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The PH connector is designed to be compact wire-to-PC board connector to meet the demand for high density mounting and for flexible PC board design of all electronic product. This handling manual describes operation points of crimping, assembling and mounting on PC board to increase further reliability and exert the connector's features.

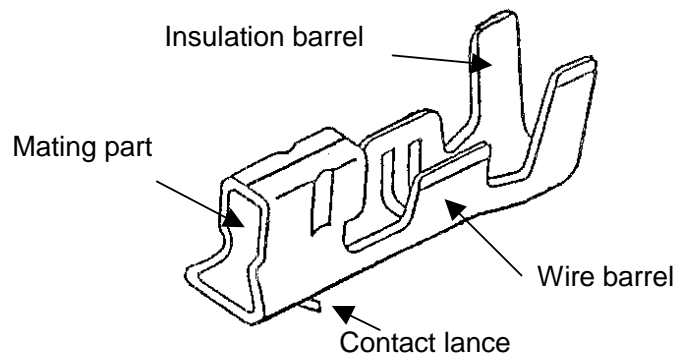
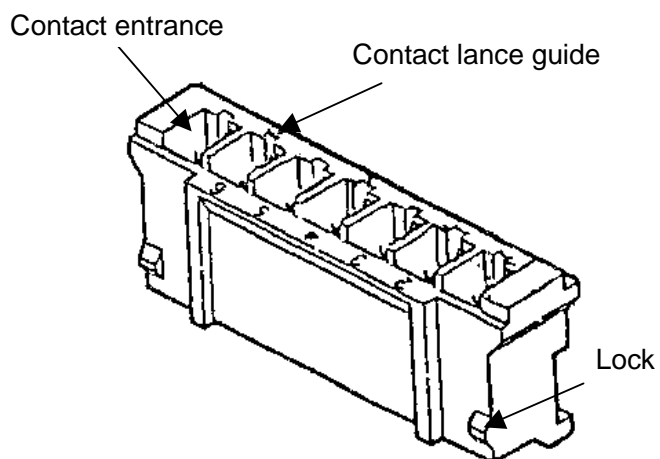
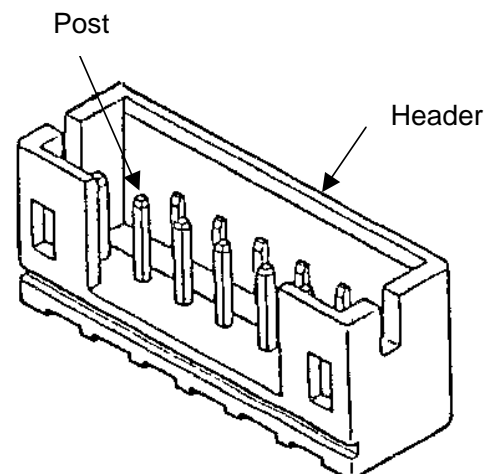
C O N T E N T S

	Page
1. Parts Identification	2
2. Model Number	3
3. Applicable Wire	3
4. Crimping Tool	4
5. Crimping Operation	4
5-1 Wire strip	4
5-2 Crimping	4
5-3 Handling method of special wires	8
5-4 Precautions for crimping operation	8
5-5 Control of crimping operation	9
5-6 Precautions for the storage and the handling of the crimped contact	9
6. Harness Assembly Operation	9
6-1 Precautions before inserting the crimped contact into the housing	9
6-2 Method of inserting the contact	10
6-3 Check after inserting the crimped contact into the housing	10
6-4 How to extract the crimped contact from the housing in case of mis-insertion	11
7. Inspection of Finished Product (Continuity Check)	12
7-1 Simple wiring inspection using a tester	12
7-2 Wiring inspection using an inspection jig	12
8. Header	12
9. Mating and Unmating Connector	13
9-1 Mating the connector	13
9-2 Unmating the connector	13
9-3 Prying	13

Prepared by: <i>S.Hoshikawa</i>	Checked by: <i>M.matsunaka</i>	Reviewed by: <i>N.Amemiya</i>	Approved by: <i>H.Tomimoto</i>
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1. Parts Identification

The PH connector consists of the contact, the housing and the header. On processing and assembling, understand each structure and name.

