COMMON PARTS/MATERIALS, SPACE USE, APPLICATION DATA SHEET FOR

Part Description	CONNECTORS, RECTANGULAR, MINIATURE, HIGH DENSITY, HIGH RELIABILITY, SPACE USE
Part Number and Type	ND114-*P-** ND114-*S-**
Applicable Specification	JAXA-QTS-2060 JAXA-QTS-2060/D114

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Prepared and Established by Japan Aviation Electronics Industry, Limited

Issued by Japan Aerospace Exploration Agency

This application data sheet was originally written and established in the Japanese language. This application data sheet has been translated into English for international users. Note that this document is a working document for international users. Any discrepancies found in this document should be verified against the latest Japanese document before any significant decisions are made.

Contents

COMMON PARTS/MATERIALS, SPACE USE,
APPLICATION DATA SHEET FOR

1. GENERAL

1.1 Scope

This Application Data Sheet details additional general information necessary for parts selection and/or equipment design that is not contained in JAXA-QML. Users are encouraged to look into other information sources for specific applications, and responsible for their decisions on part selection and usage.

1.2 Applicable Documents

JAXA-QTS-2060	Capacitors, Fixed, High Reliability, Space Use, General Specification for
JAXA-QTS-2060 Appendix D	Capacitors, Chip, Multiple Layer, Fixed, Ceramic Dielectric
MIL-STD-1344	Test Methods for Electrical Connectors
MIL-STD-202	Test Methods for Electronic and Electrical Component Parts
MIL-C-22520	Crimping Tools, Terminal, Hand or Power Actuated, Wire Termination, and Tool Kits, General Specification for

2. SUMMARY OF PRODUCTS

2.1 Outline

Connectors described in this data sheet are high reliability parts for electronic equipment to be installed on satellites and/or launch vehicles. The connectors are rectangular high density miniature connectors which are generally referred to as D-sub connectors.
Considering the space environments such as magnetism, outgassing and sublimation, nonferrous materials and gold plated surface finishes are used.
Shells are rectangular in shape and the mating opening is of D-shape to prevent mis-mating. The number of contacts is 104.
Insulators with metal contact retention clips enable easy contact insertion and removal by the rear-release method.
Contacts are gold plated over copper alloy which has good electrical conductivity, and the contact size is #22. Pin contacts are of round type, and socket contacts have a closed-entry design for high reliability contact mechanism. There are two styles of termination for contacts; i.e., crimp and right angle through hole.
The connectors are interchangeable with NASA- or MIL-certified rectangular connectors.

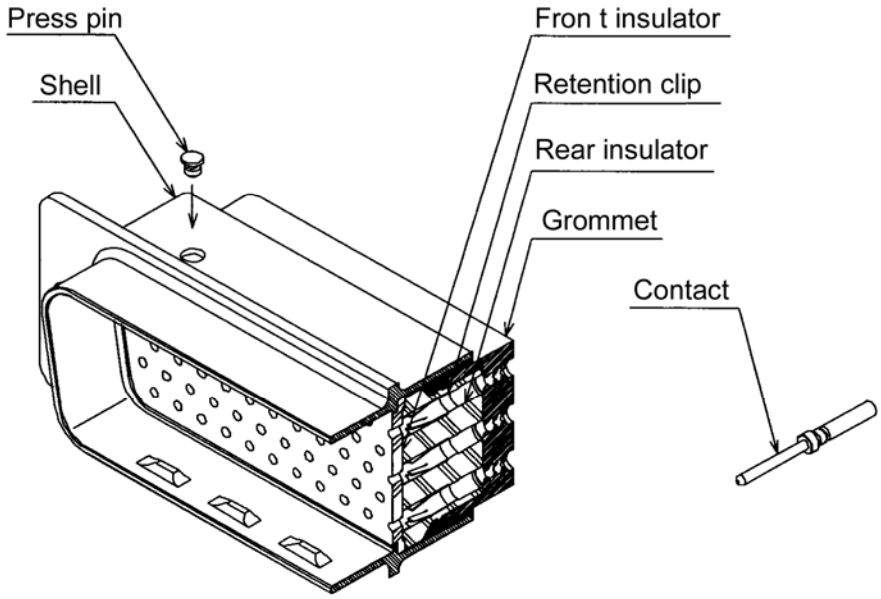


Figure 1. Connector-Cross Section View (Crimp Pin Connector)

2.2 Part Number

The part number of these connectors are assigned as follows.

[Connectors]

N D 114 – 104 P – C L R (1)

- (1): Length of right angle through hole
- R: Grommet or location plate
- L: Inclusion of contacts
- C: Termination style
- P: Contact type
- 104: Contact arrangement
- 114: Identification number
- D: Connector type
- N: Series

[Individual Contacts]

N D 104 – P – C 22D

- 22D: Contact category
- C: Termination style
- P: Contact type
- 104: Identification number
- D: Connector type
- N: Series

(1) Series: Identified by a single capital letter. “N” indicates that the part is for space use.

(2) Connector type: Identified by a single capital letter. “D” indicates a “D-sub connector.”

(3) Identification number: Identified by three digits as follows.

1 0 1

- 1 (third digit) — Series: Indicates the connector conforms to this appendix.
- 0 (second digit) — Material:
  - Connector shell: 1 – aluminum alloy
  - Individual contacts: 0 – copper alloy
- 1 (first digit) — Manufacturer

(4) Contact arrangement: Shell size is identified by a capital letter. Contact arrangement is identified by a two- or three-digit number which indicates the number of contacts (See Figure 6).

(5) Contact type: Identified by a single letter, “P” or “S”, which indicates a pin contact (male) or socket contact (female), respectively.

(6) Termination style: Identified by a single letter as shown in Table 1.

Table 1. Termination Style

Symbol	Termination style
C	Crimp
A	Right angle through hole

(7) Inclusion of contacts: Blank denotes that the connector includes contacts. “L” denotes that the connector does not include any contact. For a crimp-contact connector, the connector includes type “22D” contacts.

(8) Contact category: Applicable only to crimp termination type. “22D” denotes crimp contact of size 22D.

(9) Grommet and location plate: “R” denotes that the connector has a rear grommet. Blank denotes that the connector has no grommet. “B” denotes that the connector of right angle through hole type has no location plate, and blank denotes that the connector has a location plate

(10) Length of right angle through hole: If the length between the tip of through hole and the connector flange surface is not $5^{+0.8}_{-0.5}$mm, it may be specified in parentheses at the end of the part number. For example, size $1^{+0.8}_{-0.5}$ shall be indicated as ND*14-104S-A(1) as shown in Figures 4 and 5.

