



AEROSPACE STANDARD

AS8040™**REV. C**

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Superseding AS8040B

(R) Heater and Accessories, Aircraft
Internal Combustion Heat Exchanger Type

RATIONALE

The standard's title and body have been revised to reflect its use as minimum performance requirements for both heater and heater accessories.

AS8040C has been reaffirmed to comply with the SAE Five-Year Review policy.

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Documents

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1. SCOPE

This SAE Aerospace Standard (AS) covers combustion heaters and accessories used in, but not limited to, the following applications:

- a. Cabin heating (all occupied regions and windshield heating)
- b. Wing and empennage anti-icing
- c. Engine and accessory heating (when heater is installed as part of the aircraft)
- d. Aircraft deicing

1.1 Purpose

This document details the minimum safety, performance, design, and testing requirements for combustion heaters and accessories that are considered necessary for the utilization of heaters in any category of aircraft. This standard is to be considered currently applicable and necessarily subject to revision from time to time due to advances in the aircraft industry. This standard is based on practical engineering requirements for aircraft heaters currently in use and is applicable to aircraft heaters that will be developed to meet future requirements.

The requirements of this standard are primarily intended to be applicable to civil aircraft whose primary function is transporting passengers or cargo. For additional information regarding military applications, refer to MIL-H-5484.

2. REFERENCES

2.1 Applicable Documents

The following publications form a part of this document to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order. In the event of conflict between the text of this document and references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

2.1.1 EASA Publications

Available from European Aviation Safety Agency, Ottoplatz, 1, D-50679 Cologne, Germany, Tel: +49 221 8999 000, www.easa.europa.eu.

CS-Definitions	Definitions and Abbreviations used in Certification Specifications for Products, Parts, and Appliances
CS-23	Certification Specifications for Normal, Utility, Aerobatic and Commuter Category Aeroplanes
CS-25	Certification Specifications for Large Aeroplanes
CS-27	Certification Specifications for Small Rotorcraft
CS-29	Certification Specifications for Large Rotorcraft

2.1.2 FAA Publications

Available from Federal Aviation Administration, 800 Independence Avenue, SW, Washington, DC 20591, Tel: 866-835-5322, www.faa.gov.

AC 20-135	Advisory Circular: Powerplant Installation and Propulsion System Component Fire Protection Test Methods, Standards, and Criteria
14 CFR Part 23	Airworthiness Standards: Normal, Utility, Acrobatic, and Commuter Category Airplanes

- 14 CFR Part 25 Airworthiness Standards: Transport Category Airplanes
- 14 CFR Part 27 Airworthiness Standards: Normal Category Rotorcraft
- 14 CFR Part 29 Airworthiness Standards: Transport Category Rotorcraft

2.1.3 U.S. Government Publications

Copies of these documents are available online at <https://quicksearch.dla.mil>.

MIL-H-5484 Heater; Aircraft, Combustion Type

2.1.4 NASA Publications

NASA Technical Services, NASA STI Program STI Support Services, Mail Stop 148, NASA Langley Research Center, Hampton, VA 23681-2199, 757-864-9658, Fax: 757-864-6500, <http://ntrs.nasa.gov/>.

NASA-TM-X-74335 U.S. Standard Atmosphere, 1976, United States National Oceanic and Atmospheric Administration

2.1.5 RTCA Publications

Available from RTCA, Inc., 1150 18th Street, NW, Suite 910, Washington, DC 20036, Tel: 202-833-9339, www.rtca.org.

DO-160 Environmental Conditions and Test Procedures for Airborne Equipment

2.2 Definitions

COMBUSTION HEATER: A device that utilizes the heat produced by combustion of a fuel within the heater for the purpose of heating air being supplied to various aircraft systems.

FIREPROOF: The capability to withstand, as well as (or better than) steel, application of heat by a flame for 15 minutes minimum, while still fulfilling its ability to confine the flame. The flame shall have a temperature of $1100\text{ }^{\circ}\text{C} \pm 80\text{ }^{\circ}\text{C}$ ($2012\text{ }^{\circ}\text{F} \pm 176\text{ }^{\circ}\text{F}$) and a heat flux density $116\text{ KW/m}^2 \pm 10\text{ KW/m}^2$ ($10.2\text{ BTU/s}\cdot\text{ft}^2 \pm 0.88\text{ BTU/s}\cdot\text{ft}^2$), as defined in AC 20-135.

