Class 1

EV Charge Inlet Combo 1

| Indicates Change

Content

1. SCOPE

1.1. Content

This specification describes the assembly and handling of the vehicle charge inlets Combo 1 acc. IEC62196-3 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 is 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 Combo1 90 Degree

INLET HSG, COMBO 1, ASSY	2337006
CABLE EXIT, RECT, 90 DEG	2296039
FAMILY SEAL, AC	2350592
STRAIN RELIEF, AC	2344703
COVER, CABLE SEAL, AC	2296057
FAMILY SEAL, DC	2296058
COVER, CABLE SEAL, DC	2296059
MQS CAVITY PLUG	963143
PIN DIA 2,8mm, RIGID, PE	2293267
PIN DIA 3,6mm, RIGID, POWER AC, ASSY	2293265
PIN DIA 8,0mm, POWER DC, ASSY	2292541
SEALING	2120571
PROTECTION CAP, TE, WATER DRAIN	2292534
RADIAL SEAL	2320511

b) Specifications / Spezifikationen

108-94777	Product Spec. Vehicle Charge Inlets Combo 1
114-13000	Application Specification Micro Mate-N-Lock Connectors
108-94519	Product Spec. TE actuator for charge inlets

2.2. General Documentation

Cable Specifications of Prescribed Cables

AC-cable: cross-section 2 x 6,0mm²

Supplier	COFICAB
Outer Diameter	12.8 $^{-0,6}$ mm
Min. bending radius	3xD (static)
Cable description	*FHLR2G2GCB2G 2x6.0mm²* *similar LV216-2 Class F (T200)* *TPJLR.18.007, Issue 3*
Supplier Part No.:	FLHR2G2GCB2G 2x6mm²

DC-HV-Cable : Cross-section 1 x 50mm²

Supplier*:*	Coroplast
Outer Diameter	15,8 $^{-0,6}$ mm
Cable description*:*	*FHLR2GCB2G 50mm² / 0.21 T180 0.6/0.9kV* acc. LV216-2 Tab.A.2
Part No.:	9-2611 / 50mm²

Supplier	COFICAB
Outer Diameter	15.8 $^{-0,6}$ mm
Cable description	*FHLR2GCB2G 50mm²* *similar LV216-2 Tab. A.2*
Supplier Part No.:	LGCBG500xyzw

PE-cable: cross-section *25*mm²

Supplier	COFICAB
Outer Diameter	*8.45 $^{+0,25\ /\ -0,25}$ mm*
Cable description	*A42X-TCD* 25,0
Supplier Part No.:	A42X2500xxyy

Or:

Supplier	COFICAB
Outer Diameter	*8.45 $^{+0,25\ /\ -0,25}$ mm*
Cable description	*A42X-TBD* 25,0
Supplier Part No.:	A42XB2500xxyy

Signal-cable: cross-section 0,5mm²

Outer Diameter	1.6 $^{-0,2}$ mm
Cable description	*FLRY 0,5mm² acc. ISO6722-1*

3. APPLICATION TOOLS

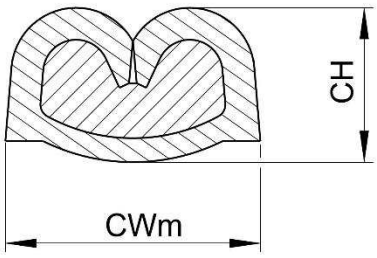
To produce a correct wire crimp, as validated by TE with the wires listed in this specification, following application tools are required.

Wire Size [mm²]	Stripping Length single wire for crimp [mm]	Crimp /WELD height CH_1 [mm]	Crimp width measurable CWm [mm]	Cable Specification	Supplier	Contact P/N	Geo-metry	Applicator	TE Crimp Validation is based on crimp press stroke / cycle time
0.5	3,2 ± 0,1	0,79 ± 0,05	1,40+0,14	FLRY-A 0.5mm²	-	0-794606-1	F	2151022-1	G-Terminator PN 354500-1 Cycle Time:<500ms
6	13,0 ± 1	3,7 ± 0,1	5,6+0,5	FHLR2G2GCB2G 2x6.0mm²	COFICAB	2293266-3	2W	4-528041-7	Hanke 971-200. Cycle time: 1.7 - 2.5s Stroke: 44mm
25	18,0 ± 1	6,3 ± 0,1	9,7+1,0	A42X-TCD 25.0 25mm² A42X-TBD 25.0 25mm²	COFICAB	2293267-5	2B	2454524-1*	
50	23,5 ±0,5	9,4±0,15	14,40+1,4	FHLR2GCB2G 50mm²	COROPLAST COFICAB	2292541-1	W	2276149-4	tbd

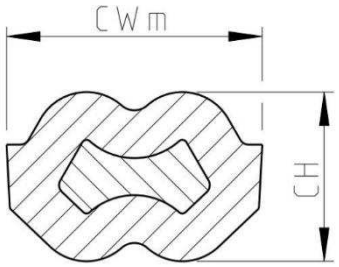
Table 1

**Conversion of the old applicator PN 2276149-6 possible by exchanging of spare parts.*

Crimp-Geometry: F



Crimp-Geometry: W / 2B



Crimp Die Sets are subject to wear and their condition and quality have to be monitored. Suspect and/or worn Die Sets have not to be used for the production of these crimps. Die Sets are available as spare parts.

4. WIRES

4.1. Assessment of the wires

To ensure the required electrical crimp contactability with stable crimp resistance a permissible maximum storage period of 8 months for unprocessed cable (referring to cable manufacturer production date) has to be respected.

4.2. Wire selection

The contact system is released for the application with wires specified in chapter 2.2
The released contact-wire-combinations and crimp parameters are given in table 1.

Other wires require 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 has to be cut accurately with a 90 deg angle.

The cable insulation must be stripped before crimping. The stripping length of the outer insulation and shield is defined in the following Assembly Steps.
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. Further more the operator should avoid touching the bare single strands and the strands shall not be twisted. All single strands need to be caught in the crimp and not a single stand must remain outside the crimp.

5. REQUIREMENTS ON THE CRIMPED CONTACT WITH W-CRIMP SHAPE (CLOSED BARREL)

The following terms shown below are used in this specification, see figure 1.

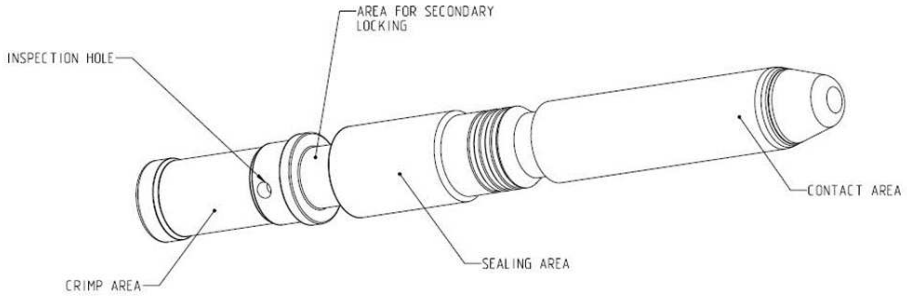


Figure 1

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 must remain outside the crimp..
The wire end must be fully inserted into the crimp area and has to be checked via the inspection hole after crimping. Insulation must not be inside of the crimping area, see figure 2

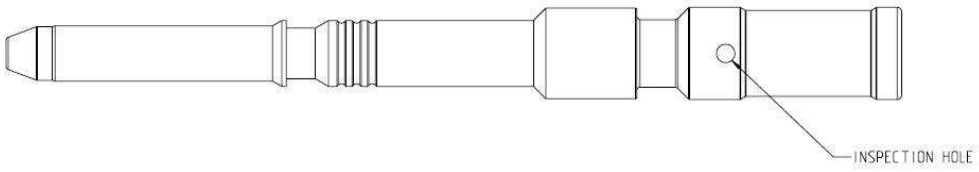


Figure 2

5.2. Crimp Geometry

The crimp geometry, crimp heights including their corresponding tolerances as well as wire sizes are given in table 1.

The crimp height is the key quality feature of a crimp connection. The measurement allows a non-destroying examination and a continuous process inspection. It is provided for every wire size and contact.
The crimp height is given in table 2.

Crimp height and width may also be measured in a cross-section image. The mechanical operated measurement though is preferred.

