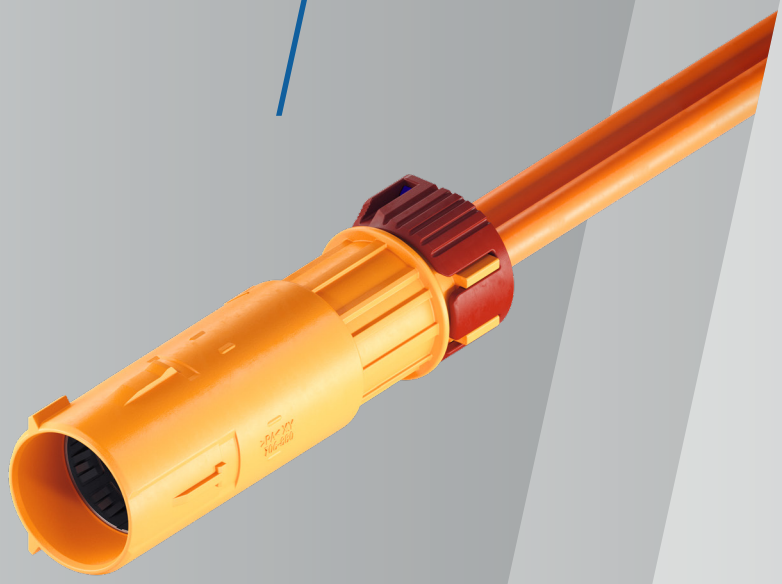


PROCESS SPECIFICATION

HPS In-Line Connector Male SCC

EVS-100132

HIRSCHMANN
AUTOMOTIVE

TABLE

1 General

1.1 Introduction

This process specification is valid for all variants mentioned and describes the product structure as well as the assembly of the HPS40-2 In-Line Connector.

System number	Coding	Wire cross section
809-999-501	A	4.0 mm² 6.0 mm²
809-999-502	B	
809-999-503	C	
809-999-504	D	

The manufacturer of the listed products is responsible for the qualitative processing and the accuracy of the version. In case of improper processes or deviation from specification that results in quality issues, the right of complaint is void.

1.2 Customer-releases

It is our suggestion that the specified dimensions are observed during processing. Further functional features must be coordinated and defined with the OEM. The adjustments in the processing specification with the status 08/ 2023 must be considered for new applications, but not for existing orders.

1.2.1 Customer: Miscellaneous

Customer: Miscellaneous					
L	**S**	**F**	**Characteristic**	**Specific Purpose**	**Place of implementation**
L1	-	-	“d” Height of shield-crimping	Strain-relief, electrical shield connection - EMC	Tier 1
L2**	-	-	Retention force of shield crimping	Strain-relief, electrical shield connection - EMC	
-	-	F1	L12 depth of contact carrier	Pluggability	

**No 100% check possible since the specimens are destroyed during testing.
Proof of capability or continuous testing of all special characteristics must be aligned with the OEM directly.

1.2.2 Customer: BMW

Customer: BMW BMW-Number.:		NAEL:	E 1C46 A –VS09 N OU53 B –VS12
Special characteristics according to GS 91011:2019-8			
L	**S**	**F**	**Characteristic**	**Specific Purpose**	**Place of implementation**
L1	-	-	“d” Height of shield-crimping	Strain-relief, electrical shield connection - EMC	Tier 1
L2**	-	-	Retention force of shield crimping	Strain-relief, electrical shield connection - EMC	
-	-	F1	L12 depth of contact carrier	Pluggability	

**No 100% check possible since the specimens are destroyed during testing.
Proof of capability or continuous testing of all special characteristics must be aligned with BMW directly.

Legend: L = Legal, S = Safety, F = Function

1.3 Other current documents

A	HCT4 Process specification (Ag)	EVS-100068
B	Datasheet Shielded SCC 4.0 mm² Huber & Suhner	H&S Nr.: FLR91XC33X-1x4 T150
C	Datasheet Shielded SCC 4.0 mm² Coficab	Coficab No.: FHLR91XCB91X T4
D	Datasheet Shielded SCC 4.0 mm² Coroplast	Coroplast No.: 9-2611 (1x 4.0 mm²)
E	~~Datasheet Shielded SCC 4.0 mm² Kroschu~~	~~Kroschu No.: 64998372~~
F	Datasheet Shielded SCC 4.0 mm² Leoni	Leoni No.: FHLR2GCB2G 00003
G	Datasheet Shielded SCC 6.0 mm² Coficab	Coficab No.: FHLR91XCB91X T4
H	Datasheet Shielded SCC 6.0 mm² Coroplast	Coroplast No.: 9-2611 (1x 6.0 mm²)
I	Datasheet Shielded SCC 6.0 mm² Kroschu	Kroschu No.: 64998762
J	Datasheet Shielded SCC 6.0 mm² Leoni	Leoni No.: FHLR2GCB2G 00004
K	Datasheet Shielded SCC 6.0 mm² Gebauer & Griller	G&G Nr.: FHLALR2GCB2G 1X6,0(0,40)/T180
L	Datasheet Shielded SCC 6.0 mm² Gebauer & Griller	G&G Nr.: FHLR2GCB2G 1X6,0/T180
M	Datasheet Shielded SCC 4.0 mm² Gebauer & Griller	G&G Nr.: FHLR2GCB2G 1X4,0/T180
N	HCT4 Process specification (Al)	EVS-100145

2 Product structure (single components)

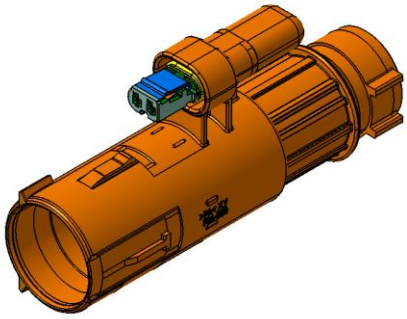
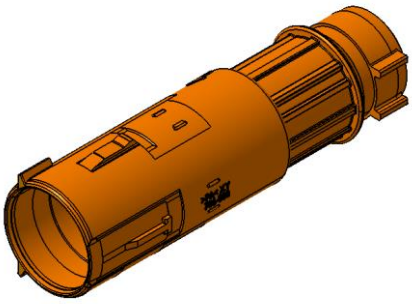
2.1 Sheated cable (see table)

Wire manufacturer	Wire cross section	
	4.0 mm²	**6.0 mm²**
Leoni	FHLR2GCB2G 4,0/ 0,31/ T180 600V AC / 1000V DC	FHLR2GCB2G 6,0/ 0,31/ T180 600V AC / 1000V DC
Kroschu	~~FHLR2GCB2G 4.00 QMM/0.21/T180 600/1000V OR~~	FHLR2GCB2G 6.00 mm² 0.21/ T180/ 600/1000V OR
Coroplast	FHLR2GCB2G 4.0 mm² 0,21/ T180/ 0,6/ 1,0 kV	FHLR2GCB2G 6.0 mm² 0,21/ T180/ 0,6/ 1,0 kV
Coficab	FHLR91XCB91X T4 4.0 mm²	FHLR91XCB91X T4 6.0 mm²
Huber & Suhner	FLR91XC33X 1x4 T150 1x 4.0 mm² RADOX 155S FLR	-
Gebauer & Griller	FHLR2GCB2G 4,0/ T180 600V AC / 1000V DC	FHLR2GCB2G 6,0/T180 600V AC / 1000V DC
	-	FHLALR2GCB2G 1X6.0 (0,40)/ T180*

Only wires which are listed here and released by the respective OEM are allowed to use.

*If aluminium conductors are used, special processing steps and responsibility apply; see Appendix for Alu wiring EVS-100111-A1.

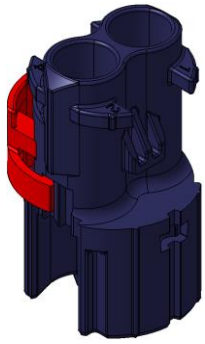
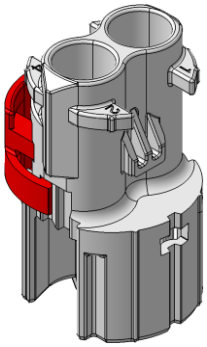
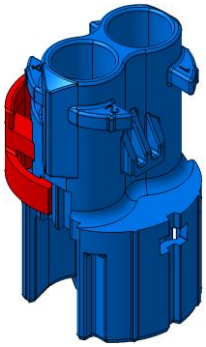
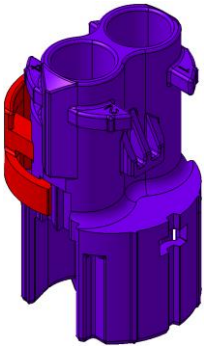
2.2 HPS40-2 In-Line male housing

	
with Sealstar HVIL bridge	without HVIL

Hirschmann Automotive No.	Wire cross section	Product description
706-880-502	4.0 mm² 6.0 mm²	Male housing
810-000-501		TB Male Housing unit with HVIL

Delivery condition: The male housings are delivered as bulk good.

2.3 HPS40-2 In-Line contact carrier

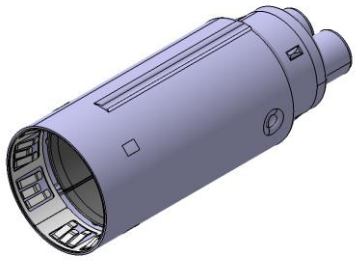
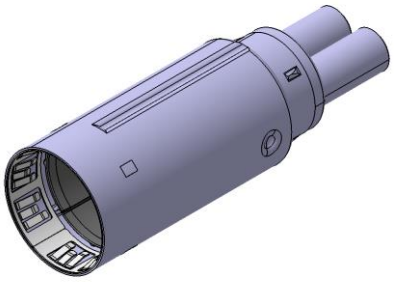
			
Cod. A	Cod. B	Cod. C	Cod. D

Hirschmann Automotive No.	Coding	Colour	HVIL Bridge	Wire cross section
809-365-541	A	Black	No	4.0 mm² 6.0 mm²
809-365-542	B	Natural/ White	No	
809-365-543	C	Blue	No	
809-365-544	D	Purple	No	

Flammability according to UL94: V04

Delivery condition: The contact carriers are delivered as bulk good.

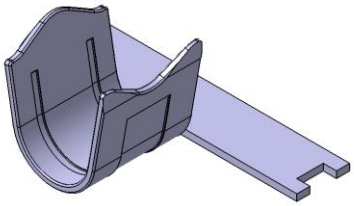
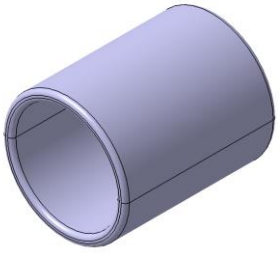
2.4 HPS40-2 In-Line shielding sleeve

	
-502	-503

Hirschmann Automotive No.	Wire cross section
810-001-502	4.0 mm²
810-001-503	6.0 mm²

Delivery condition: The shield sleeves are delivered as bulk good.