2.3 Externals of Connectors

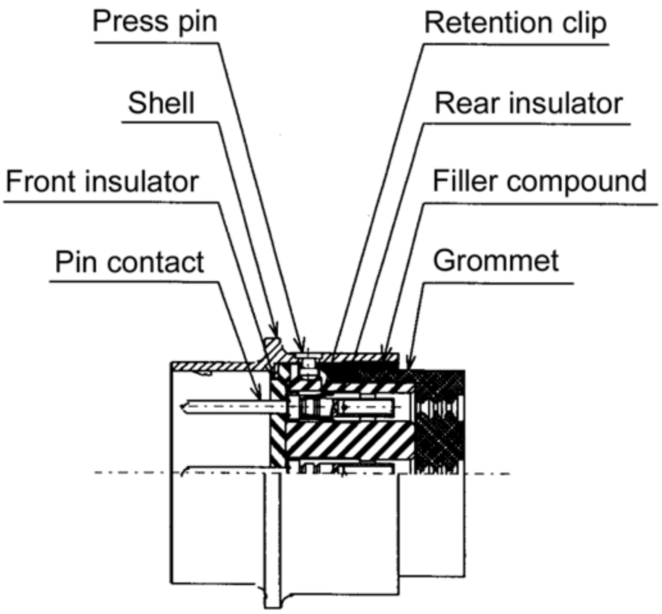


Figure 2. ND114-*P-CR

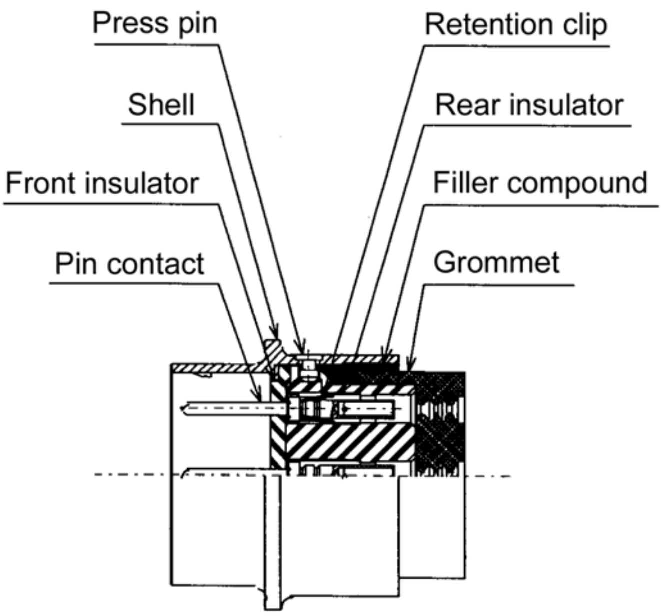


Figure 3. ND114-*S-CR

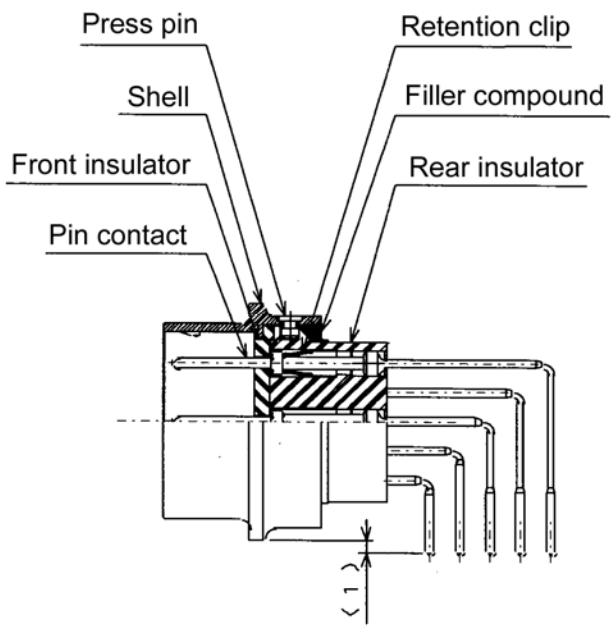


Figure 4. ND114-*P-AB(1)

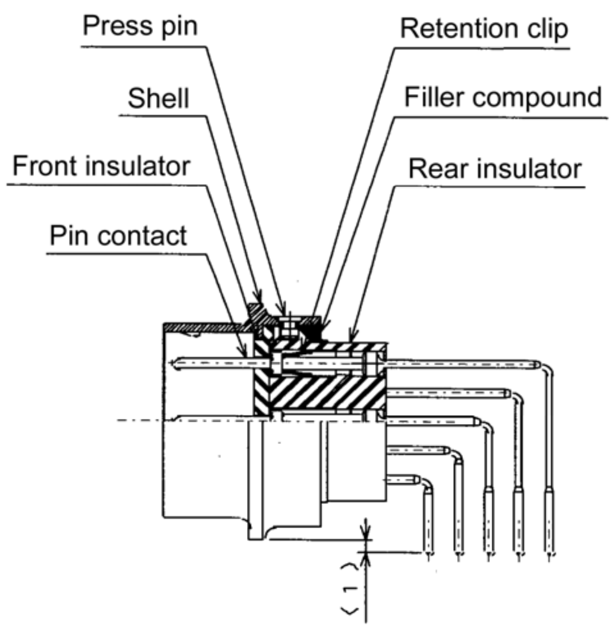
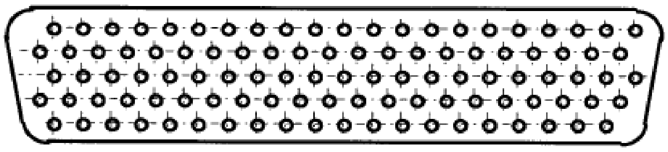


Figure 5. ND114-*S-AB(1)

2.4 Contact Arrangement

The contact arrangement is shown in Figure 6.



104 contacts (pin)

Figure 6. Contact Arrangement

Note: The figure above is the engaging face of the pin connector. The engaging face of the socket connector is a mirror image of the above figure.

2.5 Connection Options

The following connections are possible

Between panel and rack

Between panel and cable

Between cable and cable

Between cable and PWB

Between PWB and PWB

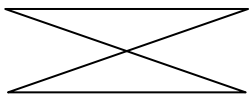
2.6 Interchangeability of Connectors

Pin connectors and socket connectors of the same number of pins and sockets are intermatable in any combination.

[Pin connector]

Crimp type

Right angle through hole type



[Socket connector]

Crimp type

Right angle through hole type

2.7 Applicable Wire Sizes

Applicable wire sizes to crimp contacts are AWG#22 through #28.

For right angle through hole contacts, the through hole diameter shall be selected to allow φ0.6mm for contact soldering,.

3. USAGE

3.1 Tools for Wiring and Assembly

In addition to general tools such as wire strippers and soldering irons, the following tools are required.(Table 2)

Table 2. Tools Required for Wiring and Assembly

Tool \ Connector	Crimp type
Crimping tool	M22520/2-01
Locator	M22520-2-09 (for pin), M22520-2-06 (for socket)
Inspection gauge for crimping tool	M22520/3-01
Contact insertion tool	CIET-22D (plastic) or MS27495A22M (metal)
Contact removal tool	CIET-22D (plastic) or MS27495R22M (metal)

3.2 Wiring and Assembly Methods

Wiring and assembly shall be performed in accordance with the processes shown in Table 3. Each process is detailed in paragraph shown in the "Paragraph no." column.

Table 3. Processes for Wiring and Engagement

Paragraph no.		Process	Connector type	
			Crimp	Right angle through hole
3.2.1		Stripping wire jacket	O	
3.2.2		Contact crimping	O	
	(1)	Crimping tool inspection	O	
	(2)	Crimping tool setting	O	
	(3)	Contact insertion	O	
	(4)	Wire insertion	O	
	(5)	Crimping	O	
	(6)	Contact extract	O	
	(7)	Crimped condition check	O	
3.2.3		Contact installation	O	
	(1)	Preparing insertion tool	O	
	(2)	Insertion tool setting	O	
	(3)	Contact insertion	O	
	(4)	Contact retention check	O	
	(5)	Installed condition check	O	
3.2.4		Contact change	Δ	
	(1)	Preparing removal tool	Δ	
	(2)	Removal tool setting	Δ	
	(3)	Contact extraction	Δ	
3.2.5		Soldering		O
	(1)	Right angle through hole		O

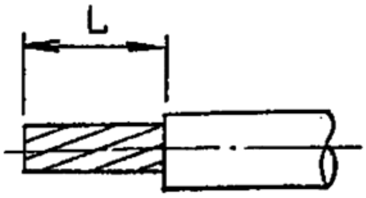
Note: "O" marking denotes "mandatory" processes and "Δ" denotes "non-mandatory" processes.

3.2.1 Stripping Wire Jacket

Strip the jacket at the termination side end by the length shown in Table 4.

Table 4. Stripping Length of Wire Jacket

Contact type	Length (L) (mm)
Crimp	$4.1\ ^{0}_{-0.5}$



Notes

(1) "L" length is a recommended dimension. Use an appropriate length according to wire type and wire insertion condition (Figure 11).

(2) Ensure not to damage or lose the individual wires while stripping. Keep the stranded wires from loosening.

(3) For jackets which are difficult to remove, part of the jackets may stick to the conductor. Remove any jacket fragments from the conductor.

