

[Federal Register, Volume 87 Number 196 (Wednesday, October 12, 2022)]
[Rules and Regulations]
[Pages 61445-61450]
From the Federal Register Online via the Government Publishing Office [www.gpo.gov]
[FR Doc No: 2022-22061]

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Part 39

[Docket No. FAA-2022-0467; Project Identifier AD-2022-00174-E; Amendment 39-22196; AD 2022-20-12]

RIN 2120-AA64

Airworthiness Directives; General Electric Company Turbofan Engines

AGENCY:

Federal Aviation Administration (FAA), DOT.

ACTION:

Final rule.

SUMMARY:

The FAA is adopting a new airworthiness directive (AD) for certain General Electric Company (GE) GENx-1B and GENx-2B model turbofan engines. This AD was prompted by the detection of melt-related freckles in the forgings and billets, which may reduce the life of certain compressor discharge pressure (CDP) seals, interstage seals, high-pressure turbine (HPT) rotor stage 2 disks, and stages 6-10 compressor rotor spools. This AD requires revising the airworthiness limitations section (ALS) of the applicable GENx-1B and GENx-2B Engine Manual (EM) and the operator's existing approved maintenance program or inspection program, as applicable, to incorporate reduced life limits for these parts. The FAA is issuing this AD to address the unsafe condition on these products.

DATES:

This AD is effective November 16, 2022.

ADDRESSES:

AD Docket: You may examine the AD docket at *regulations.gov* by searching for and locating Docket No. FAA-2022-0467; 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:

Alexei Marqueen, Aviation Safety Engineer, ECO Branch, FAA, 1200 District Avenue, Burlington, MA 01803; phone: (781) 238-7178; email: Alexei.T.Marqueen@faa.gov.

SUPPLEMENTARY INFORMATION:

Background

The FAA issued a notice of proposed rulemaking (NPRM) to amend [14 CFR part 39](#) by adding an AD that would apply to certain GE GEnx-1B54/P2, GEnx-1B58/P2, GEnx-1B64/P2, GEnx-1B67/P2, GEnx-1B70/P2, GEnx-1B70C/P2, GEnx-1B70/72/P2, GEnx-1B70/75/P2, GEnx-1B74/75/P2, GEnx-1B75/P2, GEnx-1B76/P2, GEnx-1B76A/P2, and GEnx-1B78/P2 (GEnx-1B) and GEnx-2B67, GEnx-2B67B, and GEnx-2B67/P (GEnx-2B) model turbofan engines. The NPRM published in the **Federal Register** on June 1, 2022 ([87 FR 33071](#)). The NPRM was prompted by the engine manufacturer notifying the FAA of the detection of melt-related freckles in the forgings and billets, which may reduce the life of certain CDP seals, interstage seals, HPT rotor stage 2 disks, and stages 6-10 compressor rotor spools (life-limited parts (LLPs)). The manufacturer's investigation determined that, as a result of such freckles forming in the forgings and billets, certain LLPs may have undetected subsurface anomalies that developed during the manufacturing process, resulting in reduced material properties and a lower fatigue life capability. Reduced material properties may cause premature LLP fracture, which could result in uncontained debris release. As a result of its investigation, the manufacturer determined the need to reduce the life limits of certain LLPs. To reflect these reduced life limits, the manufacturer revised the ALS of the affected GEnx-1B and GEnx-2B EMs. In the NPRM, the FAA proposed to require operators to update the ALS of the applicable GEnx-1B and GEnx-2B EM and the operator's existing approved maintenance program or inspection program, as applicable, to incorporate reduced life limits for certain LLPs. The FAA is issuing this AD to address the unsafe condition on these products.

Discussion of Final Airworthiness Directive

Comments

The FAA received comments from seven commenters. The commenters were Air China, Air Line Pilots Association, International (ALPA), American Airlines (AAL), GE, The Boeing Company (Boeing), TUI Airways, and United Airlines Powerplant Engineering (United Airlines). ALPA, Boeing, and United Airlines supported the proposed AD without change. AAL supported the proposed AD, with one comment relating to the service information. Three commenters, Air China, GE, and TUI Airways, requested changes to the proposed AD. The following presents the comments received on the NPRM and the FAA's response to each comment.

