

Change NO.	LTR	Description	Author	Date	Approved	Date

## Aerospace Silicon Diode Temperature Probes Series 44D

### 1. SCOPE

This specification defines the requirements and design for Series 44 silicon diode 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 (excluding the connector shell which is 303 or better).

**3.1.1 Sensing Element** The sensing element is a silicon diode 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 <sub>3</sub> )	Nitrogen (N <sub>2</sub> )
Helium (He)	Nitrogen tetroxide (N <sub>2</sub> O <sub>4</sub> )
Hydrogen (H <sub>2</sub> )	Oxygen (O <sub>2</sub> )
Hydrazine (N <sub>2</sub> H <sub>4</sub> )	Unsymmetrical dimethylhydrazine (UDMH)
Monomethylhydrazine (MMH)	Water (H <sub>2</sub> O)

**3.4 Performance Characteristics** Each unit shall exhibit the following performance characteristics.

**3.4.1 Operating Current** The operating current of the unit should be 10 microamperes (μA) ± 0.1 μA for the 44D units and 100 μA ± 1 μA for the 44DX units (the sensor excitation is supplied by an external signal conditioner).

**3.4.2 Overcurrent** The unit is capable of withstanding 1 mA continuously without damage.



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**3.4.3 Insulation Resistance** The insulation resistance between each connector pin with respect to the case shall be 100 megohms minimum with 50 volts direct current (VDC) applied by a megohmmeter.

**3.4.4 Repeatability** The unit is capable of repeating test parameter results under identical test conditions, within  $\pm 0.1$  K ( $\pm 5$  mVDC) at the boiling point of liquid helium and within  $\pm 0.5$  K (1.2 mVDC) from 25 K to 400 K.

**3.4.5 Accuracy** The unit shall be accurate to within  $\pm 0.25$  K ( $\pm 12.8$  mVDC) from 1.5 K to 25 K and within  $\pm 0.5$  K (1.2 mVDC) from 25 K to 400 K.

**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>I<sup>2</sup> Power</u>
44D	$\pm 0.01$ K maximum	0.2 milliwatts
44DX	$\pm 0.10$ K maximum	2.0 milliwatts

**3.4.7 Response Time** The unit shall respond within 63.2 percent of total temperature change, for a step change in temperature from 293.15 K  $\pm 3$  K to 373.15 K  $\pm 3$  K and a step change from 293.15 K  $\pm 3$  K to 77.35 K  $\pm 3$  K, within 20 seconds.

**3.4.8 Thermal Cycle** The probe shall perform within requirements following ten alternating exposures to two different temperatures with a differential of not less than 273 K, using pre- and post thermal cycle outputs at any given temperature as comparison.

**3.4.9 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).

**3.4.10 Pressure Seal** The unit shall operate with no leakage or degradation to a maximum (burst) 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 of 1.5 K (-271.66°C) to 400 K (126.85°C).

**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.

Probe Model Number		
44	Series 44 probe	
Probe Type		
D	For Use with 10 $\mu$ A excitation	
DX	For Use with 100 $\mu$ A excitation	
Probe Length		
	###	Length: Tenths of Inches

Example			
44	D	105	10 $\mu$ A probe with 10.5 inch Immersion Length

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

**3.10.1 Calibration Point** With a constant current of 10  $\mu$ A  $\pm$  0.1  $\mu$ A for a 44D or 100  $\mu$ A  $\pm$  1.0  $\mu$ A for a 44DX, the unit is calibrated using the following set points.

- a. Boiling point of helium      4.22 K (-268.93 °C)
- b. Boiling point of nitrogen    77.35 K (-195.8 °C)
- b. Triple point of water        273.15 K (0.0 °C)

**3.10.2 Data Sheet** The data sheet is in tabular form in Kelvin versus voltage in 1 Kelvin increments from 1 K to 400 K.

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

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 PERPENDICULAR TO SENSOR AXIS TO WITHIN 0.002.
3. DIAMETERS CONCENTRIC WITH SENSOR AXIS TO WITHIN 0.012 TOTAL INDICATOR READING.
4. SENSOR HOUSING IS 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 MS33656E4 FOR BOSS SEALING WITH 7/16 HEX UNF-3A

PER MS33656E4

IDENTIFICATION DATA TO BE LOCATED IN APPROXIMATE POSITION SHOWN.

CAPACITIVE DISCHARGE STAINLESS STEEL BALL SEAL

STAINLESS STEEL HERMETICALLY SEALED ELECTRICAL RECEPTACLE

PROBE TIP

$\frac{\varnothing .156}{.158}$

0.875

1.50

EXTENSION TUBE AS REQ.

$\frac{\varnothing .336}{.340}$

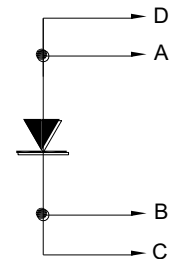
$L \pm .030$ . REFER TO PART NO. FOR VALUE OF L.

0.50 MIN

1.562 (REF) MAX

GTAW FLANGE WELD

CONNECTOR TO MATE WITH MS3106R-6S.



**SCHEMATIC**

**Figure 1. Series 44 Probe Configuration**