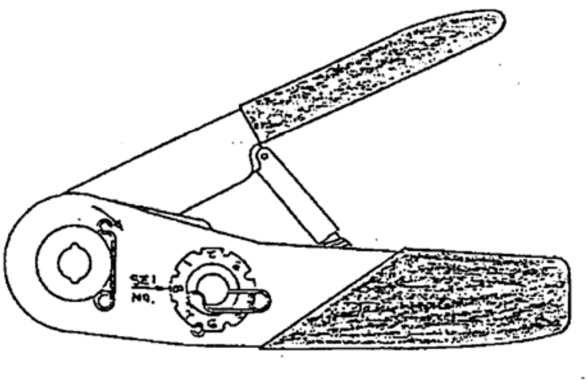
(4) Perform crimping or soldering immediately after removal of the jacket before the conductor surface is oxidized.

3.2.2 Contact Crimping

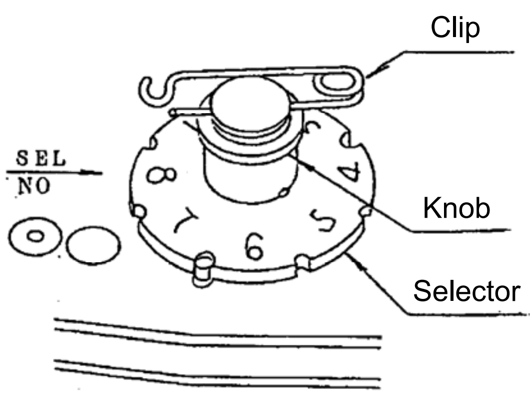
Wires shall be crimped to the contacts in accordance with following procedures.

(1) Inspection of crimping tool

(a) Set the selector number of the crimping tool of M22520/2-01 (See Figure 7) to "8" and tighten the handle fully. To set the selector number, remove the clip, and pull up and rotate the knob.



(Crimping tool)



(Enlarged view of the selector)

Figure 7. Crimping Tool

(b) While the handle is being tightened, check the gap of jaw (virtual diameter) using the inspection gauge of M22520/3-01. Verify “GO” side pin (green) passes the gap and “NO GO” side pin (red) does not.
Perform this inspection every time before performing crimping to ensure proper crimping results.

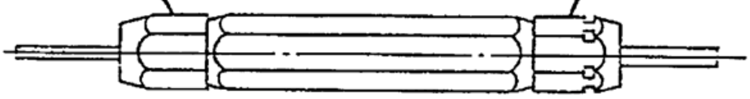


Figure 8. Inspection Pin Gauge

(2) Crimping tool setting

(a) Attach the locator shown in Table 2 to the crimping tool.
Remove the clip from the tool and push the locator guided by the grooves. Rotate the locator clockwise all the way to the end. The locator slightly goes back after it hit the end Insert the clip back to the tool (See Figure 9).

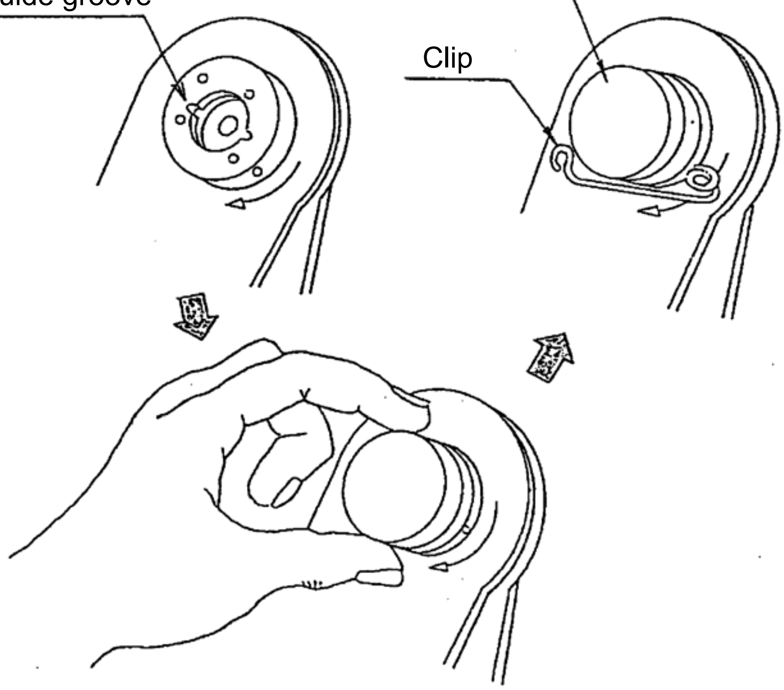


Figure 9. Attaching Locator

(b) Set the selector number by rotating the knob according to the part number of contact and wire size as specified in Table 5.
Secure the knob with the clip to keep the knob from rotating during the crimping operation.

Table 5. Applicable Selector Number

Contact Part Number	Wire size (AWG)	Selector number
ND104-P-C22D ND104-S-C22D	22	4
	24	3
	26	2
	28	1

(c) To verify that the tool is in a good condition, operate the tool a few times. The handle shall be fully tightened to the ratchet release position as it is not released in the mid way.

(3) Contact insertion
Insert the contact into the crimping hole of the tool (See Figure 10).

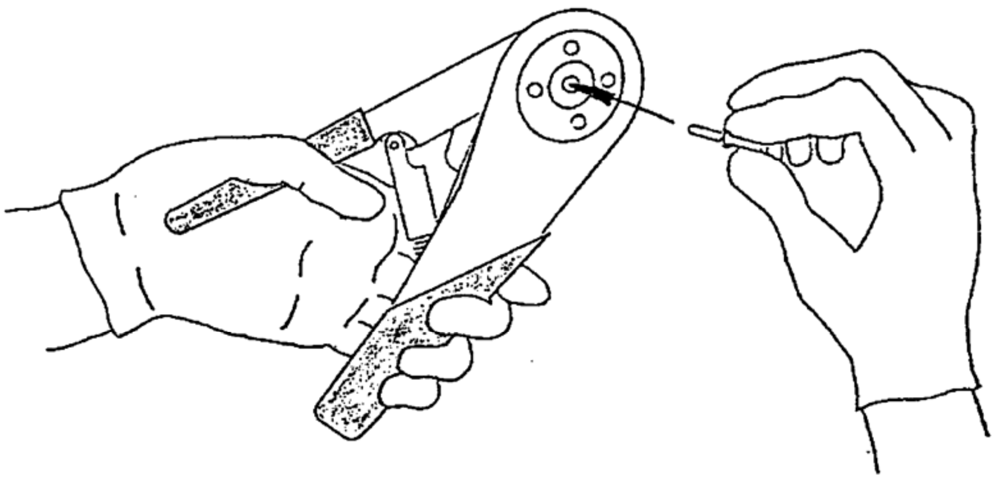


Figure 10. Contact Insertion

(4) Wire insertion
Insert the bare conductor without the jacket into the contact deeper than the check pinhole on the contact (See Figure 11).