2.5 HPS40-2 In-Line stress relief

	
710-195-502	710-671-501

Hirschmann Automotive No.	Wire cross section	Product description
709-841-501	6.0 mm²	Stress relief
709-841-502	4.0 mm²	Crimp Ferrule

Wire manufacturer: On the product drawing (HA No. 807-655-…00), you can find the released cables for each part.

2.6 HPS40-2 X-ring

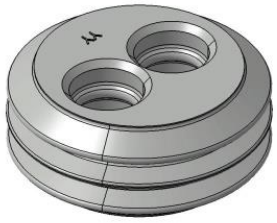
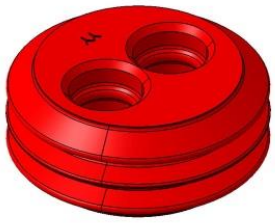
710-675-501

Hirschmann Automotive No.	Wire cross section
710-675-501	6.0 mm²

Wire manufacturer: On the product drawing (HA No. 807-655-…00), you can find the released cables for each part.

Delivery condition: The x-rings are delivered as bulk good.

2.7 HPS40-2 2+2 wire seal

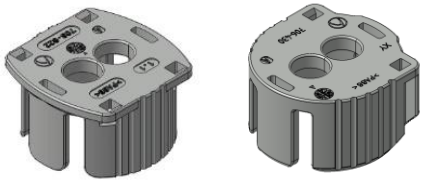
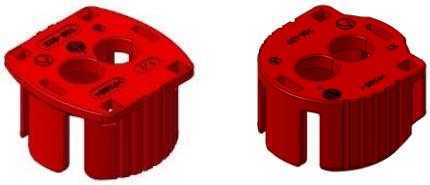
	
-502	-504

Hirschmann Automotive No.	Colour	Wire cross section
709-972-502	Gey	4.0 mm²
709-972-504	Red	6.0 mm²

Wire manufacturer: On the product drawing (HA No. 809-999-…01), you can find the released cables for each seal.

Delivery condition: The seals are delivered as bulk good.

2.8 HPS40-2 2+2 cover cap

	
(4.0 mm²)	(6.0 mm²)

Hirschmann Automotive No.	Colour	Wire cross section	Product description
706-822-503	Grey	4.0 mm²	-
706-430-504	Grey	4.0 mm²	Polarized
706-822-505	Red	6.0 mm²	-
706-430-505	Red	6.0 mm²	Polarized

Wire manufacturer: On the product drawing (HA No. 809-999-…01), you can find the released cables for each cover cap.

Delivery condition: The cover caps are delivered as bulk good.

2.9 HCT4 male terminal

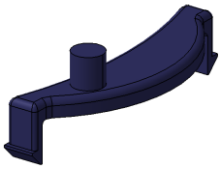
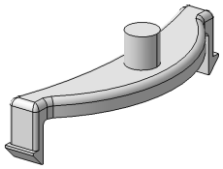
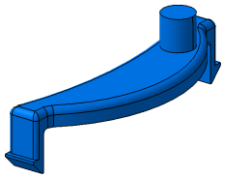
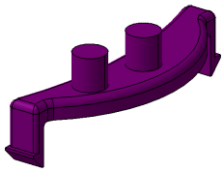
	
-505	-506

Hirschmann Automotive No.	Wire cross section
709-633-505	4.0 mm² (Cu) 6.0 mm² (Al)
709-633-506	6.0 mm²

Delivery condition: The male terminals are delivered reeled on a spool.

3 Product structure (optional parts)

3.1 HPS40-2 2+2 coding clip

			
Cod. A	Cod. B	Cod. C	Cod. D

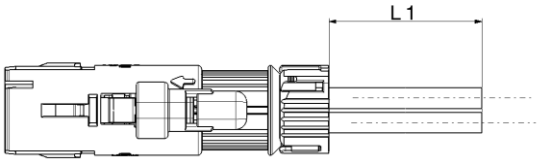
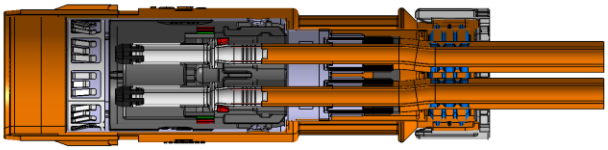
Hirschmann Automotive No.	Coding	Colour	Wire cross section
706-505-501	A	Black	4.0 mm² 6.0 mm²
706-505-502	B	Natural / white	
706-505-503	C	Blue	
706-505-504	D	Purple	

Delivery condition: The coding clips are delivered as bulk good.

4 Processing steps (4.0 mm²)

Use the following described processing steps for the wire cross sections 4.0 mm².

4.1 Cut the shielded cable

	+ wire add-on
	

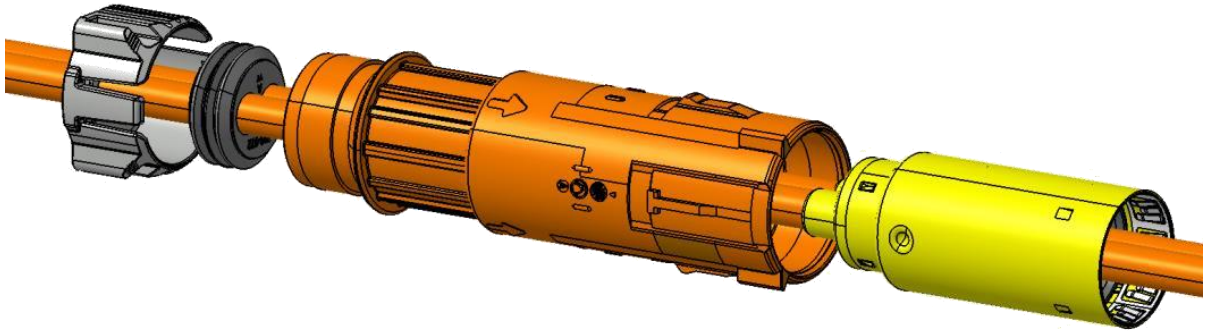
Add the following lengths for the HPS In-Line Connector:

Wire cross section	Dimensions L after zero-cut (mm)	Dimension L for the HCT4 terminal incl. zero-cut (mm)
4.0 mm²	L + 48	L + 52

These dimensions must be added to the planned length at the cutting process of the wire for each connector.

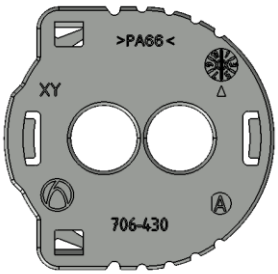
4.2 Assembly of the single components

Slide the cover cap (1), the seal (2), the male housing (3) and the shielding sleeve (4) onto the shielded cable. Seal is 180° symmetrical and can be assembled either way.

1	2	3	4
			

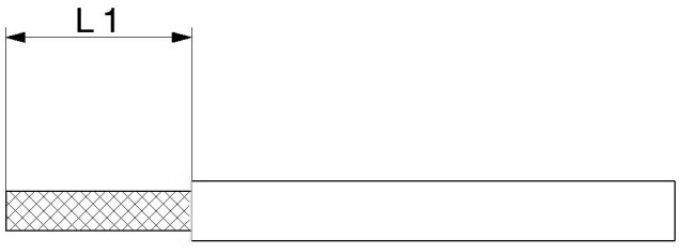
Note: The (TB) male Housing unit (3) and shielding sleeve (4) may as well be assembled onto the cable after crimping of HCT4-male terminals.

ATTENTION: The cover cap (1) can not be changed after assembly!

Pin 1		**Pin 2**

4.3 Strip off the shielded cable

Stripping length:

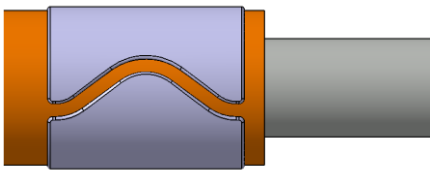


Wire cross section	Dimension L1 after zero-cut (mm)	Dimension L1 for the HCT4 terminal incl. zero-gut (mm)
4.0 mm²	16.0 ± 1	20.1 ± 1

Do not damage the shielding during the processing operation.

4.4 Wire processing I

Crimp the crimp ferrule remove the foil and shorten the shielding

		
	max. 2.0 mm	Reference for L5

The following process steps must be done, but the manufacturer can choose the sequence:

- Crimp the crimp ferrule
- Remove the foil
- Shorten the shielding

If required, the stripping of the cable can be done after the crimping of the crimp ferrule. Then, a maximum overlap of the inner jacket of 2.0 mm must be ensured.

It has to be ensured, that L5 is referenced to the ferrule nevertheless.

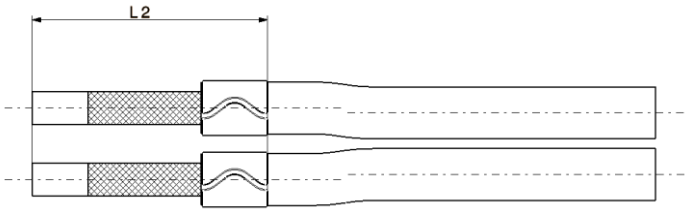
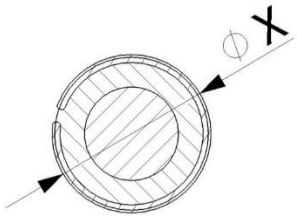
- **Single stroke crimping machine**

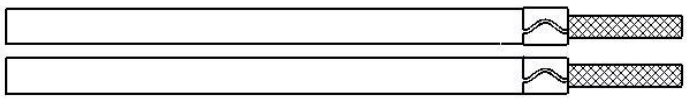
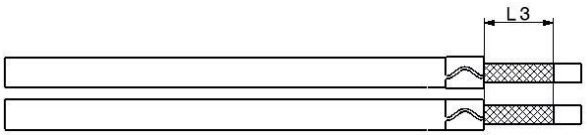
It is up to the manufacturer to decide which device/ machine is to be used. The crimping and positioning data described on the following pages must be observed during the crimping process.

The order of a crimping device is the responsibility of the assembler. The test facility used by Hirschmann Automotive is described in chapter 9.

- **Process data**

  a) The crimp ferrules need to be crimped in relation to the single wires.
  b) For the 6.0 mm² variant, additional tape must be applied behind the crimp-ferrule to prevent axial displacement.

	**L2** = max. 23.5 mm after zero-cut = max. 27.5 mm incl. zero-cut = max. 29.0 mm if L5 is guaranteed via dimensional reference-cut
	**Wire cross section:** 4.0 mm²
	Dimension ØX: 6.1 ± 0.1
The measurement of ØX must be in crimping direction.	

	
An overlap of the foil around the crimp max. 1.0 mm is allowed.	Dimension of the shielding. Depending on the production method of each manufacturer, the dimension L3 can vary.

After cutting the shielding, there are no wire residues or parts of the shielding allowed on the cable. This must be ensured with some actions like the following:

- Can be avoided by removing the residues of the shielding.
- Can be avoided by blowing out or by suction of the residues of the shielding.

In the next process step, make sure that the shielding is rising over the crimp 100%.

