

Exhaust Gas Temperature Instruments

FOREWORD

This document has been declared "NONCURRENT". It is recommended, therefore, that this document not be specified for new designs. "NONCURRENT" refers to those documents which have previously been widely referenced and may continue to be required on some existing designs. "NONCURRENT" documents are available from SAE upon request.

1. PURPOSE:

This standard establishes the essential minimum safe performance standards for exhaust gas temperature instruments primarily for use with turbine powered, subsonic aircraft, the operation of which may subject the instruments to the environmental conditions specified in paragraph 3.3 et seq.

2. SCOPE:

The exhaust gas temperature instruments covered by this standard are of the electrical servo null balance type, actuated by a varying emf output of one or more parallel connected Chromel-Alumel thermocouples.

3. GENERAL REQUIREMENTS:

3.1 Material and Workmanship:

3.1.1 Materials: Materials shall be of a quality which experience and/or tests have demonstrated to be suitable and dependable for use in aircraft instruments.

3.1.2 Workmanship: Workmanship shall be consistent with high-grade aircraft instrument manufacturing practice.

(This document supersedes and cancels ARP 428, issued 11-15-59.)

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3.2 Identification:

The following information shall be legibly and permanently marked on the instrument or nameplate attached thereto:

- a. Name of instrument
- b. SAE AS 428
- c. Manufacturer's part number
- d. Manufacturer's serial number or date of manufacture
- e. Manufacturer's name and/or trademark
- f. Range (if applicable)
- g. Rating (electrical, vacuum, etc.) (if applicable)
- h. Explosion category (if applicable)

3.3 Environmental Conditions:

The following conditions have been established as minimum design requirements. Tests shall be conducted as specified in Sections 5, 6, and 7.

- 3.3.1 Temperature: When installed in accordance with the instrument manufacturer's instructions, the instruments shall function over the range of ambient temperatures shown in column A below, and shall not be adversely affected by exposure to the temperatures shown in column B below:

<u>Instrument Location</u>	<u>A</u>	<u>B</u>
Pressurized Areas	0 to 70 C	-65 to 70 C

- 3.3.2 Altitude: When installed in accordance with the instrument manufacturer's instructions, the instrument shall function from sea level up to the altitudes and temperatures listed below. Altitude pressure values are per NACA Report 1235. The instrument shall not be adversely affected following exposure to extremes in ambient pressure of 50 and 3 in. Hg abs, respectively.

<u>Instrument Location</u>	<u>Altitude</u>	<u>Temp.</u>
Pressurized areas	15,000 ft	50 C
Non-pressurized or external areas	60,000 ft	40 C

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- 3.3.3 Vibration: When installed in accordance with the instrument manufacturer's instructions, the instrument shall function and shall not be adversely affected when subjected to vibrations of the following characteristics:

<u>Instrument Location</u>	<u>Frequency (cps)</u>	<u>Maximum Double Amplitude (in.)</u>	<u>Maximum Acceleration (g)</u>
Nacelle, nacelle mounts, wings, empennage, and wheel wells	5-1000	0.036	10
Fuselage			
Forward of spar area	5-500	0.036	2
Center of spar area	5-1000	0.036	4
Aft of spar area	5-500	0.036	7
	500-1000	---	5
Vibration isolated rack	5-1000	0.030	1
Flight deck area	5-30	0.020	
	30-1000	--	0.25

- 3.3.4 Humidity: The instrument shall function and shall not be adversely affected following exposure to any relative humidity in the range from 0 to 95% at a temperature of approximately 70 C.

3.4 Explosion Category:

The instrument component, when intended for installation either in uninhabited areas of non-pressurized aircraft or in non-pressurized areas of pressurized aircraft, shall not cause an explosion when operated in an explosive atmosphere. The component shall meet the requirements applicable to the explosion category below. Specifically, any instrument component which can be an ignition source and is intended for installation in an area in which combustible fluid or vapor may result from abnormal conditions (e.g., fuel line leakage) shall meet the requirements of category I. If the intended location is an area where combustible fluid or vapor can occur during normal operation (e.g., fuel tank), the instrument component shall meet the requirements of category II, listed below:

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<u>Category</u>	<u>Definition</u>	<u>Requirement</u>
I	Explosion proofed - case not designed to preclude flame or explosion propagation	paragraph 7.5.1
II	Explosion proofed - case designed to preclude flame or explosion propagation	paragraph 7.5.2
III	Hermetically sealed	paragraph 6.2
IV	Instrument not capable of causing an explosion	shall not be capable of producing a spark of more than 1.0 millijoule of energy and shall not have a short circuit current of more than 100 milliamperes

3.5 Fire Hazard:

The instrument shall be so designed to safeguard against hazards to the aircraft in the event of malfunction or failure, and the maximum operating temperature of surfaces of any instrument component contacted by combustible fuel or vapor shall not exceed 200 C due to self-heating.

3.6 Radio Interference:

The instruments shall not be the source of objectionable interference under operating conditions at any frequencies used on aircraft, either by radiation or feedback, in electronic equipment installed in the same aircraft as the instrument. Reference RTCA DO 108 including appendix A.

3.7 Magnetic Effect:

The magnetic effect of the instruments shall not adversely effect the performance of other instruments installed in the same aircraft.

3.8 De-Compression:

When installed in accordance with the instrument manufacturer's instructions, the instrument shall function and not be adversely affected following exposure to a pressure decrease from 22 to 2 in. Hg in 2 sec.

3.9 A-C Noise Rejection and Beat Frequency:

The instrument shall withstand the effects of beat frequencies in power input and stray a-c signals in thermo couple circuit as specified in paragraph 7.3.

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4. DETAIL REQUIREMENTS:

4.1 Calibration:

Calibration shall be in accordance with the emf versus temperature values for Chromel-Alumel thermocouples shown in Table I.

4.2 Power:

The instrument shall be designed to operate on $115\text{ v} \pm 10\%$ a-c, and $400 \pm 5\%$ cps power.

4.3 Power Malfunction Indication:

Means shall be incorporated in the instrument to indicate when adequate power (voltage and/or current) is not being made available to all phases required for the proper operation of the instrument. The indicating means shall indicate a failure or a malfunction in a positive manner.

4.4 Hermetic Sealing:

When hermetically sealed, the case shall be filled with an inert gas, free of dust particles, and sufficiently dry so that fogging of the indicator glass does not occur during the low temperature and fogging tests of this standard.

4.5 Connector:

A single, hermetically sealed AN-type connector shall be used for all electrical connections to the instrument.

4.6 Vacuum Tubes:

No vacuum tubes shall be used in the electronic circuit of the instrument.

4.7 Display Markings:

4.7.1 Finish: Unless otherwise specified by the user, matte white material shall be applied to all major graduations, numerals, and indicating means. Non-functional surfaces shall be a durable dull black.

4.7.2 Numerals and Graduations: Sufficient numerals and graduations shall be marked to positively and quickly identify temperature indications. Numerals shall distinctly indicate the graduations to which they apply.

4.7.3 Visibility: The indicating means and all significant dial markings shall be readable from any point within the frustum of cone whose side makes an angle of not less than 30° with the perpendicular to the dial, and whose small diameter is the aperture of the instrument case. The distance between the dial and the cover glass shall be a practical minimum.