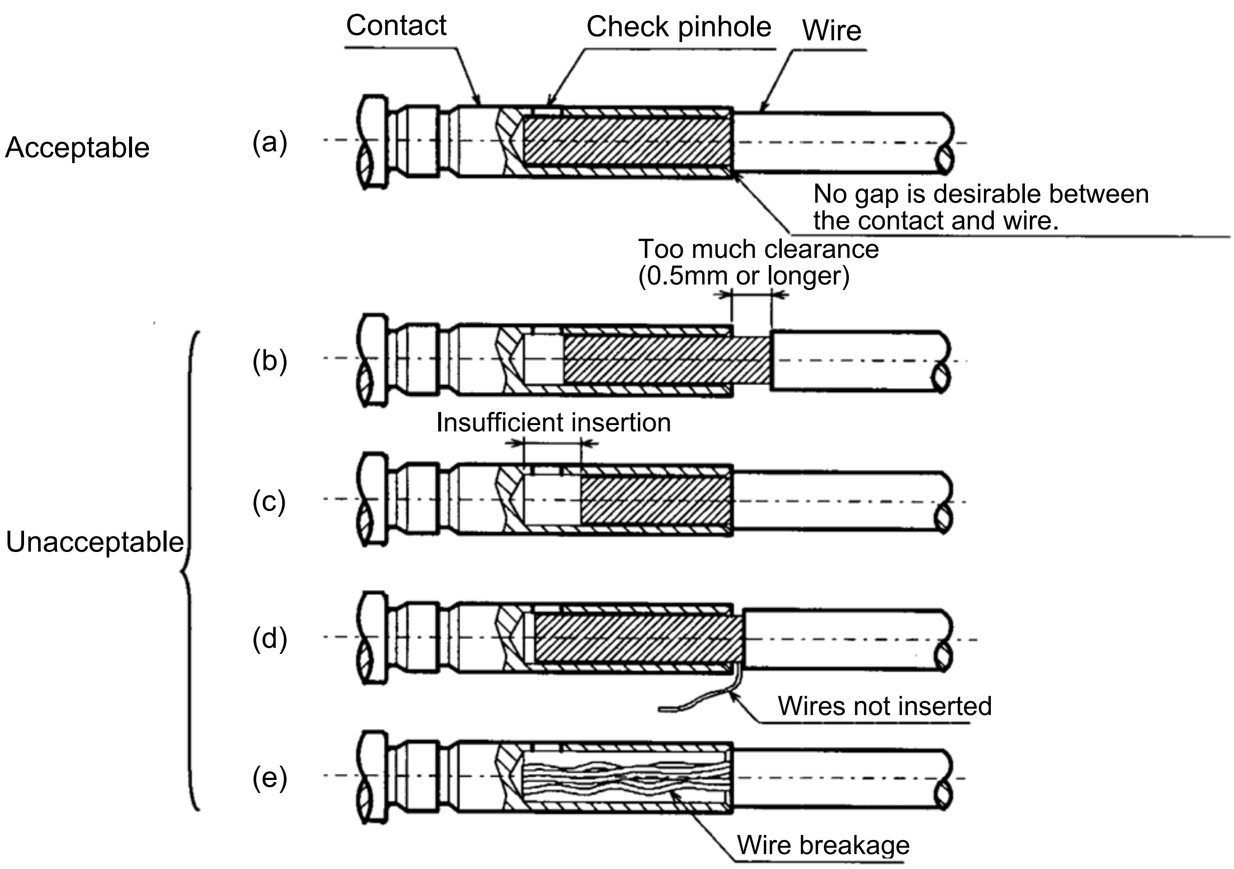


Figure 11. Wire Insertion

(5) Crimp
While pushing the wire lightly toward the contact to ensure a proper insertion length, tighten the handle gradually until the ratchet is released.

(6) Contact extraction
After the contact is crimped, stop tightening the handle. The handle automatically returns to the original position by its inner spring and the jaw opens. The crimped contact can be easily extracted by pulling the wire lightly.
The contact can not be extracted until the handle opens fully.

(7) Inspection of crimped contacts
The following items shall be checked for crimped contacts.

(a) The wire insertion condition shall not be any of "unacceptable" examples shown in Figure 11.
(b) The jaw teeth shall be positioned at a point close to the center between the contact edge and the check hole (See Figure 12).
(c) The contact is free of extreme scratches or cracks.

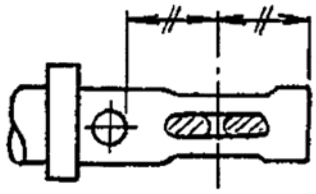


Figure 12. Jaw Teeth Position

Crimp tensile strength required for the contacts is shown in Table 6 for information only. Users are encouraged to check the crimp tensile strength using left-over contacts and wires occasionally.

Table 6.   Crimp Tensile Strength

Contact size	Wire size (AWG)	Min. crimp tensile strength N (kgf)	Wire specification
ND104-P-C22D ND104-S-C22D	22	57 (5.81)	NASDA-QTS-2120 or equivalent
	24	36 (3.67)	
	26	36 (3.67)	
	28	22 (2.24)	

3.2.3   Contact Installation

(1) Preparing insertion tool
An insertion tool specified in Table 2 shall be prepared.

(2) Insertion tool setting
Mount the wire into the cylindrical tip of tool, and move the tool along the wire till the tool tip touches the contact retention area.

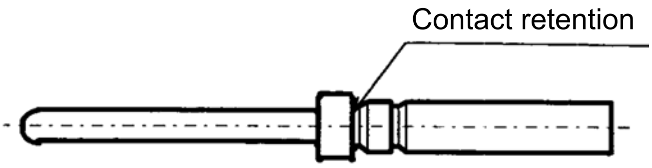


Figure 13.   Contact Retention Portion

(3) Contact insertion
Hold the wire mounted tool with fingers and insert the contact from the insulator hole (grommet hole) at the connector rear surface.

(4) Contact retention check
Pull the wire backward with 9.8N (1kgf) force to confirm that the contact has been installed in the connector.

(5) Inspection of installed condition

(a) For the pin connectors, verify the pin contacts from the mating side for slant and height (See Figure 14).
Generally, slants or height variations that are less than 0.5mm do not pose any risk if there is looseness for the contacts to correct the slants or the height variations.

(b) For the socket connectors, proper looseness in the insulator holes shall be verified.

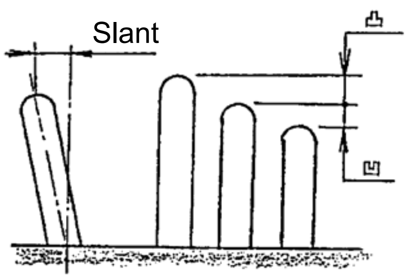


Figure 14.
Slant and Unevenness of Contact

3.2.4 Contact Replacement

When installed contacts need to be replaced for reasons such as wrong wiring and circuit design modification, follow the procedure given below.
The right angle through hole contacts cannot be replaced.

(1) Preparing removal tool
Prepare a removal tool specified in Table 2.
(2) Removal tool setting
Insert the wire into the cylindrical tip of tool, and insert the tool tip into the insulator hole along the wire.
(3) Contact extraction
When the tool tip reaches the contact shoulder, the contact retention clip comes off from the contact shoulder.
Hold and pull straight the wire and tool together to extract the contact.
The contact cannot be extracted if the tool tip insertion is insufficient or if the wire is pulled before the tool.

3.2.5 Soldering

Right angle through hole type
Install the connector on a PWB securely using screws or by other methods and solder at the through hole.
Remove residue flux after soldering.

3.3 Dimensions for Mounting Holes

3.3.1 Crimp and Soldering Type Connectors

Recommended dimensions for the mounting holes on a panel are shown in Table 7.

