**DEPARTMENT OF TRANSPORTATION**

**Federal Aviation Administration**

**14 CFR Part 23**

**[Docket No. 28011; Amendment No. 23–52]**

**RIN 2120–AF41**

## Powerplant Instruments; Fuel Pressure Indication

**AGENCY:** Federal Aviation Administration (FAA), DOT.

**ACTION:** Final rule.

**SUMMARY:** This document amends the certification requirement for fuel pressure indicators on pump-fed engines of normal, utility, acrobatic, and commuter category airplanes to permit regulatory alternatives to fuel pressure indicators to warn pilots of fuel system problems. A fuel pressure indicator is not technically the only means available to the pilot of indicating a fuel system problem. The amendment allows airplanes to be certificated with a means that indicates fuel flow or that monitors the fuel system and warns the pilot of any fuel flow trend that could lead to engine failure. New technology incorporated as a means of compliance with the revised rule could improve engine operation and reduce airplane operating costs.

**EFFECTIVE DATE:** July 25, 1996.

**FOR FURTHER INFORMATION CONTACT:** J. Lowell Foster, Aerospace Engineer, Standards Office, 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 FAA proposed to amend Title 14 of the Code of Federal Regulations (CFR), Part 23, § 23.1305(b)(4), which required a fuel pressure indicator for each pump-fed engine. The pressure indicator gives continuous fuel pressure readings to the pilot. This information provides an advance warning of engine failure only when a pilot notices the pressure reading has deviated from the norm and when the pilot can diagnose what those deviations mean in terms of potential engine failure. The change would allow the options of a fuel pressure indicator, a fuel flow indicator, or a means that continuously monitors the fuel system and warns the pilot of any fuel flow trend that could cause engine failure. A fuel flow indicator would give continuous fuel flow readings to the pilot. Fuel flow information presents the fuel system status to the pilot in a manner similar to the fuel pressure indicator, but it also allows the pilot to quickly assess the engine's performance during critical phases of flight, such as takeoff. A continuous fuel system monitoring device would alert the pilot to any fuel flow trend that could lead to engine failure.

*History*

The Aircraft Owners and Pilots Association (AOPA) petitioned the FAA for new standards that would allow, on all pump-fed engines, a fuel flow system employing a differential pressure transducer to be accepted as a means of compliance equivalent to the current fuel pressure indicator requirements (55 FR 39299, September 26, 1990). The FAA requested that the Aviation Rulemaking Advisory Committee (ARAC) review the petition and recommend a course of action. In January 1992, the Fuel Pressure Indicators Working Group of the ARAC on General Aviation and Business Airplane Issues began a review of the AOPA's petition. As a result of the review, a Notice of Proposed Rulemaking (NPRM), Notice No. 94–37, was published on December 28, 1994 (59 FR 67114).

Discussion of Comments

*General*

This amendment is based on the NPRM, Notice No. 94–37, published December 28, 1994 (59 FR 67114). Interested persons were invited to participate in the development of this final rule by submitting written data, views, or arguments to the regulatory docket on or before February 27, 1995. Four comments were received on the proposal, including a letter of support from the Air Line Pilots Association.

The intent of the fuel pressure indicator requirement for pump-fed engines is to advise the pilot of a fuel pressure deficiency before total engine failure. The term ''indicator'' in § 23.1305(b)(4) implies that the fuel pressure be constantly displayed.

The FAA proposed a change to allow a fuel pressure indicator or a fuel flow indicator. The fuel flow indicator would constantly display information that the pilot could use to evaluate engine power, fuel mixture, and other engine performance factors in addition to fuel system status. It is technologically possible to have a microprocessor that monitors engine operation and triggers a warning if the fuel system operation does not match the other monitored engine trends; therefore, the FAA also proposed to change the rule to accept a means that monitors the fuel system and warns the pilot of any fuel flow trend that could lead to engine failure.

Accordingly, the FAA proposed to adopt a performance standard, instead of a requirement for specific equipment. An applicant could show compliance with paragraph (b) of the proposal by using any design that monitors the fuel system and warns the pilot of any fuel flow trend that could lead to engine failure.

*Discussion of Comments to Section 23.1305*

One commenter, a private individual, does not feel that § 23.1305(b)(4) should be changed as proposed. The commenter believes that ''an accurate indication is necessary for the pilot to have a situation awareness of his operating environment.'' The FAA understands and agrees with the overall basis for the comment; however, the FAA does not agree with all of the commenter's arguments and will address them individually.

