Application Specification

114-32376 Rev. A

JAN 2022

Class 1

Ford Connector 52A – Type 1 DCFC Inlet

Table of Contents

1. SCOPE

1.1. Content

This specification describes the assembly and handling of the vehicle charge inlets Combo 1 acc. IEC 62196-3 and SAE J1772 for conductive charging of electric vehicles with AC current and DC current for fast charging. This specification applies to manual assembly of the components in series production configuration.

1.2. Processing note

The processor is responsible for the quality of the manufacturing process to ensure the correct function of the system. The warranty and liability are excluded if quality deficiency or damages occur due to non-compliance to this specification or use of not specified or not released tools, cables, and components.

2. APPLICABLE DOCUMENTS

The following technical documents, if referred to, are part of this specification. In case of a contradiction between this specification and the product drawing or this specification and the specified documentation, the product specification has priority.

2.1. TE Connectivity Documents

a) Customer drawings for inlet type Combo 1

INLET HSG, COMBO 1, ASSY	2371186
INLET REAR COVER	2369944
INLET COMBO CHARGE PERIPHERAL SEAL	2338079
DC SINGLE WIRE SEAL	2840783
DC SINGLE WIRE SEAL COVER	2369943
DC SINGLE COLLET	2340458
AC/GND SINGLE WIRE SEAL	2369839
AC/GND STRAIN RELIEF	2369840
AC/GND SEAL RETAINER	2369841
LV 7X0.35MMSQ WIRE SEAL	2365785
LV STRAIN RELIEF	2369838
CCS1 DC TERMINAL ASSEMBLY	2347581
DC TERMINAL SEAL	2338077
AC TERMINAL Ø3.6, 16MM2	2293266
GROUND TERMINAL, Ø2.8, 16MM2	2293267
CAVITY PLUG	963143
NANO MQS PLUG ASSEMBLY	2312420
GEN 50 LL SOCKET TERMINAL	2272196
MQS PLUG ASSEMBLY	967640
MQS SOCKET TERMINAL	929454
MQS CABLE SEAL	967067
MQS WIRE SEAL PLUG	967056

b) Specifications

114-160121	DIA 8MM, PIN TERMINAL, WELDING APPLICATION OF ULTRASONIC WELD CONNECTION
108-94519	Product Spec. TE actuator for charge inlets
114-94391	GENERAL GUIDELINE FOR THE APPLICATION OF ULTRASONIC WELD CONNECTIONS
114-18061	Application Specification Micro Quadlock System (MQS)
114-18025	Application Specification MQS Contact System SWS
114-18858	Application Specification – Nano MQS System
114-32153	Application Specification – Generation 50 LL Unsealed Female Terminals

2.2. General Documentation

2.2.1. Cable Specifications of Prescribed Cables

Recommendation: TE advises to not use PVC wires due to the low performance after a heat exposure, it can cause leakage issues during the lifetime due to the low compression set between seals.

The following cables are validated for the seals and terminals in this specification. Alternative cables are not permitted without being validated by TE Connectivity.

AC-CABLE: 16MM² CABLE

Supplier	Coficab (Cofflex) – Ford ES-AU5T-1A348-AA Rev H
Outer diameter	Ø6.40mm – Ø7.20mm
Cable description	Unshielded single core XPO E-beam cross linked, reduced wall thickness -40°C to +150°C (3000 h)
Supplier part no.	HCF4SR164500

PE-CABLE (GND): 16MM² CABLE

Supplier	Coficab (Cofflex) – Ford ES-AU5T-1A348-AA Rev H
Outer diameter	Ø6.40mm – Ø7.20mm
Cable description	Unshielded single core XPO E-beam cross linked, reduced wall thickness -40°C to +150°C (3000 h)
Supplier part no.	HCF4SR164500

SIGNAL-CABLE: 0.35MM² CABLE

Supplier	Coficab – Ford ES-AU5T-1A348-AA Rev H
Outer Diameter	Ø1.20mm – Ø1.40mm
Cable description	FLR2Xsp, XPE E-beam cross linked, reduced wall thickness
Supplier Part No.:	2XASP0035XXYY

SIGNAL-CABLE: 0.5MM² CABLE

Supplier	Coficab – Ford ES-AU5T-1A348-AA Rev H
Outer Diameter	Ø1.40mm – Ø1.60mm
Cable description	FLR2Xsp, XPE E-beam cross linked, reduced wall thickness
Supplier Part No.:	2XASP0050XXYY

DC-CABLE: 95MM² CABLE

Supplier	Coficab (Cofflex) – Ford ES-AU5T-1A348-AA Rev H
Outer diameter	Ø16.2mm – Ø16.70mm
Cable description	Unshielded single core XPO E-beam cross linked, reduced wall thickness -40°C to +150°C (3000 h)
Supplier part no.	HCF4CR954500

3. APPLICATION TOOLS

To produce a correct wire crimp, as validated by TE with the wires listed in this specification, the application tools outlined in Table 1 are required.

Table 1: Terminal Crimping Requirements

Wire Size [mm²]	Stripping Length single wire for crimp [mm]	Crimp height CH_1 [mm]	Cable Specification	Supplier	Contact P/N	Geometry	Applicator	TE Crimp Validation is based on crimp press stroke / cycle time
0.35	3.75 ± 0.15	0.70 ± 0.02	COFICAB (Ford ES-AU5T-1A348-AA Rev H)	COFICAB	2272196-2	F	2266703-2	Stroke: 30mm or 40mm
0.5	3.5 ± 0.15	1.4 + 0.15	COFICAB (Ford ES-AU5T-1A348-AA Rev H)	COFICAB	5-965906-1	F	2151038-1	TBD
16	16±0.5	4.8±0.1	COFICAB Cofflex (Ford ES-AU5T-1A348-AA Rev H)	COFICAB	2293266-9	W	TBD	TBD
16	16±0.5	5.10±0.1	COFICAB Cofflex (Ford ES-AU5T-1A348-AA Rev H)	COFICAB	2293267-4	W	2276149-7	Stroke: 44mm Cycle time: 1.7-2.5s
95	19.0±1.0	N/A	COFICAB Cofflex (Ford ES-AU5T-1A348-AA Rev H)	COFICAB	2347581-1	WELD	N/A	N/A

Crimp die sets are subject to wear and their condition and quality must be monitored. Suspect and/or worn die sets must not to be used to produce these crimps. Die sets are available as spare parts.

The welding terminals must be welded using an ultrasonic welding machine per TE spec 114-160121.

4. WIRES

4.1. Assessment of wires

To ensure the required electrical crimp with stable crimp resistance a permissible maximum storage period of 8 months for unprocessed cable (referring to cable manufacturer production date) must be documented by tier harness makers.

4.2. Wire selection

The contact system is released for the application with wires specified in preceding *Section 2.2* The released contact-wire-combinations and crimp parameters are provided in Table 1. Use of any other wire requires the validation and approval of the TE engineering department. The wires are applied as single wire terminations. Double terminations are not intended.

4.3. Wire preparation

The cable must be cut accurately with a 90-degree angle. The cable insulation must be stripped before crimping. The stripping length of the outer insulation is defined in the following section.

Note:

- The insulation must be cut accurately and pulled off from the conductor.
- Offcut of insulation must not remain on the conductor.
- Single strands may not be damaged, fanned out, cut, or pulled out.
- The operator should avoid touching the bare single strands and the strands must not be twisted.
- **All single strands need to be caught in the crimp and not a single strand shall remain outside the crimp.**
- **DC+ weld must have electrical tape applied during assembly.**

Circuit ID	Cable Length (mm)	Tolerance (mm)
LV	75.0	±5.0
AC – L1	90.0	±3.0
AC – L2/N	80.0	±3.0
GND	100.0	±3.0
DC+	88.5	±3.0
DC-	62.5	±3.0

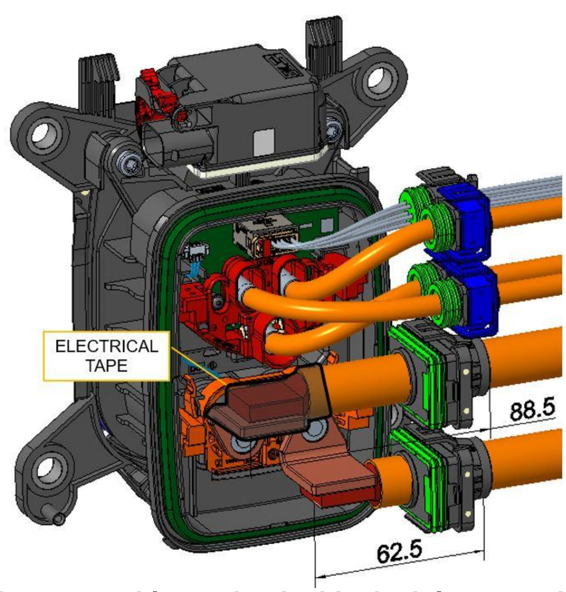


Figure 1: Cable routing inside the inlet assembly

5. W-STYLE CRIMPED CONTACT REQUIREMENTS (CLOSED BARREL)

The following terms shown below are used in this specification, see Figure 2.

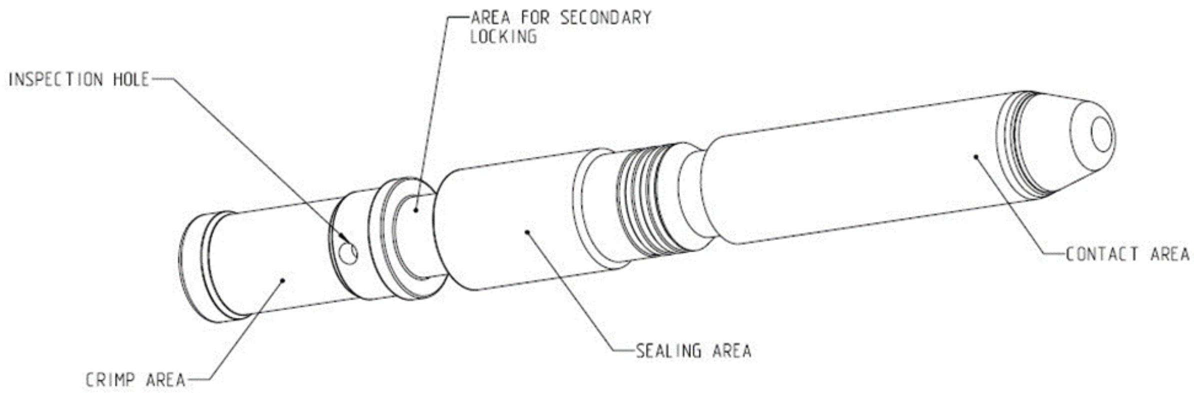


Figure 2: Terminal component identification

5.1. Conductor position

The single strands of the conductor are clamped inside the crimp area. All single strands need to be caught in the crimp and not a single stand can remain outside the crimp. The wire end must be fully inserted into the crimp area and must be checked via the inspection hole after crimping, shown in Figure 3. Wire insulation must not be inside of the crimping area.

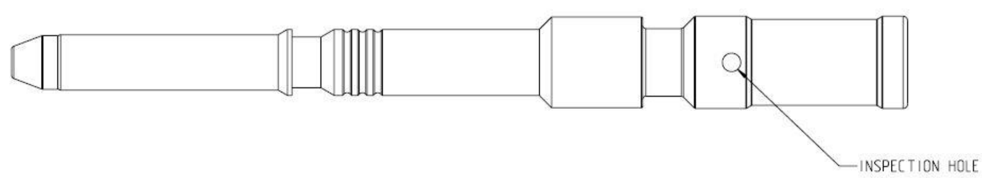


Figure 3: Wire inspection hole location

5.2. Crimp Geometry

Terminal crimp geometry and crimp heights with corresponding tolerances were provided in Table 1 above. Crimp height is the key quality criterion of a crimped connection. The crimp height measurement allows a non-destructive examination and continuous process inspection. At a minimum, the crimp heights must be checked for each batch and after every change/switchover of a contact reel, wire bundle, applicator setup, or any applicator components. The crimp height must be measured over both extensions in the middle of the crimp, see Figure 4.

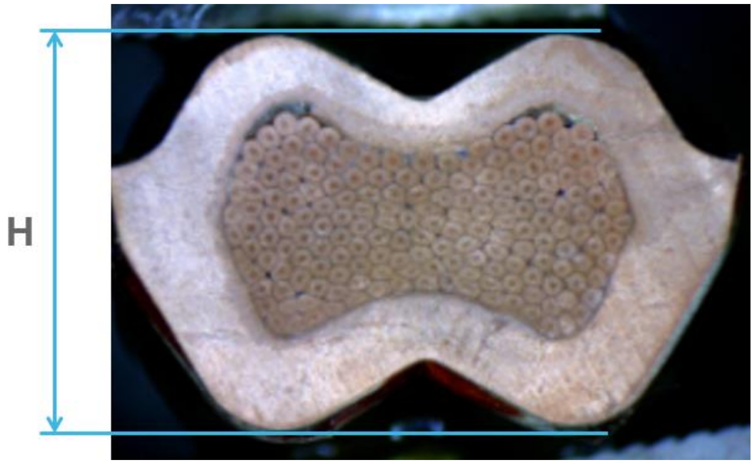


Figure 4: Crimp height measurement location, W- style crimp

Mechanically operated height and width measurements are preferred; however, crimp height and width may also be measured using a cross-section (destructive examination) detailed in Section 5.3.

5.3. Cross Sections

When creating cross-sections, the correct grinding layer must be selected. The grinding layer must be at the middle of crimp area and not inside of a serration, see Figure 5.

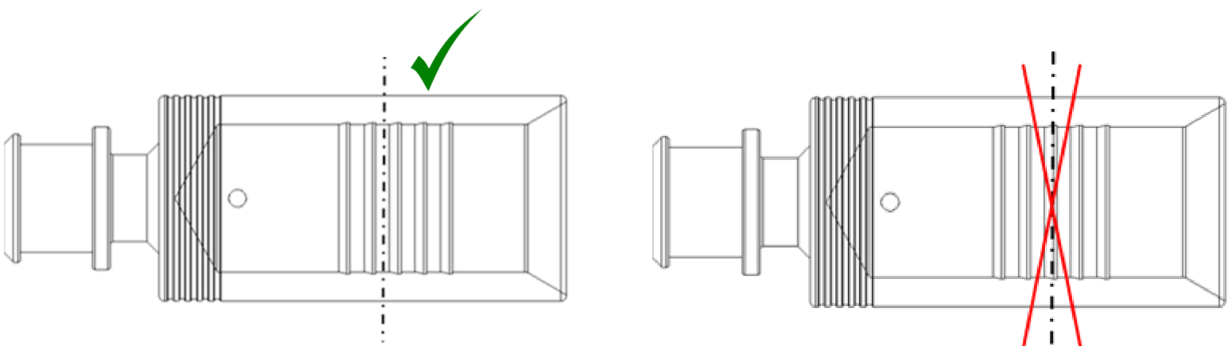


Figure 5: Correct location of crimp cross-sections (exemplary image)

5.4. Wire pull-out forces

Measurement of wire pull-out forces from the wire crimp is a supporting manufacturing control. The pull-out forces must fulfil the requirements detailed in Table 2.

Table 2: Required Wire Pull-Out Forces

TE Contact PN	Wire size [mm²]	Pull-out force (N) $\bar{x} - 3\sigma$	Per standard
2272196-2	0.35	50	USCAR21-4
5-965906-1	0.50	50	USCAR21-4
2293266-9	16.0	600	USCAR21-4
2293267-4	16.0	600	USCAR21-4
2347581-1	95.0	4200	USCAR38-1 / TE

5.5. Terminal identification

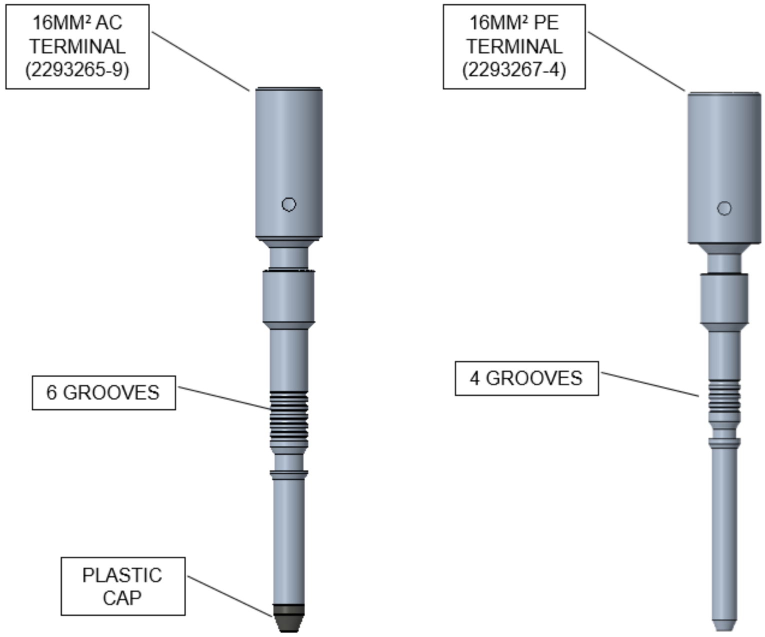


Figure 6: AC and PE terminal identification

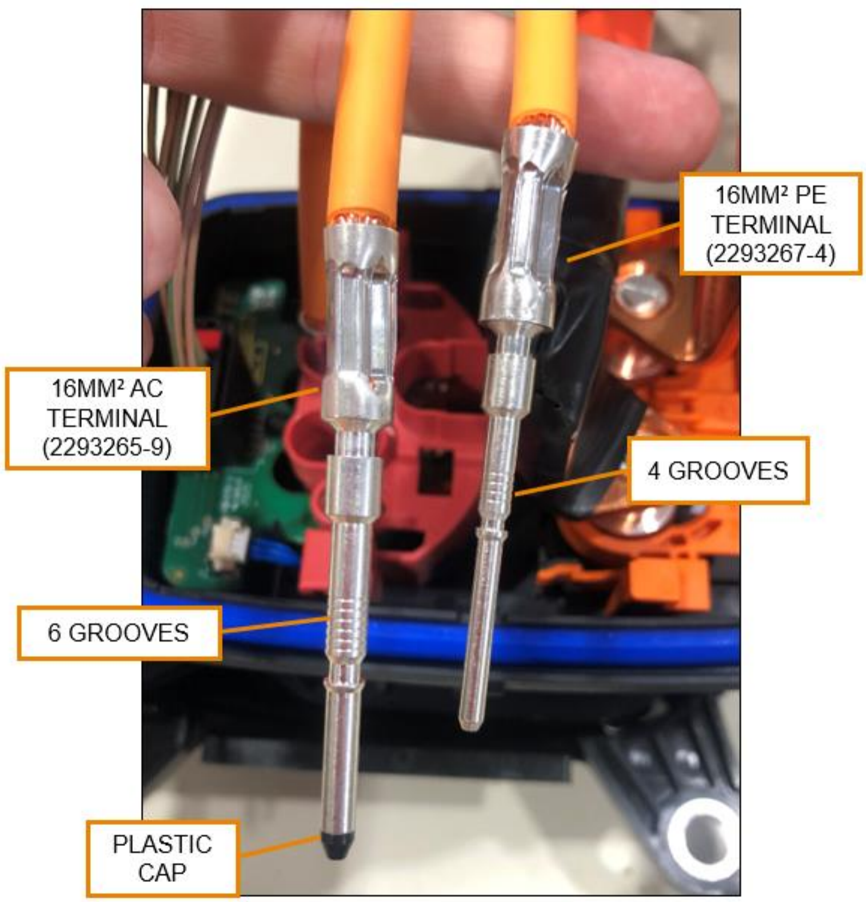


Figure 7: AC and PE terminal identification – post-crimped state

5.6. **Applicator Positioning**

The TE applicator must be positioned in the middle of the contact's crimp area as shown correctly in Figure 8, and incorrectly in Figure 9 below. Correct position and condition of the applicator must be checked for every production lot.

