ISH® CONNECTOR

Product Specification

Qualification Test Report No. STR-23002,23008,23009

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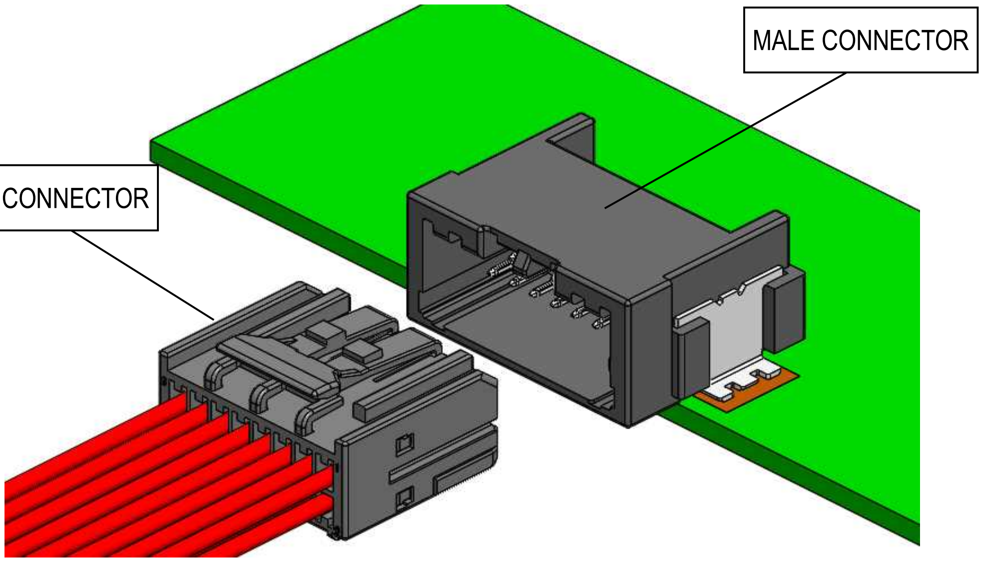
0	RS0942	June 14, 2023	Y. Nishimura	J. Mukunoki	J. Tateishi
Rev.	ECN	Date	Prepared by	Checked by	Approved by

1. Scope： This CONNECTOR is a 0.5mm terminal miniature SMT connector.

2. Purpose：This specification covers the requirements for product performance and test methods of ISH CONNECTOR.

3. Application items

This specification is applicable to the items listed below



ISH CONNECTOR HORIZONTAL TYPE

Table 1. Product Line

Pole	TYPE		PART No.					
	KEY CODING	Lock	MALE ASS'Y	FEMALE HOUSING	RETAINER	FEMALE TERMINAL	CABLE COVER	REAR COVER
3P	-	NORMAL	V0111-003E-01	V0113-91003-01	-	VT009-**	V0113-93003-01	-
6P	A	NORMAL	V0114-006E-01	V0116-91006-01	V0116-92006-01		V0116-93006-02	-
	B	NORMAL	V0114-006E-11	V0116-91006-11			V0116-93006-01	-
8P	A	INERTIA LOCK	V0114-008E-02	V0116-91008-02	V0116-92008-01		-	-
	B	INERTIA LOCK	V0114-008E-12	V0116-91008-12			-	-
	C	INERTIA LOCK	V0114-008E-22	V0116-91008-22			-	-
	D	INERTIA LOCK	V0114-008E-32	V0116-91008-32			-	-
	A	INERTIA LOCK	V0114-008E-02	V0116-91008-03			-	V0116-94008-01
12P	A	NORMAL	V0114-012E-01	V0116-91012-01	V0116-92012-01		-	-
				V0116-91012-02			-	V0116-94012-01
	B	NORMAL	V0114-012E-11	V0116-91012-11			-	-
	C	INERTIA LOCK	V0114-012E-21	V0116-91012-21			-	-
				V0116-91012-22			-	V0116-94012-01
	D	INERTIA LOCK	V0114-012E-31	V0116-91012-31			-	
	B	INERTIA LOCK	V0114-012E-12	V0116-91012-12			-	
16P	-	INERTIA LOCK	V0114-016E-01	V0116-91016-01	V0116-92016-01		-	-
	-			V0116-91016-02			-	V0116-94016-01
20P	-	INERTIA LOCK	V0114-020E-01	V0116-91020-01	V0116-92020-01		-	V0116-94020-01
32P	-	NORMAL Low insertion force	V0114-032E-**	V0116-91032-02	V0116-92032-01	VT009-02	-	-

4. Operating Condition

Temperature ：-40～125℃ including temperature rise

5. Construction, Materials and Finish

5.1 ISH CONNECTOR

(1)MALE HOUSING・・・・・Material：Glass-filled LCP, Flame retardance：UL94-V0, Color：BLACK or NATURAL

(2)MALE TERMINAL・・・・・Material：BRASS, Plating：Sn(Reflow)

(3)PEG・・・・・Material：BRASS, Plating：Sn(Reflow)

(4)FEMALE HOUSING・・・・・Material：PBT, Flame retardance：UL94-HB, Color：BLACK or NATURAL

(5)FEMALE RETAINER・・・・・Material：PBT, Flame retardance：UL94-HB, Color：BLACK

(6)FEMALE TERMINAL・・・・・BOX Material：BRASS, Plating：Sn(Reflow)

Spring Material：Copper alloy, Plating：Sn(Reflow)

(7)Applicable Cable・・・・・Cross section：$0.3mm^2$、$0.5mm^2$、 Outer diameter：1.60mm MAX.

