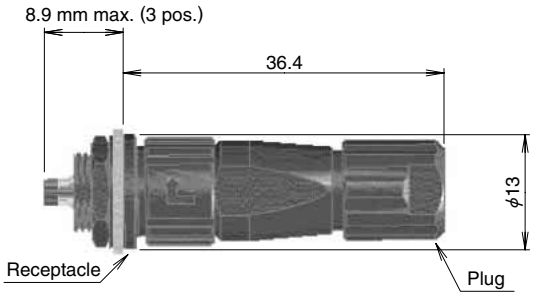
Miniature Waterproof Shielded Connectors

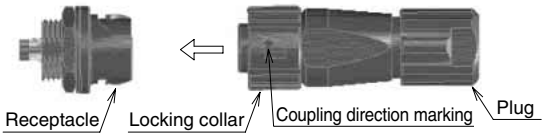
LF Series

Mated dimensions

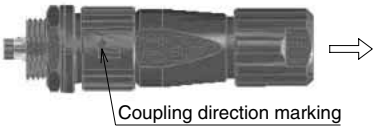


Short turn bayonet lock

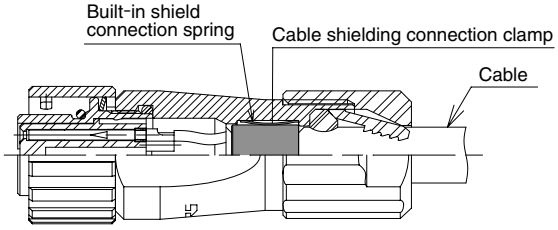
Mating:
Insert the plug, and then turn the locking collar clockwise, as indicated by the coupling direction marking.



Un-mating:
Turn the locking collar counter-clockwise than pull off the plug.



Shielding Connection - Plug



■Features

1. Ease of shielded termination and connector assembly

All components are self-aligning and do not require complex assembly tooling. The shield of the cable is connected with the metal housing of the connector using simple shielding clamp, supplied with the connector.

2. Water and dust protected

IP67 protection rating. Complete protection against dust penetration and against water penetration when mated assembly is submerged at the depth of 1.8 meter for 48 hours.

3. Bayonet lock

Short turn bayonet lock assures secure vibration resistant mating of the connectors.

4. Acquired safety standard

4 pos. is 10A and meets safety standards (TÜV)
Also 3- and 4-pos. have acquired the UL standard.

5. High current rating capacity

Number of contacts	Current rating
3	5A max.
4	10A max.
6, 12 and 20	2A max.
11	10A max. 2A max.

■Product Specifications

Rating	Voltage rating	125V AC, 175V DC (3 pos.) 125V AC, 125V DC (4 pos.) 30V AC, 42V DC (6 pos. , 12pos. , 20pos.) 125V AC, DC (11 pos. A to D) 30V AC, 42V DC (11 pos. 1 to 7)
	Current rating	5A max. (3 pos.) 10A max. (4 pos.) 2A max. (6 pos. , 12pos. , 20pos.) 10A(11 pos. A to D), 2A(11 pos. 1 to 7)
	Operating temperature range	–25℃ to +85℃ (Note 1)
	Storage temperature range	–10℃ to +60℃ (Note 2)

Item	Specification	Conditions
1.Contact resistance	15 mΩ max. (3, 6, 12, 20 pos.) 5 mΩ max. (4 pos.) 5 mΩ max. (A to D), 15mΩ max. (1 to 7)(11 pos.)	1A DC
2.Insulation resistance	1000 MΩ min.	500V DC (3, 4 pos.) 100V DC (6, 12, 20 pos.) 500V DC (A to D), 100V DC (1 to 7)(11pos.)
3.Withstanding voltage	No flashover or insulation breakdown.	1250V AC/one minute (3, 4 pos.) 300V AC/one minute (6, 12, 20 pos.) 1250V AC(A to D),300V AC(1 to 7) / one minute(11pos.)
4.Vibration	No electrical discontinuity for 10μs max.	Frequency: 10 to 55Hz, single amplitude of 0.75mm, acceleration of 98 m/s² for 3 hours in 3 axis.
5.Shock	No electrical discontinuity for 10μs max.	Acceleration of 490m/s², 11ms duration, sine half-wave waveform, 3 cycles in each of the 3 axis.
6.Durability (Mating/un-mating)	30 mΩ max. (3, 6, 12, 20 pos.) 10 mΩ max. (4 pos.) 10 mΩ max.(A to D), 30 mΩ max.(1 to 7)(11pos.)	1000 cycles
7.Temperature cycle	Insulation resistance: 100 MΩ min.	Temperature: -55℃ → Room temperature → +125℃ → Room temperature Time: 30 → 2 to 3 → 30 → 2 to 3 (minutes) 5 cycles
8.Humidity	Insulation resistance: 10 MΩ min. (When temperature high) Insulation resistance: 100 MΩ min. (Dray state)	96 hours at temperature of 40℃ and humidity of 90% to 95%.
9.Water / dust protection	When mated with corresponding connector.	Complete dust protection. No water penetration when submerged for 48 hours at the depth of 1.8 meter.

