Title of Document:	HANDLING MANUAL	Issue No. CHM-1-2002	Rev. 7
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Title subject:	PA Connector	Revision date: October 29, 2019	

This handling manual describes points to check for smooth crimping operation of PA connector contact.

C O N T E N T S

1. Part Name and Model Number

Part name			Model No.
Contact			SPHD-001T-P0.5
			SPHD-002T-P0.5
Receptacle housing			PAP-∗V-#
Header	Top entry type	Without boss	B∗B-PA#K (LF)(SN)
		With boss	B∗B-PA#K-1 (LF)(SN)
	Side entry type		S∗B-PA#K-2 (LF)(SN)

Note$_1$: 2-digit figure in "∗" denotes circuit number.
A letter in "#" denotes the housing color.
Note$_2$: Identification marking "(LF)(SN)" stands for lead-free product.
"(LF)(SN)" shall be displayed on product label.

2. Applicable Wire

2-1 Applicable wire for each barrel size

UL1007 (stranded wire) and its equivalent stranded wire can be used.
Regarding AWG #22, use UL1061 with small insulation outer diameter, and its equivalent stranded wire.
Wire size and wire insulation outer diameter for each contact are as below.

Model No.	Wire size	Insulation outer dia.	Conductor spec.
SPHD-001T-P0.5	AWG#26 ~ #22	ϕ1.0 ~ ϕ1.5 mm	Annealed copper stranded wire with tin plating
SPHD-002T-P0.5	AWG#28 ~ #24	ϕ0.76 ~ ϕ1.5 mm	

Note$_3$: Special wires such as solid wire, tin-coated wire, shielded wire and other than above wires cannot be used.

3. Crimping Tool

Part name	Model No.	
	SPHD-001T-P0.5	SPHD-002T-P0.5
Semi-automatic press	AP-K2(N)	
Applicator	MKS-L-10 or MKS-SC-10	
Die	MK/SPHD-001-05	MK/SPHD-002-05
Applicator and die set	APLMK SPHD001-05	APLMK SPHD002-05

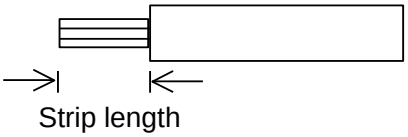
Note$_4$: When crimping operation is conducted by using other than the above applicator and die set, JST cannot guarantee the performance of the connector.

4. Crimping Operation

4-1 Wire strip length

Referring to the reference value of the wire strip length stated below, conduct wire stripping.
As the wire strip length differs depending on the wire type and the crimping method, decide the best wire strip length considering the processing condition. When a wire is stripped, do not damage or cut off the wire conductors.

Reference value of wire strip length: 2.1 mm

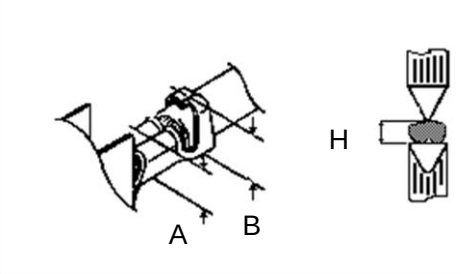


4-2 Crimping

Before crimping operation, be sure to check the combination of the contact, wires and the crimping die are correct.
Check the below points for correct crimping at the beginning and the middle of crimping operation.

Measurement of crimp height

According to a wire to be used, adjust the dials of the applicator to a proper crimp height.



A: The crimp height at the wire barrel should be set to the pre-determined dimensions.

B: Adjust the crimp height at the wire insulation barrel to the extent that the wire insulation is slightly pressed, and set it so that crimping is not excessive.

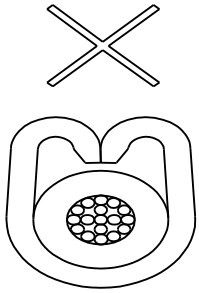
H: Measure the crimp height at the center of the barrel using a micrometer.

