

Change No.	Rev.	Description	Author	Date	Approved	Date
10513	D	Revise Pressure Specification	JWS	4/26/13	JWS	4/29/13
DCR	E	Added Ordering Information for DX1, Updated Format	AC/AS	6/12/2020	ARK	6/16/2020

Purpose

This specification defines the requirements and design for Series 46 silicon diode temperature probes.

Standards and Referencing Documents

Specifications:

MIL-DTL-38999	Detail Specification: Connectors, Electrical, Circular, Miniature, High Density, Quick Disconnect
MIL-C-5015	Connectors, Electric, Circular Threaded, AN Type
AS1043	Safety Wire Holes, Fitting, Location of Design Standard

Standards:

KSC-S-126	Sealing of Electrical Components and Enclosures
KSC-STD-E-0010	Soldering of Electrical Connections (Hand or Machine)
ANSI B46.1	Surface Texture (Surface Roughness, Waviness, and Lay)
MIL-STD-130	Identification Marking

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Requirements

- Materials:** The housing is 316 stainless steel (excluding the connector shell which is 303 or better).
- Sensing Element:** The sensing element is a silicon diode supported and contained in a well closed housing.
- Interchangeability:** The unit is designed to permit interchangeability of units with the same number.
- 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:
- | | |
|---|---|
| <i>Alcohol</i> | <i>Neon (Ne)</i> |
| <i>Ammonia (NH₃)</i> | <i>Nitrogen (N₂)</i> |
| <i>Helium (He)</i> | <i>Nitrogen teroxide (N₂O₄)</i> |
| <i>Hydrogen (H₂)</i> | <i>Oxygen (O₂)</i> |
| <i>Hydrazine (N₂H₄)</i> | <i>Unsymmetrical dimethylhydrazine (UDMH)</i> |
| <i>Monomenthylhygrazine (MMH)</i> | <i>Water (H₂O)</i> |
- Performance Characteristics:** Each unit shall exhibit the following performance characteristics (refer to **Ordering Information**) for appropriate letter and number designators)
- Operating Current:** The operating current of the unit should be 10 microamperes (μA) \pm 0.1 μA for the 46D units and 100 μA \pm 1 μA for 46DX and 46DX1 units (the sensor excitation is supplied by an external signal conditioner).
- Overcurrent:** The unit is capable of withstanding 1 mA continuously without damage.
- Insulation Resistance:** The insulation resistance between each connector pin with respect to the case shall be 100 megohms minimum 50 volts direct current (VDC) applied by a megohmmeter.
- Repeatability:** The unit is capable of repeating test parameter results under identical test conditions, within \pm 0.1K (\pm 5 mVDC) at the boiling point of liquid helium and within \pm 0.5K (1.2 mVDC) from 25 K to 400 K.
- Accuracy:** The unit shall be accurate to within \pm 0.25K (\pm 12.8 mVDC) from 1.5K to 25K and within \pm 0.5K (1.2 mVDC) from 25K to 400K. (46DX and 46DX1, within \pm 0.75K from 273K to 400K)

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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>
46D	±0.01 K maximum	0.2 milliwatts
46DX (46DX1)	±0.10 K maximum	2.0 milliwatts

Response Time:

The unit shall respond within 63.2 percent of total temperature change, for a step change in temperature from 293.15 K ± 3K to 77.35 K ± 3K, within 15 seconds.

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.

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).

Pressure Seal:

The probes shall show no leakage at the operating pressures below (depending on the safety factor required for the application). See Below Table.

Pressure	1.5X Applications	1.2X Applications
<i>MEOP</i>	2000 psi	2500 psi
<i>Proof</i>	3000 psi	3000 psi
<i>Burst</i>	4000 psi	4000 psi

Environmental Conditions:

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

a. 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).

Vibration:

Each unit is capable of operating under vibration up to 30g rms at 200-2000Hz.

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Connector: The connector shall mate with an MIL38999/26-A-35 Series III connector. Pin assignment is as follows.

<u>Pin</u>	<u>Function</u>
1	Signal Output (positive)
2	Excitation (positive)
3	Not used
4	Excitation (return)
5	Signal Output (negative)
6	Not used

Size: The size is in accordance with Figures 1 and 2. (refer to **Ordering Information** for length).