During the application process the crimp height must be checked. This is valid for each batch and after every change or switchover of contact reel or wire bundle or applicator respective it's setup or components.

The crimp height has to be measured over both extensions in middle of the crimp, figure 3:

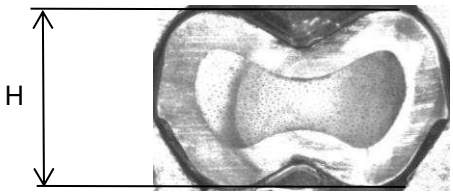


Figure 3 (pic exemplarily)

5.3. Cross Sections

When creating cross sections the correct grinding layer must be selected. The
Grinding layer had to be at middle of crimp area and may not be inside of serration, see figure 4.

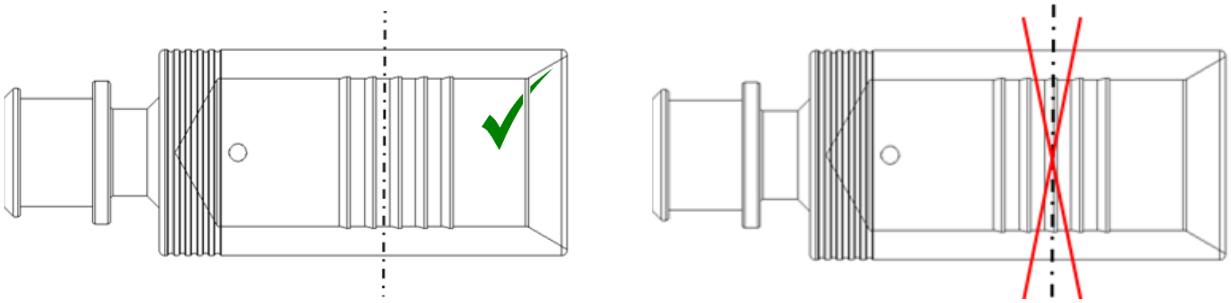


Figure 4 (pic exemplarily)

5.4. Wire pull-out forces

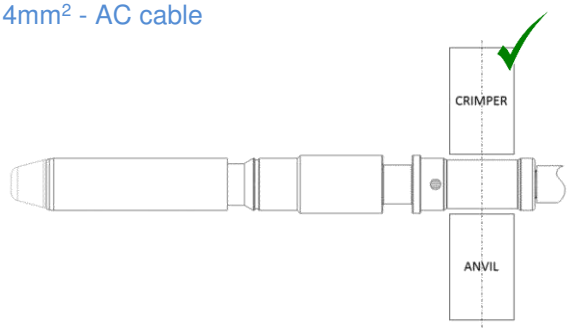
Measurement of wire pull-out forces from the wire crimp is a supporting manufacturing control.

The pull-out forces must fulfil the requirements according product specification 108-94777

5.5. Crimp Position

The TE applicator positions the contacts in the crimping tool at middle position as shown, figure 5 and 6. Correct position and condition of applicator has to be checked for every production lot.

4mm² - AC cable



25mm² – PE cable

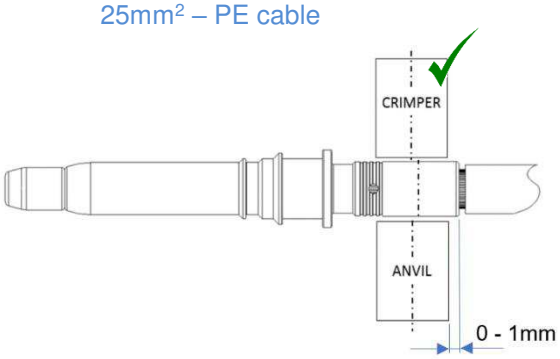


Figure 5 (pic exemplarily)

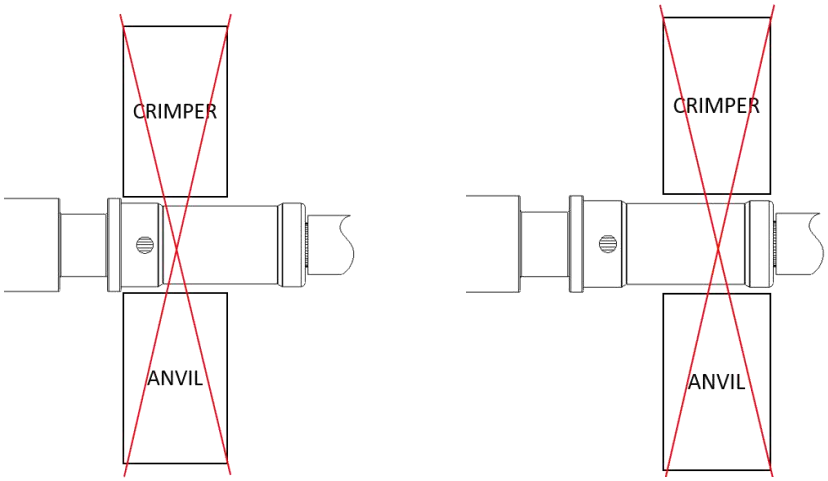


Figure 6 (pic exemplarily)

5.6. Contact area

During processing and following processing the contact area may not be damaged or bended.

5.7. Sealing area

During processing and following processing the sealing area may not be damaged or bended

5.8. Shape and position tolerances

Measuring the shape and position deviation is not always necessary, if the contact is obviously straight by eye. In case a measurement is required, the measurement equipment required at least a 10-time better measuring precision compared with the requirement tolerances, see figure 7 and 8.
Meeting the specific shape and position tolerances must be ensured before the contact is inserted into the housing.
If contacts are bent during the application process and exceed the specified tolerances these must not be bent back or reworked but have to be scrapped.

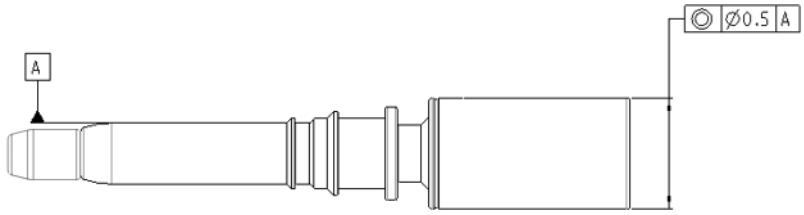


Figure 7 (pic exemplarily)

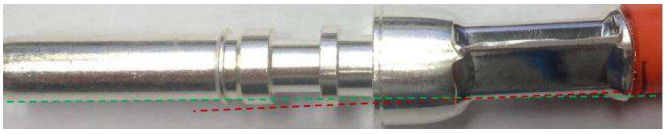


Figure 8 (pic exemplarily)

5.9. Measuring equipment and measuring position

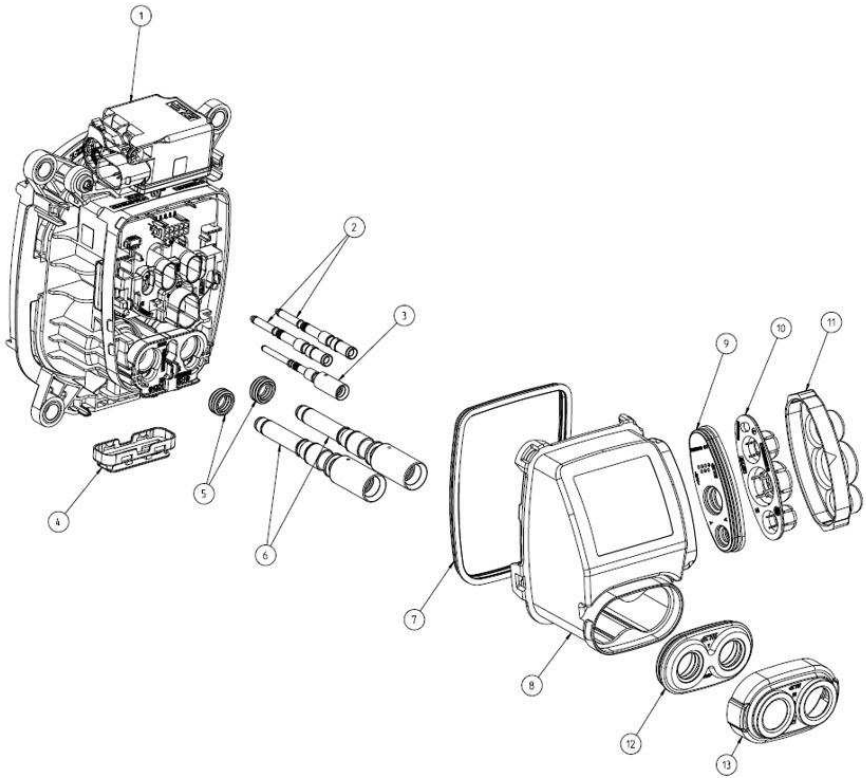
As measuring equipment for measuring crimp height, a digital caliper with accuracy of measuring 0.01mm is the minimum requirement. Measuring of crimp height had to be done according as following always in middle of crimp area across whole crimp, see figure 9 and figure 3.

