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6 February 2025

TEMPERATURE SENSORS, PLATINUM, SURFACE TYPE, RADIATION HARDENED, LONG-LIFE, HIGH RELIABILITY, SPACE USE, DETAIL SPECIFICATION FOR

Prepared and Established by Mitsubishi Heavy Industries, Ltd.

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This document is the English version of JAXA QTS/ADS which was originally written and authorized in Japanese and carefully translated into English for international users. If any question arises as to the context or detailed description, it is strongly recommended to verify against the latest official Japanese version.

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Record of revisions

Rev.	Date	Description
NC	11 Aug. 2009	Original
A	24 Sept. 2015	Reflected the change of document by Mitsubishi Heavy Industries, Ltd. Document No: VET25109 (Rev. A)
B	6 Feb. 2025	Reflected the change of document by Mitsubishi Heavy Industries, Ltd. Document No: VET25109 (Rev. B)
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Revision history

Rev.	Date	Description
NC	11 Aug. 2009	Original
A	24 Sept. 2015	(1) Cover page: The name of organization was changed (however no name change in English) (2) Clarified the description ・ Paragraph 3 and Table 5 Interchangeability: Reflected and clarified Measured temperature range. ・ Paragraphs 4.2 and 4.3: Added the description of test in Tables 5, 6, and 7 and clarified the test items whose results will be substitued by the inspection data during manufacturing process.
B	6 Feb. 2025	(1) Added measured temperature condition ・ Table 1 and Table 2: Added the measured temperature ranges of "-196°C to +400°C" (for 90 series) and "-183°C to +400°C" (for 91 series.) ・ Table 3: Changed the description from "the series and the applicable caliblation temperature level" to "the measured temperature range and the applicable caliblation temperature level" in "interchangeability." ・ Added new part numbers to Figure 1, and Note (1) to Tables 4 and 5.

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TEMPERATURE SENSORS, PLATINUM, SURFACE TYPE, RADIATION HARDENED, LONG-LIFE, HIGH RELIABILITY, SPACE USE, DETAIL SPECIFICATION FOR

1. GENERAL

1.1 Scope

This specification establishes the detail requirements and quality assurance provisions for long-life, radiation hardened, surface type, platinum temperature sensors (hereinafter referred to as “temperature sensors”) of the space use, high reliability, platinum temperature sensors (JAXA-QTS-2180).

1.2 Part Number

The part number is as shown in the example below. The details shall be shown in Table 1.

(Example) N1043 / 501 - □□ - □□□

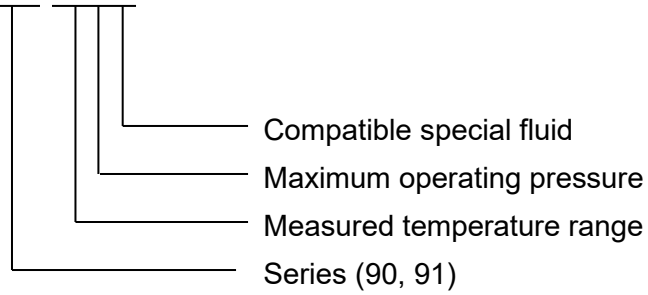

Table 1. Part Number

Item	JAXA-QTS-2180 Paragraph	Requirement	
		90 series	91 series
Measured temperature range	3.7 a)	3: -260°C to +400°C 4: -196°C to +400°C	6: -183°C to +400°C 7: -196°C to +400°C
Maximum operating pressure	3.7 b)	0: Atmospheric pressure	0: Atmospheric pressure
Compatible special fluid (See table 3)	3.3.2.1	0: Cryogenic fluid	0: Cryogenic fluid

1.3 Rating

The ratings shall be in accordance with Table 2.

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Table 2. Ratings

Item	Specification	
	90 series	91 series
Measured temperature range (Operating temperature range)	-260°C to +400°C/(-260°C to +400°C) -196°C to +400°C/(-260°C to +400°C)	-183°C to +400°C/(-196°C to +400°C) -196°C to +400°C/(-196°C to +400°C)
Maximum Operating Pressure	Atmospheric pressure	Atmospheric pressure
Supply Current	Max. 5mA	Max. 5mA
Nominal Resistance	2000±4Ω (at 0°C)	500±1Ω (at 0°C)

2. APPLICABLE DOCUMENTS

2.1 Applicable Documents

The applicable documents shall be as specified in paragraph 2.1 of JAXA-QTS-2180.

2.2 Reference Documents

The reference documents shall be as specified in paragraph 2.2 of JAXA-QTS-2180.

