



U.S. Department
of Transportation
Federal Aviation
Administration

Advisory Circular

Subject: Operational Use of Radio Frequency Identification Systems Onboard Aircraft **Date:** 10/17/17 **AC No:** 119-2
Initiated by: AFS-300 **Change:**

- 1 PURPOSE OF THIS ADVISORY CIRCULAR (AC).** This AC provides aircraft operator guidance on the use of radio frequency identification (RFID) devices and systems in operational and maintenance environments as an alternative means of performing specific maintenance and inspection tasks in accordance with Title 14 of the Code of Federal Regulations (14 CFR) parts [43](#), [91](#), [121](#), [125](#), [129](#), and [135](#). This AC limits its scope to aircraft RFID applications, where RFID tags are installed directly on aircraft, parts, and components to verify identification, serviceability status, or presence. This AC is not mandatory and does not constitute a regulation. It describes an acceptable means, but not the only means, to show compliance with installation and operational requirements. However, if operators use the means described in this AC, operators must follow it in all important respects.
 - 2 AUDIENCE.** This AC applies to:
 1. Operating certificate holders under parts 91, 121, 125, 129, and 135.
 2. Persons or entities holding certificates under 14 CFR parts [65](#), [145](#), and [147](#).
 3. Persons performing maintenance or preventive maintenance under part 43.
 4. Operators using RFID technology to perform or report completion or accomplishment of inspections to confirm:
 - a. Proper configuration of parts and components, such as life preservers or repairable components;
 - b. Serviceability of components, such as life preservers, oxygen generators, and other life-limited miscellaneous emergency equipment and repairable components based on predetermined expiration dates, automated calculations of expirations that will occur between inspection intervals and near-expiration thresholds; and
 - c. The security or tampering of installation, such as life preserver container, access panels, and other equipment, requiring a security seal for restricted access in compliance with part 121, § [121.538](#) and part 135, § [135.125](#).
 - 3 WHERE YOU CAN FIND THIS AC.** You can find this AC on the Federal Aviation Administration's (FAA) website at http://www.faa.gov/regulations_policies/advisory_circulars.
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- 4 SCOPE.** This AC addresses Title 47 of the Code of Federal Regulations (47 CFR) part [15](#), § [15.245](#) compliant passive, battery-assisted passive, and active RFID devices and systems only installed within aircraft and on aircraft components. Airworthiness approval guidance and definitions of these RFID systems are in AC 20-162, Airworthiness Approval of Installed Radio Frequency Identification (RFID) Tags. For guidance on RFID systems installed on or in carry-on and checked baggage or cargo containers, refer to AC [91.21-1](#), Use of Portable Electronic Devices Aboard Aircraft. Other RFID system usage discussed in this AC include:
- 4.1** RFID devices and systems used in aircraft maintenance, including inspections for presence, serviceability, configuration control, or identity or quantity of components.
 - 4.2** RFID systems used to determine the as-flying configuration of a component for an aircraft or fleet of aircraft.
 - 4.3** The potential risk to aircraft safety if RFID systems are not designed to a minimum set of maintenance criteria, yet are installed to perform specific aircraft maintenance or inspection tasks. These tasks may include:
 - 4.3.1** Maintenance Instructions. Revision-controlled maintenance instructions parallel to or integrated with an operator's approved aircraft maintenance program containing RFID as an alternative means of component inspection and identification. Refer to part 91, § [91.405](#); §§ [121.139](#) and [121.369](#); part 125, § [125.249](#); and §§ [135.421](#), [135.425](#), and [135.427](#).
 - 4.3.2** Maintenance Records. RFID-enabled aircraft maintenance actions are recorded and filed as evidence of compliance with an operator's maintenance requirements. Refer to part 43, §§ [43.9](#), [43.11](#), and [43.12](#); and §§ [91.417](#), [121.709](#), [125.411](#), [135.63](#), [135.439](#), and [135.443](#).
 - 4.3.3** Reliability of Source Data. Subjective evidence showing the source of RFID data used to perform and record aircraft maintenance actions is equal to or greater than the reliability of visual or other manual means by which the same data is acquired for that same purpose. Refer to § 43.11.
 - 4.3.4** System Integrity. RFID devices and systems must demonstrate the same degree of life-cycle integrity to be as good as, or better than, non-RFID systems and methods.
 - 4.3.5** Aircraft Records and Digital Signatures. Recording aircraft maintenance action taken and personnel who took the action is required by §§ 43.9, 43.12, [121.363](#), [121.365](#), [121.371](#), [121.379](#), [125.245](#), [125.251](#), and [135.429](#). An RFID system performing any maintenance action must include recording who performed the action and the result. In other words, if an RFID system is employed for aircraft maintenance, it must produce a point of accountability and the appropriate records or reports to show compliance with aircraft maintenance instructions. Further guidance on digital signatures and electronic records is in AC [120-78](#), Electronic Signatures, Electronic Recordkeeping, and Electronic Manuals.