Figure 9 (pic exemplarily)

6. ASSEMBLY INSTRUCTIONS

6.1. Assembly overview Charge Inlet Combo1

Charge Inlet Left Combo 1 180Degree



Charge Inlet Right Combo 1 180Degree

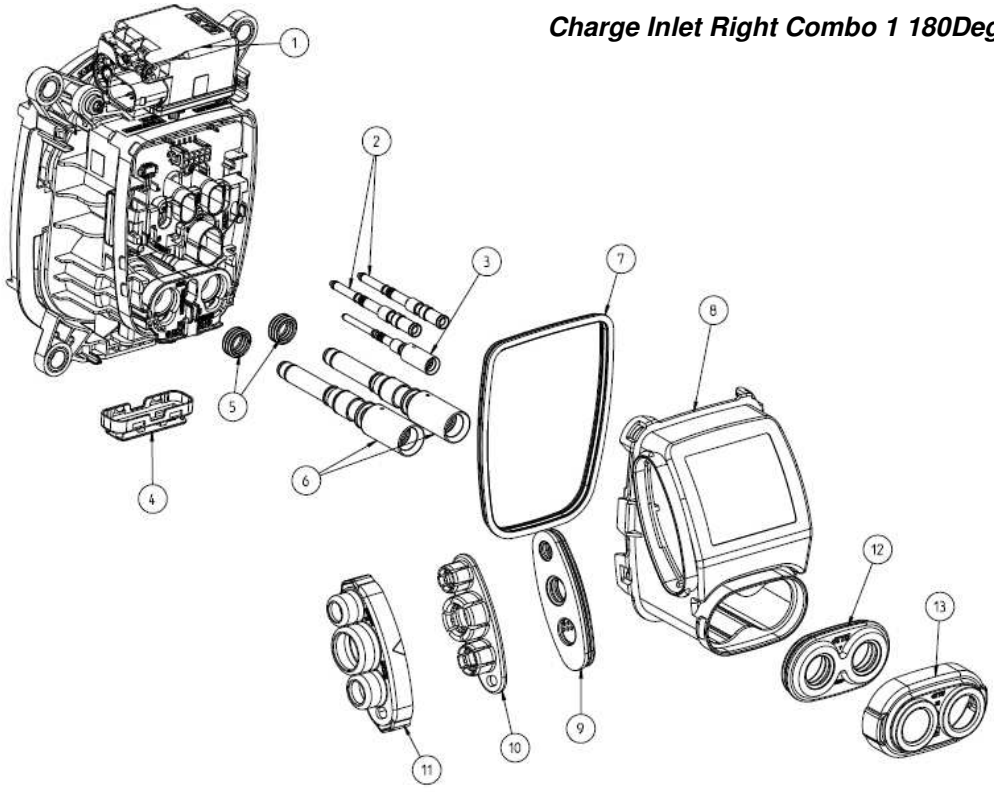


Figure 10

6.2. Parts to order

Charge inlet Combo 1 180 Degree			Charge Inlet Left	Charge Inlet Right
Part \ Variant			1-phase AC 6mm² Ground 25mm² DC 50mm²	1-phase AC 6mm² Ground 25mm² DC 50mm²
Pos.	Qty.	Name / Bezeichnung	P/N	P/N
1	1	INLET HSG, COMBO1, ASSY	9-2337006-1	9-2337006-1
-	1	10P MICRO MNL HSG	Additional part for charge inlet cabling: 1-794617-0	Additional part for charge inlet cabling: 1-794617-0
	7	CONTACT MICRO MNL	Additional part for charge inlet cabling: 0-794606-1	Additional part for charge inlet cabling: 0-794606-1
2	2	PIN DIA 3.6, RIGID, POWER AC, ASSY	2293266-3	2293266-3
3	1	PIN DIA 2.8, RIDIG, PE	2293267-5	2293267-5
4	1	PROTECTION CAP, TE, WATER DRAIN	2292534-1	2292534-1
5	2	SEALING	2120571-1	2120571-1
6	2	PIN DIA 8.0, 90 DEG, CONTACT, ASSY	2292541-1	2292541-1
7	1	RADIAL SEAL	0-2320511-1	0-2320511-1
8	1	CABLE EXIT RECT, COMBO	2296039-3	2296039-4
9	1	FAMILY SEAL, AC	2350592-7	2350592-7
10	1	STRAIN RELIEF, AC	1-2344703-2	1-2344703-2
11	1	COVER, CABLE SEAL, AC	2296057-3	2296057-3
12	1	FAMILY SEAL, COMBO DC	2296058-4	2296058-4
13	1	COVER, CABLE SEAL, DC	2296059-4	2296059-4
-	-	4POS MQS Connector HSG, Seals and Contacts	Additional part for Actuator cabling: p/n acc. Prod. Spec. 108-94519	Additional part for Actuator cabling: p/n acc. Prod. Spec. 108-94519

Table 2

6.3. Assembly Configurations Cable Exit

The inlet is designed for alternative cable exit directions to the left or right. Actually, only the version with exit direction to the right is tooled and available. This configuration is shown in figures 11.

Configurations for cable exit sidewards:

Charge Inlet with Cable Exit on the left

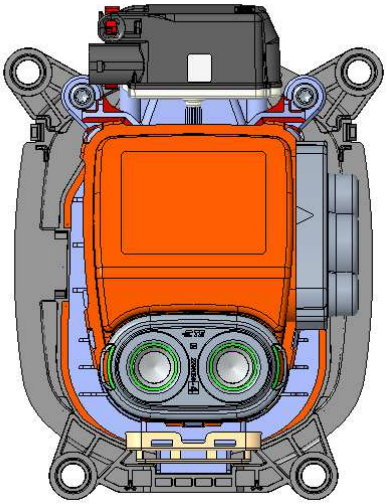


Figure 11a

Charge Inlet with Cable Exit on the right

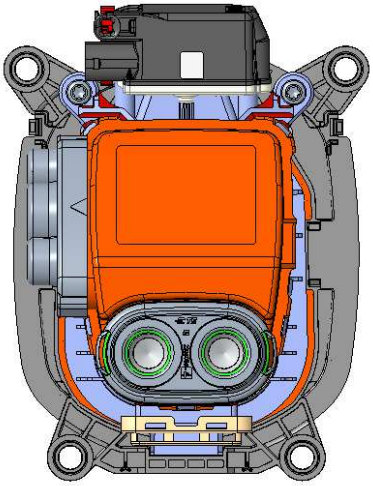
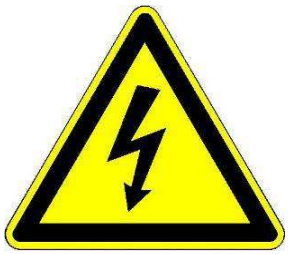


Figure 11b

6.4. Security Advice / *Sicherheitshinweis*

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



ACHTUNG !
- HOCHSPANNUNGSANWENDUNG -
LEITUNGSISOLATION DARF NICHT BESCHÄDIGT WERDEN!

The assembly has only be performed by trained personnel.