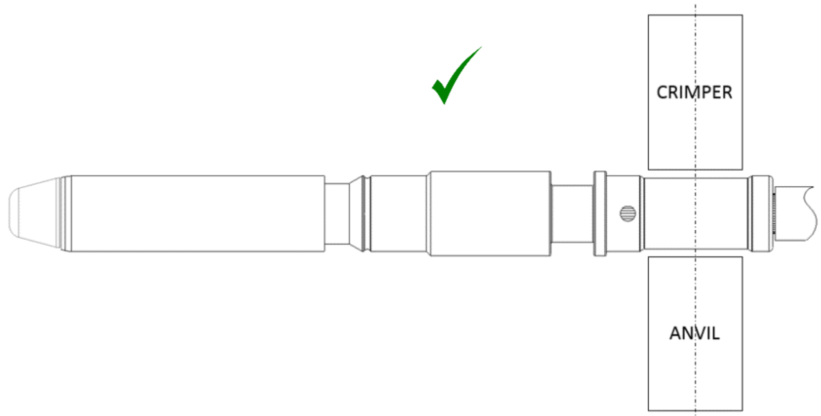


Figure 8: Correct applicator positioning (exemplary image)

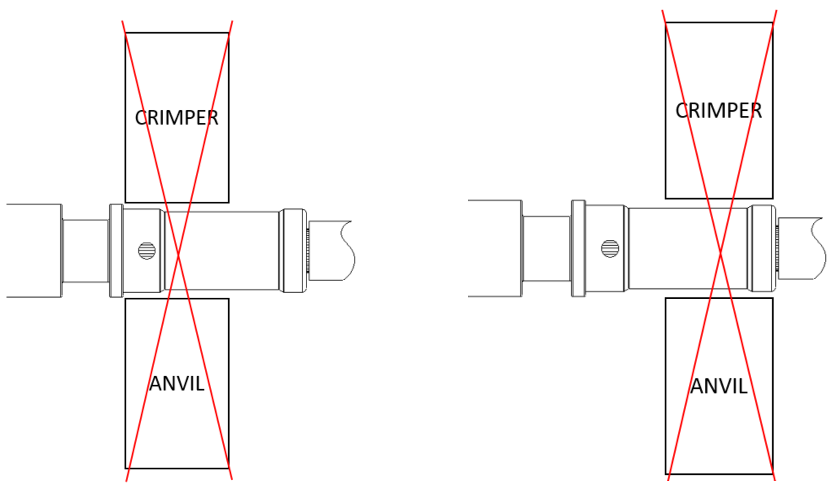


Figure 9: Incorrect applicator positioning (exemplary image)

5.7. **Contact area**

During and following processing the contact area may not be damaged or bent, see Figure 10 for contact area identification.

5.8. **Sealing area**

During and following processing the sealing area may not be damaged or bent, see Figure 10 for sealing area identification.

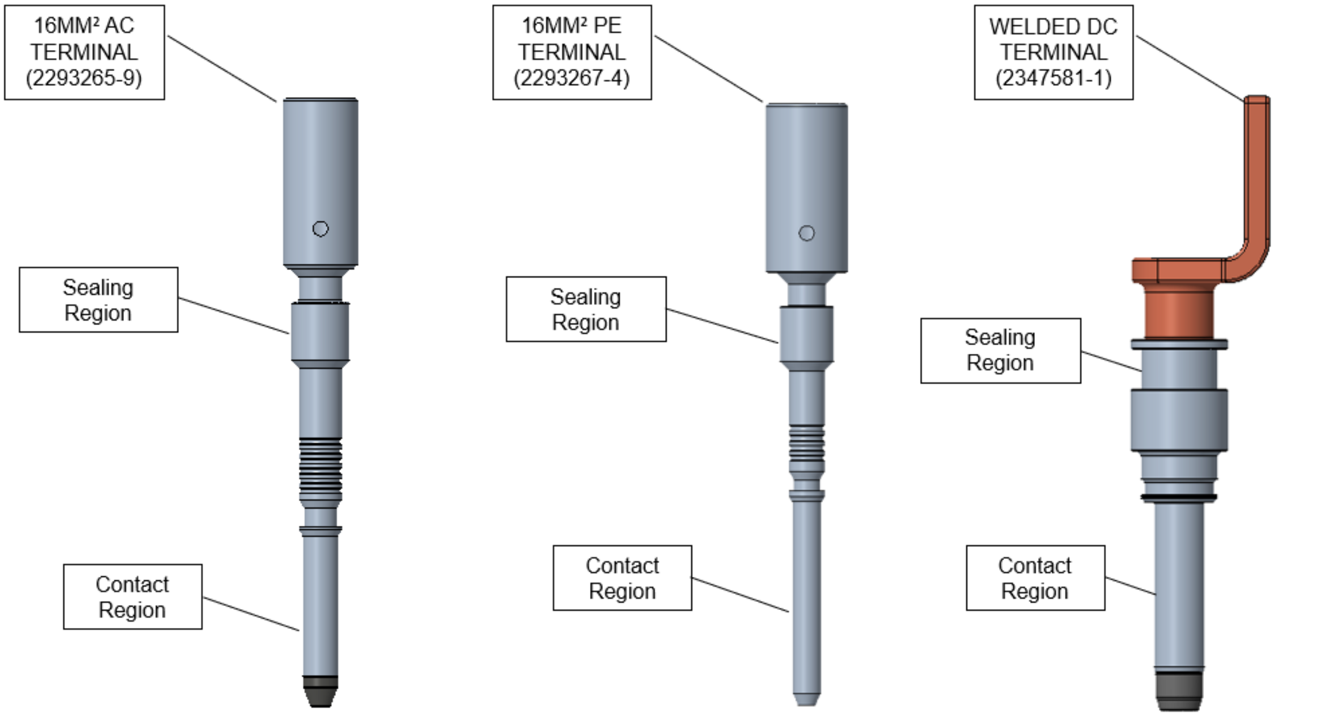


Figure 10: AC, GND, and DC Terminals - Sealing and Contact Region Identification

5.9. Shape and position tolerances

Measuring shape and positional deviation is not always necessary if the contact is obviously straight by visual inspection. In case a measurement is required, the measurement equipment must have at least a 10-times better measuring precision compared to the requirement tolerances, see Figure 11.

Meeting the specific shape and position tolerances must be ensured before the contact is inserted into the housing.

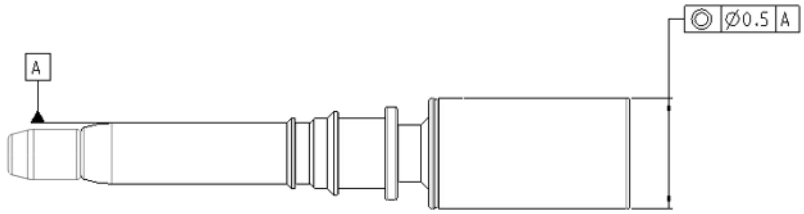


Figure 11: Barrel crimp positional tolerance (exemplary image)

If contacts are bent during the application process and exceed the specified tolerances, these contacts must be scrapped. Do not bend or rework contacts. Figure 12 shows a contact that does not pass visual inspection and must be examined using proper measuring equipment.

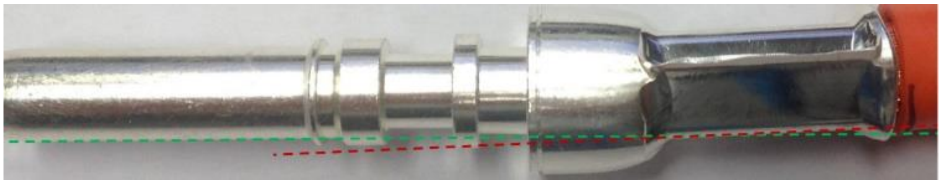


Figure 12: Bent contact after processing (exemplary image)

5.10. **Measuring equipment and measuring position**

For measuring crimp height, a digital caliper with measuring accuracy of 0.01mm is the minimum requirement. Figure 13 below shows proper positioning of digital calipers in the middle of the crimp and extended across the entire crimp width.

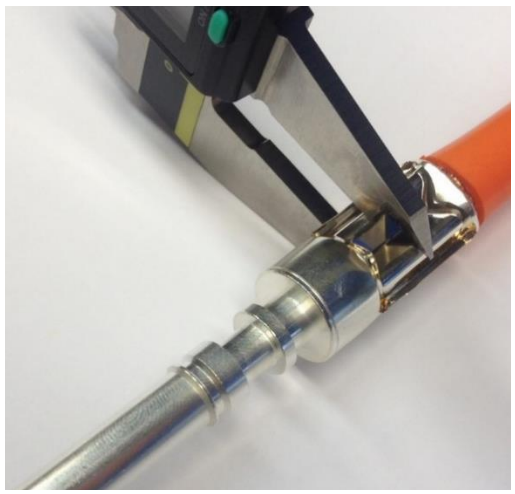


Figure 13: Digital caliper positioning on processed crimp (exemplary image)

6. REQUIREMENTS FOR THE WELDED CONTACTS

The welding of the 95mm² cables on 90 DEG DC power contacts with weld flag geometry must be processed according Application Specification 114-160121. Weld nugget dimensions are shown in Figure 14; required welded cable centerline spacing and orientation for DC+ and DC- are shown in Figure 15 and Figure 16, respectively. These values are subject to variability based on welding machine. **Weld centerline spacing, and orientation are not preliminary; these values are required to ensure proper alignment with wire seals**. Per USCAR 38, the maximum allowable broken and/or missing strands must not exceed 5% of the strand count (i.e. maximum of 150 broken/missing strands for 3000 strand, 95mm² cable). **Electrically isolating tape is required to be applied around the DC+ weld and terminal.**

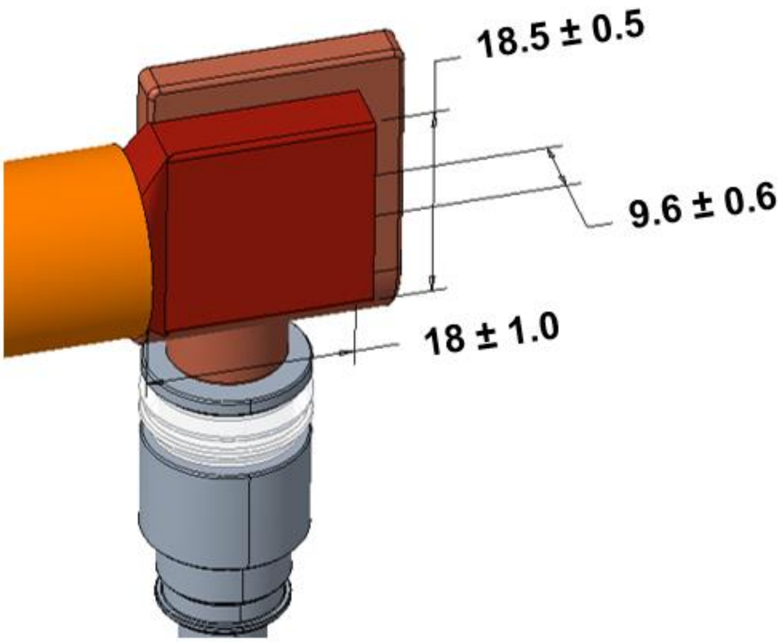


Figure 14: Weld nugget dimensions (using Telsonic MT8000)

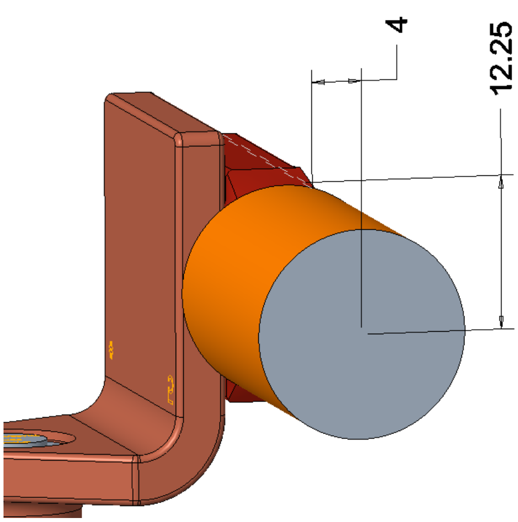


Figure 15: DC+ centerline spacing and weld orientation - REQUIRED

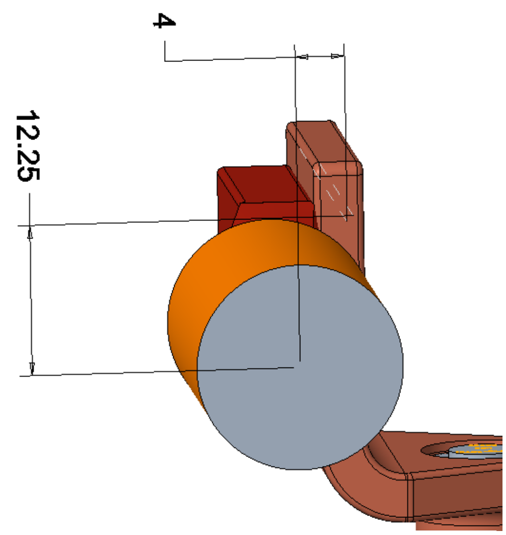


Figure 16: DC- centerline spacing and weld orientation - REQUIRED

7. ASSEMBLY INSTRUCTIONS

7.1. Assembly exploded view

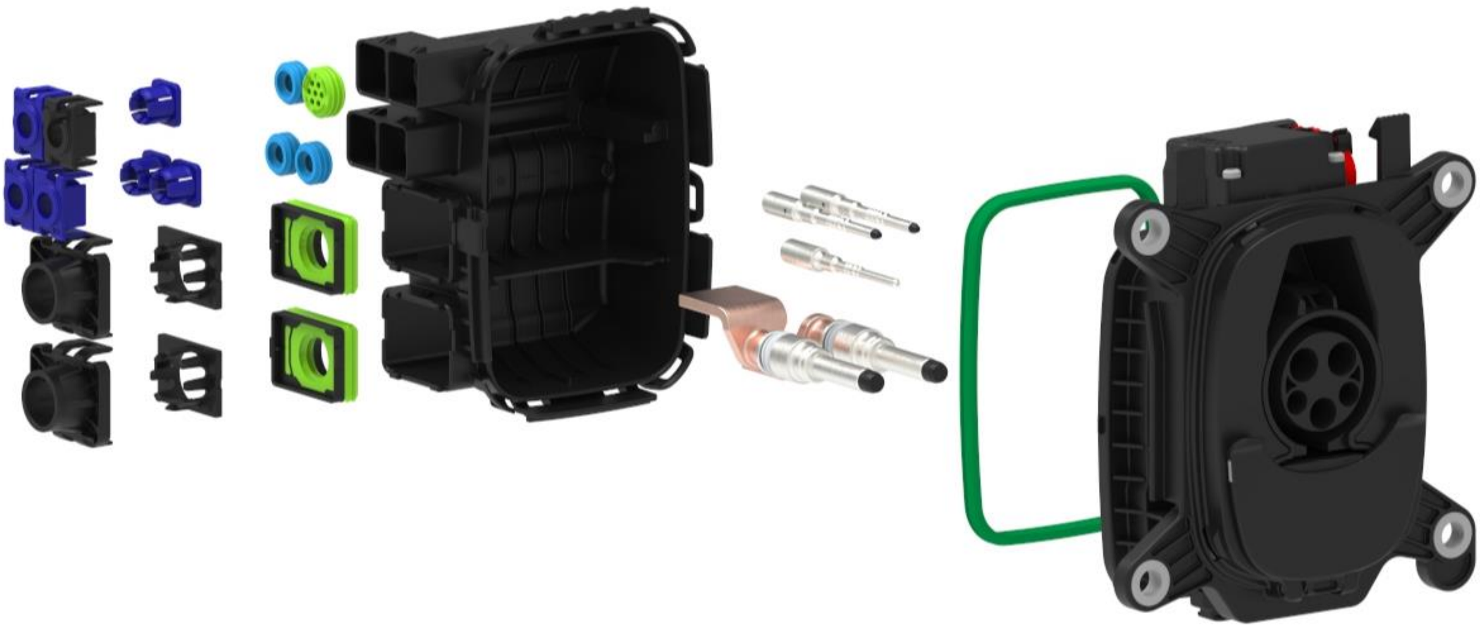
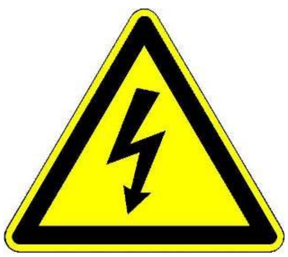


Figure 17: Inlet Assembly Exploded View

7.2. Security Advice

ATTENTION!
- HIGH VOLTAGE APPLICATION -
CABLE INSULATION MUST NOT BE DAMAGED!



The assembly must be performed by trained personnel.

Avoid prolonged or repeated skin contact with silver plated contacts (wear protective gloves)!

