[4910-13-P]

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Part 39

[Docket No. FAA-2022-1416; Project Identifier AD-2022-00725-E; Amendment 39-22358; AD 2023-04-11]

RIN 2120-AA64

Airworthiness Directives; General Electric Company Turbofan Engines

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Final rule.

SUMMARY: The FAA is superseding Airworthiness Directive (AD) 2012-02-07 for certain General Electric Company (GE) CF6-45 and CF6-50 series model turbofan engines with a specified low-pressure turbine (LPT) rotor stage 3 disk installed. AD 2012-02-07 required inspections of high-pressure turbine (HPT) and LPT rotors, engine checks, vibration surveys, an optional LPT rotor stage 3 disk removal after a failed HPT blade borescope inspection (BSI) or a failed engine core vibration survey, established a lower life limit for the affected LPT rotor stage 3 disks, and required removing these disks from service at times determined by a drawdown plan. This AD was prompted by the occurrence of four events of separation of the LPT rotor assembly, which resulted in the LPT rotor assembly departing the rear of the engine. This AD requires inspections of HPT and LPT rotor stage 1 and stage 2 blades, vibration surveys, and use of a lower life limit for the affected LPT rotor stage 3 disks and, as terminating action to the inspections, engine checks, and vibration surveys, this AD requires removal and replacement of the LPT rotor stage 3 disk with a redesigned LPT rotor stage 3 disk. This AD also requires revising the compliance time of the drawdown plan for the removal and replacement of the LPT rotor stage 3 disk and prohibits the installation or reinstallation of certain LPT rotor stage 3 disks. The FAA is issuing this AD to address the unsafe condition on these products.

DATES: This AD is effective [INSERT DATE 35 DAYS AFTER DATE OF

PUBLICATION IN THE FEDERAL REGISTER].

ADDRESSES:

AD Docket: You may examine the AD docket at regulations.gov by searching for and locating Docket No. FAA-2022-1416; or in person at Docket Operations between 9 a.m. and 5 p.m., Monday through Friday, except Federal holidays. The AD docket contains this final rule, any comments received, and other information. The address for Docket Operations is U.S. Department of Transportation, Docket Operations, M-30, West Building Ground Floor, Room W12-140, 1200 New Jersey Avenue SE, Washington, DC 20590.

FOR FURTHER INFORMATION CONTACT: Sungmo Cho, Aviation Safety Engineer, ECO Branch, FAA, 1200 District Avenue, Burlington, MA 01803; phone: (781) 238-7241; email: Sungmo.D.Cho@faa.gov.

SUPPLEMENTARY INFORMATION:

Background

The FAA issued a notice of proposed rulemaking (NPRM) to amend 14 CFR part 39 to supersede AD 2012-02-07, Amendment 39-16930 (77 FR 4650, January 31, 2012), ("AD 2012-02-07"). AD 2012-02-07 applied to certain GE CF6-45A, CF6-45A2, CF6-50A, CF6-50C, CF6-50CA, CF6-50C1, CF6-50C2, CF6-50C2B, CF6-50C2D, CF6-50E, CF6-50E1, CF6-50E2, and CF6-50E2B model turbofan engines, including engines marked on the engine data plate as CF6-50C2-F and CF6-50C2-R, with a specified LPT rotor stage 3 disk, identified by part number (P/N), installed. The NPRM published in the *Federal Register* on December 08, 2022 (87 FR 75181). The NPRM was prompted by the occurrence of four events of separation of the LPT rotor assembly, occurring after the effective date of AD 2012-02-07, which resulted in the LPT rotor assembly departing the rear of the engine. Following the most recent separation event, the FAA determined that due to the complexity of AD 2012-02-07, the limitations of certain operators to access required equipment and training needed to accomplish the inspections, and the manufacturer’s redesign of the LPT rotor stage 3 disk, AD 2012-02-07 required supersedure. The redesigned LPT rotor stage 3 disk, P/N 2453M80P01, has a thicker

forward spacer arm, which reduces stress on the forward arm area and increases its high cycle fatigue alternating stress capability. In the NPRM, the FAA proposed to continue to require inspections of HPT and LPT rotor stage 1 and stage 2 blades, vibration surveys, and use of a lower life limit for the affected LPT rotor stage 3 disks. As a terminating action to the inspections, engine checks, and vibration surveys, the FAA also proposed to require removal and replacement of the LPT rotor stage 3 disk with a redesigned LPT rotor stage 3 disk. In the NPRM, the FAA also proposed to require revision of the compliance time of the drawdown plan for the removal and replacement of the LPT rotor stage 3 disk, and to prohibit the installation or reinstallation of certain LPT rotor stage 3 disks.

