

PROCESS SPECIFICATION **HPS Y/H Distributor MCC**

EVS-100130



HIRSCHMANN
AUTOMOTIVE

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1 General

1.1 Introduction

This process specification is valid for all variants and describes the product structure as well as the assembly of the HPS Distributor-systems.

System number	Type	Wire cross section	Remark
809-852-502	H	2.5 mm ² 4.0 mm ²	2 Inputs / 2 Outputs
809-852-501	Y	6.0 mm ²	1 Input / 2 Outputs

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

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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 10/ 2023 must be considered for new applications, but not for existing applications.

1.2.1 Customer: Miscellaneous

Customer: Miscellaneous					
L	S	F	Characteristic	Specific Purpose	Place of implementation
-	S1**	-	Retention force of welding (longitudinal)	Quality of welding	Tier 1
L1	-	-	d Height of shield-crimping	Strain-relief, electrical shield connection – EMC	
L2**	-	-	Retention force of shield-crimping	Strain-relief, electrical shield connection - EMC	

**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 OEM directly.

1.2.2 Customer: BMW

Customer: BMW BMW-Number.: 5 A2A 493				NAEL:	E 1X05 0- VS11 E 2437 0 – VS12 N OU53 B –VS18
Special characteristics according to GS 91011:2019-8					
L	S	F	Characteristic	Specific Purpose	Place of implementation
-	S1**	-	Retention force of welding (longitudinal)	Quality of welding	Tier 1
L1	-	-	d Height of shield-crimping	Strain-relief, electrical shield connection – EMC	
L2**	-	-	Retention force of shield-crimping	Strain-relief, electrical shield connection - EMC	

**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

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1.3 Other current documents

A	Datasheet 2x 2.5 mm ² shielded cable (T180) Kroschu	Kroschu Nr. 64996918
B	Datasheet 2x 4.0 mm ² shielded cable (T180) Kroschu	Kroschu Nr. 64997293
C	Datasheet 2x 6.0 mm ² shielded cable (T180) Kroschu	Kroschu Nr. 64995979 Kroschu Nr. 64997213
D	Datasheet 2x 2.5 mm ² shielded cable Coroplast	Coroplast Nr.: 9-2641 (2x 2.5 mm ²)
E	Datasheet 2x 4.0 mm ² shielded cable Coroplast	Coroplast Nr.: 9-2641 (2x 4.0 mm ²)
F	Datasheet 2x 6.0 mm ² shielded cable Coroplast	Coroplast Nr.: 9-2641 (2x 6.0 mm ²)
G	Datasheet 2x 2.5 mm ² shielded cable Leoni	Leoni Nr.: FHLR2G2GCB2G 00001
H	Datasheet 2x 4.0 mm ² shielded cable Leoni	Leoni Nr.: FHLR2G2GCB2G 00002
I	Datasheet 2x 6.0 mm ² shielded cable Leoni	Leoni Nr.: FHLR2G2GCB2G 00003
J	Datasheet 2x 6.0 mm ² shielded cable NBKBE	NBKBE Nr.: FHLR2G2GCB2G 2x 6.0 mm ²
K	Data sheet 2x 4.0 mm ² shielded cable from Coficab (not validated yet)	Coficab Nr.: H3XXCBX240Hxx

This document is no subject to change service!

2 Product structure (single components)

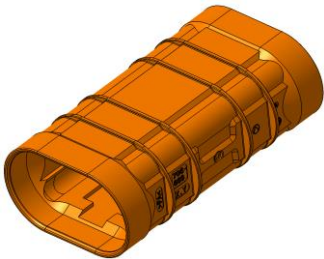
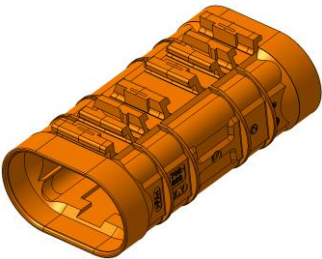
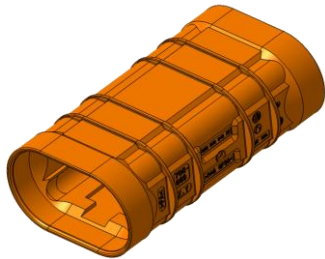
2.1 Sheated cable (see table)

Wire manufacturer	Wire cross section		
	2.5 mm ²	4.0 mm ²	6.0 mm ²
NBKBE	FHLR2G2GCB2G 600/1000V T180 Supplier production site: China		
	-	-	2x 6.0 mm ²
Kroschu	FHLR2G2GCB2G 600/1000V T180 Supplier production site: China/ Deutschland, 46414 Rhede		
	64996918	64997293	64995979 64997213
Leoni	FHLR2G2GCB2G 600/900V T180 Supplier production site: China/ Italien, 29010 Monticelli		
	00001	00002	00003
Coficab	FHLR91X91XCB91X T3 (not validated yet) Supplier production site: t.b.d.		
	-	H3XXCBX240Hxx	-
Coroplast	FHLR2G2GCB2G 600/1000V T180 Supplier production site: China/ Deutschland, 42279 Wuppertal		
	9-2641 (2 x 2.5 mm ²)	9-2641 (2 x 4.0 mm ²)	9-2641 (2 x 6.0 mm ²)

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

This document is no subject to change service!

2.2 HPS Distributor shield housing

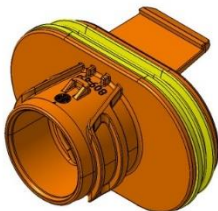
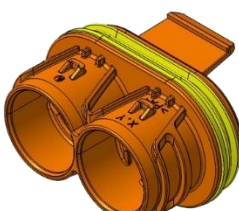
		
-501	-502	-503

Hirschmann Automotive No.	Wire cross section	Product description
706-669-501	2.5 mm ² 4.0 mm ² 6.0 mm ²	HPS Distributor shield housing neutral
706-669-502		HPS Distributor Shield housing locator element
706-669-503		HPS Distributor Shield housing AUDI (optional)

Delivery condition: The HPS Distributor shield housings are delivered as bulk good.

This document is no subject to change service!

2.3 HPS Distributor cable housing

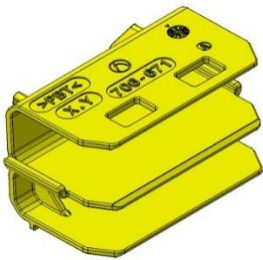

	
-501	-502

Hirschmann Automotive No.	Wire cross Section	Product description
809-853-501	2.5 mm ² 4.0 mm ²	HPS Distributor cable housing ONE
809-853-502	6.0 mm ²	HPS Distributor cable housing TWO

Delivery condition: The HPS Distributor cable housings are delivered as bulk good.

This document is no subject to change service!

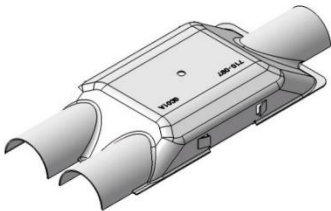
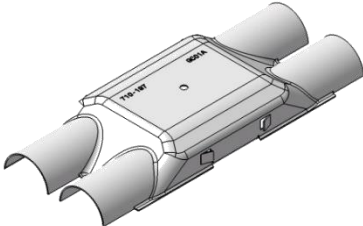
2.4 HPS Distributor insulator

	
-501	-502
Hirschmann Automotive No.	Wire cross section
706-671-501	2.5 mm ² 4.0 mm ² 6.0 mm ²
706-671-502	

Delivery condition: The HPS Distributor insulators are delivered as bulk good.

This document is no subject to change service!

2.5 HPS Distributor shield

	
710-097-501	710-197-501
Hirschmann Automotive No.	Wire cross section
710-097-501	2.5 mm ² 4.0 mm ² 6.0 mm ²
710-197-501	

Delivery condition: The HPS Distributor shields are delivered as bulk good.

This document is no subject to change service!

2.6 HPS Distributor shield sleeve



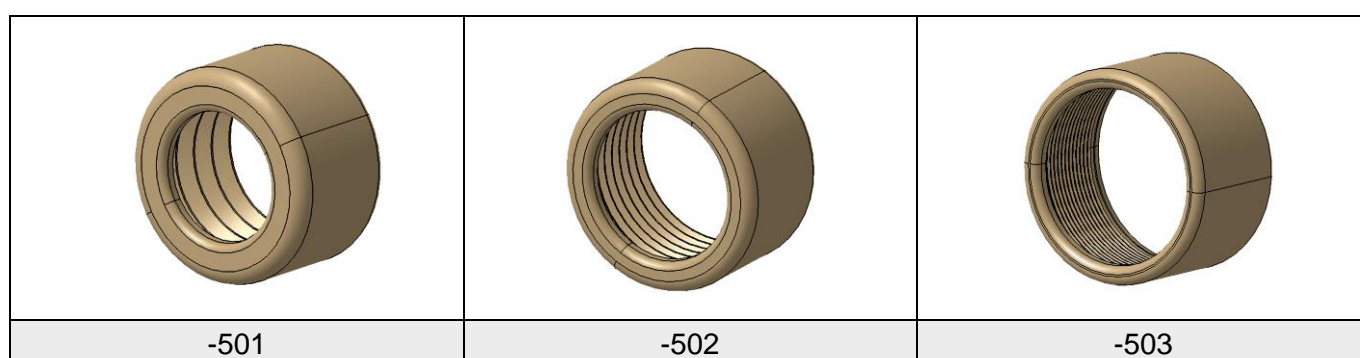
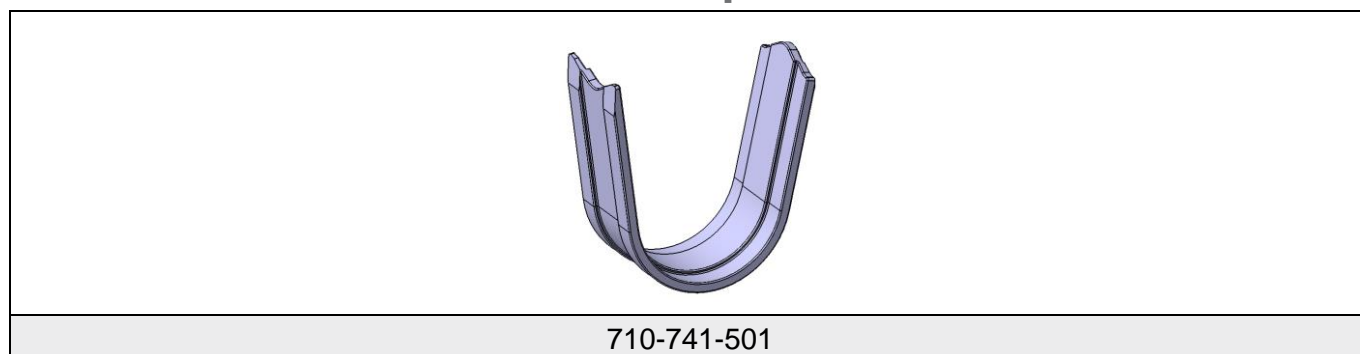
-501

Hirschmann Automotive No.	Wire cross section
710-099-501	2.5 mm ² 4.0 mm ² 6.0 mm ²

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

This document is no subject to change service!