Note 1: Includes temperature rise caused by the current flow.
Note 2: The term “storage” refers to products stored for long period of time prior to mounting and use. Operating temperature range and humidity range covers non-conducting condition of installed connectors in storage, shipment or during transportation.

■Materials / Finish

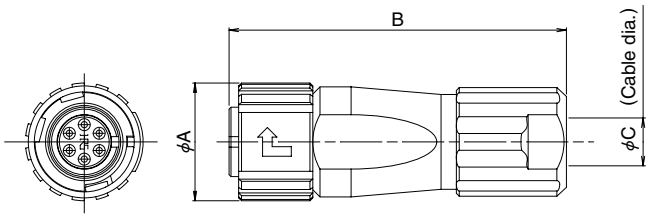
Components	Material	Finish / Color	Remarks
Body / back shell	Zinc alloy	Nickel plated	————
Insulator	PPS	Black	UL94V-0
Contacts	Copper alloy	Gold plated	————
Gasket	Chloroprene rubber	Black	————

■Ordering Information

LF 07 - W B P* - 6 S
❶ ❷ ❸ ❹ ❺ ❻ ❼

❶ Series name		: LF
❷ Shell size		07 10 13
❸ Waterproof		W : Waterproof type
❹ Lock Mechanism		B : Bayonet lock
❺ Connector type		P : Plug R : Receptacle J : Jack (*:Form change zoning symbols in an identical class)
❻ Number of contacts		: 3, 4, 6, 11, 12, 20
❼ Contact type		P : Male contact S : Female contact

■Plugs

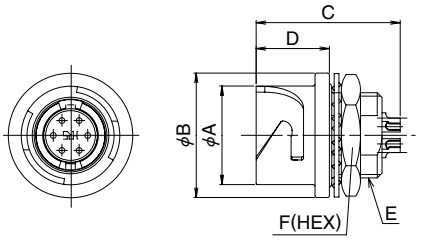


(Shown one example)

Unit:mm

Part number	CL No.	Contact	Number of contacts	ϕA	B	ϕC	Weight
LF07WBP-3S	136-0003-7	Female	3	12.3	35.8	5	11g
LF07WBP-3P	136-0004-0	Male					
LF07WBP-6S	136-0001-1	Female	6				
LF07WBP-6P	136-0002-4	Male					
LF10WBP-4S	136-0005-2	Female	4	14.8	41.8	7.3	17g
LF10WBP-4P	136-0006-5	Male					
LF10WBP-12S	136-0007-8	Female	12				
LF10WBP-12P	136-0008-0	Male					
LF13WBP-20S	136-0009-3	Female	20	17.9	51.9	8.7	29g
LF13WBP-20P	136-0010-2	Male					
LF13WBP-11S	136-0011-5	Female	11				
LF13WBP-11P	136-0012-8	Male					

■Receptacles



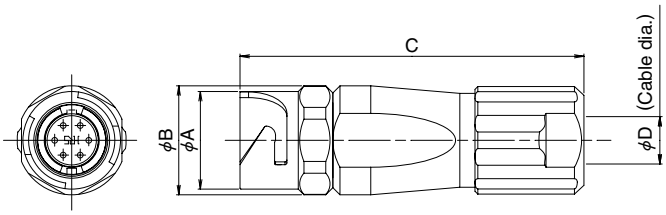
(Shown one example)

Unit:mm

Part number	CL No.	Contact	Number of contacts	ϕA	ϕB	C	D	E	F	Weight
LF07WBR-3P	136-1003-2	Male	3	10.3	13	16.55	7.65	M9×0.75	11	4g
LF07WBR-3S	136-1004-5	Female								
LF07WBR-6P	136-1001-7	Male	6			15.05				
LF07WBR-6S	136-1002-0	Female				15.25				
LF10WBR-4P	136-1005-8	Male	4	12.8	15.3	19.05	7.75	M11×0.75	13	6g
LF10WBR-4S	136-1006-0	Female								
LF10WBR-12P	136-1007-3	Male	12			17.25				5g
LF10WBR-12S	136-1008-6	Female								6g
LF13WBR-20P	136-1009-9	Male	20	15.9	18.3	19.05	7.75	M14×0.75	17	9g
LF13WBR-20S	136-1010-8	Female								10g
LF13WBR-11P	136-1011-0	Male	11							9g
LF13WBR-11S	136-1012-3	Female								10g

Note: Recommended hex nut tightening torque: 1.5 to 2 N·m (3,4,6, and 12 pos.), 2 to 2.5 N·m (11, 20 pos.)