Discussion of Final Airworthiness Directive

Comments

The FAA received comments from two commenters. Commenters included Air Line Pilots Association, International and The Boeing Company. All commenters supported the NPRM without change.

Conclusion

The FAA reviewed the relevant data, considered the comments received, and determined that air safety requires adopting the AD as proposed. Accordingly, the FAA is issuing this AD to address the unsafe condition on these products. Except for minor editorial changes, this AD is adopted as proposed in the NPRM.

Costs of Compliance

The FAA estimates that this AD affects 26 engines installed on airplanes of U.S. registry.

The FAA estimates the following costs to comply with this AD:

Estimated costs

Action	Labor Cost	Parts Cost	Cost per product	Cost on U.S. operators
HPT blade inspection, vibration survey, UI, EGT resistance check, EGT thermocouple inspection, cleaning	28 work-hours x $85 per hour = $2,380	$0	$2,380	$61,880

and FPI of the LPT rotor stage 3 disk				
Remove and replace LPT rotor stage 3 disk	620 work-hours x $85 per hour = $52,700	$276,300	$329,000	$8,554,000

Authority for this Rulemaking

Title 49 of the United States Code specifies the FAA's authority to issue rules on aviation safety. Subtitle I, Section 106, describes the authority of the FAA Administrator. Subtitle VII, Aviation Programs, describes in more detail the scope of the Agency's authority.

The FAA is issuing this rulemaking under the authority described in Subtitle VII, Part A, Subpart III, Section 44701, General requirements. Under that section, Congress charges the FAA with promoting safe flight of civil aircraft in air commerce by prescribing regulations for practices, methods, and procedures the Administrator finds necessary for safety in air commerce. This regulation is within the scope of that authority because it addresses an unsafe condition that is likely to exist or develop on products identified in this rulemaking action.

Regulatory Findings

The FAA has determined that this AD will not have federalism implications under Executive Order 13132. This AD will not have a substantial direct effect 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.

For the reasons discussed above, I certify that this AD:

(1) Is not a "significant regulatory action" under Executive Order 12866,

(2) Will not affect intrastate aviation in Alaska, and

(3) 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.

List of Subjects in 14 CFR Part 39

Air transportation, Aircraft, Aviation safety, Incorporation by reference, Safety.

The Amendment

Accordingly, under the authority delegated to me by the Administrator, the FAA amends 14 CFR part 39 as follows:

PART 39 - AIRWORTHINESS DIRECTIVES

1. The authority citation for part 39 continues to read as follows:

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

§ 39.13 [Amended]

2. The FAA amends § 39.13 by:

a. Removing Airworthiness Directive 2012-02-07, Amendment 39-16930 (77 FR 4650, January 31, 2012); and

b. Adding the following new airworthiness directive:

2023-04-11 General Electric Company: Amendment 39-22358; Docket No. FAA-2022-1416; Project Identifier AD-2022-00725-E.

(a) Effective Date

This airworthiness directive (AD) is effective [INSERT DATE 35 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER].

(b) Affected ADs

This AD replaces AD 2012-02-07, Amendment 39-16930 (77 FR 4650, January 31, 2012) (AD 2012-02-07).

(c) Applicability

This AD applies to General Electric Company (GE) CF6-45A, CF6-45A2, CF6-50A, CF6-50C, CF6-50CA, CF6-50C1, CF6-50C2, CF6-50C2B, CF6-50C2D, CF6-50E, CF6-50E1, CF6-50E2, and CF6-50E2B model turbofan engines, including engines marked on the engine data plate as CF6-50C2-F and CF6-50C2-R, with an installed low-pressure turbine (LPT) rotor stage 3 disk having a part number listed in Table 1 to paragraph (c) of this AD.

