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DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Part 39

[Docket No. 87-CE-14-AD; Amendment 39-6195]

Airworthiness Directive; Piper PA-28 and PA-32 Series Airplanes.

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Final Rule, Rescission.

SUMMARY: This amendment rescinds Airworthiness Directive (AD) 87-08-08, and all revisions thereto, applicable to certain Piper PA-28 and PA-32 series airplanes. This AD required, (1) a visual inspection with a 10-power magnifying glass and a dye penetrant inspection of the lower spar cap for both wings; (2) replacement of any spars found to be cracked; and (3) visual inspection of the wing upper skin for cracks and repair as required. This AD was issued following an in-flight wing failure on a Piper PA-28 airplane.

Subsequent to its issuance, the FAA has learned that two Piper PA-32-300 airplanes were found to have similar type cracks. Piper Aircraft Corporation has presented evidence that these airplanes were subjected to heavy use and extensive damage. An extensive evaluation of the fracture surface from these airplanes has shown that it would require an extraordinary stress level to produce the growth rate of those cracks. Therefore, such failure is not likely to exist or develop in other Piper Model airplanes of the same type design operated in a normal manner.

EFFECTIVE DATE: May 22, 1989.

ADDRESSES: Piper Service Letter No. 997, dated May 14, 1987, and Piper Service Bulletin No. 886, dated June 8, 1989, applicable to this AD may be obtained from Piper Aircraft Corporation, 2926 Piper Drive, Vero Beach, Florida 32960. This information may also be examined at the Rules Docket, FAA, Office of the Assistant Chief Counsel, Room 1558, 601 East 12th Street, Kansas City, Missouri 64106.

FOR FURTHER INFORMATION CONTACT:

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SUPPLEMENTARY INFORMATION: A proposal to amend Part 39 of the Federal Aviation Regulations by rescinding AD 87-08-08, Amendment Number 39-5615; AD 87-08-08R1, Amendment 39-5669; and AD 87-08-08R2, Amendment 39-5731, pertaining to certain Piper PA-28 and PA-32 series airplanes was published in the Federal Register on August 31, 1988, (Volume 53, No. 169, page no. 33501).

The proposal resulted from a reevaluation of AD 87-08-08, Amendment 39-5615 (52 FR 15302, April 28, 1987), which was issued to require on certain Piper Model PA-28 and PA-32 series airplanes (1) The removal of both wings and a visual inspection with a ten power magnifying glass and a dye penetrant inspection of the lower spar cap for both wings; (2) The replacement of any spars found to be cracked; and (3) visual inspection of the wing upper skin for cracks and repair as required. AD 87-08-08R1, Amendment 39-5669 (52 FR 29505, August 10, 1987), which was issued effective August 12, 1987, revised the AD to delete the Model PA-28-201T since it was verified that its spar design configuration was different in detail and should not have been included. On September 28, 1987, the AD was suspended by AD 87-08-08R2 (Amendment 39-5731, 52 FR 35907) pending further evaluation, since it was becoming apparent, from the relevant data being collected, that only those airplanes used in a severe operating environment were susceptible to fatigue cracks.

The original AD was issued following an in-flight wing separation of a Piper PA-28-181, S/N 8090115, on March 30, 1987, near Marlin, Texas. The airplane was flying low level pipeline patrol at the time of the accident.

Investigation revealed that the left wing separated from the airplane at the lower spar wing root attachment to the fuselage. National Transportation Safety Board, FAA, and Piper Aircraft Corporation personnel determined that the lower cap on the main spar had sustained a fatigue failure. The lower cap had a fatigue crack across its forward face just outboard of the outboard attachment hole. During the time that the unrevised AD was in effect, approximately 560 spar inspections were performed. These inspections resulted in three additional reports of spar cracks in two PA-32-300 airplanes operated in Alaska. It was determined that these airplanes had been operated in a severe environment based on repairs recorded in the airplane logbooks and their general condition. The environment included rough rock/gravel fields and overweight operation. Prior to the accident leading to the issuance of the original AD, neither the FAA nor the Piper Service Department had received a report of problems in the area where the cracks occurred. However, the FAA realized that the inspections required would necessitate the removal and reinstallation of high tolerance critical wing spar attachment bolts; and, that if this was not done carefully, such process could cause damage to the wing spar cap material that could in turn result in a future fatigue failure. There are airplanes in the fleet with 19,000 plus hours time-in-service (TIS) that complied with the inspections of the AD and reported no cracks found.