4.5 Wire processing II

Reverse the shield backwards, hold the shield with tape

100% of the shield must be turned over the stress relief. A targeted unbraiding of the shield is not necessary. By turning over the shield, a process related unbraiding is possible. After this the shield must be fixed with a fixing device after the stress relief. (for example: tape) The fixing tape needs to stay on, until the pressing procedure is done and can be left inside the connector. The max. width of the tape is **5.0 mm**. The fixing tape must be positioned immediately after the stress relief and must not reach the stress relief. No shielding allowed outside the fixing tape.

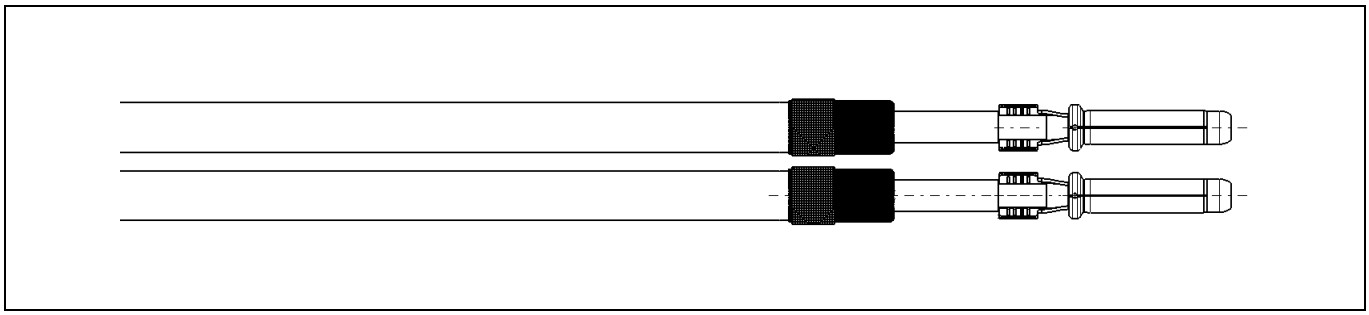
The max. position of the tape is shown with the dimension L4.

L4 = max. 33.0 after zero-cut
= max. 37.0 incl. zero-cut

In this specification the PET- fabric tape 837X (838X) 5mm of the company Coroplast is used. It is possible to use another product to fix the shield. The max. outer diameter after assembling is Ø 6.75 mm and the shield sleeve must be able to be mounted easily. The product must have min. 150° C thermal resistance.

Single strands of the shield, which are not fixed with tape and stick out, must be removed before further process steps. Do not damage the single wires during the complete processing operation.

4.6 Crimp the HCT4 male terminal



- **Double stroke crimping machine**

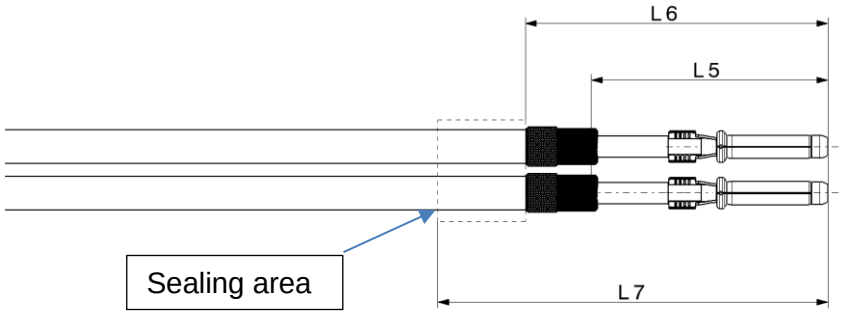
It is up to the manufacturer to decide which device/ machine is to be used. The crimping and positioning data described on the following pages must be observed during the crimping process.

The order of a crimping device is the responsibility of the assembler. The test facility used by Hirschmann Automotive is described in chapter 8.

- **Process data**

a) The crimp data can be seen in the „Process specification HCT4 male terminal EVS-100068“.
b) The HCT4 male terminals need to be crimped in relation to the single wires. For a smooth assembly into the contact holder, the terminals need to be crimped in the correct position.

The dimensions on the following drawing need to be adhered to.

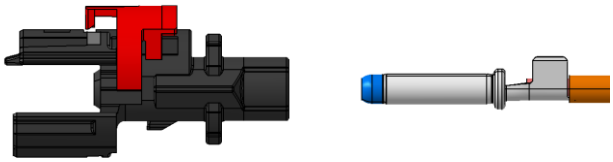
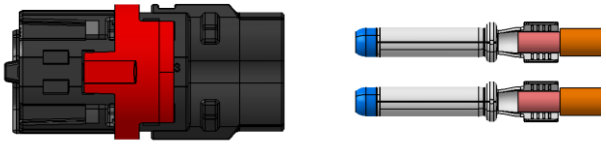
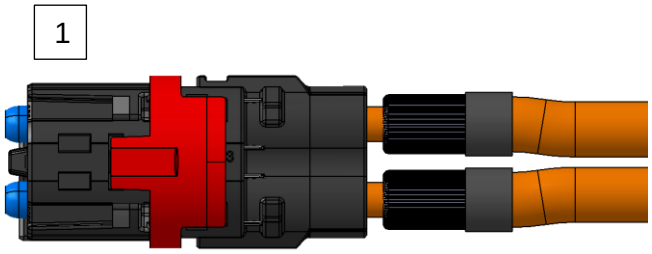
<table>
<tr><td rowspan="3"> 
</td><td>L5 = 38.20 ± 0.75</td></tr>
<tr><td>L6 = max. 59.00</td></tr>
<tr><td>L7 = min. 71.00</td></tr>
</table>

The dimension L5 and L6 are for information only. The dimensions are given through the dimensions L1, L4 and the EVS-100068.

A mark on the insulation of the single wires or on the outer sheath which is caused due to fixing the wire at the crimping process is allowed. It must be ensured that the insulation will not be damaged because this will lead to an insulation resistance failure. On the area of the wire seal, it is not allowed to deform or damage the outer sheath which has negative influence on the sealing function.

If agreed to by the OEM, either L2 or L5 must be proven, since they are correlating.

4.7 Assembly I

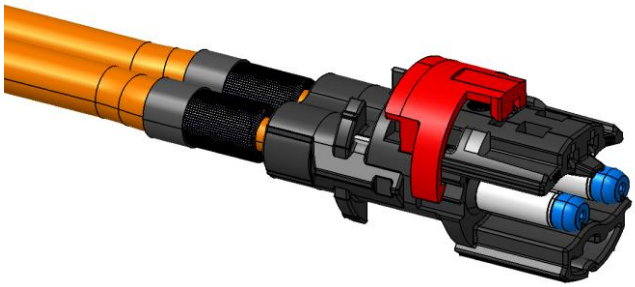
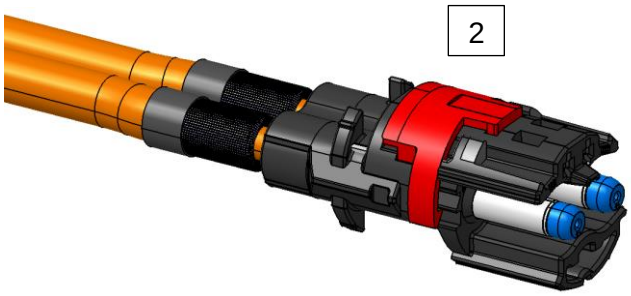
<table>
<tr><td colspan="3">Assemble male terminals into the contact holder (1).</td></tr>
<tr><td colspan="2">  </td><td>  </td></tr>
<tr><td rowspan="3">  </td><td>Pin</td><td>Polarity/ Colour</td></tr>
<tr><td>1</td><td>+</td></tr>
<tr><td>2</td><td>-</td></tr>
</table>

While assembling the HCT4 male terminals, the terminal will audibly engage oonce the end position is reached. The male terminals must be crimped. When two wires with the same colour are used, the pinning must be confirmed via electrical testing.

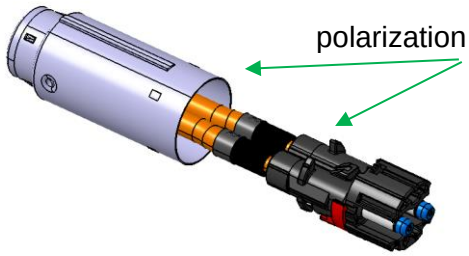
4.8 Assembly II

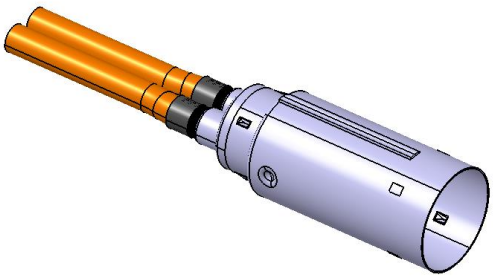
Assemble secondary locking (2)

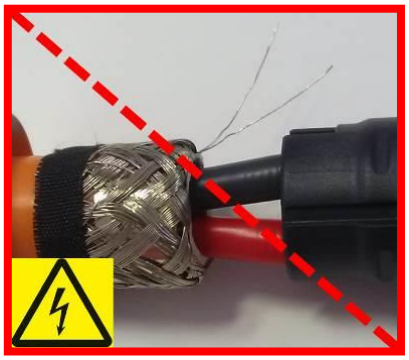
The secondary locking can only be assembled if the terminals are in the end position. A visible difference of the terminals to each other can be possible in the contact cavity. Because of the position of the contacts on the wire, and the play of the contacts in the contact cavity it is possible and acceptable.

Secondary lock pre-locking	Secondary lock end position
	

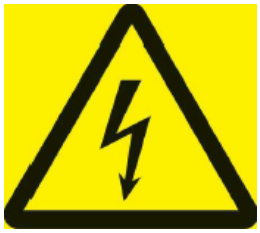
4.9 Push shielding sleeve onto contact carrier







- Do not damage the shielding sleeve during the assembly.
- The shielding sleeve must be assembled until the end position is reached.
- The fixing tape must completely stick out of the shield sleeve after assembling.
- It must be ensured that no single strands of the shield stick out before the shield sleeve is mounted. Demand-oriented, protruding single strands can be removed. This rework must be clarified with each OEM.

• 	**Risk of insulation failure!**

4.10 Pressing shield sleeve

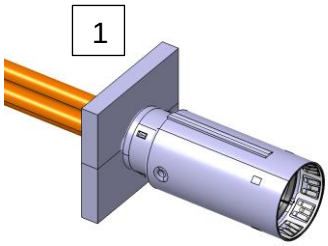
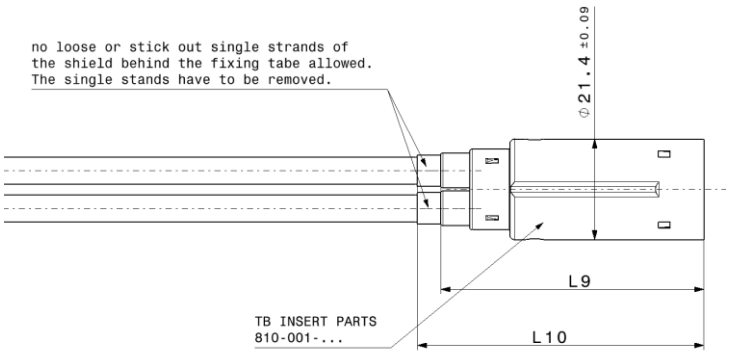
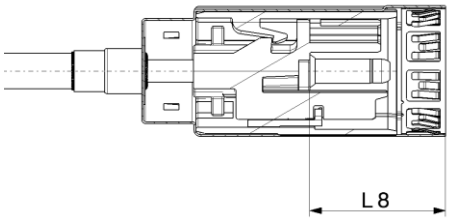
- **Pressing device**

The manufacturer is free to choose which device/ machine is used. The pressing and positioning data described on the following pages must be observed during the pressing process.