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

6.5. Assembly Steps

Step 1
The COVER CABLE SEAL AC 5-2296057-3, STRAIN RELIEF AC 1-2344703-2 and FAMILY SEAL AC 2350592-7 must be pushed over the signal wires, the ground wire and the AC-Multicore wire. Pay attention to place all wires at correct positions, figure 12. Especially ensure the correct position of the flange of the L-shaped FAMILY SEAL AC towards the STRAIN RELIEF, figure 12a

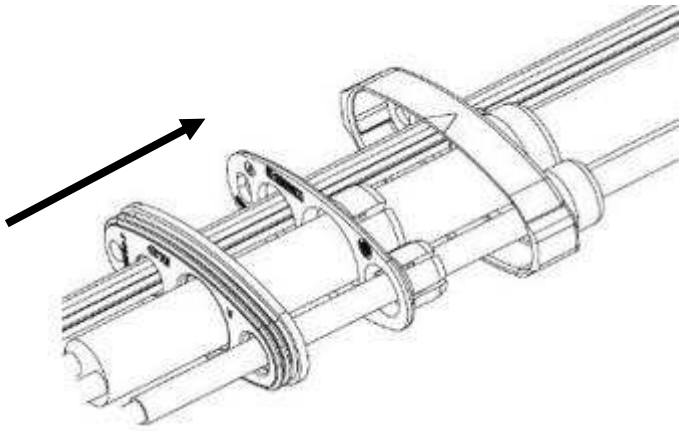


Figure 12

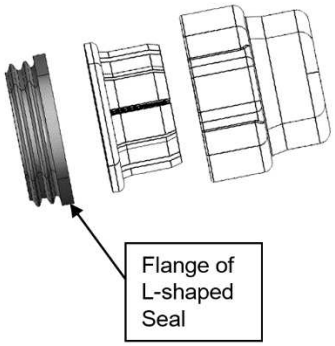


Figure 12a

Step 2

Dismantle the wires and crimp the contacts: **2x6 mm² AC-Multicore Cable**

Remove outer insolation, shield and filler of AC-multicore-cable acc. figure 13 and table 3.
The given length of the single wires ensures that the outer sheath of the multicore cable seals to the FAMILY SEAL AC 2350592-7. Alternatively, a marking on the outer sheath in a certain distance to the cut off position can be used to ensure the proper position of the outer sheath in the FAMILY SEAL AC.

Figure 13

Wire Size	Removal of insulation dim. "A"	Length of single wires “B”
6 mm²	13 mm +/- 1mm	53 +/-2 mm

Table 3

Crimp the conductors to the PIN DIA3.6 RIGID CONTACTS 2293266-3 with the specified tools listed in table 1. The crimp has to fulfill the requirements acc. Chapter 5.

Step 3

Dismantle the wires and crimp the contact: **25 mm² PE (ground) single wire**

Remove outer insolation acc. Figure 14 and table 4.

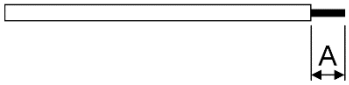


Figure 14

Wire Size	Removal of insulation dim. "A"
25 mm²	18 mm +/- 1mm

Table 4

Crimp the conductors to the PIN DIA 2.8 RIGID CONTACT 2293267-5 with the specified tools listed in table 1. The crimp has to fulfill the requirements acc. Chapter 5.

Step 4

Dismantle the wires and crimp the contacts: **Signal-Wires 0,5mm²**

Dismantle single wires acc. spec. 114-13000 and crimp the contacts 0-794606-1 acc. spec. 114-13000, see figure 15.

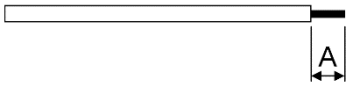


Figure 15

After Crimping the different cables, the subassembly of cables with cable exit components is in the condition shown in figure 16:

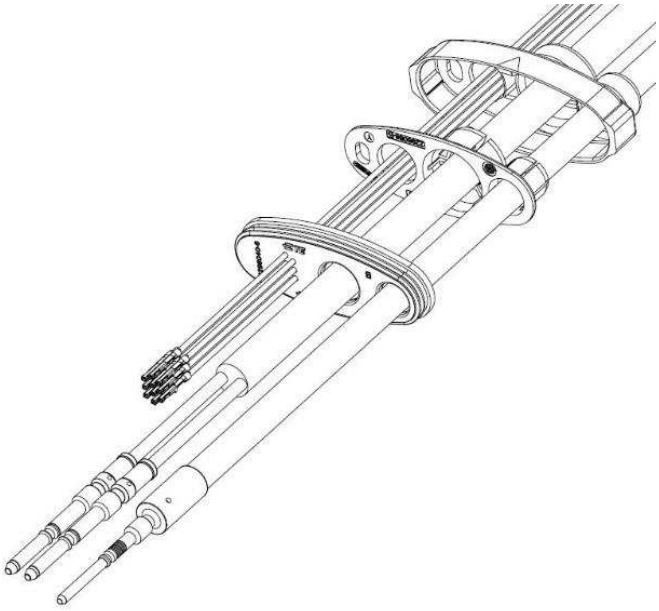


Figure 16 (schematic; crimp geometry not shown)

Step 5

Push signal terminals 0-794606-1 (Micro Mate'N'Lock) into the Connector Housing 1-794617-0 acc. application spec 114-13000. Pinning according figure 17:

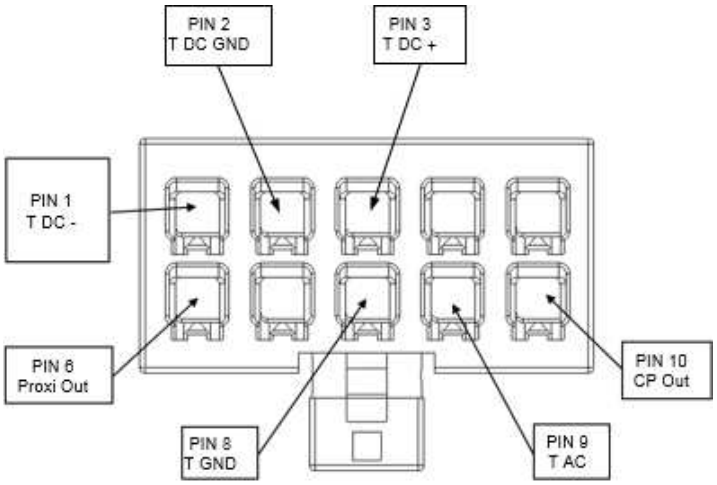


Figure 17

After Micro Mate'n'Lock connector housing assembly the subassembly of cables with cable exit components is complete, see figure 18:

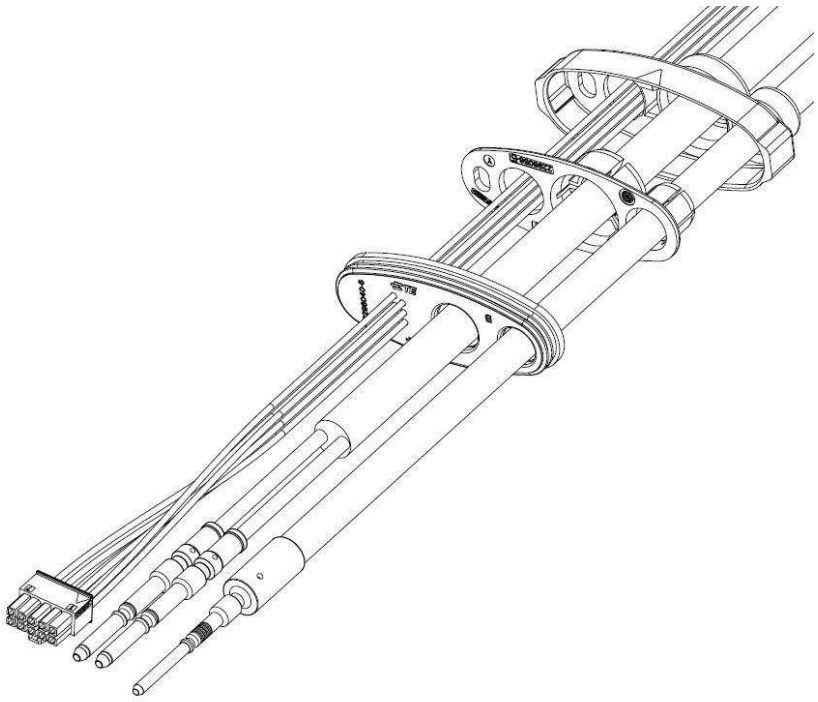


Figure 18 (schematic; crimp geometry not shown)