Fatigue tests were conducted on a full-scale test article in the late 1950's and early 1960's prior to certification of the PA-28. These tests were run to the equivalent of 300,000 unfactored cycles with no failure. The FAA has carefully reviewed all of the available information including a credible fracture mechanics analysis. Striation counts on the fracture surface of the spar cap removed from one airplane showed that it would require extraordinary stress levels to produce the growth rate found. Airplanes operated in a normal general aviation type environment would not be exposed to sufficient loads to create these high stress levels. Therefore, it is concluded that the cracks found were isolated occurrences and those failures are not likely to

exist or develop in other PA-28 series or PA-32 series airplanes operated in a normal manner.

In addition, Piper conducted an extensive fracture mechanics and fatigue analysis program to establish more accurately an inspection threshold and appropriate reinspection intervals based on different categories of airplane operations. Their study showed that airplanes used for low level pipeline patrol have a fatigue life approximately 20 times less than airplanes used for normal operations. Piper issued Service Bulletin (SB) No. 886, dated June 8, 1988, addressing the spar damage that can occur from different types of operational usage and providing applicable inspection thresholds, intervals, and procedures for detecting damage. This SB should serve to alert owners and operators of PA-28 series or PA-32 series airplanes used in severe operational environments to inspect the wing spar/fuselage attachments. In addition to this SB, information will be provided in the appropriate maintenance manuals to fully ensure that pilots and mechanics are aware of the effect severe operational usage has on the structural durability of an airplane, and the need for repetitive inspections of the wing spar attachment area for cracks. The SB also specified an initial inspection threshold of 30,600 hours TIS for normal usage airplanes which was also based on the above mentioned study. Since the high time airplane in the fleet has only accumulated approximately 19,000 hours TIS, and furthermore, only a relatively few airplanes have accumulated more than 10,000 hours TIS, no action is deemed necessary at this time. The FAA will continue to monitor the service history of these high time airplanes and as the 30,600 hour TIS threshold is approached, appropriate regulatory action may be considered. Consequently, as a result of the approximately 560 wing spar inspections, the fatigue study, and the SB, the FAA proposes to rescind AD 87-08-08.

Interested persons have been afforded an opportunity to comment on the proposal. Forty-seven commentors responded. Forty-five of the commentors provided responses to the proposals that were similar in nature. First and foremost, these forty-five commentors supported rescinding the AD. Nearly half of the commentors stated there was a lack of justification for an AD.

The possible adverse effect on wing attachment structure caused by wing removal and reinstallation was mentioned by several commentors. Several of these commentors cited airplanes with wing cracks which were the result of use in severe operational environments. Other commentors pointed out the lack of any real safety benefits arising from the AD. The commentors citing a lack of justification for the AD were doing so on the basis of the many inspections performed on airplanes around the world without detecting cracks, except for those two airplanes in Alaska that were operated in a severe environment. Since there is such a large fleet of airplanes and the approximate 560 inspections represent a substantial sample, this does provide a sound basis for this assumption. Furthermore, the extensive fracture mechanics and fatigue analysis programs submitted to the FAA by Piper concerning airplanes with less than 30,000 hours, provide additional evidence that airplanes used for normal flight should not be affected. Wing removal and reinstallation was a concern from the time the original AD was considered. The fatigue life of a joint is highly dependent on the quality of the hole. Removal and replacement

of tight-fitting bolts can create stress risers which result in earlier than usual fatigue failures.