The order of a pressing device is the responsibility of the assembler. The test facility used by Hirschmann Automotive is described in chapter 8.

- **Pressing data**

a) The contact holder incl. the male contacts must be put into the device in the correct position.
b) Make sure, the shielding sleeve is on the end position of the contact holder. The tape must stick out at the end of the shielding sleeve.
c) The circularity of the shielding sleeve in the contact area must be ensured.
d) The measurements on the following drawing, must be adhered to, before and after pressing.
e) Two pressing actions will be done in one step

	Shield pressing (shielding sleeve, shielding, stress relief and wire)
	L9 = 56.00 ± 0.2 L10 = 62.00 ± 1.0
	L8 = 22.25 $^{+0,25}_{-0,35}$

The dimension L9 and L10 are just for information. The dimensions are given through the dimensions L1, L4 and the EVS-100068.
Do not damage the following parts during the pressing process:

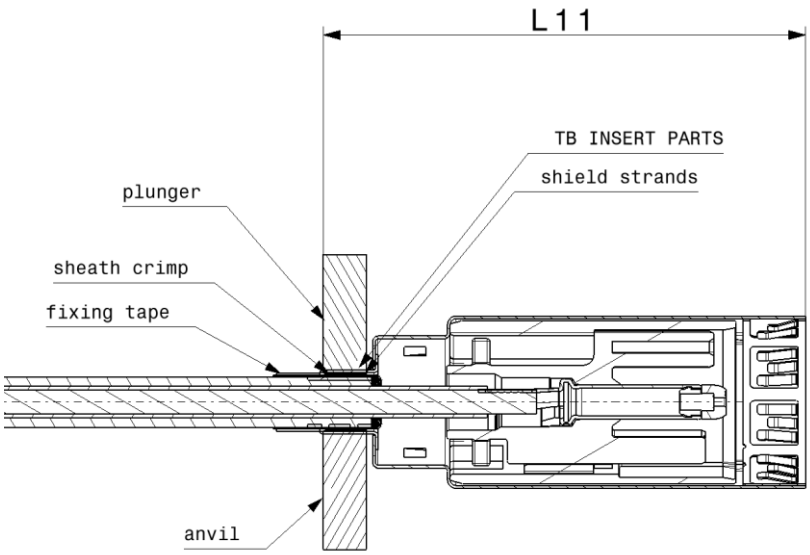
- Insulation of the wire
- Insulation of the single wires
- Stress relief
- Shield sleeve
- Shield strands of the wire

4.10.1 Shield pressing by two half-shells

- **Embossing position:**

The exact geometry of the plunger and anvil is given. The position of the plunger and the anvil must be revered to the front plane of the contact holder. The chamber at the plunger and the anvil must be on the side to the contact holder.

The dimension L11 is for the position of the plunger and the anvil.

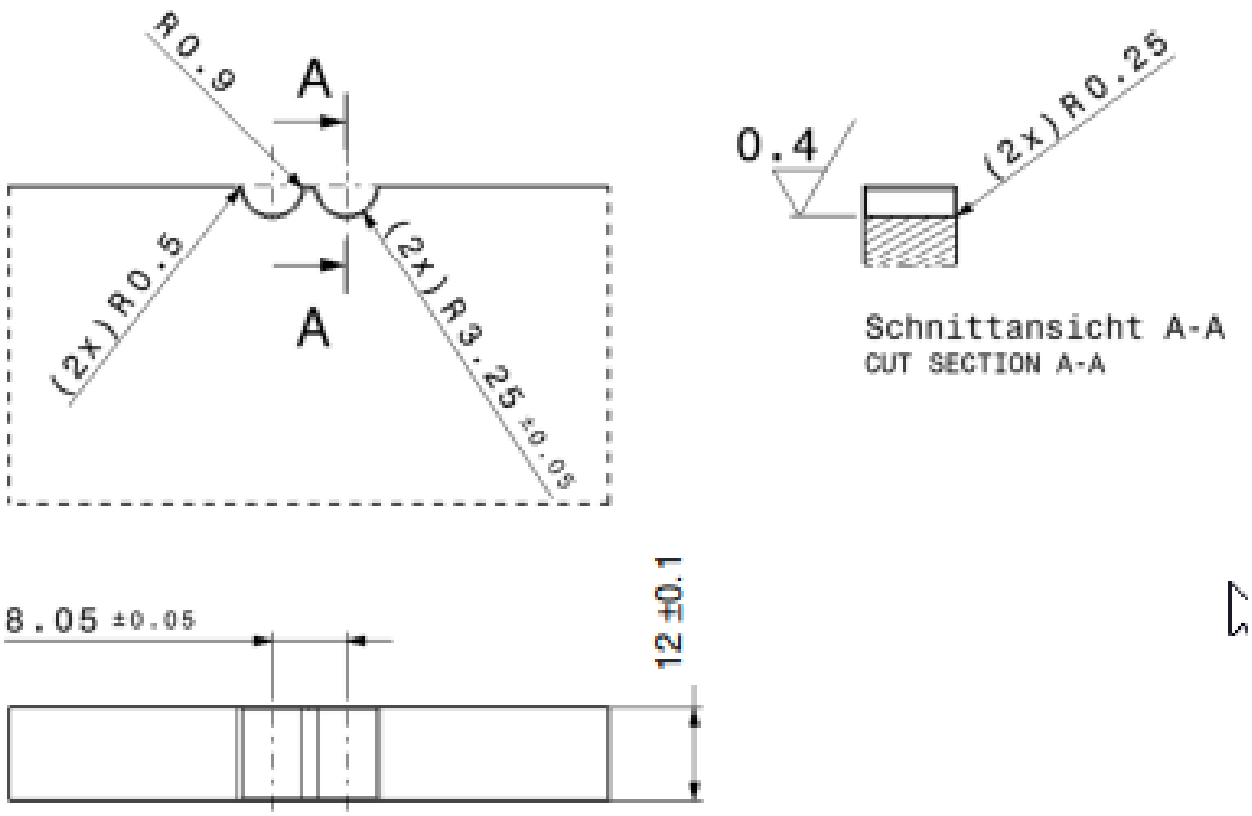


L11 = 55.45 ± 0.1

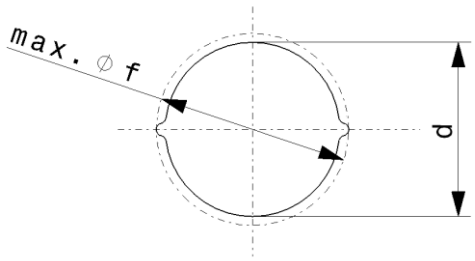
The chamber on both anvil and plunger must face towards the shield-sleeve.

- **Plunger and anvil geometry of the wire shield pressing**

Plunger geometry of the wire shield pressing
Material: 1.2721 vaccum hardened 58hrc



- **Embossing height „d“**

	The plunger and anvil are pressed together to 0.2 mm clearance. Due to this, the dimension “d” will be given. See table of each cross section.

Wire manufacturer	**Dimension “d” in mm**
	4.0 mm²
~~Kroschu~~	6.80 ± 0.1
Leoni	6.80 ± 0.1
Coroplast	6.80 ± 0.1
Coficab	6.80 ± 0.1
Huber & Suhner	6.80 ± 0.1
Gebauer & Griller	6.80 ± 0.1

During the pressing process a fold appears on two sides.
This fold must not be bigger than the diameter **Ø f = 17.2 mm** refer to the centerline of the connector.
In the area of the fold the material of the shield sleeve must not be cracked.

- **Check measurement of the embossing height “d” and the max. diameter “f”**

To check the dimension “**f”**, a gauge with an inner diameter of 17.2 mm must be used.
To check the dimension “d”, the height needs to be measured acc. to the drawing. All the dimensions must be within the given tolerance.

The measuring of the embossing height must be done with a suitable measuring device.
(Micrometer, measuring range: 0-25mm)

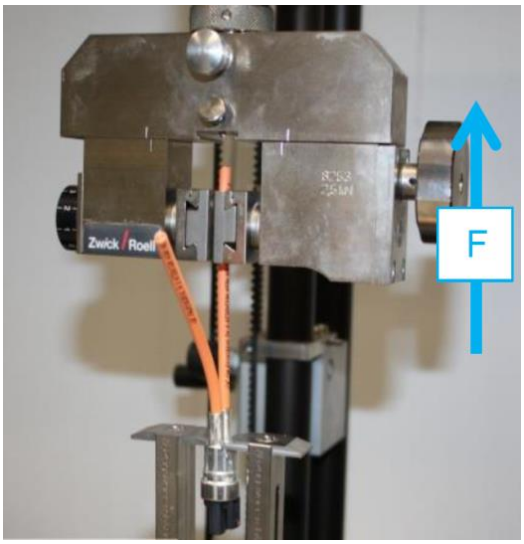
Proposal:

- **Pulling force of the wire**

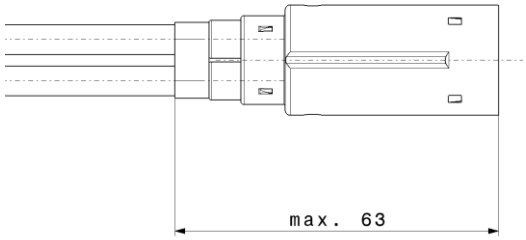
To measure the pull-out force, the wire must be clamped firmly into a clamping device. The distance between the clamping position of the wire and the fixing tape is about 70 mm. The connector must be fixed on the shield sleeve at the transition between the largest and the second largest diameter.

HCT4 terminals must not be installed in the test specimens, to test the shield pressing only. In this state, the figure in the table must be reached. The single wires must be tested individually.

	Wire cross section	Pulling force L2
	4.0 mm²	≥ 150 N

4.11 Taping the wires

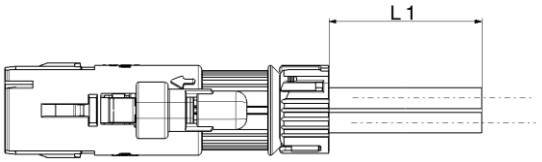
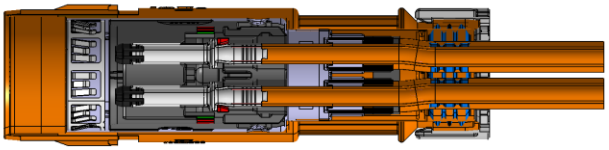
To ensure that the welding of the shield-sleeve is not damaged, the two wires must be taped together. In this specification the PET- fabric tape 837X (838X) 5mm of the company Coroplast is used. It is possible to use another product to fix the wires. The product must have min. 150° C thermal resistance.