ContactHousingHeader (Top entry type)

JST	Title subject: PH Connector	No. CHM-1-105 R11
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2. Model Number

Part name		Model No.
Contact	Standard product	SPH-002T-P0.5S
	Standard product (for thin wire)	SPH-004T-P0.5S
	Low insertion force product	SPH-002T-P0.5L
Housing		PHR-()
Header	Top entry type	B()B-PH-K-S (LF)(SN)
	Side entry type	S()B-PH-K-S (LF)(SN)

Note₁: Two-digit figure in () denotes the circuit number.

Note₂: The identification marking "(LF)(SN)" stands for lead-free product.

The "(LF)(SN)" shall be displayed on the product label until all products are shifted to lead-free.



CAUTION

- The crimp height of the low insertion force product differs from that of the standard one. The following label is put on the product reel and the carton box of the low insertion force type, pay careful attention to the crimp height. Refer to item 5-2-1 "Crimp height" for each contact.

注意 !
標準品とはクリンプハイトが異なります
CAUTION !
Crimp height differs from standard one

Note₃: The letter of "注意 !", "CAUTION !" and the frame are colored in red.

3. Applicable Wire

- ① SPH-002T-P0.5S (Standard product)
UL1007 (stranded wire) and its equivalent annealed copper stranded wire with tin-plated can be used.
Wire size: AWG #30 ~ AWG #24
Wire insulation O. D.: $\phi 0.8 \sim \phi 1.5$ mm
- ② SPH-004T-P0.5S (Standard product for thin wire)
UL1571 (stranded wire) and its equivalent annealed copper stranded wire with tin-plated can be used.
Wire size: AWG #32 ~ AWG #28
Wire insulation O. D.: $\phi 0.5 \sim \phi 0.9$ mm
- ③ SPH-002T-P0.5L (Low insertion force product)
UL1007 (stranded wire) and its equivalent annealed copper stranded wire with tin-plated can be used.
Wire size: AWG #28 ~ AWG #24
Wire insulation O. D.: $\phi 0.8 \sim \phi 1.5$ mm
- ④ Note
Special wires such as solid one, tin-coated one, shielded one and other than above one cannot be used in principle. When using such special wires, contact JST.
Regarding shielded wires, refer to item 5-3 "Handling method of special wires."

4. Crimping Tool

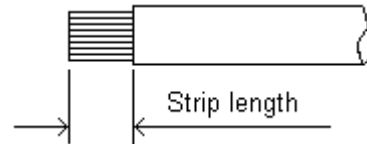
	Model No. of applicable crimping tool			
	Crimping machine	Applicator	Dies	Applicator and dies set
SPH-002T-P0.5S	AP-K2N	MKS-L	MK/SPH-002-05S	APLMK SPH002-05S
SPH-004T-P0.5S		MKS-L-10	MK/SPH-004-05S	APLMK SPH004-05S
SPH-002T-P0.5L		MKS-L	MK/SPH-002-05L	APLMK SPH002-05L

Note₄: When crimping operation is conducted by using other than the above applicator and die set, JST cannot guarantee the connector performance.

5. Crimping Operation

5-1 Wire strip

When a wire is stripped, do not damage or cut off the wire conductors. As the wire strip length differs depending on wire type and crimping method, decide the best wire strip length considering the processing condition.



Reference value of wire strip length: 1.9 ~ 2.5 mm

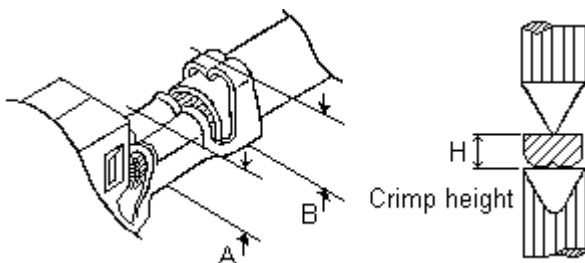
Note₅: Do not leave such a stripped wire for a long time in order to prevent the oxidation of the conductor's surface, since such oxidation may lead to the fluctuation of the contact resistance.