5.2 Terminal crimp specification

Terminal crimp specification compliant with Handling Manual【HDM-0020】

6. Reflow Temperature Profile

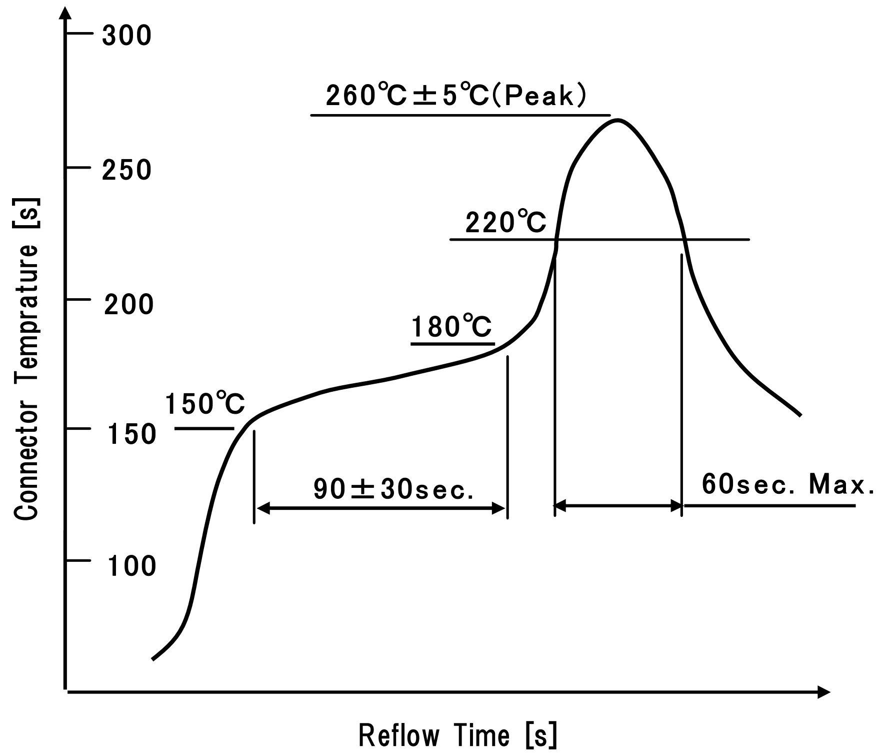


Fig.1. Reflow Temperature Profile

Use Metal Mask which has a thickness of 0.15mm MIN. when the male connector is mounted on the PCB.

7. Test Methods and Performances

7.1 Initial characteristics

Test method is described in 8.1 Initial characteristics Test Method.

Table 2. Initial characteristics

Item	Measurement	Requirements		
1	Terminal appearance	No detrimental deformation		
2	Terminal outer dimension	Satisfy drawing dimension		
3	Housing appearance	No detrimental deformation		
4	Housing outer dimension	Satisfy drawing dimension		
5	Feeling (insertion/removal)	No discomfort		
6	Connector mating force	NORMAL	3P	22N Max.
			6P	34N Max.
			12P	58N Max.
		INERTIA LOCK	8P	35N Max.
			12P	45N Max.
			16P	55N Max.
			20P	65N Max.
		NORMAL Low insertion force	32P	75.4N Max.
7	Connector unmating force	NORMAL	3P	12N Max.
			6P	24N Max.
			12P	48N Max.
		INERTIA LOCK	8P	20N Max.
			12P	30N Max.
			16P	40N Max.
			20P	50N Max.
		NORMAL Low insertion force	32P	70.4N Max.
8	Connector retention force	90N Min.		
9	Unlocking force	50N Max.		
10	Insulation resistance	100MΩ Min.		

Table 3. Initial characteristics

Item	Measurement		Requirements	
11	Withstanding voltage		No insulation breakdown or errosion	
12	Temperature rise	Single pole	ΔT=50°CMax.	
		All poles	ΔT=50°CMax.	
13	Leak current		1mA Max.	
14	Coplanarity		0.1mm Max.	
15	Peg strength		Position1 ： 70N Min.　Position2、3 ： 100N Min.	
16	Lead strength		30N Min.	
17	Audible click		60db(A) Min.	
18	Terminal crimp strength		70N Min.	
19	Terminal insertion force		0.5N Min.～3N Max.	
20	Terminal removal force		0.5N Min.～3N Max.	
21	Terminal contact force		3N Min.	
22	Terminal bend strength		a	Must not bend 1mm or over
			b	Terminal bending 30°MAX
23	Voltage drop		Initial	10mV/A Max.
			After test	20mV/A Max.
24	Dry circuit resistance		Initial	10mΩ Max.
			After test	20mΩMax.
25	Microcut monitoring		Not exceed 7Ω for more than 1μs	
26	Terminal retention force		With secondary lock	49N Min.
			Without secondary lock	20N Min.
27	Terminal to housing insertion force		10N Max.	
28	Retainer insertion/removal force		Insertion force	29.4N Max.
			Removal force	5.5N Min.
29	Housing lock strength without terminals		49N Min.	
30	Ｓｎ whisker		125μm Max.	

