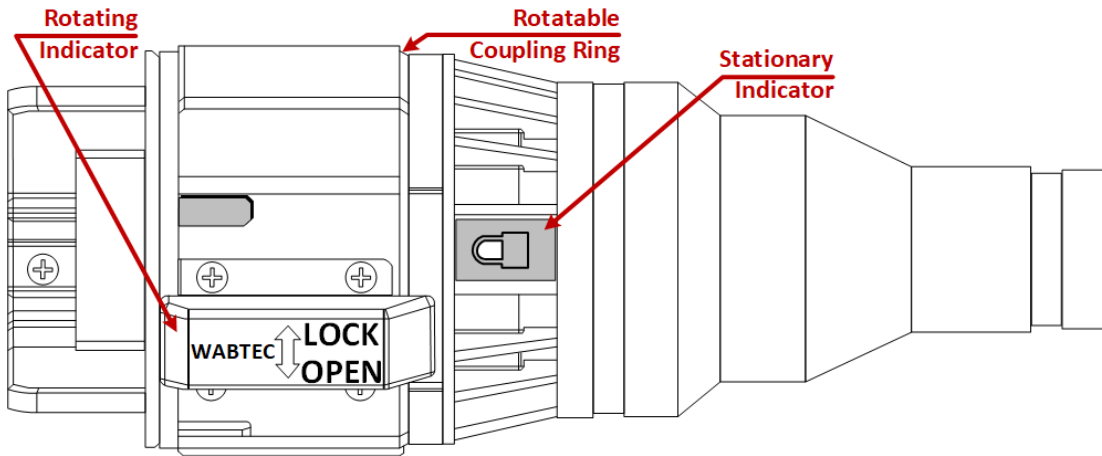


Figure 16: Intercar Cable TwistLink™ Connector - Open Position

Turn the Rotatable Coupling Ring toward the Stationary Indicator to place the Inline Connector in the Lock position. The Lock position is illustrated in Figure 17; note that in this position the Rotating Indicator and the Stationary Indicator are aligned.

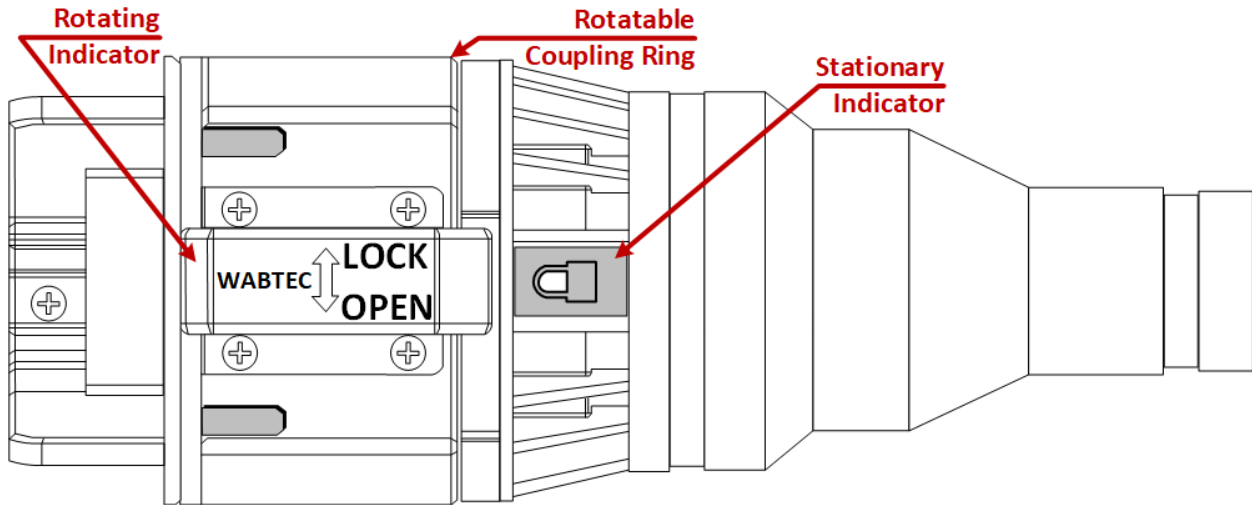


Figure 17: Intercar Cable TwistLink™ Connector - Lock Position

4. Safety When Working with TwistLink™ Cables

WARNING

TwistLink™ Intercar Cables carry 230 VDC during ECP system operation, and after ECP system power down a locomotive or railcar may have no braking capability. To avoid injury when following any of the procedures in this guide associated with Intercar Cables:

- Chock the wheels and/or set the handbrake for any railcar or locomotive on which Intercar Cables will be replaced.
- Visually verify that the 230 VDC Trainline is de-energized by ensuring that the locomotive(s) containing ECP power supplies are not connected to the Trainline for any locomotive or railcar on which TwistLink™ Cables will be replaced.
- Visually verify that the 230 VDC Trainline is de-energized by ensuring that all ECP circuit breakers are in the Off position.
- Comply with all operating authority PPE and Blue Flag/Track Lockout procedures.

5. TwistLink™ Cable Replacement Procedure

5.1. Tool Used for TwistLink™ Cable Removal and Installation

Table 5 lists the tool used when detaching a TwistLink™ cable from an EOC Receptacle (see Figure 18).

Table 5: Tool Required for TwistLink™ Intercar Cable Removal and Installation

Name	Where or How Used
Techni-Tool® Plier Soft Jaw Cushion Grip 3/4 in.-2 1/2 in. or equivalent	Used to grip the molded rubber TwistLink™ Cable insulation to prevent Cable rotation when tightening or loosening the Hexnut or Extended Hexnut during Cable removal or installation. See Figure 18.



Figure 18: Soft Jaw Pliers Used to Prevent Cable Twisting When Turning the Hexnut

5.2. Cable Removal and Replacement Procedure

This procedure describes removal and installation of a TwistLink™ Intercar Cable.

1. Locate the existing Intercar Cable that is to be replaced.
2. Hold the TwistLink™ Cable boot (behind the Hexnut) tightly with soft jaw pliers to prevent it from turning and use a 2¼” open end wrench to unscrew the Hexnut on the Cable.

⚠ CAUTION

During installation or removal, ensure that the TwistLink™ Cable does not twist when tightening or loosening the Hexnut. Use the line on the molded end of the Cable (see Figure 19) to determine visually that the cable is not being twisted.