5-2 Crimping

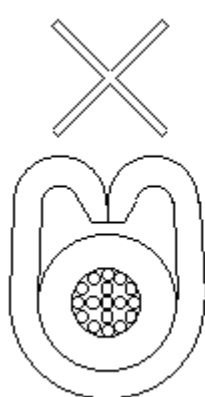
Check the below points for correct crimping at beginning, middle and end of crimping operation.

5-2-1 Crimp height

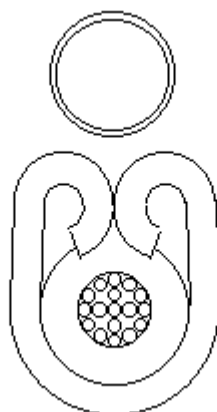
According to wires to be used, adjust the dials of the applicator at the wire conductor part and the wire insulation part to a proper crimp height.

Measurement of crimp height

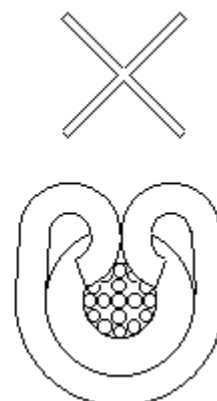
- A: The crimp height at the wire barrel should be set to the pre-determined dimensions.
- B: Adjust and set the crimp height at the insulation barrel as per finished outer diameter and wire type so that the wire insulation does not come off of the contact easily and it is not crimped excessively.
- H: Measure the crimp height at the center of the barrel using a specified micrometer.

Crimping condition at wire insulation barrel

Insufficient crimping
(pressed weak)
When tension applies
to the wire, the wire insulation
easily comes off of the contact.



Good

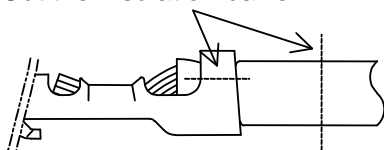


Excessive crimping
(pressed excessively)
The barrel bites the wire,
which may damage
the wire conductors.

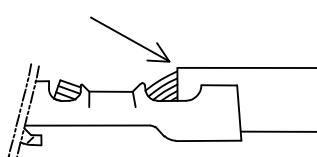
Checks of crimping condition at wire insulation barrel

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

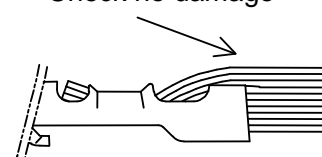
Cut the insulation barrel



Remove the wire insulation.



Check no damage

Table of crimp height

① SPH-002T-P0.5S (Standard type)

Wire (UL1007)		Crimp height (mm)	
Wire size	Insulation O. D. (mm)	Conductor part	Insulation part (Ref. value)
AWG #30	1.1	0.52 ~ 0.57	1.5
AWG #28	1.2	0.55 ~ 0.60	1.5
AWG #26	1.3	0.57 ~ 0.62	1.6
AWG #24	1.5	0.62 ~ 0.67	1.7

② SPH-004T-P0.5S (Standard type for thin wire)

Wire (UL1571)		Crimp height (mm)	
Wire size	Insulation O. D. (mm)	Conductor part	Insulation part (Ref. value)
AWG #32	0.6	0.47 ~ 0.52	1.1
AWG #30	0.8	0.50 ~ 0.55	1.2
AWG #28	0.9	0.55 ~ 0.60	1.2

③ SPH-002T-P0.5L (Low insertion force type)

Wire (UL1007)		Crimp height (mm)	
Wire size	Insulation O. D. (mm)	Conductor part	Insulation part (Ref. value)
AWG #28	1.2	0.50 ~ 0.55	1.7
AWG #26	1.3	0.52 ~ 0.57	1.8
AWG #24	1.5	0.57 ~ 0.62	1.8

5-2-2 Tensile strength at crimped part

After adjusting the crimp height, check the tensile strength using test samples.