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

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

Probe Model Number	
46	
Probe Type	
D	<i>For use with 10µA excitation</i>
DX	<i>For use with 100µA excitation (Typ response curve: 018-045)</i>
DX1	<i>For use with 100µA excitation (Typ response curve: 018-045-1)</i>
Probe length	
XXX	<i>Length: Tenths of Inches</i>

Example			
46	D	025	10µA Probe with 2.5inch Immersion Length

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

Calibration Point:

1. With a constant current of **10 μ A \pm 0.1 μ A** for a 46D or 100 μ A \pm 1.0 μ A for a 46DX (46DX1), the unit is calibrated as follows using the following set points.
 - a. Boiling point of Helium 4.22K (-268.93 °C)
 - b. Boiling point of Nitrogen 77.35K (-195.8° C)
 - c. Triple point of water 273.15K (0.0°C)

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

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

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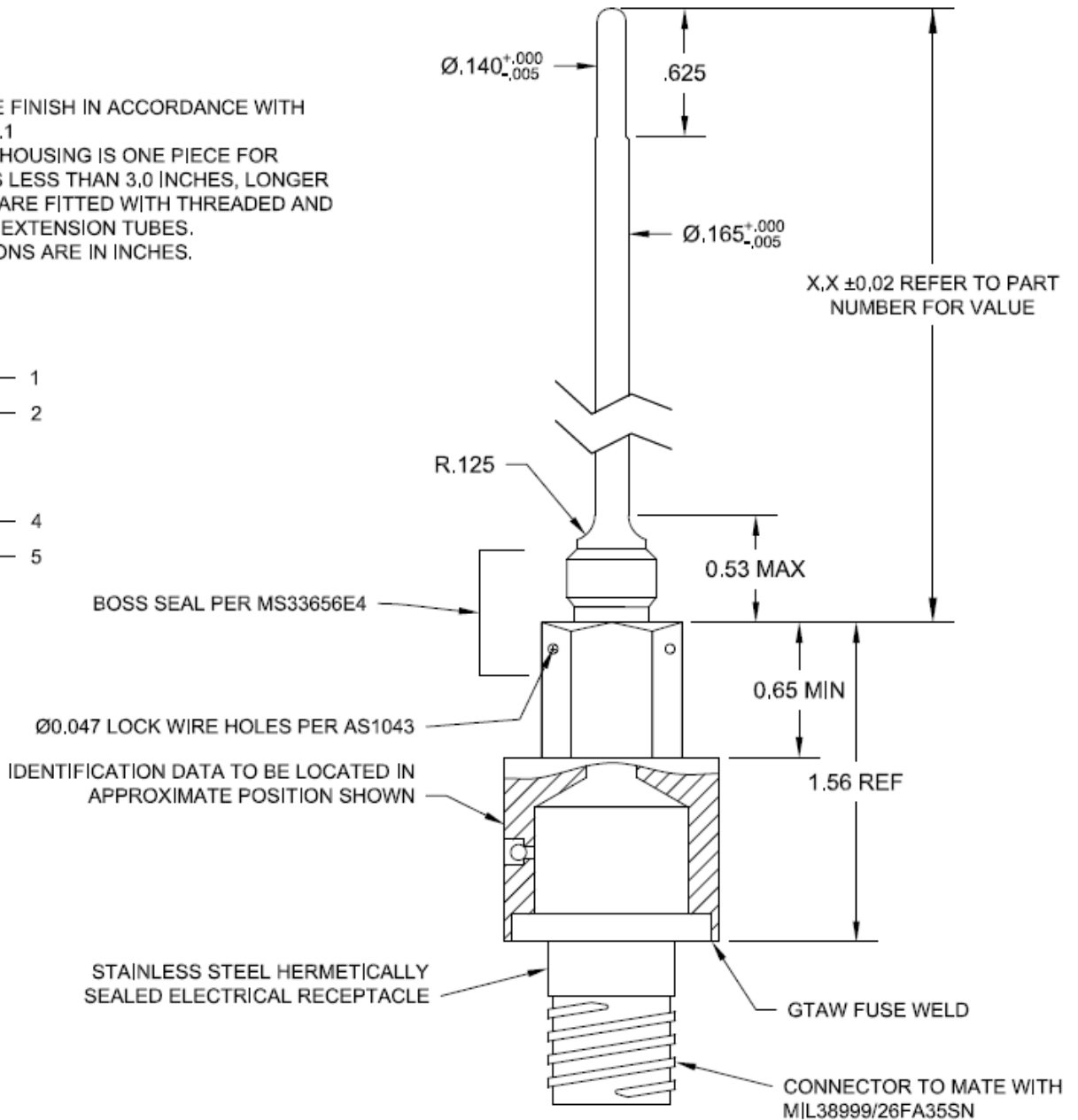
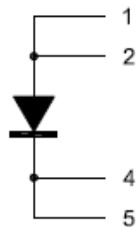
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Figure 1. Series 46D Probe Configuration, Probes 3 Inches or Less

NOTES:

1. SURFACE FINISH IN ACCORDANCE WITH ANSI B46.1
2. SENSOR HOUSING IS ONE PIECE FOR LENGTHS LESS THAN 3.0 INCHES, LONGER PROBES ARE FITTED WITH THREADED AND WELDED EXTENSION TUBES.
3. DIMENSIONS ARE IN INCHES.