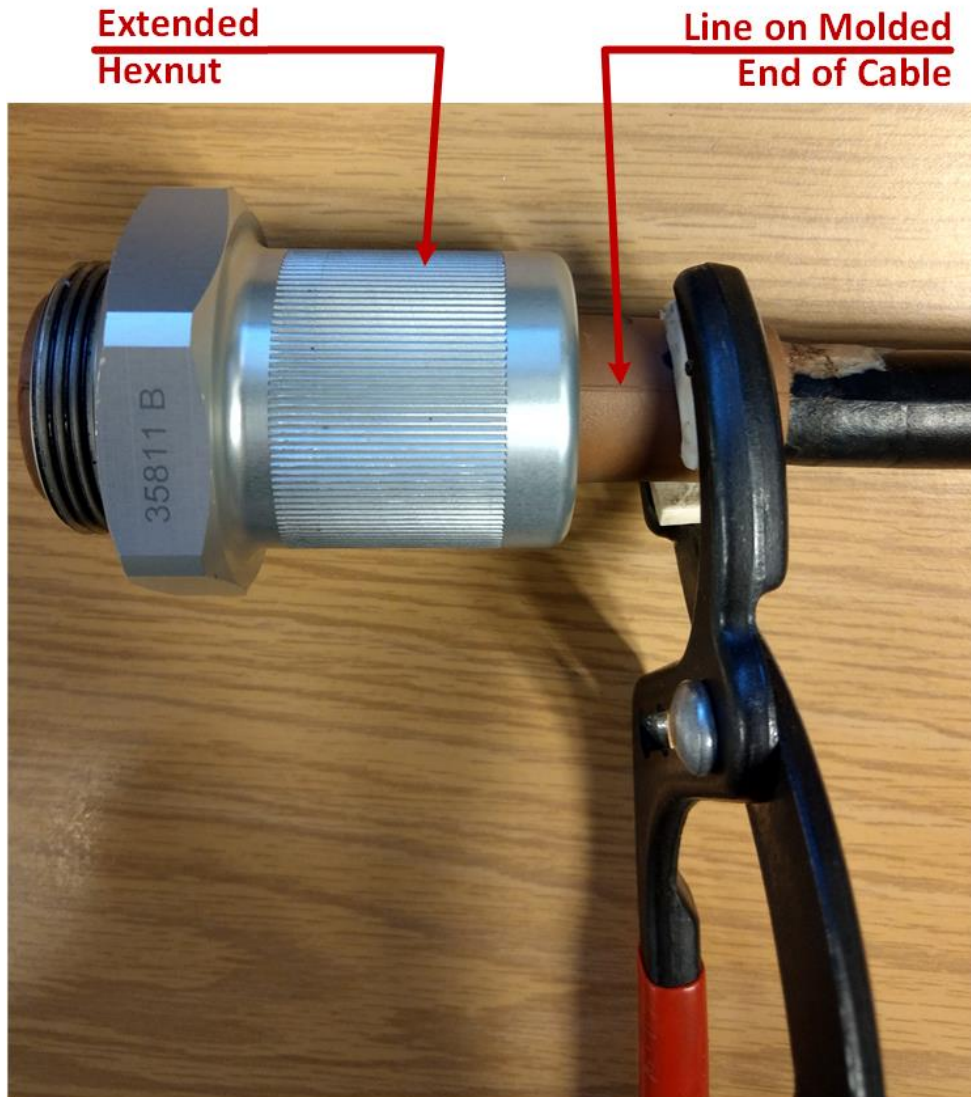


Figure 19: Preventing Cable Twisting with Soft Jaw Pliers

3. Clean as necessary the outward face of the EOC Receptacle attached to the railcar. Figure 20 shows a clean EOC Receptacle.



Figure 20: Ensure EOC Receptacle is Free of Debris

4. Remove the plastic dust cover (installed at the factory on a new TwistLink™ Cable) from the 3 pin EOC Plug on the TwistLink™ Cable to be installed then pull back the Hexnut. Figure 21 illustrates a Hexnut in the pulled back position (right-hand cable in the photograph).



Figure 21: EOC Plug with Hexnut Pulled Back

5. Insert the 3 pin EOC Plug on the TwistLink™ Cable being installed into the EOC Receptacle mounted to the railcar then hand tighten the Hexnut until it is fully seated.
6. Hold the TwistLink™ Cable boot (behind the Hexnut) tightly with soft jaw pliers to prevent it from turning and use a 2¼" open end wrench to tighten the Hexnut on the Cable being installed.

⚠ CAUTION

During installation or removal, ensure that the TwistLink™ Cable does not twist when tightening or loosening the Hexnut. Use the line on the molded end of the Cable (see Figure 19) to determine visually that the cable is not being twisted.

7. Connect the available end of the Lanyard to the locomotive or railcar so that the fully extended Lanyard will be shorter than the Intercar Electrical Cable.

⚠ CAUTION

The Lanyard must be shorter than the Intercar Electrical Cable to prevent damage during pull-apart operations.

6. Intercar Cable TwistLink™ Connector Mating Procedure

Use this procedure to mate a pair of Intercar Cable Inline Connectors installed on adjacent railcars, on adjacent locomotives, or a railcar hitched to a locomotive.

1. Grasp one Inline Connector in each hand and align them opposite one another as shown in Figure 22.

NOTE:

It is not necessary to set the TwistLink™ Connectors in either the Open or Lock position prior to mating them to one another. Either can be in the Open or the Lock position.

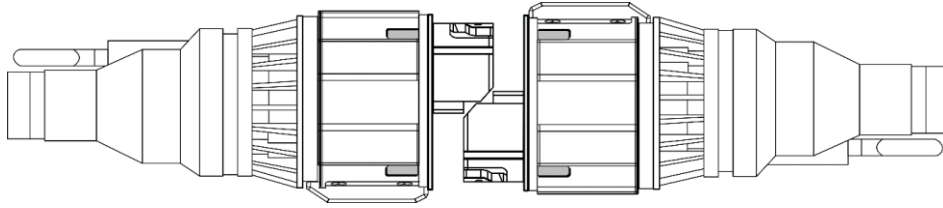


Figure 22: Connectors Unmated and in the Lock Position

2. Press the Inline Connectors toward one another as illustrated in Figure 23. If both Connectors are in the Open position they will fully mate, otherwise they will partially mate as shown in Figure 23.