In case the tensile strength greatly differs from the normal tensile strength (actual value), check if there is a defect. The tensile strength may be different even in the same wire size due to the difference in strength of wire itself.

Table of tensile strength at crimped part

① SPH-002T-P0.5S (Standard type)

Wire size	Requirement (N) min.	Measured value (Ref. value) (N)
AWG #30	7.8	12 ~ 15
AWG #28	14.7	22 ~ 27
AWG #26	19.6	34 ~ 38
AWG #24	29.4	61 ~ 68

② SPH-004T-P0.5S (Standard type for thin wire)

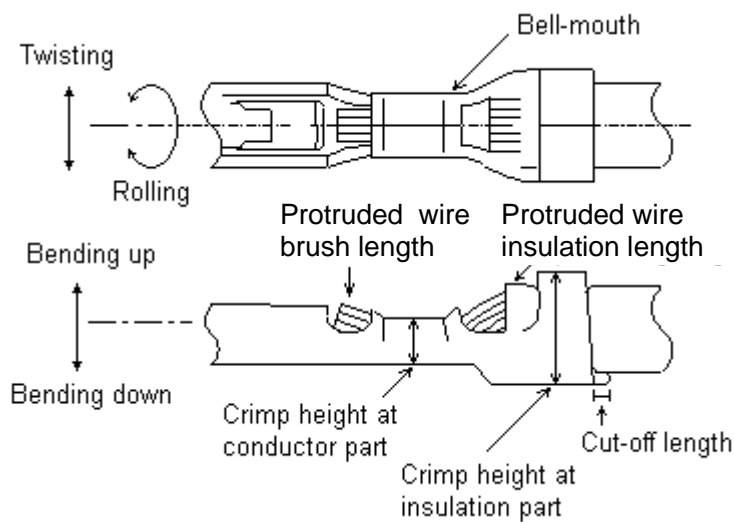
Wire size	Requirement (N) min.	Measured value (Ref. value) (N)
AWG #32	3	11 ~ 13
AWG #30	5	21 ~ 23
AWG #28	10	33 ~ 36

③ SPH-002T-P0.5L (Low insertion force type)

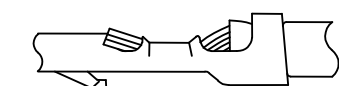
Wire size	Requirement (N) min.	Measured value (Ref. value) (N)
AWG #28	9.8	22 ~ 32
AWG #26	19.6	35 ~ 46
AWG #24	29.4	48 ~ 58

5-2-3 Crimping appearance

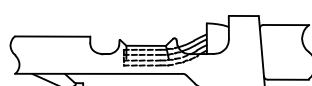
Check the crimping appearance visually for correct crimping with equipment such as a loupe.

Part name of crimped contact

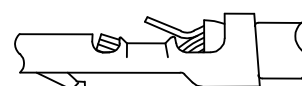
Item	Reference value
Bending up	6° max.
Bending down	6° max.
Twisting	5° max.
Rolling	7° max.
Bell-mouth (wire side)	0.1 ~ 0.3 mm
Cut-off length	0 ~ 0.5 mm
Protruded wire brush length	0.3 ~ 0.6 mm

Examples of defective crimping

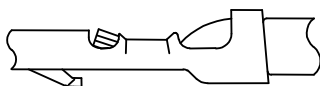
Long protruded wire brush



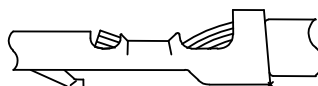
Short protruded wire brush



Stray wire conductors



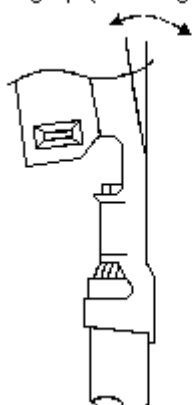
Bitten wire insulation with wire barrel



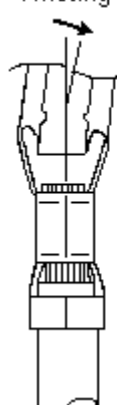
Poor crimping on wire insulation

Bending up, bending down, twisting and rolling

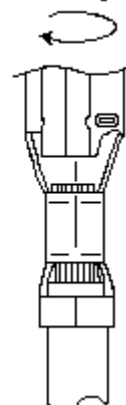
Bending up (Bending down)



