U.S. Department of Transportation
Federal Aviation Administration

Policy Statement

Subject: Post-Maintenance Checks and Tests

Date: 02/16/16

Policy No: PS-ANM-25-18

Initiated By: ANM-112

Summary

The purpose of this policy statement is to describe a process that applicants for design approval may use to identify appropriate checks and tests that could prevent a transport category airplane from being returned to service in an unsafe condition. These checks and tests are intended to detect and correct errors and other issues that could be introduced during maintenance, including preventive, out-of-sequence, or segmented maintenance; rebuilding; or alteration activities. This policy specifies that applicants should use system safety assessment (SSA) data developed to show compliance with Title 14, Code of Federal Regulations (14 CFR) part 25 system certification rules to help determine where appropriate checks and tests are needed. This policy provides criteria for determining when these checks and tests are appropriate (i.e., failure to perform them could result in hazard categories of hazardous or catastrophic as defined in Advisory Circular (AC) 25.1309-1A).

This policy provides a means of complying with §§ 25.1529 and 25.1729 and appendix H to part 25. This policy neither directs nor alters FAA Flight Standards Service procedures or practices for certification or surveillance of operators and maintenance providers. The intent of this policy is to provide guidance to applicants for design approval only, for certification of transport airplane products.

Definition of Key Terms

Post-maintenance checks or tests: Generic terms for checks or tests that are conducted following completion of tasks performed by maintenance personnel and organizations, including preventive maintenance, out-of-sequence maintenance, and segmented maintenance; rebuilding; or alteration activities. The purpose of these checks and tests is to detect errors and issues introduced during maintenance that could adversely affect safety. A test typically requires the use of an instrument to determine quantitative information relative to system or airplane functionality and performance. Tests could require airplane power, activation of systems, and input(s) to flight or cabin crew interfaces. A check is similar to a test; however, a check requires only qualitative information. For example—

- A check to ensure proper functionality might only require verifying that the control surface moves in the correct direction, or a low pressure hydraulic light illuminates.

- A test to ensure proper functionality of a control system may require measuring the actual displacement of a control surface, or taking the actual pressure measurement of a hydraulic system.

In the text below, the terms "must," "should," and "recommend" have a specific meaning explained in Appendix 1 to this policy.

Current Regulatory and Advisory Material

The regulations applicable to establishing the instructions for continued airworthiness (ICA), including selecting the appropriate post-maintenance checks and tests, are §§ 25.1529 and 25.1729 and appendix H to part 25. These rules define the basis for requiring an applicant seeking design approval to provide appropriate maintenance procedures in the ICA. The Aircraft Certification Service, with support from the Aircraft Evaluation Group, is responsible for ensuring that applicants for design approval comply with these regulations.

Section 25.1529 states: "The applicant must prepare Instructions for Continued Airworthiness in accordance with appendix H to this part that are acceptable to the Administrator. The instructions may be incomplete at type certification if a program exists to ensure their completion prior to delivery of the first airplane or issuance of a standard certificate of airworthiness, whichever occurs later."

Section 25.1729 states: "The applicant must prepare Instructions for Continued Airworthiness applicable to EWIS [electrical wiring interconnection system] in accordance with appendix H sections H25.4 and H25.5 to this part that are approved by the FAA."

ICA documentation gives instructions and requirements for the maintenance, preventive maintenance, rebuilding, and alteration essential to the continued airworthiness of an aircraft, engine, or propeller. Section H25.3(b)(1) of appendix H requires that "the applicant must include an inspection program that includes the frequency and extent of the inspections necessary to provide for the continued airworthiness of the airplane." This policy statement is based on the FAA's conclusion that post-maintenance checks and tests are "inspections necessary to provide for the continued airworthiness of the airplane."

In addition, section H25.3(b)(4) of appendix H requires that maintenance instructions include: "Other general procedural instructions including procedures for system testing during ground running, symmetry checks, weighing and determining the center of gravity, lifting and shoring, and storage limitations." The post-maintenance functional checks and tests discussed in this policy are consistent with the system testing required by section H25.3(b)(4). Additionally, the FAA released Order 8110.54A, *Instructions for Continued Airworthiness Responsibilities, Requirements, and Contents,* dated October 23, 2010, that includes instructions to include appropriate checks and tests after maintenance.

Relevant Past Practice

The FAA and industry have used AC 25-19A, *Certification Maintenance Requirements*, dated October 3, 2011; and AC 121-22C, *Maintenance Review Boards, Maintenance Type Boards, OEM/TCH Recommended Maintenance Procedures*, dated August 27, 2012, which also refers to the *ATA MSG-3, Operator/Manufacturer Scheduled Maintenance Development* processes to identify mandatory and recommended maintenance tasks for transport category airplanes. The FAA has had no explicit guidance on the selection of post-maintenance checks and tests intended to prevent potential hazards resulting from maintenance activity.

