Title of Document:	HANDLING MANUAL	Issue No. CHM-1-2481	Rev. 3
Customer:	GENERAL	Issue date: March 25, 2013	
Title subject:	LBT Connector A Type	Revision date: June 12, 2020	

This handling manual describes points to check for the handling and the contact crimping operation of the LBT connector type A.
Be sure to read through this manual before handling and crimping; keep it at the place where a person who handle the connector and adjust the tool can check it when required.

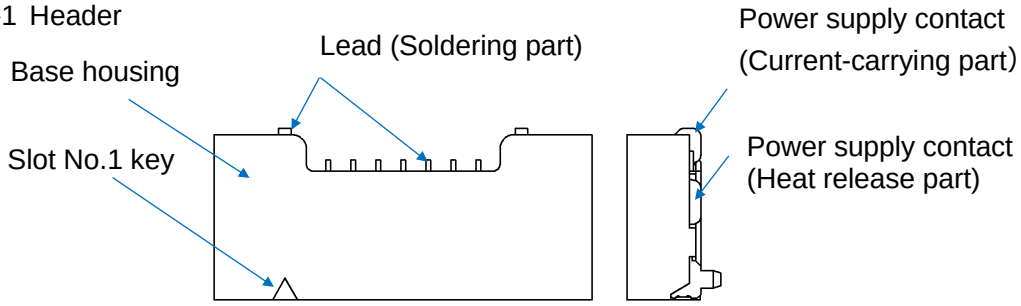
C O N T E N T S

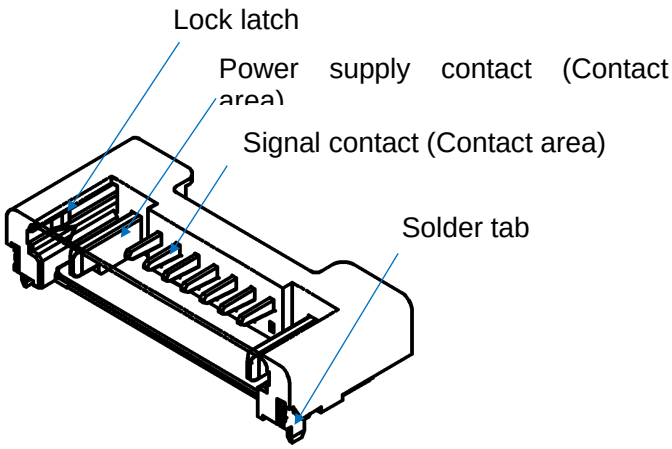
1. Part Name and Model Number

Part name		Circuit No.	Model No.
Socket	Housing	3	LBTAR-03V-2K-K(HF)
		5	LBTAR-05V-2K-K(HF)
		7	LBTAR-07V-2K-K(HF)
		9	LBTAR-09V-2K-K(HF)
	Signal contact	---	SSH-003T-P0.2-H
	Power supply contact	---	SLBTAD-01T-M0.5
Header		3	SM03B-LBTAKS-TD-N2T-K(HF)
		5	SM05B-LBTAKS-TD-N2T-K(HF)
		7	SM07B-LBTAKS-TD-N2T-K(HF)
		9	SM09B-LBTAKS-TD-N2T-K(HF)

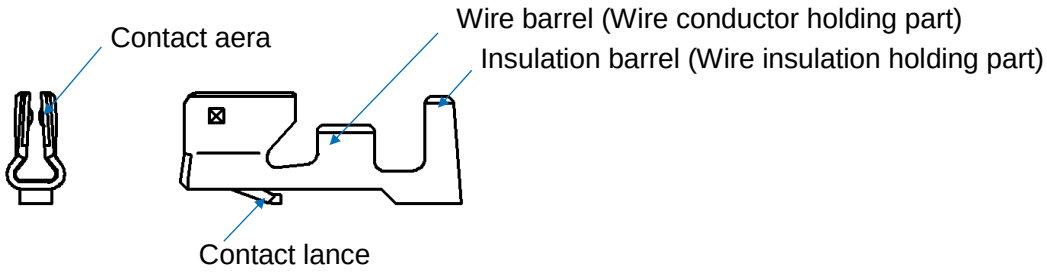
2. Each Part Name

2-1 Header

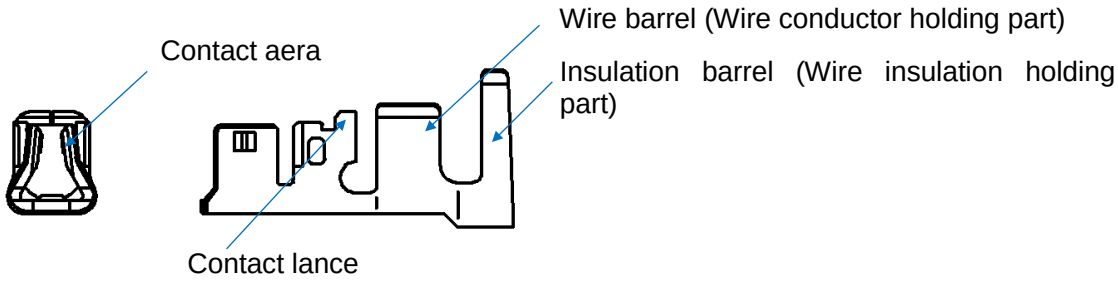




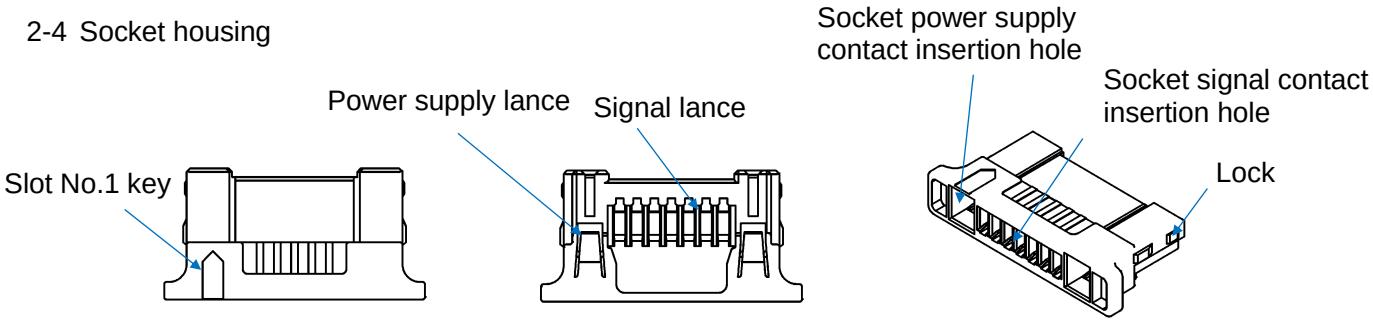
2-2 Socket signal contact



2-3 Socket power supply contact



2-4 Socket housing



3. Storage

3-1 Storing the connectors

Recommended storage condition: Temperature: 5 – 35 ˚C, Relative humidity 60 % or less
(Under packaging like the state of JST shipment)

Keep off direct sunlight, places exposing to such corrosive gas as industrial gas (generate from a stove and whatnot) and ammonia gas (generate from a toilet and whatnot) and dusty place.
After unpacking, return the products in the original package to store.