The risk of damage during this operation can be higher than the risk of failure on airplanes operated in a more benign environment. As some of the commentors mentioned, the cracks that have been documented have occurred only on airplanes that fall in the categories of abused airplanes or those used in a severe operating environment. Examination of the airplane log books of the airplanes that were operated in Alaska makes it quite evident that the airplanes were subjected to severe use.

The examinations of the right inboard section of spar from one of those airplanes by an independent laboratory reveal that at some point it was subjected to abnormally high loads. The same laboratory examined the cracked spar of the pipeline patrol airplane that crashed and observed that the problem resulted from an unusual use of the airplane. The commentors who cited a lack of safety benefits indicated that there is no structural problem based on the inspections and accordingly, no substantiated safety benefit commensurate with the cost. For the general flying public who do not use their airplanes in any of the risk categories, the wing spar inspections are supporting evidence. In fact, the FAA mandated inspection program did not find cracks other than in the Alaskan airplanes and the fatigue analysis/fracture mechanics program reports corroborate the commentors' opinions. However, for those airplanes that are abused or operated in a severe environment, there are safety benefits since the inspection of airplanes in accordance with Piper SB No. 886 could detect a crack that may represent a potential for a catastrophic failure. The FAA position is to rescind the AD and encourage voluntary compliance with the SB.

There were eighteen comments regarding cost. They were outright statements that the cost of this inspection is extremely high or the safety benefits were not commensurate with the cost of the inspection. The FAA agrees.

A commentor responded that Piper Aircraft Corporation issued FAA-approved SB No. 886, dated June 8, 1988, which provides for an inspection program for the wing spars in PA-28 and PA-32 series airplanes. The commentor stated that only those airplanes subjected to "severe" operational conditions, those damaged from exposure to "extreme" usage, or those for which the operational histories are "unknown" are candidates for wing spar inspections at a relatively low number of hours TIS. The commentor is concerned that none of the inspections established in SB No. 886 are required inspections. The commentor further states that the operating histories of many of the older airplanes may be difficult if not impossible to accurately establish, and the owners of these airplanes may tend to ignore the provisions of SB No. 886. As a consequence, the commentor believes that unless the provisions of SB No. 886 are made mandatory by airworthiness directive, the probability of further wing spar failures may be significant among the approximately 38,500 PA-28 and PA-32 airplanes that are affected. Therefore, the commentor believes that the AD should be amended to mandate the inspection provisions of Piper SB No. 886.

However, the FAA has no evidence to indicate that the vast majority of airplanes are utilized in abnormal operating environments. The FAA believes

that the owners/operators of airplanes used for this type of flying are concerned enough about flying safety to comply with the SB if their airplane is subjected to one of the categories of usage specified. As the commentor pointed out, it is difficult, if not impossible, to accurately establish the operating histories of the older airplanes. If the FAA mandated SB No. 886 with an AD, it would be impossible for the FAA to establish conclusively which airplanes must comply with the SB. Therefore, from an enforcement standpoint, the FAA would find it difficult, if not impossible, to require compliance with the AD because positive proof of the airplane usage would be lacking.

Consequently, the FAA position remains to rescind the AD and encourage voluntary compliance with the SB.