7.3. Parts to order

Table 3: Parts to order for this specification

No.	Qty.	Description	P/N
1	1	INLET HSG, COMBO1, ASSY	2371186-1
2	1	10P NANO MQS PLUG ASSEMBLY	Additional part for charge inlet cabling: 2312110-1
	7	GEN 50 LL FEMALE TERMINAL	Additional part for charge inlet cabling: 2272196-2
3	1	4P MQS PLUG ASSEMBLY	Additional part for charge inlet cabling: 1-967640-1
	3	MQS SOCKET TERMINAL	Additional part for charge inlet cabling: 5-965906-1
	3	Ø3.45MM MQS CABLE SEAL	Additional part for charge inlet cabling: 967067-1
	1	Ø3.45MM MQS SEAL PLUG	Additional part for charge inlet cabling: 967056-1
4	2	PIN DIA 3.6, RIGID, POWER AC, ASSY	2293266-9
5	1	PIN DIA 2.8, RIGID, PE	2293267-4
6	1	INLET COMBO PERIPHERAL SEAL	2338079-1
7	1	CABLE EXIT, REAR COVER	2369944-1
8	3	SINGLE WIRE SEAL (AC/GND)	2369839-4
9	3	1P STRAIN RELIEF (AC/GND)	2369840-3
10	3	1P SEAL RETAINER (AC/GND)	2369841-3
11	1	SEAL, LV, 7X0.35MMSQ	2365785-1
12	1	1P SEAL RETAINER, LV	2369838-1
13	2	DC OVERMOLDED WIRE SEAL	2340457-4
14	2	DC 1P COLLET	2340458-4
15	2	DC 1P WIRE SEAL COVER	2369943-1
16	2	DC PIN DIA 8.0	2347581-1
17	2	DC TERMINAL SEAL	2338077-1
18	1	MQS CAVITY PLUG, REAR COVER	963143-1

7.4. Assembly Steps

7.4.1. Step 1: Install wire cover, collet, and seal to AC and GND cables

Assemble WIRE COVER (2369840-3), then COLLET (2369841-3), then SINGLE WIRE SEAL (2369839-4) over the 16mm² cable in the orientation shown in Figure 18. Pay attention to place all components in the correct position/order and orientation; these components cannot be removed once the wire is crimped.

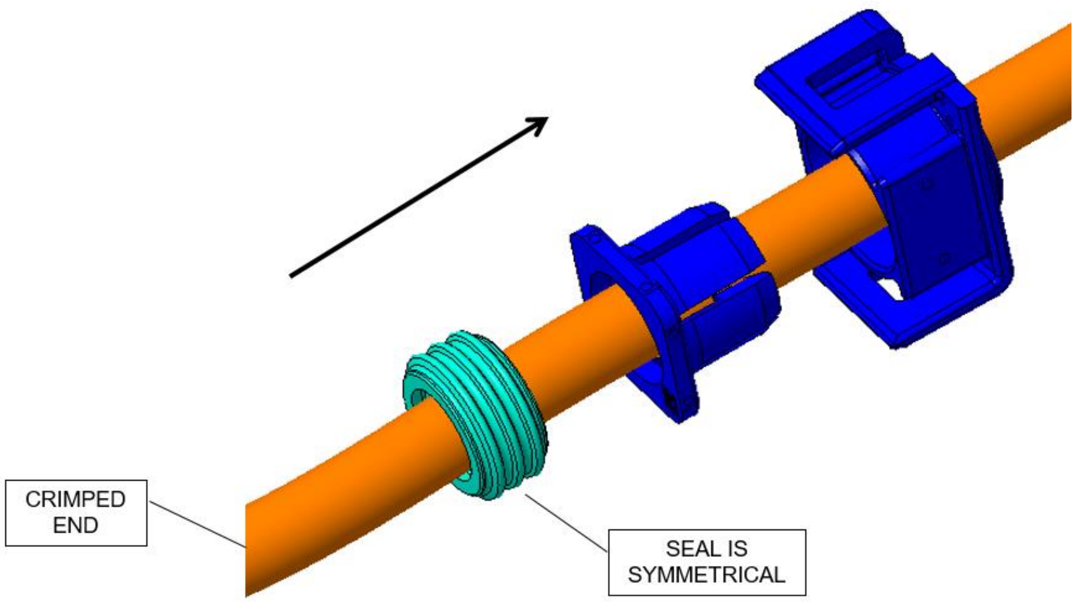


Figure 18: 16mm² wire cover, collet, and seal – assembly direction and orientation

7.4.2. Step 2: Strip wires and crimp contacts (16 mm² AC)

Remove outer insulation of the 16mm² cable, per the dimension shown in Figure 19.

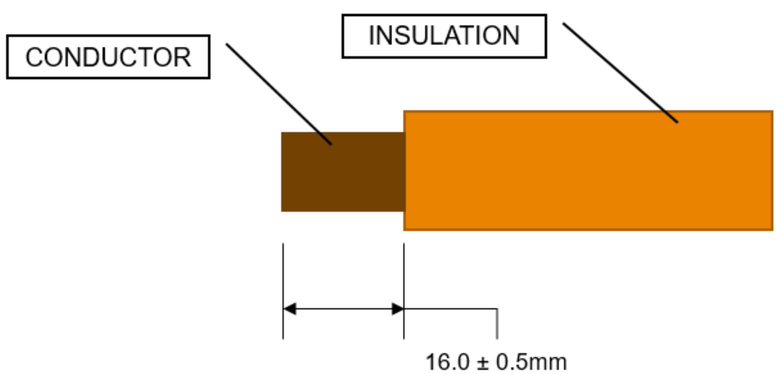


Figure 19: 16mm² AC wire strip length

Crimp the conductor to the PIN DIA3.6 RIGID 2293266-9 with the specified tools listed in *table 1*; the crimp must fulfil the specified requirements. After crimping, the AC cable assembly should reflect the image shown in Figure 20.

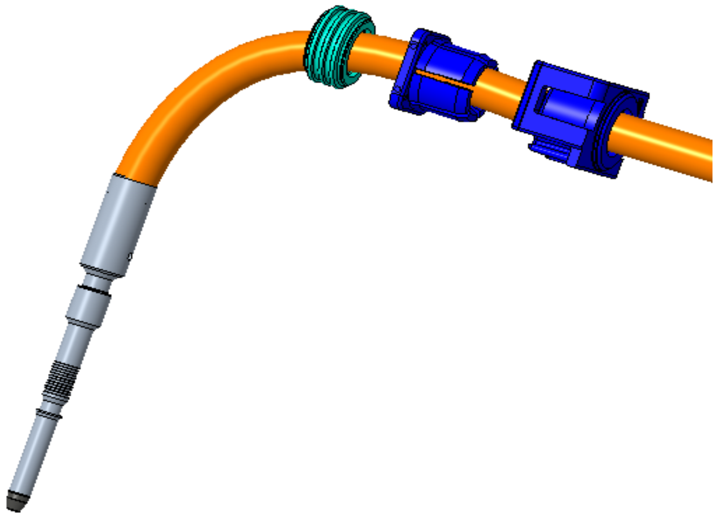


Figure 20: AC cable assembly (schematic, crimp geometry not shown)

7.4.3. **Step 3: Strip wires and crimp contacts (16 mm² GND/PE)**

Remove outer insulation of the 16mm² cable per the dimension shown in Figure 21.

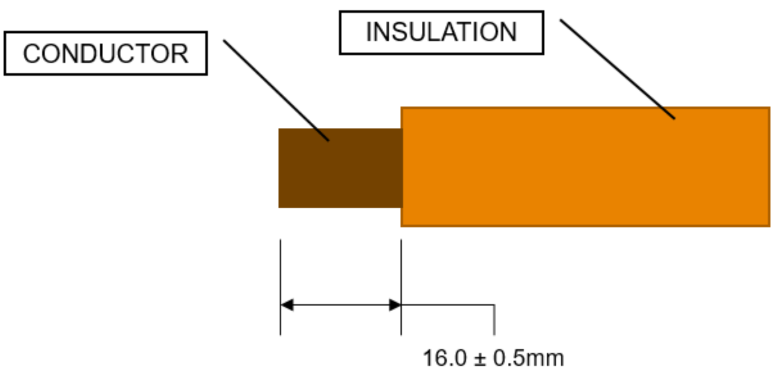


Figure 21: 16mm² GND/PE wire strip length

Crimp the conductor to the PIN DIA2.8 RIGID 2293267-4 with the specified tools listed in table 1; the crimp must fulfil the specified requirements. After crimping, the GND cable assembly should reflect the image shown in Figure 22.

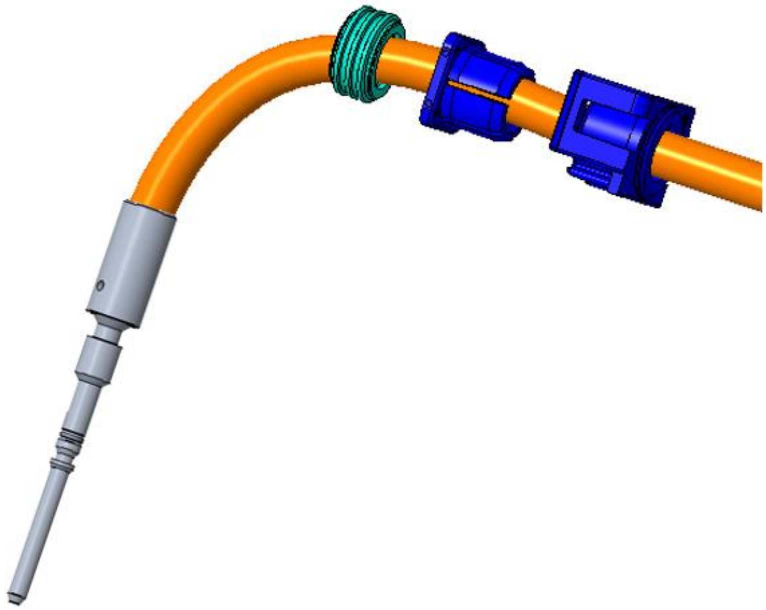


Figure 22: GND cable assembly (schematic, crimp geometry not shown)

7.4.4. **Step 4: Strip wires and crimp contacts (0.35mm² signal wires)**

Remove outer insulation of single wires and crimp contact (2272196-2) according to TE specification 114-32153.

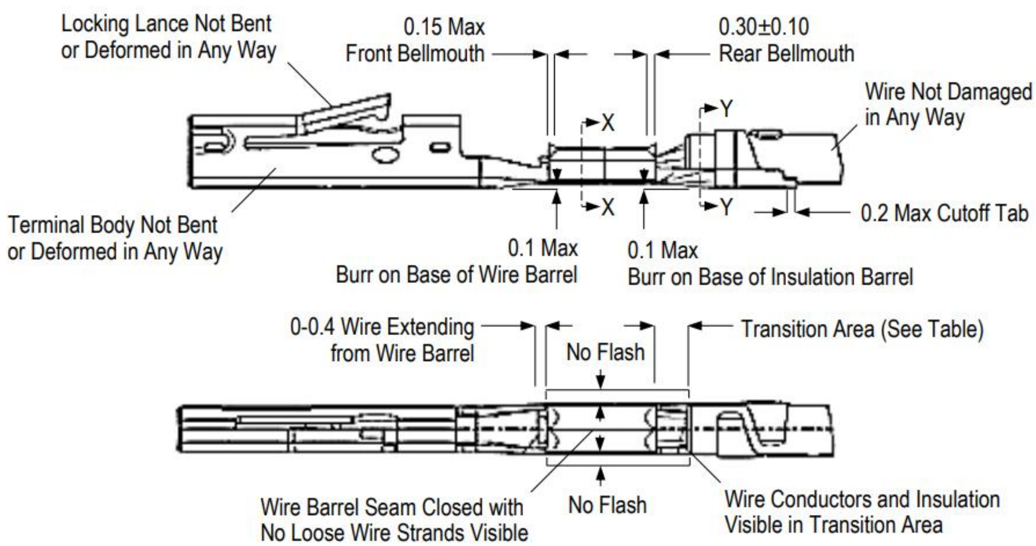


Figure 23: Crimped Gen 50 terminal (exemplary image)

7.4.5. **Step 5: Install wire cover and seal (0.35mm² signal wires)**

Assemble (7) Gen 50 wire and terminal assemblies through the LV WIRE COVER (2369838-1) and LV 7POS FAMILY SEAL (2365785-1) in the orientation shown in Figure 24.

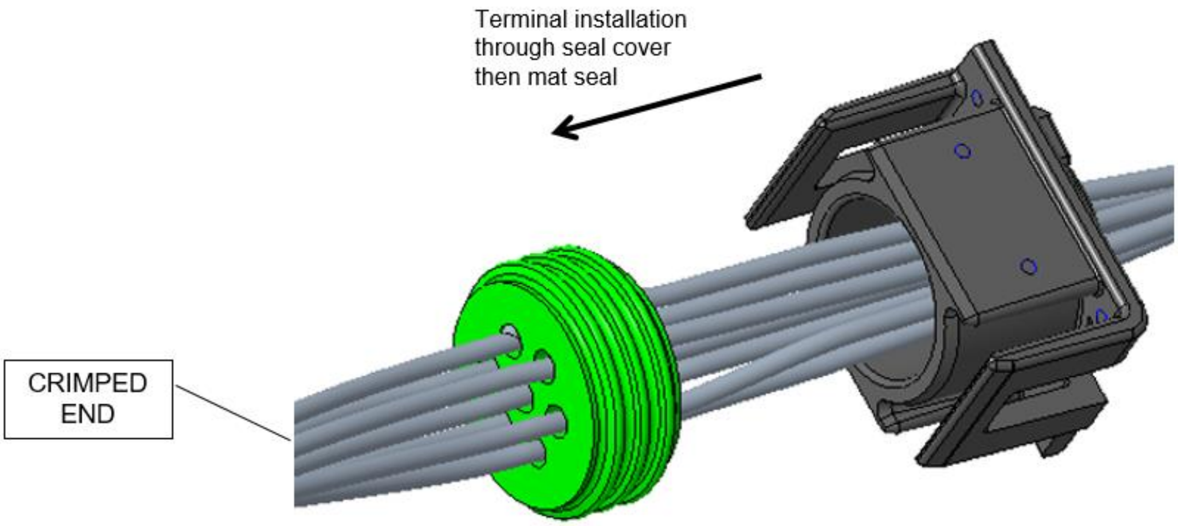


Figure 24: LV seal cover and mat seal installation

7.4.6. **Step 6: Install wire cover, collet, and seal to DC cables**

Assemble WIRE COVER (2369943-1), then COLLET (2340458-4), then SINGLE WIRE SEAL (2340457-4) over the 95mm² cable in the orientation shown in Figure 25. Pay attention to place all components in the correct position/order and orientation; these components cannot be removed once the wire is welded.

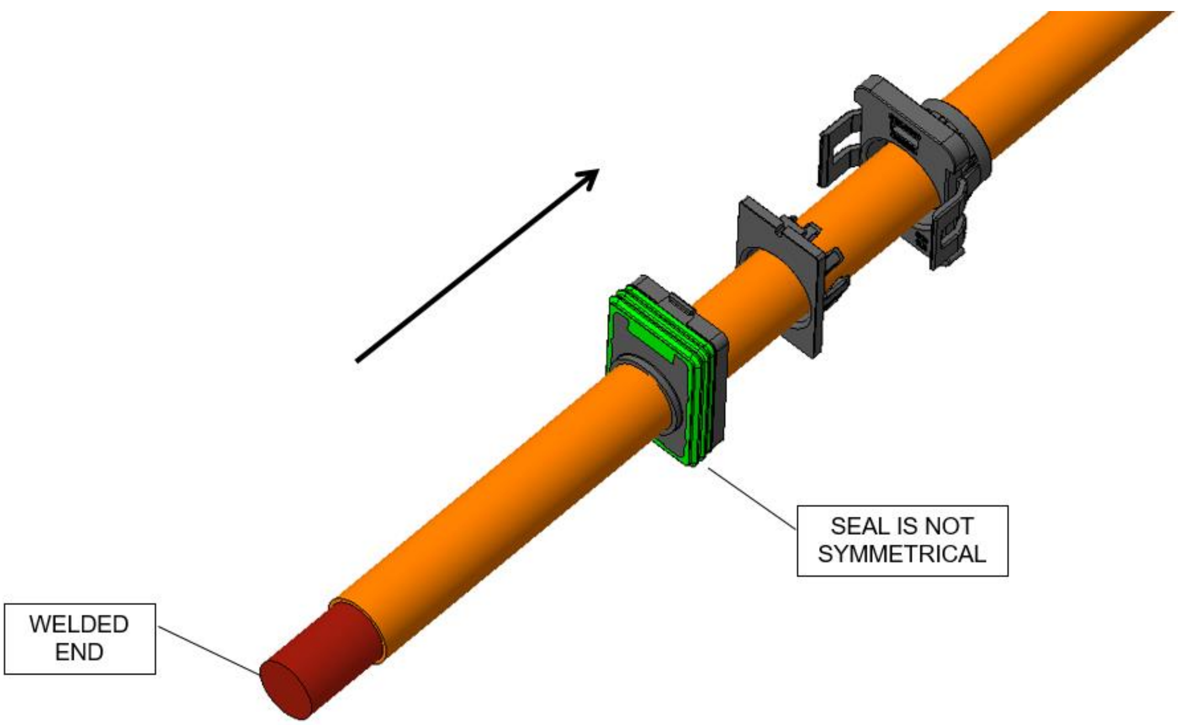


Figure 25: 95mm² wire cover, collet, and seal – assembly direction and orientation

7.4.7. Step 7: Weld DC terminals

Weld the TERMINAL ASSEMBLY (2347581-1) according to TE specification 114-160121.