7.2 Environmental Performances

Test method is described in 8.2 Environmental Performances Test Method.

Table 4. Environmental Performances

Item	Test name	Measurement		Requirements
1	Repeated insertion/removal	Connector mating force	After 5 repeat	See Table2-Item6 (Sheet 4/18)
			After test	
		Connector unmating force	After 5 repeat	See Table2 - Item7 (Sheet 4/18)
			After test	
		Voltage drop	Initial	10mV/A Max.
			After test	20mV/A Max.
2	Resistance to forced mating (with 98N in 4 directions)	Connector mating force	After test	See Table2-Item6 (Sheet 4/18)
		Connector unmating force	After test	See Table2-Item7 (Sheet 4/18)
		Voltage drop	Initial	10mV/A Max.
			After test	20mV/A Max.
3	Fretting corrosion	Dry circuit resistance	Monitor dry circuit resistance during test.	20mΩ Max.
4	Thermal aging	Housing appearance		No detrimental deformation
		Feeling(insetrion/removal)		No discomfort
		Connector retention force	Direction 1	90N Min.
		Terminal crimp strength		70N Min.
		Dry circuit resistance	Initial	10mΩ Max.
			After test	20mΩ Max.
		Terminal retention force	With secondary lock	49N Min.
			Without secondary lock	20N Min.
		Housing lock strength without terminals		49N Min.
5	Low temperature aging	Housing appearance		No detrimental deformation
		Feeling(insetrion/removal)		No discomfort
		Dry circuit resistance	Initial	10mΩ Max.
			After test	20mΩ Max.
		Terminal retention force	With secondary lock	49N Min.
			Without secondary lock	20N Min.
		Housing lock strength without terminals		49N Min.
6	Thermal shock	Housing appearance		No detrimental deformation
		Feeling(insetrion/removal)		No discomfort
		Connector retention force	Direction 1	90N Min.
		Terminal crimp strength		70N Min.
		Dry circuit resistance	Initial	10mΩ Max.
			After test	20mΩ Max.
		Terminal retention force	With secondary lock	49N Min.
			Without secondary lock	20N Min.
7	Temperature/humidity cycle	Housing appearance		No detrimental deformation
		Feeling(insetrion/removal)		No discomfort
		Insulation resistance		100MΩ Min.
		Withstand voltage		No insulation breakdown or errosion
		Leak current		1mA Max.
		Dry circuit resistance	Initial	10mΩ Max.
			After test	20mΩ Max.
		Terminal retention force	With secondary lock	49N Min.
			Without secondary lock	20N Min.
8	Resistance to humidity	Housing appearance		No detrimental deformation
		Connector retention force	Direction 1	90N Min.
		Insulation resistance		100MΩ Min.
		Withstand voltage		No insulation breakdown or errosion
		Leak current		1mA Max.
		Dry circuit resistance	Initial	10mΩ Max.
			After test	20mΩ Max.
		Terminal retention force	With secondary lock	49N Min.
			Without secondary lock	20N Min.

Table 5. Environmental Performances

Item	Test name	Measurement		Requirements
9	Resistance to abrasion	Terminal appearance		No detrimental deformation
		Housing appearance		No detrimental deformation
		Voltage drop	Initial	10mV/A Max.
			After test	20mV/A Max.
10	Corrosion gas	Terminal appearance		No detrimental deformation
		Housing appearance		No detrimental deformation
		Terminal crimp strength		70N Min.
		Voltage drop	Initial	10mV/A Max.
			After test	20mV/A Max.
11	Resistance to stress corrosion	Terminal appearance		No detrimental deformation
		Terminal crimp strength		70N Min.
12	Condensation	Terminal appearance		No detrimental deformation
		Housing appearance		No detrimental deformation
		Insulation resistance		100MΩ Min.
		Withstand voltage		No insulation breakdown or errosion
		Leak current		1mA Max.
		Dry circuit resistance	Initial	10mΩ Max.
			After test	20mΩ Max.
13	Dump heat cycle	Housing appearance		No detrimental deformation
		Leak current		1mA Max.
		Insulation resistance	250h	100MΩ Min.
			500h	100MΩ Min.
			750h	100MΩ Min.
			1000h	100MΩ Min.
		Migration		No migration
14	Current cycle	Temperature rise		⊿T=50℃ Max.
		Voltage drop	Initial	10mV/A Max.
			After test	20mV/A Max.
15	Shock	Voltage drop	Initial	10mV/A Max.
			After test	20mV/A Max.
		Microcut		Not exceed 7Ω for more than 1μs
16	Vibration	Temperature rise		⊿T=50℃ Max.
		Voltage drop	Initial	10mV/A Max.
			After test	20mV/A Max.
		Dry circuit resistance	Initial	10mΩ Max.
			After test	20mΩ Max.
		Microcut		Not exceed 7Ω for more than 1μs
17	Vibration with temperature change	Terminal appearance		No detrimental deformation
		Housing appearance		No detrimental deformation
		Terminal contact force		3N Min.
		Dry circuit resistance	Initial	10mΩ Max.
			After test	20mΩ Max.
		Voltage drop	Initial	10mV/A Max.
			After test	20mV/A Max.
		Microcut		Not exceed 7Ω for more than 1μs

