DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Part 31

[Docket No. 27543; Amendment No. 31–7]

RIN 2120–AE87

Airworthiness Standards; Manned Free Balloon Burner Testing

AGENCY: Federal Aviation Administration, DOT.

ACTION: Final rule.

SUMMARY: This final rule amends the certification test requirements for burners used on manned free balloons. The current test requirements do not test the burner's most critical operating conditions. This amendment will increase the current level of safety by requiring more realistic tests and cut the fuel costs to balloon manufacturers seeking certification.

EFFECTIVE DATE: May 24, 1996.

FOR FURTHER INFORMATION CONTACT: J. Lowell Foster, Standards Office (ACE–110), Small Airplane Directorate, Aircraft Certification Service, Federal Aviation Administration, 601 East 12th Street, Kansas City, Missouri 64106; telephone (816) 426–5688.

SUPPLEMENTARY INFORMATION:

Background

Statement of the Problem

The current burner certification requirement resembles the testing requirement for airplane engines. Airplane engines are operated continuously at high percentage powers, while balloon burners are operated on an intermittent basis to maintain level or buoyant flight. The burner requirement calls for maximum fuel flow burning over the majority of the test time. This requirement does not reflect the fact that a burner is continually turned on and off every few seconds or that a minimum heat output condition is much more critical than a maximum heat output condition. The challenging test conditions for a burner are short blasts to maximize the thermal shock and operation on vapor, which can result in the burner coils glowing red.

Since certification testing should simulate flight conditions and the critical concern is not the duration of operation but the number of mechanical and thermal cycles, this final rule would change the balloon burner requirements to include testing of mechanical and thermal cycles, and testing of operation on vapor. As a result, the burners would be tested over a 40-hour period instead of 50-hour period.

The Proposal

This amendment is based on Notice of Proposed Rulemaking (NPRM), Notice No. 93–16, which was published on December 7, 1993 (58 FR 64450). The Federal Aviation Administration (FAA) proposed to amend § 31.47(d) to remove 30 test hours at maximum heat output and require, instead, additional testing that focuses on critical functions experienced during flight. More specifically, the FAA proposed changes in the balloon burner requirements to include testing of mechanical and thermal cycles, and testing of operation on vapor. The burners would be tested over a 40-hour period instead of 50 hours. The testing would be for specified periods at maximum, intermediate, and minimum fuel pressures and would include burn times of 3 to 10 seconds per minute instead of continuous burning. The term ''intermediate fuel pressure'' would be defined as 40 to 60 percent of the range between the maximum and minimum applicable fuel pressures in order to provide for testing the burners near the mid-point of their ranges of operation.

The FAA also proposed to change the word ''heater'' to ''burner'' in § 31.47. The industry universally uses the term ''burner,'' and this change reflects accepted industry terminology.

Discussion of Comments

Comments to the NPRM were requested with a closing date of February 7, 1994. All comments received have been considered in adopting this amendment.

The FAA received comments from Transport Canada, which supports the proposal, and from two prominent balloon manufacturers. One manufacturer agrees in general with the proposals, but offers three suggestions that are outside the scope of this proposal. The other recommends that the FAA adopt the British standard for § 31.47. The FAA will address these comments in the order they were submitted.

Concerning proposed § 31.47(d)(1)(i), the commenter states, ''Mechanically cycling the main blast valve not only demonstrates wear but provides the hydraulic shock necessary to adequately test the entire fuel system. However, the on/off cycle for each system should be different because of its thermal mass. For example, our burner has two cast alloy base plates and thin wall Inconel vaporizing coils. Some burners have very heavy coils and only pipe-type tubing to and from the blast valve. A pre-test should be done to determine the widest possible temperature swing of any of the elements that will be 'in the fire' and subject to heat-stress failures. This will provide the on/off time.'' The commenter proposes that the rule be reworded to include, ''a burn time for each one minute cycle which has been previously established [by a pre-test to determine the widest possible temperature change of any of the elements, as discussed above] to provide the maximum thermal shock to temperature effected [sic] elements, but in no case less then four seconds.''

The FAA recognizes the merit of this comment concerning a burn time that would provide the maximum thermal shock to temperature-affected elements. The intent of proposed § 31.47(d)(1)(i) was to allow each applicant to pre-determine a burn time for the particular system undergoing certification testing such that the thermal cycle used in the testing would provide approximately the maximum difference between the coolest and hottest temperatures the burner coils and affected hardware would experience in service. Although the preamble to Notice No. 93–16 did not refer specifically to testing that would achieve the maximum temperature differential, it did emphasize the need to simulate actual flight conditions, during which the burner is subjected to thermal shock from its intermittent operation. Referring to the extreme temperature change that occurs when vaporized fuel cools the entire assembly followed by flames engulfing the vaporizing coils, the notice stated that the critical concern was the number of mechanical and thermal cycles.