3-2 Storing the crimped contacts

Not leaving the crimped contact to stand in a place exposed to high humidity and direct sunshine, and not placing them directly on the ground. Keep them in a clean storage room.

4. Applicable Wire

Type of contact	Applicable wire size	Wire insulation O.D.	Conductor
Socket signal contact	AWG#28	ϕ0.6 ~ 0.8	Annealed copper stranded wire with tin plating
Socket power supply contact	AWG#24~20	ϕ1.11 ~ 1.44	Annealed copper stranded wire with tin plating

Note$_1$: Special wires such as bare ones, solid ones, tin-coated ones and shielded ones other than the above ones cannot be used in principle.

5 Crimping Tool

	Part name	Model No.
Socket signal contact	Semi-automatic press	AP-K∗
	Applicator	MKS-L-10-3
	Die	MK/SSHL-003-02
	Applicator with die	APLMK SSHL003-02
Socket power supply contact	Semi-automatic press	AP-K∗
	Applicator	MKS-L
	Die	MK/SLBTAD-01-05
	Applicator with die	APLMK SLBTAD01-05

Note$_2$: A figure or an alphabet come into an asterisk. (e.g.) AP-K2N, AP-K2
Note$_3$: When crimping operation is conducted by using other than the above applicator and die set, JST cannot guarantee the connector performance.

6. Check Points of Crimping Operation and Harness Assembly

Crimping and assembly operations affect the reliability of the connector.
We recommend that crimping and assembly operations and finished products are controlled concentrating upon the following check points:

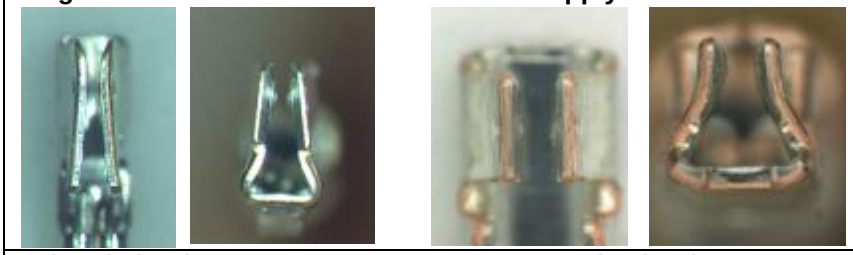
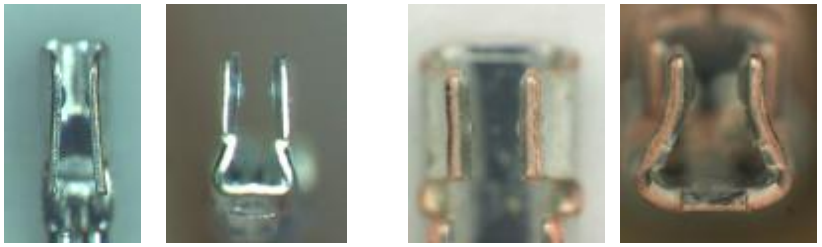
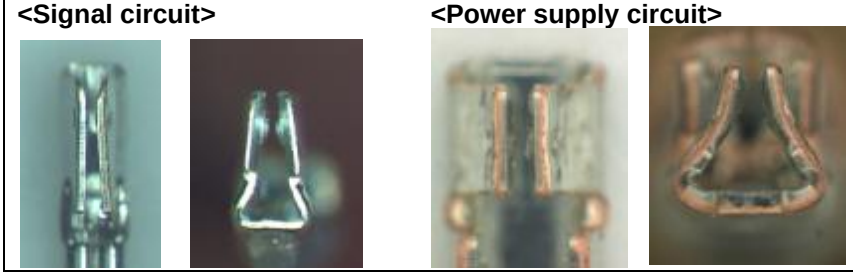
Process	Check point	Description
Crimping	Appearance	① Check that the model Nos. of the contact and the applicator are adequate for wire to be used. ② Check that wires are crimped at the normal position. ③ Check that the crimping configuration is normal and excessive burr does not appear. ④ Check that 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
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 that the housing is free from dirt and foreign matters.
Finished product (Harness)	Appearance	① Follow all descriptions stated above in “Appearance.”

Note$_4$: The LBT connector contact is designed to be slim and compact to meet the demand for narrow pitch and space saving.
We recommend using a microscope or a loupe at appearance inspection.

7. Example of Defective Crimping and Adjustment Points
Defects shown here to serious performance defects such as poor contact of the connector. At the time of the operation start, be sure to inspect the appearance of the contact and check no abnormality.

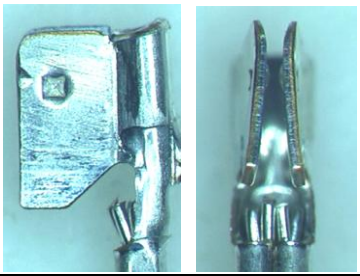
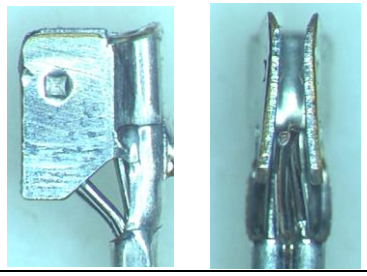
7-1 Deformation of contact part

Defective example: Deformation of mating part

<Signal circuit> **<Power supply circuit>** 	-Proper crimping-
<Signal circuit> **<Power supply circuit>** 	-Too wide mating part- Due to insufficient contact pressure, electrical discontinuity may be caused.
<Signal circuit> **<Power supply circuit>** 	-Too narrow mating part- It may cause the collision with the header contact.

Compare the configuration of the contact-contacting part before and after crimping and check no abnormality shown above.