8. Test method

8.1 Initial characteristics Test Method

(1) Terminal appearance

Test method・・・・Visual(e.g. magnifier) and tactile verification.

(2) Terminal outer dimension

Test method・・・・Measure dimensions using caliper, micrometer, projector.

(3) Housing appearance

Test method・・・・Visual(e.g. magnifier) and tactile verification.

(4) Housing outer dimension

Test method・・・・Measure dimensions using caliper, micrometer, projector.

(5) Feelinng (insertion/ extraction)

Test method・・・・Verification of feeling by insertion/extraction of connector and single terminal.

(6) Connector mating force

Test method・・・・Measure the force required to mate female and male connectors at a rate of 100 mm/min. (terminals must be fully populated)

(7) Connector unmating Force

Test method・・・・Measure the force to pull the connectors apart at a rate of 100 mm/min. without the locking feature.

(8) Connector Retention Force

Test method・・・・Measure the maximum force to pull out female connector from mated state (Fig.2). Pull in four directions at a speed of 50mm/min. (terminals must be fully populated)

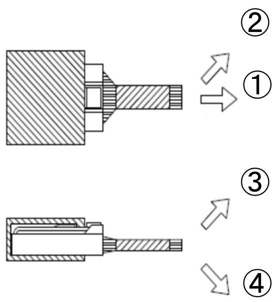


Fig.2. Measurement of connector retention force

(9) Unlocking force

Test method・・・・Measure the force required to disengage the lock.

(10) Insulation resistance

Test method・・・・Supply DC500V insulation resistance between (a) terminals (b) terminal and earth on mated connectors.

(11) Insulation resistance

Test method・・・・Supply AC1000V between (a) terminals (b) terminal and ground on mated connectors for 1minute.
Same connection as for insulation resistance test

(12) Temperature rise

Test method・・・・Supply current to mated connectors, measure the temperature rise at crimp area, when temperature is saturated. Female connector wire length: 300mm

Single pole：7A to 1 terminal

All poles：Connect all poles and apply the current that is calculated by 7A multiplied by the coefficient in Table 6.

Table 6. Coefficient

Pole	Coefficient
1	1
2～3	0.75
4～5	0.6
6～8	0.55
9～12	0.5
13～20	0.4

(13) Leak current

Test method・・・・Supply 16±0.1V to mated connector terminals. Measure maximum leak current.

(14) Coplanarity

Test method・・・・Measure coplanarity of male connector lead and peg at initial and 5 points specified in Fig. 3 during the reflow.