In order to achieve the necessary thermal shock, the FAA proposed a burn time range of from three to ten seconds for each one minute cycle of the test. From within that time range, an applicant, through pre-certification testing, would determine the burn time that would maximize the temperature differential experienced by the system's temperature-affected elements. Although Notice No. 93–16 did not explain how the FAA arrived at the proposed 3 to 10 second range for the burn time, that range was proposed because the FAA had learned from previous certification testing that this time range is reasonable and reflects the range of burn times within a one-minute cycle from which the maximum temperature differential may be obtained.

Nevertheless, because, as pointed out by the commenter, the requirement as proposed did not make clear that the purpose of the 3 to 10 seconds of burn

time was to ensure that the burner being tested is subjected to the maximum thermal shock, the regulatory text of § 31.47(d)(1)(i) is being clarified by adding a sentence to state explicitly that requirement. The FAA believes that the added requirement to assure that the maximum thermal shock is achieved during testing reflects the intent of the proposed amendment and is necessary to increase safety by more closely simulating flight conditions. Although the commenter suggested a minimum burn time of four seconds, based on the FAA's prior certification experience the burn time requirement for each minute cycle of testing remains at 3 to 10 seconds as proposed.

Referring to § 31.47(d)(1)(iv), the commenter states, ''A pilot who consistently uses incorrect fuel management techniques may get into situations where he subjects the burner to the stress of running on vapor. The degradation of some parts is cumulative and it would be good to be assured that vaporizing coils, for example, would not fracture without warning in flight.'' To achieve this goal, the commenter recommends the FAA double the time for this test.

The FAA has determined that testing for a total of 15 minutes, as specified in the proposal, should provide confidence that the burner will not suffer from undue thermal stresses while not imposing an unwarranted burden on the manufacturer. Manufacturers have told the FAA that their balloons would not fly long on vapors before the pilot would notice the balloon descending. The manufacturers state that the heat output from a burner operating on vapor is not enough for the balloon to hold altitude. Even with vapor burning constantly, the balloon will develop an increasing rate of descent. For this reason, several manufacturers suggested that 30 minutes was extreme and would constitute a burden to them. The FAA could not justify, based on any adverse service history, requiring a test of more than the originally proposed 15 minutes total time of burner operation on vapor; therefore, the § 31.47(d)(1)(iv) will retain the 15 minute standard as proposed.

The same commenter offers the following suggested rewrite for § 31.47(d)(1)(v): ''Fifteen hours of normal flight operation during which backup burner and pilot lights must be extinguished and relighted at least twice in each flight hour.'' The commenter justifies this recommended change by explaining that backup burner and pilot lights may be easy to relight on the ground when the burner is mounted in a test fixture but may be difficult to relight when it is in position during flight.

The FAA acknowledges the merits of this comment concerning backup burners and notes that currently § 31.47(e) does not specify testing the backup burner. However, the FAA may not impose an additional burden on the public without offering the public an opportunity to comment on the proposed requirements. This comment addresses a matter that is beyond the scope of the proposed rule change; therefore, it can be considered only for future rulemaking projects. Section 31.47(d)(1)(v) is adopted as proposed.

The commenter recommends rewording the proposal for § 31.47(d)(2) to read as follows: ''The test program for the secondary or backup operations of the burner must include two hours of operation of the backup burner with a continuous cycle time of five minutes on and five minutes off. Test must include extinguishing and relighting this burner, without the use of the pilot light system, at least one time per 30 minutes of testing, while under a crosswind airflow, the speed of which must be equal to the highest demonstrated maximum sink rate for the balloon systems for which approval is being sought.'' The commenter's explanation follows:

''The use of the backup burner in flight may include operation for up to three or four minutes at a time. During several certification flights, we were required to use only the backup for some flight maneuvers. For example, on several occasions we did an entire recovery from Maximum Sink Rate Descent and on another we did almost an entire flight using the backup burner alone.''

''It is important to do this test with some airflow to simulate conditions in flight should the burner have to be used during a high speed descent. Each balloon flies at a different rate because of the drag coefficient/gross weight, hence the air velocity requirement. In our testing we use 1300 fpm as a descent rate maximum and if we exceed it in our certification flights we reduce allowable Max Gross System Weight. This figure appears in the LIMITATIONS and PERFORMANCE section of the Aircraft Flight Manual.''