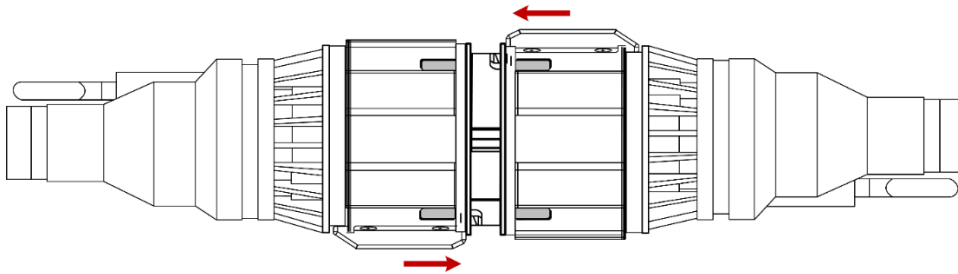


Figure 23: Connectors Partially Mated and in the Lock Position

3. Turn the Rotatable Coupling Ring on each Inline Connector in the direction of the arrows in Figure 24 so that the Inline Connectors are both in the Open position.

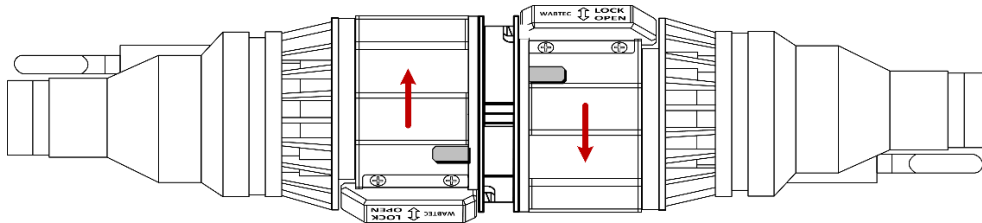


Figure 24: Connectors Partially Mated and in the Open Position

4. Press the Inline Connectors toward one another so they fully mate as depicted in Figure 25.

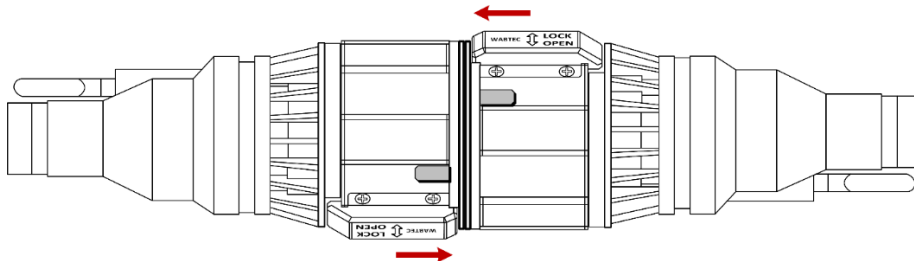


Figure 25: Connectors Mated and in the Open Position

5. Turn the Rotatable Coupling Ring on each Inline Connector in the direction of the arrows in Figure 26 so that both Connectors will be in the Lock position. You will hear two audible clicks, one for each Latch Pin, as the Inline Connectors enter the Lock position.

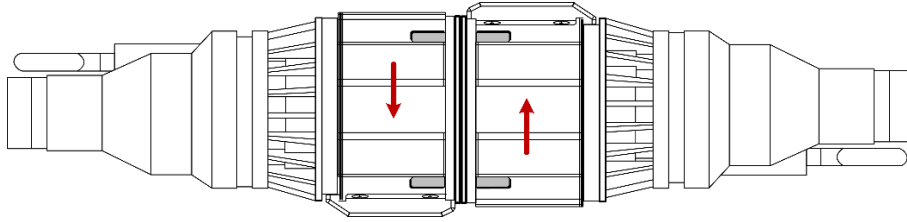


Figure 26: Connectors Mated and in the Lock Position

6. Verify that the Reflective Indicators are aligned to one another as illustrated in Figure 26. Turning the mated cables to the position depicted in Figure 27, note that in the Lock position the Stationary Indicator aligns with the Rotating Indicator and the Reflective Indicators on this side are also aligned.