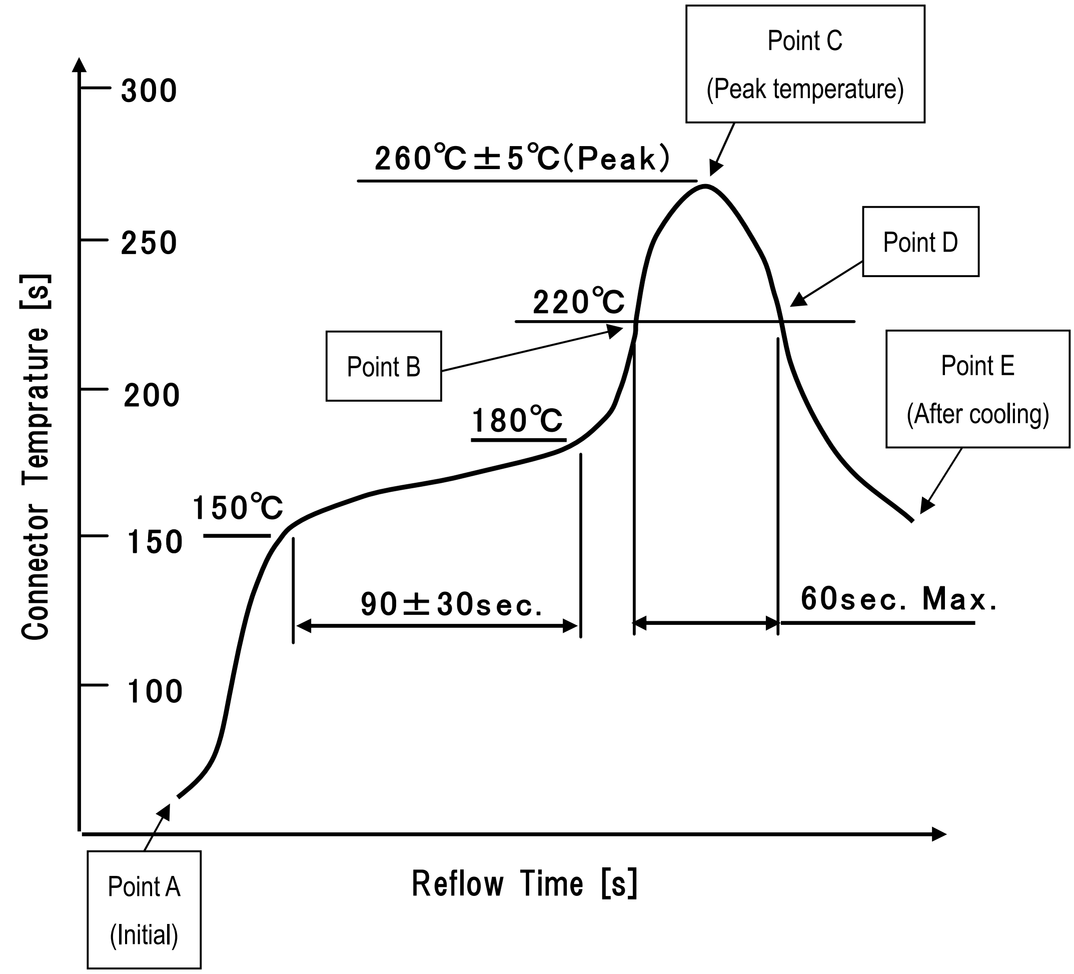


Fig.3.Coplanarity Measurement points

(15) Peg strength

Test method ・・・・Mate a wired female connector to the soldered male connector, and pull the wire at a rate of 100mm/min. Measure the force when the peg comes out from the PCB.
If mating portion has some breakage, it is needed to reinforce them.
Fix the connector in the following 3 positions, and pull towards the arrowed direction.

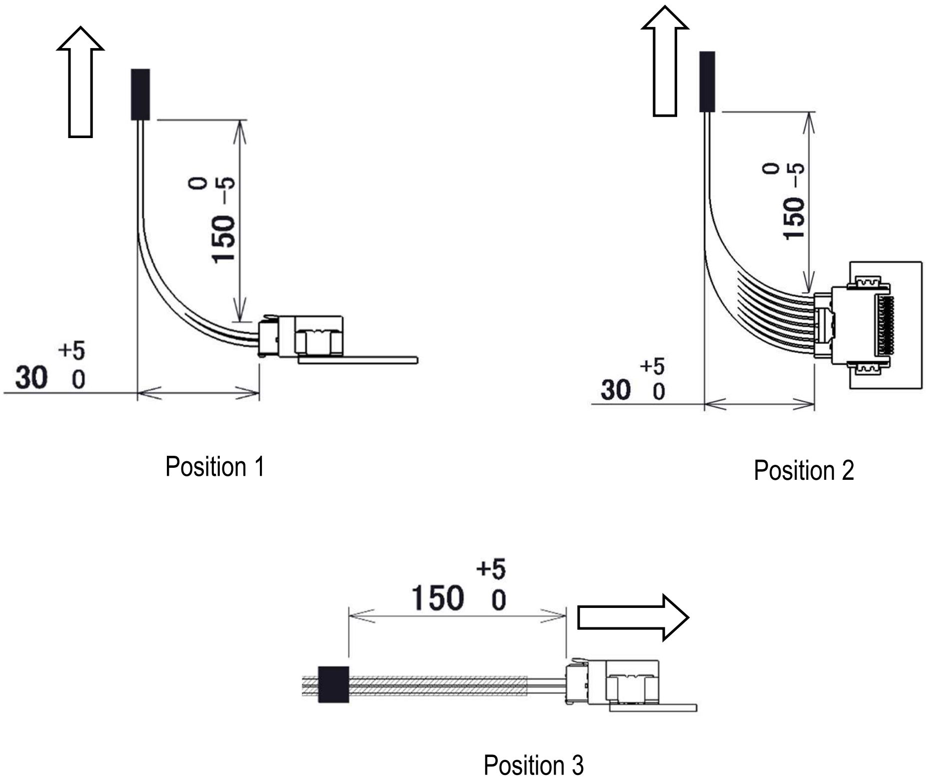


Fig.4 .Peg strength measuring method

(16) Lead strength

Test method・・・・Using a hook, pull a lead which is soldered onto the male connector, at the rate of 10mm/min at 45°, measure the force when lead comes off the PCB.

(17) Audible click

Test method・・・・Horizontally insert fully populated female connector to male connector which is soldered onto PCB.
Measure by the sound with sound level meter, and analyze the frequency analyzer (FFT).
Measurement range:10kHz～20kHz
Background noise: 5kHz MIN, Peak: 50dB MAX
Measurement must be done in a room.
Keep the position of the connector lock 600mm away from sound level meter.
Fix PCB and measure the lock sound without any touches.