Selecting checks and tests and including them in the ICA is not a new practice. Most airplane maintenance manuals have test and adjustment sections containing these procedures. However, not all applicants follow an adequate process for selecting post maintenance tests and checks. For example, as part of their internal processes, some follow guidelines from *i*Spec 2200, *Information Standards for Aviation Maintenance*, published by Airlines for America (A4A) (formerly the Air Transport Association of America). These guidelines state that the adjustment/test portion of the maintenance documentation shall contain all procedures and parameters to evaluate the operational efficiency and integrity of a system, subsystem, unit, component, or interrelationship of parts that perform a functional operation.[1] These procedures should be followed after a task is performed. However, *i*Spec 2200 does not provide direction on how to select the checks and tests.

The intent of this policy is to emphasize that appropriate post-maintenance checks and tests are part of the necessary instructions that applicants for a type certificate, amended type certificate, or supplemental type certificate should provide to comply with §§ 25.1529 and 25.1729 and appendix H to part 25. The FAA reviewed several cases of unsafe conditions that occurred because maintenance crews executed the intended tasks incorrectly and did not perform adequate checks and tests to identify the errors and issues. Based on this review, we concluded that, to meet the intent of these part 25 regulations, applicants should identify necessary checks and tests and include them in the ICA. The applicant should select post-maintenance checks and tests using a process that considers the safety impact of maintenance (including potential errors) based on data in SSA or other equivalent analyses.

Maintenance tasks may also affect adjacent systems not being serviced. One example is maintenance personnel disconnecting adjacent wire harnesses to gain access to the system needing service. Another example, which has been a contributing factor in several accidents, is airplane washing that affected air data systems. Therefore, applicants may also need to specify checks or tests, or both, for various tasks to ensure that safe operations of adjacent systems are not adversely affected.

[1] See Section 1.7, Adjustment/Test, of Chapter 3.3.1, Aircraft Maintenance Manual (AMM) of *i*Spec 2200.

Background

There have been several cases of unsafe conditions occurring because of maintenance issues. Some of these could have been detected by appropriate post-maintenance checks and tests. For example, the Air Midwest Flight 5481 accident on January 8, 2003, is one. The National Transportation Safety Board (NTSB) determined that the probable cause of that accident was the airplane's loss of pitch control during takeoff. The loss of pitch control resulted from multiple causes, including incorrect rigging of the elevator control system, as well as loading to a center of gravity outside of the approved envelope.

As part of its investigation, the NTSB identified maintenance errors that might have been detected and corrected if steps were not skipped and more detailed checks and tests had been in place. These errors and issues included:

- While adjusting the cable tension, the maintenance crew inserted a rig pin incorrectly. As a result, the airplane's elevator control system was incorrectly rigged. This was the only task performed that night. The misrigging restricted the airplane's elevator nose down travel.

- After adjusting the cable tension the maintenance crew did not do all post-maintenance functional tests for the rigging task. They stated they did not believe it was necessary to complete all of the tests after only retensioning cables.

If the ICA had specified all appropriate checks and tests necessary after adjusting cable tension or provided instructions for a complete functional test, this event may have been avoided.

Another example is an in-service incident on April 6, 2004, where the flightcrew reported inadvertent gust lock lever movement during cruise flight. They also reported that the gust lock lever could not be returned to its forward unlock position, and that its position limited throttle movement. It was later determined that the event was caused due to gust lock solenoid misalignment and inadvertent lock lever movement during flight. The corrective action was to revise the current solenoid adjustment airplane maintenance manual task to include a check after the solenoid adjustment, ensuring that the gust lock lever cannot be moved from the unlocked position during flight. If the ICA task had included this check, this incident may have been prevented.

NTSB Safety Recommendation A-04-007 states that the FAA should:

> "Require manufacturers of aircraft operated under 14 Code of Federal Regulations Part 121 to identify appropriate procedures for a complete functional check of each critical flight system; determine which maintenance procedures should be followed by such functional checks; and modify their existing maintenance manuals, if necessary, so that they contain procedures at the end of maintenance for a complete functional check of each critical flight system."

In its response to the NTSB, the FAA agreed with the intent of A-04-007. However, the FAA also determined that complete system functional tests are not necessary after every maintenance

task or subtask. The FAA concluded that specific checks and tests are only necessary when the failure to perform those tasks correctly can have a detrimental effect on safety.

This policy provides guidance on developing processes for selecting post-maintenance checks and tests. It does not give applicants specific processes or identify specific systems. It does not describe specific post-maintenance checks and tests. It does provide high-level safety criteria that should be included in the processes that applicants develop. By following their processes established under this policy, applicants will address maintenance errors and issues that can impact safety, and thus ensure compliance with §§ 25.1529 and 25.1729 and appendix H to part 25.