	This process step can be skipped, if it is ensured that the wires are not pulled apart in a different way.

5 Processing steps (6.0 mm²)

Use the following described processing steps for the wire cross sections 6.0 mm².

5.1 Cut the shielded cable

	+ wire add-on
	

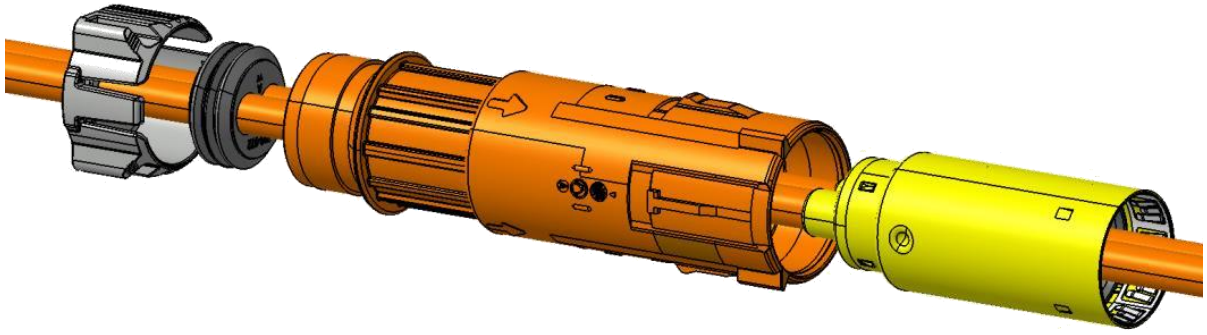
Add the following lengths for the HPS In-Line Connector:

Wire cross section	Dimensions L after zero-cut (mm)	Dimension L for the HCT4 terminal incl. zero-cut (mm)
6.0 mm²	L + 48	L + 52

These dimensions must be added to the planned length at the cutting process of the wire for each connector.

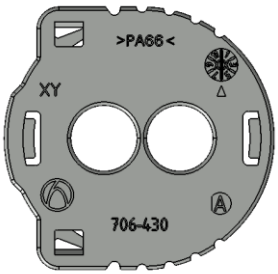
5.2 Assembly of the single components

Slide the cover cap (1), the seal (2), the male housing (3) and the shielding sleeve (4) onto the shielded cable. Seal is 180° symmetrical and can be assembled either way.

1	2	3	4
			

Note: The (TB) male Housing unit (3) and shielding sleeve (4) may as well be assembled onto the cable after crimping of HCT4-male terminals.

ATTENTION: The cover cap (1) can not be changed after assembly!

Pin 1		**Pin 2**

5.3 Strip off the shielded cable

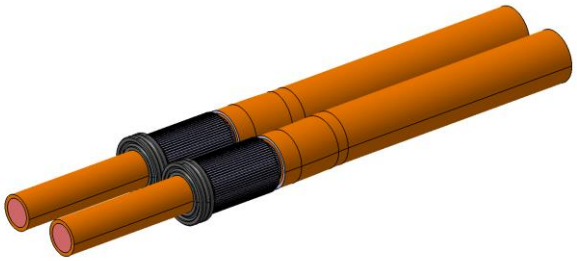
Stripping length:

Wire cross section	Dimension L1 after zero-cut (mm)	Dimension L1 for the HCT4 terminal incl. zero-gut (mm)
6.0 mm² (Cu)	30.5 ± 1	34.5 ± 1
6.0 mm² (Al)	29.5 ± 1	33.5 ± 1

Do not damage the shielding during the processing operation.

5.4 Wire processing I

Assemble strain-relief, remove the foil and shorten the shielding

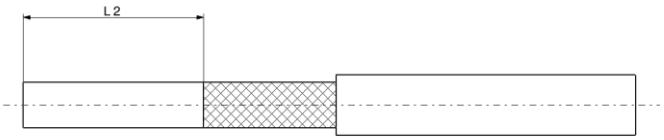


The following process steps must be done, but the manufacturer can choose the sequence:

- Assemble the strain-relief
- Remove the foil (max. 1.0 mm revolving or single edges ≤ 3.0 mm)
- Shorten the shielding

- **Process sequence**

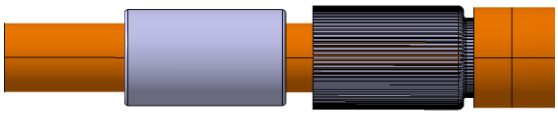
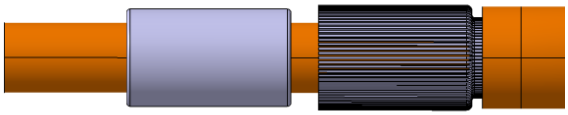
The shielding needs to be cut:

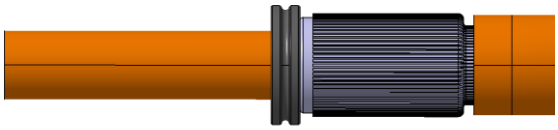
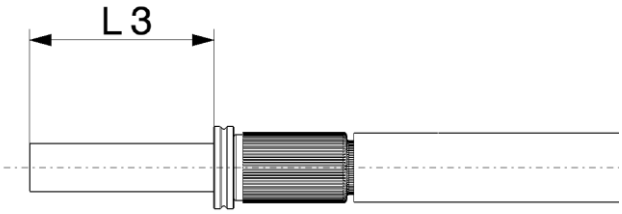


Wire cross section	Dimension L2 after zero-cut (mm)	Dimension L2 for the HCT4 terminal incl. zero-gut (mm)
6.0 mm² (Cu)	22.6 ± 1	26.6 ± 1
6.0 mm² (Al)	21.6 ± 1	25.6 ± 1

After cutting the shielding, there are no wire residues or parts of the shielding allowed on the cable. This must be ensured with some actions like the following:

- Can be avoided by removing the residues of the shielding.
- Can be avoided by blowing out or by suction of the residues of the shielding.

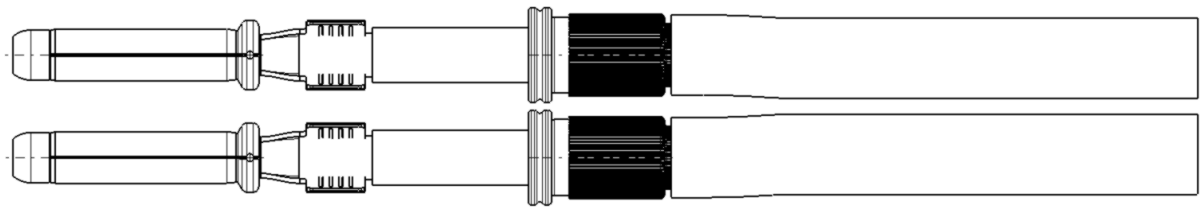
Shielding needs to be spread slightly, strain-relief has to be assembled:	
	

Strain-relief needs to be fixed in place with X-ring. The assembly of the strain-relief and fixture with X-ring can be done in one step.	
	

Wire cross section	Dimension L3 after zero-cut (mm)	Dimension L3 for the HCT4 terminal incl. zero-gut (mm)
6.0 mm² (Cu)	19.2	23.2
6.0 mm² (Al)	18.2	22.2

- L3 ensures the correct position of the strain-relief.
- The strain-relief shall be assembled so it will block on the final position.
- The X-ring shall be assembled so it will block on the strain-relief.
- Do not damage the single wires during the complete processing operation.

5.5 Crimp the HCT4 male terminal



- **Double stroke crimping machine**

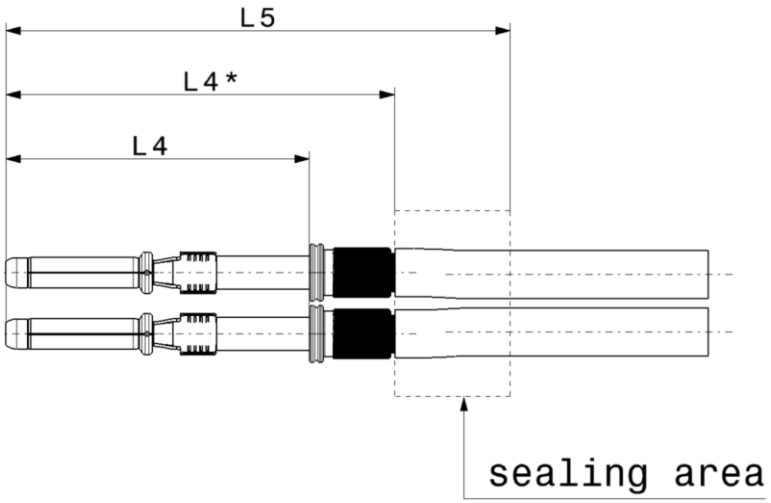
It is up to the manufacturer to decide which device/ machine is to be used. The crimping and positioning data described on the following pages must be observed during the crimping process.

The order of a crimping device is the responsibility of the assembler. The test facility used by Hirschmann Automotive is described in chapter 8.

Process data

a) The crimp data can be seen in the „Process specification HCT4 male terminal EVS-100068“.
b) HCT4 male terminals need to be crimped in relation to the single wires. For a smooth assembly into the contact holder, the terminals need to be crimped in the correct position. The dimensions on the following drawing need to be adhered to.
c) If aluminium conductors are used, special processing steps and responsibility apply; see Appendix for Alu wiring EVS-100111-A.

The dimensions on the following drawing need to be adhered to.



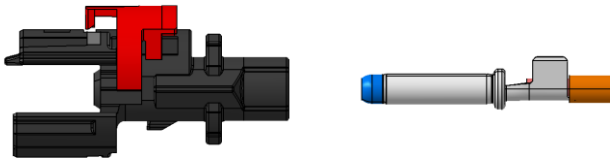
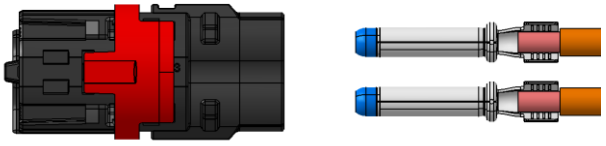
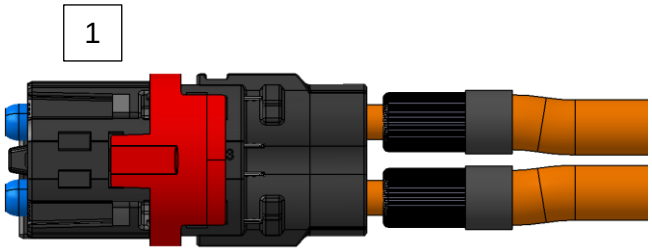
L4 = 41.4 ± 0.95
L4* = 52.70 ± 2.00
L5 = max. 71.00

The dimension L5 and L6 are for information only. The dimensions are given through the dimensions L1, L4 and the EVS-100068.

A mark on the insulation of the single wires or on the outer sheath which is caused due to fixing the wire at the crimping process is allowed. It must be ensured that the insulation will not be damaged because this will lead to an insulation resistance failure. On the area of the wire seal, it is not allowed to deform or damage the outer sheath which has negative influence on the sealing function.

If agreed to by the OEM, either L3, L4* or L4 must be proven, since they are correlating.