(18) Terminal crimp strength

Test method・・・・Crimp wire of 100mm approx. to female terminal and pull the wire at the speed of 50-100mm/min. Measure the force when the wire breaks or the wire comes out from the terminal. Do not use insulation barrel.

(19) Terminal insertion force

Test method・・・・Measure the force to insert female terminal into fixed male connector at a speed of 100 mm/min.

(20) Terminal removal force

Test method・・・・Measure the force to pull out female terminal from male connector at a speed of 100 mm/min.

(21) Terminal contact force

Test method・・・・Calculate a contact force of female terminal and male terminal.
Measure female terminal spring displacement-force characteristics, and calculate a contact force from displacement upon male terminal insertion.
(accuracy 0.01mm MAX)

(22) Terminal bend strength

Test method・・・・(a) Push male terminals in mating direction from housing entrance at speed of 50mm/min with the load (maximum of connector insertion force).
(b) Remove housing walls around male terminals. Push terminals at speed of 50mm/min in the direction perpendicular to mating axes (4 directions: up, down, left, right)with force of 3N.

(23) Voltage drop

Test method・・・・Open: 12V, Short circuit: 1A

Measure the voltage drop between male connector lead and temp. measurement point after where is 75mm for from the crimp area of female terminal.

temperature reached saturation at 75mm from female terminal crimp.

Then, subtract voltage drop of wires and male connector lead

Wire resistance: 3.77mΩ/75mm (20℃) or actual measurement.

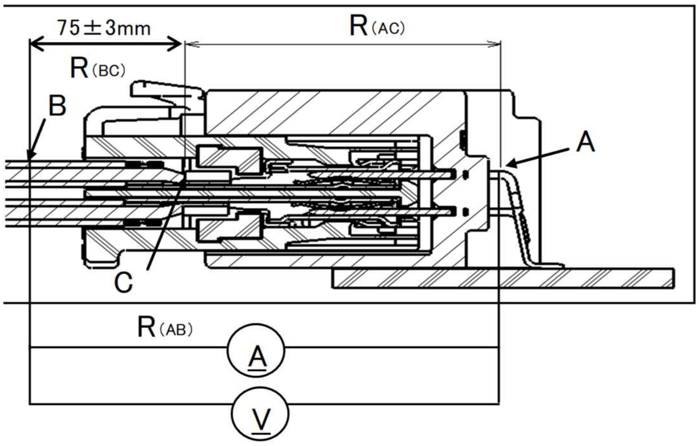


Fig. 5.In-line Circuit Test Lead Location

(24) Dry circuit resistance

Test method・・・・Open: 20±5mV, Short circuit: 10±0.5mA

Measure resistance of point where is 75mm for from the crimp area of female terminal and male connector lead.

Then, subtract resistance of wire and male connector lead.

Wire resistance: 3.77mΩ/75mm (20℃) or actual measurement

(25) Microcut monitoring

Test method・・・・Measure dry circuit resistance.

(26) Terminal retention force

Test method・・・・Measure the force to pull out female terminal from female connector housing at a speed of 100mm/min. Test with and without retainer.

(27) Terminal to housing insertion force

Test method・・・・Measure the force to fully insert female terminal into female connector housing at a speed of 100mm/min.

(28) Retainer/hinge insertion/removal force

Test method・・・・Fully populate female connector housing. Measure the force required to insert and extract the retainer/hinge at speed of 100mm/min.

(29) Housing lock strength without terminals

Test method・・・・Measure the maximum force to pull out unpopulated female connector housing from mated status at a speed of 100mm/min.

(30) Sn whisker

Test method・・・・Check the surface of connector's metal portions(terminals, lead) with microscope, etc. to find Sn whisker. Use microscope with magnification of X100 MIN.
Check closely not to lose sight of whisker with different magnifications.

8.2 Environmental Performances Test Method

(1) Repeated insertion/removal

Test method・・・・Measure the force required to insert/remove populated female connector into/from fixed male connector at speed of 100mm/min. Repeat 10 times. Lock must be disengaged.

(2) Resistance to forced mating (with 98N in 4 directions)

Test method・・・・Insert populated female connector into male connector. Apply force of 98N from 4 directions perpendicular to insertion axes.
Apply force twice per direction. Repeat 10 times.
Female connector insertion depths: 1)depth at which terminals start to touch and 2) depth of maximum insertion

(3) Fretting corrosion

Test method・・・・Insert female terminals into male connector and subject them to micro motion.
Frictional distance: 0.23mm, Cycle time: 1-2 Hz, No. of cycles: 5,000
Monitor dry circuit resistance during test.

(4) Thermal Aging

Test method・・・・Place mated connectors in thermal chamber at 125±3℃ for 120h.
Remove the connectors from the chamber and leave it to ambient temperature to recover.

(5) Low temperature aging

Test method・・・・Place mated connector in thermal chamber at －40±3℃ for 120h.
Repeat insert/remove for 5 times immediately after removing from the chamber, then leave to recover to ambient temperature.