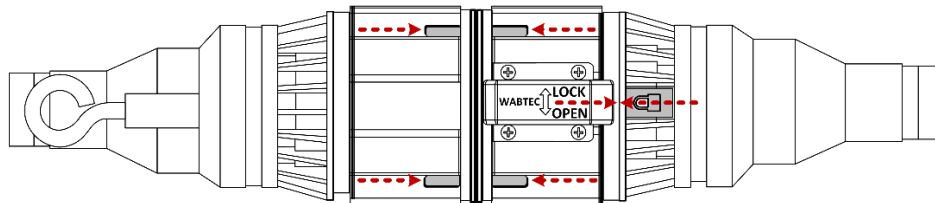


Figure 27: Rotating Indicator Aligns with Stationary Indicator when Connectors are in the Lock Position

⚠ CAUTION

It is important to verify that the TwistLink™ Connectors are in the Lock position to ensure the Connectors do not become detached from one another during train operation. Electrical connectivity is present in both the Lock and Open positions when the TwistLink™ Connectors are fully mated (Lip Seal to Lip Seal), however vibration could detach these Connectors from one another if the train operates with them in the Open position.

Stationary Indicator when Connectors are in the Lock Position

7. Intercar Cable TwistLink™ Connector Unmating Procedure

1. Figure 28 depicts the starting point for this procedure, in which Inline Connectors are mated and in the Lock position.

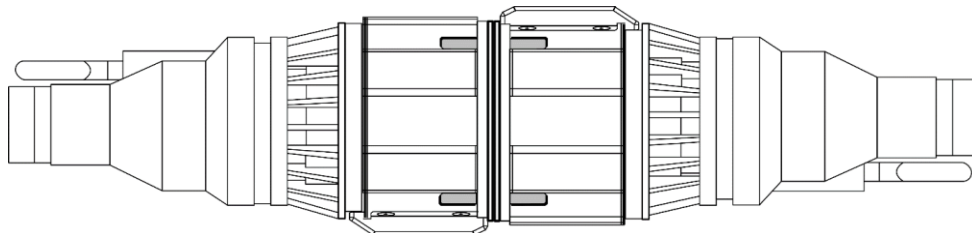


Figure 28: Connectors Mated and in the Lock Position

2. Grasp one Inline Connector in each hand and turn the Rotatable Coupling Ring on each Inline Connector in the direction of the arrows in Figure 29 so that both Connectors will be in the Open position.

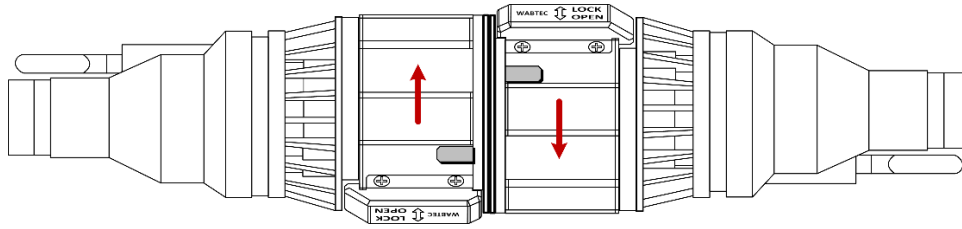


Figure 29: Connectors Mated and in the Open Position

3. Pull the Inline Connectors in opposite directions to detach them as shown by the arrows in Figure 30.

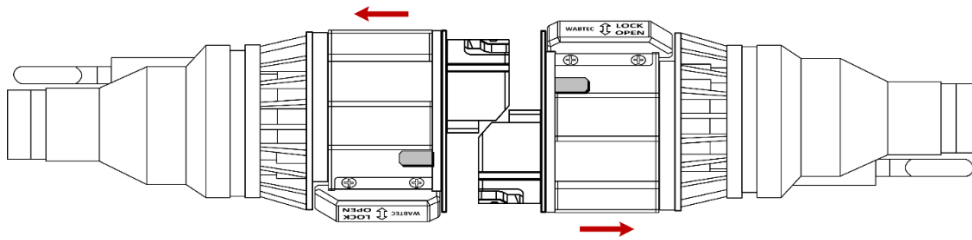


Figure 30: Connectors Unmated