



[4910-13]

**DEPARTMENT OF TRANSPORTATION**

**Federal Aviation Administration**

**14 CFR Part 33**

**[Docket No. FAA-2017-0586; Special Conditions No. 33-019-SC]**

**Special Conditions: Safran Aircraft Engines, Silvercrest-2 SC-2D; Rated Takeoff**

**Thrust at High Ambient Temperature**

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

**ACTION:** Final special conditions.

**SUMMARY:** These special conditions are issued for the Safran Aircraft Engines (SAE), Silvercrest-2 SC-2D engine model. This engine model will have a novel or unusual design feature associated with an additional takeoff rating that maintains takeoff thrust in certain high ambient temperature conditions for a maximum accumulated usage of 20 minutes in any one flight. The applicable airworthiness regulations do not contain adequate or appropriate safety standards for this design feature. These special conditions contain the additional safety standards that the Administrator considers necessary to establish a level of safety equivalent to that established by the existing airworthiness standards.

**DATES:** Effective **[Insert date of publication in the Federal Register]**.

**FOR FURTHER INFORMATION CONTACT:** Tara Fitzgerald, AIR-6A1, Engine and Propeller Standards Branch, Aircraft Certification Service, 1200 District Avenue, Burlington, Massachusetts, 01803-5213; telephone (781) 238-7130; facsimile (781) 238-7199; e-mail [Tara.Fitzgerald@faa.gov](mailto:Tara.Fitzgerald@faa.gov).

**SUPPLEMENTARY INFORMATION:** Under standard practice, the effective date of final special conditions would be 30 days after the date of publication in the **Federal Register**. However, as the certification date for the SAE, Silvercrest-2 SC-2D engine model is imminent; the FAA finds that good cause exists to make these special conditions effective upon publication.

### **Background**

On April 19, 2011, SNECMA, now known as SAE, applied for a type certificate for the Silvercrest-2 SC-2D engine model. On April 30, 2014, SAE requested an extension to their original type certificate application, which the FAA granted through June 30, 2015. On May 26, 2015, SAE requested another extension to their type certificate application, which the FAA granted through September 30, 2018.

SAE proposed an additional takeoff rating that maintains takeoff thrust in certain high ambient temperature conditions with all engines operating (AEO) for the Silvercrest-2 SC-2D engine model. Therefore, the Silvercrest-2 SC-2D engine model would have two different takeoff ratings. The first rating corresponds with the rated takeoff thrust of the engine. The second rating maintains the takeoff thrust in certain high ambient temperature conditions. This additional takeoff rating is named “Rated Takeoff Thrust at High Ambient Temperature” (Rated TOTHAT). The “Rated TOTHAT” is an approved engine thrust developed under specified altitudes and temperatures within the operating limitations established for the engine during takeoff operation for a maximum usage of 20 minutes in any one flight.

## **Type Certification Basis**

Under the provisions of Title 14, Code of Federal Regulations (14 CFR) 21.17, SAE must show that the Silvercrest-2 SC-2D engine model meets the applicable provisions of 14 CFR part 33, amendments 33-1 through 33-34 in effect on the date of application. The FAA has determined that the applicable airworthiness regulations in part 33 do not contain adequate or appropriate safety standards for the Silvercrest-2 SC-2D engine model because of their novel and unusual design feature referred to as “Rated TOTHAT”. Therefore, these special conditions are prescribed under the provisions of 14 CFR 11.19 and 14 CFR 21.16, and will become part of the type certification basis for Silvercrest-2 SC-2D engine models in accordance with § 21.17(a)(2).

If the Administrator finds that the applicable airworthiness regulations do not contain adequate or appropriate safety standards for the SAE, Silvercrest-2 SC-2D engine model because of a novel or unusual design feature, special conditions are prescribed under the provisions of § 21.16.

Special conditions are initially applicable to the engine model for which they are issued. Should the type certificate for that engine model be amended later to include any other engine model(s) that incorporates the same novel or unusual design feature, the special conditions would also apply to the other engine models under § 21.101.

In addition to complying with the applicable product airworthiness regulations and special conditions, the Silvercrest-2 SC-2D engine model must comply with the fuel venting and exhaust emission requirements of 14 CFR part 34.

## **Novel or Unusual Design Features**

The Silvercrest-2 SC-2D engine model will incorporate a novel or unusual design feature, referred to as “Rated TOTHAT”. This additional takeoff rating increases the exhaust gas temperature (EGT) limit that maintains takeoff thrust in certain high ambient temperature conditions for a maximum of 20 minutes in any one flight.

## **Discussion**

The “Rated TOTHAT” is designed for use during takeoff in specified high altitudes and high ambient temperature conditions. It maintains thrust during takeoff for a maximum of 20 minutes in any one flight. These special conditions contain additional mandatory post-flight inspection and maintenance action requirements associated with any use of the “Rated TOTHAT”. These requirements add a rating definition in paragraph 1.1 below and mandate required inspections in the instructions for continued airworthiness (ICA); instructions for installing and operating the engine; engine rating and operating limitations; instrument connection; and endurance testing.