Table of crimp height

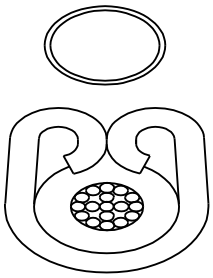
Contact	Wire		Insulation O.D. (mm)	Crimp height (mm)	
	Type	Size		Conductor part	Insulation part
SPHD-001T-P0.5	UL1007	AWG #26	1.3	0.60 ~ 0.70	1.7
	UL1007	AWG #24	1.5	0.65 ~ 0.75	1.8
	UL1061	AWG #22	1.4	0.70 ~ 0.80	1.8
SPHD-002T-P0.5	UL1007	AWG #28	1.2	0.55 ~ 0.60	1.6
	UL1007	AWG #26	1.3	0.60 ~ 0.65	1.7
	UL1007	AWG #24	1.5	0.62 ~ 0.67	1.8

Note$_5$: The crimp height at the insulation part is a reference value, so adjust it according to a wire to be used.

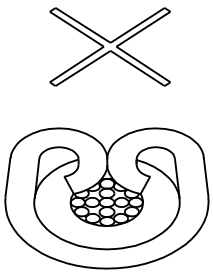
Crimping condition at insulation barrel



Insufficient crimping
(pressed weak)
When tension is applied to a wire, the wire insulation easily comes off the contact.



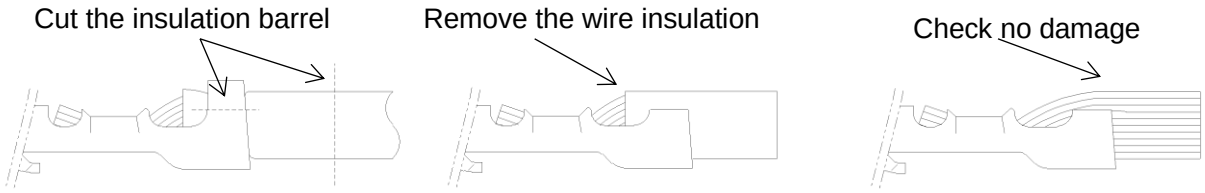
Good



Excessive crimping
(pressed excessively)
The barrel bites the wire too much and may damage the wire conductors.

Check of crimping condition at insulation barrel

Cut only the wire insulation barrel, remove the wire insulation and check if the wire conductors are not damaged as below.



4-3 Tensile strength at crimped part

After adjusting the crimp height, check the tensile strength using the test samples, and then, start continuous crimping operation. In case the tensile strength greatly differs from the normal tensile strength (actual value), check if there is a defect. The actual value may be different depending on the difference in wire strength even if wire size is same.

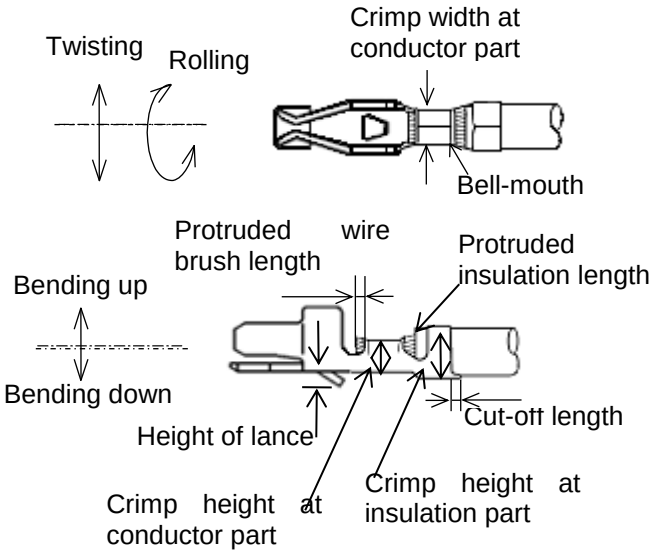
Unit: N

Contact	Wire		Tensile strength (actual value)			Requirement
	Type	Size	Ave.	Max.	Min.	
SPHD-001T-P0.5	UL1007	AWG #26	42.6	45.1	39.2	20 min.
	UL1007	AWG #24	71.3	74.5	68.6	30 min.
	UL1061	AWG #22	93.9	96.0	92.1	40 min.
SPHD-002T-P0.5	UL1007	AWG #28	31.7	34.3	27.0	15 min.
	UL1007	AWG #26	46.1	48.0	44.1	20 min.
	UL1007	AWG #24	69.7	71.5	66.6	30 min.