Table 1 to Paragraph (c) – Applicable LPT Rotor Stage 3 Disk Part Numbers

9061M23P06	9061M23P07	9061M23P08	9061M23P09	9224M75P01
9061M23P10	1473M90P01	1473M90P02	1473M90P03	1473M90P04

9061M23P12	9061M23P14	9061M23P15	9061M23P16	1479M75P01
1479M75P02	1479M75P03	1479M75P04	1479M75P05	1479M75P06
1479M75P07	1479M75P08	1479M75P09	1479M75P11	1479M75P13
1479M75P14	N/A	N/A	N/A	N/A

(d) Subject

Joint Aircraft System Component (JASC) Code 7250, Turbine Section.

(e) Unsafe Condition

This AD was prompted by the occurrence of four events of separation of the LPT rotor assembly, occurring after the effective date of AD 2012-02-07, which resulted in the LPT rotor assembly departing the rear of the engine. The FAA is issuing this AD to prevent critical life-limited rotating engine part failure. The unsafe condition, if not addressed, could result in an uncontained engine failure and damage to the airplane.

(f) Compliance

Comply with this AD within the compliance times specified, unless already done.

(g) Required Actions

(1) *Borescope Inspections (BSI) of High-Pressure Turbine (HPT) Rotor Stage 1 and Stage 2 Blades*. For the BSIs required by paragraphs (g)(1)(i) through (iii) of this AD, inspect the blades from the forward and aft directions. Inspect all areas of the blade airfoil. The inspection must include blade leading and trailing edges and their convex and concave airfoil surfaces. Inspect for signs of impact, cracking, burning, damage, and distress.

(i) Within 75 cycles since last inspection (CSLI) or before further flight, whichever occurs later, perform an initial BSI of the HPT rotor stage 1 and stage 2 blades.

(ii) Thereafter, within every 75 CSLI, repeat the BSI of the HPT rotor stage 1 and stage 2 blades.

(iii) Within the cycle limits after the engine has experienced any of the events specified in Table 2 to paragraph (g)(1)(iii) of this AD, perform a BSI of the HPT rotor stage 1 and stage 2 blades.

Table 2 to Paragraph (g)(1)(iii) – Conditional BSI Criteria

If the engine has experienced:	Then borescope inspect:
An exhaust gas temperature (EGT) above redline	Within 10 cycles
A shift in the smoothed EGT trending data that exceeds 18 °F (10 °C), but is less than or equal to 36 °F (20 °C)	Within 10 cycles
A shift in the smoothed EGT trending data that exceeds 36 °F (20 °C)	Before further flight
Two consecutive raw EGT trend data points that exceed 18 °F (10 °C), but are less than or equal to 36 °F (20 °C), above the smoothed average	Within 10 cycles
Two consecutive raw EGT trend data points that exceed 36 °F (20 °C) above the smoothed average	Before further flight

(iv) If the engine fails any of the BSIs required by this AD, before further flight, remove the engine from service.

(2) *Engines with Damaged HPT Rotor Blades*, For those engines that fail any BSI requirements of this AD, before returning the engine to service, accomplish the actions required by paragraph (g)(2)(i) or (ii) of this AD:

(i) Remove the LPT rotor stage 3 disk from service; or

(ii) Perform a fluorescent-penetrant inspection (FPI) of the inner diameter surface forward cone body (forward spacer arm) of the LPT rotor stage 3 disk as specified in paragraphs (g)(6)(i)(A) through (C) of this AD.

(3) *EGT Thermocouple Probe Inspections*. (i) Within 750 CSLI, or before further flight, whichever occurs later, inspect the EGT thermocouple probe for damage.

Note 1 to paragraph (g)(3)(i): Damage to the EGT thermocouple probe may be indicated by wear through the thermocouple guide sleeve or contact between the turbine mid-frame liner and the EGT thermocouple probe.