5.6 Assembly I

<table>
<tr><td colspan="3">Assemble male terminals into the contact holder (1).</td></tr>
<tr><td colspan="2">  </td><td>  </td></tr>
<tr><td rowspan="3"> 
</td><td>Pin</td><td>Polarity/ Colour</td></tr>
<tr><td>1</td><td>+</td></tr>
<tr><td>2</td><td>-</td></tr>
</table>

While assembling the HCT4 male terminals, the terminal will audibly engage oonce the end position is reached. The male terminals must be crimped. When two wires with the same colour are used, the pinning must be confirmed via electrical testing.

The male terminals must be crimped (Cu).

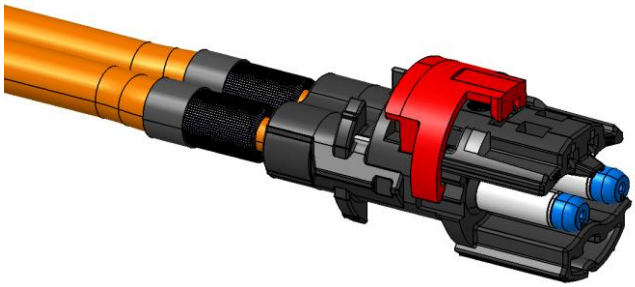
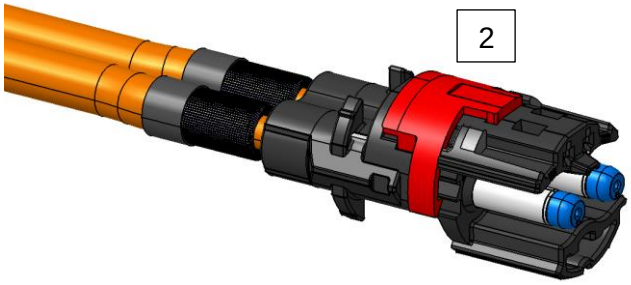
If aluminium conductors are used, special processing steps and responsibility apply; see Appendix for Alu wiring EVS-100111-A. For automatic assembly of the HCT4 contacts into the contact carrier, either force- or distance surveillance must be proven.

Wire manufacturer	Wire cross section
	6.0 mm²
Leoni	FHLR2GCB2G 6,0/ 0,31/ T180 600V AC/ 1000V DC
	36 N
Kroschu	FHLR2GCB2G 6.00 mm² 0.21/ T180/ 600/ 1000V OR
	36 N
Coroplast	FHLR2GCB2G 6.0 mm² 0,21/ T180/ 0,6/ 1,0 kV
	36 N
Coficab	FHLR91XCB91X T4 6.0 mm²
	36 N
Gebauer & Griller	FHLALR2GCB2G 1X6,0/ (0,40)/ T180 FHLR2GCB2G 6.0/ T180
	36N

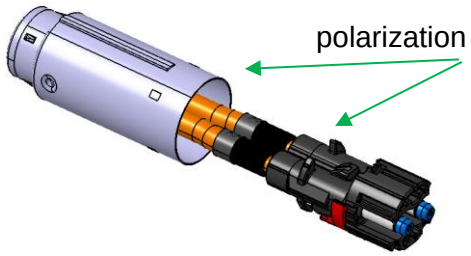
5.7 Assembly II

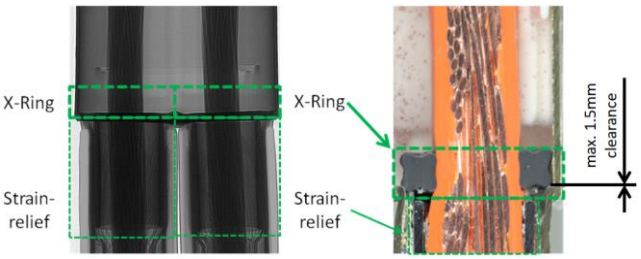
Assemble secondary locking (2)

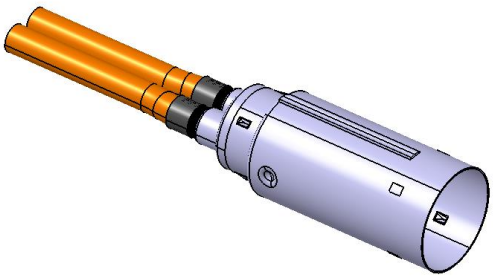
The secondary locking can only be assembled if the terminals are in the end position. A visible difference of the terminals to each other can be possible in the contact cavity. Because of the position of the contacts on the wire, and the play of the contacts in the contact cavity it is possible and acceptable.

Secondary lock pre-locking	Secondary lock end position
	

5.8 Push shielding sleeve onto contact carrier



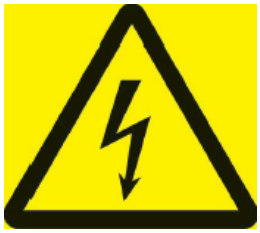




x-ray picture

Micro section

- The wires shall be fixed during this process to prevent the cable and/or the strain-relief from being compressed or pushed inside the connector, for this can cause damage on the insulation and therefore a dielectric breakdown.
- The implemented assembly process can be verified via x-ray analysis. Especially the compression of wires, positioning of the strain-relief and positioning of the x-ring can be confirmed. Also, other impacts from this and previously applied assembly steps can be checked.
- The x-ring shall be adjacent to the shield-sleeve.
- Deviations of this figure must be double-checked with Hirschmann Automotive.
- The shielding sleeve must be assembled until the blocking position is reached.
- It must be ensured that no single strands of the shield stick out before the shield sleeve is mounted. Demand-oriented, protruding single strands can be removed.
- This rework must be clarified with each OEM.

- 

Risk of insulation failure!

5.9 Pressing shield sleeve

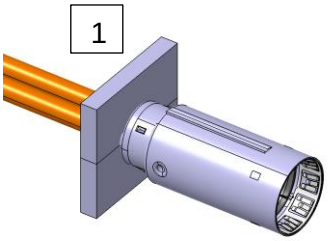
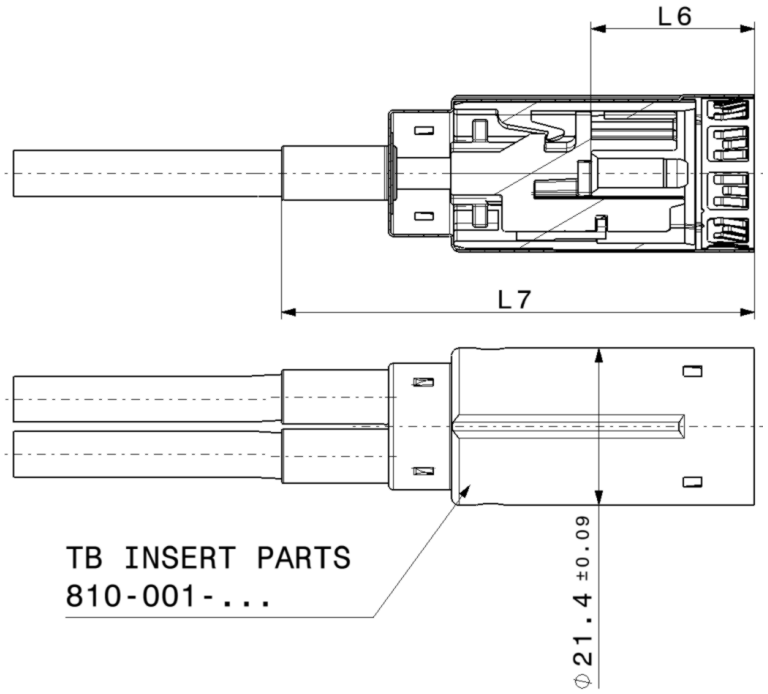
- **Pressing device**

The manufacturer is free to choose which device/machine is used. The pressing and positioning data described on the following pages must be observed during the pressing process.

The order of a pressing device is the responsibility of the assembler. The test facility used by Hirschmann Automotive is described in chapter 9.

- **Pressing data**

f) The contact holder incl. the male contacts must be put into the device in the correct position.
g) Make sure, the shielding sleeve is on the end position of the contact holder. The tape must stick out at the end of the shielding sleeve.
h) The circularity of the shielding sleeve in the contact area must be ensured.
i) The measurements on the following drawing, must be adhered to, before and after pressing.
j) One pressing actions will be done in one step

	Shield pressing (shielding sleeve, shielding, stress relief and wire)
	L6 = 22.25 $^{+0,25}_{-0,35}$ L7 = 64.50 ± 0.2

The dimension L7 is just for information.

Do not damage the following parts during the pressing process:

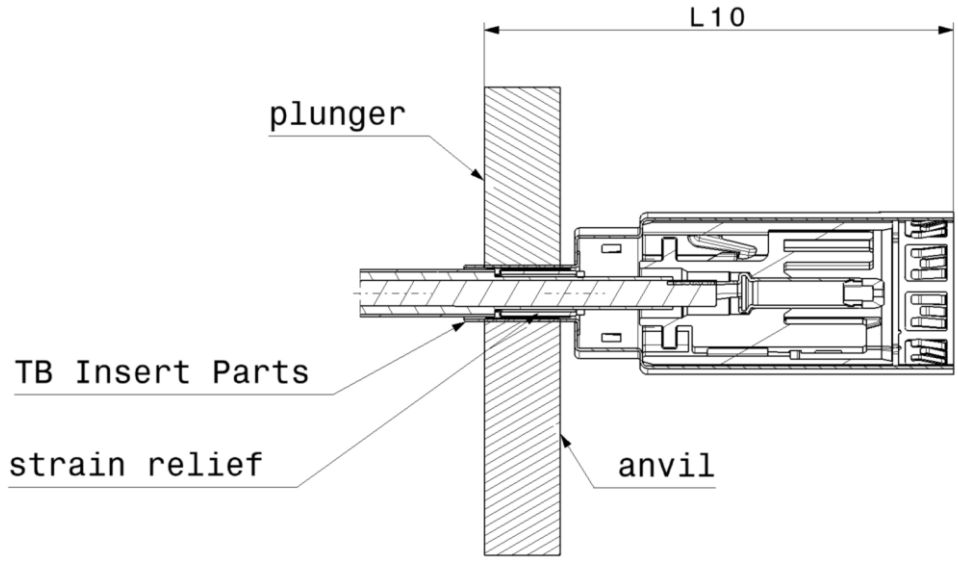
- Insulation of the wire
- Insulation of the single wires
- Stress relief
- Shield sleeve
- Shield strands of the wire

5.9.1 Shield pressing by two half-shells

- **Embossing position:**

The exact geometry of the plunger and anvil is given. The position of the plunger and the anvil must be revered to the front plane of the contact holder.