Twisting

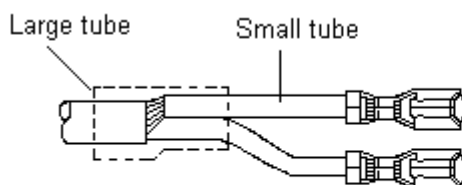


Rolling

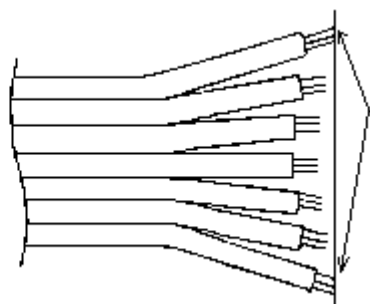


5-3 Handling method of special wires

Split length of core wire and braided shielding wires



Split length of flat-ribbon cable



The outer wires should be longer than the inner side's ones.

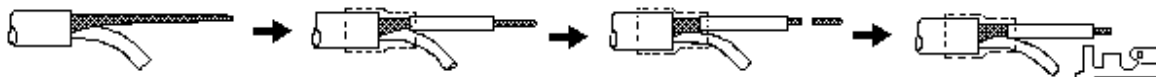
The processing shown above is necessary for special wires when the contact is inserted into the housing to ensure good insertion and to prevent the deformation and wire cutting in inserting the contact.

After inserting the contact into the housing, adjust the split length of the braided shielding wire and flat-ribbon cable so that a tension does not apply to the smaller size wire for braided shielding wire, and so that a tension does not apply to the both sides only for flat-ribbon cable.

Crimping of braided shielding wire

After stripping and slightly twisting the braided shielding wires, trim the tip with nipper to arrange and crimp the contact. If the tip is not arranged, the contact may not be crimped properly. When the conductor's cross-sectional area of the braided shielding wire is over that of the applicable wire range, adjust the cross sectional area so that it conforms to the crimp height of the applicable range, and do crimping operation.

The insulation's outer diameter of the tube should conform to the one applicable to the contact.



5-4 Precautions for crimping operation

- ① Conduct crimping operation properly and inspect the crimping appearance of the crimped product with loupe, etc.
 Note₆: If the conductors are not crimped at the center of the barrel, the contact may twist slightly but it does not affect the performance.
- 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 Crimping die is a consumable.
 When chips or excessive roughness are observed on the crimping die, replace it without delay.
- ⑤ As 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.

JST	Title subject: PH Connector	No. CHM-1-105 R11
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5-5 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

5-6 Precautions for the storage and the handling of the crimped contact

As the crimped contact before inserting into the housing is exposed, it is easy to be deformed by an external force. Pay careful attention to the following 5 points for the storage and the handling:

- ① The number of the crimped contacts for one bundle should be 300 pcs. max. Protect the contacts by wrapping with paper to prevent from the deformation and the adhesion of foreign substances, and 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 stack too much quantity of the crimped contacts nor place anything on them, because the weight of themselves may cause the deformation of the contact and troubles such as defective contacting.
- ④ Do not stain the contact with household goods such as oils, detergent, seasoning, fruit juice and insecticide. If stained, never use the stained contact.
- ⑤ Do not use improperly crimped or deformed contact.

