

| Change NO. | LTR | Description | Author | Date | Approved | Date |
|------------|-----|---|--------|--------|------------|--------------------------------|
| 10296 | A | Correct Thread Desc. In Figure 1 | JWS | 6-8-10 | JWS | 6-8-10 |
| 10346 | B | CHG Conn. Mate to a MS3106-14S-6S, Temp. Range of B | AR | 2-8-11 | <i>JWS</i> | 2011.02.08 14:05:34 - 05:00 |

Aerospace Temperature Probes Series 44

1. SCOPE

This specification defines the requirements and design for Series 44 platinum resistance temperature probes.

2. APPLICABLE DOCUMENTS

2.1 Specifications

KSC-S-126 Sealing of Electrical Components and Enclosures,
MIL-C-5015 Connectors, Electric, Circular Threaded, AN Type

2.2 Standards

KSC-STD-E-0010 Soldering of Electrical Connections (Hand or Machine)
MS3106 Connector, Plug, Electric, Straight
MS33656 Fitting/End, Standard Dimensions for Flared Tube Connection and Gasket Seal

3. REQUIREMENTS

3.1 Materials The housing is 316 stainless steel.

3.1.1 Sensing Element The sensing element is pure, annealed, strain-free platinum wire supported and contained in a closed well housing.

3.2 Interchangeability The unit is designed to permit interchangeability of units with the same number.

3.3 Service Media The unit will operate in the following gaseous or liquid media where compatible with the sheath-housing material and within the temperature range of the unit.

| | |
|--|---|
| Alcohol | Neon (Ne) |
| Ammonia (NH ₃) | Nitrogen (N ₂) |
| Helium (He) | Nitrogen tetroxide (N ₂ O ₄) |
| Hydrogen (H ₂) | Oxygen (O ₂) |
| Hydrazine (N ₂ H ₄) | Unsymmetrical dimethylhydrazine (UDMH) |
| Monomethylhydrazine (MMH) | Water (H ₂ O) |

3.4 Performance Characteristics Each unit shall exhibit the following performance characteristics (refer to 3.9 for appropriate letter and number designators)

3.4.1 Operating Current The operating current of the unit should be 1.0 milliamperes (mA) (the sensor excitation is supplied by an external signal conditioner).

3.4.2 Overcurrent The unit is capable of withstanding 20 mA continuously or 60 mA peak commutated at 10 hertz (Hz) without damage.



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| | | | | | | |
|--|-----------|-------------------|-----------|-----------------|-----------|---------|
| Title: Specification, Series 44 Platinum Temperature Probes | | | | | Dwn: JWS | 4-27-10 |
| FSCM NO 53547 | Size A | Dwg No 020-131 | Rev. B | Sheet 1 of 5 | Appr: JWS | 4-28-10 |

3.4.3 Insulation Resistance The insulation resistance between each connector pin with respect to the case shall be 100 megohms minimum, plus or minus 50 volts (V) direct current (dc) applied by a megohmmeter.

3.4.4 Repeatability The unit is capable of repeating test parameter results under identical test conditions, with the resistance change of 0 degrees Celsius (°C) 32 degrees Fahrenheit (°F) as follows.

| <u>Unit</u> | <u>Resistance Change</u> |
|-------------|--------------------------|
| 44B | ±0.1 ohm maximum |
| 44C | ±0.5 ohm maximum |

3.4.5 Thermoelectric Potential With the probe at a temperature that is 70°C (158°F) greater than the base and plug, the thermoelectric output potential due to the temperature differential is 20 microvolts maximum under steady state conditions.

3.4.6 Self-Heating The unit shall have a temperature self-heating error, within the operating temperature range as follows.

| <u>Unit</u> | <u>Temperature Error</u> | <u>I² Power</u> |
|-------------|--------------------------|----------------------------|
| 44B | ±1.1°C (5.4°F) maximum | 0.065 watts |
| 44C | ±3°C (5.4°F) maximum | 0.2 watts |

3.4.7 Resistance The resistance at 0°C (32°F) is as follows.

| <u>Unit</u> | <u>Pins</u> | <u>Resistance</u> | <u>Temperature Accuracy</u> |
|-------------|-------------|-------------------|-----------------------------|
| 44B | A to B | 200 ± 1.0 ohms | ± 1.28°C |
| 44C | A to B | 1000 ± 2.5 ohms | ± 0.63°C |

3.4.8 Resistance Ratio The ratio of the resistance is as follows.

| | |
|--|---|
| $\frac{R \text{ at } -195.8^{\circ}\text{C}}{R \text{ at } 0.0^{\circ}\text{C}}$ | 0.190 maximum for the 44C unit |
| $\frac{R \text{ at } 100^{\circ}\text{C}}{R \text{ at } 0.0^{\circ}\text{C}}$ | 1.3895 minimum (2 inches or shorter, can be 1.3850 minimum) |

3.4.9 Response Time The unit shall respond within 63.2 percent of total temperature change, for a step change in temperature from 25°C (77°F) to 100°C (212°F) plus or minus 3°C (5°F), within 20 seconds.