First, the commenter believes the proposal implies that small airplane engines are ''antiquated'' using ''antiquated fuel flow means.'' The NPRM sections discussing the history of this rule focused on fuel pump reliability, radial engines, and diagnosing fuel pump failures, which were more frequent in the 1940's and 1950's than today. The FAA's intention in discussing the rule's history was to point out that the reliability of fuel pumps has improved since the 1940's. The FAA did not intend to imply that these engines were in some way ''antiquated.'' In fact, as the commenter points out, the basic engines used on most small airplanes are derivatives of the engines designed in the 1940's. Civil Air Regulation 3 airplanes, which constitute over 85 percent of the existing small airplanes flying today, have an excellent service history.

The commenter also points out that ''continual reference to automobile monitoring systems is well taken, except that automobiles can have a problem and pull off to the side of the road.'' Additionally, ''[a]utomobiles may have indicator lights and warnings as to the state of fule consumption, but they also have a fuel quantity gauge so the driver can monitor the system in use to also determine an accurate fuel flow.'' The FAA used the reference to automobile technology to make the point that sophisticated engine monitoring is inexpensive enough to be mass produced for automobiles. Complex fuel

monitoring systems are available in business jets and recently-certificated jet transport aircraft. This technology may soon be affordable to small airplane owners and manufacturers, and the FAA does not want to impede progress with rules offering no alternatives.

The commenter believes that the proposal would allow ''idiot lights.'' On the contrary, the FAA stated in the NPRM, ''A light that comes on at the same time that the engine quits is useless. A warning light system that would comply with this proposal would be sophisticated enough to read transients and trends, and would give a useful warning to the pilot.'' Also, the rule as proposed would require that any warning light system continuously monitor the fuel system and warn the pilot of any fuel flow trend that could lead to an engine failure.

Transport Canada questions the ability to show compliance with the requirement in § 23,1549 to identify maximum and, if applicable, minimum safe operating limits as well as the normal operating range of the instrument. This commenter points out that the typical fuel flow meter is a digital type, and it would be difficult for the applicant to provide equivalent markings, Engine manufacturers provide the information required by § 23.1549, which is then usually transcribed to the installed fuel pressure gauge. It appears that this information would not be presented through the use of typical digital fuel flow meters. The commenter offers the following suggestion: ''FAR 23.1549 was written with a traditional dial instrument in mind where the engine limitations could be easily displayed on the face of the unit and monitored by the crew. To allow flow meters or other fuel system monitors to satisfy the requirements of § 23.1549 where such a gauge no longer exists, compliance could be shown by (1) different colors to indicate changing trends in system performance (e.g., amber color for a low pressure/flow condition, red for impending engine failure), or (2) placarding, if appropriate, to indicate the normal and abnormal operating ranges.''

The FAA agrees with the commenter's suggestions as an acceptable means of compliance with § 23.1549. Suggested items (1) and (2) above offer the pilot a means to determine fuel flow limitations, which may be needed if a fuel flow meter is installed.

A commenter from Australia supports the proposal; however, the commenter feels that the proposed text would require a monitoring system that provides a warning of any trend that could lead to engine failure, which is an extremely difficult compliance requirement. The commenter further states: ''The historic requirement, and the NRPM preamble, clearly addresses fuel pressure (as an indication of the availability of fuel flow) or fuel flow only. Such wording may stifle the development of monitoring instrumentation for small airplanes.'' The commenter suggests that, for clarification, the proposed text for § 23.1305(b)(4)(ii), be amended to read as follows: ''That continuously monitors the fuel system and warns the pilot of any fuel flow trend that could lead to engine failure.''

The FAA agrees with the commenter that the proposed wording may be too broad, making compliance difficult or the system unnecessarily complex. The FAA encourages ''smart'' systems; however, the intent of the proposal was to warn the pilot of any fuel flow trend and, for that reason, the final rule and the preamble adopt the commenter's language.

Section 23.1305 is adopted with the change in paragraph (b)(4)(ii) to add the words ''fuel flow'' before the word ''trend.''

*International Compatibility*

The agency has reviewed corresponding International Civil Aviation Organization international standards and recommended practices and Joint Aviation Authorities requirements for compatibility. The FAA has determined that this final rule, if adopted, would not present any differences.

Paperwork Reduction Act

In accordance with the Paperwork Reduction Act of 1990 (44 U.S.C. 3501 et seq.), there are no reporting or recordkeeping requirements associated with this rule.

Regulatory Evaluation Summary

*Economic Evaluation, Regulatory Flexibility Determination, and Trade Impact Assessment*

Proposed changes to federal regulations must undergo several economic analyses. First, Executive Order 12866 directs Federal agencies to promulgate new regulations or modify existing regulations only if the potential benefits to society outweigh the potential costs. Second, the Regulatory Flexibility Act of 1980 requires agencies to analyze the economic impact of regulatory changes on small entities. Finally, 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 exceeding its costs and is not significant as defined in Executive Order 12866; (2) is not significant as defined in DOT's Policies and Procedures; (3) will not have a significant economic impact on small entities; and (4) will not affect international trade. These analyses, available in the docket, are summarized below.