PRESSURIZED HEATER: A combustion heater that heats pressurized fuselage air.

3. GENERAL REQUIREMENTS

3.1 Heater Components

A combustion heater shall include:

- a. Combustion chamber and heat exchanger assembly
- b. Casing or shroud
- c. Igniter
- d. Burner
- e. Ventilating air inlet
- f. Ventilating air outlet
- g. Combustion air inlet

- h. Exhaust outlet
- i. Fuel inlet
- j. Fuel drain(s)

A typical installation of an aircraft combustion heater is shown in Figure 1 with all heater components identified.

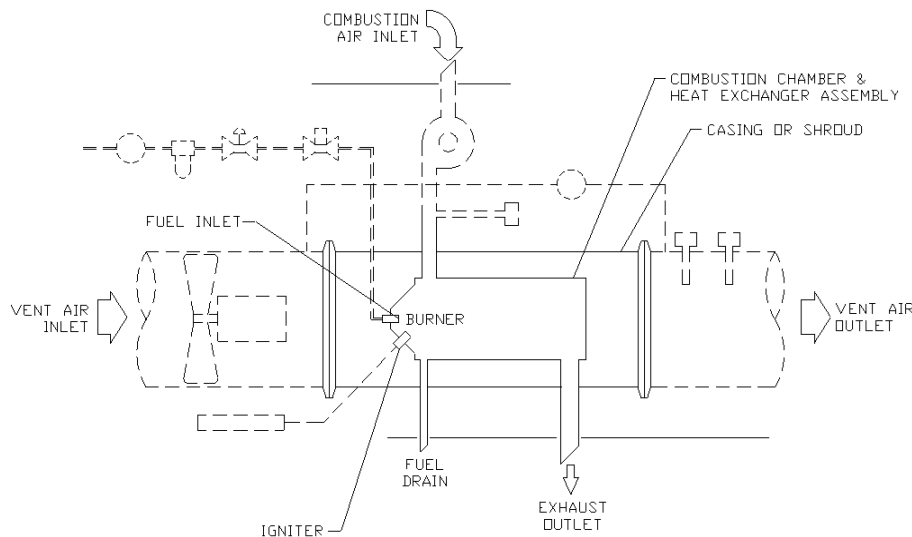


Figure 1 - Typical aircraft installation, combustion heater elements labeled

3.2 Accessories

There are several accessory devices that may be utilized when installed on an aircraft to improve the safety and performance of the heater. These devices may be furnished separately or as part of the heater. Those accessories considered necessary to the safety and performance shall be required and will be covered in that respect by this standard. This standard does not cover all tests necessary on these devices, but only those relevant to the heater. Not all of the following accessories are required for a combustion heater installation and there may be additional accessories included that are not listed in this section.

A typical installation of an aircraft combustion heater is shown in Figure 2 with some heater accessories (including required safety accessories) identified.