''A condition may occur in flight where the backup burner is metered down to a low flame and is used as a pilot light system. It is important that it be demonstrated to light without the use of pilots [lights].''

Again, the FAA recognizes the merit of this comment concerning backup burner flameouts and relights. Because this comment addresses a matter that is beyond the scope of the proposed rule change, it can be considered only for future rulemaking projects. Accordingly, § 31.47(d)(2) is adopted as proposed.

The commenter recommends adding new paragraphs (3) and (4) to § 31.47(d). The recommendation for a new § 31.47(d)(3) is to require two hours of operation of the pilot light system while under a crosswind airflow with the wind speed equal to the highest demonstrated maximum sink rate. The test would induce extinguishing and relighting the pilot light at least one time per 10 minutes of testing. This test would include testing a piezo-electric element or other electrical means of igniting the pilot lights. Again, the commenter's reasoning is that backup burner and pilot lights may be easy to relight on the ground when the burner is mounted in a test fixture but may be difficult to relight when in position during flight. Also, the commenter believes that the piezo-electric igniters are not as reliable in airflow as devices currently used.

This comment is also beyond the scope of the proposed rule change and can be considered only for future rulemaking projects.

The recommendation for a new § 31.47(d)(4) concerns a post-test teardown of the burner. The commenter proposes adding the following requirement: ''A teardown of the burner should be done to reveal any abnormalities.'' Current § 31.47(f) requires that each element of the burner system be serviceable at the end of the test. The FAA agrees with the commenter that a teardown inspection at the end of testing is an acceptable procedure and a means of demonstrating compliance. However, a teardown inspection is not an airworthiness safety standard. The term ''serviceable,'' as used in aviation, defines a standard for airworthiness based on certification testing of the burner and its components.

The second commenter states that if the goal of international harmonization is to be approached, the FAA should take into account the British, German, and French codes in proposing changes to 14 CFR part 31. The commenter also notes that a number of balloon manufacturers and representatives of European regulatory authorities met at London Heathrow Airport in March 1992 to consider the member nations' airworthiness requirements for balloons, and to make recommendations for a future JAR 31. The commenter includes the British Civil Airworthiness Requirements (BCAR) wording that was recommended for JAR 31.47. BCAR § 31.47(d) reads as follows:

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 designed to reflect the limiting conditions likely to be encountered in service, both in kind and duration. The endurance test proposed by the manufacturers must be approved by the certification authority.

Though the commenter expresses the view that the version of § 31.47(d) proposed in No. 93–16 is better than the existing version, the commenter, nevertheless, asserts that the proposed requirement is over-specified and will soon be rendered obsolete by technical change. The commenter further states that the proposals leaves out some important points, but the commenter did not identify them.

To adopt the British testing requirement would be beyond the scope of the NPRM. The FAA does recognize the importance of harmonization and is currently expending extensive resources to harmonize the Federal Aviation Regulations with the European Joint Aviation requirement (JAR). Though the requirements in BCAR § 31.47(d) may accommodate new technology more readily than those proposed in Notice 93–16, the British rule requires the manufacturer to develop an endurance test and have it approved by the certification authority even for current technology. The proposed amendment of § 31.47(d) provides a specific minimum requirement for all burners to meet. If changing technology were to render the proposed requirements obsolete for a new burner, the FAA may apply ''special conditions'' for new and novel technology (14 CFR 21.16). Accordingly, the rule is adopted as proposed.

International Compatibility

The agency has reviewed corresponding International Civil Aviation Organization international standards and recommended practices and Joint Aviation Authorities requirements and has identified no differences in these amendments and the foreign regulations.

Regulatory Evaluation Summary

Proposed changes to Federal regulations must undergo several economic analyses. First, Executive Order 12866 directs that each Federal agency shall propose or adopt a regulation only upon a reasoned determination that the benefits of the intended regulation justify its costs. Second, the Regulatory Flexibility Act of 1980 requires agencies to analyze the economic effect of regulatory changes on small entities. Third, the Office of Management and Budget directs agencies to assess the effects of regulatory changes on international trade. In conducting these analyses, the FAA has determined that this rule: (1) will generate benefits that justify its costs; (2) is not a ''significant regulatory action'' as defined in the Executive Order and is not ''significant'' as defined in DOT's Regulatory Policies and Procedures; (3) will not have a significant economic impact on a substantial number of small entities; and (4) will not constitute a barrier to international trade. These analyses, available in the docket, are summarized below.