Table 7. Dimensions for Mounting Hole

No. of contacts	A±0.15	B±0.2	C±0.2
102	63.5	59.9	16.0

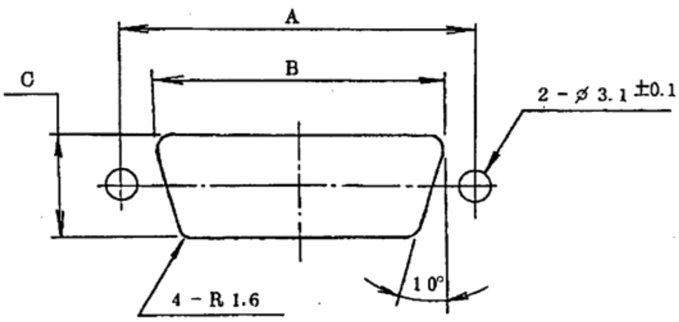
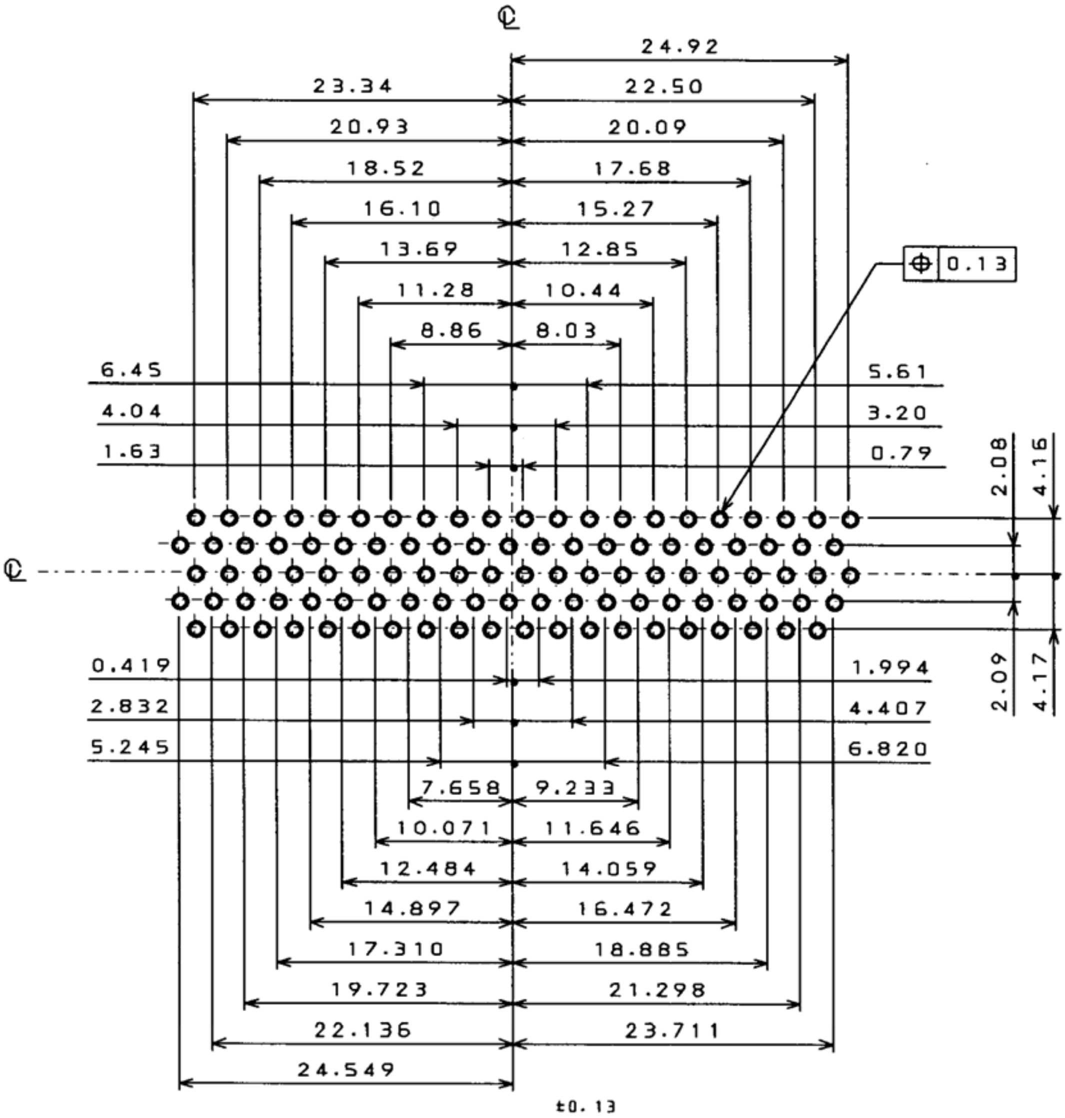


Figure 15. Dimensions for Mounting Holes

3.3.2 Right Angle Through Hole Type Connectors

Recommended dimensions for the through holes on a PWB are shown in Figure 16. Through hole diameters shall be φ0.8mm as a minimum.



104 contacts (PIN)

Figure 16. Dimensions for Through Holes on PWB

3.4 Precautions

3.4.1 Wiring

(1) After connectors and contacts are removed from a sealed bag, wear clean white gloves or finger cots to handle them.

(2) When right angle through hole type connectors are cleaned for residue flux, ensure that flux doesn't adhere to the contact surfaces.

3.4.2 Assembly

(1) The locator attached to the right angle thorough hole type connector shall be detached prior to mounting the connector to a PWB by unlocking both sides of the locator. Use caution not to bend or damage the contacts while detaching the locator.

(2) To bind the wires, allow sufficient slack for the wires so that the contacts can align straight. If the wires are bent significantly and bound at a point close to the connector rear face, the contacts may stay slanted, the wire-contact junction may be over stressed, and/or mating becomes difficult.

(3) To pot the connector rear face, use a potting material that has an appropriate viscosity to prevent the material from flowing into the connector.
In addition, the opposite connector (jig) shall be mated to prevent the contacts from slanting.

3.4.3 Electrical Conductivity Check

(1) Use the opposite connector or an individual contact not to damage the contact in checking the electrical conductivity.

(2) To test an individual contact, insert the contact straight not to generate bending moments on the contact under test.

3.4.4 Mating and Unmating

Mating and unmating the connectors shall be performed gently in parallel with the mating axis. Do not attempt to mate or demate the connectors by applying forces not in parallel with the mating axis.

4. CHARACTERISTICS UNDER NORMAL OPERATING CONDITIONS

4.1 Ratings

(1) Rated voltage: At barometic pressure·········330V_{AC}
At reduced pressure ···········100V_{AC} (70,000ft)

(2) Operating temperature range: -65 to +125°C

(3) Applicable wires: AWG22 to 28

4.2 Electrical Characterisitcs

(1) Insulation resistance: 5,000MΩ min.

(2) Dielectric withstanding voltage: 1,000V_{AC}

(3) Contact resistance: 7.3mΩ max. (AWG22)

(4) Current: 5A per contact

4.3 Mechanical Characteristics

(1) Operation life: 500 times of mating and demating operations

(2) Vibration: High frequency vibration ··· 10 to 2,000Hz, 294ms^2 (30G) peak
Random vibration ············· 333.6m/s^{2}rms effective acceleration (34.02Grms)

(3) Shock: Shock (I)························· 2,942m/s^2 (300G), 3ms
Shock (II)························ 14,710m/s^2 (1,500G), 0.5ms

4.4 Thermal Characteristics

(1) Thermal shock: Temperature cycle (I)···· -65 to +125°C, 5 cycles
Temperature cycle (II)··· -30 to 100°C, 1,000 cycles

4.5 Current Capacity

Although the maximum current is defined for each contact size and wire size, the maximum total current for the connector needs to be defined to limit the temperature rise. MIL-W-5088 specifies the current derating as shown in Table 8.

Table 8. Current Derating

No. of contacts	Reduction rate (%)	No. of contacts	Reduction rate (%)
1	100	9	54.3
2	94.3	10	48.6
3	88.6	11	42.9
4	82.9	12	37.1
5	77.1	13	31.4
6	71.4	14	25.7
7	65.7	15 or more	20.0
8	60.0		