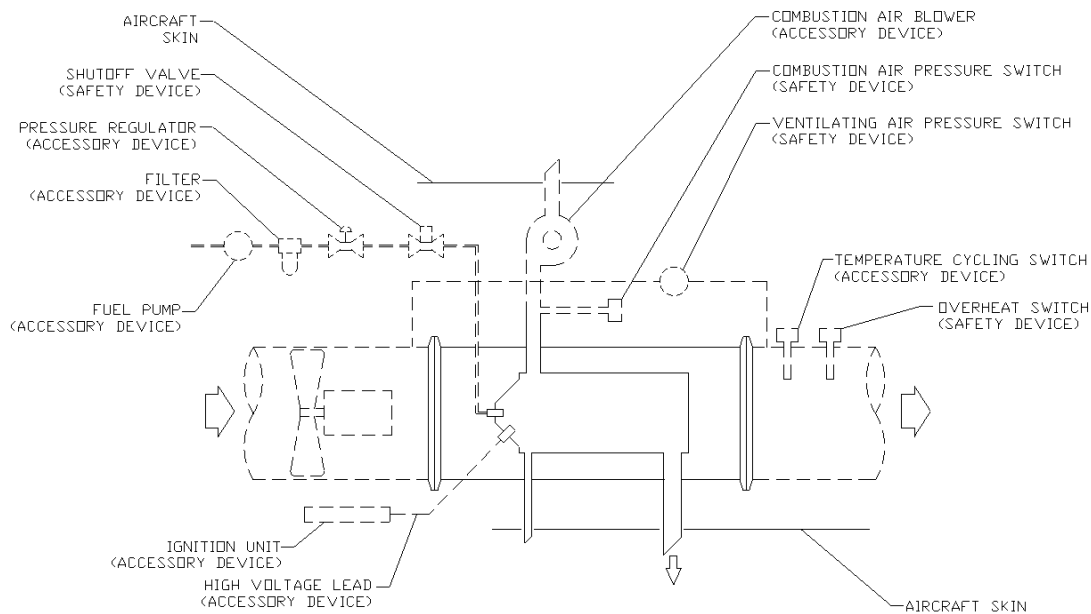


**Figure 2 - Typical aircraft installation,
examples of combustion heater accessories labeled**

The following accessories are discussed to the extent that they are relevant to heater design and operation:

- a. Fuel System: The fuel system supplies fuel to the heater at the correct pressure, temperature, and flow rate. Examples of accessory devices that may be utilized in a heater fuel system include, but are not limited to:
 1. Fuel nozzle, restrictor, orifice, or equivalent (required)
 2. Fuel shutoff valve (required)
 3. Fuel filter (required)
 4. Fuel pressure regulator
 5. Fuel pump
 6. Fuel/air ratio controller
 7. Fuel lines
 8. Preheater
- b. Spark Ignition System: The spark ignition system uses aircraft electrical power to generate a high-temperature electric discharge across an air gap within the combustion chamber of the heater. Components of the spark ignition system include:
 1. Device to provide high voltage power (required for spark ignition only)
 2. High-voltage ignition lead assembly or equivalent electrical linkage between high voltage device and igniter (required for spark ignition only)
 3. Radio interference shielding; radio interference suppression and test method shall be specified by the procuring and/or regulatory entity

- c. **Air Supply System:** The air supply system provides both air for the combustion process and air (usually referred to as ventilation air) to be heated and distributed to various aircraft systems. Air supply components may be required to be fireproof, especially in fire zones, and should comply with applicable FAA, EASA, or other local civil aviation authority regulations (see 3.7). Examples of accessory devices that may be utilized in an air supply system include, but are not limited to:
1. Ducting/tubing
 2. Combustion air blower
 3. Combustion air inlet scoop
 4. Ventilation air blower
 5. Combustion air flow sensor
 6. Air flow/pressure regulator
- d. **Temperature Control System:** The heater shall be supplied with a temperature control system to maintain the desired heater downstream temperature. Examples of accessory devices that may be utilized in a temperature control system include, but are not limited to:
1. A cabin or compartment temperature sensor
 2. A cycling switch located on or just downstream of the heater that limits heater air discharge temperature
 3. An overheat switch, located on the heater, that prevents overheating
 4. Cabin temperature controls
- e. **Safety Controls:** Heater controls shall be provided to prevent hazardous or unsafe operation of the heater. Unsafe conditions include excessive heat exchanger temperature, insufficient combustion air to support complete combustion of the fuel, and insufficient ventilating airflow. Examples of accessory devices that may be utilized to prevent unsafe operating conditions include, but are not limited to:
1. A device that senses heat exchanger temperature (required)
 2. A device that senses combustion airflow, inlet pressure, or differential pressure across the combustion chamber (inlet to outlet)
 3. A device that senses excessive downstream air temperature
 4. A device that senses heater ventilating air pressure differential
 5. A device that senses combustion
 6. A device that senses excessive combustion byproducts in the ventilating air
 7. A device that shuts off fuel flow to the heater (required)
 8. A device that alerts crew that a safety system is engaged