Benefits and Costs

The rule will enhance safety by targeting critical functions and conditions experienced in actual flight and will significantly reduce certification testing costs. The current requirements call for a total of at least 50 hours of testing, which typically consumes about 7,000 gallons of fuel per type certification. The new requirements, in contrast, are expected to consume about 350 gallons of fuel because the burners will be tested over a total of 40 hours instead of 50 hours and be tested about 3 to 10 seconds per minute instead of the full 60 seconds. Applying a price of $1.20 per gallon of propane, the revised requirements are expected to yield almost $7,800 in net cost savings per type certification. Accordingly, the FAA finds the rule to be cost-beneficial.

Regulatory Flexibility Determination

The Regulatory Flexibility Act (RFA) of 1980 was enacted by Congress to ensure that small entities are not unnecessarily or disproportionately burdened by Government regulations. The RFA requires a Regulatory Flexibility Analysis if a rule is expected to have a ''significant (positive or negative) economic impact on a substantial number of small entities.'' Based on the standards and thresholds specified in FAA Order 2100.14A, Regulatory Flexibility Criteria and Guidance, the FAA has determined that the rule will not have a significant economic impact on a substantial number of small entities.

International Trade Impact Assessment

The rule will have little or no effect on the sale of U.S. balloons in foreign markets and the sale of foreign balloons into the United States.

Federalism Implications

The regulations herein will not have substantial direct effects on the States, on the relationship between the national government and the States, or on the distribution of power and responsibilities among the various levels of government. Therefore, in accordance with Executive Order 12866, it is determined that this regulation will not have sufficient federalism implications to warrant the preparation of the Federalism Assessment.

Conclusion

The FAA proposed to amend the airworthiness standards for testing balloon burners because test requirements did not test the burner's most critical operating conditions. This amendment will cut the cost to balloon manufacturers seeking certification and increase the current level of safety by requiring more realistic tests.

For the reasons discussed in the preamble, and based on the findings in the Regulatory Flexibility Determination and the International Trade Impact Analysis, the FAA has determined that this regulation is not significant under Executive Order 12866.

In addition, the FAA certifies that this regulation will not have a significant economic impact, positive or negative, on a substantial number of small entities under the criteria of the Regulatory Flexibility Act. This regulation is not considered significant under DOT Regulatory Policies and Procedures (44 FR 11034; February 26, 1979). A regulatory evaluation of the regulation, including a Regulatory Flexibility Determination and International Trade Impact Analysis, has been placed in the docket. A copy may be obtained by contacting the person identified under **FOR FURTHER INFORMATION CONTACT**.

List of Subjects in 14 CFR Part 31

Aircraft, Aviation safety.

The Amendment

In consideration of the foregoing, the Federal Aviation Administration amends part 31 of the Federal Aviation Regulations (14 CFR part 31) as follows:

PART 31—AIRWORTHINESS STANDARDS: MANNED FREE BALLOONS

1. The authority citation for part 31 continues to read as follows:

Authority: 49 U.S.C. 106(g), 40113, 44701–44702, 44704.

2. Section 31.47 is amended by revising the heading and paragraphs (a) and (d) to read as follows:

§ 31.47 Burners.

(a) If a burner is used to provide the lifting means, the system must be designed and installed so as to create a fire hazard.

* * * * *

(d) The burner 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 40 hours. Each element of the system must be installed and tested to simulate actual balloon installation and use.

(1) The test program for the main blast valve operation of the burner must include:

(i) Five hours at the maximum fuel pressure for which approval is sought, with a burn time for each one minute cycle of three to ten seconds. The burn time must be established so that each burner is subjected to the maximum thermal shock for temperature affected elements;

(ii) Seven and one-half hours at an intermediate fuel pressure, with a burn time for each one minute cycle of three to ten seconds. An intermediate fuel pressure is 40 to 60 percent of the range between the maximum fuel pressure referenced in paragraph (d)(1)(i) of this section and minimum fuel pressure referenced in paragraph (d)(1)(iii);

(iii) Six hours and fifteen minutes at the minimum fuel pressure for which approval is sought, with a burn time for each one minute cycle of three to ten seconds;

(iv) Fifteen minutes of operation on vapor, with a burn time for each one minute cycle of at least 30 seconds; and

(v) Fifteen hours of normal flight operation.

(2) The test program for the secondary or backup operation of the burner must include six hours of operation with a burn time for each five minute cycle of one minute at an intermediate fuel pressure.

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Issued in Washington, DC, on April 8, 1996.

David R. Hinson,

Administrator.

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