Cause of deformation: Protruded wire conductor length

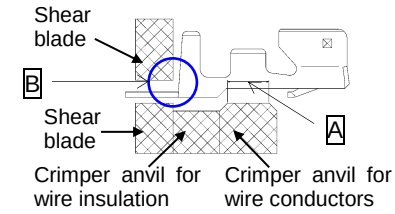
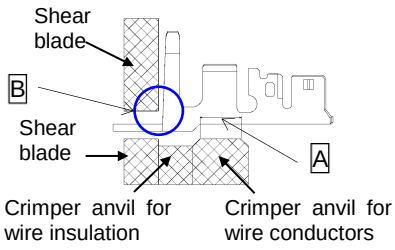
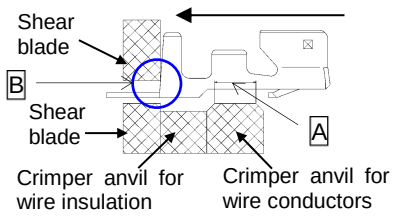
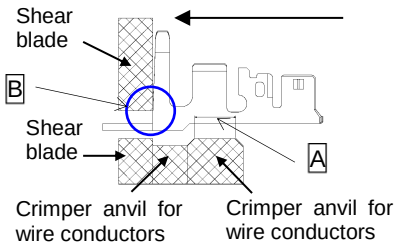
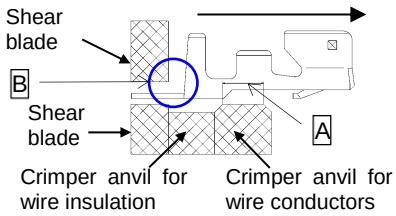
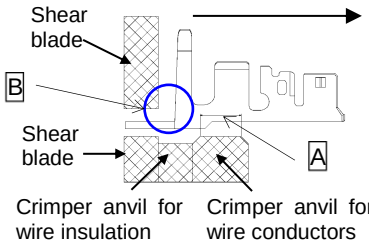
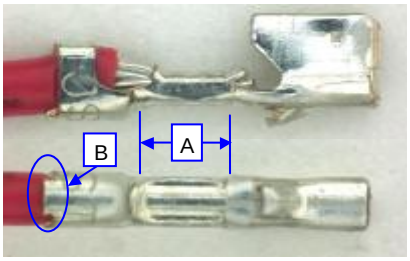
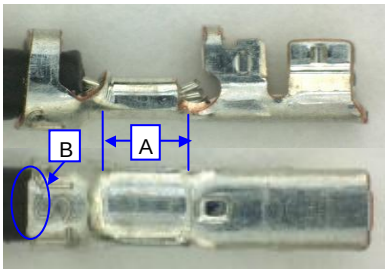
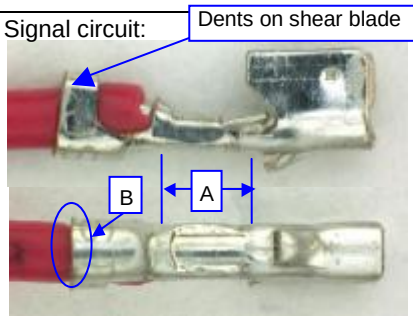
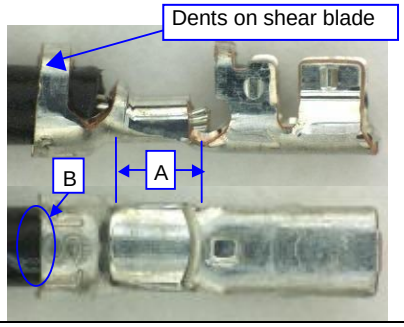
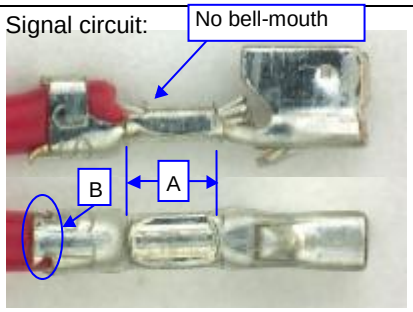
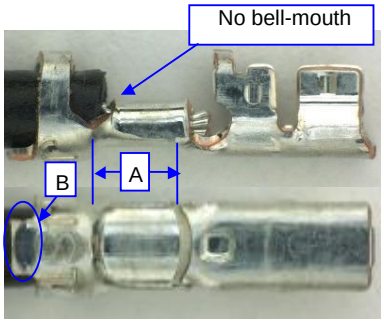
Proper crimping	Improper crimping (Too wide mating part)
	

When protruded wire conductor length is long as shown above, the mating part of the contact is clogged with wire conductors, so that the mating part is widened.
In such cases, adjust protruded wire conductor short like proper crimping product.

- When a scratch is observed on the tip of the protruded wire conductor and the back of the contact beam even if the mating part is not clogged with wire conductors like defective example, same adjustment is required because wire conductors may deform the mating part.
- When wire conductors come in contact with the outside of the mating box part, the mating part may be deformed narrowly.

7-2 Deviation of crimping position

Improper adjustment of crimping position may cause such a defect as contact deformation.

Proper crimping position	Improper crimping position	
	Crimping at crimping part side	Crimping at mating part side
Signal circuit:  Power supply circuit:  	Signal circuit:  Power supply circuit:  	Signal circuit:  Power supply circuit: 
Signal circuit:  Power supply circuit:  	Signal circuit:  Power supply circuit:  	Signal circuit:  Power supply circuit: 
A: Crimping range of wire Crimping range A (crimping	A: Crimping range of wire Crimping range A protrudes towa	A: Crimping range of wire There is few bell-mouth at this side (crimping part side). The barrel edge may damage wires.
B: Cut-off tab Cut-off tab must be visible.	B: Cut-off tab Cut-off tab cannot be visible. In this case, wire insulation barrel shear blade, so that the	B: Cut-off tab Cut-off tab is too long. In this case, when the contact is inserted into the housing, cut-off tab comes out. So, it come in contact with other parts.

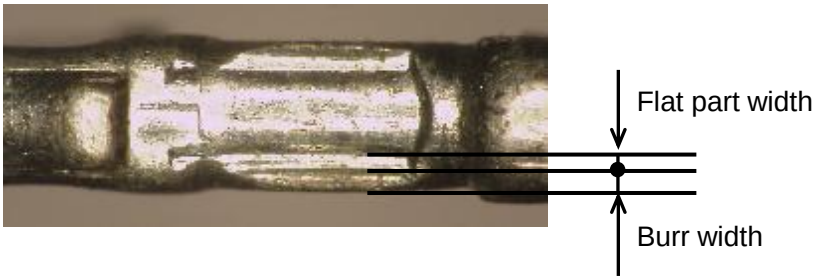
7-3 Abrasion of crimping die

In order to prevent electrical discontinuity from cracks due to abrasion of the crimping die, check the appearance of the crimping part and replace the die with the new one periodically.

- Replacement timing of crimping die

① The size of burr exceeds the following condition in the appearance at the underside of wire conductor crimped part.

