



AEROSPACE STANDARD

Society of Automotive Engineers, Inc.
400 COMMONWEALTH DRIVE, WARRENDALE, PA. 15096

AS 8028

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POWERPLANT FIRE DETECTION INSTRUMENTS THERMAL & FLAME CONTACT TYPES (RECIPROCATING AND TURBINE ENGINE POWERED AIRCRAFT)

1.0 PURPOSE

This Standard establishes minimum requirements for powerplant fire detection instruments primarily for use in reciprocating and turbine engine powered aircraft.

2.0 SCOPE

2.1 This Standard covers the following basic types of fire detection instruments, or combinations thereof, intended for use in protecting aircraft powerplant installation, auxiliary powerplants, combustion heaters and other installations where fuel, oil or similar fires may occur.

2.2 Types

Type I: Thermal - Fixed Temperature, an instrument which will actuate an alarm signal when exposed to any temperature above a definite pre-established level.

Type II: Thermal - Rate of Rise, an instrument which will actuate an alarm signal when exposed to any rate of temperature change above a definite pre-established level.

Type III: Flame - Contact, an instrument which will actuate an alarm signal when exposed to physical contact with flame.

2.3 Range

The range and/or setting of the instrument shall be as marked on the instrument.

2.4 Applicable Documents

The following documents shall form a part of this specification to the extent specified herein:

Radio Technical Commission of Aeronautics (RTCA) Document DO-160 "Environmental Conditions and Test Procedures for Airborne Electronic/Electrical Equipment and Instruments," dated 28 February 1975 (copies may be obtained from the RTCS Secretariat, 1717 H Street, N.W. Washington, D.C. 20006).

"Rules for SAE use of SI (metric) units - SAE document J 916B," dated July 1976 - Copies may be obtained from Society of Automotive Engineers, 400 Commonwealth Drive, Warrendale, PA., 15096.

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3.0 GENERAL STANDARDS

- 3.1 Materials: Materials shall be of a quality which experience and/or tests have demonstrated to be suitable and dependable for use in aircraft instruments.
- 3.2 Workmanship: Workmanship shall be consistent with high-grade aircraft instrument manufacturing practice.
- 3.3 Accessibility of Controls: Controls which are not normally adjustable in flight shall not be readily accessible to flight personnel when the instrument is installed in accordance with the manufacturer's instructions.
- 3.4 Interchangeability: Instruments which are identified with the same manufacturer's part or model number range and/or setting shall be completely interchangeable.
- 3.5 Integrity Test Means: The instrument shall be of such design to provide a means for testing the integrity of the instrument when the aircraft engines are operating.
- 3.6 Identification: The following information shall be legibly and permanently marked on the instrument or attached thereto:
- (a) Name of Instrument (Powerplant Fire Detector)
 - (b) Manufacturer's Part Number
 - (c) Manufacturer's Serial Number or Date of Manufacture
 - (d) Manufacturer's Name and/or Trademark
 - (e) Type Number
 - (f) Alarm Temperature or range (Sensing element, where applicable)
 - (g) Rating (Electrical, Vacuum, etc.)
- 3.7 Environmental Conditions: The following conditions have been established as minimum design requirements.
- 3.7.1 Temperature: When installed in accordance with the manufacturer's recommendations, the instrument 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 (deg. C)</u>	<u>A (deg. F)</u>	<u>B (deg. C)</u>	<u>B (deg. F)</u>
Powerplant Compartments	-55 to 150	-67 to 302	-65 to 150	-85 to 302
Pressurized Areas	-30 to 50	-22 to 122	-65 to 70	-85 to 158
Non pressurized or External areas	-55 to 70	-67 to 158	-65 to 70	-85 to 158

If instrument is intended for use in compartments where ambient exceeds range limits noted in Columns A or B appropriate special limits shall be selected for Columns A and B, and specified by the manufacturer.

- 3.7.2 Humidity: The instrument shall function and shall not be adversely affected when exposed to a relative humidity in excess of 95 percent

- 3.7.3 Altitude: When installed in accordance with the instrument manufacturer's instructions, the instruments shall function from sea level up to the altitudes and temperatures listed below. Altitude pressures are per U.S. Standard Atmosphere, 1962.

<u>Instrument Location</u>	<u>Altitude</u>		<u>Temperature</u>	
	<u>Ft.</u>	<u>M</u>	<u>°C</u>	<u>°F</u>
Powerplant Compartments	50,000	15,240	80	176
Other Areas	50,000	15,240	50	122

The instrument shall not be adversely affected following exposure to extremes in ambient pressure of 50 in. (127 cm), and 3 in. (7.62 cm) of mercury absolute, respectively.

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

<u>Reciprocating Engines</u>	<u>Frequency Cycles Per Sec.</u>	<u>Max. Double Amplitude</u>		<u>Maximum Acceleration</u>
		<u>In.</u>	<u>Cm</u>	
Airframe Structure Mounted	5-500	.050	.127	10g
Shock-Mounted Panel	5-50	.020	.051	1.5g
Powerplant Mounted	5-500	.100	.254	20g
<u>Turbine Engines</u>	<u>Frequency Cycles Per Sec.</u>	<u>Max. Double Amplitude</u>		<u>Maximum Acceleration</u>
		<u>In.</u>	<u>Cm</u>	
Nacelle and Nacelle Mounts, Wings, Empennage and Wheel Wells	5-2000	0.036	.091	10g
Fuselage				
Forward of Spar Area	5-500	0.036	.091	2g
Center of Spar Area	5-1000	0.036	.091	4g
Aft of Spar Area	5-500	0.036	.091	7g
	500-1000	-----	----	5g
Vibration Isolated	5-50	0.020	.051	1.5g
Racks	50-500	-----	----	0.5g
Instrument Panel	5-500	.030	.076	1.0g

- 3.8 Radio Interference: The instrument 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.