(ii) Thereafter, within every 750 CSLI, re-inspect the EGT thermocouple probe for damage.

(iii) If any EGT thermocouple probe shows wear through the thermocouple guide sleeve or contact between the turbine mid-frame liner and the EGT thermocouple probe, before further flight, remove and replace the EGT thermocouple probe and ensure the turbine mid-frame liner does not contact the EGT thermocouple probe.

(4) *EGT System Resistance Checks*. (i) Within 750 cycles since the last resistance check on the EGT system or before further flight, whichever occurs later, perform an EGT system resistance check.

(ii) Thereafter, within every 750 cycles since the last resistance check, repeat the EGT system resistance check.

(iii) If an EGT system component fails the resistance system check, before further flight, remove and replace, or repair the EGT system component.

(5) *Engine Core Vibration Survey*. (i) Within 350 cycles since the last engine core vibration survey or before further flight, whichever occurs later, perform an initial engine core vibration survey.

(ii) Use about a one-minute acceleration and a one-minute deceleration of the engine between ground idle and 84% N2 (about 8,250 rpm) to perform the engine core vibration survey.

(iii) Use a spectral/trim balance analyzer or equivalent to measure the N2 rotor vibration.

(iv) If the vibration level is above 5 mils Double Amplitude, before further flight, remove the engine from service.

(v) For those engines that fail any engine core vibration survey requirements of this AD, before returning the engine to service:

(A) Remove the LPT rotor stage 3 disk from service; or

(B) Perform an FPI of the inner diameter surface forward spacer arm of the LPT rotor stage 3 disk as specified in paragraph (g)(6)(i)(A) through (C) of this AD.

(vi) Thereafter, within every 350 cycles since the last engine core vibration survey, perform the engine core vibration survey as required in paragraphs (g)(5)(i) through (v) of this AD.

(vii) If the engine has experienced any vibration reported by maintenance or flight crew that is suspected to be caused by the engine core (N2), within 10 cycles after the report, perform the engine core vibration survey as required in paragraphs (g)(5)(i) through (v) of this AD.

(viii) Vibration surveys carried out in an engine test cell as part of an engine manual performance run fulfill the vibration survey requirements of paragraphs (g)(5)(ii) and (iii) of this AD.

(6) *Initial and Repetitive FPI of LPT Rotor Stage 3 Disk*. (i) At the next shop visit after accumulating 1,000 cycles since the last FPI of the LPT rotor stage 3 disk forward spacer arm or before further flight, whichever occurs later:

(A) Clean the LPT rotor stage 3 disk forward spacer arm, including the use of a wet-abrasive blast, to eliminate residual or background fluorescence;

(B) Perform an FPI of the LPT rotor stage 3 disk forward spacer arm for cracks and for a band of fluorescence. Include all areas of the disk forward spacer arm and the inner diameter surface forward spacer arm of the LPT rotor stage 3 disk; and

(C) If a crack or a band of fluorescence is present, before further flight, remove the disk from service.

(ii) Thereafter, at each engine shop visit that occurs after accumulating 1,000 cycles since the last FPI of the LPT rotor stage 3 disk forward spacer arm, clean and perform an FPI of the LPT rotor stage 3 disk forward spacer arm, as specified in paragraph (g)(6)(i)(A) through (C) of this AD.

(7) *Removal of LPT Rotor Stage 3 Disk*. (i) For any installed LPT rotor stage 3 disk having a part number listed in Table 1 to paragraph (c) of this AD, at the first occurrence of any one of the conditions identified in paragraphs (g)(7)(i)(A) through (C) of this AD, remove the LPT rotor stage 3 disk from service and replace with LPT rotor stage 3 disk part number 2453M80P01.

(A) For a disk that has accumulated fewer than 3,200 cycles since new (CSN) as of March 6, 2012 (the effective date of AD 2012-02-07), remove the disk from service before accumulating 6,200 CSN.

(B) For a disk that accumulated 3,200 or more CSN as of March 6, 2012 (the effective date of AD 2012-02-07), do the actions required by paragraphs (g)(7)(i)(B)(1) or (2) of this AD, as applicable to your engine.