Several applicants currently have processes to select post-maintenance checks and tests that they include in their ICA. However, this is not an industry-wide practice. Further, some applicants do not use SSAs or other equivalent methods for selecting post-maintenance checks and tests, and existing checks and tests may not adequately address all the safety issues that can result from a maintenance error.

While the Flight Standards Service conducts certification and surveillance of aircraft maintenance and operational functions, the Aircraft Certification Service addresses maintenance functions as part of maintaining type design and ensuring the intent of associated certification requirements is met. Aircraft Certification Service personnel evaluate airplane and system safety analyses and the safety impact of failures during the certification process. It is important for applicants to analyze the impact of part, component, assembly, and system failures after maintenance, during the design and certification process.

Policy

This policy statement provides guidance for developing a process to establish post-maintenance checks and tests, as applicable, and for incorporation of these checks and tests in the ICA.

1 **Process Development.**

As part of complying with §§ 25.1529 and 25.1729 and appendix H to part 25, for each system, each applicant should develop a process, which uses SSA methods and data, to identify appropriate post-maintenance functional checks and tests that verify the system performs its intended function correctly after maintenance (including preventive, out-of-sequence maintenance, and segmented maintenance; rebuilding; or alteration activities). Examples of such maintenance include rigging of flight controls, or removal and replacement of system components, etc. Each applicant should use this process and include the identified post-maintenance checks and/or tests in the ICA. The post-maintenance test/check should—

1.1 Ensure that the maintenance task would not inadvertently result in an unsafe operating condition.

1.2 Ensure that adjacent systems are not inadvertently affected.

2 **Best Practice.**

The process should include the following steps:

2.1 For each maintenance task, the applicant reviews SSA data to determine catastrophic or hazardous functional failures and to determine if the components being maintained can contribute to one or more of these hazardous or catastrophic functional failures according to the definitions given in AC 25.1309-1A or latest revision. This step should also address any adjacent systems that might be disturbed while completing the task.

Examples.

2.1.1 **Issue 1.**

- Task: Gust lock adjustment.
- SSA states loss of pitch control leading to an unsafe flight path is catastrophic.
- Malfunctioning gust lock can lead to or contribute to loss of pitch control leading to unsafe flight path.

2.1.2 **Issue 2.**

- Task: Gust lock adjustment - Adjacent system: potential effect on pitch autopilot servo.
- SSA indicates that temporary loss of pitch control due to autopilot malfunction leading to deviation in flight path is hazardous.

2.2 For each issue identified in step 2.1, select the appropriate post-maintenance functional checks and tests to verify that the systems (including adjacent systems) will operate safely after maintenance.

2.3 Include any post-maintenance checks and tests, identified in step 2.2, in the ICA by either—

2.3.1 Providing a list of appropriate post-maintenance checks and tests after each isolated task, or

2.3.2 Incorporating an instruction to accomplish all post-maintenance checks and tests for that particular system and adjacent systems impacted by the maintenance.

3 **Process Submission.**

During airplane certification, each applicant should submit to the applicable aircraft certification office (ACO), or other appropriate delegated oversight office, the process used to identify appropriate post-maintenance checks and tests in showing compliance with §§ 25.1529 and 25.1729 and appendix H. Each applicant should obtain concurrence of the proposed process from that ACO or office.

Effect of Policy

The general policy stated in this document does not constitute a new regulation. Agency employees and their designees and delegations must not depart from this policy statement without appropriate justification and concurrence from the FAA management that issued this policy statement. The authority to deviate from this policy statement is delegated to the Transport Standards Staff Manager.

Implementation

This policy statement discusses compliance methods that should be applied to type certificate, amended type certificate, supplemental type certificate, and amended supplemental type certification programs. The compliance methods apply to those programs with an application date that is on or after the effective date of the final policy. If the date of application precedes the effective date of the final policy, the applicant may choose to either follow the previously acceptable methods of compliance or follow the guidance contained in this policy statement.

Conclusion

The FAA has concluded that it is necessary to provide guidance on procedures for identifying post-maintenance checks and/or tests for 14 CFR part 25 certificated airplanes. This policy statement provides new guidance on the recommended steps to establish a process for identifying post-maintenance checks and/or tests and ensuring that they could be incorporated into the operator's maintenance program. If other data were to be presented that demonstrated otherwise, the FAA might reconsider the intent and content of this policy.

Michael Kaszycki
Acting Manager, Transport Airplane Directorate
Aircraft Certification Service

Terms

Table A-1 defines the use of key terms in this policy statement. The table describes the intended functional impact.

Table A-1. Definition of Key Terms

	Regulatory Requirements	Acceptable Methods of Compliance (MOC)	Recommendations
Language	Must	Should	Recommend
Meaning	Refers to a regulatory requirement that is mandatory for design approval	Refers to instructions for a particular MOC	Refers to a recommended practice that is optional
Functional Impact	No Design Approval if not met	Alternative MOC has to be approved by issue paper	None because it is optional