2.7 HPS Distributor ferrule crimp/ strain relief






Hirschmann Automotive No.	Wire cross Section	Description
709-841-501	2.5 mm ²	Strain relief
709-841-502	4.0 mm ²	
709-841-503	6.0 mm ²	
710-741-501	6.0 mm ²	Ferrule crimp (optional)

Information: On the product drawing Hirschmann Automotive no. 809-852-...00 you can find the released cables for each strain-relief.

Delivery condition: The HPS Distributor strain-reliefs and the ferrule crimp are delivered as bulk good.

This document is no subject to change service!

2.8 HPS Distributor wire seal

		
-504	-505	-506

Hirschmann Automotive No.	Colour	Wire cross section
709-113-504	Faun	2.5 mm ²
709-113-505	Grey	4.0 mm ²
709-113-506	Red	6.0 mm ²

Information: On the product drawing Hirschmann Automotive no. 809-852-...00 you can find the released cables for each seal.

Delivery condition: The HPS Distributor seals are delivered as bulk good.

This document is no subject to change service!

2.9 HPS Distributor cap

		
-501	-502	-503

Hirschmann Automotive No.	Colour	Wire cross section
706-668-501	Faun	2.5 mm ²
706-668-502	Grey	4.0 mm ²
706-668-503	Red	6.0 mm ²

Information: On the product drawing Hirschmann Automotive no. 809-852-...00 you can find the released cables for cables for each cap.

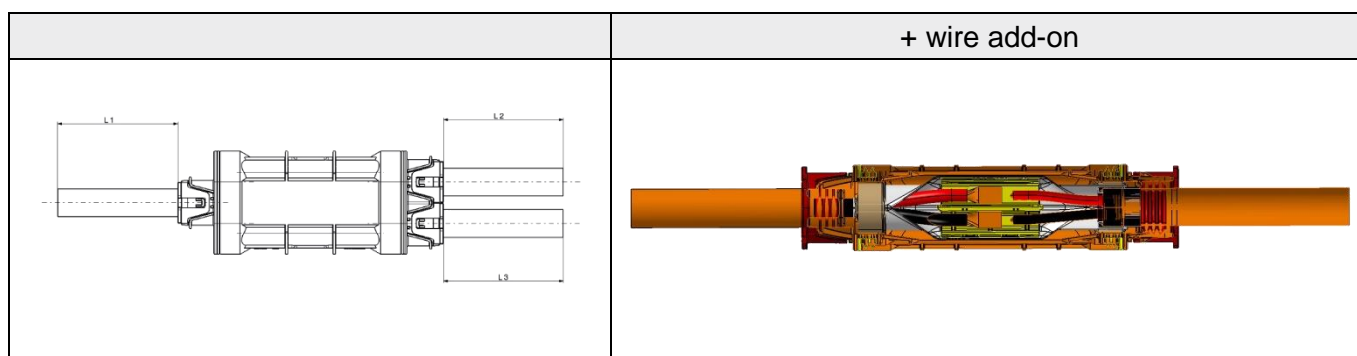
Delivery condition: The HPS Distributor caps are delivered as bulk good.

This document is no subject to change service!

3 Processing steps

The following process steps are valid for 2.5 mm²/ 4.0 mm² and 6.0 mm² wires. As reference sample, the version Y-Distributor with 6.0 mm² wire was chosen.

3.1 Cut the shielded cable



Wire add-on for the HPS Distributor:

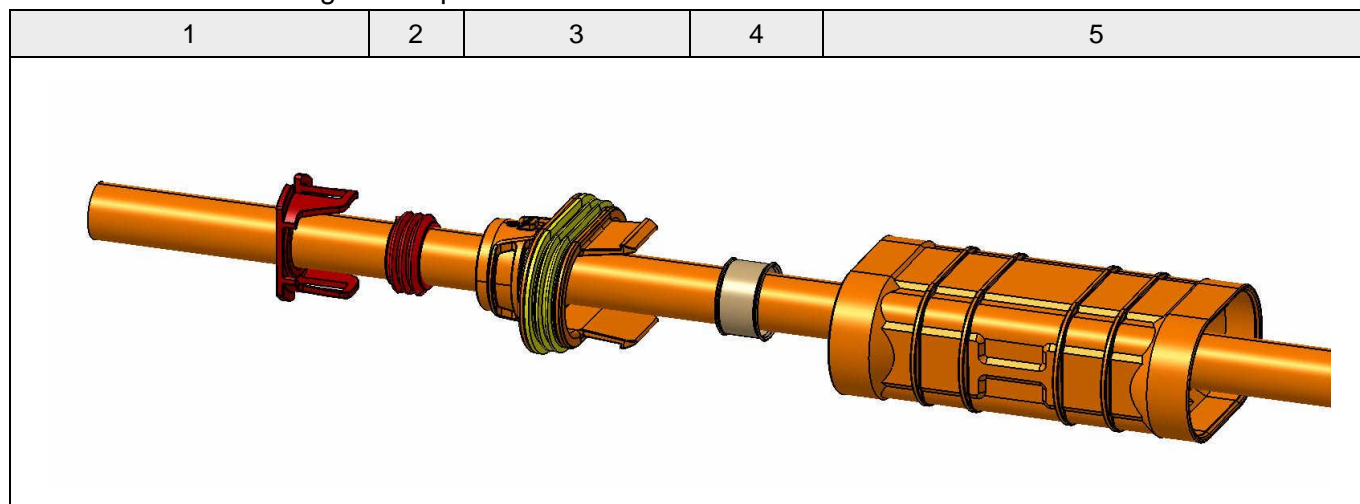
Wire cross section	Dimension L1/ L2/ L3 (mm)
2.5 mm ²	L1/ L2/ L3 + 70
4.0 mm ²	
6.0 mm ²	

This length must be added to the planned length (L) of the system and is valid for the Y- and H-distributor-system.

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3.2 Assembly of the single components

Preassemble Cap (1), wire-seal (2), cable housing (3), shield housing (4) and shield-sleeve (5) onto the cable. The cable housing can be preassembled from either side of the distributor.



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3.3 Strip off the shielded cable



Stripping length:



Wire cross section	Dimension L4 (mm)
2.5 mm ²	42.0 ± 1
4.0 mm ²	
6.0 mm ²	

Do not damage the shielding during the processing operation.

Alternative Dimensions: In exceptional cases, deviations from the dimensions given can be made. Such deviations require clarification with Hirschmann Automotive and the approval of the respective OEM. A deviation of the cut-to-size length L4 is permissible provided that the functionally relevant dimensions F and X are adhered to. The length dimension L7 and any cutting length allowance must be taken into account in accordance with the deviation in length L4.

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3.4 Wire processing I

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

3.4.1 Version 1

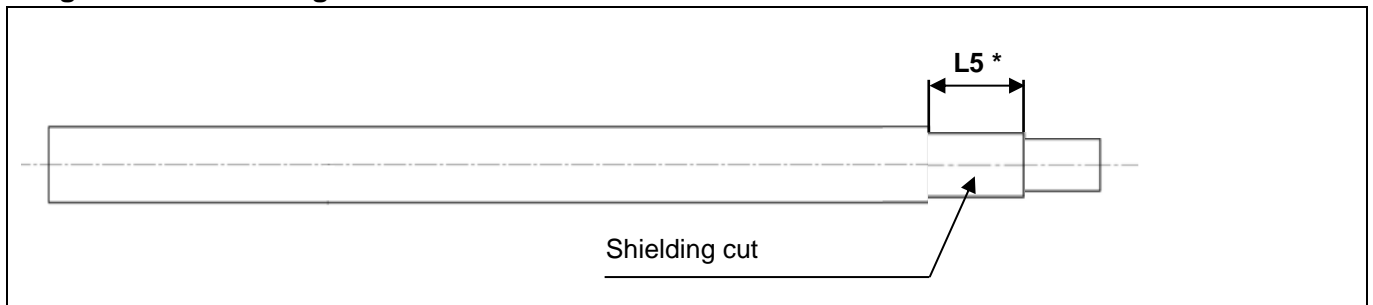


The following process steps must be done, but the manufacturer may choose the sequence:

- Assemble the strain relief
- Remove the foil
- Shorten the shielding

An overlap of the foil around the strain-relief like small edges is allowed.

Length of the shielding:



Depending on the production method of each manufacturer, the dimension L5 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 actions like the following:


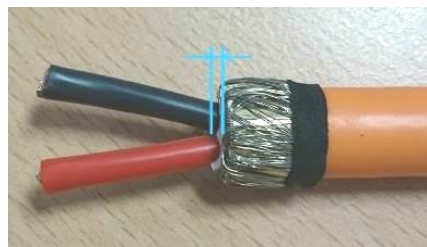
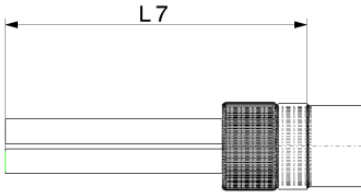
- Avoiding by removing the residues of the shielding-
- Avoiding by blowing out or suction of the residues of the shielding.

In the next process step, ensure that the shielding is rising over the strain-relief 100%.

This document is no subject to change service!

3.5 Wire processing II

Remove the filling, put shield back and tape the shielding.