3. REQUIREMENTS

The requirements shall be as specified in paragraph 3 of JAXA-QTS-2180 and as follows.

3.1 Performance

The performance of the temperature sensors shall be as shown in Table 3.

Table 3. Performance (1/2)

Item		Paragraph in JAXA-QTS-2180	Performance
Parts and materials			
	Machined parts	3.3.1.1	As specified in JAXA-QTS-2180.
	Compatibility with fluids	3.3.2.1	Shall be compatible with the basic fluids and special fluids A-1 and B.
	Outgassing	3.3.2.2	As specified in JAXA-QTS-2180.
	Radiation hardness	3.3.2.3	As specified in JAXA-QTS-2180.
Design and structure		3.4	As specified in JAXA-QTS-2180.
Externals, dimensions and markings		3.5	As specified in Figures 1 and 2.
Workmanship			
	Structure (DPA)	3.6.1	(1) Internal structure and main dimensions (2) Welding state (3) Soldering state
	Cleanliness	3.6.2	As specified in JAXA-QTS-2180. For the particle count, the requirement level B shall apply.
Basic characteristics			
	Proof pressure	3.8.1.1	As specified in JAXA-QTS-2180.
	Leakage	3.8.1.2	Not applicable
	Insulation resistance	3.8.1.3	As specified in JAXA-QTS-2180. The measuring method shall be as specified in paragraph 4.6.4.3 b).
	Dielectric withstanding voltage	3.8.1.4	As specified in JAXA-QTS-2180.
	Interchangeability	3.8.1.5	As specified in Tables 4 and 5. The applicable levels of the calibration temperature shall be as follows. Measured temperature range: -260 to +400°C : Level B Measured temperature range: -183 to +400°C : Level D Measured temperature range: -196 to +400°C : Level K
Other characteristics			
	Strength of extension wire connection	3.8.2.1	Not applicable
	Over current	3.8.2.2	As specified in JAXA-QTS-2180.
	Pressure dependence	3.8.2.3	Not applicable
	Repeatability	3.8.2.4	90 series: Within ±0.65°C (level A) (equivalent to ±5.18Ω at 0°C) 91 series: Within ±0.60°C (level A) (equivalent to ±1.19Ω at 0°C)
	Response time	3.8.2.5	Maximum of 0.4 seconds.
	Self-heating	3.8.2.6	The temperature rise due to self-heating shall be: 90 series: 1°C max. at an input level of 160mW. 91 series: 1°C max. at an input level of 100mW.
	Thermoelectromotive force	3.8.2.7	As specified in JAXA-QTS-2180.

Table 3. Performance (2/2)

Item		Paragraph in JAXA-QTS-2180	Performance
Environmental characteristics			
	Dynamic pressure	3.8.3.1	Not applicable
	Sine wave vibration (I)	3.8.3.2	As specified in JAXA-QTS-2180
	Sine wave vibration (II)	3.8.3.3	Not applicable
	Random vibration	3.8.3.4	As specified in JAXA-QTS-2180. For test condition, the followings shall apply. 90 series: Level H 91 series: Levels D, J and K
	Shock	3.8.3.5	As specified in JAXA-QTS-2180. For test condition, the followings shall apply. 90 series: Level B 91 series: Levels B and D
	Radiation hardness	3.8.3.6	As specified in JAXA-QTS-2180.
	Pressure cycle	3.8.3.7	Not applicable
	Humidity resistance	3.8.3.8	Not applicable
Life			
	Storage life	3.8.4.1	As specified in JAXA-QTS-2180. For test condition, the level A shall apply.
	Operating life (High temperature life)	3.8.4.2.1	The change in temperature/resistance characteristics shall be as follows. 90 series: within ±0.65°C (level C) 91 series: within ±0.60°C (level C)
	Operating life (Temperature cycling)	3.8.4.2.2	The change in temperature/resistance characteristics shall be as follows. 90 series: within ±0.65°C (level D) 91 series: within ±0.60°C (level D)
Destructive characteristics			
	Burst pressure	3.8.5.1	As specified in JAXA-QTS-2180, however the requirement in paragraph 3.8.5.1b) shall not apply.

3.2 Externals, Dimensions and Markings

3.2.1 Externals, Dimensions, Mass and Interface

The externals, dimensions, mass and interface of the temperature sensor shall be as shown in Figure 1.

