Society of Automotive Engineers, Inc.
TWO PENNSYLVANIA PLAZA, NEW YORK, N.Y. 10001

AEROSPACE STANDARD

AS 1304

Issued May 1973
Revised

CONTINUOUS FLOW CHEMICAL OXYGEN GENERATORS

1. SCOPE

This Aerospace Standard (AS) provides recommended design guidelines for composition formation, performance, testing and reliability of metal-chlorate-perchlorate class solid chemical oxygen generators, supplying oxygen at essentially ambient pressure, for aircraft whose cabin pressure altitude does not exceed 40,000 feet (12,192 m).

2. REQUIREMENTS

2.1 Generator Assembly Characteristics:

2.1.1 The chemical oxygen generator shall consist of a properly housed chemical core that will, upon activation, produce oxygen at a programmed rate and quantity according to a procurement document requirement.

2.1.2 An over pressure relief valve shall be provided to prevent rupture of the housing in the event of malfunction or accidental blockage of the flow lines.

2.1.3 A fitting shall be provided for attachment of a mask or tube. The size and location of the mask tube fitting shall be specified by the procurement document.

2.2 Generator Assembly Performance:

2.2.1 Functional Characteristics: The assembly shall provide breathing oxygen in one or more of the following applications or classes. (1) Emergency Supplemental oxygen in the event of a loss of cabin pressurization, for individual passengers or for several passengers from a manifold. (2) Crew and/or passenger oxygen for use in an unpressurized aircraft at altitudes in excess of 8,000 feet (2,438 m). (3) First aid oxygen, either fixed or portable. (4) Crew oxygen from a fixed system. (5) Breathing oxygen for emergency egress from a disabled aircraft.

2.2.1.1 Oxygen Flow: The start of flow, flow and duration shall be specified in the procurement requirement. (The prescribed start of flow, flow and duration shall meet FAA requirements.)

2.2.1.2 Oxygen Purity: The oxygen delivered to the outlet tube shall be free of nauseous odor and smoke and shall not contain moisture, impurities or particles in excess of the following values:

2.2.1.2.1 Water Vapor: Water vapor shall not exceed 15 milligrams of water per liter (15g of water/m^3) of oxygen at 70° F (21.1° C) and 760 mm of Hg. This corresponds to a dew point of 64° F (17.8° C).

2.2.1.2.2 Chlorine: Chlorine contamination shall not exceed 0.2ppm by volume. (Note: Odor, rather than toxicity, is the limiting factor in the establishment of this value.)

2.2.1.2.3 Carbon Monoxide: Carbon monoxide shall not exceed 50 ppm by volume for any sample taken before one minute and 15 ppm by volume average for all subsequent samples.

2.2.1.2.4 Carbon Dioxide: Carbon dioxide content shall not exceed 5,000 ppm by volume for any sample taken before one minute and 2,000 ppm by volume average for all subsequent samples.

2.2.1.2.5 Total Impurities: Total impurities excluding moisture shall not exceed one half of one percent (0.5%) by volume. This percentage may contain traces of gases other than those listed above if sufficient proof is presented to ensure their presence will not be a physiological hazard.

2.2.1.2.6 Solid Particles: Solid particles shall not exceed 500 microns (μm) in size.

2.2.1.2.7 Fibers: Fibers shall not exceed 0.12 in. (3 mm) in length.

2.2.1.2.8 Total Solids: Total solids shall not exceed 0.1 milligram (0.1 mg) per cubic decimeter (dm^3) of oxygen.

2.2.1.3 Gas Temperature: The temperature of the gaseous oxygen delivered to the tube at the outlet of the generator shall meet the procurement specification. Oxygen has a low specific heat and carries little heat to the mask through the plastic tubing.

2.2.1.4 Generator Assembly Pressure: The internal operating pressure of the generator shall be kept at the lowest possible level. In no case shall the internal pressure be higher than 25% of the housing burst pressure.