Another commentor who did not concur with rescinding the AD addressed the operating environment of the airplanes in Alaska with known wing spar cracks. The commentor suggested that the spar cracks resulted from a loading environment which produced high-cycle fatigue failures rather than severe usage resulting in structural static overloads. The commentor made reference to the spar crack examination that showed approximately 20,000 relatively uniform striations as strong evidence of high-cycle fatigue. He expressed a concern that cracks are small and hard to detect and although the basic steps of dye penetrant testing are known to most aviation technicians, the individual techniques can cause significant variations in the results. The commentor further denied claims of overgross and rough field operations and also denied that the airplanes were highly modified. Even so, he did mention that the Alaskan airplanes did endure a lot of use and varying degrees of main gear damage. He alleged that turbulence in Alaska is generally not as significant as that found during summer afternoons and in mountainous areas of the lower 48 States. He requested that a caution note should be added to the AD requiring particular attention to the front spar attach point bushing, as it is very small and easily lost when reinstalling the wings, and cannot reliably be determined to be in place once the wing is installed. Also, the commentor indicated that the AD should show the location and orientation of the tapered skins underneath the spar cap where the main spar is bolted into the fuselage. He also indicated that an experienced shop can remove PA-28/32 wings for inspection easily and quickly with little chance of damage to the airplane. Furthermore, he stated that the inspection and reinspection intervals should be established after new studies are made by an independent source. He recommended that "Classes of Service" published in the Piper SB should be discarded and that the AD should be reissued.

The commentor's position of excluding overload and severe use in favor of high cycle fatigue does not adequately substantiate that the Alaskan airplanes only engaged in normal usage. Piper and FAA engineers went to Alaska to observe the cracks in wing spars of the Alaskan airplanes. Those airplanes revealed landing gear modifications per STC SA281AL. The nose and main tires on the airplanes were 6-ply rating Goodyear 8.00-6 and 8.50-6, respectively. The tires were inflated to 35 psi and the struts inflated to expose an additional 2 inches of strut. Also, a Cleveland 199-62 wheel and brake conversion kit was used.

Investigation revealed the STC was for nose gear only and the main gear modification was apparently approved by FAA Form 337 (field approved). The airplane log book entries showed several significant structural replacements/repairs. There were numerous entries in both airplane logbooks of landing gear scissors being replaced. Physical observations of the two airplanes revealed other apparent replacement/repairs and other damage. It was determined that the airplanes were occasionally used to haul 1/2 ton caribou and snowmobiles, as well as operate from tundra, ice, and gravel bottoms.

Also, gussets were added to the engine mount gear attach area due to mount failures induced by nose gear loads. An analysis by an independent laboratory of the accident PA-28-181 airplane concluded that the problem results from unusual use of the airplane. This included observation of striation spacing which suggests high stress (low cycle) fatigue. It is apparent that cracks will not initiate unless fretting occurs. The area was inspected using a stereomicroscope and a scanning electron microscope. During the fracture surface examination, striation spacing counts were performed. Results of this analysis indicated the load cycles applied (which were sufficient to cause crack propagation) from the time the crack began to propagate from a depth of 0.030 inches until it failed would be approximately 15,000 to 20,000 cycles. This is a low number of cycles and from a knowledge of fatigue, it is apparent that high stresses (high loads) would be required to cause crack propagation to critical crack. This appears to relate to the abnormal loads incurred in pipeline patrol airplanes.

In regard to methods of inspections several alternatives were investigated. Piper contracted with a consulting firm who specializes in non-destructive test methods. They evaluated eddy current (hole and surface probes), ultrasonic, radiographic (x-ray), visual (magnified), and dye penetrant or fluorescent NDI methods. Their conclusions are as follows:

Eddy Current - Ultrasonic - Radiographic

- No evidence of adequate reliability.
- Would require technical specialists.
- Limited access in the field to equipment.
- Known damage must be found to establish a model.
- If in doubt, remove wing.

Visual with Magnification - Dye Penetrant Verification

- Highly reliable.
- No extraordinary training or experience required.
- High confidence level of detection.

In his efforts to show that the Alaskan airplanes were utilized mostly in normal flight and not abused or highly modified, the commentor seemed to confirm just the opposite. He mentioned, as previously noted, that the airplanes did suffer a lot of use and sustained various degrees of main gear damage. The FAA regards the commentor's statements, that turbulence is generally not as significant as that found during summer afternoons and in mountainous areas of the lower 48 states, as unverified. He did not offer any substantiating data to support his allegations.