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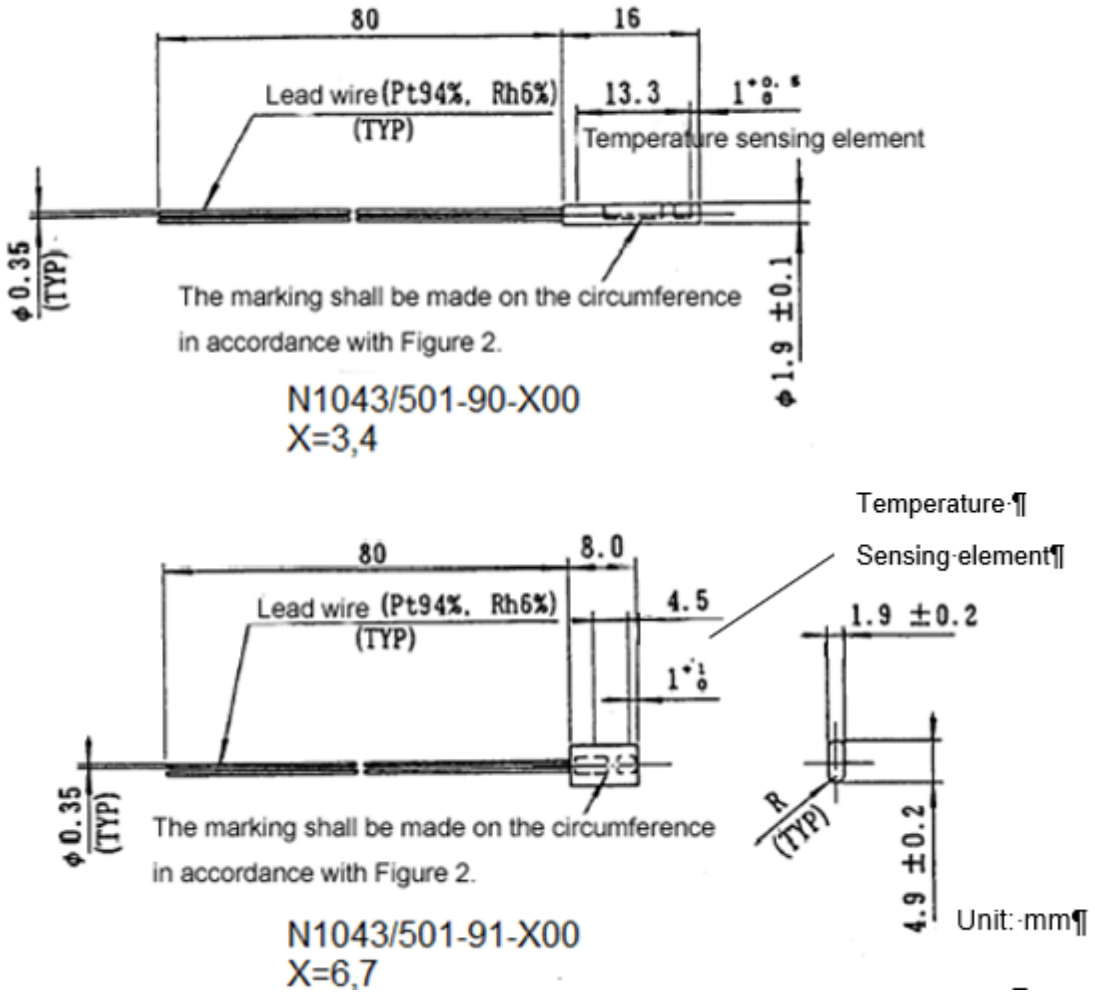
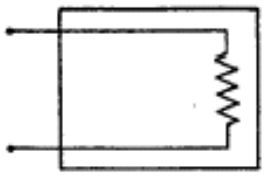


Note: For dimensions without specified tolerances in the above figure, the tolerance values specified below shall apply.

Significant figures shown in the above figure	Tolerance
X	±1
X.X	±0.5
X.XX	±0.25



Wiring diagram

Part Number	Mass
N1043/501-90-X00 X=3,4	5g max.
N1043/501-91-X00 X=6,7	5g max.

Figure 1. Externals, Dimensions, Mass and Interface of Temperature Sensors

3.2.2 Markings

The marking on the temperature sensors shall be as specified in Figure 2. The location of the marking shall be specified in Figure 1.