		
	Max. L6 = 3 mm	

100% of the shielding must be turned over the strain-relief. A targeted unbraiding of the shield is not necessary. By turning over the shield, a process related unbraiding is possible. The fixing tape needs to stay on until the assembly is finished and can be left inside the system. The max. width of the tape is **5.0 mm**. The fixing tape must be positioned immediately after the strain-relief and must not reach the strain-relief. No shielding is allowed outside the fixing tape. The max. position of the tape is shown with dimension L7: max. 58.5 mm.

In this process specification the PET fabric tape 837X (838X) 5.0 mm of the company Coroplast is used. It is possible to use another product to fix the shield. The max. outer diameter after assembly is Ø14.3 mm and the shield sleeve must be able to be mounted easily. The product must resist at least 150° C.

The filling material can protrude max. 3.0 mm towards the outer sheath. In the area between the single cores, the filling material may protrude more than L6. Single shielding strands which are not fixed with tape and stick out must be removed before the following process steps. During the whole processing, no damages may occur on the single wires.

A deviation in the length of the partial strip and the dimensions of the welding-splice is permitted under the condition that the functionally relevant dimensions F and X are observed.

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3.5.1 Version 2 - optional

Ferrule crimp assemble (2x 6.0mm²)

- **Ferrule crimping machine**

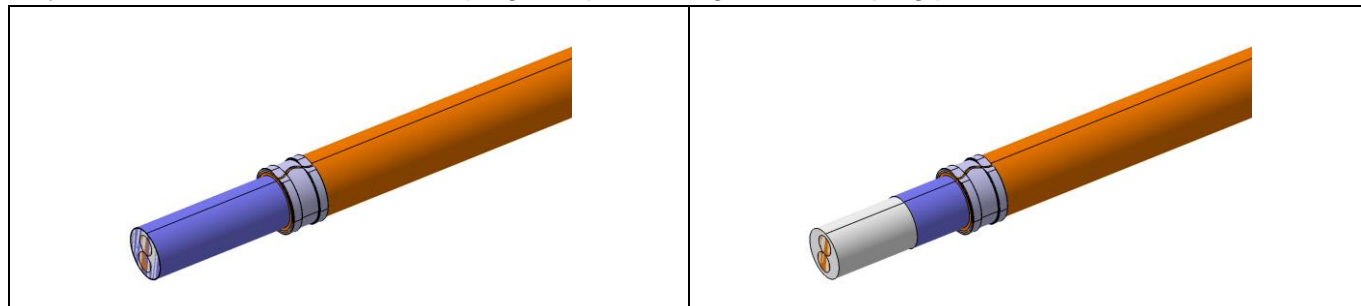
For the positioning and the crimping process of the HCT4 female terminals, the crimping machine of the company "Schaefer" can be used:

<u>Name of the device:</u>	HPS40-2 MCC Ferrule crimp
<u>Article number:</u>	EPS3000-HPS40-2-ZE

The device was designed and implemented by the processing guidelines of Hirschmann. The individual details referring to commissioning, handling and process description of the device can be requested directly at the supplier:

Schaefer Werkzeug- und Sondermaschinenbau GmbH
Dr.-Alfred-Weckesser-Str. 6
76669 Bad Schoenborn-La, Deutschland
Tel: +49 7253 9421-0
Fax: +49 7253 9421-94
www.schaefer.biz

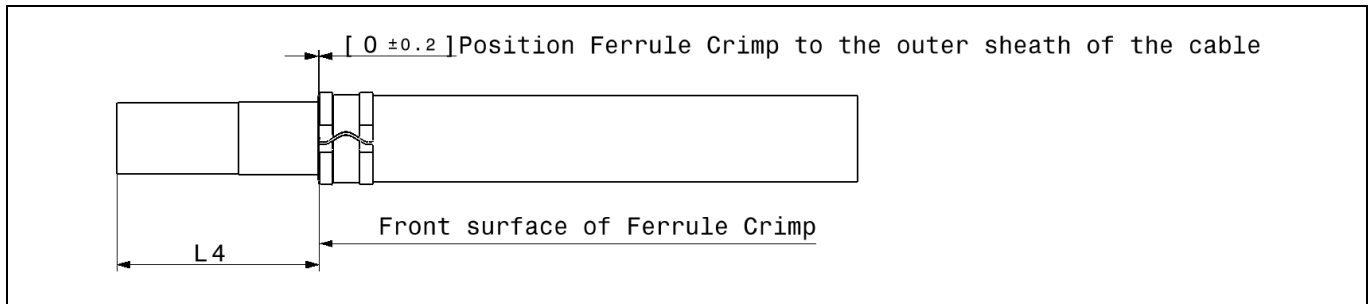
The commissioning of the crimping device must be done through the manufacturer. In this edition you can only find the information of the crimping and positioning of the crimping process.



The following process steps must be done, but the processor can choose the sequence.

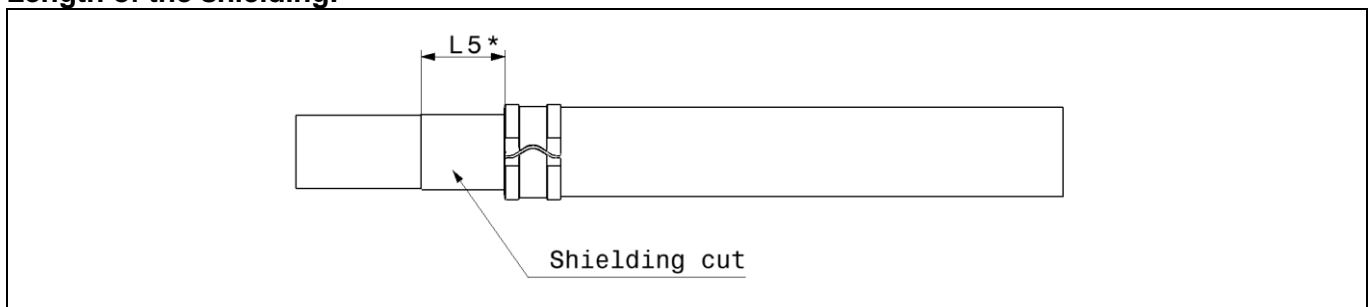
- Assemble the ferrule crimp and crimp onto cable
Note: In this working step, no zero cut is performed, for this reason the required tolerances must already be met at stripping of the cables.
- Remove the foil
- Shorten the shielding

This document is no subject to change service!



The ferrule crimp must be positioned in relation to the outer jack of the wire. The dimension of $[0 \pm 0.2]$ must be maintained. When the ferrule crimp is crimped on the wire, the insulation can be pushed forward, and the dimension can no longer be maintained. Therefore, dimension L4 should be used as a check. An overlap of the foil in the area of the ferrule crimp like small edges is allowed.

Length of the shielding:

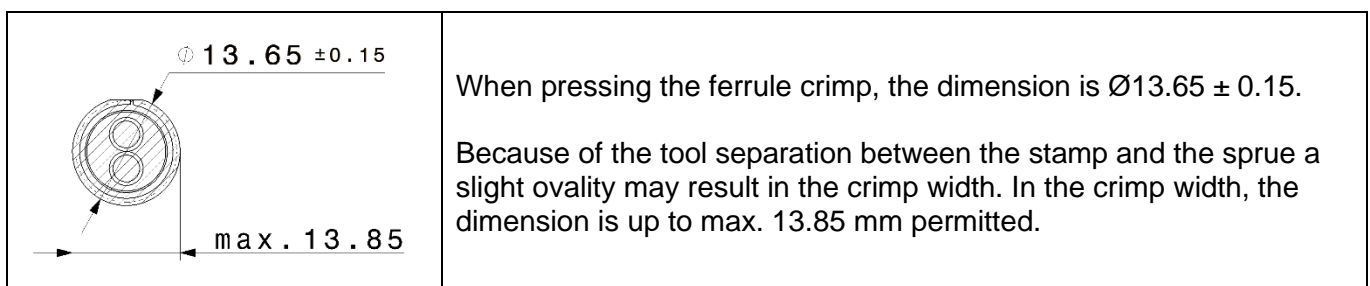


Depending on the production method of each manufacturer, the dimension L5 can vary. After cutting the shield, there are no wire residues or parts of the shielding allowed on the cable. This must be ensured with actions like the following:

- Avoiding by removing the residues of the shielding
- Avoiding by blowing out or suction of the residues of the shielding

In the next process step, ensure that the shielding is rising over the ferrule crimp 100%.


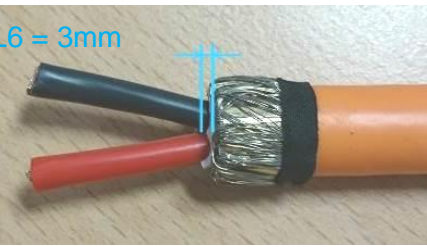
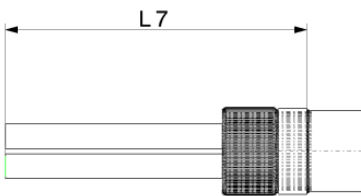
• Ferrule crimp pressing dimension



This document is no subject to change service!

3.6 Wire processing II

Remove the filling, put shielding back, tape the shielding

		
	Max. L6 = 3 mm	

100% of the shielding must be turned over the ferrule crimp. A targeted unbraiding of the shield is not necessary. By turning over the shield, a process related unbraiding is possible. The fixing tape needs to stay on until the assembly is finished and can be left inside the system. The max. width of the tape is **5.0 mm**. The fixing tape must be positioned immediately after the ferrule crimp and must not reach the ferrule crimp. No shielding is allowed outside the fixing tape. The max. position of the tape is shown with dimension L7: max. 58.5 mm

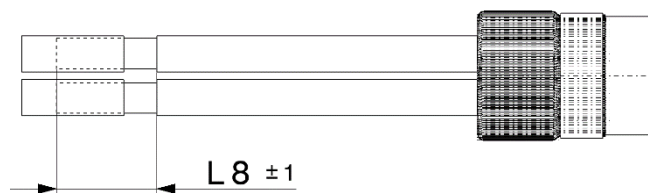
In this process specification the PET fabric tape 837X (838X) 5,0 mm of the company Coroplast is used. It is possible to use another product to fix the shield. The max. outer diameter after assembly is Ø 14.3 mm and the shield sleeve must be able to be mounted easily. The product must resist at least 150° C.