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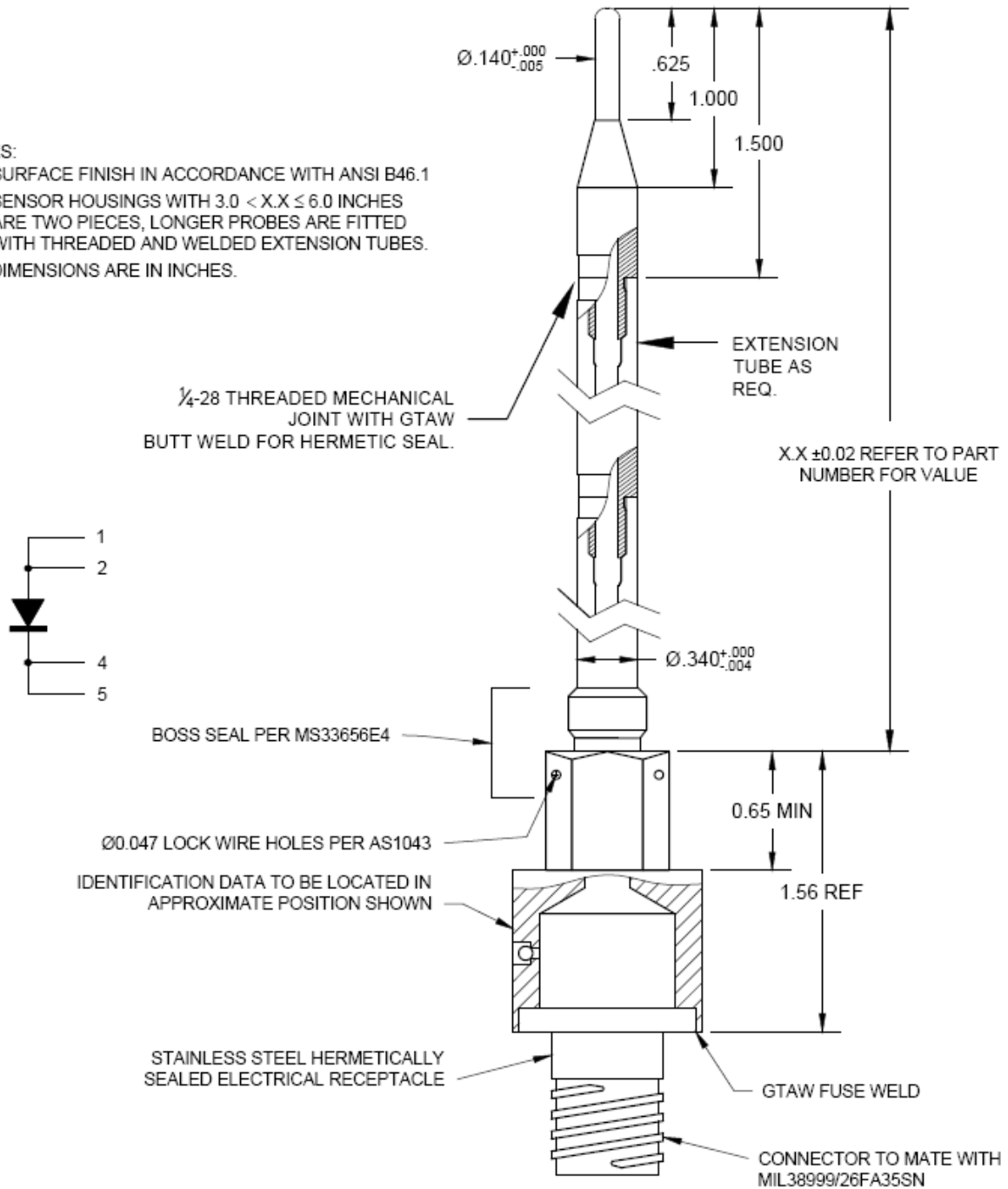
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Figure 2. Series 46D Probe Configuration, Probes Greater Than 3 Inches

NOTES:

1. SURFACE FINISH IN ACCORDANCE WITH ANSI B46.1
2. SENSOR HOUSINGS WITH $3.0 < X.X \leq 6.0$ INCHES ARE TWO PIECES, LONGER PROBES ARE FITTED WITH THREADED AND WELDED EXTENSION TUBES.
3. DIMENSIONS ARE IN INCHES.



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