Step 6
The COVER CABLE SEAL DC 5-2296059-4 and FAMILY SEAL DC 2296058-4 must be pushed over the 50mm² DC-Power wires, figure 19. Especially ensure the correct position of the flange of the L-shaped FAMILY SEAL AC towards the COVER CABLE SEAL, figure 19a

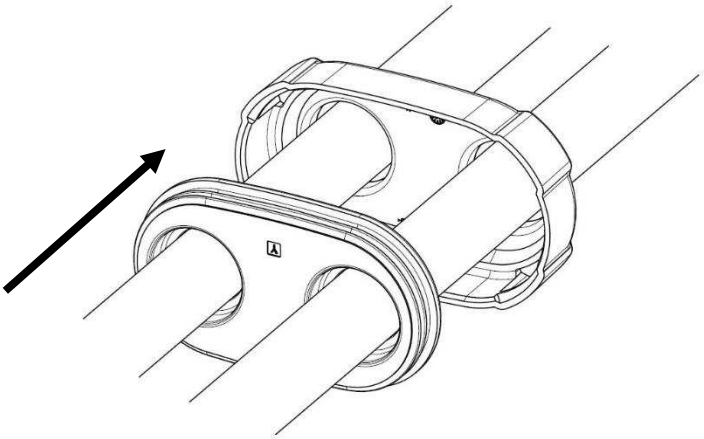


Figure 19

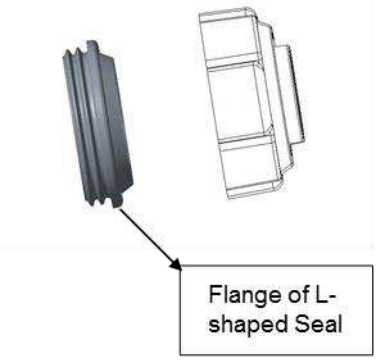


Figure 19a

Pass the cables through the DC area in the Cable Exit Combo Left 5-2296039-3 (figure 20) or Cable Exit Combo Right 5-2296039-4 (figure 20 a)

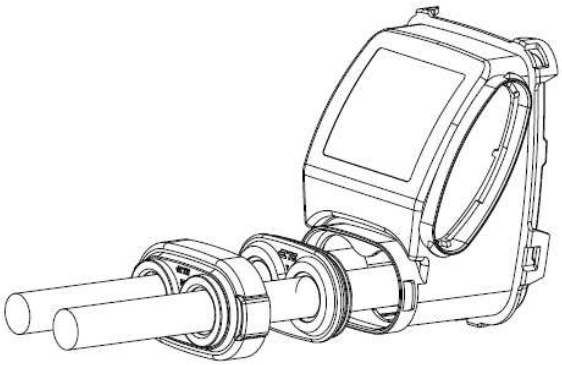


Figure 20

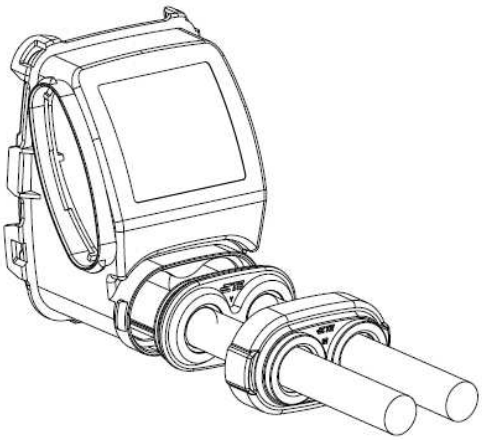


Figure 20a

Step 7

Dismantle the wires and crimp the contacts: **50 mm² DC Power Cables.**

Remove inner isolation acc. dimension B (figure 21).

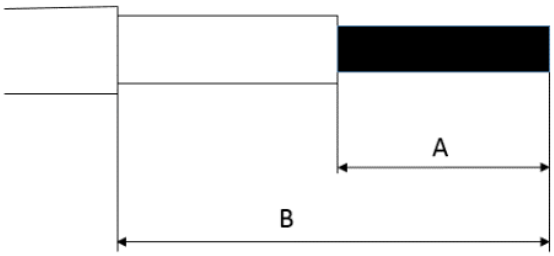


Figure 21

Wire Size	Removal of isolation dim. "A"	Removal of outer insulation dim "B"	Length inside Inlet
50mm²	23 +/-0,5 mm	29 +/-0,5 mm	50 mm

Table 5

Step 8

Assemble the DC contact seals 2120571-1 on the DC contact assy 2292541-1 (figure 22). 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 22a

Figure 22

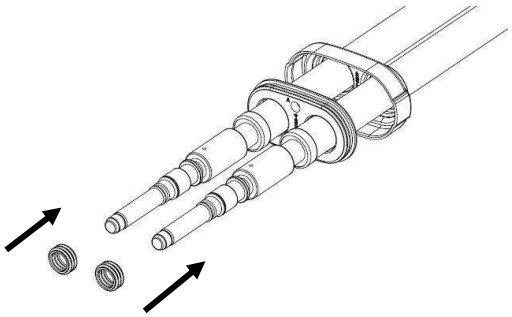
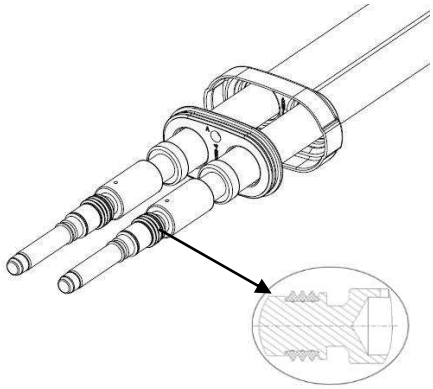


Figure 22a



Step 9

Assemble the Radial Seal 0-2320511-1 to the Cable Exit Cover 5-2296039-3 or 5-2296039-4. Radial Seal should be properly seated into the Collar of the Cable Exit Cover. Ensure also correct orientation of seal acc. figure 23.

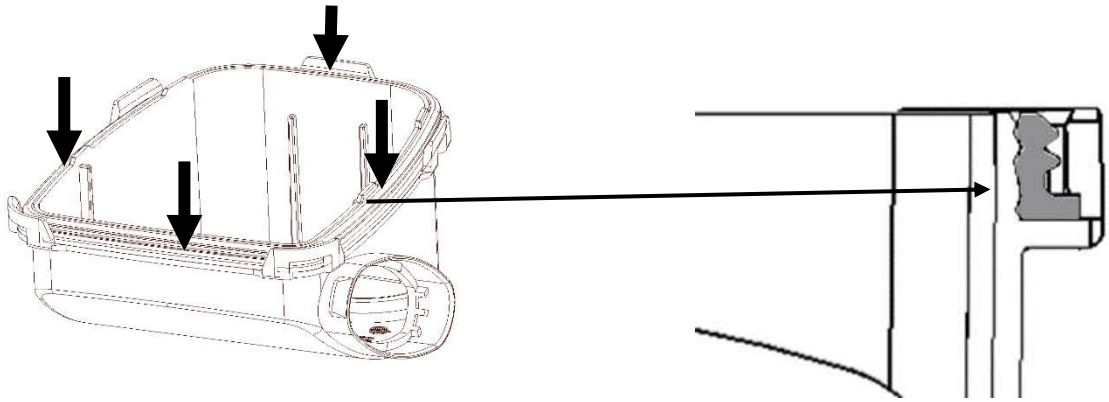


Figure 23

Step 10

Pass the AC cable subassembly through the AC slot in Cable 5-2296039-3 or 5-2296039-4 (figure 24).