Appearance at underside of wire conductor crimped part



Replacement timing of crimping die:

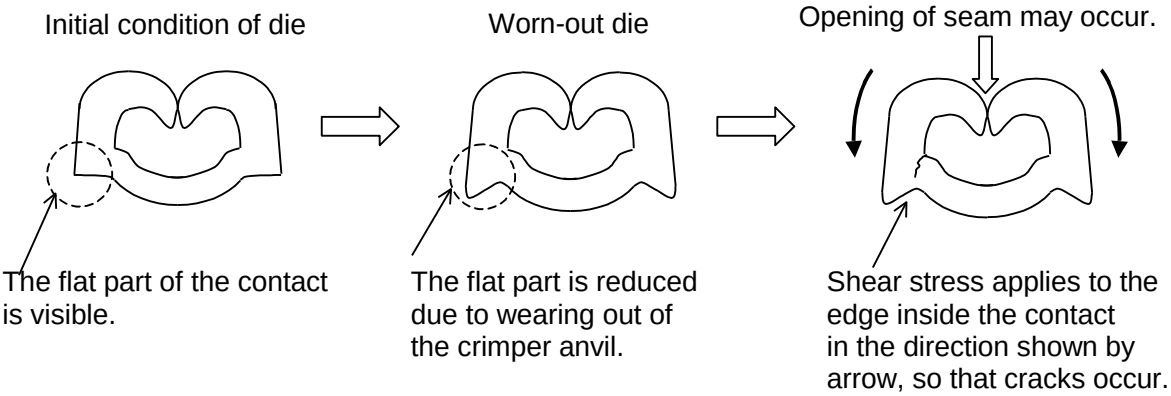
$$\frac{\text{Burr width}}{\text{Flat part width + Burr width}} > \frac{1}{3}$$

② When the surface of the contact-crimping part is too rough.
(Gloss of the contact surface disappears.)

③ When the seam opens. (See figure below.)

Note$_5$: In the case that crimping is conducted beyond the reference timing, cracks may appear on the contact as shown below.

- Mechanism of occurrence of crack (Cross section at wire conductor part)



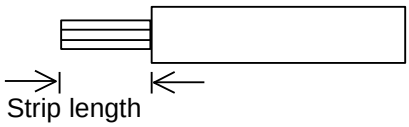
8. Crimping Operation

Before crimping operation, be sure to check the combination of the contact, wires and the crimping die are correct.

8-1 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 wire type and crimping method, decide the best wire strip length considering the processing condition. When wires are stripped, do not damage or cut off the wire conductors.

Type of contact	Reference value of wire strip length
Socket signal contact	1.5 mm
Socket power supply contact	2.0 mm



Note$_6$: Do not leave the stripped wire for a long time, because the oxidation of the conductor surface makes progress, which may cause the variation of the contact resistance.
After stripping, complete crimping operation quickly.

8-2 Crimp height

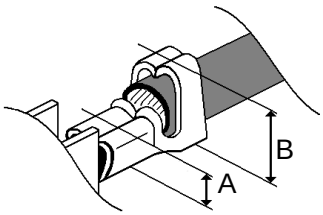
Depending on wires, adjust the dial of the applicator to a proper crimp height as follows.

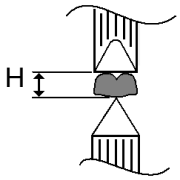
Note$_7$: The crimp height at the wire insulation part is a reference value.
The crimp height at the wire insulation part depends on the wire insulation O.D. and the material, so set the crimp height at the wire insulation part according to item 8-2-4 Check of crimping condition at the insulation barrel.

Type of contact	Wire		Crimp height (mm)		
	Size	Insulation O.D.	Conductor part		Ref. value at insulation part
			Target	Range	
Socket signal contact	AWG#28	ϕ0.6mm	0.44	0.43~0.47	(0.95)
		ϕ0.8mm	0.44	0.43~0.47	(1.00)
Socket power supply contact	AWG#24	ϕ1.11mm	0.80	0.75~0.85	(2.00)
		ϕ1.43mm			(2.10)
	AWG#22	ϕ1.26mm	0.85	0.80~0.90	(2.05)
	AWG#20	ϕ1.44mm	0.90	0.88~0.95	(2.10)

The crimp height of the socket power supply contact shall be 2.10 mm max.
(Because it may affect the contact retention force)

8-2-1 Measurement of crimp height





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

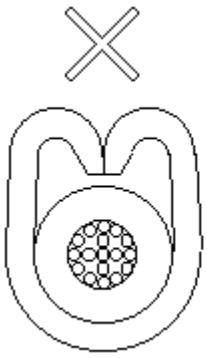
B: Adjust the crimp height at the wire insulation barrel to the extent that the wire insulation is slightly pressed, and set it so that crimping is not excessively.

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

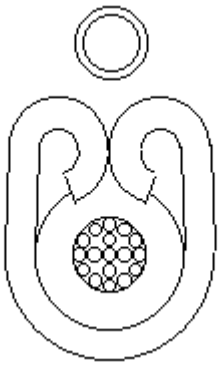
8-2-2 Measurement timing of crimp height

① When the operation starts at morning and afternoon, starts after pausing and finishes.
② When the contact reel is exchanged.
③ When the crimping applicator is adjusted. (When trouble)
④ When the crimping dies are exchanged.

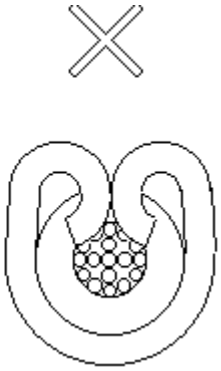
8-2-3 Crimping condition at the insulation barrel



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



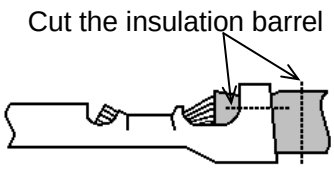
Good

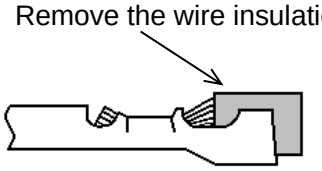


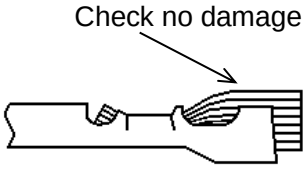
Excessive crimping
(pressed excessively)
The barrel bites the wire too much and may damage the wire conductors.

8-2-4 Check of crimping condition at the insulation barrel

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







8-3 Tensile strength at the 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. Tensile strength may be different even in the same wire size due to the difference in wire strength.