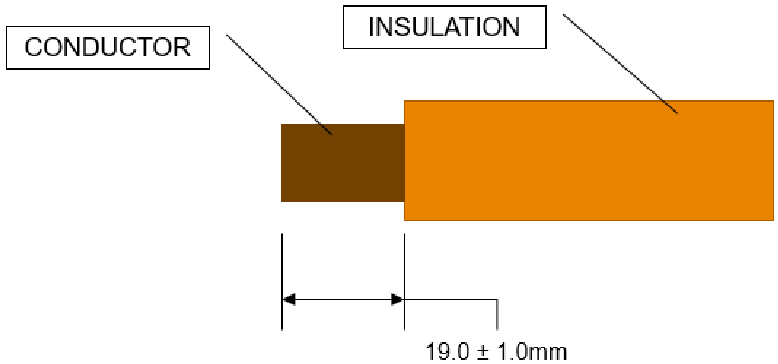


Figure 26: DC cable strip length

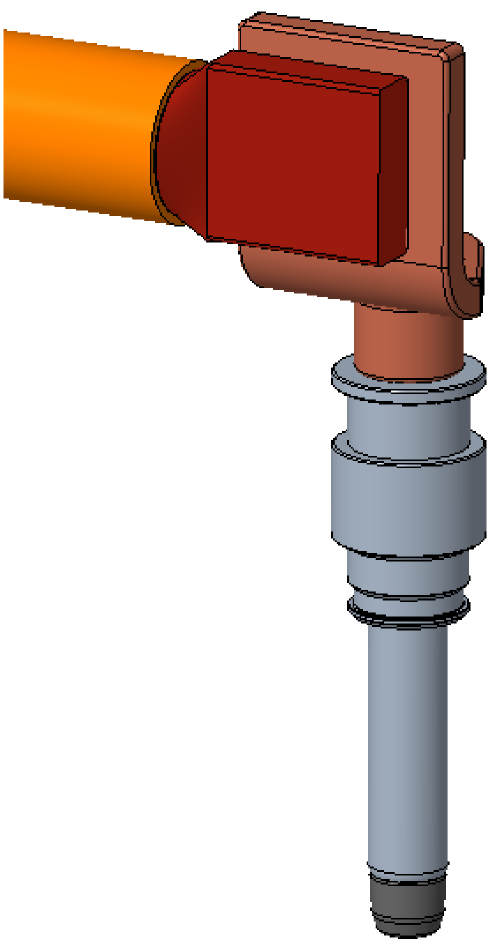


Figure 27: DC+ weld orientation

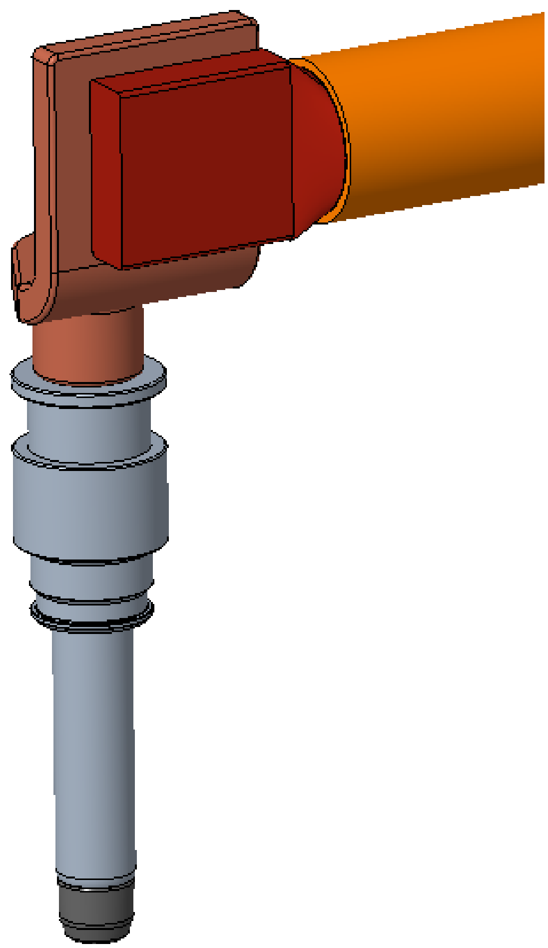


Figure 28: DC- weld orientation

After welding the DC+ terminal, apply electrically isolating tape to the weld area; exemplary image shown in Figure 29 and actual image shown in Figure 30 below.

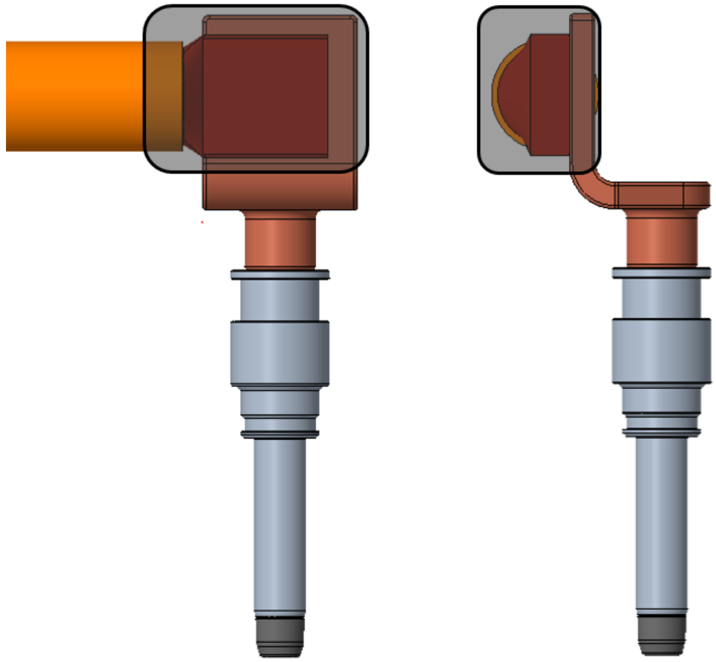


Figure 29: Welded DC+ terminal, back and side view, requires tape in area shown

Figure 30: DC+ terminal with electrical tape applied

7.4.8. **Step 8: Install DC terminal seal**

Assemble the DC terminal seals (2338077-1) on the welded DC terminal assemblies, as shown in Figure 31. Pay attention to not damage the seal during handling. Make sure the seal does not twist or flip around, correct assembly is shown in Figure 32 and Figure 33.

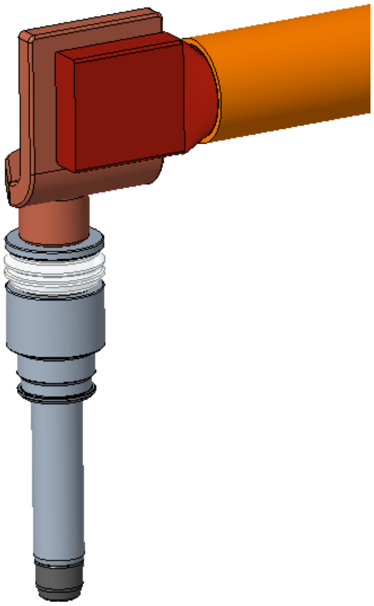


Figure 31: DC- terminal with seal installed

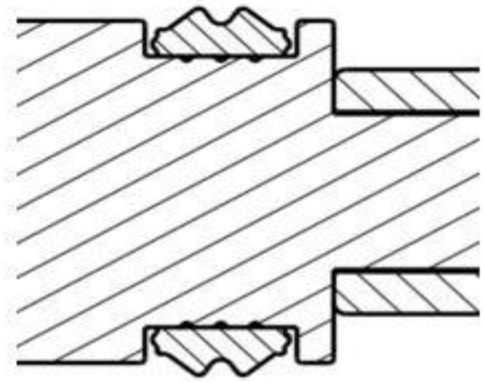


Figure 32: Cross-sectional view of proper DC terminal seal installation

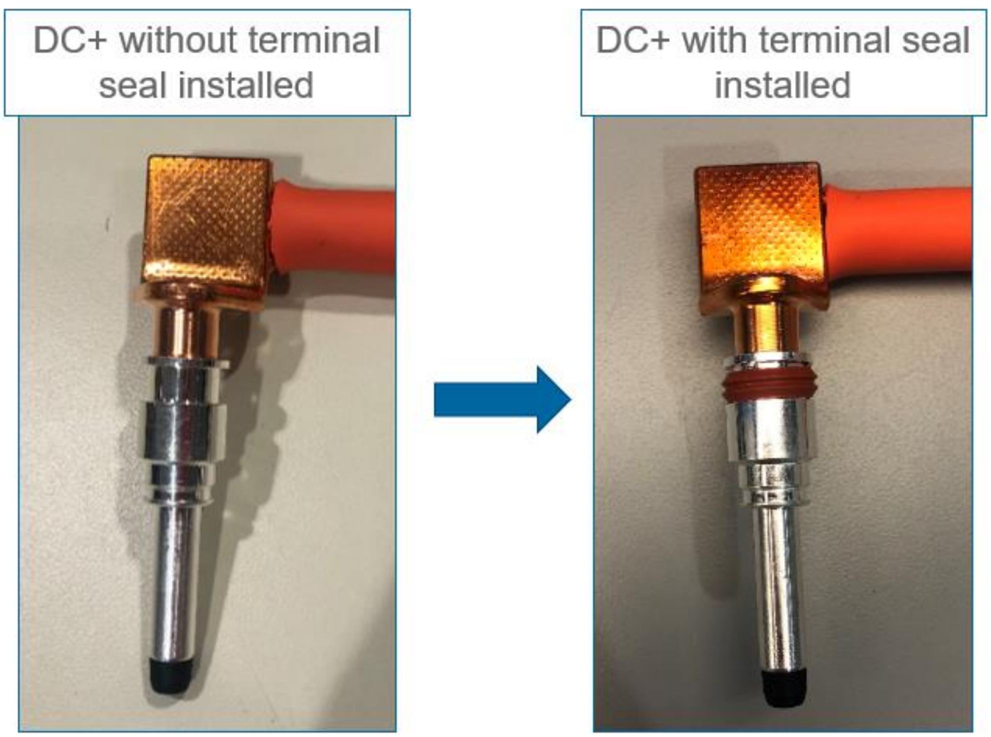


Figure 33: DC terminal seal installation

7.4.9. **Step 9: Install peripheral seal**

Install PERIPHERAL SEAL (P/N 2338079-1) to the inlet assembly per Figure 34 and Figure 35.

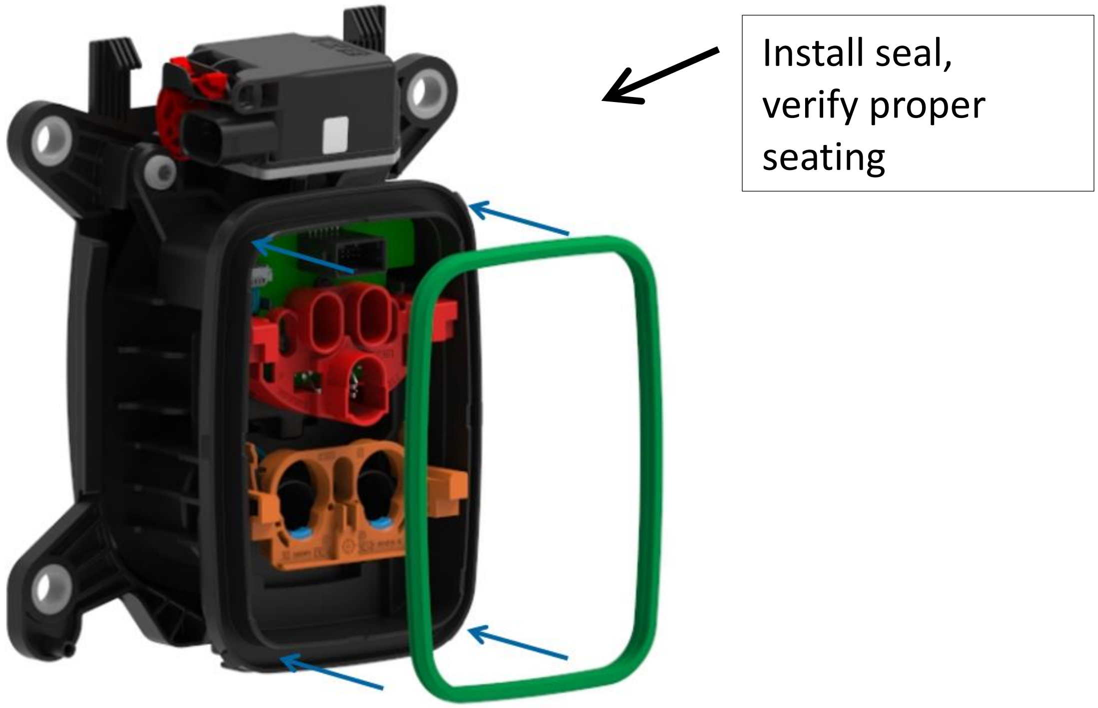


Figure 34: Peripheral seal installation to inlet assembly

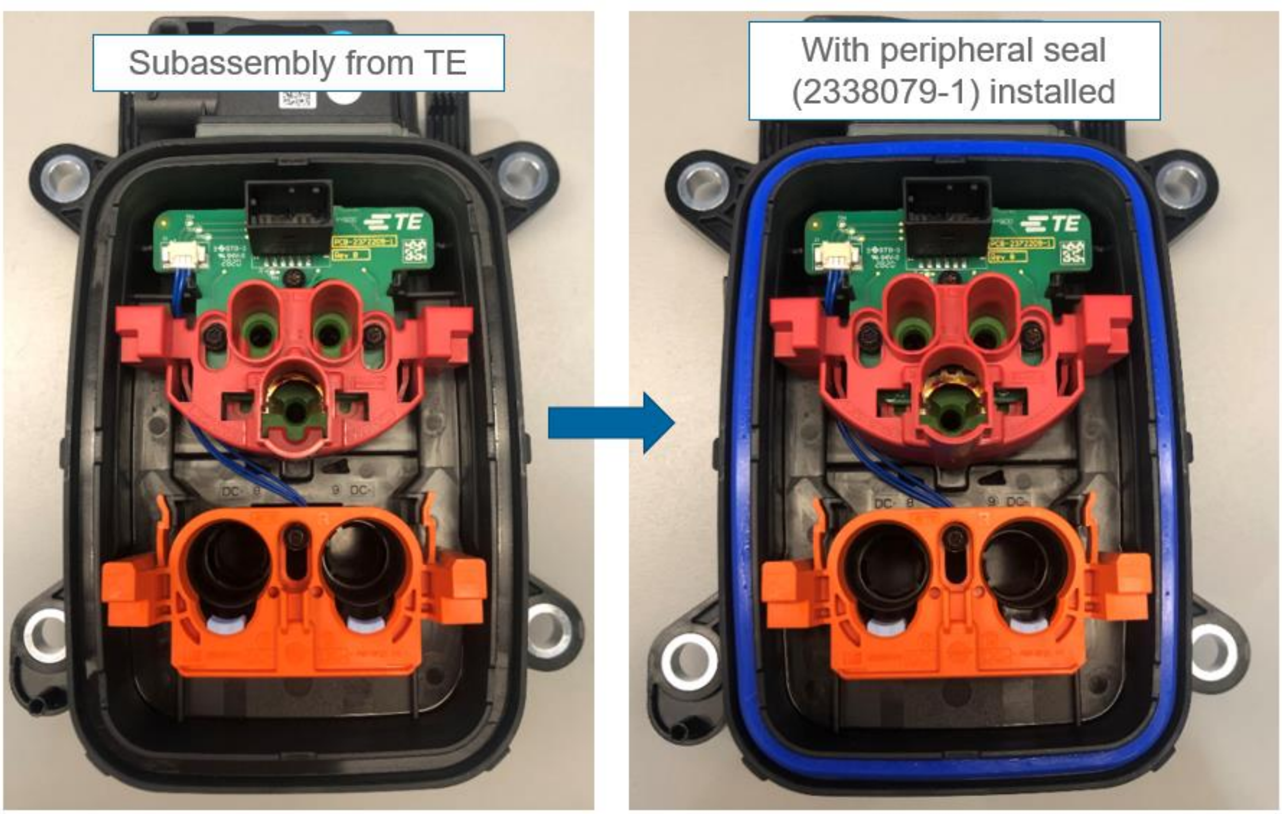


Figure 35: Peripheral seal installation to inlet assembly

7.4.10. **Steps 10-21: Install cable assemblies through rear cover to inlet housing**

Proposed sequence for contact insertion:

1. 7 x Signal (LV) cables with Gen 50 contacts through rear cover then into Nano MQS plug
2. 2 x 95mm² DC power cable with contacts into DC+ and DC- cavities
3. 2 x 16mm² AC power cable with contacts into L2/N and L1 cavities
4. 16mm² ground cable with contact into GND/PE cavity

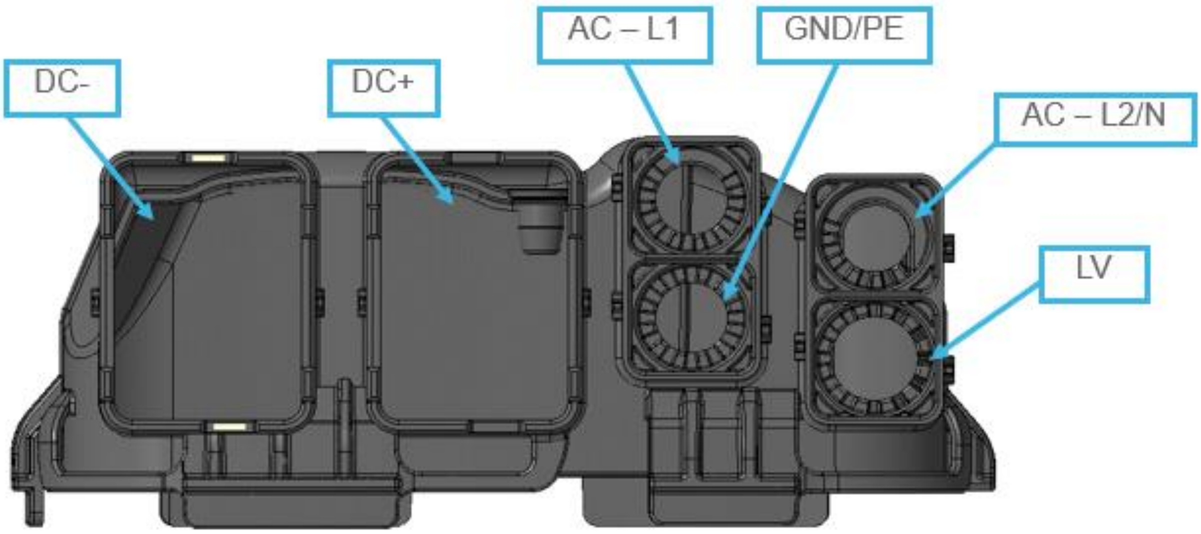


Figure 36: Rear cover circuit identification

7.4.11. **Step 11: Install Gen 50 cable subassembly**

Pass the GEN 50 CABLE ASSEMBLY (STEP 5) through the inlet REAR COVER (2369944-1) as shown in Figure 37 and Figure 38 per the circuit identification previously shown in Figure 36.