The current requirements of the endurance test under 14 CFR 33.87 represent a typical airplane flight profile and the severity of the takeoff rating. Therefore, the endurance test under § 33.87 covers normal, AEO takeoff conditions for which the engine control system limits the engine to the takeoff thrust rating. It is intended to represent the airplane flight profile during takeoff under specified ambient temperatures for a time until the mandatory inspection and maintenance actions can be performed.

These special conditions require additional test cycles that include at least a 150 hours of engine operation as specified in § 33.87(a), to demonstrate the engine is capable of performing the “Rated TOTHAT” rating during AEO conditions without disassembly or modification.

The associated engine deterioration, after use of the “Rated TOTHAT”, is not known without the intervening mandatory inspections in these special conditions. These mandatory inspections ensure the engine will continue to comply with its certification basis, which includes these special conditions, after any use of the “Rated TOTHAT”. The applicant is expected to assess the deterioration from use of the “Rated TOTHAT”. The airworthiness limitations section (ALS) must prescribe the mandatory post-flight inspections and maintenance actions associated with any use of the “Rated TOTHAT”.

These requirements maintain a level of safety equivalent to the level intended by the applicable airworthiness standards in effect on the date of application.

### **Discussion of Comments**

Notice of proposed special conditions No. 33-17-01-SC for the SAE, Silvercrest-2 SC-2D; Rated Takeoff Thrust at High Ambient Temperature engine model was published in the **Federal Register** on July 03, 2017 (82 FR 30800). No comments were received, and the special conditions are adopted as proposed.

### **Applicability**

As discussed above, these special conditions are applicable to the Silvercrest-2 SC-2D engine model. Should SAE apply at a later date for a change to the type certificate to include another model on the same type certificate incorporating the same novel or unusual design feature, these special conditions would apply to that model as well.

## **Conclusion**

This action affects only the “Rated TOTTHAT” features on Silvercrest-2 SC-2D engine models. It is not a rule of general applicability and applies only to SAE who requested FAA approval of this engine feature.

## **List of Subjects in 14 CFR Part 33**

Aircraft, Engines, Aviation Safety, Reporting and Recordkeeping requirements.

The authority citation for these special conditions is as follows:

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

## **The Special Conditions**

Accordingly, pursuant to the authority delegated to me by the Administrator, the following special conditions are issued as part of the type certification basis for SAE, Silvercrest-2 SC-2D engine model.

### **1. Part 1 Definition.**

“Rated Take-off Thrust at High Ambient Temperature” (Rated TOTTHAT) means the approved engine thrust developed under specified altitudes and temperatures within the operating limitations established for the engine during takeoff operation. Use is limited to two periods, no longer than 10 minutes each under one engine inoperative (OEI) conditions or 5 minutes each under all engines operating (AEO) conditions in any one flight for a maximum accumulated usage of 20 minutes in any one flight. Each flight where the “Rated TOTTHAT” is used must be followed by mandatory inspection and maintenance actions.

### **2. PART 33 REQUIREMENTS.**

In addition to the airworthiness standards in 14 CFR part 33, effective February 1, 1965, which are applicable to the engine and the “Rated TOTTHAT”, the following special conditions apply:

(a) Section 33.4, Instructions for Continued Airworthiness.

(1) The ALS must prescribe the mandatory post-flight inspections and maintenance actions associated with any use of the “Rated TOTHAT”.

(2) The applicant must validate the adequacy of the inspections and maintenance actions required under paragraph 2(a)(1) of these special conditions.

(3) The applicant must establish an in-service engine evaluation program to ensure the continued adequacy of the instructions for mandatory post-flight inspections and maintenance actions prescribed under paragraph 2(a)(1) of these special conditions, and of the data for thrust assurance procedures required by paragraph 2(b)(2) of these special conditions. The program must include service engine tests or equivalent service engine test experience on engines of similar design and evaluations of service usage of the “Rated TOTHAT”.

(b) Section 33.5, Instruction manual for installing and operating the engine.

(1) Installation Instructions:

(i) The applicant must identify the means, or provisions for means, provided in compliance with the requirements of paragraph 2(e) of these special conditions.

(ii) The applicant must specify that the engine thrust control system automatically resets the thrust on the operating engine to the “Rated TOTHAT” level when one engine fails during takeoff at specified altitudes and temperatures.

(iii) The applicant must specify that the “Rated TOTHAT” is available by manual crew selection at specified altitudes and temperatures in AEO conditions.

(2) Operating Instructions: The applicant must provide data on engine performance characteristics and variability to enable the airplane manufacturer to establish airplane thrust assurance procedures.

(c) Section 33.7, Engine ratings and operating limitations.

(1) “Rated TOTHAT” and the associated operating limitations are established as follows:

(i) The thrust is the same as the engine takeoff rated thrust with extended flat rating corner point.

(ii) The rotational speed limits are the same as those associated with the engine takeoff rated thrust.