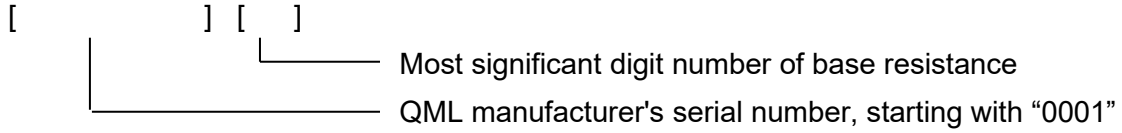


Figure 2. Marking

Table 4. Interchangeability (90 series)

Temperature (°C) (1)	Resistance (Ω)		Temperature (°C)	Resistance (Ω)	
	Minimum	Maximum		Minimum	Maximum
-260	2.62	8.62	60	2466.84	2480.84
-253	9.86	14.46	80	2621.94	2637.54
-240	48.89	53.49	100	2776.12	2793.12
-220	174.76	182.56	120	2929.30	2947.70
-200	339.79	348.39	140	3081.47	3101.27
-196	374.26	382.86	160	3231.84	3254.64
-183	486.86	495.46	180	3382.12	3406.12
-180	512.84	521.44	200	3531.30	3556.70
-160	684.82	693.42	220	3679.48	3706.28
-140	854.34	862.74	240	3826.78	3854.78
-120	1021.43	1029.83	260	3972.29	4003.09
-100	1186.80	1195.00	280	4117.61	4149.61
-80	1350.62	1358.82	300	4261.94	4295.14
-60	1513.27	1521.47	320	4405.29	4439.69
-40	1675.03	1683.03	340	4547.64	4583.24
-20	1835.87	1843.87	360	4688.31	4726.51
0	1996.00	2004.00	380	4828.68	4868.08
20	2154.18	2163.78	400	4968.16	5008.56
40	2311.42	2322.42	-	-	-

Note: (1) Measured temperature range: Values below the lower limit temperature are for reference only.

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Table 5. Interchangeability (91 series)

Temperature (°C) (1)	Resistance (Ω)		Temperature (°C)	Resistance (Ω)	
	Minimum	Maximum		Minimum	Maximum
-200	84.79	86.99	100	693.59	697.79
-196	93.41	95.61	120	731.79	736.39
-183	121.59	123.79	140	769.76	774.76
-180	128.10	130.30	160	807.38	812.98
-160	171.17	173.37	180	844.87	850.87
-140	213.61	215.81	200	882.11	888.51
-120	255.56	257.56	220	919.22	925.82
-100	296.95	298.95	240	955.99	962.99
-80	337.96	339.96	260	992.43	1000.03
-60	378.64	380.64	280	1028.73	1036.73
-40	419.02	421.02	300	1064.79	1073.19
-20	459.14	461.14	320	1100.71	1109.31
0	499.00	501.00	340	1136.30	1145.30
20	538.43	540.83	360	1171.55	1181.15
40	577.61	580.41	380	1206.76	1216.56
60	616.35	619.95	400	1241.63	1251.83
80	655.14	658.94	—	—	—

Note (1) Measured temperature range: Values below the lower limit temperature are for reference only.

4. QUALITY ASSURANCE PROVISION

The quality assurance provisions shall be in accordance with paragraph 4 of JAXA-QTS-2180 and as follows.

4.1 In-process Inspection

The in-process inspection shall be in accordance with paragraph 4.3 of JAXA-QTS-2180.

4.2 Qualification Test

The qualification test shall be in accordance with paragraph 4.4 of JAXA-QTS-2180 and Table 6.

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Table 6. Qualification Test

Group	Sub-group	Order	Test item	Requirement paragraph	Test method paragraph	Number of samples	Quantity of allowable defects
I Basic characteristics tests	A	1	Externals, dimensions, marking and others	3.5	4.6.2	4	0
		2	Proof pressure(1)	3.8.1.1	4.6.4.1		
		3	Leakage	NA	NA		
	B	1	Insulation resistance	3.8.1.3	4.6.4.3		
		2	Dielectric withstanding voltage	3.8.1.4	4.6.4.4		
	C	1	Interchangeability(1)	3.8.1.5	4.6.4.5		
	D	1	Humidity resistance	NA	NA		
	E	1	Cleanliness(1)	3.6.2	4.6.3.2		
II Other characteristics tests	A	1	Strength of extension wire connection	NA	NA	4	0
		2	Over current	3.8.2.2	4.6.5.2		
		3	Pressure dependence	NA	NA		
	B	1	Repeatability	3.8.2.4	4.6.5.4		
		2	Response time	3.8.2.5	4.6.5.5		
		3	Self-heating	3.8.2.6	4.6.5.6		
		4	Thermoelectromotive force	3.8.2.7	4.6.5.7		
III Environmental tests	A	1	Dynamic pressure	NA	NA	2	0
	B	1	Sinusoidal vibration (I)	3.8.3.2	4.6.6.2		
	C	1	Random vibration	3.8.3.4	4.6.6.4		
	D	1	Shock	3.8.3.5	4.6.6.5		
	E	1	Radiation hardness	3.8.3.6	4.6.6.6		
	F	1	Sinusoidal vibration (II)	NA	NA		
	G	1	Pressure cycle	NA	NA		
	H	1	Humidity resistance	NA	NA		
IV Life tests	A	1	Storage life	3.8.4.1	4.6.7.1	2	0
		2	Operating life – High temperature life	3.8.4.2.1	4.6.7.2.1		
			Operating life – Temperature cycling	3.8.4.2.2	4.6.7.2.2		
V Destructive test	A	1	Destructive pressure	3.8.5.1	4.6.8.1	2	0
VI Construction	A	1	Construction (DPA)	3.6.1	4.6.3.1	2	0
-	-	1	Parts and materials	3.3	N/A	(2)	N/A