The filling material can protrude max. 3.0 mm towards the outer sheath. In the area between the single cores, the filling material may protrude more than L6. Single shielding strands which are not fixed with tape and stick out must be removed before the following process steps. During the whole processing, no damages may occur on the single wires.

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3.7 Wire processing III

Both single wires must be partially stripped.

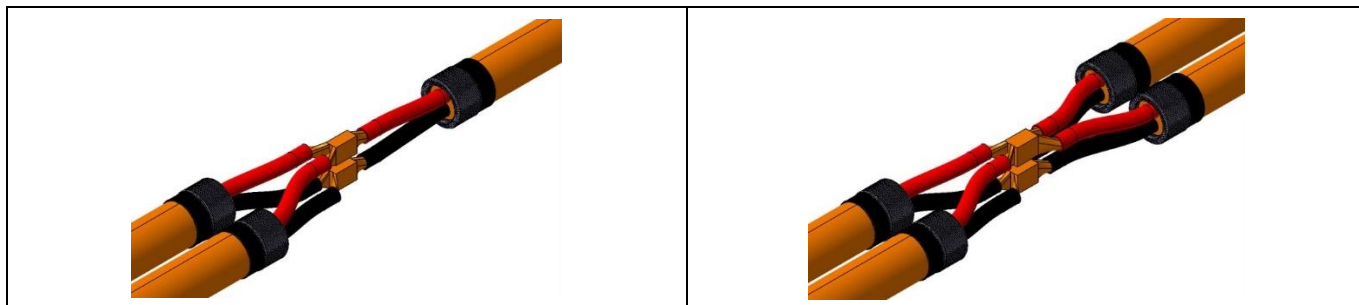


When stripping the wires, the conductor may not be damaged.

Wire cross section	Dimension L8 (mm)
2.5 mm ²	12
4.0 mm ²	12
6.0 mm ²	12

This document is no subject to change service!

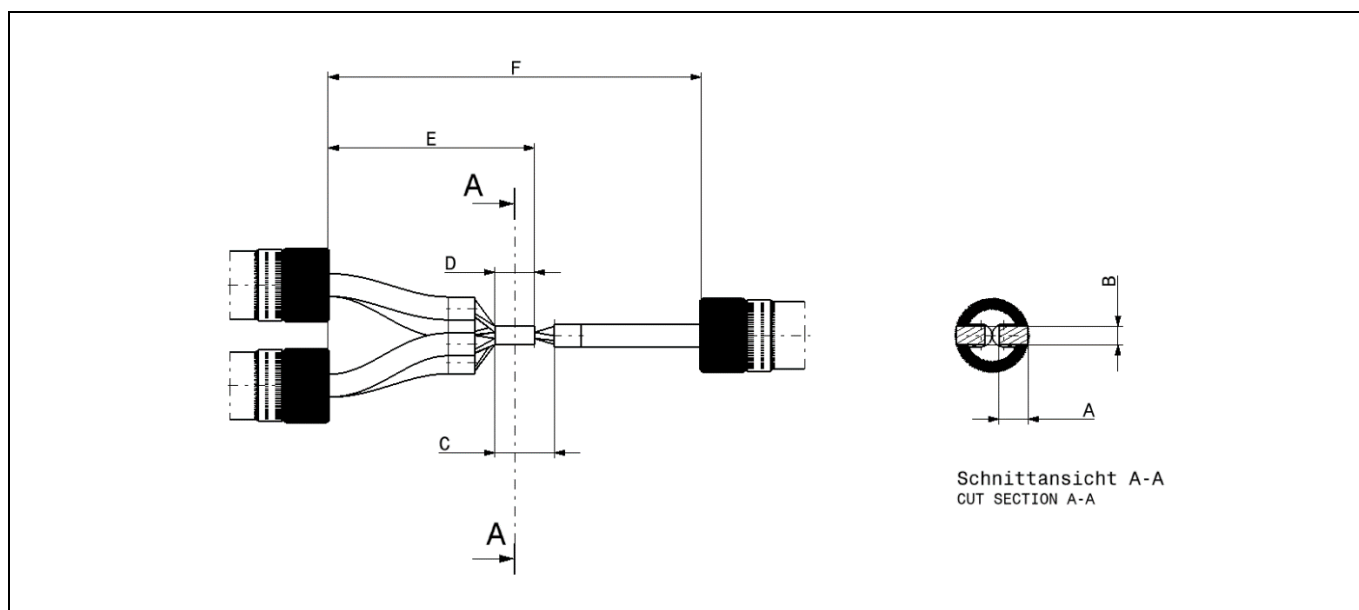
3.8 Welding-splice



- **Welding machine**

The harness maker is free to choose which device/ machine is used. The welding and positioning data described on the following pages must be respected during the welding process. The test machine used by Hirschmann Automotive can be found in the appendix.

- **Process data**



Wire cross section	(A) Y-Distributor	(A) H-Distributor	(B) Y-Distributor	(B) H-Distributor	C	D	E	F
6.0 mm ²	6.1 ± 0.2	6.1 ± 0.2	[3.2]	[3.9]	12,0	9,0	42,0	70,0
4.0 mm ²	5.0 ± 0.2	5.0 ± 0.2	[2.5]	[3.3]	± 1	± 1	± 1	± 2.5
2.5 mm ²	not validated							

All measurements are in mm

The dimension B derives from the degree of compacting and the machine-settings, the dimensions C and E derive from previous processing steps and are just for information. The dimension F may vary between

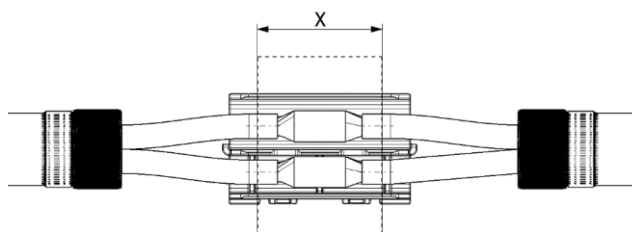
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the wire-ends due to tolerances from previous processing steps has to be kept between all wire-ends and is essential to ensure the crimping position in the following process.

- **Deviation from the recommended welding geometry depending on voltage**

In accordance with the respective OEM, deviations from the recommended welding geometry are possible if a voltage of <1,000 V is applied to the system. The dimension "X" defines the area in which blank HV wires are permitted, depending on the used voltage.

Using this dimension, tolerances from previous processing steps, as well as the positioning of the welding knot in the insulator must be respected additionally. Inside the area "X", special attention must be paid to not damaging the wire insulation, and to completely avoid metallic flitters >1,000µm.

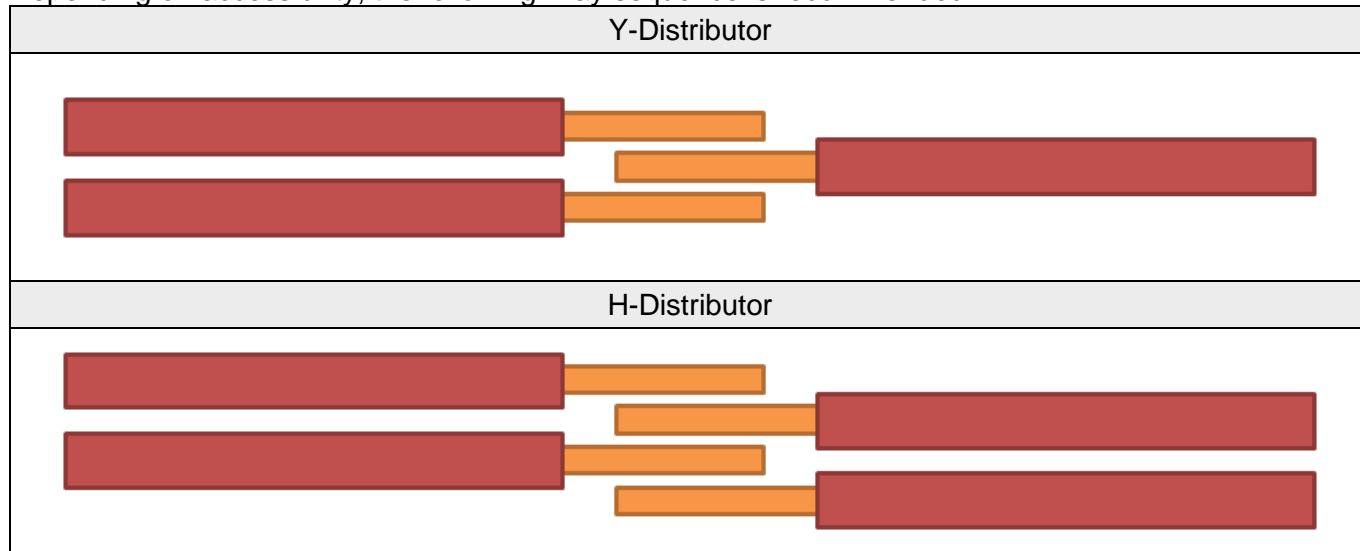


System voltage (V)	Rated surge voltage (VDC)	Dimension X (mm)
500	3,000	26.0
750	4,000	24.0
1,000	4,000	22.0
		Risk of insulation failure!

This document is no subject to change service!