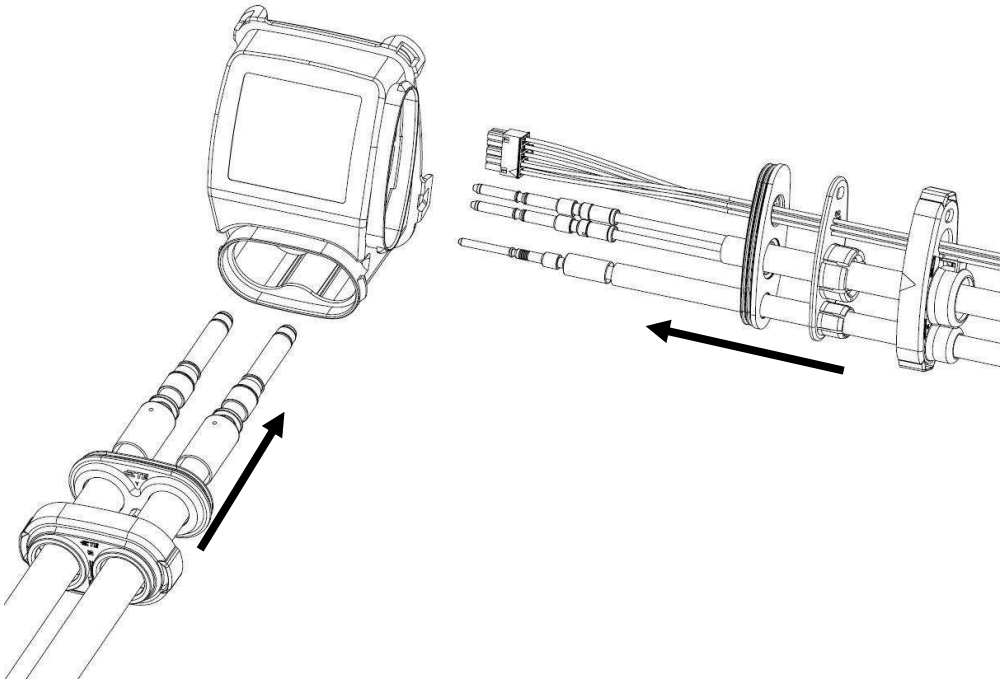


Figure 24

Step 11

Insert the Contacts from the backside into the Inlet Housing according to the cavity description (see figure 25) into their locking position, see figure 26. To ensure that the contacts are correctly inserted, pull with a low force on the cables (max. 10N). Figure 26a shows contacts assembled in end position.

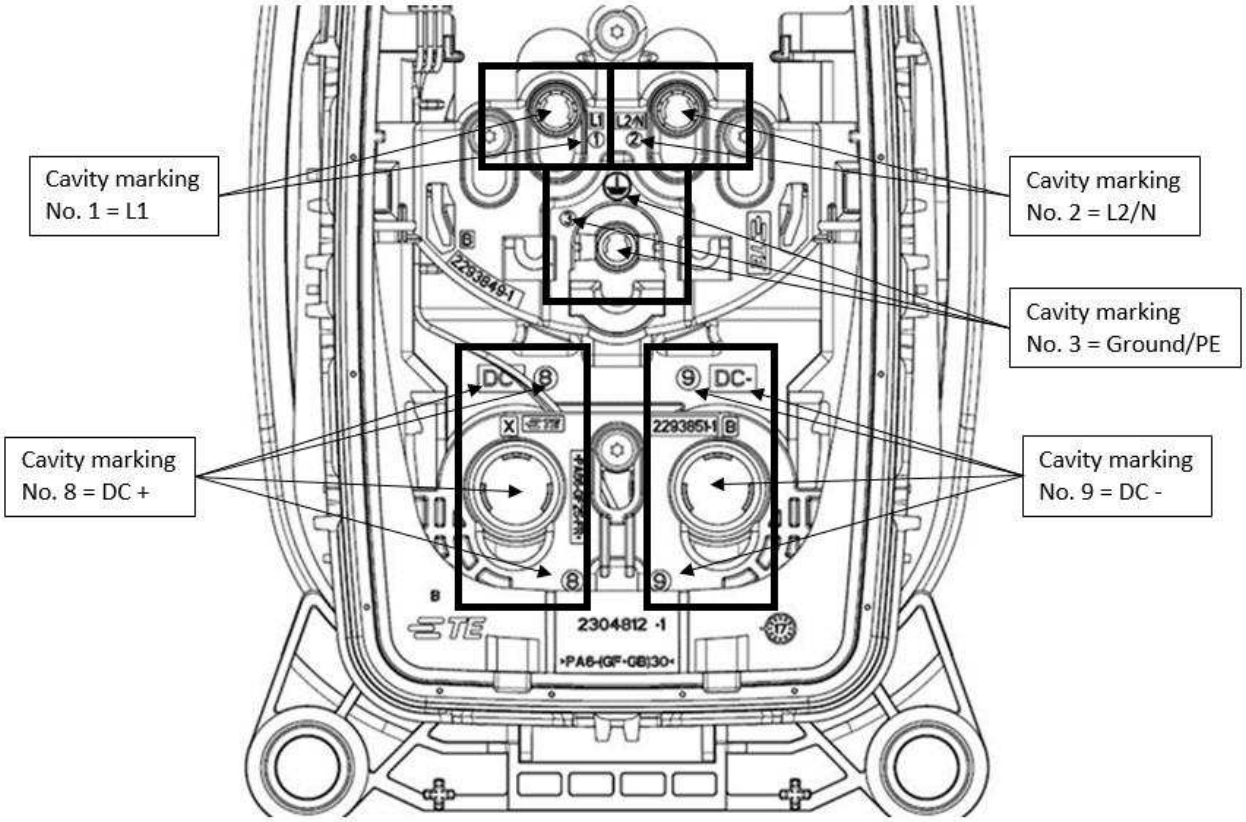


Figure 25

ATTENTION: The correct contact positions have to be ensured BEFORE pushing the contacts into locking their cavities in locking position.

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

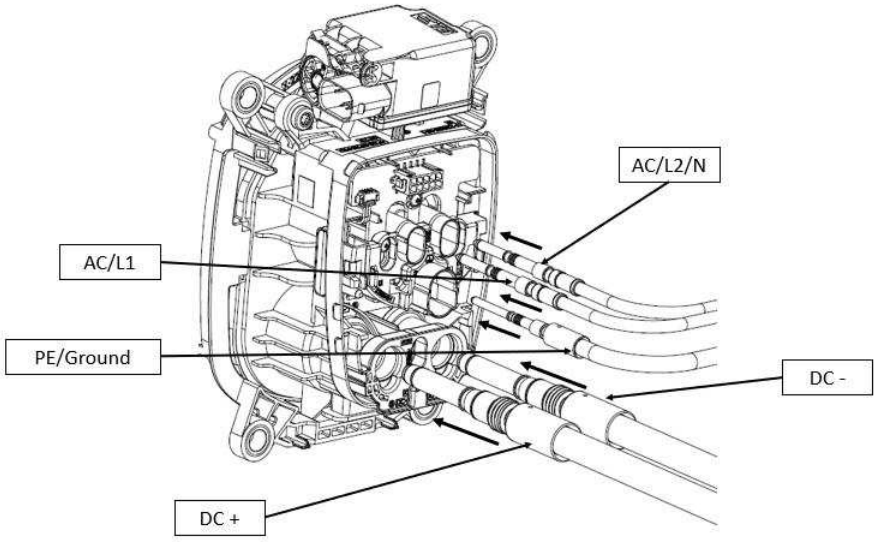


Figure 26

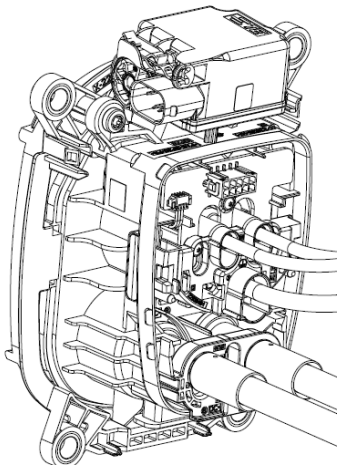


Figure 26a

Proposed sequence for contact insertion:
1.) 2x6mm² AC Power Cable with contacts into L2/N and L1 cavities
2.) 25 mm² Ground Cable with contact into PE/ground cavity
3.) 2x 50mm² DC Power Cable with contacts into DC+ and DC- cavities

Step 12

After the contacts have been controlled for correct positioning and locking, both SECONDARY LOCKS have to be pushed upwards (Figure 27). Ensure that both latches are properly engaged with the inlet housing, which has to be controlled by the double audible click and by visible inspection. Secondary Locks in end position shown in figure 29 and 29a:

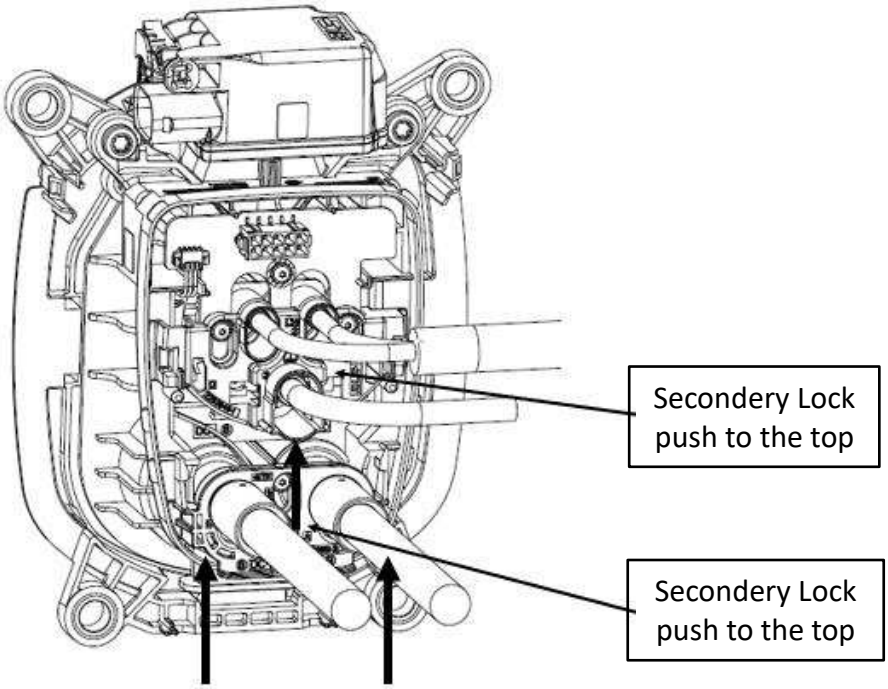
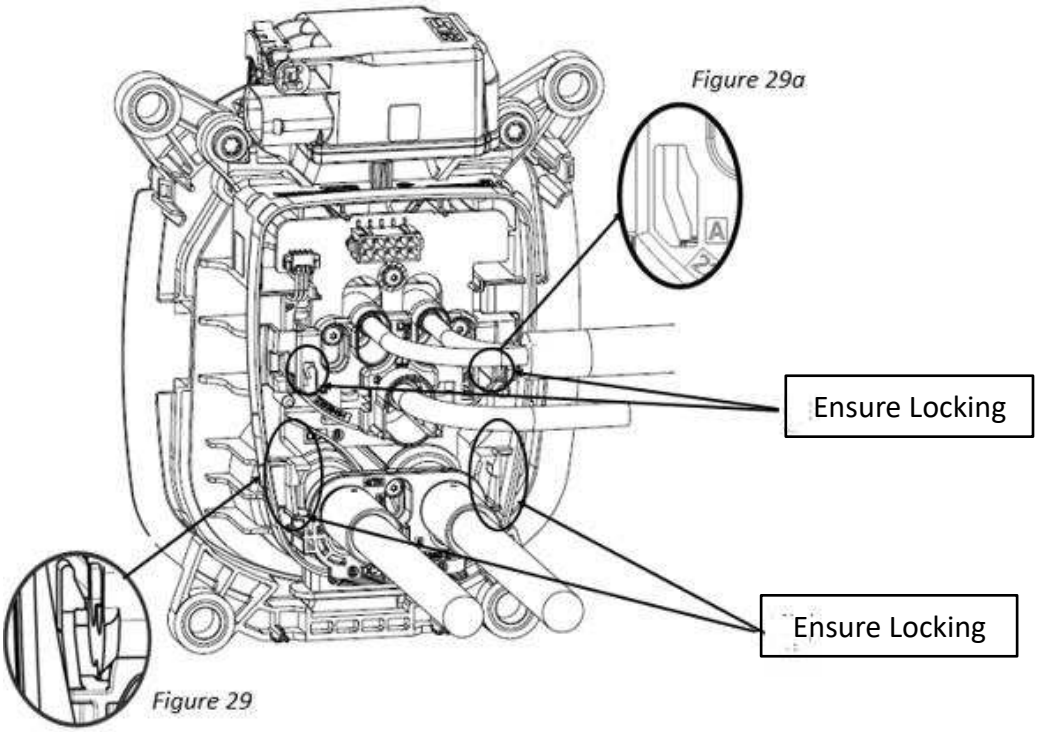


Figure 27



Step 13

Connect Micro Mate'N'Lock Connector to PCB-Header. Ensure the hook is properly engaged with the header, see figure 30.

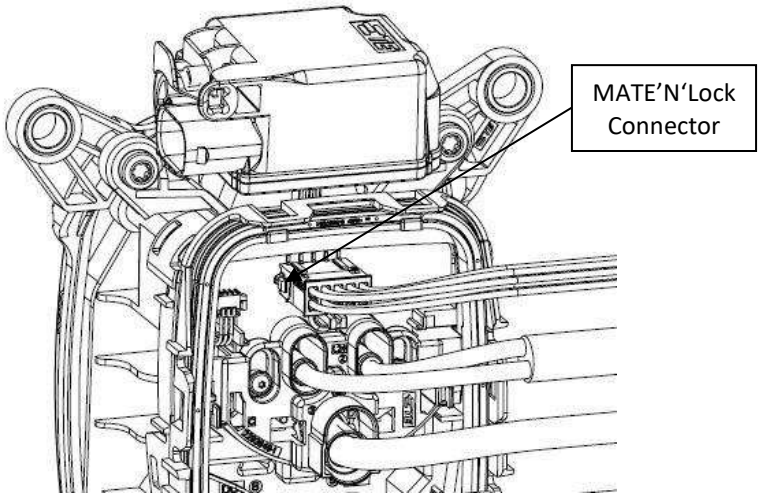


Figure 30

Step 14

Assemble the Cable Exit Cover Left 5-2296039-3 or Exit Cover Right 5-2296039-4 to the Inlet. Ensure that all 5 hooks are correctly engaged. (Figure 31or 32). The press force has to be applied on the marked locations close to the latches, see figure 33.

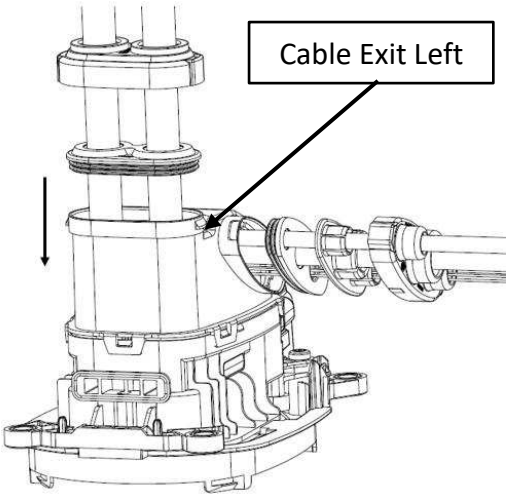


Figure 31

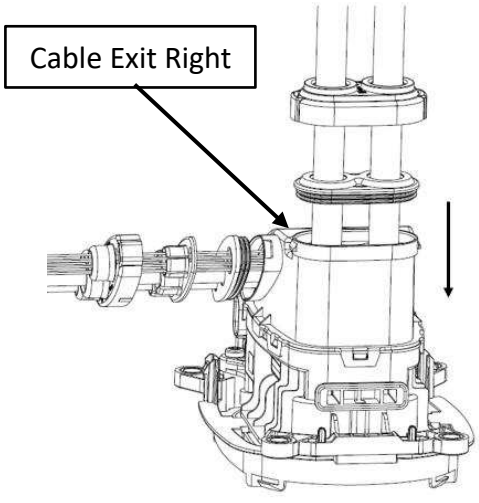


Figure 32

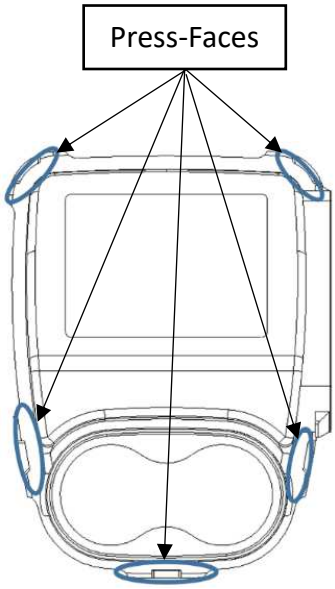


Figure 33

Step 15

Move the STRAIN RELIEF AC 1-2344703-2 together with FAMILY SEAL AC 2350592-7 into their position in the CABLE EXIT 5-2296039-3, see figure 34.