2.2.1.5 The maximum generator housing temperature shall be specified by the procurement document.

2.2.1.6 Generator Assembly Orientation: The assembly shall be designed to operate properly under the conditions specified herein when mounted in the aircraft in any position relative to the aircraft.

2.2.1.7 Generator Assembly Leakage: During operation of the assembly, as tested under 3.5.10, there shall be no leakage of oxygen from the assembly unless a low leakage rate is specified in procurement document.

2.2.1.8 Generator Assembly Expended Indicator: The assembly shall have an indicator to show when the generator has been expended. This may be combined with an activator tamper indicator if a particular design or application dictates a requirement for same.

2.2.2 Environmental Characteristics: The assembly shall operate without premature actuation or degradation of performance as specified herein, during or after exposure to the following environmental conditions. As the conditions would vary with different aircraft used in differing environments and for differing purposes, only suggested guidelines can be given. (Note: The procurement document may specify other environmental conditions.)

2.2.2.1 Temperature: The assembly shall operate at any ambient temperatures within the range of 0° F (-17.8° C) through 120° F (48.9° C), and storage-transportation exposure to temperatures within the range of -67° F (-55° C) through +160° F (+71.1° C) in the non-operating condition. (Any temperature requirement outside of this range shall be specified for individual applications.)

2.2.2.2 Ambient Pressure: The assembly shall withstand continuous exposure to varying atmospheric pressure in the range defined in the procurement document.

2.2.2.3 Humidity: The assembly shall withstand prolonged exposure to relative humidities up to 100 percent, including condensation due to temperature change and those conditions under which condensation occurs in the form of frost as well as water.

2.2.2.4 Salt Fog: The performance of the assembly shall not be adversely affected and shall remain as specified herein, after exposure to salt fog as specified in MIL-STD-810, Method 509, Procedure I.

2.2.2.5 Sand and Dust: The assembly shall function as specified herein after exposure to sand and dust per MIL-STD-810, Method 510, Procedure I.

2.2.2.6 Acceleration: The assembly shall be subjected to one of the procedures of Method 513, MIL-STD-810. The minimum acceleration shall be greater than that found in common methods of transportation and shall be specified by procurement requirements. All integral parts must remain attached during the test, and the unit must function as specified herein after the test is completed.

2.2.2.7 Vibration: The assembly shall be subjected to one of the procedures of Method 514, MIL-STD-810. The minimum vibration shall be greater than Procedure X or XI and shall be specified by procurement requirements. The assembly must function as specified herein during the test.

2.2.2.8 Shock: The assembly shall be subjected to both of the procedures of Method 516, MIL-STD-810. The minimum shall be specified by the procurement document. The assembly must function as specified herein after the test is completed.

2.2.2.9 Flight Safety: The design of the assembly shall be such that failure or any malfunctioncausing performance degradation below the minimum specified level shall not create a hazardous or catastrophic condition by reason of its mode of failure or by the direct effect of such failure on the aircraft, related equipment, or personnel.

2.2.2.10 Altitude Cycling and Overpressurization: The procurement document may specify an altitude cycling and overpressurization requirement depending on the application of the generator. When required there shall be no degradation of performance as a result of this test.

3. QUALITY ASSURANCE PROVISIONS

3.1 Classification: The quality assurance requirements can consist of qualification testing as well as the normal acceptance testing.

3.1.1 Qualification Tests: All tests under 3.5.3 and 3.5.4 shall be used for a reliability analysis on the number of units shown in the procurement requirements. All tests under 3.5.3 through 3.6.6 shall be conducted as qualification testing on the number of units as shown in the procurement requirements.

3.1.2 Acceptance Tests:

3.1.2.1 All tests under 3.5.4 and 3.5.5.1 may be conducted on the cores as manufactured using rechargeable generator parts. The lot size and number of samples shall be determined from MIL-STD-105 or as shown in Procurement Requirements.