(6) Thermal shock

Test method・・・Place mated connectors in thermal chamber and subject them to heat /cold cycle (85±3℃/-40±3℃). No of cycles: 3000

Duration (0.5h) may be shortened if sample's temperature reaches test temperature requirement early.

Monitor resistance during test, open circuit 20±5mV, short circuit 10±0.5mA.

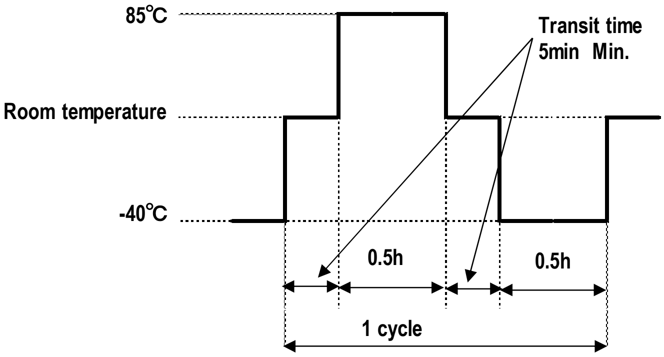
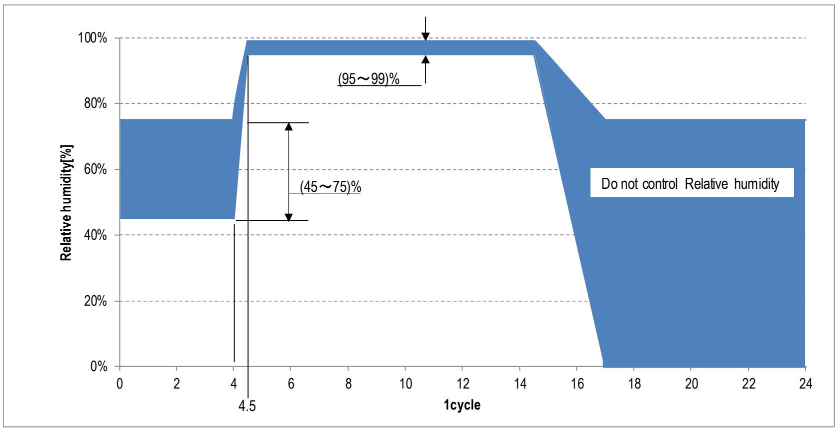


Fig.6 . Thermal shock

(7) Temperature/humidity cycle

Test method・・・Place mated connectors in climatic chamber and subject them to the cycle pattern specified in Fig. 7. Duration 24h, No. of cycles: 10, Temperature: 85±3℃



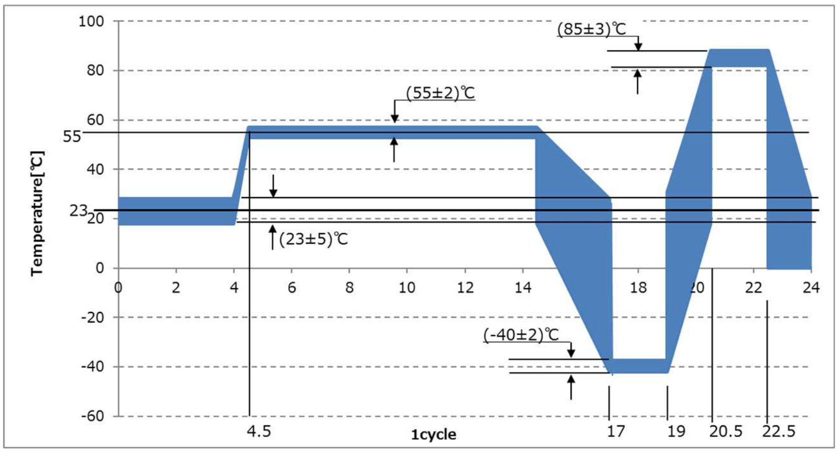


Fig.7 .Temperature/humidity cycle

(8) Resistance to humidity

Test method・・・・Place mated connectors in climatic chamber and subject them to 60℃±5℃, 90～95%RH for 96h.
Hang connectors to prevent any dews developing on the connectors.

(9) Resistance to abrasion

Test method・・・・Suspend mated connectors in the chamber and spray dust for 10s every 15 min.
Insert/extraction connectors every other cycle.
No. of cycles: 8
Chamber length must be 900-1200mm. Use approx. 1.5kg of dust particles of Kanto Loam layer or Portland cement (JIS R5210).

(10) Corrosion gas

Test method・・・・Place male and female connectors (not mated) in 25±5ppm, 40±2℃, 90-98%RH, SO_2 gas for 96h.

(11) Resistance to stress corrosion

Test method・・・・Degrease female terminals, cleanse with 10%H_2SO_4, rinse under water and dry.
Submerge in solution of free ammonia 6N, copper 10.2g/L for 3h, then remove.
Making test solution:
Mix, ammonia (28%～30%): Purified water = 1:1.6, to make 6N ammonia water.
Mix copper powder (10.2g) with 6N ammonia solution (1L).