Request To Update Service Information

AAL and GE noted that the preamble of the NPRM refers to service information that has been superseded. GE published GE GEnx-1B Service Bulletin (SB) 72-0484 R01, dated March 17, 2022 (GE GEnx-1B SB 72-0484 R01), and GE GEnx-2B SB 72-0423 R01, dated March 17, 2022 (GE GEnx-2B SB 72-0423 R01). The revisions contain corrections to serial number errors published in the original service information. GE requested that the FAA update the service information to reflect the current revisions to avoid confusion among the operators.

The FAA agrees and updated the Related Service Information paragraph in the preamble of this final rule to reference GE GEnx-1B SB 72-0484 R01 and GE GEnx-2B SB 72-0423 R01. This change places no additional burden on operators who are required to comply with this AD.

Requests To Modify the Tables to Paragraph (g)

Air China noted that there is a revision to the service information in tables 5 through 8 to paragraph (g)(2) of the proposed AD. The commenter requested that the FAA modify the service information in the tables from "GEnx-2B SB 72-0423, latest revision" to "GEnx-2B SB 72-0423 R01 revision."

The FAA disagrees. Paragraph (g)(2) of this AD requires the operator to revise the ALS of the applicable GEnx-2B EM and the operator's existing approved maintenance program or inspection program, as applicable, by inserting the information in the tables to paragraph (g)(2) into the applicable table for their respective part numbers. The description of the service information in the tables to paragraph (g) of this AD is consistent with the description of the service information in the applicable tables in the ALS. The FAA did not change this AD as a result of this comment.

GE requested that the FAA clarify the wording in the proposed AD regarding parts not affected or listed in GE GEnx-1B SB 72-0484 R01 and GE GEnx-2B SB 72-0423 R01. The commenter noted that the proposed AD includes updating the ALS language for parts not affected by the population listed in GE GEnx-1B SB 72-0484 and GE GEnx-2B SB 72-0423. GE requested that the FAA modify the tables to paragraph (g) of this AD to remove the life cycles for part serial numbers not

listed in GE GENx-1B SB 72-0484 and GE GENx-2B SB 72-0423. If such modifications cannot be done, GE requested that the FAA add language to clarify that future LLP life extensions on part serial numbers not listed in the SB populations would not require an alternative method of compliance (AMOC).

The FAA agrees with the modification. The FAA revised the tables to paragraph (g) of this AD to remove the entries for life cycles for part serial numbers not listed in the service information. This change places no additional burden on operators who are required to comply with this AD.

Responsibility for Revising the EM

Air China commented that paragraph (g)(2) of the proposed AD states to “revise the ALS of the existing GENx-2B EM.” The commenter stated that the responsibility for revising the EM belongs to the manufacturer, not the operator.

The FAA disagrees. While the manufacturer does revise the engine manuals, this AD requires the operator to revise the ALS of the existing GENx-2B EM and the operator's existing approved maintenance program or inspection program, as applicable. This includes revising the operator's copies of the EM to incorporate the reduced life limits for certain LLPs. The FAA did not change this AD as a result of this comment.

Request To Confirm Compliance With Previous Actions

Air China stated that it performed certain required actions proposed in paragraph (g)(2) of the NPRM using GE GENx-2B SB 72-0423 before the NPRM was issued:

1. For the affected LLPs that had already been installed on GENx-2B67/P engines of Air China, Air China listed the LLPs' time limits in the continuous airworthiness maintenance program.
2. For the affected LLPs that were not installed on GENx-2B67/P engines of Air China, Air China issued engineering order documents that prohibit the installation of affected LLPs on the Air China GENx-2B67/P fleet.

Air China asked if the FAA would consider these actions as being in compliance with the proposed requirements in paragraph (g)(2) of the proposed AD.

In response to this comment, the FAA notes that paragraph (g)(2) of this AD requires the operator to revise the ALS of the existing GENx-1B EM and the operator's existing approved maintenance program or inspection program, as applicable, by inserting the information in the tables to paragraph (g)(2) into the applicable table for their respective part numbers. This AD requires revising the life limits with the entirety of the information provided in the tables to paragraph (g)(2) of this AD, regardless of the installation of affected parts. Additionally, this AD does not contain an installation prohibition.