4-4 Crimping appearance

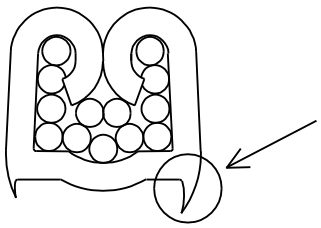
Check the crimping appearance visually for correct crimping with equipment such as a loupe.

Bending up and rolling

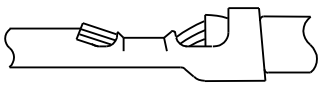


Item	Reference value
Bending up	3°≧
Bending down	3°≧
Twisting	3°≧
Rolling	5°≧
Bell-mouth	0.1 ~ 0.3 mm
Cut-off length	0 ~ 0.3 mm
Protruded wire brush length	0.3 ~ 0.6 mm
Crimp width at conductor part	approx. 1.4 mm

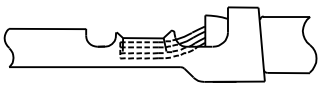
There must not be large burr or one-sided burr.



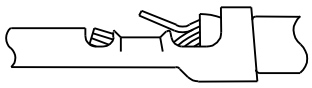
Examples of defective crimping



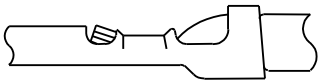
Protruded wire brush length is long.



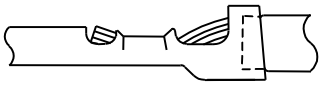
Protruded wire brush



Stray wire conductor length is short.



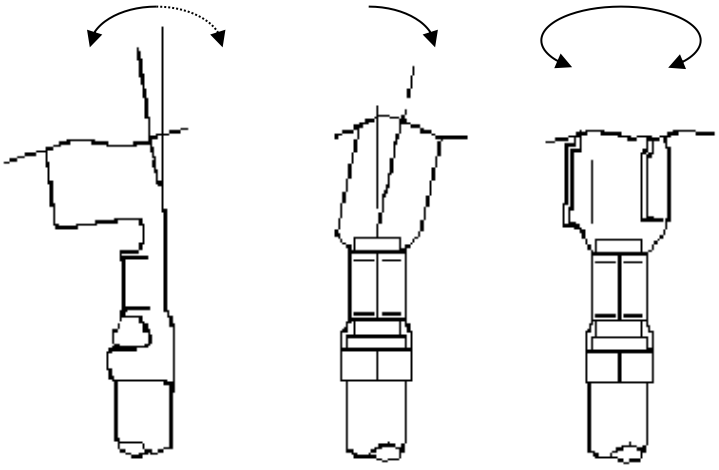
Wire barrel bites wire insulation.



Wire insulation is not crimped sufficiently.

Bending up, bending down, twisting and rolling

Bending up (bending down) Twisting Rolling



Note that bending up, bending down, twisting and rolling may deteriorate the contact insertion in the housing and the contact retention force and cause poor contact.

4-5 Precautions for crimping operation

① Conduct crimping operation properly and inspect the crimping appearance of the crimped product with loupe, etc.

② Do not crimp with no terminal and do crimping twice, because they may cause outstanding burrs at the crimped part and may lead to the abrasion of the crimping die quickly.

③ As cutting residues (powder), etc. adhered to the crimping die part affects the life of the dies, clean around the crimping part occasionally and conduct appropriate crimping.

④ When chips or excessive roughness are observed on the crimping die, replace it without delay.

⑤ As the abrasion of the crimping die and insufficient adjustment of the applicator may cause defective crimping appearance, do not fail to conduct daily inspection.

⑥ When crimping operation is conducted with the wire-holding spring damaged or extracted, the wire conductors may come off or the wire barrel may bite the wire insulation.

4-6 Control of crimping operation

To conduct secure crimping operation, record the following items for semi-automatic press and crimping applicator.

① Model No. or control No. of semi-automatic press and applicator
② Contact lot No.
③ The number of crimping and cumulative total
④ Crimp height
⑤ Wire retention force
⑥ Crimping appearance and record of adjustment and replacement of crimping die

4-7 Precautions for storage and handling of crimped contact

The crimped contact is subject to deformation, etc. by external force before inserting into the housing, pay careful attention to the following 4 points for storage and handling:

① Protect the contacts by wrapping with thick paper to prevent the deformation of the contact surface and adhesion of foreign substances. Keep them in an adequate box.