■Jacks

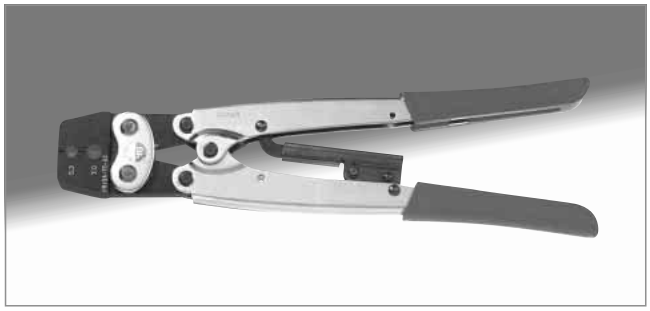


(Shown one example)

Unit:mm

Part number	CL No.	Contact	Number of contacts	φA	φB	C	φD	Weight
LF07WBJ-3P	136-2003-8	Male	3	10.3	11.5	36.3	5	11g
LF07WBJ-3S	136-2004-0	Female						
LF07WBJ-6P	136-2001-2	Male	6					
LF07WBJ-6S	136-2002-5	Female						
LF10WBJ-4P	136-2005-3	Male	4	12.8	13.8	42.4	7.3	16g
LF10WBJ-4S	136-2006-6	Female						
LF10WBJ-12P	136-2007-9	Male	12					
LF10WBJ-12S	136-2008-1	Female						
LF13WBJ-20P	136-2009-4	Male	20	15.9	16.9	52.4	8.7	29g
LF13WBJ-20S	136-2010-3	Female						30g
LF13WBJ-11P	136-2011-6	Male	11					29g
LF13WBJ-11S	136-2012-9	Female						30g

■Applicable tools



Unit:mm

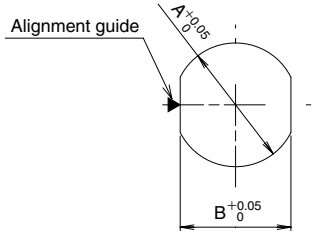
Description	Part number	CL No.	LF series Applicable cable dia.
Manual cable clamp crimp	HR10A-TC-02	150-0041-2	5 (Note)
	LF-TC-01	150-0234-6	7.3 · 8.7

Note: Applicable cable dia. is only 5mm for LF series.

■Solder termination fixture

Part number	CL No.	Applicable connectors
LF07BP-T01	150-0232-0	LF07WBP-6S,6P,3S,3P
LF07BJ-T01	150-0233-3	LF07WBJ-6S,6P,3S,3P
LF10BP-T01	150-0235-9	LF10WBP-4S,4P,12S,12P
LF10BJ-T01	150-0236-1	LF10WBJ-4S,4P,12S,12P
LF13BP-T01	150-0237-4	LF13WBP-20S,20P,11S,11P
LF13BJ-T01	150-0238-7	LF13WBJ-20S,20P,11S,11P

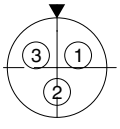
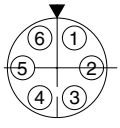
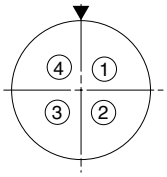
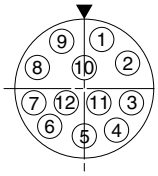
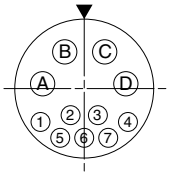
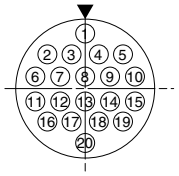
■Panel Cutout



unit (mm)

Shell size	A	B	Panel thickness
LF07	ϕ9.05	8.1	0.7 to 2
LF10	ϕ11.05	10.2	0.7 to 2
LF13	ϕ14.05	13.1	0.7 to 2