ATTENTION: Ensure that the AC-Multicore cable is well positioned in the FAMILY SEAL, that all seal lips are safely placed on the outer isolation of the cables. (Figure 35a)

Push the COVER CABLE SEAL DC 5-2296059-4 over it and snap it on the CABLE EXIT COVER 5-2296039-3. Ensure that both hooks are correctly engaged (double audible click), see figure 35a

Move the FAMILY SEAL DC 2296058-4 into position in the CABLE EXIT 5-2296039-3 and snap the COVER CABLE SEAL DC 5-2296059-4 on the CABLE EXIT. Ensure that all hooks are correctly engaged (audible click), see figure 35b

ATTENTION: Ensure that the DC power cables are well positioned in the FAMILY SEAL, that all seal lips are safely placed on the outer isolation of the cables. (Figure 35b)

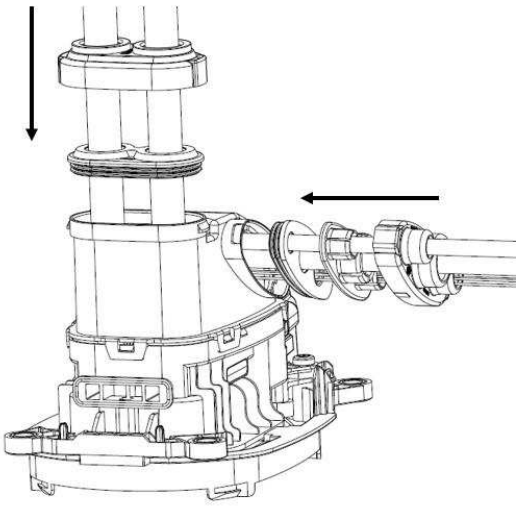


Figure 34

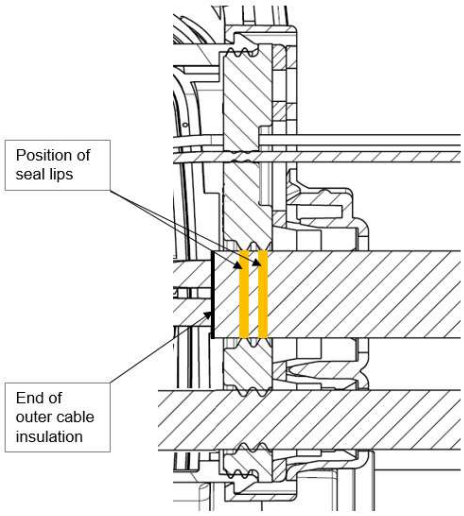


Figure 35a – AC seal lips

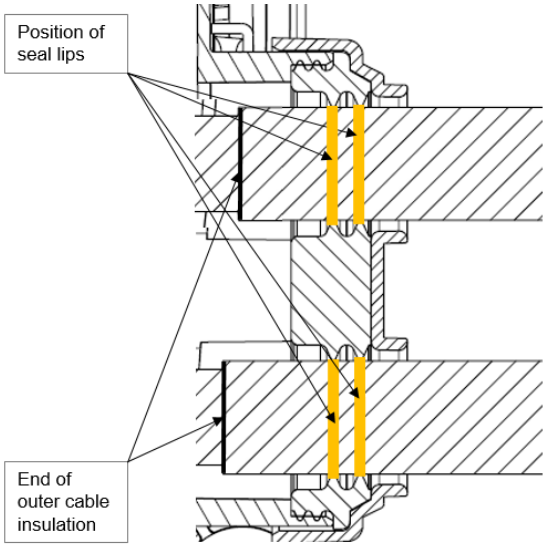


Figure 35b – DC seal lips

Step 16

Assemble Protection Cap 2292534-1 at Inlet Housing, see figure 36.

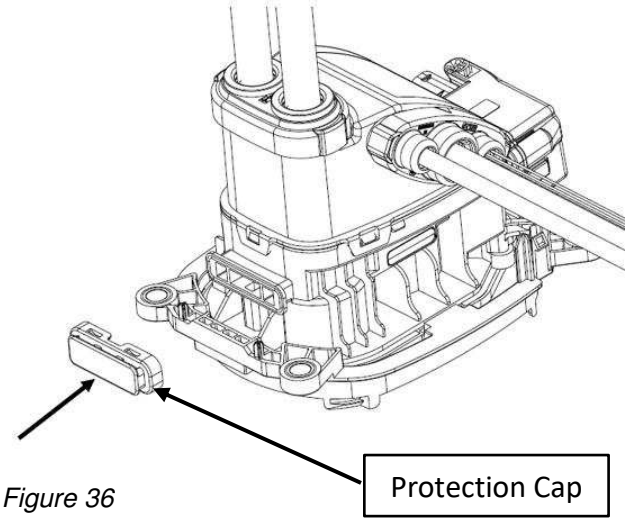


Figure 36

Step 17

For identification apply the label on this specified polished face on the CABLE EXIT, see figure 38. The label needs to include information acc. requirements of IEC 62196-x and IEC 61851 and SAE 1772. Also information acc. to customer requirements can be applied here.

Marking acc. IEC62196-3 /SAE J1772:

Manufacturer's name or trademark	xxxxxxxx
Type reference of identification number	Art: xxxxxxxx
Rated currents, maximum voltages and frequency	Max. 32A, 250V~ 50-60Hz / Max. 200A 600V
Number of phases	1L / N /⏚/ DC+ / DC-⎓
Degree of protection	IP67

There may apply additional national marking requirements, depending on the market/country the car will be configured for. Also information acc. to customer requirements can be applied here.
As a compatible label TE p/n 5-1768421-9 is recommended.

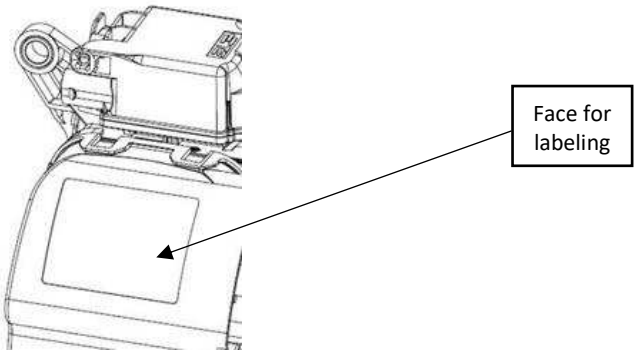


Figure 37

6.6. End of Line Test

The assembled Charge Inlet has to be tested electrically and mechanically to applicable requirements, including High Voltage test.

As a minimum, following tests have to be performed:

- Isolation Resistance:
  Test Voltage: 500VDC
  Inspection Duration: 1s
  min. Riso: 200MOhm
  pin-to-pin, excluding CP-to-Proxi and CP/Proxi-to-Ground
  a) L1 versus N
  b) L1+N versus Ground
  c) L1+N versus AC multicore shield

- Dielectric withstand voltage:
  Test Voltage: 2000VAC
  Inspection Duration: 1s
  max. 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) L1+N versus AC multicore shield

- Correct Pinning of all Contacts

- Check seals for correct seating by Tightness Check of completed Charge Inlet Harness Assy (Air pressure test)

- 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 actuator pull ring / pull cable becomes pulled back in end position.

LTR	REVISION RECORD	DWN	APP	DATE
A	INITIAL DOCUMENT	R. CSISZOR	S. KUMAR	20.05.2020
A1	UPDATED CABLE SUPPLIER DETAILS	R. VIGNESH	JINDRICH NECAS	23.08.2022
B	MODIFICATION OF CONTACT 25MM^2 PE, TABLE 1 UPDATED	R. VIGNESH	JINDRICH NECAS	02.11.2023

DRW R. CSISZOR	TE CONNECTIVITY GERMANY GMBH AMPÈRESTRAßE 12-14 D-64625 BENSHEIM GERMANY		
CHK S. KUMAR			
APP S. KUMAR	NO 114-94649	REV B	LOC AI
TITLE	Application Specification Vehicle Charge Inlet Type COMBO 1 acc. IEC62196-3		