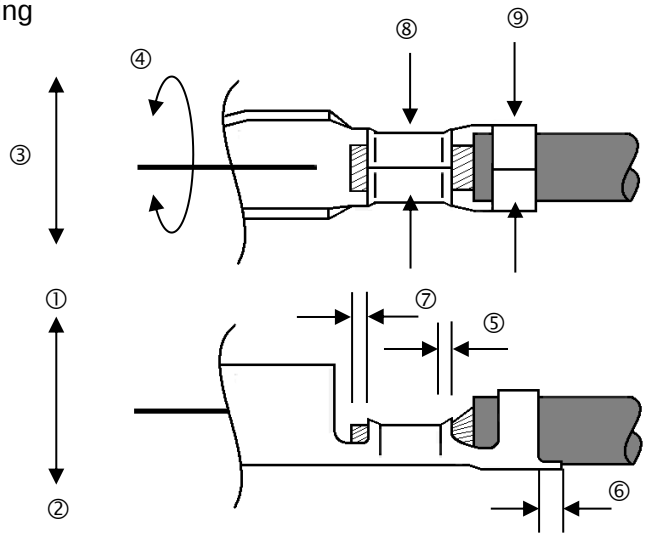
UNIT: N

Type of contact	Wire size	Requirement	Actual value
Socket signal contact	AWG#28	10 min.	20 ~ 28
Socket power supply contact	AWG#24	20 min.	50 ~ 58
	AWG#22	30 min.	79 ~ 85
	AWG#20	40 min.	108 ~ 115

8-4 Crimping appearance

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

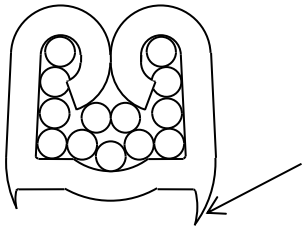
Names after crimping



Item		Reference value	
		Socket signal contact	Socket power supply contact
①	Bending up	8° max.	3° max.
②	Bending down	5° max.	3° max.
③	Twisting	5° max.	3° max.
④	Rolling	5° max.	3° max.
⑤	Bell-mouth	0.05 ~ 0.25 mm	0.1 ~ 0.25 mm
⑥	Cut-off length	0.05 ~0.3 mm	0.05 ~0.3 mm
⑦	Protruded wire conductor length	0.1 ~ 0.5 mm	0.1 ~ 0.5 mm
⑧	Crimp width at conductor part	Approx. 0.7 mm	Approx. 1.6 mm
⑨	Crimp width at insulation part	0.8 mm max.	2.0 mm max.

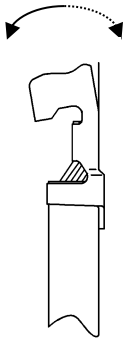
Check that the mating part and the contact lance part are free from deformation.

8-4-1 There must not be large burr or one-sided burr.

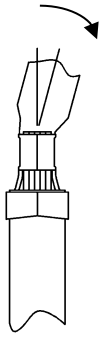


8-4-2 Examples of defective crimping

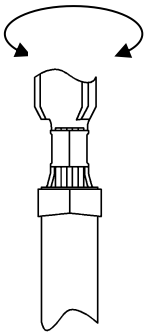
Bending-up/down



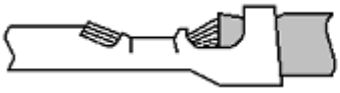
Twisting



Rolling



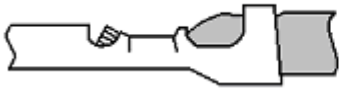
8-4-3 Examples of defective crimping



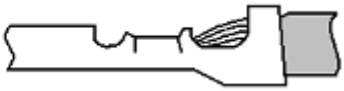
Long protruded wire brush

Short protruded wire brush

Stray wire conductors



Bitten wire insulation with wire barrel



Poor crimping on wire insulation

8-5 Precautions for crimping operation

① Conduct crimping operation properly and inspect the crimping appearance of the crimped product with a microscope or loupe.

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

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

④ As abrasion of the crimping die and insufficient adjustment of the applicator may cause defective crimping appearance, do not fail to conduct daily inspection.

⑤ When crimping operation is conducted with the wire holding spring damaged or extracted, wire conductors come off or the wire barrel bites the wire insulation.

8-6 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

8-7 Precautions for the handling of the crimped contact

As the crimped contact before inserting into the housing is subject to deformation by external forces because they are exposed, pay careful attention to the following points for the handling:

① Protect the contacts by wrapping with thick paper to prevent from damages, deformation and adhesion of foreign substances, and keep them in an adequate box.

② Do not stack too much quantity of the crimped contacts nor place anything on them, because the weight of themselves may cause the contact deformation, poor contacting and other troubles.

③ Do not stain the contact with household goods such as oils, detergent, seasoning and fruit juice. If stained, never use the stained contact.

④ Do not use the improperly crimped contact and the deformed one (such as contact lance and mating part).

⑤ When the crimped contact is taken out of the bundle, do not pull the wires as much as possible but hold ones near the crimped section and take them out.

9. Harness Assembly Operation

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

9-1 Before inserting the crimped contact into the housing

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 such a stained contact.

③ Do not use the improperly crimped contact and the deformed one.

④ Rough handling of the crimped contacts at bundling may cause the deformation.

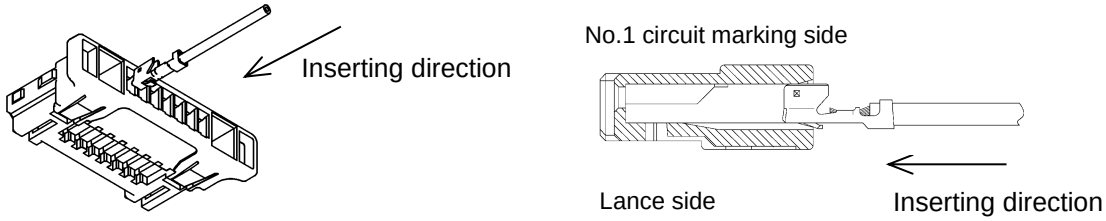
⑤ When a bundle of the crimped contacts are loosened, do not pull the crimped contacts by force even if they get entangled.

⑥ When the harness is tied up in a bundle, do not apply any tension to the both-sided wires.

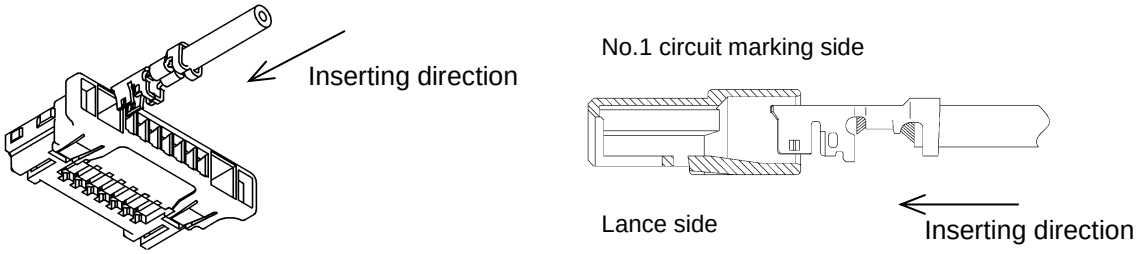
⑦ In order to prevent cracks and deformation of the housing, do not apply a strong load and shock to the housing.

9-2 Inserting the contact into the housing

① Orient the contact lance to the housing lance and insert the contact straightly into the insertion hole of the housing.