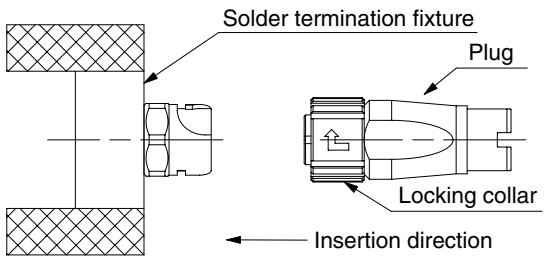
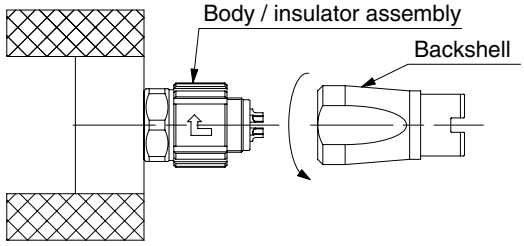
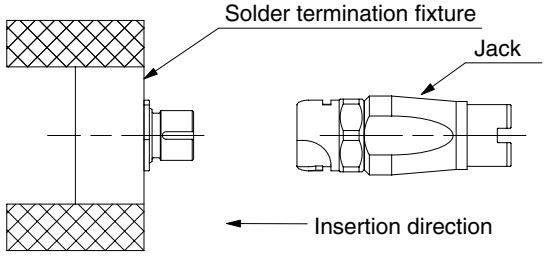
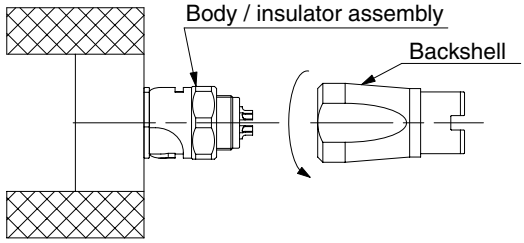
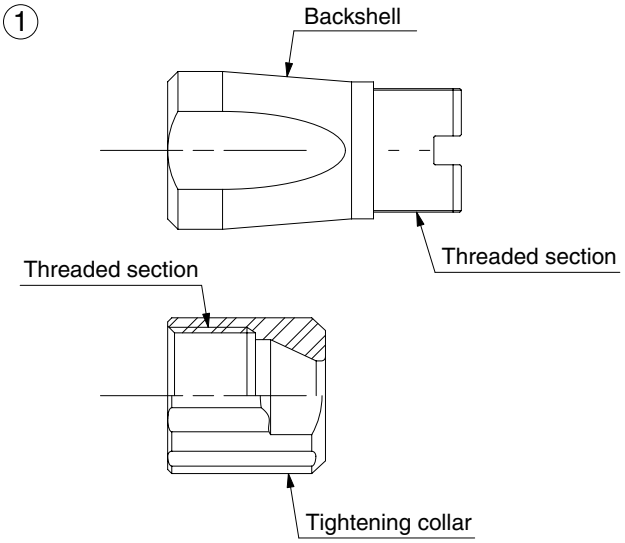
■Contact position arrangement and specifications

Shell size	LF07		LF10		LF13		
Contact configuration							
Number of contacts	3	6	4	12	11		20
Withstanding voltage	1250V AC	300V AC	1250V AC	300V AC	4: AC1250V	7: AC300V	AC300V
Current rating	5A	2A	10A	2A	4: 10A	7: 2A	2A
Insulation resistance	1000MΩ		1000MΩ	1000MΩ	1000MΩ		1000MΩ
Contact resistance	15mΩ		5mΩ	15mΩ	4: 5mΩ	7: 15mΩ	4mΩ
Solder pot inner diameter	1.15mm	0.8mm	1.7mm	0.8mm	4: ϕ1.7	7: ϕ0.8	0.8mm

Note 1: The contact configuration as viewed from the female contact connector mating side.
Note 2: The ▼ symbol indicates polarizing key position.
Note 3: Withstanding voltages are test voltage values.

■Termination and Assembly Instructions

The connectors are delivered with pre-assembed condition and the disassembly as shown No.1.

No.	Illustration	Operation
1	① 	**Plug disassembly** ① Insert the plug into securely held solder termination fixture as shown. Fixture Part No. / Applicable connector LF07BP-T01 / LF07WBP-6S,6P,3S,3P LF10BP-T01 / LF10WBP-4S,4P,12S,12P LF13BP-T01 / LF13WBP-20S,20P,11S,11P
	② 	② Loosen the backshell turning it counter clockwise and remove it from the body/ insulator assembly.
	① 	**Jack Disassembly** ① Insert the jack into the securely held solder termination fixture as shown. Fixture Part No. / Applicable connector LF07BJ-T01 / LF07WBJ-6S,6P,3S,3P LF10BJ-T01 / LF10WBJ-4S,4P,12S,12P LF13BJ-T01 / LF13WBJ-20S,20P,11S,11P
	② 	② Loosen the backshell turning it counterclockwise.
2	① 	**Connector Assembly** ① Apply a coating of Loctite 7649 (Manufactured by Henckel Japan, Ltd,) primer to the threaded sections of the backshell and the tightening collar. Completely dry the coated surfaces. Note (1) Drying time at room temperature is approximately 30 to 70 seconds. (2) Ensure sufficient ventilation of the area at time of drying. (3) Take necessary steps to protect the coated surfaces from contamination.