4.3.6 Limitation of Variability. A common approach to the design of the RFID system is expected, but designs may vary, and may vary between RFID system providers. Consistency and compliance with applicable industry standards and accepted standard best practices is one way to ensure that the RFID system meets minimum expectations of standardization and interoperability.

1. **Hardware Standard**. SAE Aerospace Standard (AS) [5678A](#), Passive RFID Tags Intended for Aircraft Use, and [AS6023](#), Active and Battery Assisted Passive Tags Intended for Aircraft Use, are the standards for RFID hardware survivability in various aircraft operational environments, including pressurized aircraft interiors and the variably harsh external aircraft areas. Testing criteria for SAE AS5678A or AS6023 certification is in RTCA [DO-160](#), Environmental Conditions and Test Procedures for Airborne Equipment. For RFID tag installations on aircraft parts, components, assemblies, or appliances, the RFID tags or devices must be certified in accordance with SAE AS5678A or AS6023 for its applicable operational conditions.
2. **The Data Content and Format Standard**. Airlines for America (A4A), formerly Air Transport Association of America (ATA), Spec [2000](#), E-Business Specification for Materials Management, defines the requirements for data standardization for all RFID tag configurations. Because RFID-tagged components may be exchanged between operators through inventory pools or original equipment manufacturer (OEM) overhaul processes, no proprietary or otherwise sensitive data should be written to an RFID tag with the exception of the birth record of the part or component that must conform to the original, as delivered, data contained in the original park marking. Otherwise, the operator has sole discretion to write any additional data or information, as desired, for its particular maintenance or inspection program.
3. **Airworthiness Approval of Installed RFID Tags on Aircraft**. For guidance on the airworthiness approval of installed RFID tags on aircraft, refer to AC 20-162.
4. **Digital Signatures and Records**. When RFID systems are an alternative means of compliance with aircraft maintenance instructions, an operator must verify when the task was accomplished and by whom, and the task's outcome. For digital signatures and electronic records management guidance, refer to AC 120-78.

4.3.7 General Standard Best Practices. Guidance for the inspection of emergency equipment is in AC [43.13-1](#), Acceptable Methods, Techniques, and Practices—Aircraft Inspection and Repair, Chapter 9, Section 3, Emergency Equipment.

4.3.8 Reducing Operational Risk. Using RFID-enabled systems and methods for aircraft maintenance will create large reductions in lead times to perform those maintenance tasks. The RFID system reliability is thus a critical aspect of preventing service disruptions. A dependency on RFID system availability is expected, but a failure resulting in a need to default to legacy methods of performing the same tasks is necessary

if the RFID system becomes unavailable. Therefore, it's a good idea to continuously maintain legacy methods as the default failover, and that, when possible, tasks using RFID be scheduled so there is enough recovery time if a system failure occurs.

4.4 The FAA intends to promote the safe use of RFID devices and systems in aircraft maintenance because it has proven achievements in improving efficiency and information reliability, a positive advantage to operators. This AC ensures that operators are aware of, and hold RFID suppliers accountable to, the degree of technical diligence required to produce reliable and auditable data for an effective RFID system.

5 APPLICATIONS. This AC includes several basic known aviation applications, including:

5.1 Life Preserver Inspections. Periodic inspection for crew, passenger, spare, infant, and demonstration of life preserver presence and serviceability.

5.2 Life Preserver Container. Verification that the life preserver container is secure and has no indication of tampering.

5.3 Oxygen Generators. Periodic inspection of presence and serviceability of oxygen passenger service units (PSU) and portable chemically-generated oxygen canisters.

5.4 Miscellaneous Cabin Safety Equipment. As required, based on the as-delivered configuration of the aircraft. Refer to §§ [121.605](#) and [121.803](#).

5.5 Aircraft Cabin Interiors and Furnishings. Periodic inspection of seat covers, appliances, monuments, and other articles of the aircraft cabin and flight deck interior.

5.6 Aircraft Cabin Security. Verification of non-tampering or unauthorized access to restricted access panels. Refer to §§ 121.538 and 135.125.