6. Harness Assembly Operation

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

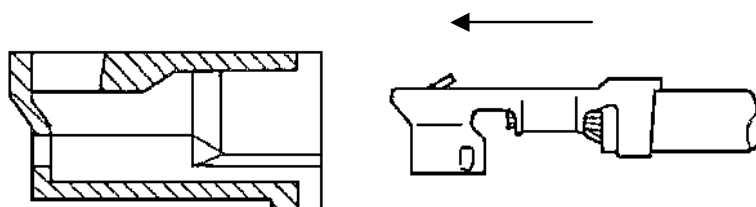
6-1 Precautions before inserting the crimped contact into the housing

Before inserting the contact into the housing, check the below points.

- ① Do not place other things on or near working table and do not conduct any other works on the same working table to prevent from operation mistake.
- ② Do not stain the contact with household goods such as oils, detergent, seasoning and fruit juice. If stained, never use the stained contact.
- ③ Do not use the contact that is improperly crimped and deformed (such as at the lance and the mating part).

6-2 Method of inserting the contact

- ① Do not apply any pulling force to the crimped part.
- ② Do not use something like a pin, because the tip of the pin accidentally reaches the contact mating part and it may cause poor contact or the contact deformation.
- ③ Hold the contact with the lance part up, and insert the contact into the housing parallel to the insertion axis so that the contact lance turns to the lance guide of the housing.



- Precautions for inserting contact

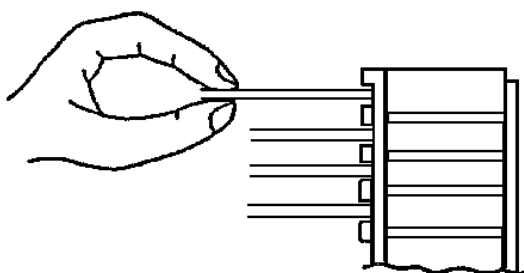
Do not tilt the contact to the direction that the contact lance is pushed or insert the contact prying up and down or right and left, because such handling may deform the contact lance and the mating part.

- ④ 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.

6-3 Check after inserting the crimped contact into the housing

Check secure locking per each insertion by pulling a wire softly with a force of approx. 3N.

Note₇: When the wire is pulled with too much force, the contact lance may be deformed and the contact may come off of the housing.



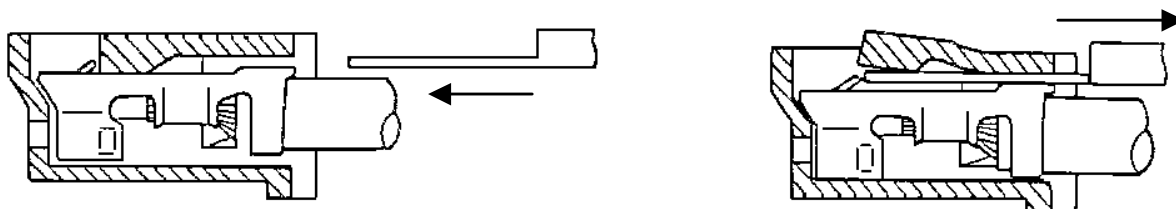
6-4 How to extract the crimped contact from the housing in case of mis-insertion

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

- ① Do not reuse the housing that the contact was extracted once but use a new one.
(The method to extract the contact from the housing is as below.)
- ② When the contact that is inserted into an improper circuit is extracted from the housing and the housing is reused.
 - Only a specified person conducts the operation.
 - The housing reuse should be once.
 - The housing lance should be pushed down to the original position.

How to extract the crimped contact from the housing

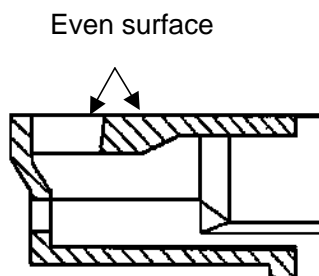
- ① Prepare the contact extraction tool, EJ-PH.
- ② Insert the EJ-PH parallel to the housing between the contact lance and the housing from its mating direction.
- ③ Insert the extraction tool to the innermost, and hold the contact lance.
- ④ Pull a wire softly with a force of approx. 10N while holding the contact lance with the tool, and extract the contact from the housing.
When the contact cannot be extracted even by pulling a wire softly, do not pull it out by force and try again back to step ①.