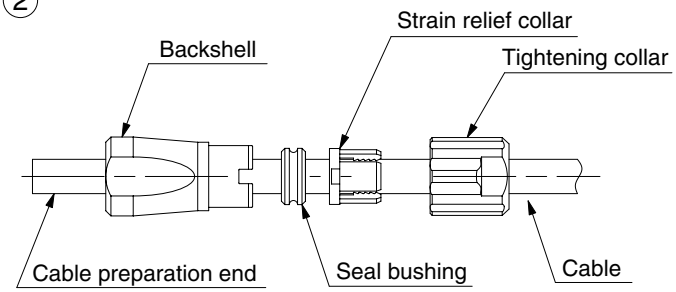
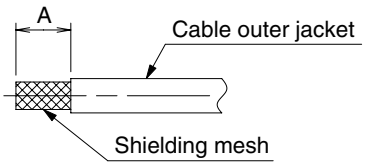
<table>
<tr><th>No.</th><th>Illustration</th><th>Operation</th></tr>
<tr><td>2</td><td>②
 
</td><td>② Thread the tightening collar, strain relief collar, seal bushing and the backshell over the cable as illustrated.</td></tr>
<tr><td rowspan="3">3</td><td>①
 

Table 1. Stripping Dimensions
<table>
<tr><th>Number of Conductors</th><th>A mm</th></tr>
<tr><td>3</td><td rowspan="2">8 to 9</td></tr>
<tr><td>6</td></tr>
<tr><td>4</td><td>13 to 14</td></tr>
<tr><td>12</td><td>14 to 15</td></tr>
<tr><td>11</td><td>22 to 23 (No.A to D)
23 to 24 (No.1 to 7)</td></tr>
<tr><td>20</td><td>23 to 24</td></tr>
</table></td><td>Cable preparation

① Strip the cable's outer jacket to the dimensions illustrated in the table 1.

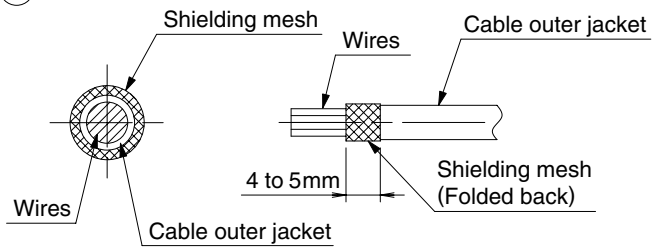
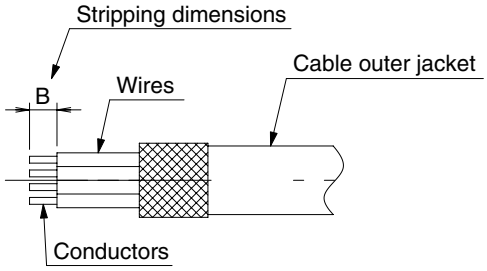
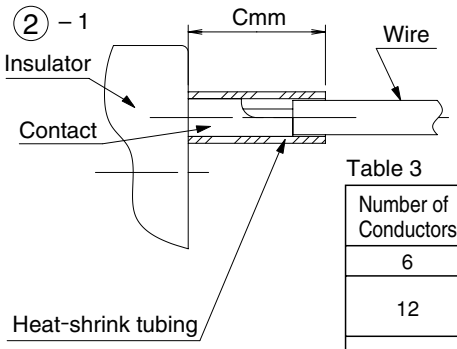
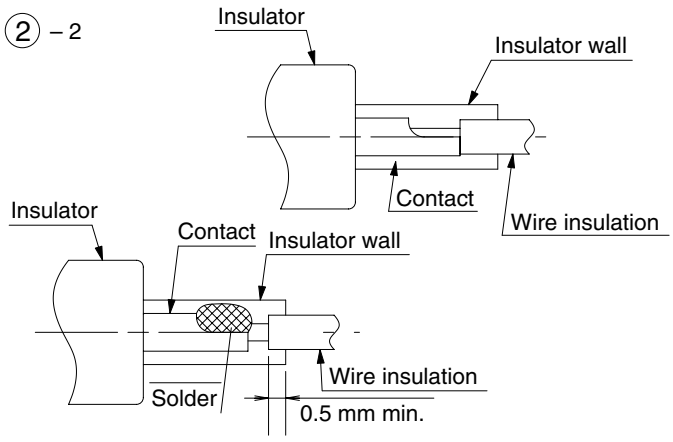
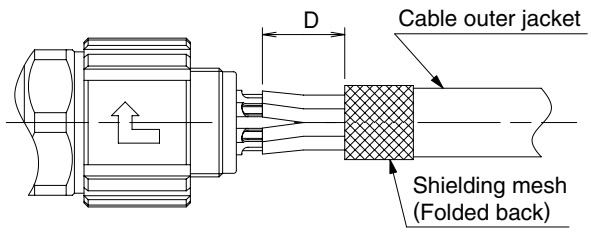
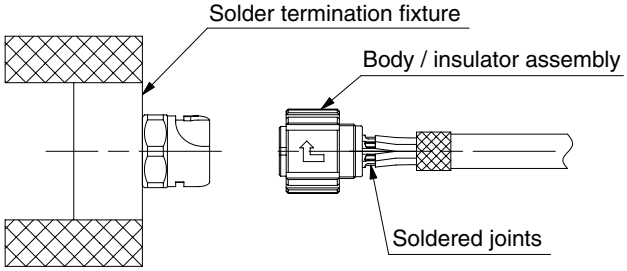
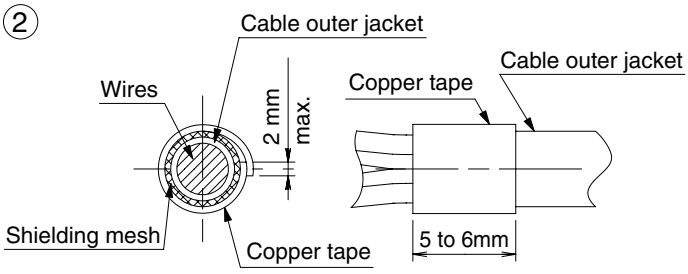
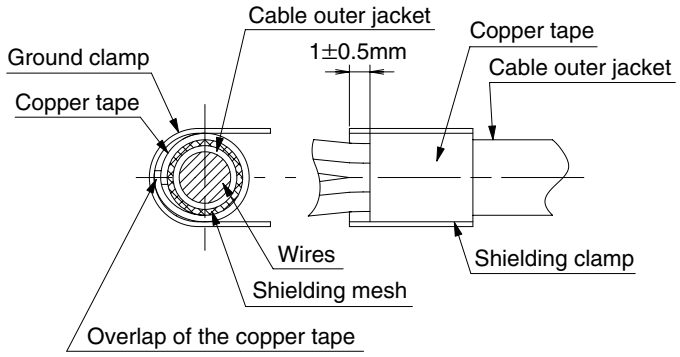
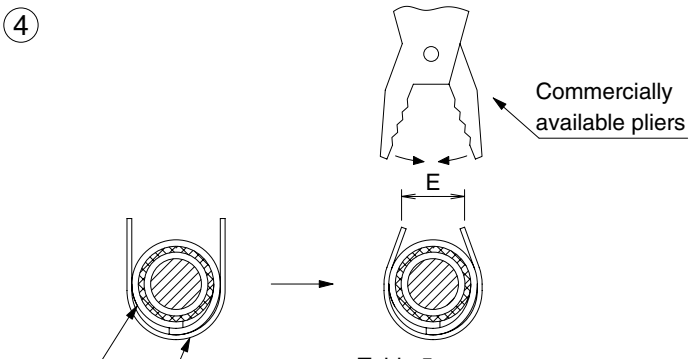
Note
(1) Exercise caution not to damage the shielding mesh.
(2) Any damage to the cable's outer jacket may affect the waterproof performance of the assembled connector.</td></tr>
<tr><td>②
 