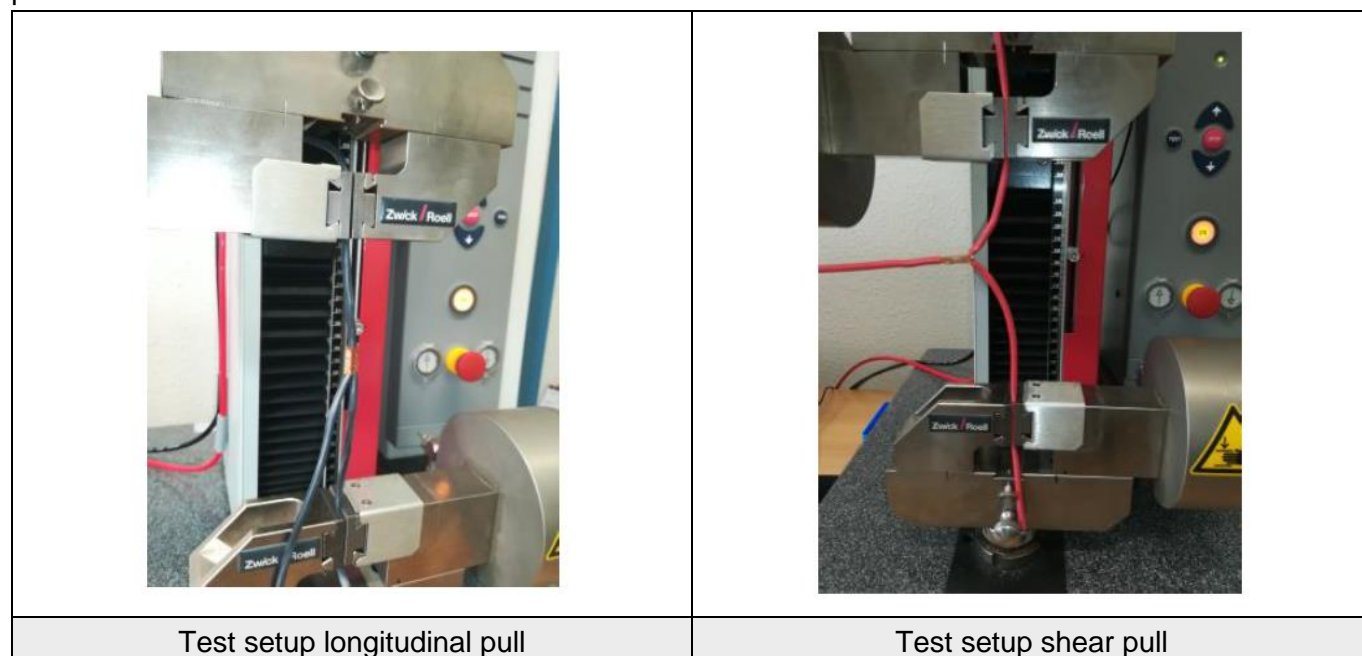
- **Welding sequence**

Depending on accessibility, the following inlay sequence is recommended.



- **Pulling force of welding**

To measure the pull-off force of the welding, the wire must be fixated into a tensile-testing device, see picture:



A clamping device can be used, which can rotate 360 °. For the shear pull, the wire which was at the anvil side while welding, has to be pulled off the welding knot (wire with the least ultrasonic permeation). The values in this table serve as reference, customer requirements may differ and have to be aligned directly with the respective OEM.

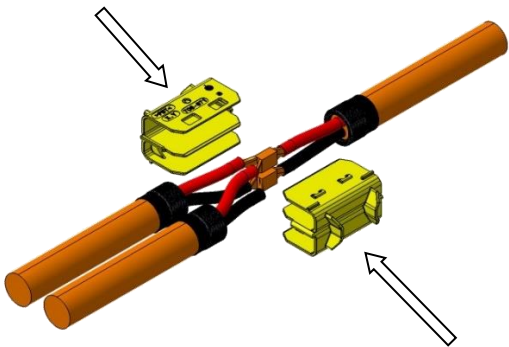
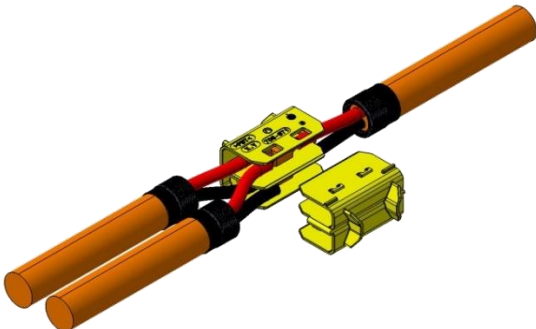
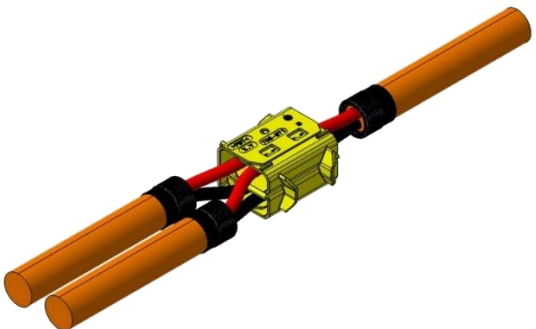
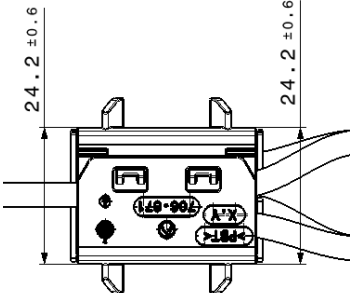
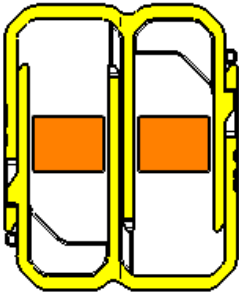
Wire cross section	Longitudinal pull-off force S1	Shear pull-off force
2.5 mm ²	not validated	not validated
4.0 mm ²	≥ 350 N	≥ 100 N
6.0 mm ²	≥ 500 N	≥ 130 N

- **General requirements**

No strands may stick out from the welding knot.

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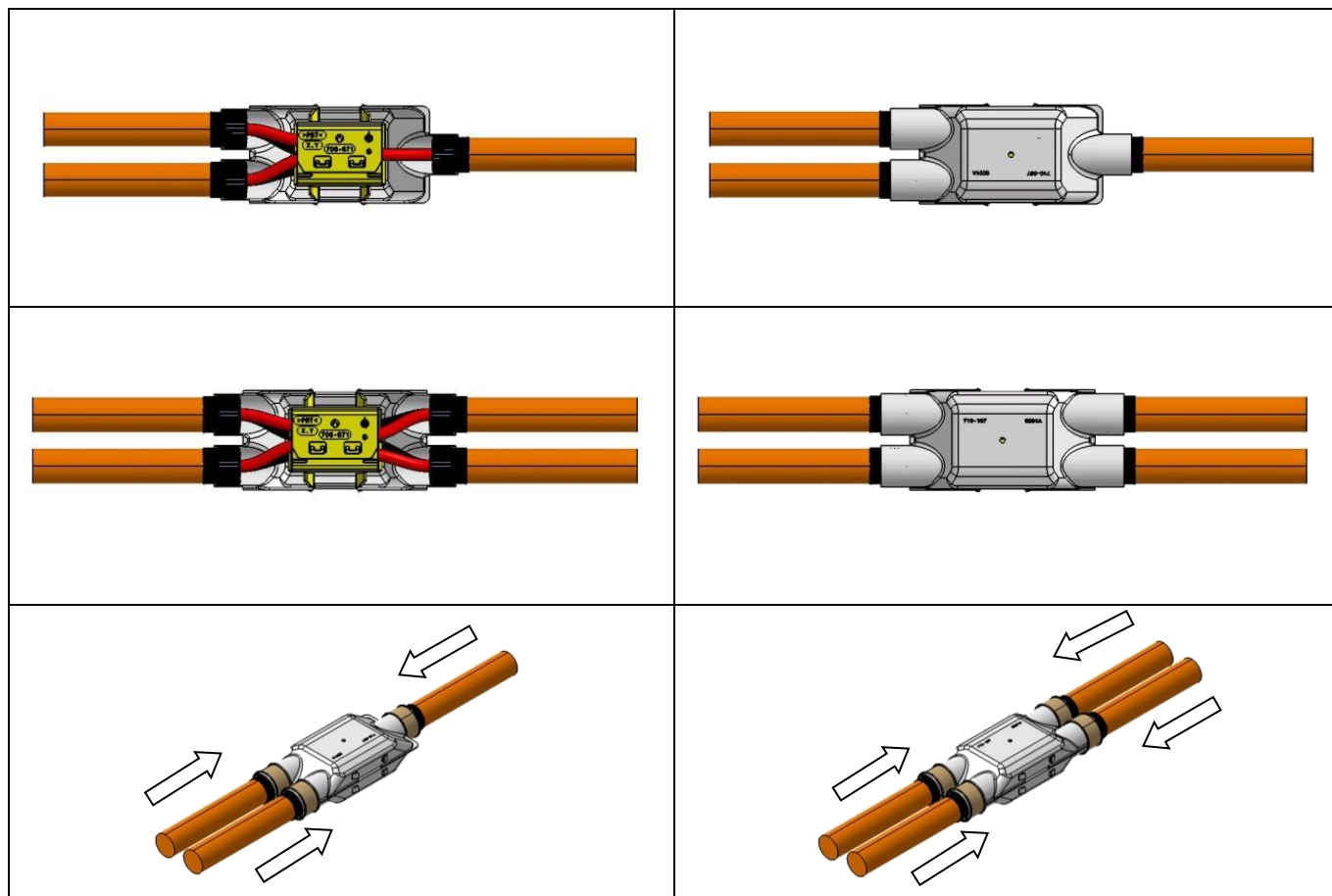
3.9 Assembly Isolator

Assemble isolator over the welding-splice.	
	
	
The isolator consists of two identical parts. (see section-cut)	
	

Depending on the query-system during shield-embossing, 1x 706-671-501 and 1x 706-671-502 can be assembled optionally. During assembly, the locking latches of the isolator are deflected and lock audible. To ensure a both sided locking of the isolator, the dimension 24.2 ± 0.6 must be met on both sides. This dimension is valid for both Y- and H-distributors. The axial position of the isolator is not set in this step. During the assembly of the isolator, the insulation of the wires may not be damaged.

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3.10 Position shield and shield-sleeves



The shield consists of two identical parts. The isolator is positioned within the shield. If the isolator is positioned correctly in the first shield, the second shield can be assembled.

The splice must be positioned inside the isolator and shield, so that the black tape is visible on both sides of the shield. It must be ensured that no single strands of the shield stick out before the shield is mounted. Demand-oriented, protruding single strands can be removed. This rework must be clarified with the OEM. The wire jacket and insulation must not be damaged during this process.



Risk of insulation failure!