(12) Condensation

Test method・・・・Place mated connectors in climatic chamber and subject them to the following cycle.
1 cycle: 1h at -30±3℃, then 1h at 25±3℃ and 90±5%RH
No. of cycles: 48

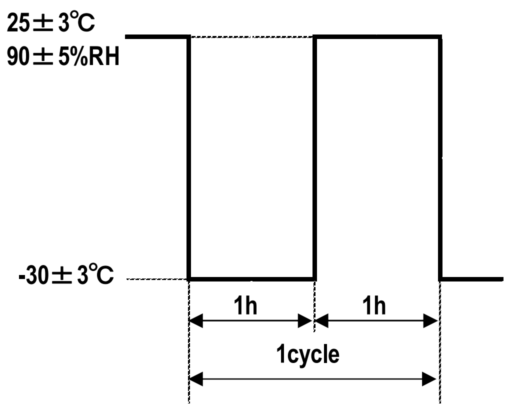


Fig.8 Condensation

(13) Dump heat cycle

Test method・・・・Place mated connectors in the chamber and apply current for 1000h at 85±3℃、85±5%RH. Measure the leak current during the test.

(14) Current cycle

Test method・・・・Place the mated connectors in thermal chamber at 70℃±3℃. Energize all terminals in series with 3A for 45min, then break for 15min. No, of cycles: 300.

(15) Shock

Test method・・・・Fix mated connectors as show in Fig.9 and subject to impact.

Use impact according to Fig.10 sinusoidal half-wave.

Duration D=6ms, Peak acceleration A=981m/s^2

Directions: 6 directions (top, down, left, right, front back), 3 shocks each direction

Connect all terminals in direct circuit.

Monitor resistance during test, open circuit 20±5mV, short circuit 10±0.5mA.

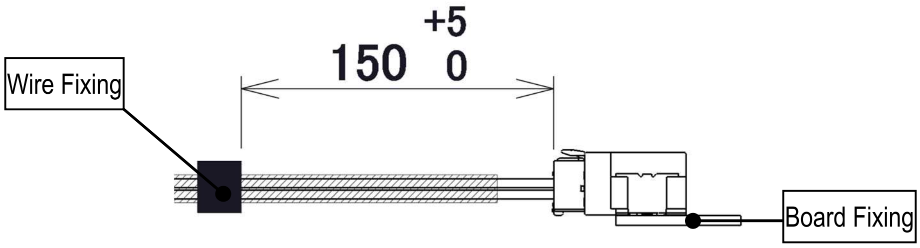


Fig.9. Fixing method

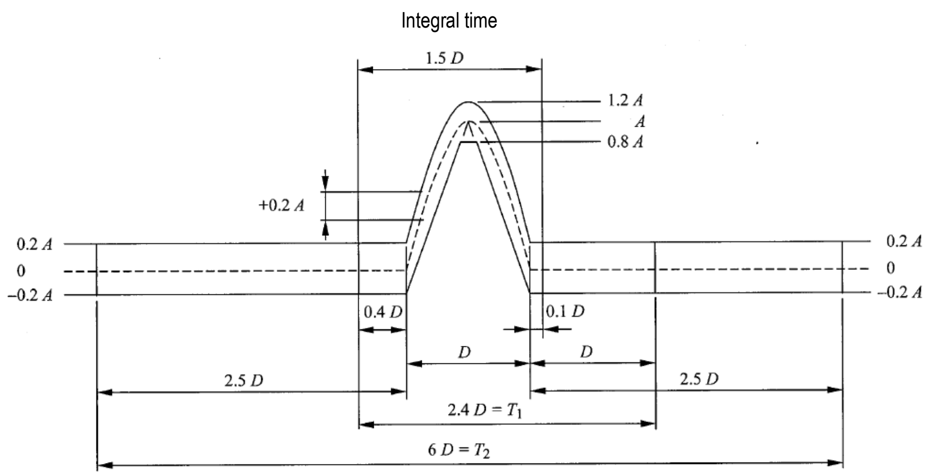


Fig.10.Sinusoidal half-wave

(16) Vibration

Test method・・・・Fix mated connectors in same way as the shock test (show in Fig.9) on fixture and subject them to vibration.

◎Vibration condition

・Direction: 3 (front-back, left-right, top-bottom)

・Acceleration: 66.6m/s^2,

・Duration: 2h(front-back, left-right), 4h(top-bottom)

・Frequency: 10-50Hz

・Sweep time: 8min (per sweep)

Energize all terminals in series with, open 13+1/0V, short circuit 10±0.5mA, continuously during test.

(17) Vibration with temperature change

Test method・・・・Fix mated connectors in same way as the shock test (show in Fig.9) on fixture and subject them to vibration at 100±3℃.

◎Vibration condition

・Acceleration: 59.8m/s^2

・Frequency: 20-200Hz

・Sweep time: 3min (per sweep)

Energize all terminals at 2.2A for 45min, break for 15min. No. of cycles: 300

Repeat with other directions.

Monitor resistance during 2.2A current supply.

After test, carry out vibration test with 3 axes, each for 1h. Check for any microcuts.