Request To Allow for Pro-Rated Life Calculations

TUI Airways requested that the FAA add an allowance for pro-rated life calculations to this AD. TUI Airways noted that paragraph (g)(3) of the proposed AD states, “After performing the actions required by paragraphs (g)(1) and (2) of this AD, except as provided in paragraph (h) of this AD, no alternative life limits may be approved for the affected parts.” TUI Airways suggested that this statement does not consider parts that have or could operate at different engine ratings or are common to two or more engine models. The commenter reasoned that a part common to multiple engine ratings or models could have different life cycle limits depending on the engine application, and therefore, a pro-rated calculation (per GE EM 05-11-00) could be made to determine the remaining cycles of the given part.

The FAA does not agree. The intent of this AD is to revise the ALS of the existing GENx-1B and GENx-2B EMs and the operator's existing approved maintenance or inspection program with the updated life limits provided in paragraph (g) of this AD. This AD does not prohibit pro-rated life limit calculations, but the FAA cautions that such calculations performed prior to the effective date of this AD may need to be re-evaluated using the new life limits provided in paragraph (g) of this AD. The FAA did not change this AD as a result of this comment.

Conclusion

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

minor editorial changes, and any other changes described previously, this AD is adopted as proposed in the NPRM. None of the changes will increase the economic burden on any operator.

Related Service Information

The FAA reviewed GE GENx-1B SB 72-0484 R01, dated March 17, 2022, and GE GENx-2B SB 72-0423 R01, dated March 17, 2022. These SBs, differentiated by engine model, provide the reduced life limits for certain LLPs.

Costs of Compliance

The FAA estimates that this AD affects 390 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
Revise ALS of EM and the operator's existing approved maintenance or inspection program	1 work-hour × \$85 per hour = \$85	\$0	\$85	\$33,150

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

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 adding the following new airworthiness directive:

2022-20-12 General Electric Company: Amendment 39-22196; Docket No. FAA-2022-0467; Project Identifier AD-2022-00174-E.

(a) Effective Date

This airworthiness directive (AD) is effective November 16, 2022.

(b) Affected ADs

None.

(c) Applicability

This AD applies to General Electric Company (GE) GENx-1B54/P2, GENx-1B58/P2, GENx-1B64/P2, GENx-1B67/P2, GENx-1B70/P2, GENx-1B70C/P2, GENx-1B70/72/P2, GENx-1B70/75/P2, GENx-1B74/75/P2, GENx-1B75/P2, GENx-1B76/P2, GENx-1B76A/P2, GENx-1B78/P2, GENx-2B67, GENx-2B67B, and GENx-2B67/P model turbofan engines.

(d) Subject

Joint Aircraft System Component Code 7230, Turbine Engine Compressor Section; 7250, Turbine Section.

(e) Unsafe Condition

This AD was prompted by the detection of melt-related freckles in the forgings and billets, which may reduce the life of certain compressor discharge pressure (CDP) seals, interstage seals, high-pressure turbine (HPT) rotor stage 2 disks, and stages 6-10 compressor rotor spools. The FAA is issuing this AD to prevent failure of the CDP seal, interstage seal, HPT rotor stage 2 disk, and stages 6-10 compressor rotor spool. The unsafe condition, if not addressed, could result in uncontained debris release, damage to the engine, and damage to the airplane.

(f) Compliance

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

(g) Required Actions

(1) For all affected GENx-1B model turbofan engines, within 90 days after the effective date of this AD, revise the airworthiness limitations section (ALS) of the existing GENx-1B Engine Manual (EM) and the operator's existing approved maintenance program or inspection program, as applicable, by inserting the following information into the applicable table for their respective part numbers:

(i) For stages 6-10 compressor rotor spool, part number (P/N) 2628M56G01, insert the information in Table 1 to paragraph (g)(1)(i) of this AD.