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3.11 Press shield-sleeves

- **Pressing device**

For the process of positioning and pressing of the stress relief and the shielding sleeve, the following pressing device of the company Schaefer can be used:

Name: Pressing device HPS40-2
Article number: 188/16

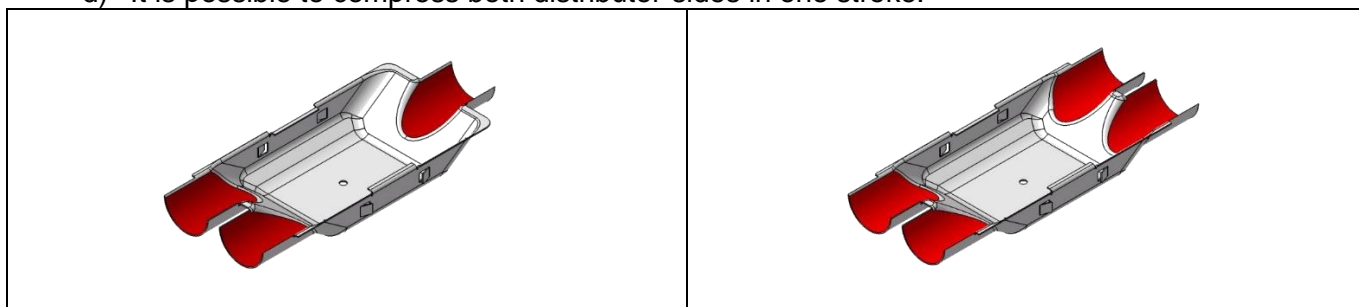
Based on the processing guidelines of Hirschmann, the device was designed and produced. The details of the commissioning, handling and the process guideline of the device can be requested directly at the supplier:

Schaefer Werkzeug- und Sondermaschinenbau GmbH
Dr.-Alfred-Weckesser-Str. 6
76669 Bad Schoenborn-La, Deutschland
Tel: +49 7253 9421-0
Fax: +49 7253 9421-94
www.schaefer.biz

The commissioning of the pressing device must be done through the manufacturer. The manufacturer is free to use a shield-crimping device of his choice. The shield-crimping process must meet the dimensional and qualitative requirements that are mentioned in the following pages.

- **Pressing data**

- The shield must be positioned correctly
- Make sure the shield-sleeves are on end position on the shield. The tape must be visible behind the shield-sleeves.
- The circularity of the shield in the contact area (red) must be ensured.
- It is possible to compress both distributor-sides in one stroke.



Do not damage the following parts during the pressing process.

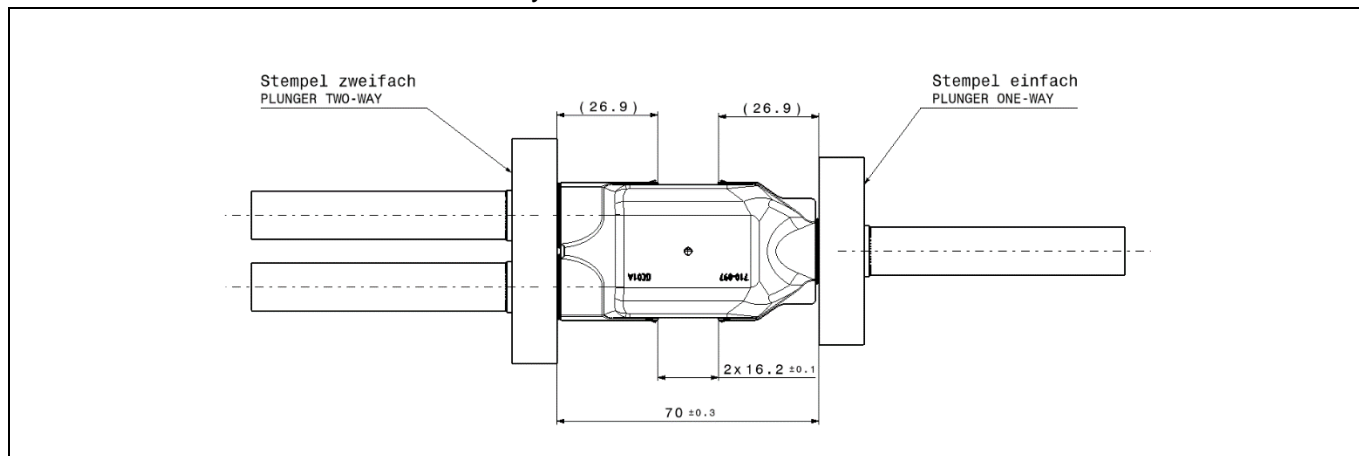
- Insulation of the wire
- Insulation of the single wires
- Stress relief
- Shield
- Shield strands of the wire

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3.12 Shield pressing by two half-shells

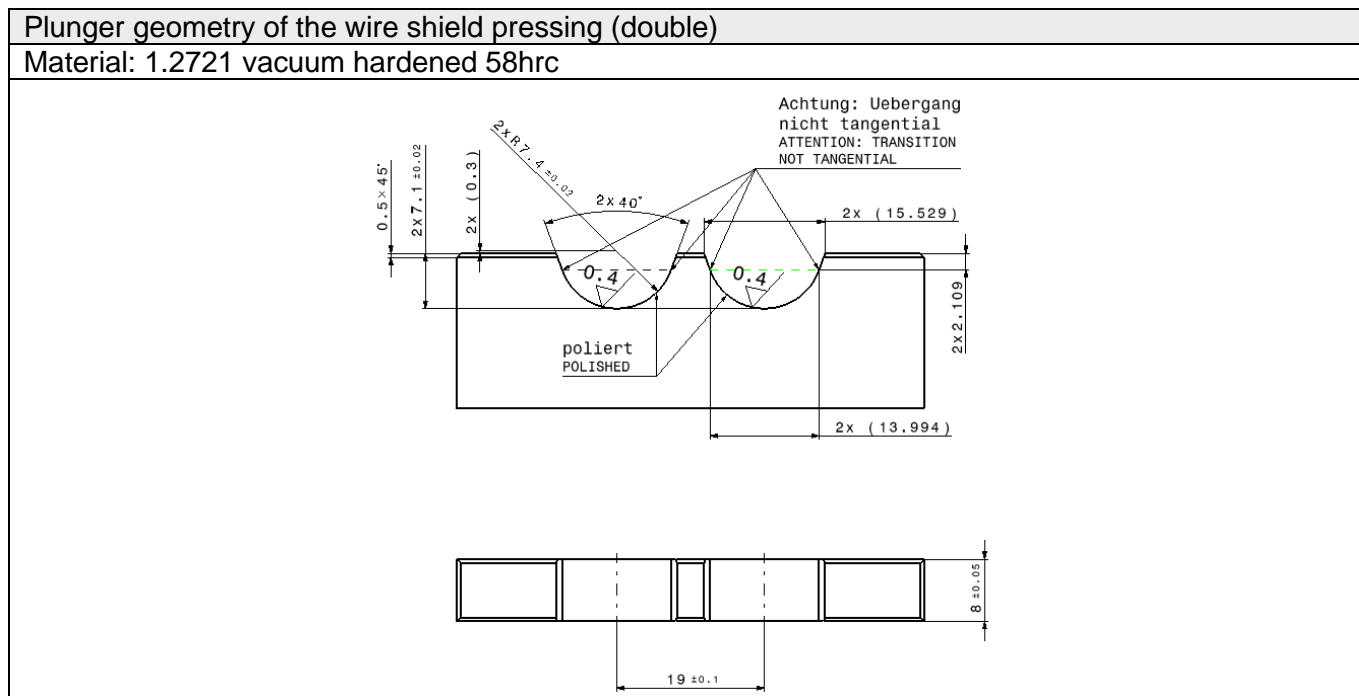
- **Embossing position**

The exact geometry of plunger and anvil is described. Plunger and anvil must be positioned according to the shield. The dimension 16.2 ± 0.1 may be taken as reference:



An orientation of the wire-ends by twisting the wires is not permitted. If necessary, wires can be untangled if they have tangled up during welding or assembly.

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

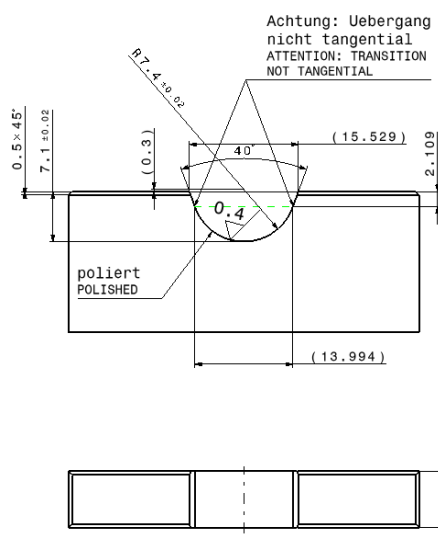


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Plunger geometry of the wire shield pressing (single)

Material: 1.2721 vacuum hardened 58hrc



Plunger and anvil are geometrically identical.

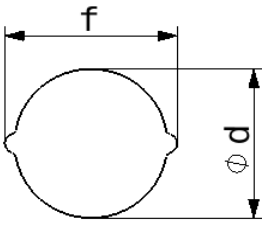
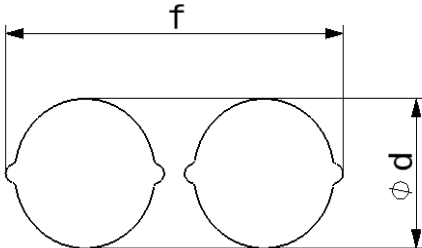
This document is no subject to change service!

- **Embossing height “d”**

The plunger and anvil must be adjusted to ensure that dimension “d” will be kept. See table of each cross section.

Wire manufacturer	Dimension “d” in mm		
	2.5 mm²	4.0 mm²	6.0 mm²
NBKBE	-	-	Ø15.7 ± 0.3
Kroschu T180 FHLR2GCB2G	Ø15.7 ± 0.3	Ø15.7 ± 0.3	
Leoni			
Coroplast			
Coficab FHLR91X91XCB91X T3 (not validated yet)	-		-

During the pressing process a fold appears on two sides. This fold is not allowed to be bigger than the diameter Ø f refer to the center of the wire.

Single-end f = max. 18.8 mm	Double-end f = max. 37.8 mm
	


In the area of the fold the material of the shield sleeve is not allowed to be cracked.

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

To check the dimension “f”, a gauge 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.