</td><td>② Fold back the shielding mesh over the cable's outer jacket assuring that it is uniform on its diameter.</td></tr>
<tr><td>③
 

Table 2. Stripping Dimensions
<table>
<tr><th>Number of Conductors</th><th>B mm</th></tr>
<tr><td>3</td><td>2.5±0.5</td></tr>
<tr><td>6</td><td>2±0.5</td></tr>
<tr><td>4</td><td>3±0.5</td></tr>
<tr><td>12</td><td>2±0.5</td></tr>
<tr><td>11</td><td>3±0.5 (No.A to D)
2±0.5 (No.1 to 7)</td></tr>
<tr><td>20</td><td>2±0.5</td></tr>
</table></td><td>③ Strip the wires to the dimensions illustrated in the Table 2.

Note
When stripping the wires exercise caution not to damage it's insulation, folded over shielding mesh or cable's outer jacket.</td></tr>
</table>

No.	Illustration	Operation
4		**Soldering** ① Soldering conditions Soldering iron tip temperature: 350±10℃ Soldering time: within 5 sec. Note (1) Assure that the solder compound is sufficiently melted on the soldering iron tip. (2) When applying, make sure that the solder will flow correctly at all the contact surfaces between the conductor and the contact.
	② – 1  Table 3 Number of Conductors / Number of contacts / C mm 6 / 1 to 6 / 4 12 / 1 to 9 / 4 12 / 10 to 12 / 6 20 / 1 to 5,16 to 20 / 4 20 / 6 to 15 / 6 11 / 1 to 4 / 6 11 / 5 to 7 / 4	② – 1 6, 12, 20, 11(No.1～7) Conductors (1) Place a heat-shrink tubing (inside diameter of 1.1 mm min.) over every other wire. (2) Perform the soldering of the contact and the conductor, with the wire's insulation touching the contact as shown. (3) After soldering, slide the heat shrink tubing over the soldered joint and shrink it. The tubing should touch the insulator as shown.
	② – 2  	② – 2 3, 4, 11(No.A～D) Conductors (1) Perform the soldering of the contact and the conductor, with the wire's insulation touching the contact as illustrated. (2) When soldering, to maintain the insulation between adjacent contacts. Make sure that the wire's insulation remains below the edge of the insulator's wall 0.5 mm min., as illustrated.
	③  Table 4. Wire Dimensions Number of Conductors / D mm 3 / 6 to 7 6 4 / 10 to 11 12 / 13 to 14 11 / 18 to 19 20	③ After the soldering, keep a distance of D between the contact end and the cable's outer jacket as illustrated. Note The distance of D is required in order to assure correct assembly of the backshell.