His comment regarding the ease with which an experienced shop can remove PA-28/32 wings for inspection easily and quickly with little chance of damage to the airplane, is not supported by others. In response to an earlier comment it was noted that removal and replacement of tight fitting bolts can create stress risers which result in premature fatigue failures. His comments pertinent to a caution note that should be added to the AD regarding the front attach bushing and tapered shims underneath the spar caps, articulate a problem that has previously been discussed with Piper. Piper has prepared a change to the maintenance manual that reflects the correct procedure to follow with this installation. The commentor requested that the "classes of service" published in the Piper SB should be discarded and the AD reissued after studies by an independent source. The FAA has determined that additional studies would serve no useful purpose. The fracture surfaces were previously examined by an independent lab. Also, Piper contracted with Lockheed-Georgia Company to conduct the fracture mechanics evaluation which was used to establish the inspection and reinspection intervals incorporated into the SB. The FAA position, which is based upon the data collected from the inspections, the independent laboratory analysis of the fracture surface, the fracture mechanics/fatigue analysis submitted by Piper and observations of the Alaskan airplanes, is to rescind the AD and to encourage voluntary compliance with the SB. Therefore, the proposal is not being changed in light of this comment.

Accordingly, the proposal is adopted without change.

There are approximately 38,500 airplanes affected by this action. Since Revision 2 to the AD suspended the effective date of the AD, the cost of this Recission is estimated to be negligible to the private sector.

The regulations adopted 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 final rule does not have sufficient federalism implications to warrant the preparation of a Federalism Assessment.

Therefore, I certify that this action (1) is not a "major rule" under Executive Order 12291; (2) is not a "significant rule" under DOT Regulatory Policies and Procedures (44 FR 11034; February 26, 1979); 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.

A copy of the final evaluation prepared for this action is contained in the regulatory docket. A copy of it may be obtained by contacting the Rules Docket at the location provided under the caption "ADDRESSES".

List of Subjects in 14 CFR 39
Air transportation, Aircraft, Aviation safety, Safety

ADOPTION OF THE AMENDMENT

Accordingly, pursuant to the authority delegated to me by the Administrator, the Federal Aviation Administration amends Section 39.13 of Part 39 of the FAR as follows:

1. The authority citation for Part 39 continues to read as follows:
Authority: 49 U.S.C 1354(a), 1421 and 1423; 49 U.S.C. 106(g) (Revised, Pub. L. 97-449, January 12, 1983); and 14 CFR 11.89.

2. By rescinding AD 87-08-08, Amendment 39-5615; AD 87-08-08R1, Amendment 39-5669; and AD 87-08-08R2, Amendment 39-5731.



U.S. Department
of Transportation
**Federal Aviation
Administration**

AIRWORTHINESS DIRECTIVE REVISION

AVIATION STANDARDS NATIONAL FIELD OFFICE
P.O. BOX 26460
OKLAHOMA CITY, OKLAHOMA 73125

The following Airworthiness Directive issued by the Federal Aviation Administration in accordance with the provisions of Federal Aviation Regulations, Part 39, applies to an aircraft model of which our records indicate you may be the registered owner. Airworthiness Directives affect aviation safety. They are regulations which require immediate attention. You are cautioned that no person may operate an aircraft to which an Airworthiness Directive applies, except in accordance with the requirements of the Airworthiness Directive (FAR 39.3).

87-08-08 R3 PIPER: Amendment 39-5615, amended by Amendments 39-5669 and 39-5731, is rescinded by Amendment 39-6195.

Applicability: Certain PA-28 and PA-32 series airplanes.

Airworthiness Directive 87-08-08, as amended, is hereby rescinded.

Airworthiness Directive 87-08-08 (Amendment 39-5615) became effective on May 5, 1987; AD 87-08-08 R1 (Amendment 39-5669) became effective on August 12, 1987; and AD 87-08-08 R2 (Amendment 39-5731) became effective on September 18, 1987.

This amendment (39-6195, AD 87-08-08 R3) becomes effective on May 22, 1989.

FOR FURTHER INFORMATION CONTACT:

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