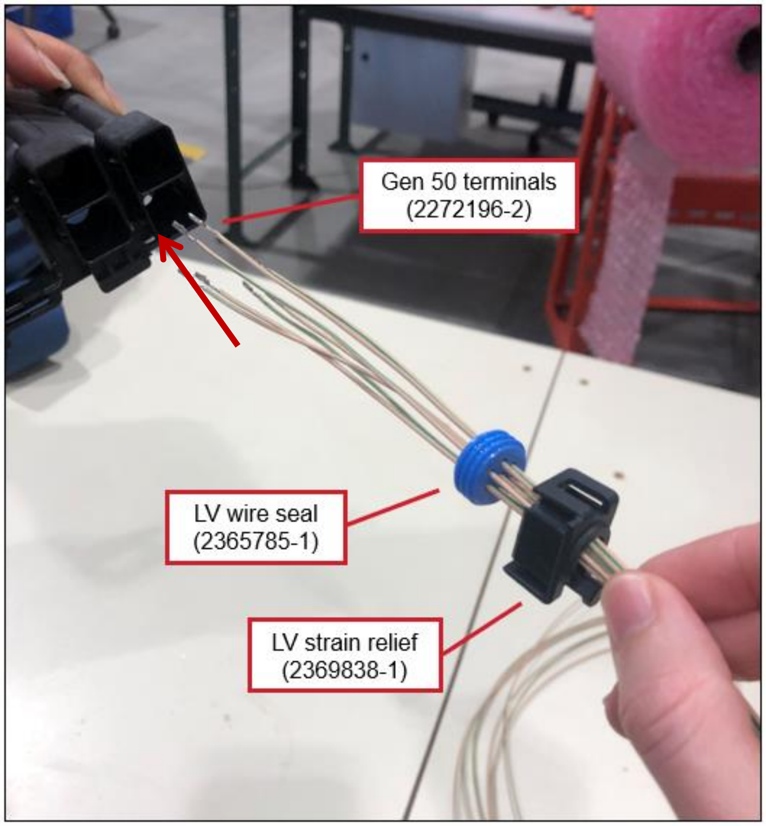


Figure 37: LV cable assembly installation into rear cover

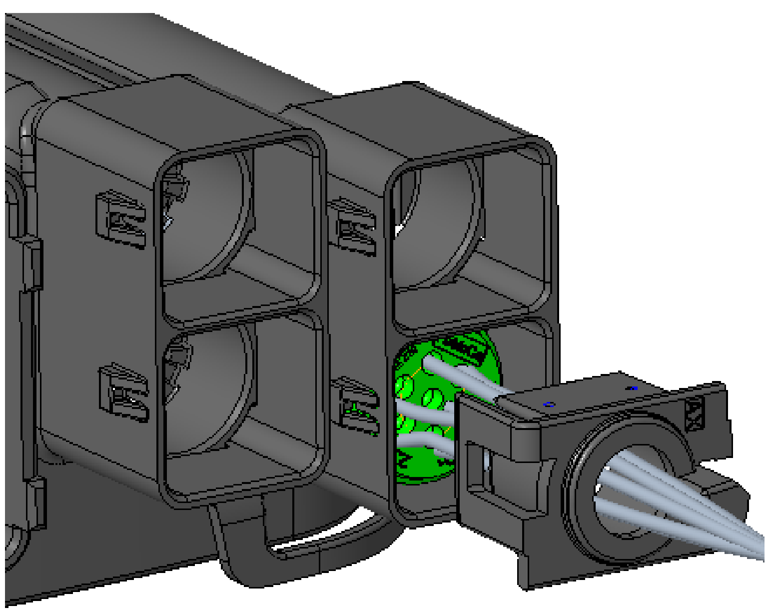


Figure 38: LV cable assembly installation into rear cover

7.4.12. **Step 12: Install Gen 50 terminals into Nano MQS plug**

With the CPA and TPAs in the pre-lock position, push crimped GEN 50 TERMINALS (2272196-2) into the NANO MQS PLUG (2312110-1) according to TE application specification 114-94491. Terminal pin-out is shown in Figure 40: Nano MQS plug pin-out and installation is shown in Figure 39.

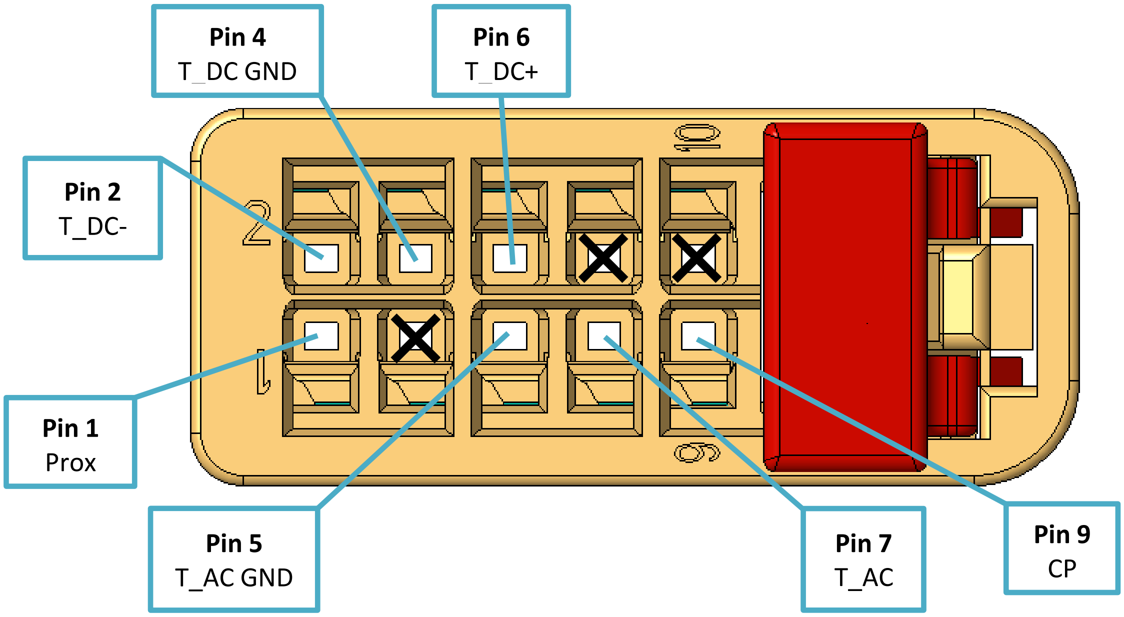


Figure 40: Nano MQS plug pin-out

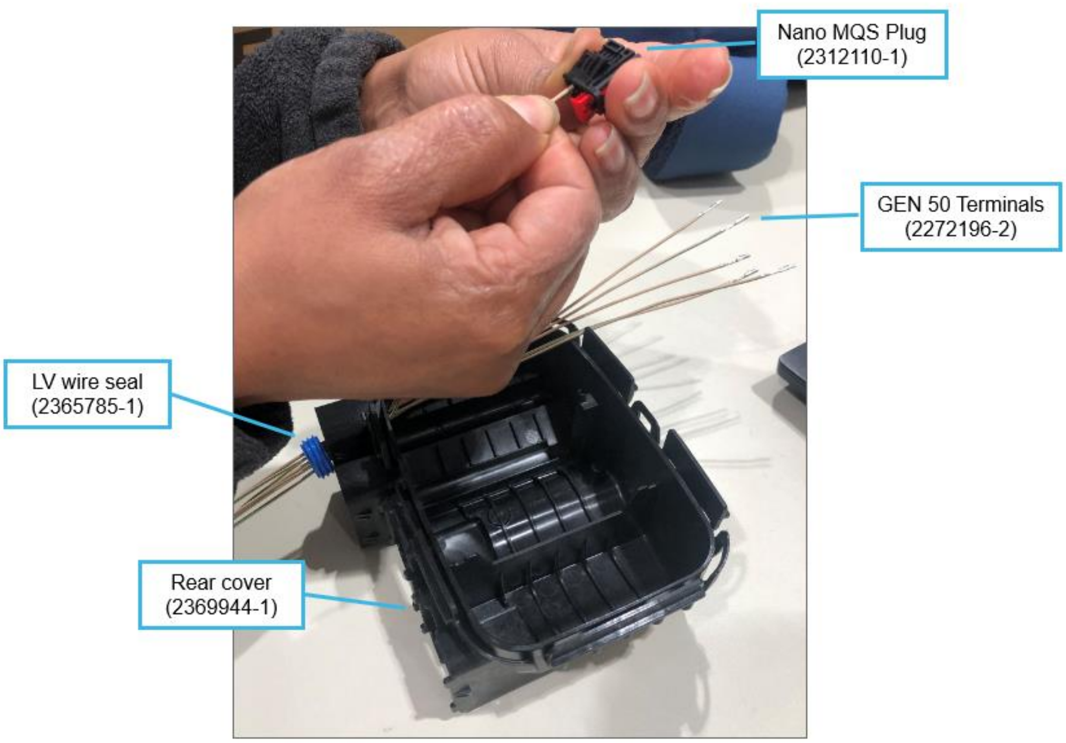


Figure 39: Gen 50 terminal installation into Nano MQS plug

After installation of the GEN 50 TERMINALS into the NANO MQS PLUG, seat the two hinged-TPAs per Figure 41 below. After installation, the LV signal cable assembly should reflect Figure 42 below.

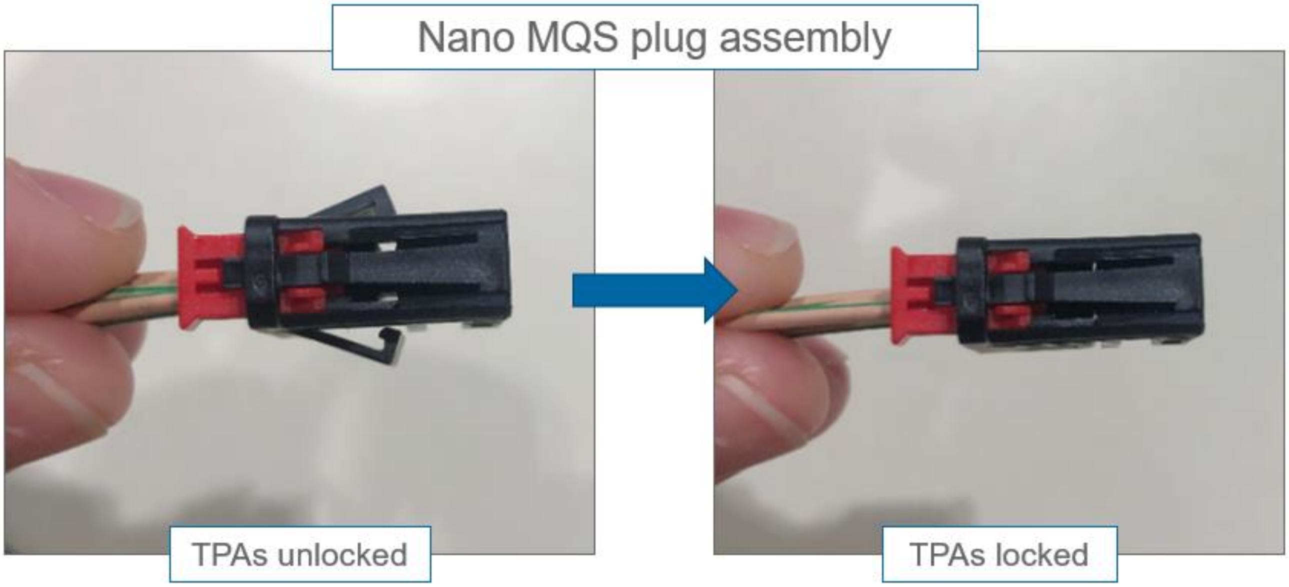


Figure 41: Nano MQS Plug - TPA Final Installation

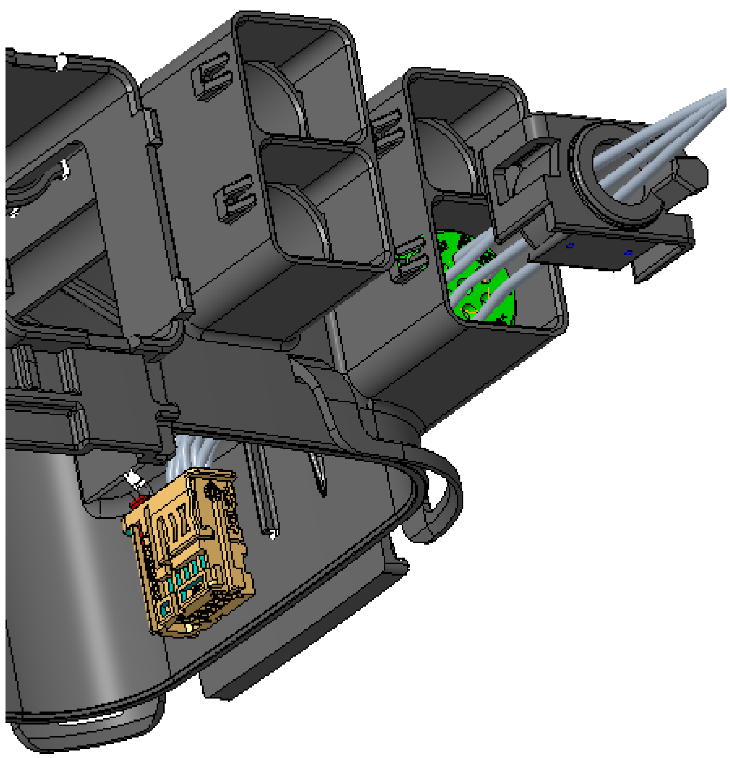


Figure 42: Rear cover with LV plug and cable assembly installed

7.4.13. **Step 13: Pass DC terminals through rear cover**

Pass the DC+ and DC- cable assemblies through the inlet rear cover (2369944-1) as shown in Figure 43 per the circuit identification previously shown in Figure 36.

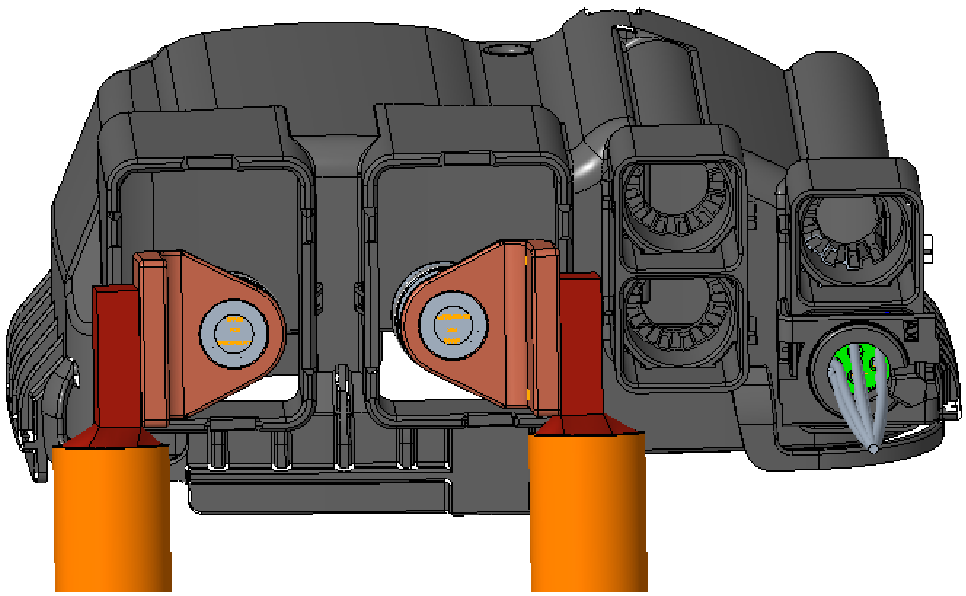


Figure 43: DC terminal installation through rear cover

7.4.14. **Step 14: Install DC contacts into housing**

Note: DC terminal insertion force is greater than 100N; assembly using a press may be necessary.

Insert the DC contacts from the backside into the inlet housing according to the cavity description in Figure 44 below. Push the contacts into their locked position; to ensure the contacts are correctly inserted, pull with a low force on the cables (max. 10N). DC contacts assembled in housing are shown in Figure 45.

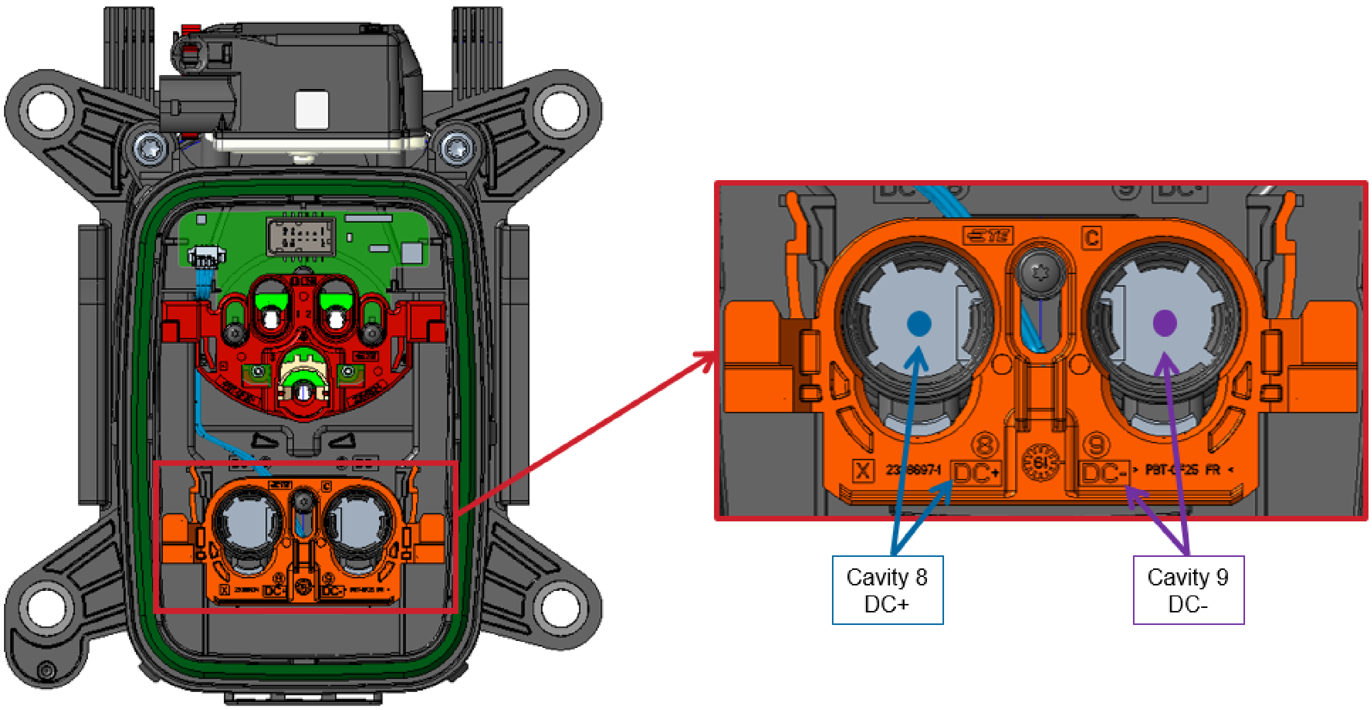


Figure 44: DC cavity identification

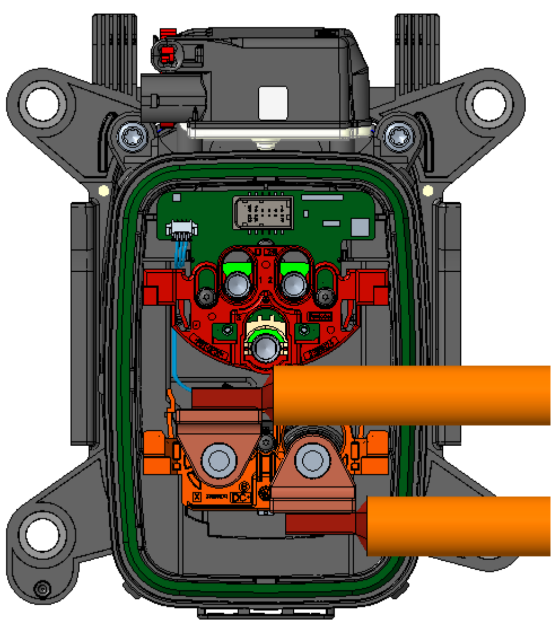


Figure 45: DC terminals installed in the proper cavity and orientation

ATTENTION: The correct contact orientation must be ensured BEFORE pushing the contacts into their locked position.