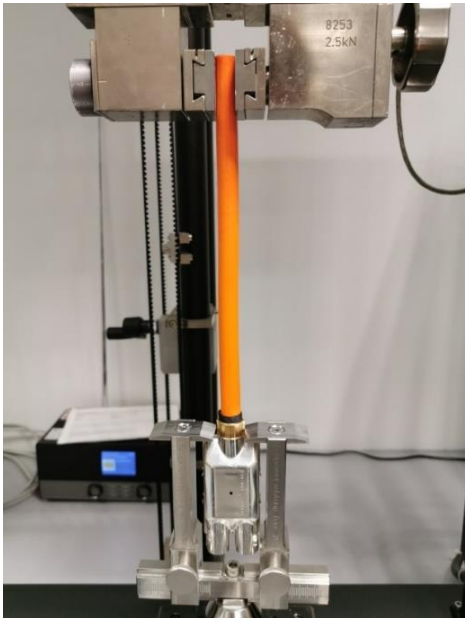
(Micrometer, measuring range: 0-25mm)

Reverence picture from the process specifications HPS40-2


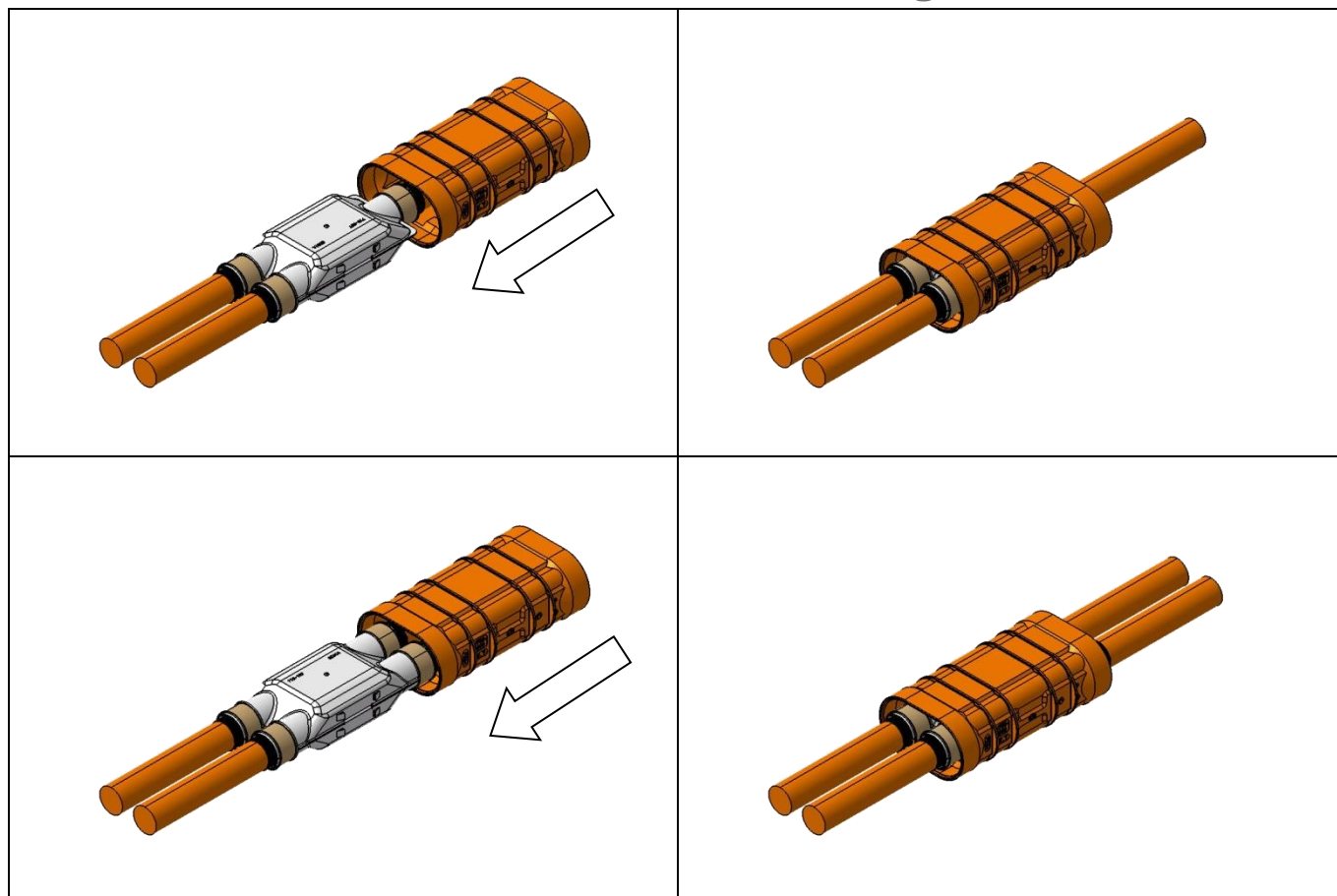
This document is no subject to change service!

- **Pulling force of the wire**

To measure the pull-out force, the wire must be clamped firmly into a clamping device. The specimen must be without welding to test the shield pressing only. In this state, the figures in the table must be reached.

	Wire cross section	Pulling force
	2.5 mm ²	≥ 120 N (L2)
	4.0 mm ²	≥ 120 N (L2)
	6.0 mm ²	≥ 120 N (L2)

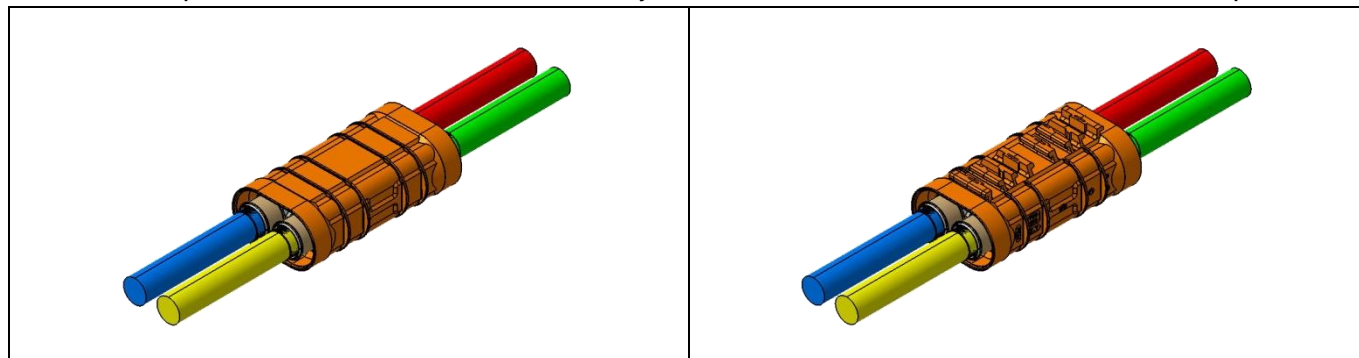
3.13 Assemble Distributor shield housing



The Distributor shield housing is symmetrical and can be assembled from both sides. During assembly, locking latches in the shield are deflected and lock audible.

Attention:

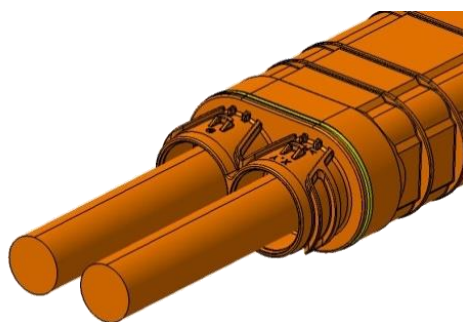
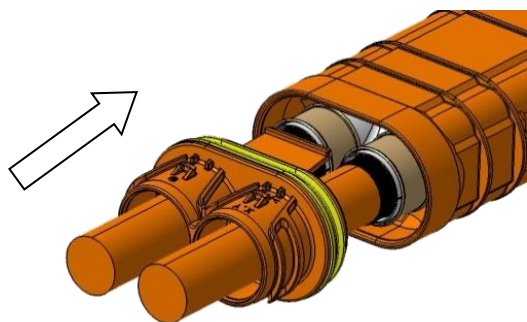
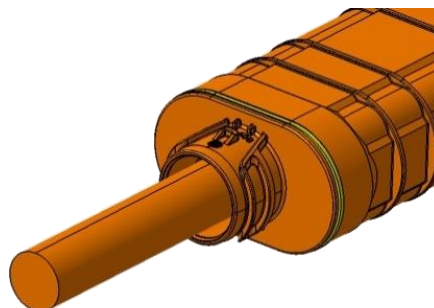
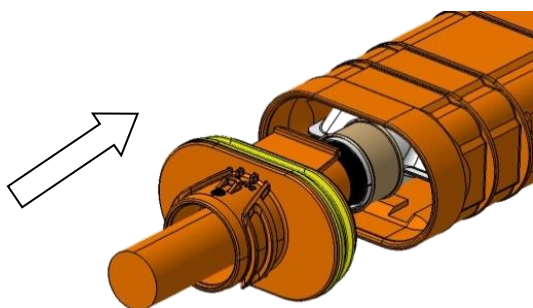
When using the shield housing with locator part (706-669-502) on the H-distributor, pay attention to the correct direction when assembling. The shield housing may only be rotated along the middle axis, and therefore the position of the locator elements may not be correct in reference to the wires, see picture:



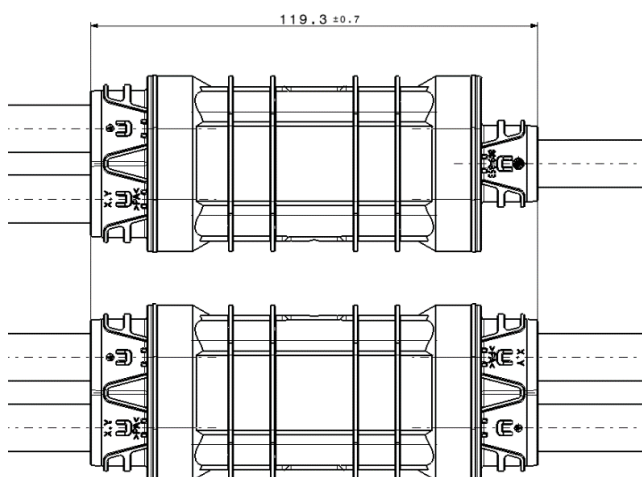
This document is no subject to change service!