3.1.2.2 All tests under 3.4.1, 3.4.2, 3.4.3.1, 3.4.4, 3.4.6, 3.4.8 and 3.4.9 shall be conducted on the completed generators. The lot size and number of samples shall be determined from MIL-STD-105 or as shown in Procurement Requirements.

3.2 Visual Inspection:

3.2.1 All generator cores shall be visually inspected. All cores with excessive chips, cracks, activation area misalignment, visible contaminant or weight discrepancies shall be rejected.

3.2.2 All completed generators shall be visually inspected. All generators not meeting standard workmanship levels, manufacturing practices and dimensional requirements shall be rejected.

3.3 Inspection Lot: The inspection lot shall be determined from production rate and shall be specified in the procurement requirements.

3.4 Test Procedures:

3.4.1 Oxygen Flow Initiation: The time required to reach full oxygen flow as shown in applicable class in 2.2.1 shall be determined.

3.4.2 Oxygen Flow Rate and Duration: The oxygen flow rate and duration shall be determined with an accurate measuring device and shall comply with values shown in paragraph 2.2.1.

3.4.3 Oxygen Purity:

3.4.3.1 All of the contaminants listed under 2.2.1.2.1, 2.2.1.2.2, 2.2.1.2.3, and 2.2.1.2.4 shall be determined by methods described in ARP or other standard analytical testing methods as might be specified in procurement specifications.

3.4.3.2 All of the items listed under 2.2.1.2.5, 2.2.1.2.6, 2.2.1.2.7 and 2.2.1.2.8 shall be determined by methods described in ARP or by standard analytical testing methods.

3.4.4 Gas Temperature: The gas temperature shall be determined with a thermocouple at the outlet of the generator housing and at the inlet part of the mask when using the standard length of tubing. Comply with 2.2.1.3 or procurement document.

3.4.5 Generator Assembly Pressure: The internal operating pressure shall be determined through a suitable connection to the generator housing. While multiple failures are unlikely, a burst test should be conducted, using due safety precautions, by blocking or plugging the normal and relief outlets and initiating the unit. The time to burst, burst pressure, and type of failure should be recorded. The burst pressure should be at least equal to that required by 2.2.1.4. The burst should not produce shrapnel nor should incendiary material be expelled. The results shall comply with 2.2.1.4.

3.4.6 Generator Housing Temperature: The maximum housing temperature shall be determined by placing thermocouples in contact with the generator housing and recording the temperatures throughout the duration of oxygen flow. The temperatures shall comply with those in procurement document.

3.4.7 Generator Assembly Orientation: The generator shall be tested in any axis normally found in its use.

3.4.8 Generator Assembly Leakage: The leakage shall be determined by checking the connections with a leak detecting fluid, or any other suitable methods specified in procurement document. The results shall comply with 2.2.1.7.

3.4.9 Generator Assembly Expended Indicator: Any color change or mechanical change is checked after the unit is expended. Environmental tests shown under 3.6 shall not affect this indicator. Results shall comply with 2.2.1.8.

3.5 Environmental Characteristics: The following tests shall be run on all qualification test assemblies.

3.5.1 Temperature: The generator assembly shall be held at specified storage temperature for 24 hours. At the end of the 24 hr soak, the assembly shall be returned to the minimum operating temperatures and shall be operated within 1 hr or as specified. This test shall be repeated on another assembly for maximum operating temperature. Theresults shall comply with 2.2.2.1. The generators may be used in many different applications where there is a varying warm up from a cold ambient or varying cool off from a warm ambient. The location of generators and type of surroundings will affect the change from one ambient temperature to another. The units shall operate within the flow and duration specifications.

3.5.2 Ambient Pressure: The generator assembly shall be activated while subjected to the ambient pressure range specified in the procurement document.

3.5.3 Humidity, Salt Fog and Sand & Dust: The assembly shall operate normally after being subjected to the conditions as specified in 2.2.2.3, 2.2.2.4 and 2.2.2.5.

3.5.4 Acceleration: The assembly shall be subjected to acceleration level and direction required in 2.2.2.6. It shall comply with 2.2.2.6.