In case of wrong positioning of the contacts the complete assembly must be scrapped. There is no rework allowed (risk of damaging contacts and/or locking geometry in housing).

7.4.15. **Step 15: Seat DC secondary lock**

After the DC contacts have been inserted and locked, the DC secondary lock must be pushed upwards 6.5mm as shown in Figure 46 and Figure 47. Ensure that both latches are properly engaged with the inlet housing; verify by an audible double click and visual inspection. The DC TPA is shown in its locked position in Figure 48.

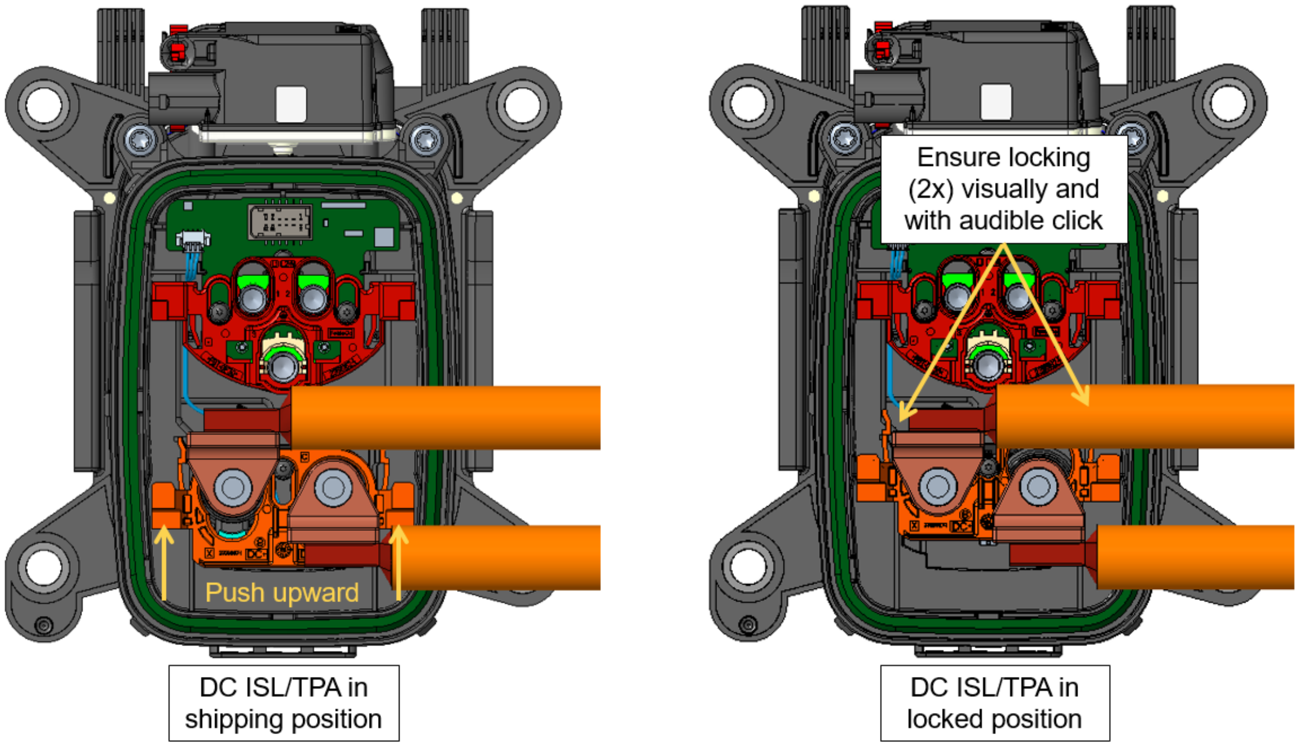


Figure 46: DC TPA installation

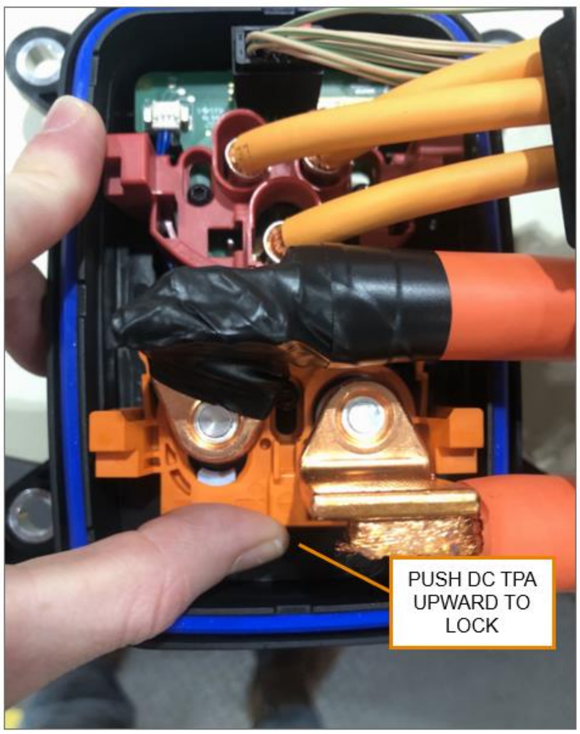


Figure 47: DC TPA Installation

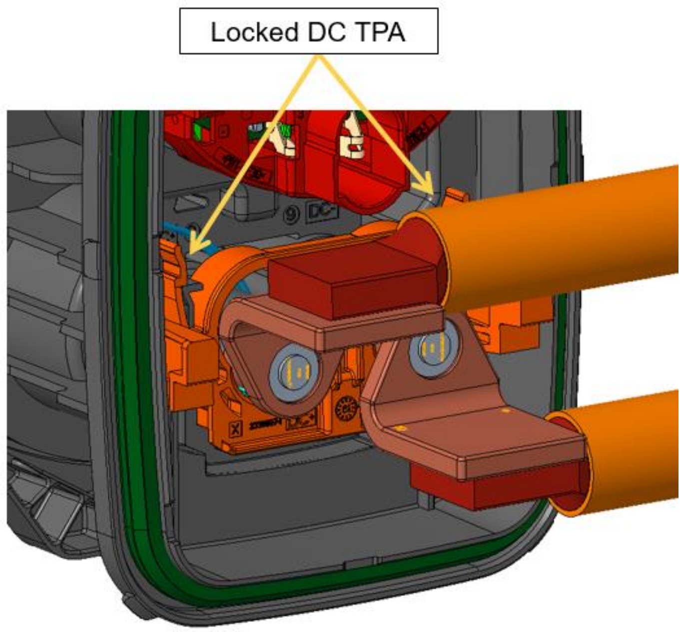


Figure 48: DC TPA in the locked position

7.4.16. **Step 16: Pass AC terminals through rear cover**

Pass the AC (L1 and L2/N) cable assemblies through the inlet rear cover (2369944-1) as shown in Figure 49 per the circuit identification shown in Figure 36.

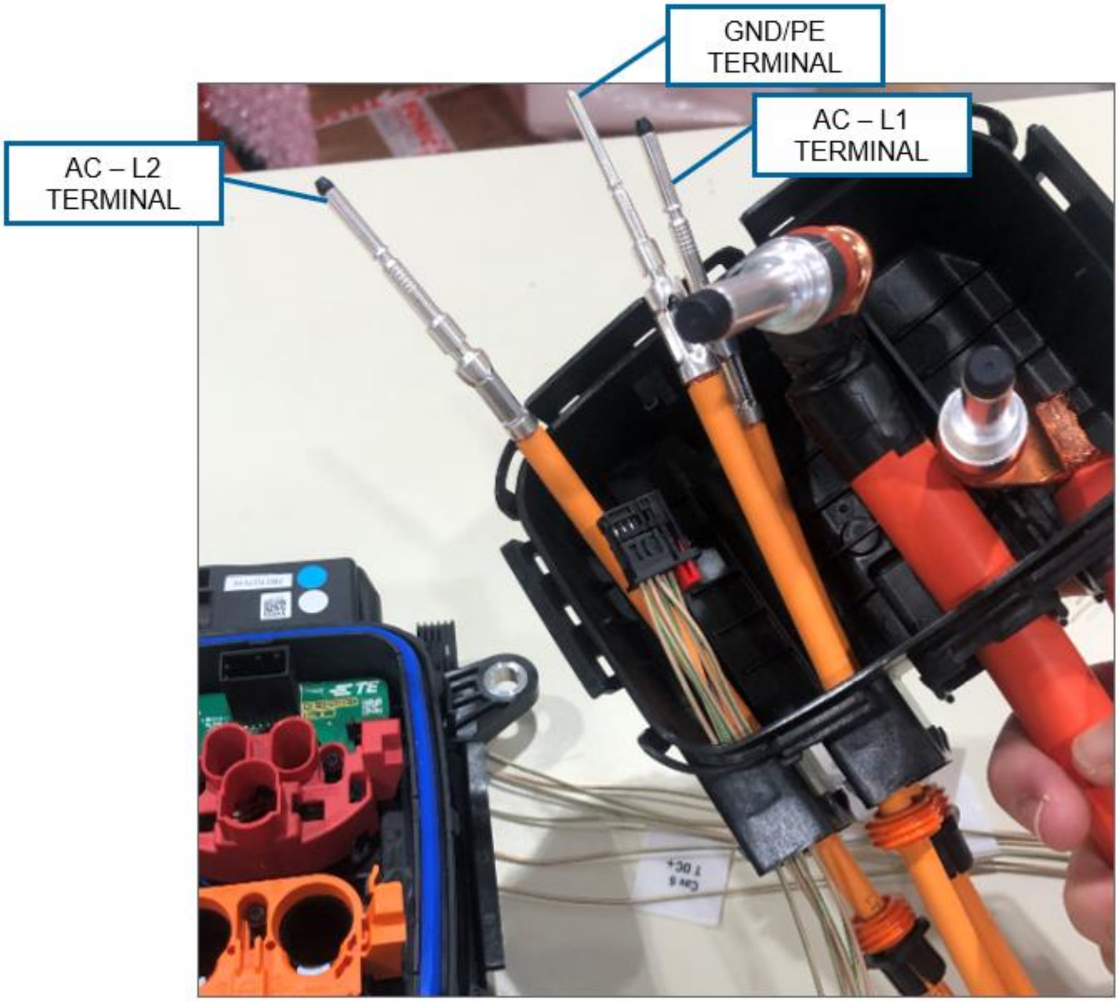


Figure 49: AC and GND terminal identification

IF TERMINALS ARE INSERTED INTO THE WRONG CAVITY, THE COMPLETE ASSEMBLY MUST BE SCRAPPED. REWORK IS NOT PERMITTED. THERE IS A RISK OF DAMAGE TO THE TERMINALS AND HOUSING LOCKS.

7.4.17. **Step 17: Install AC contacts into housing**

Insert the AC contacts from the backside into the inlet housing according to the cavity description in Figure 50 below. Push the contacts into their locked position; to ensure the contacts are correctly inserted, pull with a low force on the cables (max. 10N). AC contacts being assembled into the inlet housing are shown in Figure 51.

ATTENTION: The correct cavity must be ensured BEFORE pushing the contacts into the locked position in their cavities.

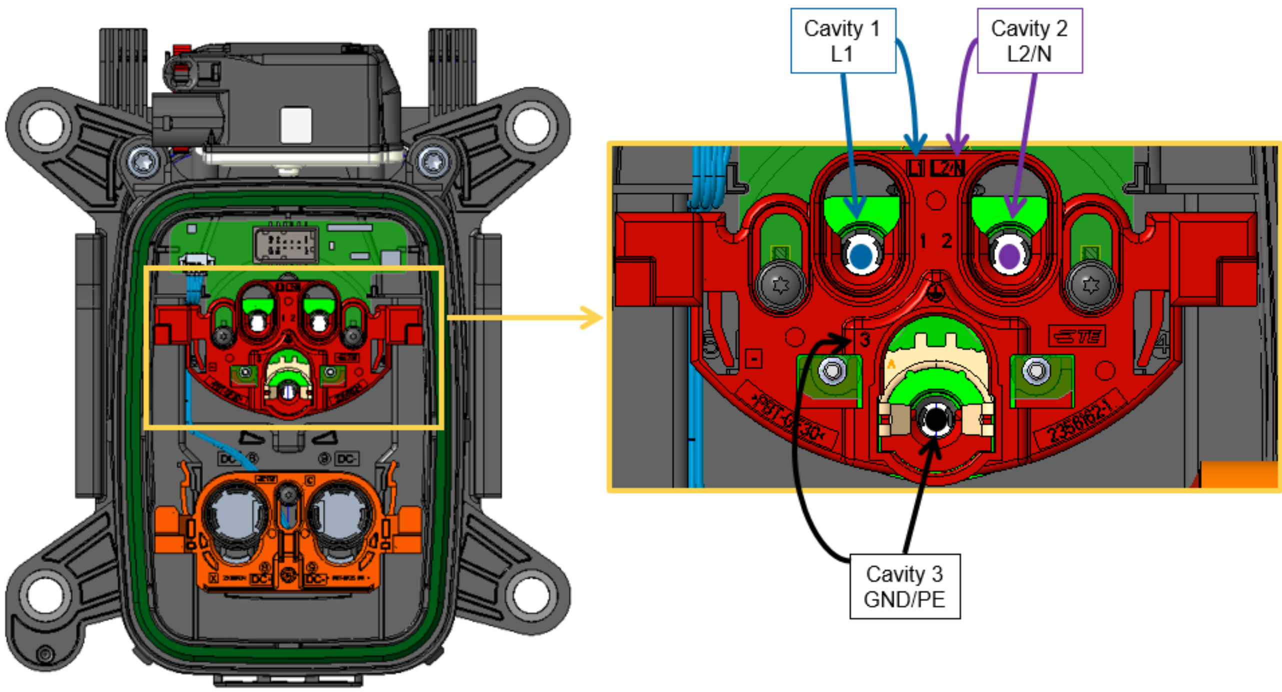


Figure 50: AC/GND circuit identification

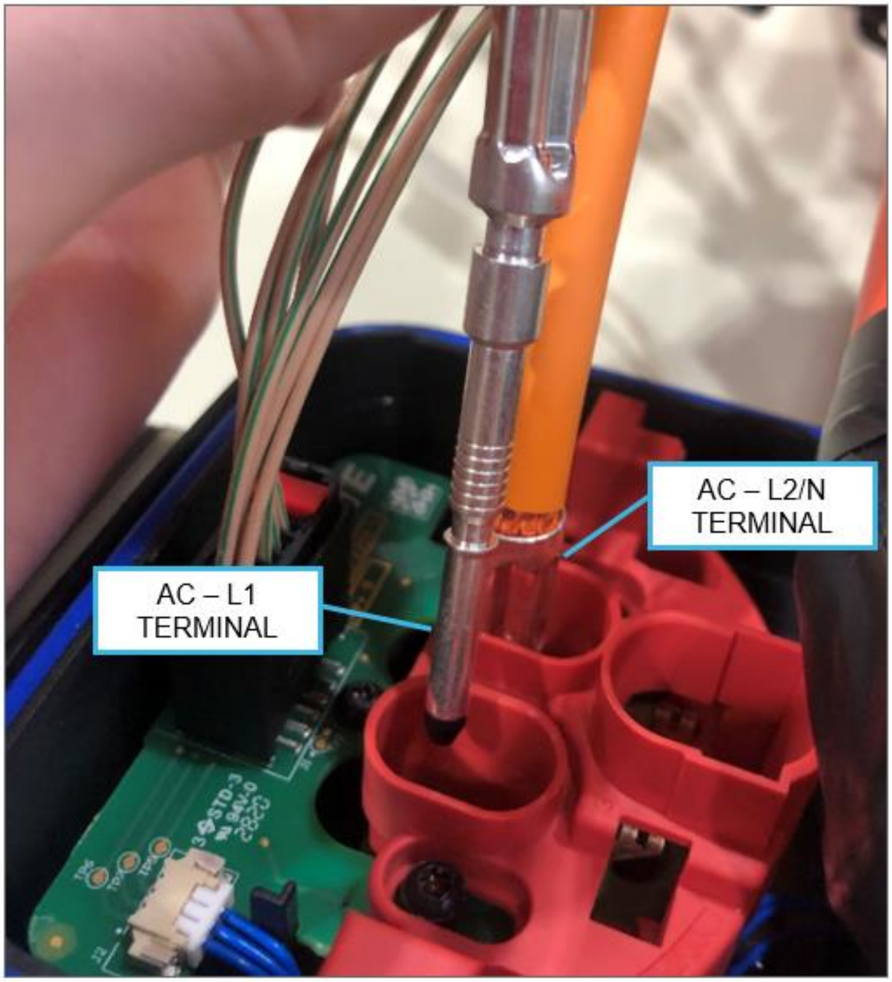


Figure 51: AC L1 and AC L2 terminal installation and circuit identification

7.4.18. **Step 18: Pass GND/PE terminal through rear cover**

Pass the GND/PE cable assemblies through the inlet rear cover (2369944-1) per the circuit identification shown in Figure 36.

7.4.19. **Step 19: Install GND/PE contacts into housing**

Insert the GND/PE contacts from the backside into the inlet housing according to the cavity description in Figure 50 above. Push the contacts into their locked position. To ensure the contacts are correctly inserted, pull with a low force on the cables (max. 10N). GND/PE contacts being assembled into the housing are shown in Figure 53.

ATTENTION: The correct cavity must be ensured BEFORE pushing the contact into the locked position in its cavity.

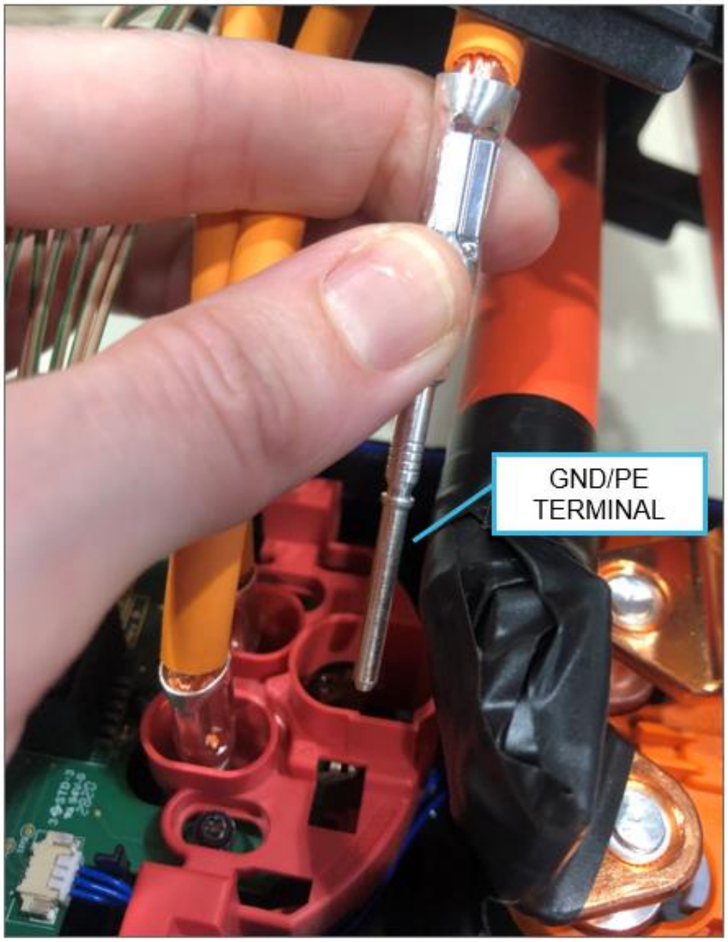


Figure 53: GND/PE Terminal installation into inlet assembly

7.4.20. **Step 20: Seat AC secondary lock**

After the AC and GND contacts have been inserted and locked, push the AC/GND secondary lock upwards 5.5mm. Ensure that both latches are properly engaged with the inlet housing; verify by an audible double click and visual inspection. The AC/GND TPA is shown in its unlocked and locked position in Figure 54 and Figure 55, respectively.