② Do not place the contacts in humid area, under direct sunshine and directly on the floor.
Store them in a clean room with ordinary temperature and humidity.

③ Do not overstack the crimped contacts or place anything on them, because the weight may cause deformation of the contact, poor contact and other defects.

④ When the crimped contact is taken out of the bundle, do not pull a wire but hold the wire near the crimped section and take it out.

5. Harness Assembly Operation

Harness assembly operation is a very important process to decide the connector performance and the harness quality. Careful operation is required for the harness assembly as well as the said crimping operation.

5-1 Inserting the crimped contact into the housing

① Insert the crimped contact parallel to the housing without prying not to apply tension to the crimping part.

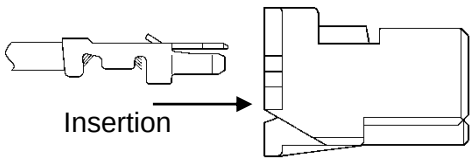
② Insert the contact into the housing without stopping to the innermost.
When the contact is fully inserted into the housing, the housing lance clicks and there is feeling of response.

③ Do not use such a pin as an insertion jig, because the tip of the pin accidentally reach the contact mating, which may cause poor contact and contact deformation.

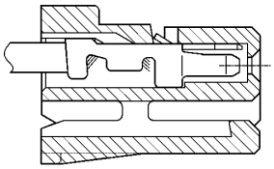
④ Check secure locking per each insertion by pulling the wire softly in order to check that the contact does not come off of the housing. Besides, check whether there is the backlash in the direction of the insertion axis.
(When a wire is pulled with too much force, the contact lance may be deformed and the contact may come off of the housing.)

⑤ Insert the contact into the housing on the same axis.
When the contact is diagonally inserted, the contact area cover part may come out of the clearance of the housing lance as was shown in the figure below.

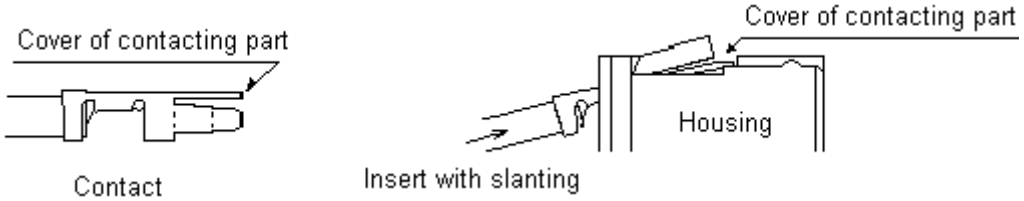
How to insert the contact into the housing



Contact inserting condition into the housing



Defect example of tilt insertion



Note$_6$: When the defect happens like the above due to the diagonally insertion of the contact, extract the contact and put it back to the original position. Then, insert it again.

6. How to Extract Crimped Contact from Housing in Case of Mis-insertion

When the crimped contact is inserted into an improper circuit hole, conduct the following points:

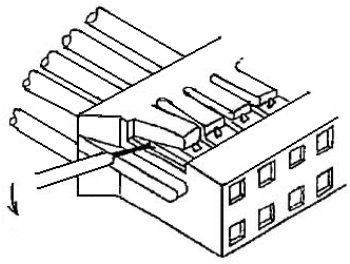
① Do not reuse the used housing and contact but use the new ones.
(The way of extracting the contact from the housing is as below.)

② When an improperly inserted contact is extracted from the housing and reused.

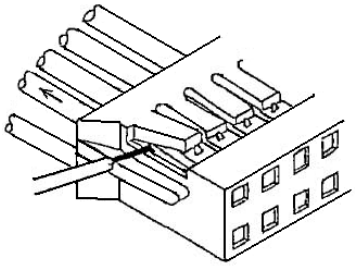
a) Only a specified person conducts the operation.
Before reusing, check strictly that the extracted contact is free from deformation.
If such an abnormality as deformation is found, replace it with the new contact.
b) In case such contact and housing are reused in some reasons, the reuse should be once.
From twice, use the new contact and housing.
c) After modification completes, be sure to check the inserted contact in the housing.
When the contact comes off of the housing, use the new housing.
d) Be sure to use JST specified tool. (Extraction tool No.: EJ-PHD of EJ-PHD-RB).
Do not conduct extracting operation using tools other than the specified by JST, since the mating part may be deformed.