3.14 Assemble cable housing

Assemble the cable housings. This process step is valid for both distributor sides.

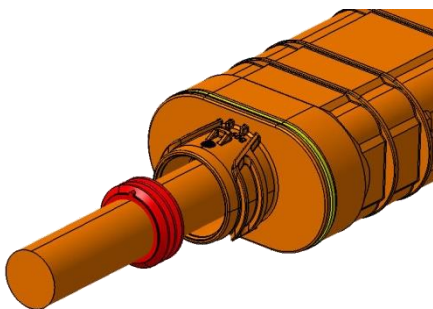
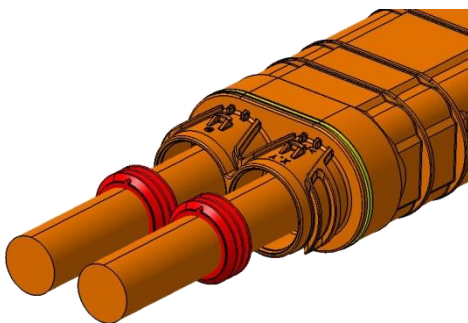
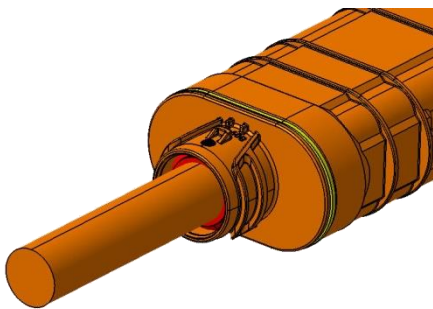
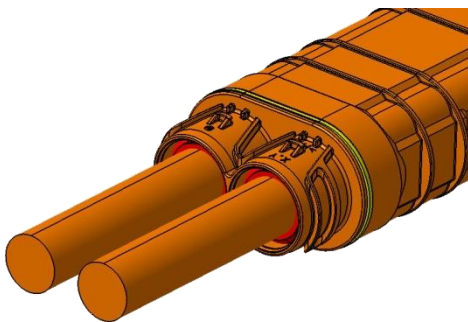


When assembling the cable housings, locking latches deflect and lock audible.



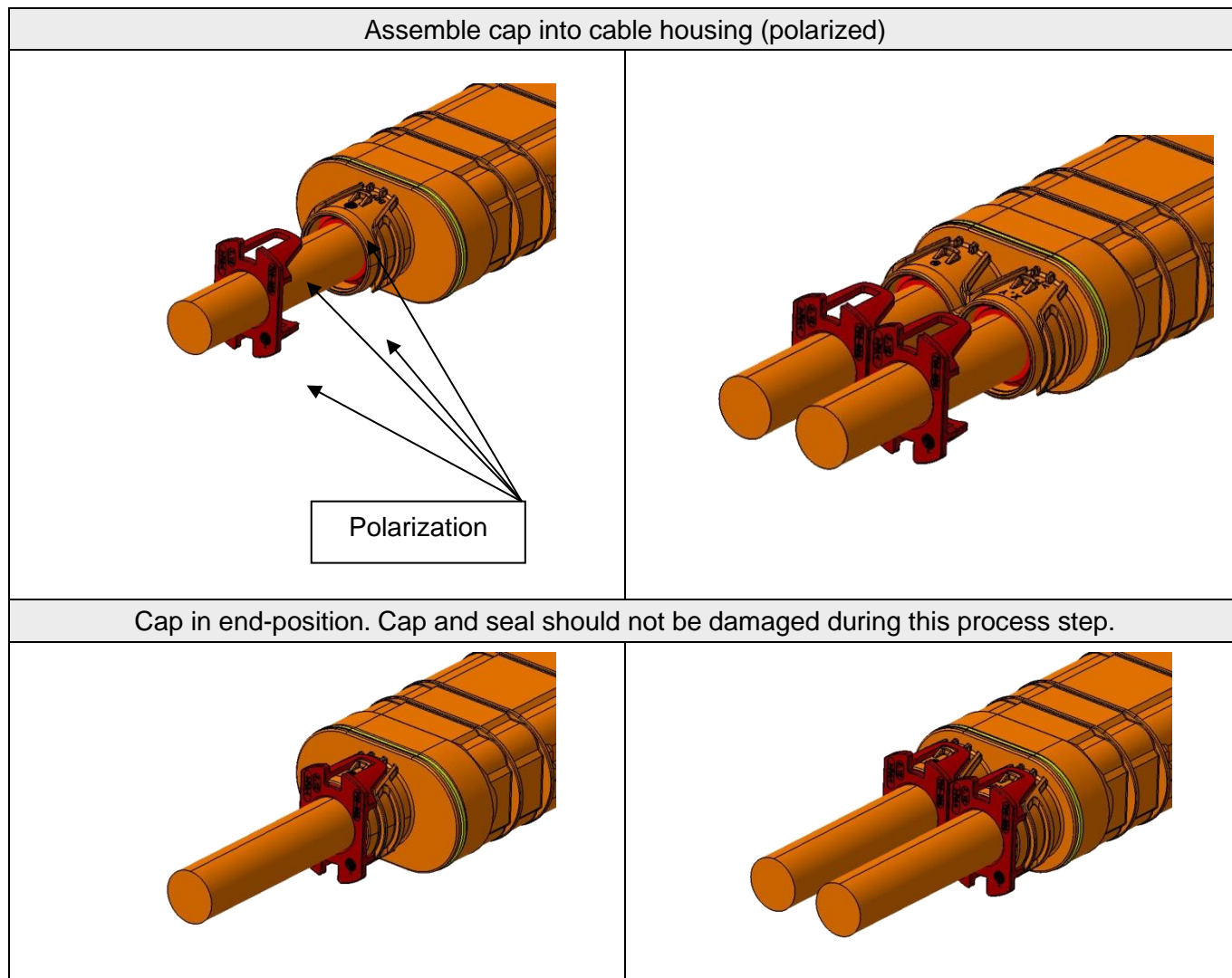
This document is no subject to change service!

3.15 Assemble wire seal and cap

Assemble the wire seal into the cable housing.	
	
Seal in end-position	
	

The seal may be expanded slightly during assembly. It may be pushed with the cap, but may not be twisted, jammed, or damaged during this process.

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3.16 Stacking of produced harnesses

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

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4 Technical information

4.1 General requirement

Single components must not be damaged during the whole production-process.

4.2 Technical cleanliness

In general, pay attention to the cleanliness on the distributor and inside of the distributor. Metallic particles generated during the assembly process, must be removed with a suitable device.

Inside the distributor, there are no metallic particles > 1,000 µm permitted.

For metallic particle at each distributor: CCC = N (J4/K0) acc. to VDA Band 19

For all other particle at each distributor: CCC = N (J10/K0) acc. to VDA Band 19

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

Technical cleanliness acc. to QV11111			
HV systeme (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
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	-

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4.3 Experimental machines

The machines and devices described in this chapter were used by Hirschmann Automotive to produce numerous experimental- and validation parts. The selection, design and commissioning of these devices lies within the responsibility of the manufacturer.

4.3.1 Ultrasonic welding

<u>Description:</u>	Telso ® Splice TS3 / Multi-wire splice kit
<u>Article number:</u>	-
<u>Contact:</u>	TELSONIC AG Industriestrasse 6b 9552 Bronschhofen/SG Switzerland

<u>Description:</u>	Minic-III-X-Splice
<u>Article number:</u>	-
<u>Contact:</u>	Schunk Sonosystems GmbH Hauptstr. 95 35435 Wettenberg Germany

4.3.2 Crimping

<u>Description:</u>	HPS40-2 Schirmverpressanlage
<u>Article number:</u>	188/16
<u>Contact:</u>	Schäfer Werkzeug- und Sondermaschinenbau GmbH Dr.-Alfred-Weckesser-Str. 6 76669 Bad Schönborn-La, Germany Tel: +49 7253 9421-0 Fax: +49 7253 9421-94 www.schaefer.biz

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5 Documentation of change

Version	Change description	Change date	Editor
10	Adapted wire add-on to 70 mm (77 mm) / Added possible rotating clamping device for pull-off force / Removed device recommendation for ultrasonic welding, appendix	04/2020	Hoor R.
11	Added Alternative Dimensions (Chapter 5)	08/ 2020	Hoor R.
12	Updated phrasing (administrative)	08/ 2020	Hoor R.
13	Chapter 2.2 – added Ferrule crimp in table and as picture (Draft) / Chapter 2.6 – added product 706-669-503 in table and as picture (optional, draft) / Chapter 3.1 – adapted wire in the picture from 77 mm to 70 mm. / Chapter 3.4 – Ferrule crimp assembly added (optional, draft)	08/ 2020	Grobnicu V.
14	Added BMW F-characteristics	03/ 2021	Hoor R.
15	Added wire manufacturer NBKBE / Hirschmann text "Must still be validated" removed from specification	07/ 2021	Schwer A.
16	Adding ultrasonic welding machine Minic-III-X-Splice (Schunk Sonosystems GmbH) in the Appendix.	03/ 2022	Natter T.
17	Version 15 & 16 skipped so that the version of process specification matches with the german version; chapter 2.1: Shielded cable - production location wire supplier added; chapter 3.4.4: Cross-section 2.5 mm ² added to table; chapter 3.6: Process data for welding-splice 4.0 mm ² added; Cross-section 2.5 mm ² added to table pull-off force of wire, Cross-section 3.0 mm ² and 5.0 mm ² removed from table; chapter 5.1/5.2: Addition/comment on permissible deviation;	06/ 2022	Kleiner T.
18	Chapter 1.4: BMW special characteristics changed acc. to OEM requirement; Chapter 3.14: Changed cleanliness requirement and added BMW specific requirement based on surface reference;	10/ 2022	Breuss L.
19	Coficab FHRLR91X91XCB91X T3 cable added (not validated yet)	12/ 2022	Natter T.
20	Update design Specification	06/ 2023	Jussel E-M.
21	Adjusting data of the bottom line	07/ 2023	Jussel E-M.
22	Topic 1.2: adjusted with additional "Miscellaneous"	10/ 2023	Jussel E-M.
23	Topic 3.3: add additional comment for L4	02/ 2024	Jussel E-M.
24	Page 4) Change of L from length to legal	04/ 2024	Jussel E-M.

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