Table 1 to Paragraph (g)(1)(i) —Stages 6-10 Compressor Rotor Spool, P/N 2628M56G01

Part name	Part No.	Life cycles -1B54/P2	Life cycles -1B58/P2 -1B64/P2 -1B67/P2 -1B70/P2	Life cycles -1B70C/P2	Life cycles -1B70/72/P2 -1B70/75/P2 -1B74/75/P2 -1B75/P2	Life cycles -1B76/P2	Life cycles -1B76A/P2	Life cycles -1B78/P2
Spool, Stage 6-10	2628M56G01 For part serial numbers listed in Table 1 of GENx-1B SB 72-0484, latest revision	10,300	10,300	10,300	10,300	8,500	8,500	8,500
Spool, Stage 6-10	2628M56G01 For part serial numbers listed in Table 2 of GENx-1B SB 72-0484, latest revision	5,700	5,700	5,700	5,700	4,800	4,800	4,800

(ii) For CDP seal, P/N 2383M82P03, insert the information in Table 2 to paragraph (g)(1)(ii) of this AD.

Table 2 to Paragraph (g)(1)(ii) –CDP Seal, P/N 2383M82P03

Part name	Part No.	Life cycles -1B54/P2	Life cycles -1B58/P2 -1B64/P2 -1B67/P2 -1B70/P2	Life cycles -1B70C/P2	Life cycles -1B70/72/P2 -1B70/75/P2 -1B74/75/P2 -1B75/P2	Life cycles -1B76/P2	Life cycles -1B76A/P2	Life cycles -1B78/P2
Seal, CDP	2383M82P03 For part serial numbers listed in Table 3 of GENx-1B SB 72-0484, latest revision	6,100	6,100	6,100	6,100	5,300	5,300	5,300
Seal, CDP	2383M82P03 For part serial numbers listed in Table 4 of GENx-1B SB 72-0484, latest revision	13,400	13,400	13,400	13,400	9,300	9,300	9,300
Seal, CDP	2383M82P03 For part serial numbers listed in Table 5 of GENx-1B SB 72-0484, latest revision	3,600	3,600	3,600	3,600	2,900	2,900	2,900

(iii) For interstage seal, P/N 2383M85P04, insert the information in Table 3 to paragraph (g)(1)(iii) of this AD.

Table 3 to Paragraph (g)(1)(iii) –Interstage Seal, P/N 2383M85P04

Part name	Part No.	Life cycles -1B54/P2	Life cycles -1B58/P2 -1B64/P2 -1B67/P2 -1B70/P2	Life cycles -1B70C/P2	Life cycles -1B70/72/P2 -1B70/75/P2 -1B74/75/P2 -1B75/P2	Life cycles -1B76/P2	Life cycles -1B76A/P2	Life cycles -1B78/P2
Seal, Interstage	2383M85P04 For part serial numbers listed in Table 6 of GENx-1B SB 72-0484, latest revision	10,500	10,500	10,500	10,500	6,400	6,400	6,400
Seal, Interstage	2383M85P04 For part serial numbers listed in Table 7 of GENx-1B SB 72-0484, latest revision	15,000	15,000	15,000	15,000	10,500	10,500	10,500
Seal, Interstage	2383M85P04 For part serial numbers listed in Table 8 of GENx-1B SB 72-0484, latest revision	5,500	5,500	5,500	5,500	2,800	2,800	2,800

(iv) For HPT rotor stage 2 disk, P/N 2383M86P02, insert the information in Table 4 to paragraph (g)(1)(iv) of this AD.

Table 4 to Paragraph (g)(1)(iv) –HPT Rotor Stage 2 Disk, P/N 2383M86P02

Part name	Part No.	Life cycles -1B54/P2	Life cycles -1B58/P2 -1B64/P2 -1B67/P2 -1B70/P2	Life cycles -1B70C/P2	Life cycles -1B70/72/P2 -1B70/75/P2 -1B74/75/P2 -1B75/P2	Life cycles -1B76/P2	Life cycles -1B76A/P2	Life cycles -1B78/P2
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Part name	Part No.	Life cycles -1B54/P2	Life cycles -1B58/P2 -1B64/P2 -1B67/P2 -1B70/P2	Life cycles -1B70C/P2	Life cycles -1B70/72/P2 -1B70/75/P2 -1B74/75/P2 -1B75/P2	Life cycles -1B76/P2	Life cycles -1B76A/P2	Life cycles -1B78/P2
Disk, Stage 2	2383M86P02 For part serial numbers listed in Table 9 of GENx-1B SB 72-0484, latest revision	6,900	6,900	6,900	6,900	5,100	5,100	5,100
Disk, Stage 2	2383M86P02 For part serial numbers listed in Table 10 of GENx-1B SB 72-0484, latest revision	10,400	10,400	10,400	10,400	7,500	6,800	7,500
Disk, Stage 2	2383M86P02 For part serial numbers listed in Table 11 of GENx-1B SB 72-0484, latest revision	3,800	3,800	3,800	3,800	3,000	3,000	3,000