No.	Illustration	Operation
5	① 	**Crimping of the Shielding Clamp** ① After completion of the soldering operations carefully remove (holding on the locking collar) the body/insulator assembly from the solder termination fixture. Note Exercise caution not to damage or deform the solder joints.
	② 	② Wrap the folded over shielding mesh with 5 to 6 mm wide copper tape to assure that it will not become loose. Apply the copper tape so that the shielding mesh does not protrude from under it. Note After wrapping the copper tape, the tape should overlap itself by 2 mm max.
	③ 	③ Insert the “U” shaped shielding clamp over the copper tape as shown on the illustration. It is critical that the overlap of the copper tape is located inside the shielding clamp as shown on the illustration. Note When the end of the copper tape wrapping is positioned at the open side of the ground fitting, the end portion of the copper tape wrapping will no longer be covered by the ground fitting when the ground fitting is crimped.
	④  Table 5 Shell size / E LF07: 5mm max. LF10: 7mm max. LF13: 7mm max.	④ Using commercially available pliers bend the open ends of the shielding clamp as illustrated, assuring that it stays in place. The dimension of E. between opposing edges of the shielding clamp is necessary to assure correct final crimp.

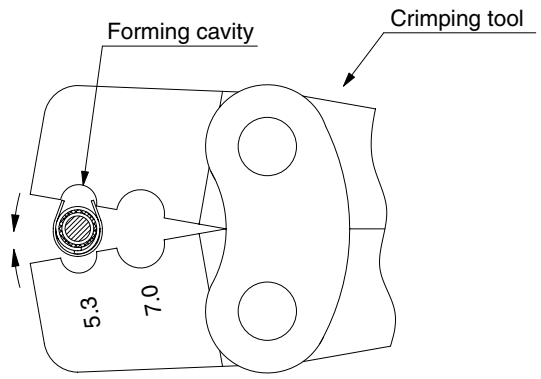
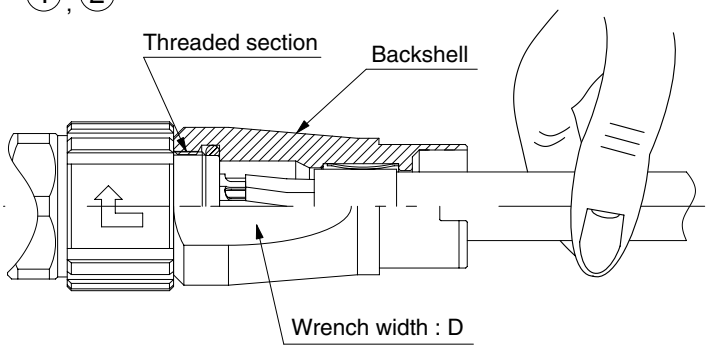
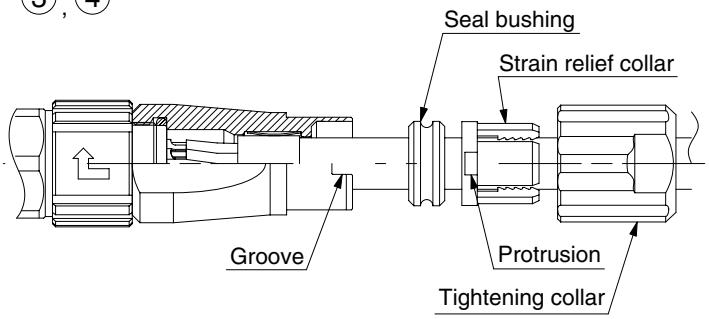
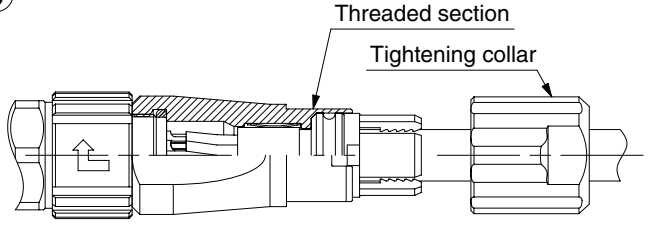
No.	Illustration	Operation
5	⑤ 	⑤ Both sides of the shielding clamp must be placed in the forming cavity of the tool (as shown on the illustration) and crimped over the cable by closing the tool completely.
6	①, ② 	**Connector Assembly** ① Place the body/insulator assembly in the applicable solder termination fixture.
	③, ④ 	③ Slide forward the seal bushing and insert it in the backshell until fully seated. ④ Slide forward the strain relief collar and insert it in the backshell, making sure that the opposing protrusions fit inside the corresponding grooves, as shown on the illustration.
	⑤ 	⑤ Verify that the Locktite 7649 primer (or equivalent) on the threaded sections of the backshell and tightening collar are dry. Apply the Locktite 271 compound to the tightening collar's threaded section and attach it to the backshell.