Note₈: Do not extract the contact using the tools other than the specified ones by JST.
The extraction by using a non-specified one may deform the mating part.

Precautions for the reuse of the housing

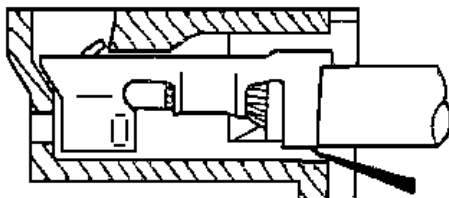
After extracting the contact, push the housing lance with finger and check if the housing lance surface is even or lower than other surfaces.



7. Inspection of Finished Product (Continuity Check)

7-1 Simple wiring inspection using a tester

- ① Do not insert a tester stick into the mating part.
- ② The inadequate diameter and the prying operation of the tester stick may deform the mating part.
- ③ Contact the tester stick with the wire insulation side by inserting it from the entrance of the contact, and do the inspection.



Tester stick

7-2 Wiring inspection using an inspection jig

Note the following points:

- ① Use the header applicable to the connector for inspection.
Do not remove the housing wall of the header. If removed, the contact may be pried easily during the inspection, which may cause poor contact.
- ② Use the header free from deformation, damage and stains. If found, replace it with a new one. The periodical replacement of the header should be conducted as well.
- ③ Mate and unmate the connector with care, holding the housing without prying.
When the inspection board is used, design it considering that the mating and unmating operation is not difficult.

8. Header

- ① Floating from PC board
The header of the PH connector has a retention mechanism not to separate from the PC board in inserting.
However, when the header floats due to such an external factor as force and vibration, press the header softly so that the bottom of the header fits on the PC board's surface, and then, solder the connector.
- ② Flux
Use rosin type flux.
As inorganic flux may corrode the header housing, do not use it.
- ③ Dip soldering
Do soldering at the temperature range of 230°C ~ 260°C within 5 seconds.
- ④ Soldering by hand and soldering repair
When the connector is soldered with a soldering iron or soldering repair is conducted for bridge, note the following points, because the header housing may deteriorate due to heating.

Soldering iron:	Use a soldering iron with small heat capacity (40W max.).
Soldering time:	Do soldering quickly within 3 seconds.
Soldering method:	Do not apply an external force by such an operation as holding the header post with the aid of the tip of the soldering iron during soldering.

- ⑤ Cleaning operation
In normal flux cleaning, the cleaning solvent does not affect the header of the PH connector.
However, when polluted cleaning solvent by flux is left in the header, poor contact and other defects may be caused.

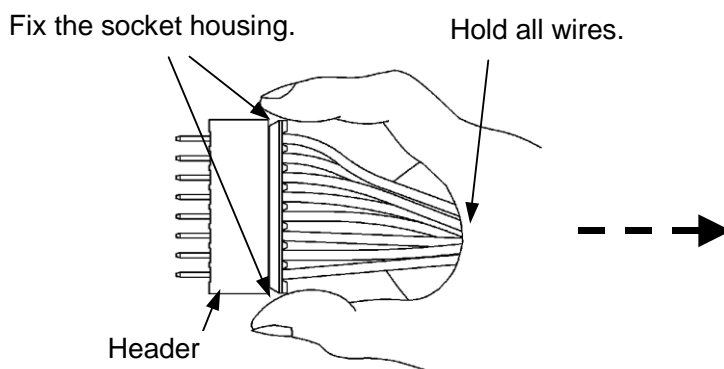
9. Mating and Unmating Connector

9-1 Mating the connector

Hold the socket housing with secure and insert it into the header straightly against to the header post until clicking.

9-2 Unmating the connector

Hold all wires and fix the socket housing by fingers so as not to pry, and then, withdraw it on the mating axis.



9-3 Prying

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