Notes: (1) These tests may be performed during the manufacturing process. (Some items are substituted by the inspection data during manufacturing process)
(2) Data to certify compliance with design specifications shall be submitted.

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4.3 Quality Conformance Inspection

The quality conformance inspection shall be in accordance with Paragraph 4.5 of JAXA-QTS-2180, and Tables 7 and 8.

Table 7. Quality Conformance Inspection (Group A)

Group	Sub-group	Order	Inspection item	Requirement paragraph	Test method paragraph	Number of samples	Quantity of allowable defects
I (Basic characteristics test)	A	1	Externals, dimensions, marking and others	3.5	4.6.2	All	0
		2	Proof pressure(1)	3.8.1.1	4.6.4.1		
		3	Leakage	NA	NA		
	B	1	Insulation resistance	3.8.1.3	4.6.4.3		
		2	Dielectric withstanding voltage	3.8.1.4	4.6.4.4		
	C	1	Interchangeability(1)	3.8.1.5	4.6.4.5		
	D	1	Humidity resistance	NA	NA		
	E	1	Cleanliness(1)	3.6.2	4.6.3.2		

Note: (1) These inspections may be performed during the manufacturing process. (Some items are substituted by the inspection data during manufacturing process)

Table 8. Quality Conformance Inspection (Group B)

Group	Sub-group	Order	Inspection item		Requirement paragraph	Test method paragraph	Number of samples	Quantity of allowable defects
II Other characteristics tests	A	1	Strength of extension wire connection		NA	NA	1	0
		2	Over current		3.8.2.2	4.6.5.2		
		3	Pressure dependence		NA	NA		
	B	1	Repeatability		3.8.2.4	4.6.5.4		
		2	Response time		3.8.2.5	4.6.5.5		
		3	Self-heating		3.8.2.6	4.6.5.6		
		4	Thermoelectromotive force		3.8.2.7	4.6.5.7		
III Environmental tests	A	1	Random vibration		3.8.3.4	4.6.6.4	1	0
	B	1	Shock		3.8.3.5	4.6.6.5		
IV Life tests	A	1	Operating life	High temperature life	3.8.4.2.1	4.6.7.2.1	1	0
				Temperature cycling	3.8.4.2.2	4.6.7.2.2		
V Destructive test	A	1	Destructive pressure		3.8.5.1	4.6.8.1	1	0
VI Construction	A	1	Construction (DPA)		3.6.1	4.6.3.1	1	0

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4.4 Long-term Storage

The long-term storage shall be in accordance with paragraph 4.7 of JAXA-QTS-2180 and as follows.

4.4.1 Disposition of Products Stored for a Long Time at Manufacturer's Site

The shipment of the temperature sensors stored for 12 months or more after quality conformance inspection (group A) shall be in accordance with paragraph 4.7.1 of JAXA-QTS-2180.

4.4.2 Storage by Purchaser

If the package needs to be opened for an incoming inspection, it shall be opened in a clean room or in the area where cleanliness level is well controlled. After the package is opened, the products shall not be touched with bare hands.

4.5 Changes of Tests and Inspections

There is no change to the test or inspection from the in-process inspection and quality conformance inspection specified in JAXA-QTS-2180.

5. PREPARATION FOR DELIVERY

The preparation for delivery shall be in accordance with paragraph 5 of JAXA-QTS-2180.

6. NOTE

Refer to the paragraph 6 of JAXA-QTS-2180.