Table 6

Shell size	Tightening torque	Wrench width
LF07	1N·m～1.5N·m	10mm
LF10	1N·m～1.5N·m	13mm
LF13	1.5N·m～2N·m	16mm

Crimping tool	Forming cavity	Applicable cable diameter	Shielding clamp diameter after crimping
HR10A-TC-02	5.3	5mm	5.3mm to 5.5mm
	7.0	——	——
LF-TC-01	7.9	7.3mm	7.9mm to 8.1mm
	9.1	8.7mm	9.1mm to 9.3mm

For plug assembly

Fixture Part No.	Applicable connector
LF07BP-T01	LF07WBP-6S,6P,3S,3P
LF10BP-T01	LF10WBP-4S,4P,12S,12P
LF13BP-T01	LF13WBP-20S,20P,11S,11P

For jack assembly

Fixture Part No.	Applicable connector
LF07BJ-T01	LF07WBJ-6S,6P,3S,3P
LF10BJ-T01	LF10WBJ-4S,4P,12S,12P
LF13BJ-T01	LF13WBJ-20S,20P,11S,11P

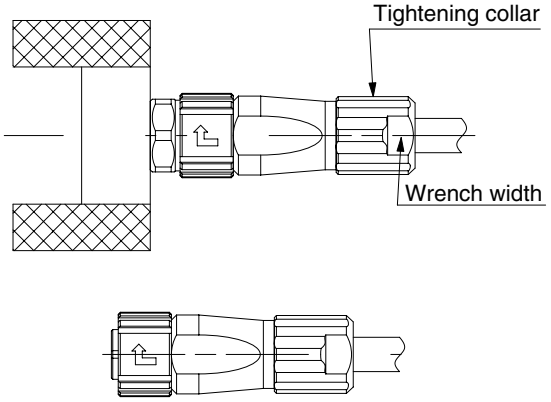
② Coat the thread section of the body/insulator assembly with Loctite 271 compound (manufactured by Henckel Japan, Ltd.) or equivalent, tightening it with a torque specified in the table 6.

Note

It is critical that the cable itself will not turn or twist during this operation.

Note

It is critical that the protrusions are inside the corresponding grooves.

No.	Illustration	Operation
6	⑥ 	⑥ Remove the connector from the solder termination fixture, holding it by the locking collar. Do not pull on the cable.

Shell size	Tightening torque	Wrench width
LF07	0.8N·m～1N·m	10mm
LF10	0.7N·m～1N·m	13mm
LF13	1 N·m～1.5 N·m	16mm

1. To maintain the water/dust protection performance and the cable clamp force, use a cable that is within the range of applicable diameter.
2. Consult HRS representative when using different cables.

■Cable Specifications (Reference)

No. of contact		3 pos.	4 pos.	6 pos.	12 pos.	20 pos.	11 pos.	
Conductor	Material	Soft copper wire	Soft copper wire	Soft copper wire	Soft copper wire	Soft copper wire	Soft copper wire	Soft copper wire
	Size (mm)	ϕ0.18	ϕ0.26	ϕ0.16	ϕ0.16	ϕ0.16	ϕ0.26	ϕ0.16
	Construction	20 /ϕ0.18 mm dia.	20 /ϕ0.26 mm dia.	7 /ϕ0.16 mm dia.	7 /ϕ0.16 mm dia.	7 /ϕ0.16 mm dia.	26 /ϕ0.26 mm dia.	7 /ϕ0.16 mm dia.
	Size (AWG)	AWG #20	AWG #16	AWG #26	AWG #26	AWG #26	AWG #16	AWG #26
	Sectional area	0.5	1.25	0.14	0.14	0.14	1.25	0.14
	Diameter (mm)	ϕ0.98	ϕ1.5	ϕ0.48	ϕ0.48	ϕ0.48	ϕ1.5	ϕ0.48
Insulator	Diameter (mm)	ϕ1.5 (Standard)	ϕ2.1 (Standard)	ϕ0.88 (Standard)	ϕ0.9 (Standard)	ϕ0.9 (Standard)	ϕ2.1 (Standard)	ϕ0.95 (Standard)
	Thickness (mm)	0.26	0.3	0.2	0.21	0.21	0.3	0.24
Shield	Material	Soft copper wire	Soft copper wire	Soft copper wire	Soft copper wire	Soft copper wire	Soft copper wire	
	Density	85%	80%	85%	80%	80%	80%	
	Diameter (mm)	ϕ3.6	ϕ5.5	ϕ3.4	ϕ4.2	ϕ5.1	ϕ6.7	
Jacket	Diameter (mm)	ϕ5±0.2	ϕ7.3±0.2	ϕ5±0.2	ϕ7.3±0.2	ϕ8.7±0.2	ϕ8.7±0.2	