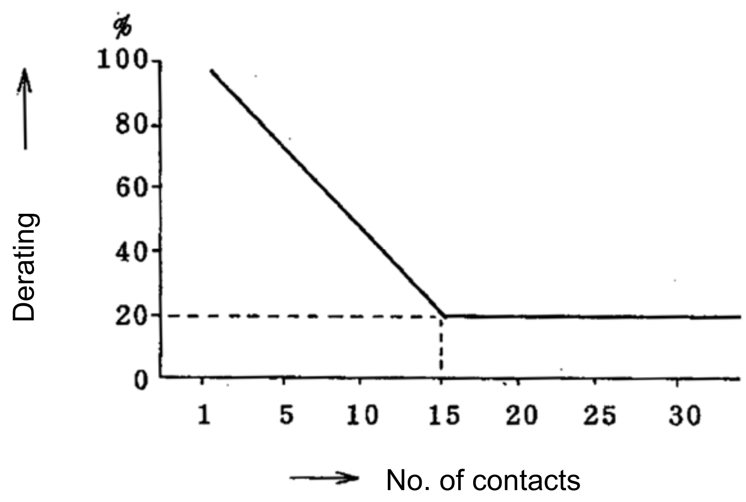


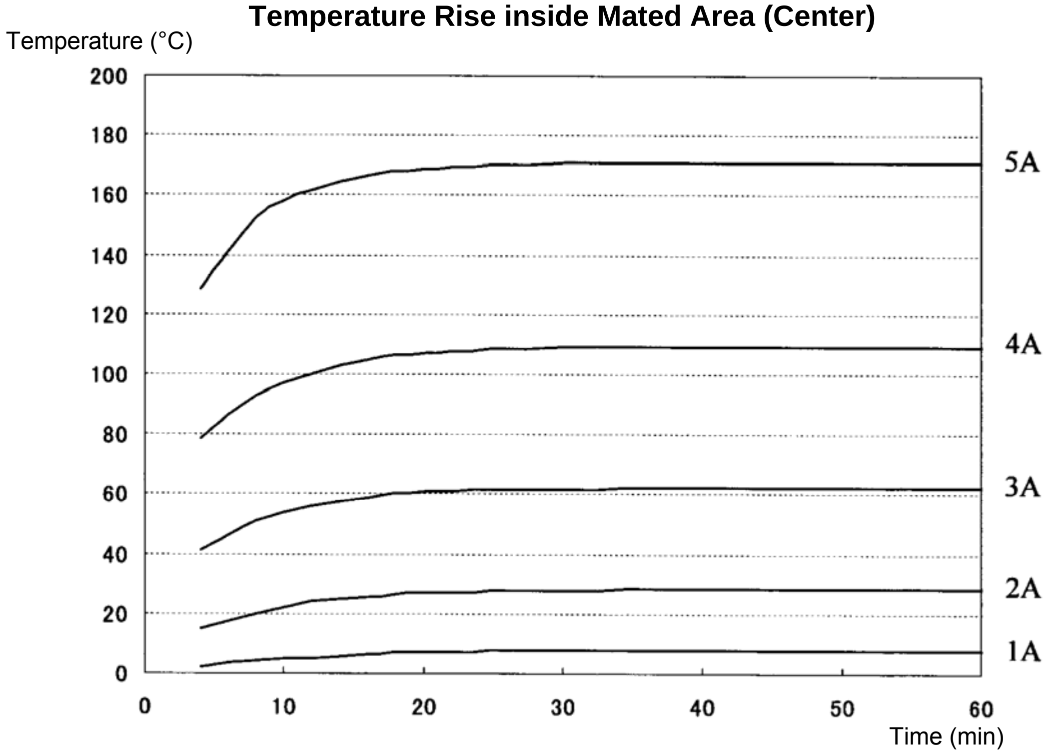
Figure 17. Current Derating Chart

In the case of 104 contacts, the maximum total current is calculated as follows:
A = Contact current capacity x no. of contacts x derating
= 5A x 104 contacts x 20.0%
= 104.0A
Even though a maximum of 5A can be flown through each contact, the total current for the connector is limited to a maximum of 104.0A.

4.6 Temperature Rise

When currents flow a connector, the connector temperature rises. The temperature rise inside the mated area was measured at ambient temperature by applying 1A to 5A currents using ND114-104P-CR and ND114-104S-CR with all contacts connected in series.

Temperature Rise inside Mated Area (Center)



4.7 Breakdown Voltage

The breakdown voltage of the connectors are as shown in Table 9 at the normal condition. Test method 3001 of MIL-STD-1344 specifies the rated voltage as one third of the dielectric withstanding voltage and the dielectric withstanding voltage as 75% of the breakdown voltage. However, the breakdown voltage of the connectors covered in this data sheet is approximately 5 times of the rated voltage. The connector has a sufficient margin against transient excessive voltages such as voltages generated at switching, surge voltages and other similar transient voltages if the operating voltage doesn't exceed the rated voltage shown in Table 9.
In practical usage, ensure that the connector insulator surface is free of dusts and water adhesion.

Table 9. Voltage

	V_{AC}	Remark
Rated voltage	330	
Dielectric withstanding voltage	1,000	
Breakdown voltage	1,600 to 3,500	Between contacts
	3,000 to 3,500	Between contacts and shell

5. CHARACTERISTICS UNDER VARIOUS OPERATING CONDITIONS AND ENVIRONMENTAL LIMITS

In this section, the connector characteristics under various environmental conditions and environmental limits of the connector are described based on the quality conformance inspection and breakdown limit test data.

5.1 Salt Spray

The connectors have superior corrosion resistance because the metal parts are gold plated of an appropriate thickness and because there is no contact between dissimilar metals.
The salt spray test was performed in accordacne with test method 1001 of MIL-STD-1344 for 96 hours which is twice as long as that is specified in the applicable specification, Appendix D of JAXA-QTS-2060 (48 hours),.
As a result, althrouhg corrosion was found at the crimped area of contacts, there was no corrosion or discoloration that could affect the connector performance. The following test results satisified the requirements specified in the applicable specification.

[Test condition]
Salt concentration: 5%
Temperature: 35°C

[Test items]
External and construction
Mating and unmating forces
Contact engagement and separation forces
Low-signal level contact resistance
Contact resistance
Crimp tensile strength

[Test samples]
Connector and individual contact

5.2 Sulfidation

Individual contacts were tested in accordance with IEC 60068-2-46 for resistance to sulfidation environments, to which the contacts may be exposed during storage and/or ground testing.
As a result, althrouhg corrosion was found at the crimped area of contacts, there was no corrosion or discoloration that could affect the connector performance. The following test results satisified the requirements specified in the applicable specification.

[Test conditions]
Hydrogen sulfide concentration: 15ppm
Relative humidity: 75%RH
Temperature: 25°C
Test duration: 500 to 1,000 hours

[Test items]
External and construction
Low-signal level contact resistance
Contact resistance

[Test samples]
Individual contact

5.3 Humidity

The humidity test was performed in accordacne with test method 1002 of MIL-STD-1344 for 504 hours that is more than twice the duration specified in the applicable specification, Appendix D of JAXA-QTS-2060,.
As a result, althrouhg corrosion was found at the crimped area of contacts, there was no corrosion or discoloration that could affect the connector performance.
Though the connectors are not of an environment resistnant type, inside of which is sealed, no degradation of the insulation peformance was observed. The following test results satisfied the requirements specified in the applicable specification.

[Test conditions]
Temperature: 65°C
Relative humidity: 90 to 98%RH

[Test items]
External and construction
Insulation resistance
Dielectric withstanding voltage
Mating and unmating forces

[Test samples]
Connectors

5.4 Thermal characteristics

Thermal characteristic tests included temperature cycling test, temperature life test and thermal vacuum test.
As a result, although the temperature life test resulted in discoloration of the insulator, there were no loose chips, cracks, peeled plating, discoloration, degradation of the contacting surfaces and the crimped area of the contacts or degradation of the insulator performance. The following test results satisfied the requirements specified in the applicable specification.

5.4.1 Temperature Cycling

The applicable specification requires 5 cycles at -65 to +125°C for the temperature cycling test. However, the temperature cycling test was performed for 100 cycles at -65 to +125°C as an environmental limit test

[Test conditions]

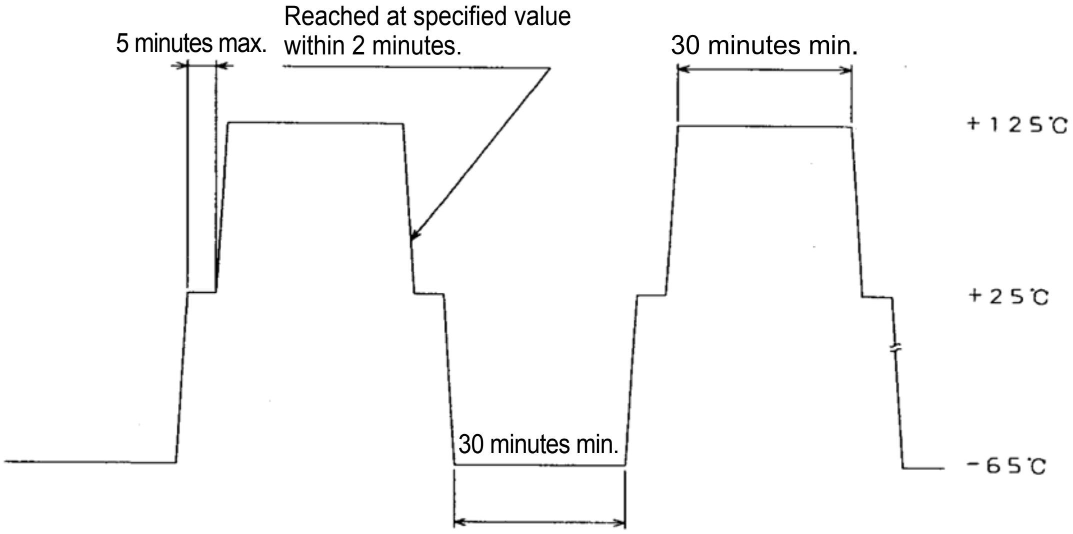


Figure 18. Temperature Cycling Test Condition Chart

[Test items]
External and construction
Insulation resistance
Dielectric withstanding voltage
Mating and unmating forces
Contact engagement and separation forces
Low-signal level contact resistance
Contact resistance
Crimp tensile strength

[Test samples]
Connectors and individual contact

5.4.2 Temperature Life

The temperature life test was performed in accordance with test method 1005 of MIL-STD-1344 for 2000 hours which is twice as long as that is required in the applicable specification, Appendix D of JAXA-QTS-2060.