(1) If the engine has a shop visit before the disk accumulates 6,200 CSN, remove the disk from service at that shop visit.

(2) If the engine does not have a shop visit before the disk accumulates 6,200 CSN, remove the disk from service at the next shop visit after accumulating 6,200 CSN, not to exceed 3,000 cycles from March 6, 2012 (the effective date of AD 2012-02-07).

(C) Before exceeding 18 months from the effective date of this AD.

(h) Terminating Action

Replacement of the LPT rotor stage 3 disk in accordance with paragraph (g)(7) of this AD constitutes terminating action for the inspections, engine checks, and vibration surveys required by paragraphs (g)(1) through (6) of this AD.

(i) Installation Prohibition

After the effective date of this AD, do not install or reinstall onto any engine an LPT rotor stage 3 disk listed in Table 1 to paragraph (c) of this AD that has accumulated 6,200 CSN or more.

(j) Definitions

For the purposes of this AD:

(1) An EGT above redline is a confirmed over-temperature indication that is not a result of EGT system error.

(2) A shift in the smoothed EGT trending data is a shift in a rolling average of EGT readings that can be confirmed by a corresponding shift in the trending of fuel flow or fan speed/core speed (N1/N2) relationship.

Note 2 to paragraph (j)(2): You can find further guidance about evaluating EGT trend data in GE Company Service Rep Tip 373 “Guidelines For Parameter Trend Monitoring.”

(3) An engine shop visit is the induction of an engine into the shop, where the separation of a major engine flange occurs; except the following maintenance actions, or any combination, are not considered engine shop visits:

(i) Induction of an engine into a shop solely for removal of the compressor top or bottom case for airfoil maintenance or variable stator vane bushing replacement;

(ii) Induction of an engine into a shop solely for removal or replacement of the stage 1 fan disk;

(iii) Induction of an engine into a shop solely for replacement of the turbine rear frame;

(iv) Induction of an engine into a shop solely for replacement of the accessory gearbox or transfer gearbox, or both; and

(v) Induction of an engine into a shop solely for replacement of the fan forward case.

(4) A raw EGT trend data point above the smoothed average is a confirmed temperature reading over the rolling average of EGT readings that is not a result of EGT system error.

(k) Credit for Previous Actions

You may take credit for the actions required by paragraph (g) of this AD if they were performed before the effective date of this AD using GE Service Bulletin (SB) No. CF6-50 SB 72-1315, Initial Issue, dated June 3, 2011, or GE SB No. CF6-50 SB 72-1315, Revision 1, dated June 30, 2011.

(l) Alternative Methods of Compliance (AMOCs)

(1) The Manager, ECO Branch, FAA, has the authority to approve AMOCs for this AD, if requested using the procedures found in 14 CFR 39.19. In accordance with 14 CFR 39 19, send your request to your principal inspector or local Flight Standards District Office, as appropriate. If sending information directly to the manager of the certification office, send it to the attention of the person identified in paragraph (m) of this AD and email it to: ANE-AD-AMOC@faa.gov.

(2) Before using any approved AMOC, notify your appropriate principal inspector, or lacking a principal inspector, the manager of the local flight standards district office/certificate holding district office.

(3) AMOCs approved previously for AD 2010-12-10, Amendment 39-16331 (75 FR 32649, June 9, 2010); AD 2011-02-07, Amendment 39-16580 (76 FR 6323,

February 4, 2011); or AD 2011-18-01, Amendment 39-16783 (76 FR 52213, August 22, 2011) are approved as AMOCs for the corresponding provisions of this AD.

(m) Related Information

For more information about this AD, contact Sungmo Cho, Aviation Safety Engineer, ECO Branch, FAA, 1200 District Avenue, Burlington, MA 01803; phone: (781) 238-7241; email: Sungmo.D.Cho@faa.gov.

(n) Material Incorporated by Reference

None.

Issued on February 17, 2023.

Christina Underwood, Acting Director,
Compliance & Airworthiness Division,
Aircraft Certification Service.

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