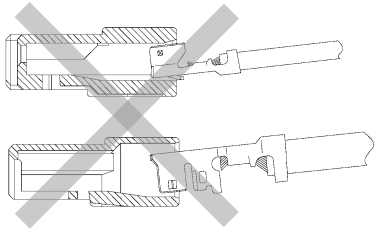


Inserting the socket signal contact

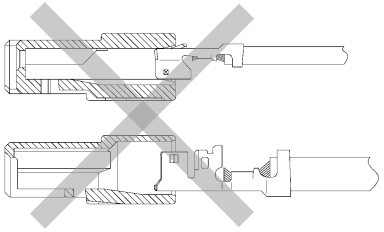


Inserting the socket power supply contact

Note$_8$: Do not insert the contact with prying, diagonally, or in reverse, because insertion defect, deformation or electrical discontinuity may be caused.

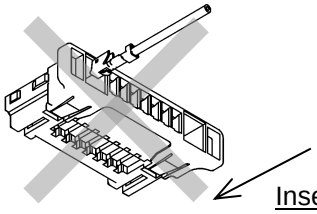


Prying insertion & diagonal insertion

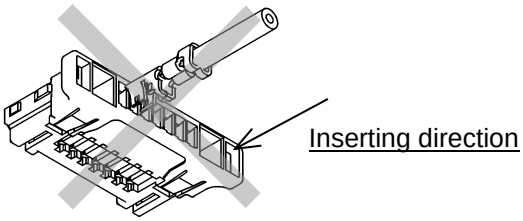


Reverse insertion

Note$_9$: Do not insert the contact into an improper hole such as inserting the socket signal contact into the hole of the socket power supply one or inserting the power supply contact into the hole of the signal one, because insertion defect, deformation and electrical discontinuity may be caused.



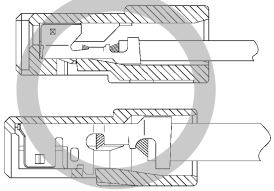
Inserting the signal contact into the hole of the power supply one



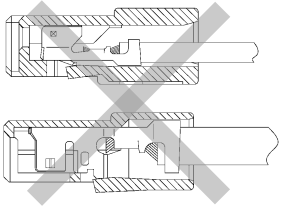
inserting the power supply contact into the hole of the signal one

② Insert the contact into the housing without stopping to innermost.
When the contact is fully inserted into the housing, the housing lance clicks and there is feeling of response. If it is difficult to insert the contact into the housing, do not insert it into the housing by force but check the direction of the contact and make sure whether the contact and housing are free from abnormalities.

③ Check secure locking by pulling wires so softly that they do not cut and make sure that the contact does not come off the housing whenever the contact is inserted into the housing.
Besides, as shown in the figure below, check that the contact lance securely engages with the housing one. Do not pull wires too much, because the housing may be broken or the wires may cut.



Good



Insufficient insertion

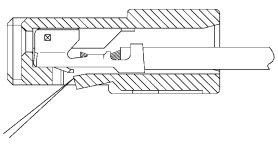
9-3 How to extract the crimped contact from the housing in case of mis-insertion

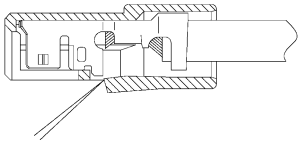
When the contact is inserted into an improper circuit hole, conduct the following points:

① Raise the housing lance by a sharp-pointed tool shown below, and release the lock.

② Pull wires softly to pull the contact out.

Note$_{10}$: Do not reuse the housing which lance has been raised but use a new one.
As a rule, do not use the contact extracted from the housing but a new one. If the extracted contact is reused by some reasons, the reuse is just once. Check whether the contact is free from damage when it is extracted.

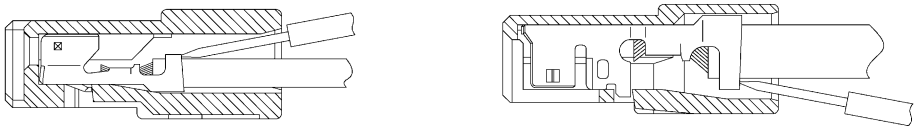




10. Inspection of Finished Product (Continuity Check)

① In case of simple wiring inspection by a tool such as tester

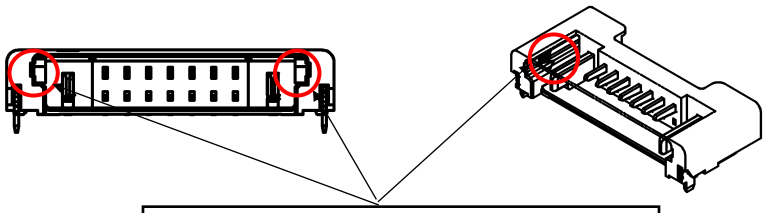
- Do not insert the tester stick into the mating part, because the mating part may be deformed.
- In the inspection, gently touch the tester stick to the insulation side of the contact from the contact insertion hole.



② In case of wiring inspection by using an inspection jig, pay attention to the following points.
Use the header applicable to the connector at the inspection. (Refer to the table below.)

Circuit No.	Model Number of socket housing	Model number of applicable header
3	LBTAR-03V-2K-K(HF)	SM03B-LBTAKS-TD-N2T-K(HF)
5	LBTAR-05V-2K-K(HF)	SM05B-LBTAKS-TD-N2T-K(HF)
7	LBTAR-07V-2K-K(HF)	SM07B-LBTAKS-TD-N2T-K(HF)
9	LBTAR-09V-2K-K(HF)	SM09B-LBTAKS-TD-N2T-K(HF)

At the inspection, we recommend using the header mounted on a PC board with the lock latches removed.



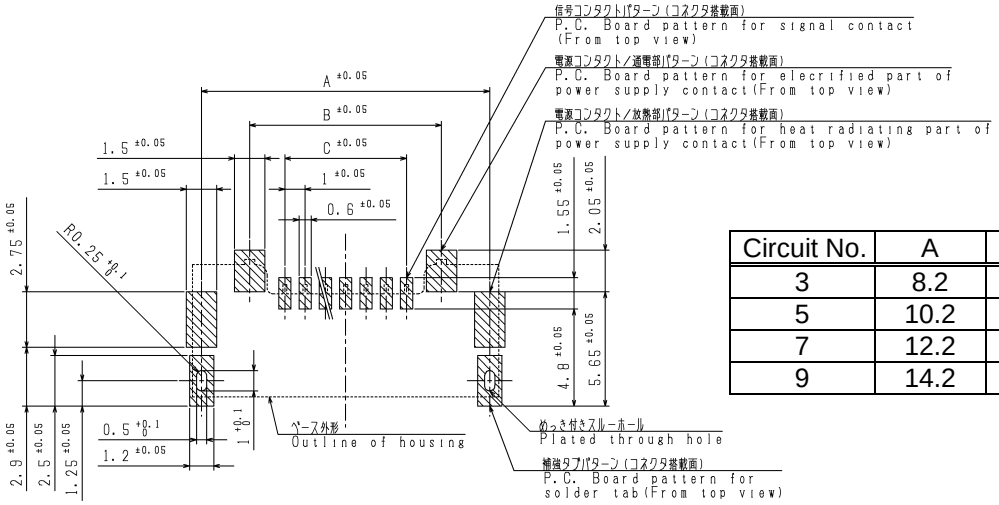
- Check that the header housing and the header contact are free from deformation, damage and stains. When they are found, replace them with the new ones at once.
  Periodical replacement of the header should be conducted as well.