5.7 Repairable Exchange Components. Identification and verification of component serviceable status.

6 TECHNOLOGY SELECTION AND INSTALLATION.

6.1 RFID Tag Selection. Taking into account SAE AS5678A, AS6023, and RTCA DO-160, as amended, RFID tags are selected according to their function and their environment. This includes standard aircraft operating conditions such as thermal cycles, pressure cycles, chemical exposure, and flammability.

Note: These degrees of exposure do not take into consideration the component overhaul environments, which can be much more severe.

6.2 Tag Preservation. When selecting RFID tags, operators must consider the life cycle of the component on which the tags will be installed. If any condition, such as maintenance, overhaul, or repair of the part or component, would destroy, damage, or otherwise degrade the RFID tag or its adhesive substrate, operators should take appropriate

corrective action to preserve the tag's integrity. Actions may include a mechanical installation for tag removal or covering the tag with a protective material, as required.

7 AIRWORTHINESS CONSIDERATIONS. An RFID system design must account for the system's environment and conditions. FAA airworthiness approval guidance is in AC 20-162 for passive, battery-assisted passive, and active RFID systems.

Considerations for system design and installation include:

1. The RFID tag must include, in human readable characters, the identity of its associated aircraft part.
2. An aircraft part must be matched to its associated tag, without physically separating the part from the tag.
3. The RFID tag must not interfere with the operation of other adjacent systems or equipment.

7.1 Data Integrity, Emergency Equipment Configuration, and Safety of Flight. RFID data used for this purpose must be highly reliable and always current to the as-flying configuration. When these inspections are performed at aircraft maintenance stations, RFID systems must always be wirelessly connected or hard-wired to an operating system server.

7.2 RFID-Enabled Aircraft Parts. A part number "roll" or change is not required on parts, components, or appliances for RFID tag or sensor installation. Operators should consider developing a procedure to track RFID marked parts or components. Operators should have knowledge of which aircraft parts or components are RFID enabled in the event an RFID tag becomes lost, misplaced, or damaged. See paragraph [8.7](#) for additional guidance.

7.3 Changing Birth Record Data. Once installed, operators should not be able to change birth record data on the RFID tag. However, an operator may need to write additional part or component birth record data to the RFID tag in the event of a required maintenance activity that changes the part number. Refer to ATA Spec 2000, chapter 9, section 9-5.

7.4 Cabin Security. RFID tags used for prevention and detection of unauthorized access are referred to as "tamper evident." These tags must be designed to detect a tamper event as a result of an attempt to gain access to the compartment that is being secured. Regardless of the means to detect tampering, the design objective must provide maintenance personnel a clear and unambiguous indication when the RFID tag is scanned. When considered as a whole, the RFID system design must prevent false indications of presence and security of the component being inspected.

7.5 RFID Tag Life Cycle vs. Component Life Cycle. RFID tags used for the purposes described within this AC shall be designed such that they either exceed the life of the part on which they are attached or exceed the intervals between component overhaul. RFID tags degrade both physically and functionally over a period of time. The tag manufacturers information regarding accelerated life-cycle testing and limitations of

serviceability should be considered when selecting the appropriate tag for each application. This is especially important when considering dual-record or multi-record tags for recording multiple overhaul intervals. An RFID tag designed for a benign pressurized environment may have a useful life cycle of 10 years. When used in a dual or multi-record application, the tag could expire or otherwise degrade to an unreliable state and require replacement before the second overhaul, such as for life preservers, if for instance the overhaul occurs every 5 or more years.

- 7.6 Toxic Fumes or Smoke.** RFID tags installed on aircraft parts must not emit toxic fumes or smoke at the highest operating temperature of that part. RFID tags must be SAE AS5678A or AS6023 qualified for its operating environment.

