



U.S. Department
of Transportation
**Federal Aviation
Administration**

Memorandum

Subject: ACTION: Equivalent Level of Safety of
Balloon Works Burner Test, Finding No.
ACE-92-3

Date: MAY 6 1992

From: Manager, Atlanta Aircraft Certification
Office, ACE-115A

Reply to
Attn. of:

To: Manager, Small Airplane Directorate, ACE-100

Background

The Balloon Works has designed and built a new burner that substitutes a fluid amplifier for the standard nozzle orifices in all hot air balloon burners currently being manufactured. This new burner uses the well-proven main blast valve and Inconel vaporizing coils from the current production model.

Because the requirements for burner testing, as set out in § 31.47, were originally linked to those of airplane engines that do not use pressurized fuel systems and run at 75 percent power in cruise, they have been found to be too stringent in some areas and invalid in others. The Balloon Works has proposed alternative testing equivalent to that required in § 31.47(d).

Applicable Regulations:

The applicable Federal Aviation Regulations (FAR) paragraph, § 31.47, states:

"(d) The heater system (including the burner unit, controls, fuel lines, fuel cells, regulators, control valves, and other related elements) must be substantiated by an endurance test of at least 50 hours. In making the test, each element of the system must be installed and tested so as to simulate the actual balloon installation. The test program must be conducted so that each 10-hour part of the test includes 7 hours at maximum heat output of the heater and 3 hours divided into at least 10 equal increments between minimum and maximum heat output ranges."

Applicant's Position

Unlike the original § 31.47 testing, the burner will not be run wide-open at maximum fuel pressure for long time periods. This test did not simulate flight conditions where the burner is operated intermittently. A short blast of the burner creates the maximum hydraulic and thermal shock. There is an instantaneous impact of cold, vaporized fuel on the entire assembly, which was previously at ambient temperature. The fuel passages are shocked by the heat of the ignited flow over them. Since the critical concern is not the duration of operation but the number of mechanical and thermal cycles, this test is more meaningful than a constant "on" type.

Burner operation with vapor withdrawal from the fuel supply is a very rigorous test since there is no flow of cooling propane on the vaporizing coils. The coils will often begin to glow red when the burner is operated in this way. Since this is an in-flight condition that may occur because of faulty fuel management by the pilot, it is a valid test for a burner.

FAA Position

The burner test that has been proposed is a better representation of actual balloon burner operation and is a more challenging test of the burner.

Compensating Features

The alternative test program will consist of the following:

1. Static tests will be conducted in four, nine hour segments and two, one hour segments. The main blast valve will be operated one time per minute with a duty cycle of at least 5 percent (3 seconds on, 57 seconds off) for nine hours at median or ambient pressure (120 psi + or - 30 psi), nine hours at minimum allowable pressure (65 psi + or - 10 psi), and nine hours at ambient pressure on vapor. The first one-hour segment will consist of the operation of the backup burner, [§ 31.47(e)] at ambient pressure with a 50 percent duty cycle (5 minutes on, 5 minutes off) in 10 minute stages with flow metered to approximately one-sixth of maximum. The second one-hour segment, which will not count toward the 50-hour total, will consist of a test for pilot light reliability. A fan will direct air, at a velocity of at least 1300 feet per minute (14.8 mph), along the lateral and then the vertical axis of the burner. At 10 minute intervals, the pilot lights will be shut down and relit [§ 31.47(e)]. At the end of the third interval, the

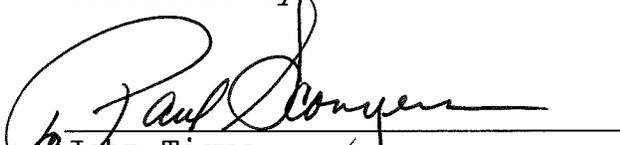
burner will be reoriented so that the airflow impinges on the bottom plate.

2. Dynamic tests will be conducted during 13 hours of flight.

Recommendation

We concur with your proposal that the alternative hot air balloon burner endurance test program for the Balloon Works burner, Model F1, is considered as providing an equivalent level of safety as envisioned in the regulations and thus meets the requirements of § 31.47(d) of the FAR.

Concurred by:



John Tigue
Manager, Atlanta Aircraft Certification
Office, ACE-115A

4/27/92
Date



John Colomy
Manager, Standards Office, ACE-110

5/6/92
Date



For Barry D. Clements
Small Airplane Directorate
Aircraft Certification Service,
ACE-100

5/6/92
Date