- Mate and unmate the connector with care so as not to pry.
  When the inspection board is used, design it so that the mating/unmaitng operation is smoothly conducted.

11. Header

11-1 Recommended PC board pattern

We recommend the following PC board layout.
This header power supply contact has heat release part and current-carrying part.
To prevent short circuit, do not connect the pattern of the heat release part with other circuits' pattern (such as Vcc, GND) or do not connect the pattern of the heat release part with each other.



Circuit No.	A	B	C
3	8.2	3.45	---
5	10.2	5.45	2
7	12.2	7.45	4
9	14.2	9.45	6

11-2 Reflow soldering method

We request soldering through a reflow temperature profile (using 1.6mm thick glass-base epoxy resin PC board) at a temperature lower than the temperature profile of the reflow soldering shown in item Resistance to Soldering Heat of the product specification (T-1-2540).
As recommended reflow temperature condition depends on soldering material, such as solder paste, solder the connector according to soldering material.
If bridge appears during reflow soldering and soldering repair is conducted by soldering iron, do soldering according to the next item (11-3).

Blister in reflow soldering

Heat-resistant resin is used for the material of the header housing, but 'blister' may generate on the outer surface of the housing during the process of reflow soldering, depending on the condition of water absorption in the header housing and the condition of reflow soldering. However, 'blister' does not bring out physical property change of the resin, not affecting the performances of the connector.

11-3 Manual soldering and soldering repair

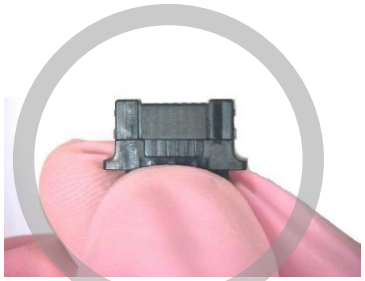
When you solder by using a soldering iron or repair soldering due to troubles, such as bridge, keep in mind the following points, because it is considered that the header housing may be affected by heating.

Soldering iron:	Use a soldering iron with smaller heat capacity (40W max.). The temperature of the soldering iron: 350 °C
Soldering time:	Do soldering quickly within 3 seconds.
Soldering method:	Do not push the tip of the soldering iron on the lead part nor apply any abnormal force such as lateral load. Do not touch the tip of the soldering iron to the header housing during soldering. If done, dismount and replace the connector. Do not reuse the dismounted connector.

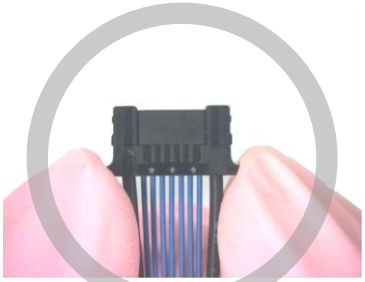
12. Mating and Unmating Connector

12-1 How to hold the connector

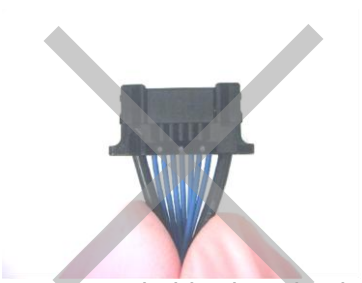
In inserting:
In inserting the connector, hold the housing and all wires together at the top and the bottom or push the housing knob straightly in the mating direction.
Do not insert the connector under the condition that wires are collected and held at the center in the pitch direction, because breakage, deformation and the mating defect of the connector may be caused.



Hold wires at the top and the bottom.

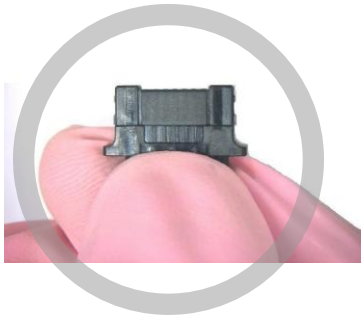


Push the housing knob.

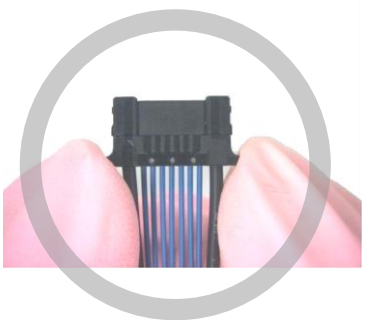


Do not hold wires in the pitch direction.

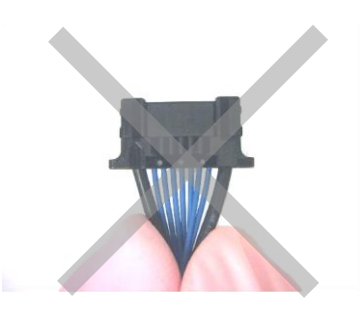
In withdrawing:
In umating the connector, hold the housing and all wires together at the top and the bottom or straightly unmate the housing knob in the mating direction.
Do not unmate the connector by the following method, because deformation, breakage and the unmating defect of the connector may be caused:



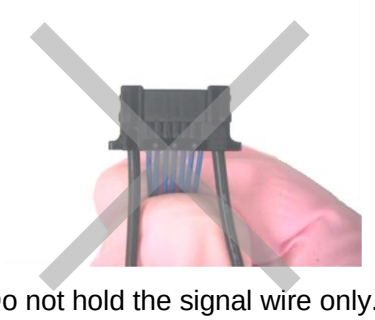
Hold wires at the top and the bottom.



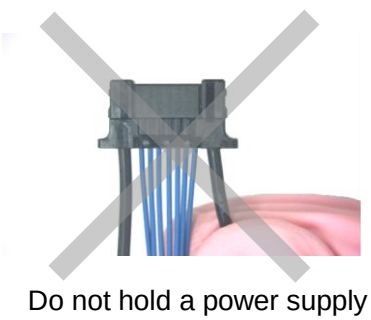
Hold the housing knob.



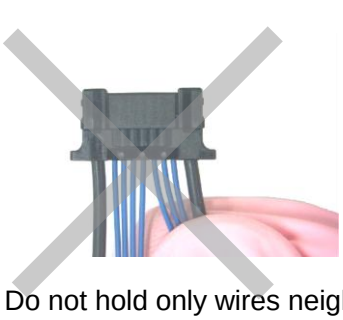
Do not hold wires in the pitch direction.



Do not hold the signal wire only.