8 OPERATIONAL CONSIDERATIONS.

- 8.1 Human Factors.** Operators should consider human factors in the design of an RFID system to ensure effective and optimum performance.
- 8.2 Training.** Operators should provide training to intended users on RFID system proficiency and competency. Refer to §§ [43.3](#), 121.365, 121.371, [121.375](#), 125.245, 125.251, 135.429, and [135.433](#).
- 8.3 Retrofit Program.** Operators should develop a master phasing schedule to track RFID system installation and deployment.
- 8.4 Maintenance Program Integration.** Operators should update maintenance procedures affected by adoption of RFID systems. Procedures can include task cards, instructions for continued airworthiness (ICA), and frequency of task completion. Refer to §§ [43.5](#), 91.405, [91.409](#), [91.415](#), [91.1109](#), 121.363, [121.367](#), [121.368](#), [121.1109](#), [125.247](#), [135.73](#), [135.419](#), and [135.423](#).
- 8.5 System Failure Procedure.** Operators must default to manual procedures if an RFID system fails. Refer to §§ 43.5 and 121.379.
- 8.6 System Shutdown Procedure.** Operators should develop a rapid RFID system-wide shutdown procedure if a safety-of-flight issue arises.
- 8.7 Maintaining System Hardware.** Operators should consider developing procedures for:
- 8.7.1 RFID Tag Expiration and Replacement.** RFID tags have serviceability limitations and an operator should consider a method for tracking the eventual replacement of every RFID tag when used for the purposes described within this AC. For RFID tag replacement, the aircraft operator should develop RFID tag installation instructions using acceptable materials, surface finishes, and surface shapes for the parts and equipment that host the RFID tag.
- 8.7.2 Replacing Components with RFID Tags with Components Without Tags.** A component's serviceability status is not dictated by the serviceability or presence of an RFID tag. A non-RFID-tagged component may be exchanged for a component that has an RFID tag

with no impact to operational continuity or configuration control. When an RFID-tagged component, such as life preservers, is replaced with a non-RFID-tagged component, the RFID-based inspection procedure remains in place and the non-RFID-tagged component must be inspected visually and reported manually.

8.7.3 Deferral of Tag Installation. When considering the continuity of the RFID system network, the operator is advised to have procedures in place to replace the RFID tag consistent with other related deferral or action-to-take procedures when an RFID-tagged component has been replaced with a non-RFID-tagged component.

8.8 **Data Sensitivity and Retention**. Operators should limit sensitive data written to RFID systems, including component identity, status, actions taken, and conditions noted. Note the following points of discussion:

8.8.1 Revision-Controlled Data. Operators should not write data, which may require revision management, to an RFID tag. This data might include aircraft maintenance manuals, structural repair manuals, illustrated parts catalogs, component maintenance manuals or ICA-specific maintenance instructions needing recurring updates.

8.8.2 Proprietary Data. Operators should not write proprietary data to an RFID tag. This is especially applicable to components exchanged for new or overhauled OEM rotatable components.

8.8.3 Personally Identifiable Information (PII). Operators should not write PII such as technician names, employee numbers, or work locations to RFID tags. This is especially applicable to components which may be exchanged for new or overhauled OEM rotatable components.

8.8.4 Retention. Operators should note that data written to an RFID tag may stay with that tag for a part's life cycle, which may exceed 30 years. Data written to an RFID tag should be consistent with the format of, and limited in content to, ATA Spec 2000, chapter 9.

8.9 **Notification of Change to Maintenance Personnel and Crew**. Once an aircraft has an RFID system, it is important to advise stakeholders of the new system, and what it will be used for, to reduce the possibility of misunderstandings.

8.10 **RFID Tag Installation Location**. Operators must consider the implications of the location, position, and method of RFID tag installation. The RFID tag must be installed in such a manner that it does not interfere with the fit, form, or function of the aircraft component or its assembly. For example, when installing RFID tags on chemically-generated oxygen canisters located within the PSUs, the tag must be installed in such a manner as to not prevent the deployment of the oxygen masks.

9 HOW TO OBTAIN REFERENCED DOCUMENTS.

- 9.1 SAE Documents.** Order SAE documents from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001. Telephone (724) 776-4970, fax (724) 776-0790, or at www.sae.org.
- 9.2 Title 14 CFR Documents.** You can find the current regulations at <http://www.ecfr.gov>.
- 9.3 ACs.** You can find a current list of ACs at http://www.faa.gov/regulations_policies/advisory_circulars.
- 10 AC FEEDBACK FORM.** For your convenience, the AC Feedback Form is the last page of this AC. Note any deficiencies found, clarifications needed, or suggested improvements regarding the contents of this AC on the Feedback Form.



John Barbagallo
Deputy Executive Director, Flight Standards Service

Advisory Circular Feedback Form

If you find an error in this AC, have recommendations for improving it, or have suggestions for new items/subjects to be added, you may let us know by contacting the Flight Standards Directives Management Officer at 9-AWA-AFS-140-Directives@faa.gov.

Subject: AC 119-2, Operational Use of Radio Frequency Identification Systems Onboard Aircraft

Date: _____

Please check all appropriate line items:

An error (procedural or typographical) has been noted in paragraph _____ on page _____.

Recommend paragraph _____ on page _____ be changed as follows:

In a future change to this AC, please cover the following subject:
(Briefly describe what you want added.)

Other comments:

I would like to discuss the above. Please contact me.

Submitted by: _____

Date: _____