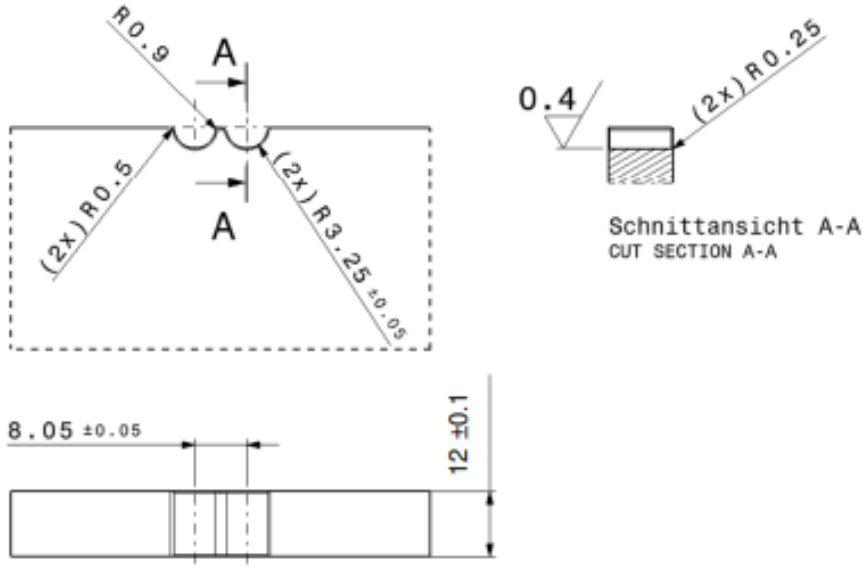
The dimension L10 is for the position of the plunger and the anvil.



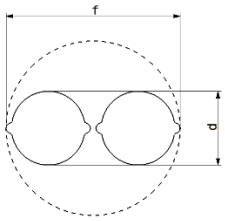
L10 = 63.50 ± 0.1

The chamber on both anvil and plunger must face towards the shield-sleeve.

- **Plunger and anvil geometry of the wire shield pressing**

Plunger geometry of the wire shield pressing
Material: 1.2721 vaccum hardened 58hrc


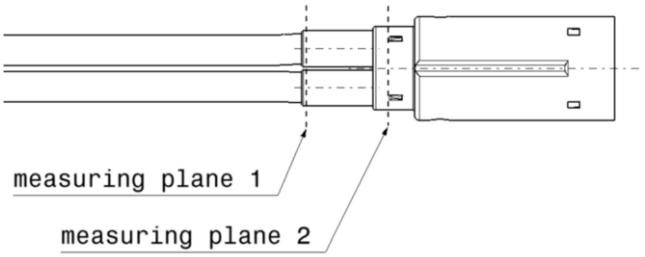
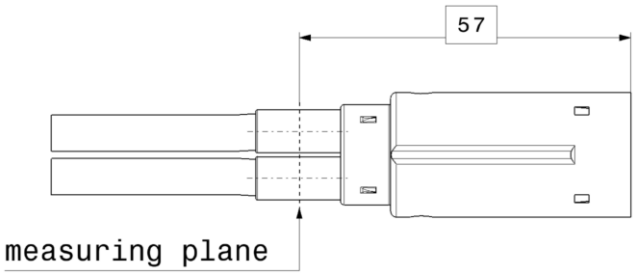
- **Embossing height „d“**

	The plunger and anvil are pressed together until block. Due to this, the dimension “d” will be given. See table of each cross section.

Wire manufacturer	Dimension “d” in mm
	6.0 mm²
Kroschu	6.80 ± 0.2
Leoni	6.80 ± 0.2
Coroplast	6.80 ± 0.2
Coficab	6.80 ± 0.2
Huber & Suhner	6.80 ± 0.2
Gebauer & Griller	6.80 ± 0.2

During the pressing process a fold appears on two sides.
This fold must not be bigger than the diameter **Ø f = 17.2 mm** refer to the centerline of the connector.
In the area of the fold the material of the shield sleeve must not be cracked.

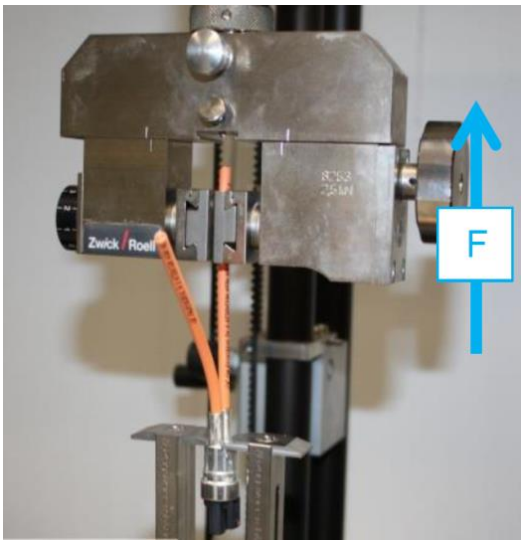
- **Check measurement of the embossing height “d” and the max. diameter “f”**

<table>
<tr>
<td> 
</td>
<td>To check the dimension “f”, a gauge with an inner diameter of 16.9 mm must be used.
The diameter “f” must be respected within the entire highlighted area.</td>
</tr>
<tr>
<td> 
</td>
<td>To check the dimension “d”, the height needs to be measured acc. to the drawing.
All the dimensions have to be within the given tolerance.</td>
</tr>
<tr>
<td colspan="2">The measuring of the embossing height must be done with a suitable measuring device.
(Micrometer, measuring range: 0-25mm)</td>
</tr>
<tr>
<td> 
</td>
<td>  </td>
</tr>
</table>

- **Pulling force of the wire**

To measure the pull-out force, the wire must be clamped firmly into a clamping device. The distance between the clamping position of the wire and the fixing tape is about 70 mm. The connector must be fixed on the shield sleeve at the transition between the largest and the second largest diameter.

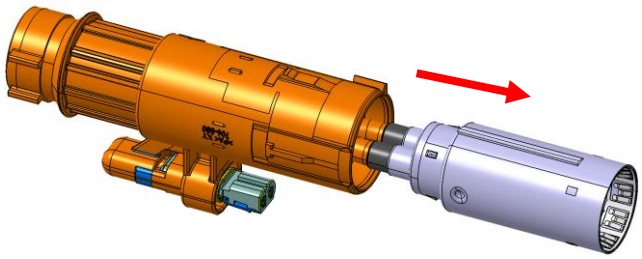
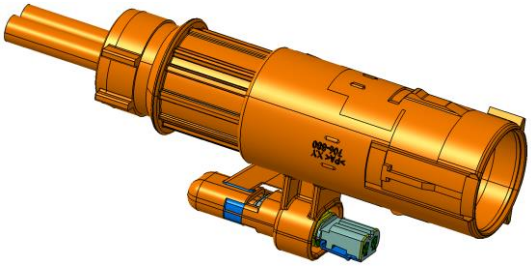
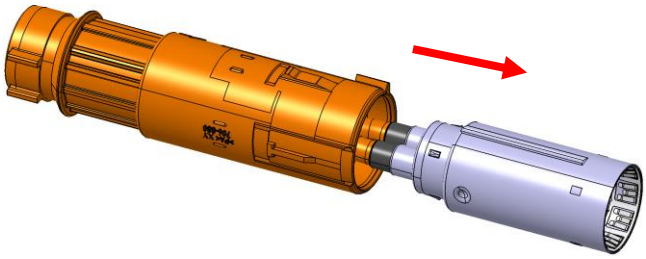
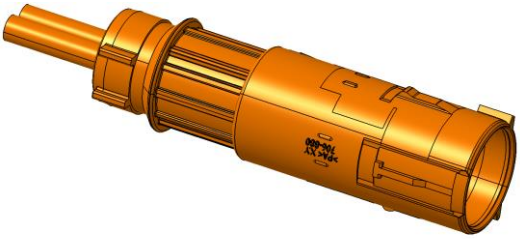
HCT4 terminals must not be installed in the test specimens, to test the shield pressing only. In this state, the figure in the table must be reached. The single wires must be tested individually.



Wire cross section	Pulling force L2
6.0 mm²	≥ 150 N

6 Completion steps (4.0 mm²/ 6.0 mm²)

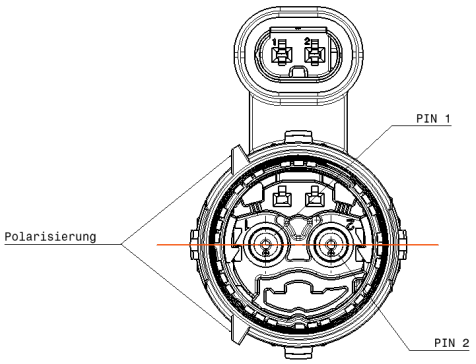
6.1 Positioning of the male locking device

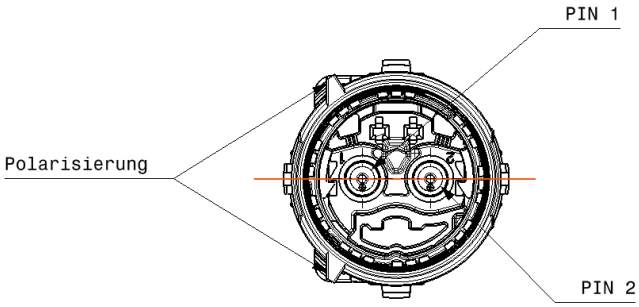
The male housing must be assembled power assisted, and in the correct position.	
	
	

The manufacturer is free to choose which device/machine is used. The positioning and assembly data described on the following pages must be observed.

It is the responsibility of the assembler to commission a fixture. The test facility used by Hirschmann Automotive is described in chapter 8.

The contact holder incl. the shield sleeve needs to be assembled into the male housing unit into the correct position. Both polarizations need to be symmetrical to the axis in between of the centre of Pin 1 and Pin 2. Also, the polarization must be on the side of Pin 1.

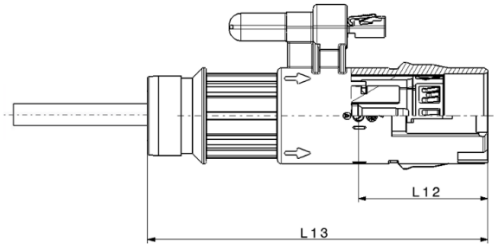




The (TB) male housing unit must be assembled onto the shield sleeve force-assisted, until the dimension L12 is reached. The dimension L13 is only for checking purposes.

L12 = 34.3 ± 0.15 F1

L13 = 89.6 (Info)



During the assembling process, there are no damages allowed on the shield sleeve, the contact carrier, or the wire. There is no pull on the wire necessary. Especially do not pull out the cable sheath out of the stress relief.