[Test condition]
Temperature: +125°C (constant)

[Test items]
External and construction
Insulation resistance
Dielectric withstanding voltage
Contact engagement and separation forces
Low-signal level contact resistance
Contact resistance
Crimp tensile strength

[Test samples]
Connectors and individual contact

5.4.3 Thermal Vacuum

The connectors were maintained at 1 x 10^{-4} Pa and -60 to +125°C for 3 hours and the following items were examined.

[Test items]
External and construction
Insulation resistance
Dielectric withstanding voltage
Contact resistance

[Test samples]
Connectors

5.5 Dielectric Withstanding Voltage

To understand the withstand voltage characteristics, dielectric withstanding voltage (life) test and dielectric withstanding voltage (altitude) test were conducted.

5.5.1 Dielectric Withstanding Voltage (Life)

90% of the breakdown voltage was applied and time to breakdown was measured. The results is as shown in Figure 19.

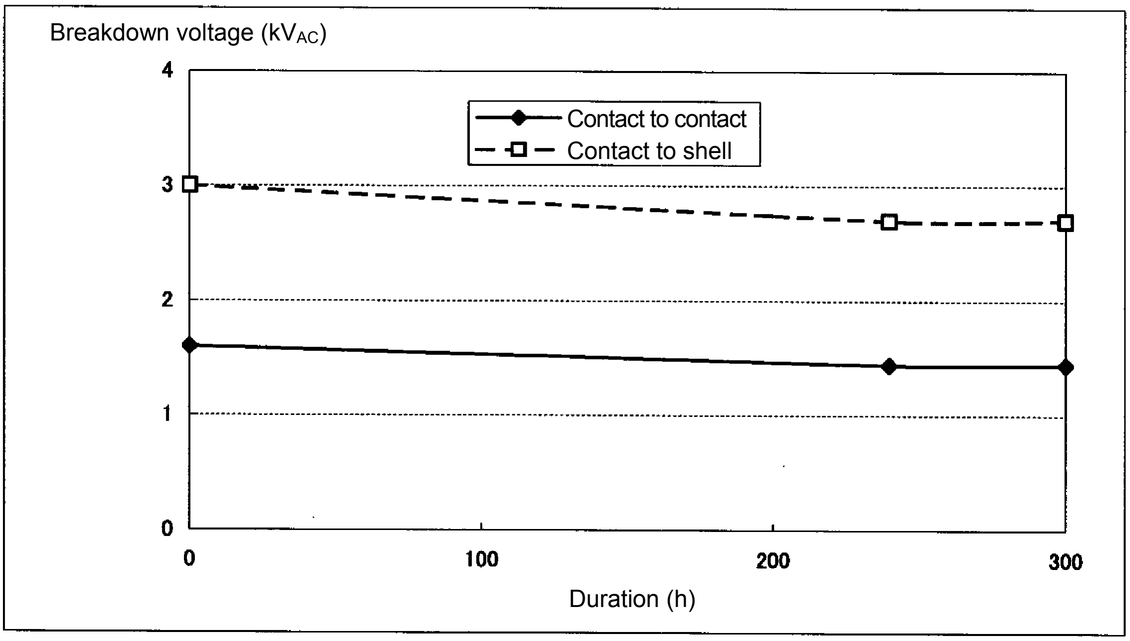


Figure 19. Dielectric Withstanding voltage (Life)

5.5.2 Dielectric Withstanding Voltage (Altitude)

The breakdown voltage was measured at various barometric pressures that simulate barometric pressures at various altitudes between the ground and space. The results are shown in Figure 21. As the minimum breakdown voltage is $400V_{AC}$, the connectors operate normally if used at $100V_{AC}$ which is the rated voltage at a reduced pressure.

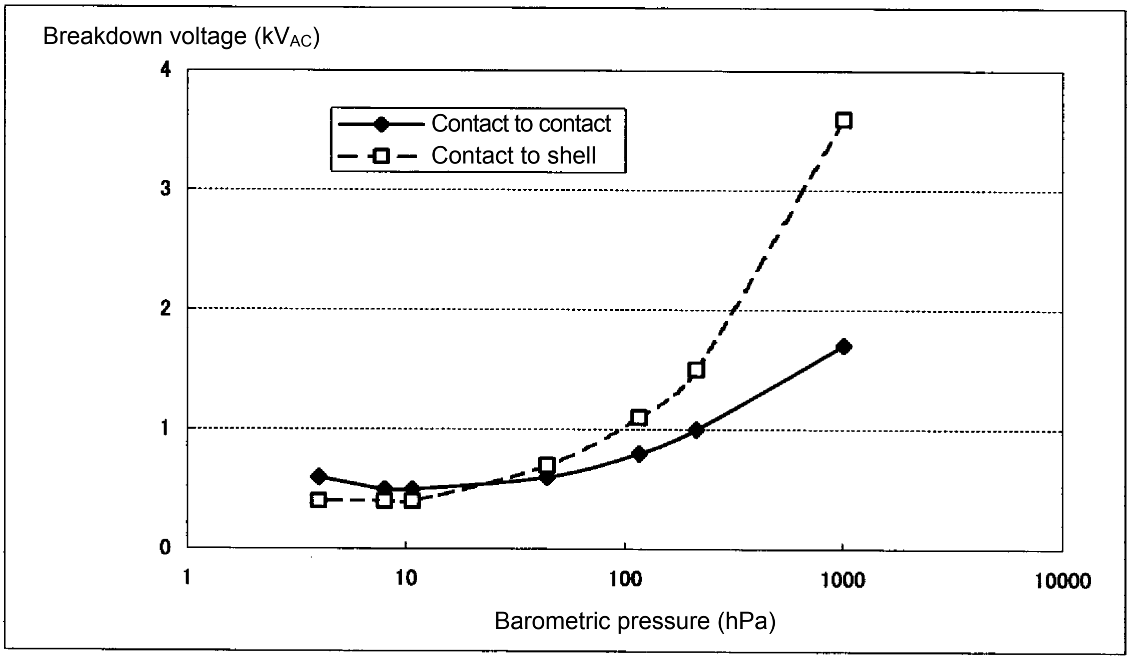


Figure 20. Dielectric Withstanding Voltage (Altitude)

5.6 Vibration

Vibration tests included high frequency vibration test and random vibration test. Though wear of the contact plating was observed due to the vibration, no intermittent current discontinuity during the test duration or loosened parts were detected, which satisfied the requirements specified in the applicable specification. In addition, post-test measurements of the contact resistance, the dielectric withstanding voltage and the insulation resistance satisfied the requirements.

5.6.1 High Frequency Vibration

The high frequency vibration test was performed in accordance with test method 204 of MIL-STD-202 at 20 to 2,000Hz, 490m/s^2 (50G) peak, 3 axes for 12 hours in total. The test condition specified in the applicable specification is 20 to 2,000Hz, 294m/s^2 (30G) peak.

5.6.2 Random Vibration

The random test was conducted in the positive and negative directions along 3 axes for 90 seconds in each direction. Figure 21 shows the vibration spectral envelope.