*Economic Evaluation*

The rule adopts a performance standard instead of requiring specific equipment. In this way, manufacturers can develop any design that monitors the fuel system and warns the pilot of any fuel flow trend that could lead to engine failure. The objective of imposing a performance standard could be met in this case by any means that ''continuously indicates to the pilot fuel pressure or fuel flow, or that continuously monitors the fuel system and warns the pilot of any fuel flow trend that could lead to engine failure.'' This will maintain the level of safety intended by the original requirement, without imposing any additional costs. For example, a warning light system could possibly alert the pilot sooner than if the pilot relied on an instrument panel scan to notice a trend in the fuel pressure indication alone (as is currently the case).

A fuel flow indicator offers additional benefits compared to a fuel pressure indicator in that it enables the pilot to monitor the engine's fuel consumption and compare it to fuel consumption listed in the airplane flight manual. Consequently, engine operation could be improved, resulting in reduced fuel consumption and operating costs. In addition, continual fuel flow readings are useful during critical phases of flight, such as takeoff and climb. Thus, flight safety could be enhanced. The other alternative, a means to continuously monitor the fuel system, will also enhance safety by alerting the pilot to any fuel flow trend that could lead to engine failure.

Since the rule will permit but not require alternative means of warning pilots of fuel system problems, it is inherently cost-beneficial. To the extent that it encourages the future development and utilization of comprehensive engine control, monitoring, and diagnostic systems, it will generate benefits in the form of enhanced safety, improved fuel efficiency, power output, and engine life.

*Regulatory Flexibility Determination*

The Regulatory Flexibility Act of 1980 (RFA) was enacted by Congress to ensure that small entities are not unnecessarily and disproportionately burdened by government regulations. The RFA requires a Regulatory Flexibility Analysis if a proposed or final rule would have a significant economic impact, either detrimental or beneficial, on a substantial number of small entities. FAA Order 2100.14A, Regulatory Flexibility Criteria and Guidance, prescribes standards for complying with RFA requirements in FAA rulemaking actions. The Order defines ''small entities'' in terms of size, ''significant economic impact'' in terms of annualized costs, and ''substantial number'' as a number which is not less than eleven and which is more than one-third of the small entities subject to a proposed of final rule.

The rule will affect manufacturers of future part 23 airplanes. For manufacturers, Order 2100.14A defines a small entity as one with 75 or fewer employees and a significant economic impact as annualized costs of $19,000 or more. The FAA has determined that the rule will not have a significant economic impact on a substantial number of small manufacturers since the annualized certification costs of the rule are less than $19,000.

*International Trade Impact Assessment*

The rule will not constitute a barrier to international trade, including the export of U.S. airplanes and airplane parts to foreign markets or the import of foreign airplanes and airplane parts in 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 12612, it is determined that this regulation will not have sufficient federalism implications to warrant the preparation of a Federalism Assessment.

*Conclusion*

The FAA amends the airworthiness standards to allow airplane manufacturers to utilize new technology for fuel system monitoring to improve the operation and economy of part 23 airplanes powered by pump-fed engines. The current rule requires a fuel pressure indication; thus, it limits the means of compliance. The advances in engines monitoring systems and electronics offer technology that should be utilized by the aviation community. By broadening this airworthiness standard, fuel flow indicators or new fuel system monitors may provide better information to the pilot.

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. The 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 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 23

Aircraft, Aviation safety, Signs and symbols.

The Amendment

In consideration of the foregoing, the Federal Aviation Administration amends 14 CFR part 23 as follows:

## PART 23—AIRWORTHINESS STANDARDS; NORMAL, UTILITY, ACROBATIC, AND COMMUTER CATEGORY AIRPLANES

1. The authority citation for part 23 continues to read as follows:

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

2. Section 23.1305 is amended by revising paragraph (b)(4) to read as follows:

**§ 23.1305 Powerplant instruments.**

* * * * *

(b) * * *

(4) For each pump-fed engine, a means:

(i) That continuously indicates, to the pilot, the fuel pressure or fuel flow; or

(ii) That continuously monitors the fuel system and warns the pilot of any fuel flow trend that could lead to engine failure.

* * * * *

Issued in Washington, D.C. on March 21, 1996.

David R. Hinson,

*Administrator.*

[FR Doc. 96–7429 Filed 3–26–96; 8:45 am]

BILLING CODE 4910–13–M