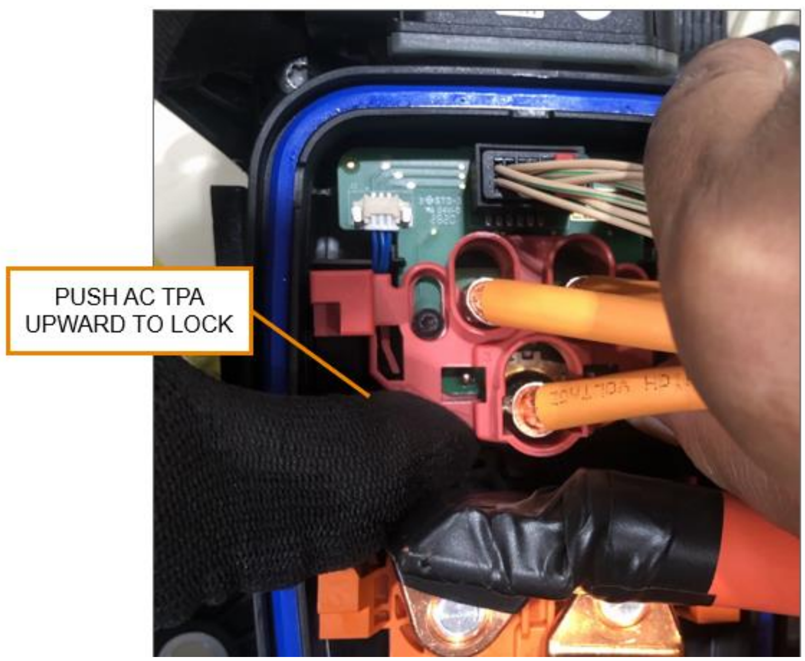


Figure 52: AC TPA installation

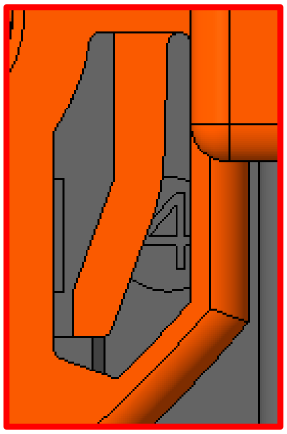


Figure 54: AC secondary lock – locked position

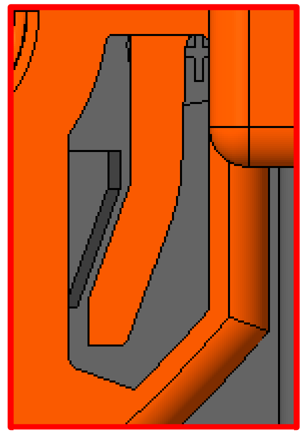


Figure 55: AC secondary lock – prelock position

IF TERMINALS ARE INSERTED INTO THE WRONG CAVITY, THE COMPLETE ASSEMBLY MUST BE SCRAPPED. REWORK IS NOT PERMITTED. THERE IS A RISK OF DAMAGE TO THE TERMINALS AND HOUSING LOCKS.

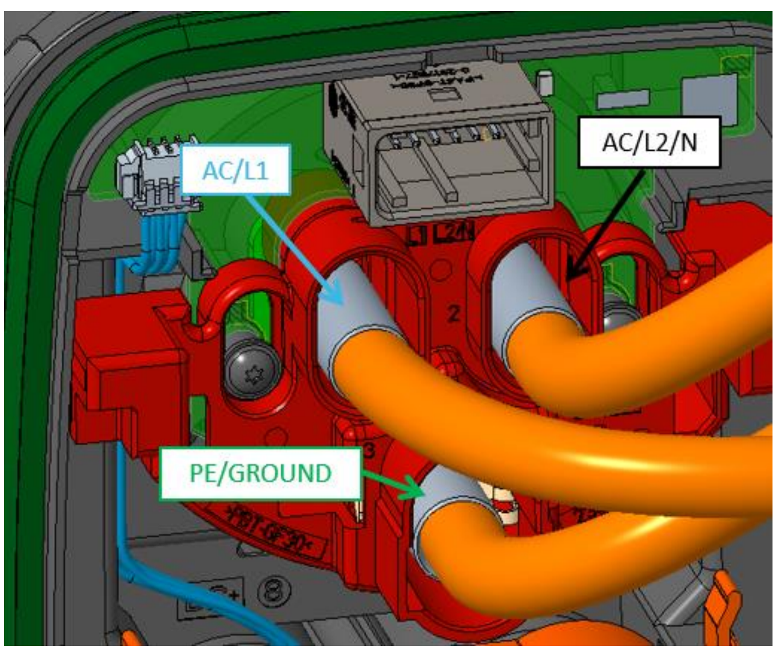


Figure 56: AC/GND Circuit Identification with TPA locked

7.4.21. **Step 21: Install Nano MQS plug**

With the CPA unlocked, install the Nano MQS plug to the PCB header with an audible click. Lock the CPA, as shown in Figure 57 and Figure 58.

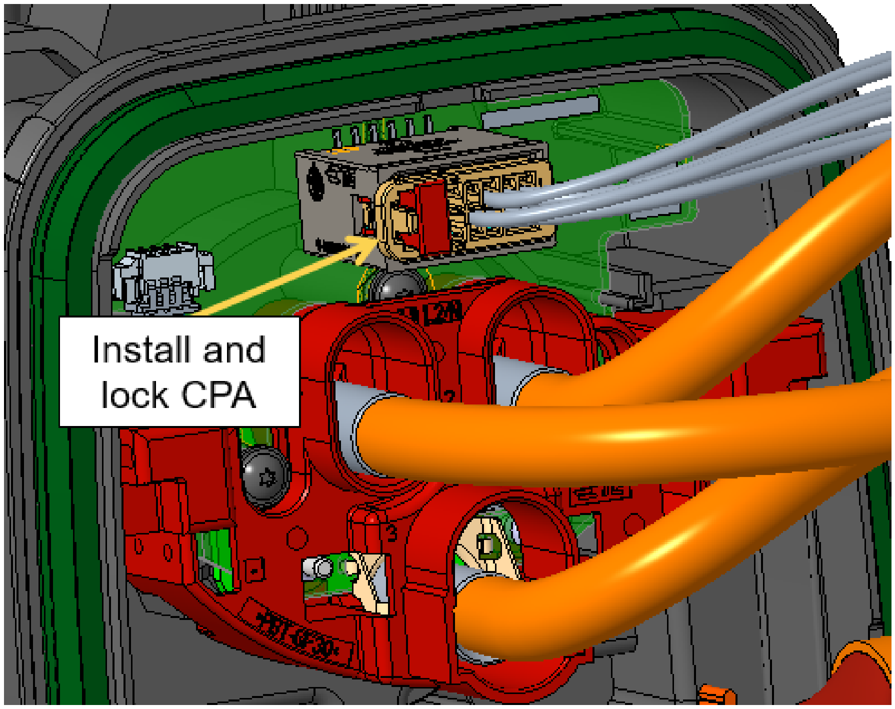


Figure 57: Installation of Nano MQS plug

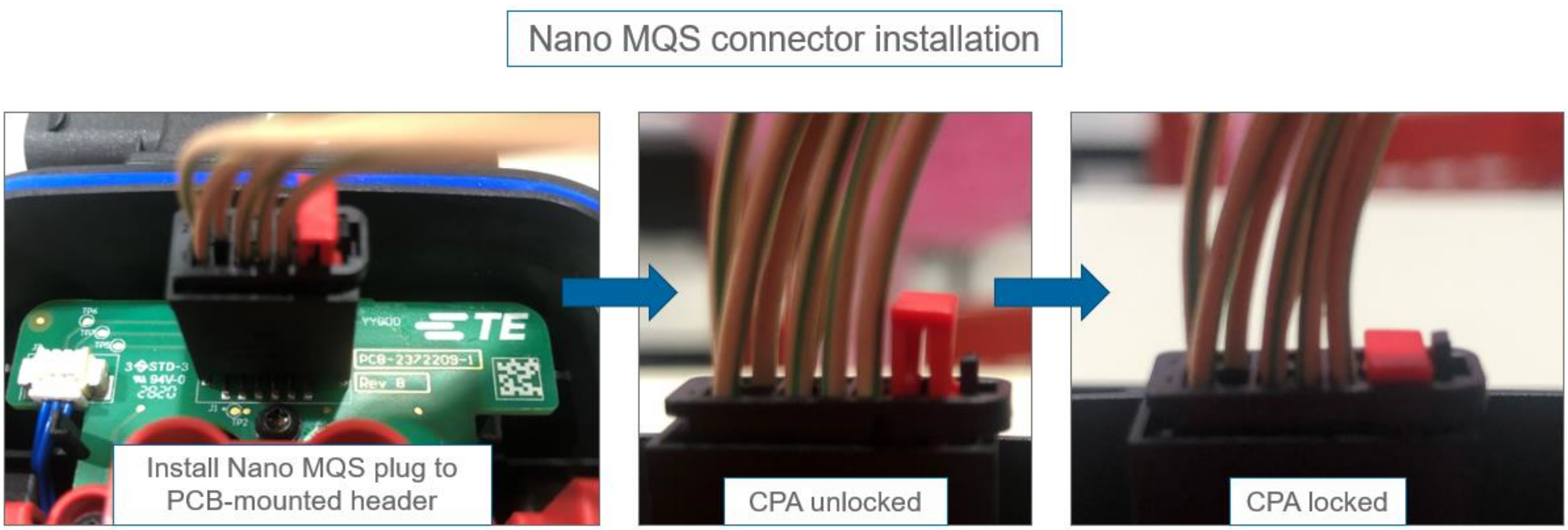


Figure 58: Nano MQS Connector Installation Sequence

7.4.22. **Step 22: Install rear cover**

Assemble the REAR COVER (2369944-1) to the Inlet. Ensure that all 6 latches are correctly engaged, shown in Figure 61. ATTENTION: The REAR COVER (2369944-1) needs to be aligned properly over the inlet and pushed vertically into position to make sure the seal slips correctly into the seating all around; cross sectional view shown in Figure 62. The force to seat the rear cover is greater than 100N and a press may be required for proper seating.

Figure 59: Proper circuit identification before rear cover installation

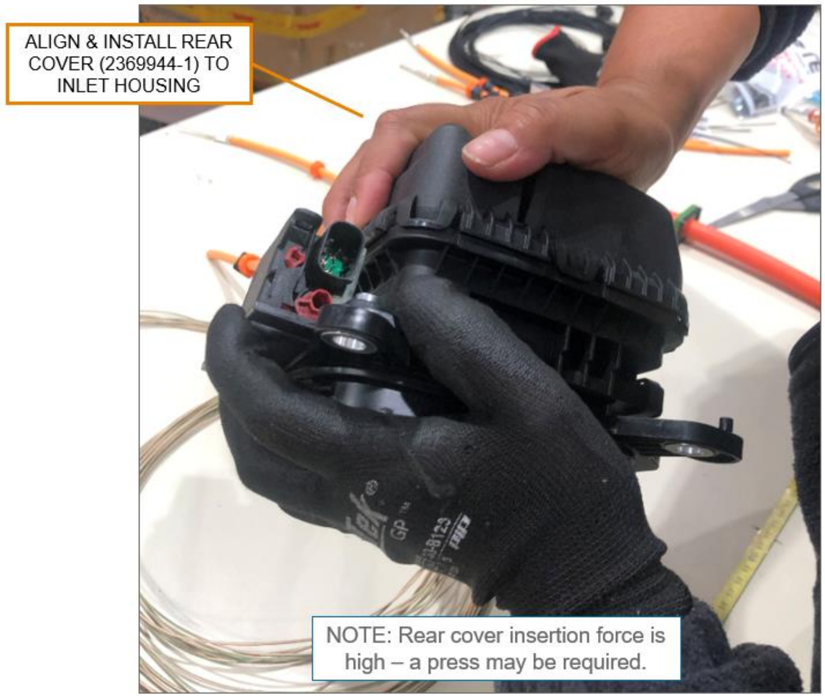


Figure 60: Rear cover installation

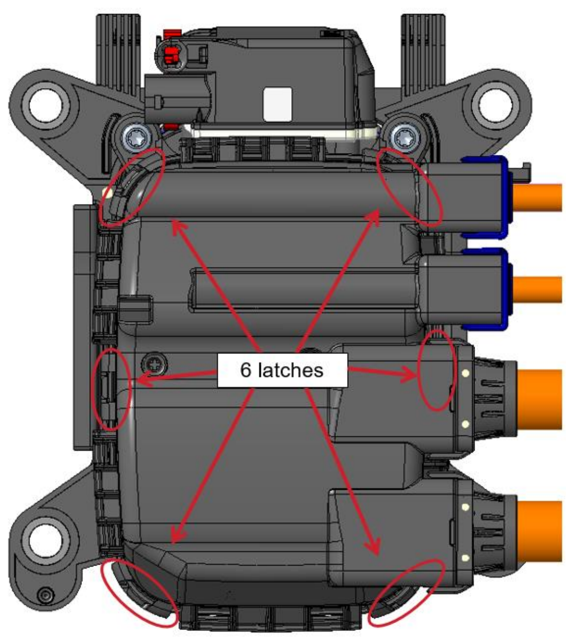


Figure 61: Rear cover latching identification

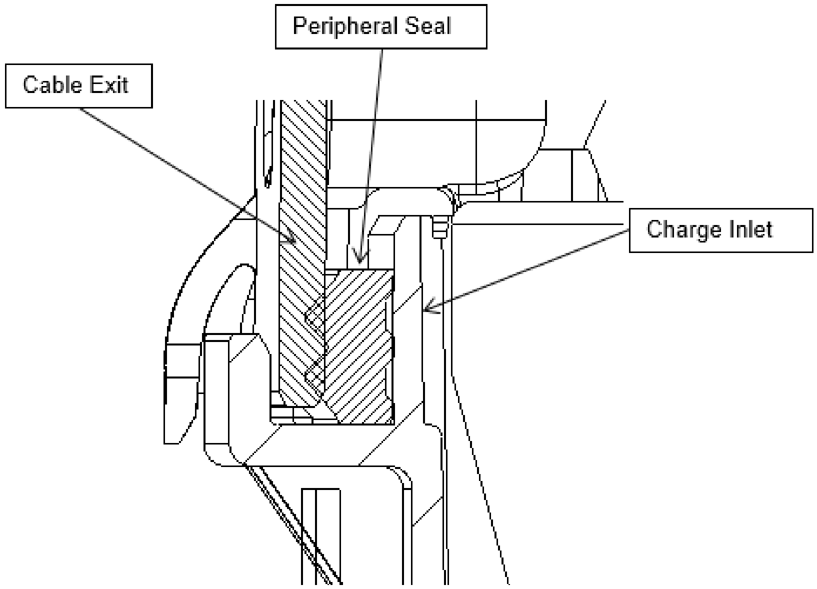


Figure 62: Cross sectional view of rear cover and peripheral seal

7.4.23. Step 23: Install seals, collets, and seal covers to rear cover

Seat the LV WIRE SEAL (2365785-1) into its position in the REAR COVER (2369944-1). Use caution when moving the mat seal down the wires to avoid damage. Push the LV STRAIN RELIEF (2369838-1) over and snap it on to the REAR COVER (2369944-1). Ensure that both latches are correctly engaged (double audible click).

Move the 3 x 16mm² COLLET (2369841-3) together with the SINGLE WIRE SEAL (2369839-4) into their position in the REAR COVER (2369944-1). Use caution in moving the seals down the wires to avoid damage. Push the 3 x 16mm² WIRE COVER (2369840-3) over and snap it on the REAR COVER (2369944-1). Ensure that both latches are correctly engaged (double audible click).

Move the 2 x 95mm² COLLET (2340458-4) together with the SINGLE WIRE SEAL (1-2840783-2) into position on the REAR COVER (2369944-1). Use caution in moving the seals down the wires to avoid damage. Push the 2 x 95mm² WIRE COVER (2369943-1) over and snap it on the REAR COVER (2369944-1). Ensure that both latches are correctly engaged (double audible click).

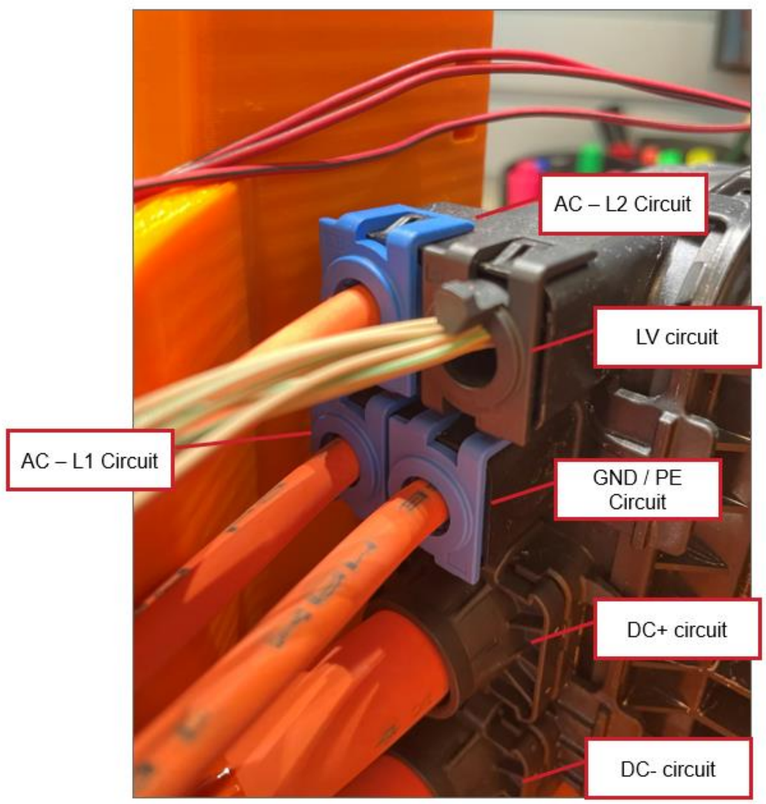


Figure 63: Inlet assembly with seals, collets, and seal covers installed

7.4.24. **Step 24: Assemble LV cable tie**

Assemble a cable tie (not provided by TE) to the LV STRAIN RELIEF by first wrapping the cable tie around the protruded feature (Figure 64) of the LV seal retainer and aligning in the notch on the protruded feature (Figure 65). Next, wrap the length of the cable tie around the (7) 0.35mmsq cables and insert the tapered end of the cable tie into the cable tie's receiving end. Tighten by pulling the tapered end of the cable tie through the receiving end until the cables are secured to the LV STRAIN RELIEF. Assembled wire tie shown in Figure 66.