(iii) The applicant must establish a gas temperature steady-state limit and, if necessary, a transient gas over temperature limit for which the duration is no longer than 30 seconds.

(iv) The use is limited to two periods of no longer than 10 minutes each under OEI conditions or 5 minutes each under AEO conditions in any one flight, for a maximum accumulated usage of 20 minutes in any one flight. Each flight where the “Rated TOTHAT” is used must be followed by mandatory inspections and maintenance actions prescribed by paragraph 2(a)(1) of these special conditions.

(2) The applicant must propose language to include in the type certificate data sheet specified in 14 CFR 21.41 for the following:

(i) “Rated TOTHAT” and associated limitations.

(ii) As required by 14 C.F.R. 33.5(b), Operating instructions, include a note stating that “Rated Takeoff Thrust at High Ambient Temperature (Rated TOTHAT) means the approved

engine thrust developed under specified altitudes and temperatures within the operating limitations established for the engine. Use is limited to two periods, no longer than 10 minutes each under OEI conditions or 5 minutes each under AEO conditions in any one flight, for a maximum accumulated usage of 20 minutes in any one flight. Each flight where the “Rated TOTHAT” is used must be followed by mandatory inspection and maintenance actions.”

(iii) As required by § 33.5(b), Operating instructions, include a note stating that “the engine thrust control system automatically resets the thrust on the operating engine to the “Rated TOTHAT” level when one engine fails during takeoff at specified altitudes and temperatures, and the “Rated TOTHAT” is available by manual selection when all engines are operational during takeoff at specified altitudes and temperatures.”

(d) Section 33.28, Engine Control Systems.

The engine must incorporate a means, or a provision for a means, for automatic availability and automatic control of the “Rated TOTHAT” under OEI conditions and must permit manual activation of the “Rated TOTHAT” under AEO conditions.

(e) Section 33.29, Instrument connection.

The engine must:

(1) Have means, or provisions for means, to alert the pilot when the “Rated TOTHAT” is in use, when the event begins and when the time interval expires.

(2) Have means, or provision for means, which cannot be reset in flight, to:

(i) Automatically record each use and duration of the “Rated TOTHAT”, and

(ii) Alert maintenance personnel that the engine has been operated at the “Rated TOTHAT” and permit retrieval of recorded data.

(3) Have means, or provision for means, to enable routine verification of the proper operation of the means in paragraph 2(e)(1) and (e)(2) of these special conditions.

(f) Section 33.85(b), Calibration tests.

The applicant must base the calibration test on the thrust check at the end of the endurance test required by § 33.87 of these special conditions.

(g) Section 33.87, Endurance test.

(1) In addition to the applicable requirements of § 33.87(a):

(i) The § 33.87 endurance test must be modified as follows:

(A) Modify the 30 minute test cycle at the rated takeoff thrust in § 33.87(b)(2)(ii) to run one minute at rated takeoff thrust, followed by five minutes at the “Rated TOTHAT”, followed by the rated takeoff thrust for the remaining twenty-four minutes.

(B) The modified 30 minute period described above in paragraph 2(g)(1)(i)(A) must be repeated ten times in cycles 16 through 25 of the § 33.87 endurance test.

(2) After completion of the tests required by § 33.87(b), as modified in paragraph 2(g)(1)(i) above, and without intervening disassembly, except as needed to replace those parts described as consumables in the ICA, the applicant must conduct the following test sequence for a total time of not less than 120 minutes:

- (i) Ten minutes at “Rated TOTHAT”.
- (ii) Eighty-eight minutes at rated maximum continuous thrust.
- (iii) One minute at 50 percent of rated takeoff thrust.
- (iv) Ten minutes at “Rated TOTHAT”.
- (v) Ten minutes at rated maximum continuous thrust.
- (vi) One minute at flight idle.

(3) The test sequence of §§ 33.87(b)(1) through (b)(6) of these special conditions must be run continuously. If a stop occurs during these tests, the interrupted sequence must be repeated unless the applicant shows that the severity of the test would not be reduced if the current tests were continued.

(4) Where the engine characteristics are such that acceleration to the “Rated TOTHAT” results in a transient over temperature in excess of the steady-state temperature limit identified in paragraph 2(c)(1)(iii) of these special conditions, the transient gas over temperature must be applied to each acceleration to the “Rated TOTHAT” of the test sequence in paragraph 2(g)(2) of these special conditions.

- (h) Section 33.93, Teardown inspection.

The applicant must perform the teardown inspection required by § 33.93(a), after completing the endurance test prescribed by § 33.87 of these special conditions.

(i) Section 33.201, Design and test requirements for Early ETOPS eligibility.

In addition to the requirements of § 33.201(c)(1), the simulated ETOPS mission cyclic endurance test must include two cycles of 10 minute duration, each at the “Rated TOTHAT”; one before the last diversion cycle and one at the end of the ETOPS test.

Issued in Burlington, Massachusetts on August 23, 2017.

Karen M. Grant  
Acting Manager, Engine and Propeller Standards Branch  
Aircraft Certification Service

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