3.4.10 Thermal Cycle The probe portion of the unit is immersed alternately in liquid nitrogen (LN₂) (allowed to stabilize) and boiling water (allowed to stabilize) 10 times with a wait of one minute between immersions. The resistance at 0°C (32°F) is made following an immersion in a temperature bath set at 100°C for two hours. The resistance change at 0°C (32°F) is as follows:

| <u>Unit</u> | <u>Resistance Change</u> |
|-------------|--------------------------|
| 44B | ±0.1 ohm maximum |
| 44C | ±0.75 ohm maximum |

3.4.11 Bending Support the probe in a rigid test fixture. Apply a load of 4536 grams (10 pounds) plus or minus 227 grams (0.5 pound) perpendicular to the longitudinal axis of the probe at a point 1.50 centimeters (cm) (0.59 inch) plus or minus 0.25 cm (0.10 inch) from the supported point. The load shall not cause a deflection of more than 0.038 cm (0.15 inch) at the applied load point. When the load is removed, this point shall return to its initial position within plus or minus 0.008 cm (0.003 inch)

3.4.12 Pressure Seal The unit shall operate with no leakage or degradation to a maximum pressure of 35 megapascals [5076 pounds per square inch, gauge (psig)].

3.5 Environmental Conditions Each unit is capable of operating within the following environmental conditions.

3.5.1 Temperature Each unit is capable of operating within an environmental temperature range as follows.

| <u>Unit</u> | <u>Resistance Change</u> |
|-------------|-----------------------------------|
| 44B | -40 °C to 200°C (-40°F / 392°F) |
| 44C | -196°C to 125°C (-320°F to 257°F) |

3.6 Connector The connector shall mate with an MS3106R-14S-6S connector in accordance with MIL-C-5015. Pin assignment is as follows.

| <u>Pin</u> | <u>Function</u> |
|------------|--------------------------|
| A | Signal Output (positive) |
| B | Signal Output (negative) |
| C | Excitation (return) |
| D | Excitation (positive) |
| E | Not used |
| F | Not used |

3.7 Size The size is in accordance with figure 1 (refer to 3.9 for length)

3.8 Identification The following information is permanently applied to the surface of the unit as specified in MIL-STD-130.

| | |
|---|---|
| a | Serial number |
| b | Manufacturer |
| c | Model number |
| d | Contract number |
| e | Date the unit was manufactured (month and year) |
| f | Unit name |

3.9 Ordering Information The following information provides the correct part number with appropriate designators to order the unit with the desired characteristics.

| <u>Probe Model Number</u> | |
|---------------------------|--|
| 44 | Series 44 probe |
| <u>Probe Type</u> | |
| B | Type B (200 ohms) -40°C to 200°C (-40°F to 392°F) |
| C | Type C (1000 ohms) -196°C to 125°C (-320°F to 257°F) |
| <u>Probe Length</u> | |
| XXX | Length: Tenths of Inches |

| <u>Example</u> | | | |
|----------------|---|-----|--|
| 44 | C | 105 | 1000 Ohm Probe with 10.5 inch Immersion Length |

3.10 Calibration Each unit is calibrated and the data recorded on a calibration table that indicates resistance output versus temperature.

3.10.1 Calibration Point With a constant current of 1.0 mA plus or minus 0.001 mA, the unit is calibrated as follows using the following set points.

- a. Boiling point of nitrogen -195.8 °C (-320.5 °F)
- b. Triple point of water 0.0 °C (32.0 °F)
- c. Boiling point of water 100 °C (212 °F)

3.10.2 Calibration Curve With the information obtained in 3.10.1, a calibration curve is derived. The interpolation method of IPTS 90 is used.

Data Sheet The data sheet is in tabular form in Celsius degrees versus resistance.

- a. For the 44B, 2 degree increments from -40°C to 200°C.
- b. For the 44C, 1 degree increments from -196°C to -170°C, and 2 degree increments to 125°C.

The data sheet shall also include the following information.

- a. Serial number
- b. Manufacturer
- c. Model number
- d. Date the unit was calibrated
- e. Unit name
- f. Data obtained from 3.10.1

Equipment used for calibration is traceable to the National Institute of Standards and Technology.

NOTES:

1. SURFACE FINISH IN ACCORDANCE WITH ANSI B46.1
2. FACE OF HEX TO BE PERPENDICULAR TO SENSOR AXIS TO WITHIN 0.002
3. DIAMETERS TO BE CONCENTRIC WITH SENSOR AXIS TO WITHIN 0.012 TOTAL INDICATOR READING
4. SENSOR HOUSING SHALL BE 316 SS ONE PIECE MACHINED TUBE 4.50 INCHES LONG OR SHORTER FOR INSERTION LENGTHS OF LESS THAN 6.00 INCHES LONG. IF NOT ONE PIECE, THREADED EXTENSION TUBES ARE TO BE USED AND WELDED.
5. DIMENSIONS ARE IN INCHES.

1/4-28 THREADED MECHANICAL JOINT WITH GTAW BUTT WELD FOR HERMETIC SEAL.

FITTING PER MS33656-E4
7/16 x 20 UNJF-3A
FOR BOSS SEALING WITH 1/16 HEX

IDENTIFICATION DATA TO BE LOCATED IN APPROXIMATE POSITION SHOWN.

CAPACITIVE DISCHARGE STAINLESS STEEL BALL SEAL

STAINLESS STEEL HERMETICALLY SEALED ELECTRICAL RECEPTACLE

PROBE TIP

$\varnothing .156$
.158

0.875

1.50

EXTENSION TUBE AS REQUIRED

$\varnothing .336$
.340

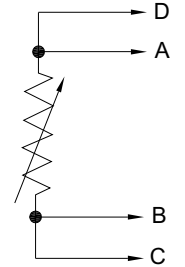
$L \pm .030$.
REFER TO PART NO.
FOR VALUE OF L

0.50 MIN

1.562 (REF)
MAX

GTAW FLANGE WELD

CONNECTOR TO MATE WITH MS3106R-14S-6S.



SCHMATIC

Figure 1. Series 44 Probe Configuration