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- 3.9 Magnetic Effect: The magnetic effect of the instrument shall not adversely affect the operation of other instruments in the same aircraft.
- 3.10 Fire Resistance: Except for small parts (such as knobs, fasteners, seals, grommets and small electrical parts) that would not contribute significantly to the propagation of a fire, all materials used must be self-extinguishing when tested in accordance with the requirements of Federal Aviation Regulations 25.1359(d) and Appendix F thereto, with the exception that materials tested may be configured in accordance with paragraph (b) of Appendix F or may be configured as used.
- 3.11 Water Spray: Instruments that are to be marked with a Water Proofness Category "W" rating shall not allow penetration of water and shall comply with all applicable equipment performance standards when tested in accordance with paragraph 10.0 of DO-160.
- 3.12 Salt Spray: Instruments that are to be marked with a Salt Spray Category "S" rating shall not exhibit evidence of corrosion of metals, clogging or binding of moving parts, insulation fault or damage to contacts or uncoated wiring, and shall comply with all equipment performance standards when tested in accordance with paragraph 14.0 of DO-160.
- 3.13 Indication Means: The instrument shall be capable of actuating visual and/or aural alarm indicators.
- 3.14 Reliability: The instrument shall be of such design to withstand the mechanical and thermal shocks and stresses incident to its use in aircraft. False alarm signals shall not be produced by the instrument as the result of variations in voltage to be encountered during operation of the aircraft, abnormal attitudes, contaminating atmospheres, ambient light conditions, accelerations which could be encountered during flight, landing and take-off.
- 3.15 Calibration Means: An instrument designed to be adjustable shall be such that all calibration means be provided with tamper-proof seals.
- 3.15.1 Adjustable Detector Systems: Instruments which incorporate means for adjustment shall be tested to prove compliance with this standard, particularly paragraphs 5.2.1, 5.2.2, 5.2.3 and 5.22, throughout the range of adjustability.
- 4.0 Minimum Performance Requirements Under Standard Test Conditions
- 4.1 Atmospheric Conditions: Unless otherwise specified, all tests required by this Standard shall be conducted at an atmospheric pressure of approximately 29.92 in. (76 cm) of mercury and at an ambient temperature of approximately 25°C (77°F) and at a relative humidity of not greater than 85 percent. When tests are conducted with the atmospheric pressure or the temperature substantially different from these values, allowance shall be made for the variation from the specified conditions.
- 4.2 Vibration to Minimize Friction: Unless otherwise specified, all tests for performance may be conducted with the instrument subjected to a vibration of 0.002 to 0.005 in. (0.005 to 0.013 cm) double amplitude at a frequency of 1500 to 2000 cycles per minute. The term double amplitude as used herein indicates the total displacement from positive maximum to negative maximum.

- 4.3 Vibration Equipment: Vibration equipment shall be used which will provide frequencies and amplitudes consistent with the requirements of Section 3.7.4 with the following characteristics:
- 4.3.1 Linear Motion Vibration: Vibration equipment for airframe structure-mounted or powerplant-mounted instrument components shall be such as to allow vibration to be applied along each of three mutually perpendicular axes of the test specimen.
- 4.3.2 Circular Motion Vibration: Vibration equipment for shock mounted panel instrument component shall be such that a point on the instrument case will describe, in a plane 45° to the horizontal plane, a circle the diameter of which is equal to the double amplitude specified.
- 4.4 Power Conditions: Unless otherwise specified, all tests shall be conducted at a power rating recommended by the manufacturer.
- 4.5 Test Position: Unless otherwise specified, the instrument shall be mounted and tested in its normal operating position.
- 4.6 Flame Temperature Measurement and Flame Size: All flame temperatures shall be measured by using chromel-alumel thermocouples of 18 AWG wire. The thermocouple bead shall be at the center of the flame and the two wires leading to the bead shall be parallel and extend for a distance of 3 inches horizontally into the flame. The nature and size of the flame and the method of test shall be as specified in Figures 2-1, 2-2, 2-3 and 2-4. The thermocouple and the test article shall be the same distance from the burner face, to assure that the test article is exposed to the temperature measured.
- 4.7 Individual Performance Requirements: All instruments or components of such shall be subjected to whatever tests the manufacturer deems necessary to demonstrate the production articles comply with this Aerospace Standard including the following requirements where applicable.
- 4.7.1 Sensitivity and Calibration: The sensor shall be tested as specified in Paragraph 5.1, or in an equivalent manner which will test the response sensitivity and calibration.
- 4.7.2 Dielectric: Each instrument shall be tested by the methods of inspection listed in Paragraphs 4.7.2.1 and 4.7.2.2.
- 4.7.2.1 Insulation Resistance: The insulation resistance measured at 200 volts D.C. for five seconds between all electrical circuits connected together and the metallic case shall not be less than 5 megohms. Insulation resistance measurements shall not be made to circuits where the potential will appear across elements such as windings, resistors, capacitors, etc. since this measurement is intended only to determine adequacy of insulation.