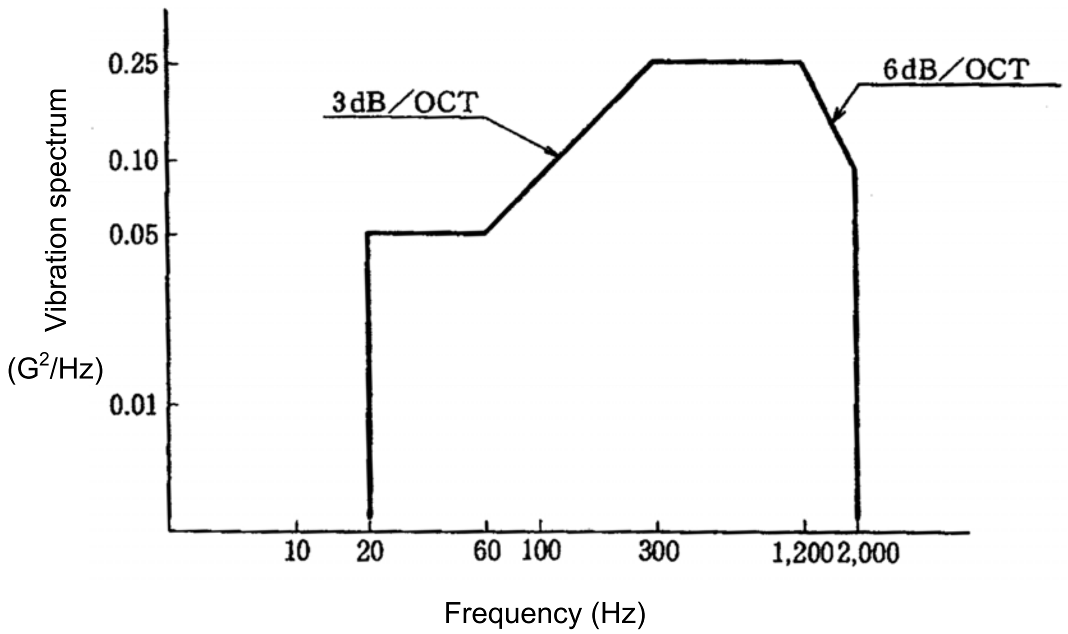


Figure 21. Vibration Spectral Envelope for Random Vibration Test (19.6Grms)

5.7 Shock

The shock test was conducted in the positive and negative directions along 3 axes at 5,884m/s^2 (60G) and 9,807m/s^2 (1,000G) for 3 times in each direction (54 times in total). The test condition specified in the applicable specification is 2,942m/s^2 (300G).
No intermittent current discontinuity during the test duration or loosened parts were detected, which satisfied the requirements specified in the applicable specification. In addition, post-test measurements of the contact resistance, the dielectric withstanding voltage and the insulation resistance satisfied the requirements.

5.8 Operating Life

The operating life test was performed by repeating the mating and unmating operation 1,000 times, which is twice the number specified in the applicable specification (500 times).
As a result, though the contact bare metal was exposed, there was no degradation in the contact elasticity that affects the contact performance. The following test results satisfied the requirements specified in the applicable specification.

[Test items]
External and construction
Mating and unmating forces
Contact engagement and separation forces
Contact resistance
Contact retention

5.9 Creep at Crimped Area

Wire of the proper gauge was crimped to the contact. Time from the application of the axial static load specified in Table 10 at an ambient temperature to a point when the wire was detached or broken was measured.
The wire wasn't detached or broken for at least 3,000 hours.

[Test condition]
The static loads which were equal to 10% and 15% of the crimp tensile strength (the breakdown point) were applied at the crimped area.

Table 10. Creep at Crimped Area

Contact	Wire (AWG)		Static load N(gr)	
			10%	15%
22D	Annealed copper wire	28	330	490
		26	570	630
		24	850	940
		22	960	1,440

5.10 Outgassing

The outgassing test was conducted in accordance with ASTM E595-77 for organic materials used for the connectors. The results are shown in Table 11.

Table 11. Outgassing Test Results

Material	Application	TML	CVCM	WVR
Diallyl phthalate resins	Insulator	0.550±0.006	0.014±0.003	0.102±0.001
Epoxy adhesive	Insulator adhesion	5.461±0.059	0.483±0.006	0.772±0.004
Epoxy resin	Potting	0.570±0.059	0.163±0.006	0.141±0.006
Marking ink	Part no. marking	18.859±0.608	0.082±0.001	0.411±0.004
Silicon resin	Grommet	0.944±0.013	0.271±0.005	0.610±0.006
Silicon resin	Potting	1.543±0.004	0.549±0.009	-1.004±0.000
Silicon resin	Grommet adhesion	0.658±0.011	0.658±0.011	0.003±0.000

TML: Total Mass Loss
CVCM: Collected Volatile Condensable Material
WVR: Water Vapor Regained

5.11 Residual Magnetization

Metal materials (copper alloy and aluminum alloy) and surface finishes (gold plated over copper and gold plating over nickel) used for the connectors are all nonmagnetic. Residual magnetization measured after the connector passed in the magnetic field of 0.5T (5000G) was 200nT (200γ) or less.

5.12 Fluid Immersion

The connector was soaked to the following fluids as specified in the applicable specification. Though swelling was observed on the silicon potting when soaked in the hydraulic fluid, the test results satisfied all requirements.

(1) Hydraulic fluid specified in MIL-H-5606
(2) Lubricating oil specified in MIL-PRF-23699

5.13 Resistance to Solvent

The test was performed in accordance with test method 215 of MIL-STD-202 for the marking ink, which is used for marking the part number and other information, against the following solvents which are generally used in the wiring and assembly processes. As a result, there was no degradation in legibility or color fading of the marking.

(1) IPA
(2) Acetone
(3) Ethanol

The insulators are made of diallyl phthalate resins and polytetrafluoroethylene and have sufficient resistance to the solvents.

5.14 Radiation Hardness

The test was performed in accordance with the applicable specification under the following conditions. The result satisfied all requirements.

(1) Radiation type: ^{60}Co γ-ray
(2) Total dose: 10^5Gy (10^7rad)

6. STORAGE CONDITIONS

(1) The connectors are ultrasonic cleaned and sealed before shipping. Do not open the sealed bag if not necessary. Re-seal the bag before storage if opened for receiving inspection or other needs.

(2) To store unmated connectors, attach the dust caps to protect the connectors from dusts and/or external forces.

(3) Store the connectors at an ambient temperature and humidity if possible.

(4) Minimize vibrations and shocks during shipping and storage.

7. OTHERS

7.1 Mass

The mass values of connectors and contacts are as follows:

(1) Connector

Table 12. Mass of Connector (1 pc.)

Termination type	Part number	Mass (g)±10%
Crimp	ND114-104P-CR	16.48
	ND114-104S-CR	20.44
Right angle through hole	ND114-104P-AB(1)	26.10
	ND114-104S-AB(1)	34.05

(2) Individual contact

Table 13. Mass of Individual Contact (1 pc.)

Termination type	Part number	Mass (g)±10%
Crimp	ND104-P-C22D	0.078
	ND104-S-C22D	0.105

7.2 Accessories

Table 14 shows accessories certified by JAXA for space use D-sub rectangular connectors. These accessories are designed for space applications and satisfy the non-magnetic, non-sublimation and outgassing requirements.
Contact the supplies for details.

Table 14. Accessories for Connectors

Item		Part number	Remark
Screw lock	Female	ND102-SL-F	Certified parts
	Male	ND102-SL-M5	

7.3 Cables

JAXA certified cables or space applications, high strength silver-coated copper alloy stranded cable per MIL-W-81381 shall be used in the qualification test. The specifications are given in Table 15.

Table 15. Cable Specifications

Item	Conductor				External diameter of insulator		Resistance at 20°C, Ω/1,000ft (Ω/km) max.
	AWG	Stranding No. of strands x AWG (no. of strands/mm)	External diameter		Inch (mm) min.	Inch (mm) max.	
			Inch (mm) min.	Inch (mm) max.			
M81381/ 10-28	28	7 x 36 (7/0.127)	.014 (0.356)	.016 (0.406)	.026 (0.660)	.030 (0.762)	79.0 (259)
M81381/ 10-26	28	19 x 38 (7/0.102)	.018 (0.457)	.020 (0.508)	.031 (0.787)	.034 (0.864)	49.4 (162)

Insulation resistance (min.): 762MΩ·km (2,500MΩ·1,000ft)

7.4 Contact Information

(1) Manufacturer: Japan Aviation Electronics Industry, Limited
(2) Address: 1-19, Aobadai 3-chome, Meguro-ku, Tokyo 153-0042, Japan
(3) Tel: +81-3-3780-2957