<u>How to extract the contact from the housing</u>

1) Raise the housing lance (0.5 mm max.) with the extraction tool (No. EJ-PHD or EJ-PHD-RB), and disengage the housing lance.



2) Pull out a wire softly.



3) Put back the housing lance to its original position.

7. Control Points of Crimping Operation and Harness Assembly

The operations of crimping and assembly affect the reliability of the connector.
It is recommended that crimping and assembly operations and the finished products be controlled concentrating upon the following check points:

7-1 Control points

Process	Check point	Description
Crimping	Appearance	① Check that the model Nos. of the contact and the applicator are adequate for wires to be used. ② Check that the wires are crimped at the normal position. ③ Check that the crimped configuration is normal and excessive burr does not appear. ④ Check that uncrimped wires are not left behind. ⑤ Check that the contact is not bent, deflected or deformed. ⑥ Check that the contact is free from dirt, scratches, stains or discoloration.
	Tensile strength	① Check that the crimp height and the tensile strength are adequate.
Harness assembly	Appearance	① Check that the contact is properly inserted into the housing. ② Check that the contact is securely locked with the housing. ③ Check no miss-wiring. ④ Check that the housing is free from such an abnormality as dirt, scratches, stains and discoloration.
Finished product (Harness)	Appearance	Follow all descriptions stated above in “Appearance.”
	Continuity	Check that harness passes continuity test.

7-2 Continuity (Wiring) check

Use the following PA connector in continuity check.
Never use such a different type pin as tester pin.

Part name		Model Number
Receptacle (Wire to Wire type)	Contact	SPAL-001T-P0.5 SPAL-002T-P0.5
	Housing	PALR-∗V
	Retainer	PMS-∗V-S
Header (PC board type)	Top entry type	B∗B-PA( )K (LF)(SN) B∗B-PA( )K-1 (LF)(SN)
	Side entry type	S∗B-PA( )K-2 (LF)(SN)

Note$_7$: Two-digit figure comes in ∗ denotes the circuit number.
A letter in ( ) denotes the housing color.
Note$_8$: Identification marking “(LF)(SN)” stands for lead-free product.
“(LF)(SN)” shall be displayed on product label.
Note$_9$: Contact JST for the above connector.

Note the following points.

- Check that the connector for inspection is free from deformation, damages and stains. When they are found, replace with a new one at once. The periodical replacement should be conducted as well.

- Mate and unmate the connector with care, holding the housing not to pry.
When an inspection board is used, design a chassis considering so that mating and unmating works are not difficult.

8. Mating and Unmating Connector

① Inserting the connector

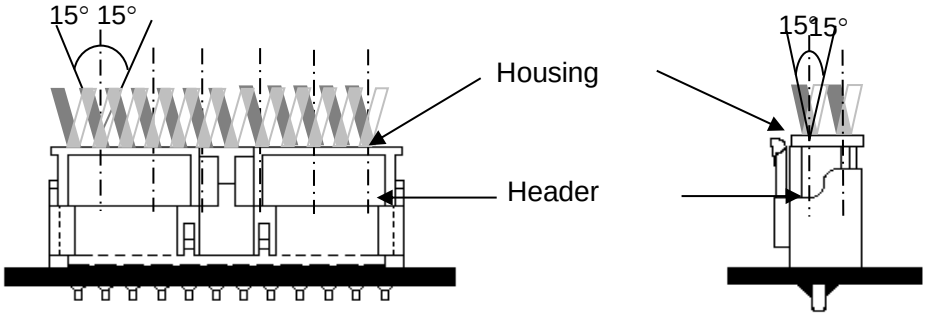
Hold the socket housing with secure and insert it into the header in a straight against until clicking.

② Unmating the connector

Hold all wires securely and withdraw the connector on the mating axis.

③ Prying

As prying withdrawal may deform the header post and damage the connector, do not conduct prying withdrawal. When withdrawal operation on the mating axis is difficult, do the operation within 15 degrees against the mating axis.



④ Wire handling

When handling the wires, do not apply other than an external load of wire bucking level by keeping an enough wire length and fixing wires.