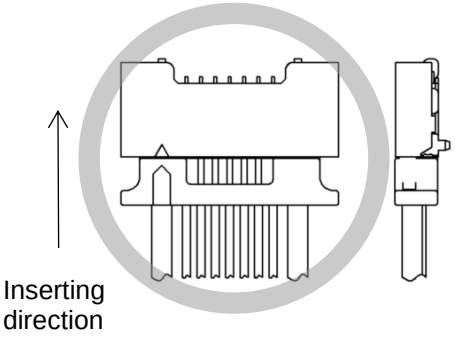
Do not hold a power supply wire at only one side.



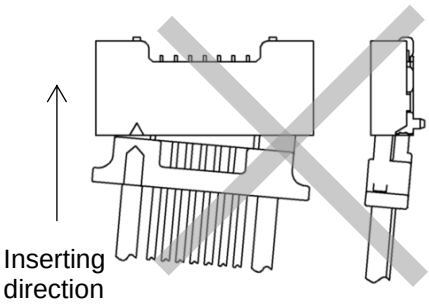
Do not hold only wires neighboring an end circuit at one side.

12-2 Inserting the connector

Insert the socket housing straightly into the header on the mating axis.
Do not insert the connector in the header with prying, because such operation may cause the insertion defect and the contact deformation.

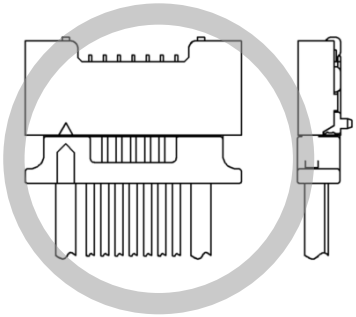


Straight insertion

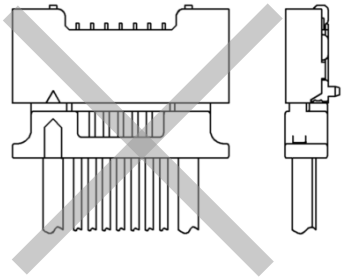


Insertion with prying

After mating, check that there is no clearance between the header and the socket housing.
Inadequate mating condition may cause electrical discontinuity.



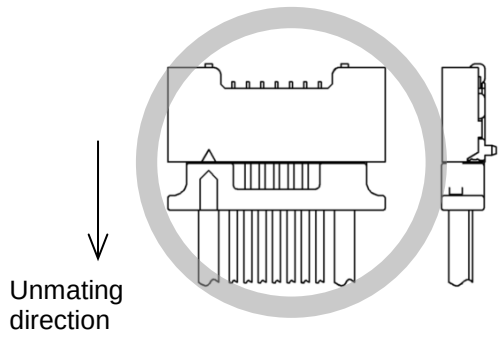
Proper mating condition



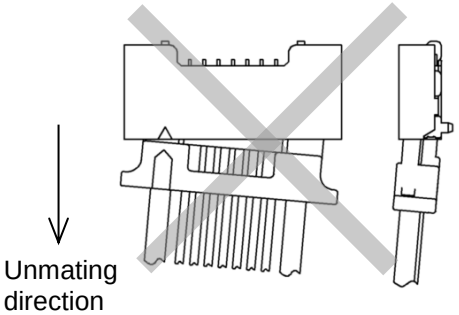
Improper mating condition

11-3 Unmating the connector

Unmate the socket housing in a straight from the header on the mating axis. When the connector's wires are held in unmating, be sure to hold all wires at the top and the bottom.
If all wires are not held in unmating, the wires may break or come off the socket.



Straight withdrawal



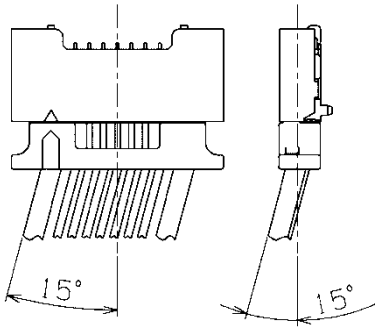
Withdrawal with prying

12-4 Unmating the connector with prying

Do not withdraw the connector with prying, because deformation on the contact or the housing may appear and electrical discontinuity may be caused.

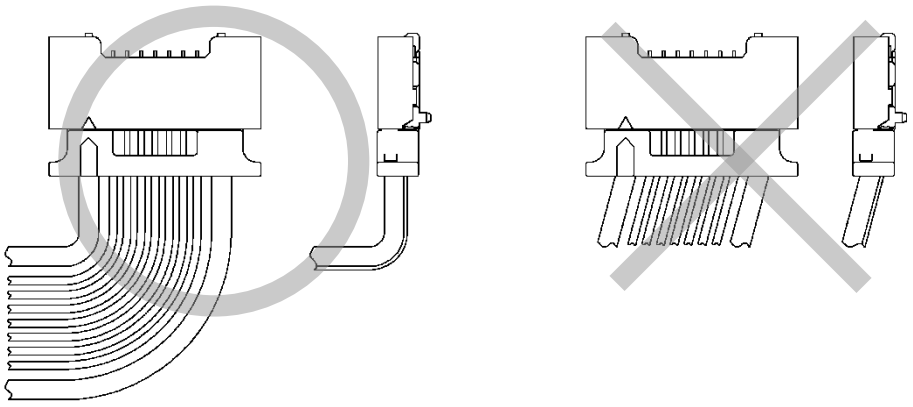
In case that the withdrawing operation of the connector on the mating axis is difficult, please take note of the following points:

- The angle of withdrawing the connector should be less than 15 degrees.
- Even though the angle to withdraw the connector is less than 15 degrees, do not withdraw the connector with prying several times.
- When holding the wire, the load to withdraw the connector should not concentrate to a wire of any circuits.
- Withdraw the connector slowly.
- Please check carefully without fail whether the contact and the housing are free from any abnormalities, such as deformation, when withdrawing the connector with prying.



12-5 Handling of wires

Do not apply to the connector at all times an external load other than tension and a load stemmed from natural wire handling. In handling the wires, take a consideration, such as keeping enough wire length and fixing wires so as not to apply an external tension to the connector and wires.
If tension applies to the connector and wires, the contact contacting part and the soldering part are damaged, which may result in electrical discontinuity.



Natural wire handling　　Handling applying tension to the connector and wires

13. Handling Precautions

① Never spray an insecticide in the storage room of the crimped contacts, because rust may appear on them.

② According to the direction, “THIS WAY UP” printed on the labeling surface of the product box of the contact reel, lay the reel during the storage and transportation.

③ Fasten the tip of the remaining chain contact with wire, string, etc. to the reel so as not to unravel, and store it in a carton box.

④ Be careful of the following items in electrical continuity inspection.

Do not insert a foreign substance such as a tester into the mating part.
Do not conduct mating/unmating operation of the connector with prying.

⑤ Do not mate the socket with the deformed header, because the housing may be damaged or the contact may be deformed.

⑥ This connector has the slim design to fulfil low profile and space saving. Therefore, do not apply any external loads, such as repeatedly loading and other shock, to the connector, because the connector is broken and deformed, which may result in the deterioration of the connector function.