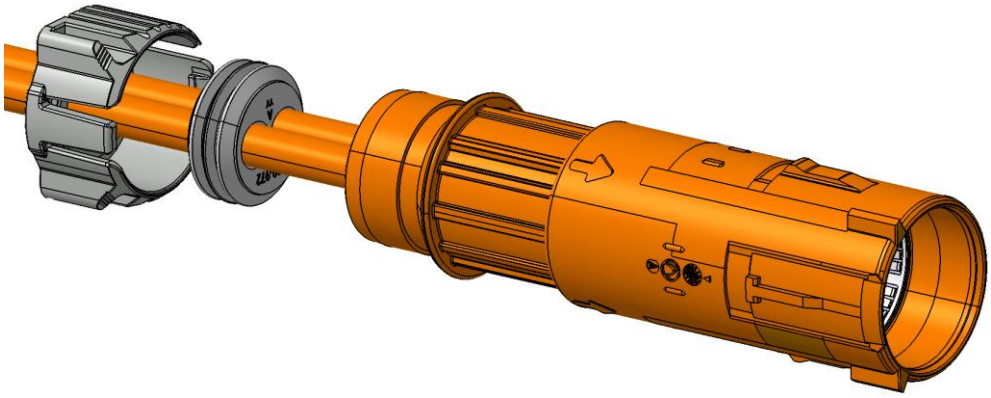
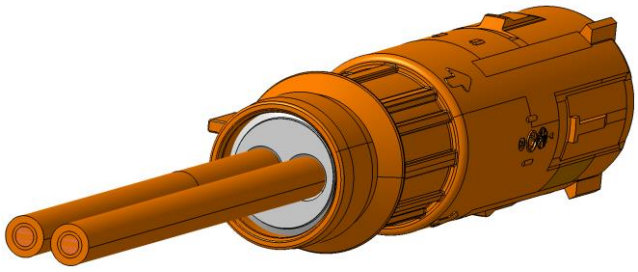
For a defined measurement of the L12 dimension, the plastic housing and the contact holder parts should be placed / measured on the reference surfaces.

Plastic housing reference surface
(see picture turquoise marked)

Contact holder reference surface
(see picture green marked)

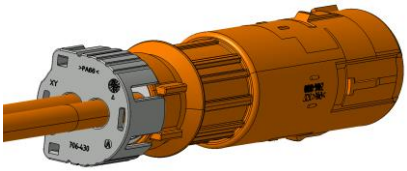
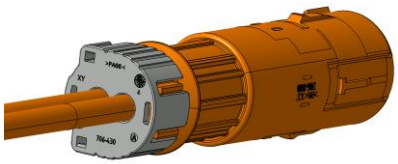
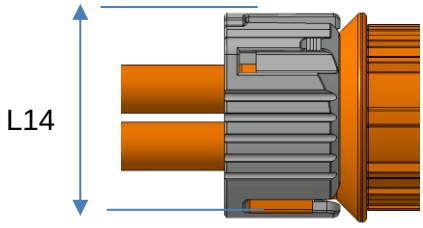
Since there is literally no geometry it is recommended to measure circumferentially on the plastic housing.

6.2 Assembly IV

Push seal (2) into the female locking device (3)		
1	2	3
		
		The cable seal can be slightly widened during assembly. It is possible to move the seal with the cover cap on the wire, but care must be taken that the seal does not twist and is not pinched or damaged. If the cover cap locks properly, the correct position of the seal is given, no additional pushing is required.

The seal is lubricated, no additional lubricants are permitted.

It is necessary to coordinate with the respective OEM whether a final inspection ensures the correct and damage-free installation of the seal.

Snap the cover cap (1) into the recess of the locking device (3) and consider the pinning, as it cannot be changed afterwards.		
		
	cover cap on end position	end position (locked)

Do not damage the cover cap (1) or the seal (2) during assembly. If the cover cap is in end position, the locking hooks must be straight on both sides and are not allowed to be deflected.
They must be within L14 = max 25.0 mm.

6.3 Stacking of produced harnesses

For an orderly and controlled stacking of the harnesses to quantitatively free defined bundles.

7 Technical information

7.1 General requirements

Damages on single components are not allowed during the whole production process.

7.2 Technical cleanliness

In general, pay attention to the cleanliness on the connector and inside of the connector. Metallic particles generated during the assembly process, must be removed with a suitable device. Inside the connector and on the connector, there are no metallic particles > 1,000 µm allowed.

For metallic particles on each connector: CCC = N (J4/K0) acc. to VDA Volume 19
For all other particles on each connector CCC = N (J10/K0) acc. to VDA Volume 19

BMW-specific requirements according to QV11111 for assembled connector can be seen in the following table. The surface information can be found in the customer drawings.

Technical cleanliness acc. to QV11111			
HV system (assembled final product without cable)			
Requirement class (t.b.d. --> BMW – manufacturer)			
Reference size A (1,000 cm²)			
Number of allowable particle by length size class			
		metallic NOT shiny	metallic shiny
G	150 - 200 µm	-	-
H	200- 400 µm	1,200	1,200
I	400 – 600 µm	130	130
J	600 – 1,000 µm	60	15
K	1,000 – 1,500 µm	4	-

7.3 Degree of automation

There is a concept developed by the company Komax in which the process steps as shown in this process specification can be produced fully automatic in various stage of expansion. This concept was developed together with the company Hirschmann Automotive. Each manufacturer is responsible of the commissioning of the pressing device. This can be requested directly at the company Komax.

KOMAX AG
Industriestraße 6
CH-6036 Dierikon
Phone: +41 41 455 04 55
www.komaxwire.com

concept of automation HPS40-2

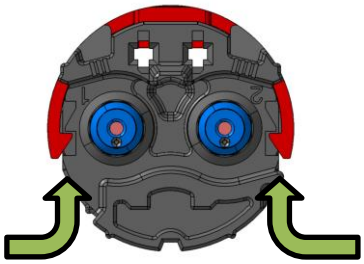
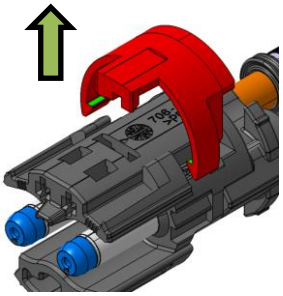
8 Appendixes

8.1 Sample preparation for shield retention force

For testing the shield retention force, the samples must be prepared accordingly. If a production without terminals is not possible, further possibilities of manipulation are described as follows.

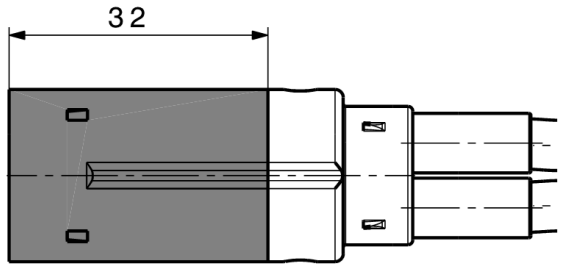
8.1.1 Manipulation of primary locking

This variant is applicable if production without terminals is not possible.

Manipulation of terminal carrier	
	
Bend the locking latches of the secondary lock outwards to remove the secondary lock	

8.1.2 Removal of terminals after shield crimping

This variant is applicable, if production without terminals is not possible and the manipulation cannot be implemented either.

	Remove the grey portion of the connector (e.g. cutting / machining)

The manipulated connectors are for testing only and must not be used in vehicles!

8.2 Machine/ Device

The test plants and fixtures described in this chapter were used at Hirschmann Automotive to assemble various test and validation parts. The selection, design and commissioning of the plants and fixtures is the responsibility of the assembler.

8.2.1 Single stroke crimping machine

Designation: Crimp-Device Crimp-Ferrule HPS40-2 SCC
Part number: EPS2001-HPS40-2-SCC

Contact: **Schaefer Werkzeug- und Sondermaschinenbau GmbH**
Dr.-Alfred-Weckesser-Str. 6
76669 Bad Schoenborn-La, Deutschland
Phone: +49 7253 9421-0
www.schaefer.biz

8.2.2 Double stroke crimping machine

Designation: HPS40-2 Double stroke crimping machine
Part number: EPS2001-HPS40-2
Designation: Interchangeable crimping unit
Part number: Shown in the process specification HCT4 male terminal EVS-100068

Contact: **Schaefer Werkzeug- und Sondermaschinenbau GmbH**
Dr.-Alfred-Weckesser-Str. 6
76669 Bad Schoenborn-La, Deutschland
Phone: +49 7253 9421-0
www.schaefer.biz

8.2.3 Pressing device shield sleeve

Name: Pressing device HPS40-2 In-Line SCC
Part number: t.b.d.

Contact: **MAXXOM Automation GmbH**
Gewerbegebiet, Salzweg 1
A-4894 Oberhofen am Irrsee
Phone: +43 6213 20053 0
www.maxxom-automation.at

Contact: **Schaefer Werkzeug- und Sondermaschinenbau GmbH**
Dr.-Alfred-Weckesser-Str. 6
76669 Bad Schoenborn-La, Deutschland
Phone: +49 7253 9421-0
www.schaefer.biz

8.2.4 Assembly device pin housing

Designation:	Press-in device horizontal for positioning assembly pin housing HPS40-2 In-Line
Part number:	197079
Contact:	**WKM - Maschinenbau GmbH** **Oberes Ried 15** **A-6833 Klaus** **Phone: +43 5523 / 54907**

9 Change of documentation

Version	Change	Change date	Editor
1	First edition (Draft)	11/ 2019	Bas Ü.
2	Activated 6mm² cables; put L10 and L11 in brackets (3.0 mm², 4.0 mm², 5.0 mm²); updated 6.0 mm² version	12/ 2019	Bas Ü.
3	Updated 6.0 mm² Version	03/ 2020	Bas Ü.
4	Added comments for the assembly of the seal; added adapted L9 for 4.0 mm²	04/ 2020	Bas Ü.
5	Added Aluminium-wire; adapted L7 (4.0 mm²) and L5 (6.0 mm²); defined measurement for ØX (4.0 mm²); permitted residual foil; added comment for L3; added L4* (6.0 mm²); added comments for the assembly of the seal	04/ 2020	Bas Ü.
6	Adapted processing length for all Cross sections, Defined L12 measuring planes	07/ 2020	Bas Ü.
7	L3 (6.0 mm²) was made theoretical, additional comments on the positioning of the strain-relief and x-ring were added; Removed 3.0 mm² and 5.0 mm²; Coficab was reactivated	12/ 2020	Bas Ü.
8	Adapted L1,L2, L3 for 6.0 mm² Cu and Ag	02/ 2021	Bas Ü.
9	Added BMW F-characteristics; changed nominal Dimension for L12;	03/ 2021	Bas Ü.
10	increased for 6.0 mm² the tolerance and added measuring plane for shield-crimping (d), Added Appendix for sample preparation	04/ 2021	Bas Ü.
11	Adjusted single core contact carrier, added link to alu appendix, added G&G Cu wire 6.0 mm² and 4.0 mm²;	11/ 2021	Breuss L.
12	Deleted 1x 4.0 mm² Kroschu cable Changed cleanliness requirement and added BMW specific requirement based on surface reference. BMW special characteristics changed acc. to OEM requirement;	10/ 2022	Breuss L.
13	Update design specification	06/ 2023	Jussel E-M.
14	Adjusting data of the bottom line	07/ 2023	Jussel E-M.
15	Update data page 6, 49	08/ 2023	Jussel E-M.
16	Update topic 4.10 – update comment	09/ 2023	Jussel E-M.
17	Update topic 8 – with manufacturer and devices	09/ 2023	Jussel E-M.
18	Update topic 1.2: adjusted with additional “Miscellaneous”	10/ 2023	Jussel E-M.
19	Page 30, 48: update the picture Page 31, 49: “Embossing height “d” – table updated	10/ 2023	Jussel E-M.
20	Page 4) Change of L from length to legal	04/ 2024	Jussel E-M.
21	Topic 1.2 Kroschu-PN updated 64998762	04/ 2024	Jussel E-M.