(2) For all affected GENx-2B model turbofan engines, within 90 days after the effective date of this AD, revise the ALS of the existing GENx-2B EM and the operator's existing approved maintenance program or inspection program, as applicable, by inserting the following information into the applicable table for their respective part numbers:

(i) For stages 6-10 compressor rotor spool, P/N 2628M56G01, insert the information in Table 5 to paragraph (g)(2)(i) of this AD.

Table 5 to Paragraph (g)(2)(i) –Stages 6-10 Compressor Rotor Spool, P/N 2628M56G01

Part name	Part No.	Life cycles -2B67	Life cycles -2B67B	Life cycles -2B67/P
Spool, Stage 6-10	2628M56G01 For part serial numbers listed in Table 1 of GENx-2B SB 72-0423, latest revision			10,300
Spool, Stage 6-10	2628M56G01 For part serial numbers listed in Table 2 of GENx-2B SB 72-0423, latest revision			5,700

(ii) For CDP seal, P/N 2383M82P03, insert the information in Table 6 to paragraph (g)(2)(ii) of this AD.

Table 6 to Paragraph (g)(2)(ii) –CDP Seal, P/N 2383M82P03

Part name	Part No.	Life cycles -2B67	Life cycles -2B67B	Life cycles -2B67/P
Seal, CDP	2383M82P03 For part serial numbers listed in Table 3 of GENx-2B SB 72-0423, latest revision			6,100

Part name	Part No.	Life cycles -2B67	Life cycles -2B67B	Life cycles -2B67/P
Seal, CDP	2383M82P03 For part serial numbers listed in Table 4 of GENx-2B SB 72-0423, latest revision			13,400
Seal, CDP	2383M82P03 For part serial numbers listed in Table 5 of GENx-2B SB 72-0423, latest revision			3,600

(iii) For interstage seal, P/N 2383M85P04, insert the information in Table 7 to paragraph (g)(2)(iii) of this AD.

Table 7 to Paragraph (g)(2)(iii) –Interstage Seal, P/N 2383M85P04

Part name	Part No.	Life cycles -2B67	Life cycles -2B67B	Life cycles -2B67/P
Seal, Interstage	2383M85P04 For part serial numbers listed in Table 6 of GENx-2B SB 72-0423, latest revision			10,500
Seal, Interstage	2383M85P04 For part serial numbers listed in Table 7 of GENx-2B SB 72-0423, latest revision			15,000
Seal, Interstage	2383M85P04 For part serial numbers listed in Table 8 of GENx-2B SB 72-0423, latest revision			5,500

(iv) For HPT rotor stage 2 disk, P/N 2383M86P02, insert the information in Table 8 to paragraph (g)(2)(iv) of this AD.

Table 8 to Paragraph (g)(2)(iv) –HPT Rotor Stage 2 Disk P/N, 2383M86P02

Part name	Part No.	Life cycles -2B67	Life cycles -2B67B	Life cycles -2B67/P
Disk, Stage 2	2383M86P02 For part serial numbers listed in Table 9 of GENx-2B SB 72-0423, latest revision			6,900
Disk, Stage 2	2383M86P02 For part serial numbers listed in Table 10 of GENx-2B SB 72-0423, latest revision			10,400
Disk, Stage 2	2383M86P02 For part serial numbers listed in Table 11 of GENx-2B SB 72-0423, latest revision			3,800

(h) 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 (i) of this AD and email 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.

(i) Related Information

For more information about this AD, contact Alexei Marqueen, Aviation Safety Engineer, ECO Branch, FAA, 1200 District Avenue, Burlington, MA 01803; phone: (781) 238-7178; email: Alexei.T.Marqueen@faa.gov.

(j) Material Incorporated by Reference

None.

Issued on September 19, 2022.

Christina Underwood,

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

[[FR Doc. 2022-22061](#) Filed 10-11-22; 8:45 am]

BILLING CODE 4910-13-P