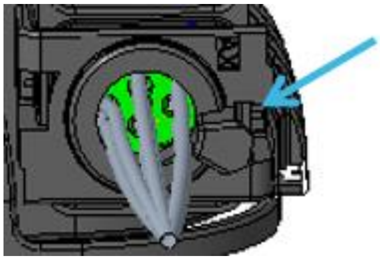


Figure 64: Cable tie feature (protrusion) call out

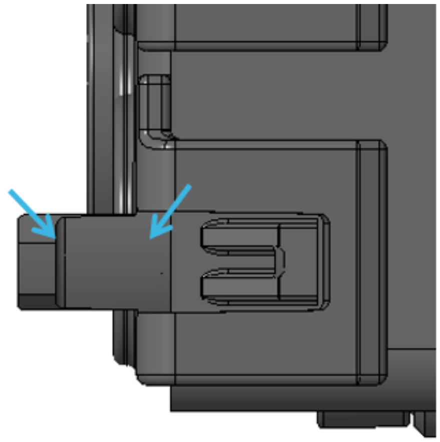


Figure 65: Cable tie notch for alignment

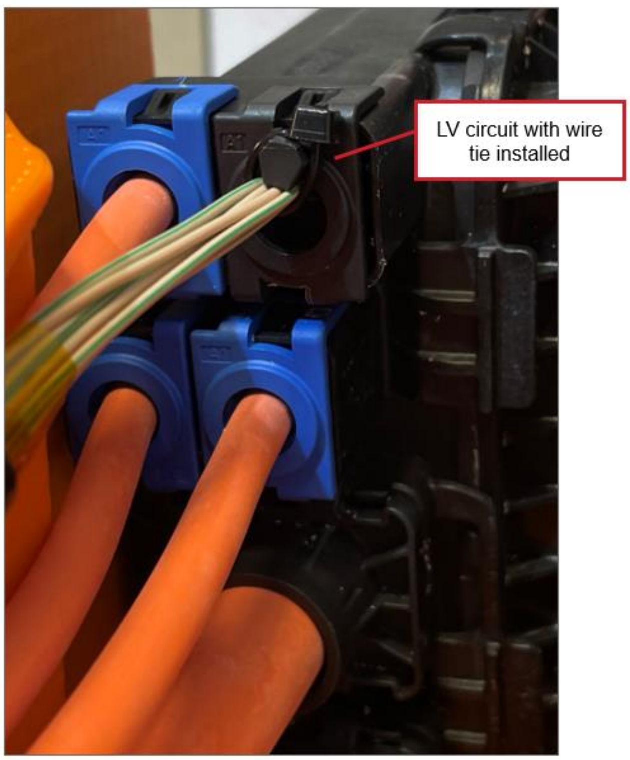


Figure 66: LV wire tie installation

7.4.25. **Step 25: EOL pressurization testing**

As part of EOL testing, perform a pressure test of the fully assembled charge inlet. The pressurization port on the rear of the rear cover 2369944-1, shown in Figure 67 is designed to fit an elastic plastic tube (polyurethane or similar) with an outer diameter of 4mm.

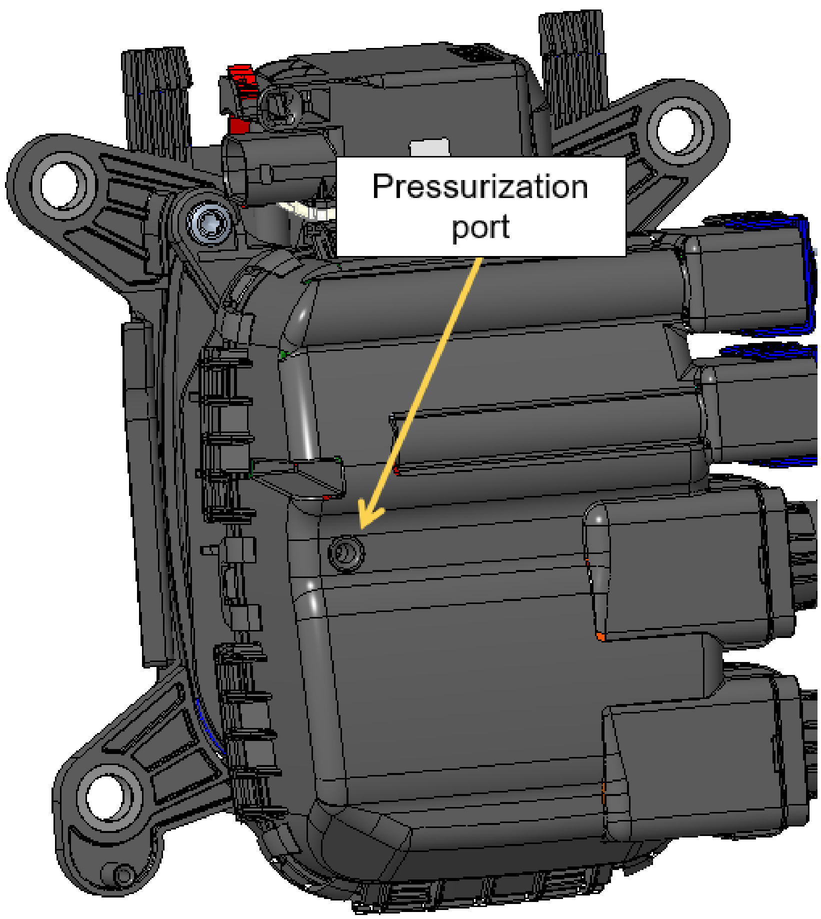


Figure 67: Pressurization port location

The tubular geometry of the pressurization port has a reduced inner diameter towards the bottom to increase the pressure on the elastic tube when being inserted. The tube needs to be pushed far enough into the pressure port to ensure enough air tightness is achieved, see Figure 68.

For the tightness check it is intended to perform an air differential pressure decay leak measurement test. Pressure profile is 0,1…0,15 bar, preferably under pressure. Acceptance criterion is measured in pressure loss over time and must be defined based on prepared test samples. After successfully passing the pressurization test, the port needs to be closed with the MQS CAVITY PLUG (963143-1).

The MQS cavity plug needs to be fully inserted into the port, see Figure 69. The bottom of the pressure port is closed off to ensure the MQS Cavity Plug cannot be pushed through; this may require a tool with a blunt end to seat fully.

The harness maker (Tier 1) is responsible for determining acceptable pressure decay criteria during EOL testing with a full harness assembly.

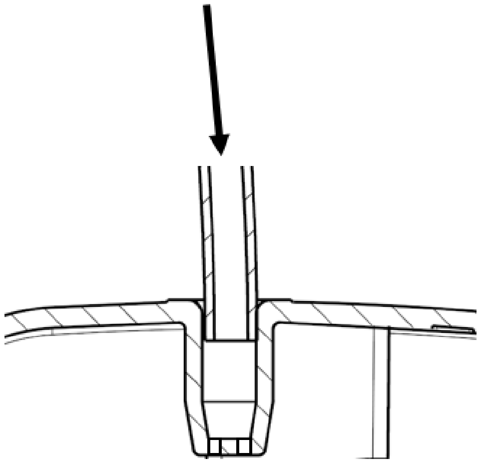


Figure 68: Tube insertion to pressurization port during EOL testing (exemplary image)

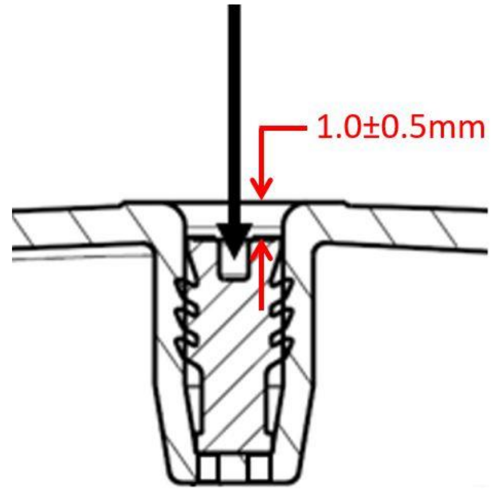


Figure 69: Cross-sectional view of the MQS cavity plug properly inserted

7.4.26. **Step 26: MQS Connector Assembly and Installation to Charging Inlet**

Refer to TE Document 114-18061 for crimping instructions of the MQS SINGLE WIRE SEAL (967067-1) to the MQS SOCKET CONTACTS (5-965906-1), and for assembly into the MQS CONNECTOR (1-967640-1). Install the MQS SOCKET CONTACTS per the pin-out shown in Figure 70 below. Plug position 3 of the MQS CONNECTOR with MQS WIRE SEAL PLUG (967056-1).

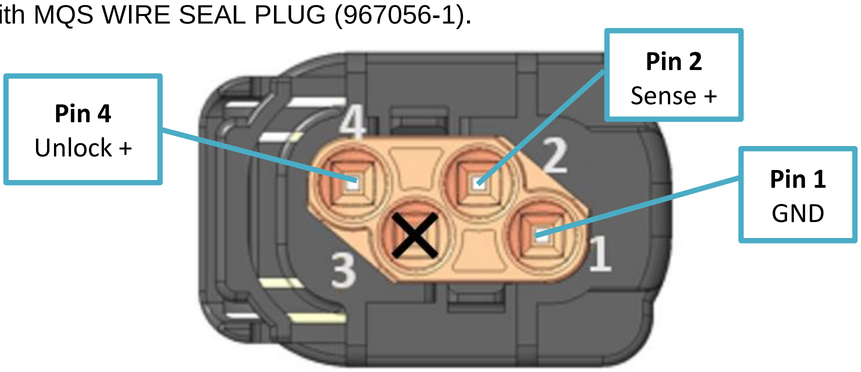


Figure 70: MQS connector pin-out

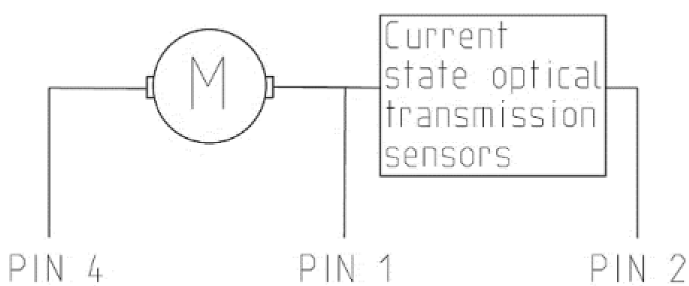


Figure 71: Actuator pin circuit diagram

Next, install the MQS connector and harness assembly to the actuator by orienting the MQS connector so the connector latch is facing the REAR COVER, as shown in Figure 72, and then push the MQS connector until it is seated (audible click).

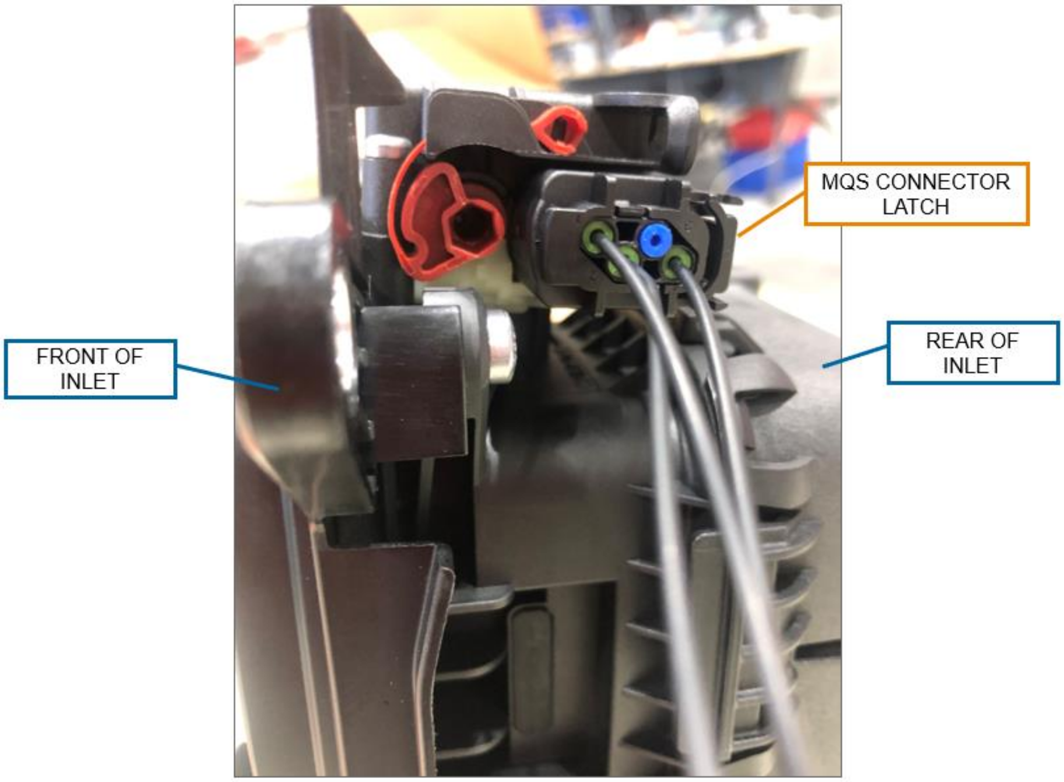


Figure 72: MQS Connector Mated to Actuator

7.5. End of Line Test

The assembled Charge Inlet must be electrically and mechanically tested to applicable requirements, including high voltage tested.

At a minimum, following tests must be performed:

- Isolation Resistance:
  Test Voltage: 500V_{DC}
  Inspection Duration: 1s
  min. R_{iso}: 200MΩ
  pin-to-pin, excluding CP-to-Proxi and CP/Proxi-to-Ground
  a) L1 versus N
  b) L1+N versus Ground
  c) DC+ versus DC-
- Dielectric withstand voltage:
  Test Voltage: 2000V_{AC}
  Inspection Duration: 1s
  Maximum leakage current: 10mA
  pin-to-pin, excluding CP-to-Proxi and CP/Proxi-to-Ground
  a) L1 versus N
  b) L1+N versus Ground
  c) DC+ versus DC-
- Correct pinning of all contacts.
- Check seals for correct seating by pressurization testing per step 24 above.
- Check correct assembly of MQS Cavity Plug in the pressurization port after pressurization testing.
- Gauge check of geometrical interface acc. IEC62196-2 / SAE1772.
- Functionality check of actuator: Drive (first) in lock and (second) in unlock position. During this operation, the pinning will be verified, and the actuator pull cable is pulled back into position.
- The status of the actuator (position of the locking pin) can be monitored by measuring the current from PIN2 (SENSE+) to PIN1 (GND) only when Motor is zero potential (PIN1 on GND). TE recommends measuring the current of the feedback signal with a 200 Ω shunt.

V_{SOURCE} : 8 V to 16 V

T_{amb} : -40℃ to +85℃

Characteristics

PIN 1	PIN 2	State of Interlock	Current I_{SENS}
-	+	Unlocked	(17 ± 2,0) mA
		Drive PIN / Fault	(10 ± 2,0) mA
		Locked	(3,0 ± 1,0) mA

- Verification of the temperature sensors should be performed by measuring resistance per the following table.

Test Item	Resistance Measurement Test Pins		Value at T = 25º±5ºC
T AC	7	5	10kΩ +2.49kΩ/–1.94 kΩ
T DC +	6	4	10kΩ +2.49kΩ/–1.94 kΩ
T DC –	2	4	10kΩ +2.49kΩ/–1.94 kΩ

LTR	REVISION RECORD	DWN	APP	DATE
1	Initial document release.	C. M. RHODES	A. DE CHAZAL	01MAY2020
2	Updated Nano MQS plug pin out (figure 31). Added wire tie instructions (step 24). Added actuator assembly instructions (step 26) and end of line testing (section 7.5). Updated LV terminal PN from Nano MQS to Gen 50 LL and all associated documentation/images updated. Updated MQS socket contact and seal plug PNs in sections 2.1 and 7.3.	C. M. RHODES	A. DE CHAZAL	09JULY2020
3	Updated formatting to AC GND pin-out (figure 31). Swapped the DC + / DC – terminal cavities. Added tape instructions (section 6, section 7 – step 7). Added figure 26. Figures updated: 1, 12, 13, 24, 25, 27, 30, 36, 37, and 38. Updated 0.35mm² strip length and crimp height from 3.4±0.15 and 0.7+0.02 to 3.75±0.15 and 0.7±0.02, respectively (table 1). Added EOL testing note for temperature sensors (section 7.5). Updated figure 43 to show 6 latches. Updated supplier description and PNs for 0.35mm² and 0.5mm² wire (section 2.2). Updated MQS socket terminal drawing to 929454 from 965906 (section 2.1) Updated Nano MQS plug assembly drawing PN to 2312420 from 2312110.	C. M. RHODES	A. DE CHAZAL	05OCT2020
4	Updated Figure 1 to include heat shrink on DC+ terminal/weld Updated PNs to reflect DCV and Breadboard build part numbers (PNs affected: 2371186-1 → 9-2371186-1, 2369944-1 → 9-2369944-1, 2340457-4 → 1-2840783-2, 2365785-1 → 9-2365785-1) Added EOL resistance measurements for temperature sensors.	C. M. RHODES	A. DE CHAZAL	27OCT2020

5	Added section 5.5: terminal identification. Updated PNs to reflect production PNs (removed all 9-**-X). Updated assembly images (all sections). Updated formatting and table of contents.	C. M. RHODES	A. DE CHAZAL	25JUN2021
6	Updated 2369839-3 seal PN to 2369839-4. Updated harness length required inside the inlet for AC L1, AC L2 and GND circuits (Section 4.3).	C. M. RHODES	A. DE CHAZAL	21OCT2021
A	Removed draft note and released to Rev A.	C. M. RHODES	A. DE CHAZAL	JAN2022

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HYBRID-ELECTRIC MOBILITY SOLUTIONS
3800 REIDSVILLE RD
WINSTON SALEM NC 27101</td></tr>
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TITLE	**Application Specification** **Ford Connector 52A – Type 1 Inlet acc. SAE J1772**