U.S. Department of Transportation
Federal Aviation Administration

Advisory Circular

Subject: Operational Use of Radio Frequency Identification Systems Onboard Aircraft

Date: 8/23/21 **AC No:** 119-2A
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 a means of identifying or scheduling 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 provides information that will assist with compliance with recordkeeping, maintenance, and other requirements that would apply when an operator elects to use RFID devices and systems.

1.1 **Effects of Guidance.** This guidance is not legally binding in its own right and will not be relied upon by the Federal Aviation Administration (FAA) as a separate basis for affirmative enforcement action or other administrative penalty. Conformity with this guidance document is voluntary only, and nonconformity will not affect rights and obligations under existing statutes and regulations.

1.2 **Regulatory Requirements.** Utilizing RFID technology in operational and maintenance environments is not required by regulation. When an operator chooses to use RFID technology, however, certain requirements apply. This document provides guidance to assist operators in accomplishing recordkeeping and other tasks associated with regulatory requirements. For more information regarding RFID certification and the associated standards, refer to AC 20-162, Airworthiness Approval of Installed Radio Frequency Identification (RFID) Tags and Sensors.

2 **AUDIENCE.** This AC applies to:

1. Certificate holders conducting operations 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 preventative maintenance under part 43.
4. Operators, to include delegated entities, using RFID technology to report completion or accomplishment of inspections to confirm:
    a. Proper aircraft configuration, such as life preservers or repairable components;

b. Serviceability of components, such as life preservers, oxygen generators, other life-limited and time-controlled 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;

c. The security 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; and

d. The electronic capture of part information to populate removal and installation information in computerized maintenance systems in compliance with part 43 and in accordance with AC 120-78, Electronic Signatures, Electronic Recordkeeping, and Electronic Manuals.

3 WHERE YOU CAN FIND THIS AC. You can find this AC on the FAA website at https://www.faa.gov/regulations_policies/advisory_circulars.

4 WHAT THIS AC CANCELS. AC 119-2, Operational Use of Radio Frequency Identification Systems Onboard Aircraft, dated October 17, 2017, is canceled.

5 SCOPE. This AC addresses passive, battery-assisted passive, and active RFID devices and systems only if installed on aircraft and aircraft components that comply with Title 47 of the Code of Federal Regulations (47 CFR) part 15, § 15.245. Airworthiness approval guidance and definitions of these RFID systems are in AC 20-162. 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. This AC also addresses:

5.1 RFID devices and systems used in aircraft maintenance, including inspections for presence, serviceability, configuration control, identity, or quantity of components.

5.2 RFID systems used to determine the as-flying configuration of a component for an aircraft or fleet of aircraft.

5.3 The potential risk to aircraft safety if RFID systems are not designed to a minimum set of maintenance criteria, yet are installed to identify or record specific aircraft maintenance or inspection tasks. These tasks may include:

5.3.1 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 §§ 91.405, 121.139, 121.369, 125.249, 135.421, 135.425, and 135.427.

5.3.2 Maintenance Records. RFID-enabled aircraft maintenance actions are recorded as evidence of compliance with an operator's maintenance requirements. Refer to §§ 43.9, 43.11, 43.12, 91.417, 121.709, 125.411, 135.63, 135.439, and 135.443.

5.3.3 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 that reports the performance of any maintenance action on an item must include recording who performed the action and the result in accordance with the pertinent regulation. 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 as required by the applicable regulation. Further guidance on digital signatures and electronic records is in AC 120-78.

5.4 Reliability of Source Data. Subjective evidence showing the reliability of 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.

5.4.1 System Integrity. RFID devices and systems should demonstrate the same degree of life-cycle integrity to be as good as, or better than, non-RFID systems and methods.

5.5 Limitation of Variability. A common approach to the design of the RFID system is expected. 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.

5.5.1 Hardware Standard. The current editions of SAE Aerospace Standards AS5678, Passive RFID Tags Intended for Airborne Equipment 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. SAE AS5678 or AS6023 testing criteria are provided 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 should be certified by the manufacturer in accordance with SAE AS5678 or AS6023 for their applicable operational conditions. RFID tag manufacturers or RFID tag installers may conduct a similarity analysis for changes to previously SAE AS5678- or AS6023-qualified RFID tags. A similarity analysis is acceptable for non-primary part marking applications (e.g., ancillary or supplemental applications) if the RFID tag design did not appreciably change the packaging material, size, weight, or read performance.

5.5.2 The Data Content and Format Standard. Air Transport Association (ATA) e-Business Program, ATA Spec 2000, Automated Identification and Data Capture (Ch. 9), defines 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, it is good practice to not write proprietary or sensitive data to an RFID tag. Otherwise, the operator, or delegated entity, has sole discretion to write any additional data or information, as desired, for its particular maintenance or inspection program. In cases when bar code initiation and control procedures are needed, ATA Spec 2000, chapter 9, section 9-4 should be used.

5.5.3 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.

5.5.4 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 in accordance with § 43.9. For digital signatures and electronic records management guidance, refer to AC 120-78.

5.6 General 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.

5.7 Reducing Operational Risk. Using RFID-enabled systems and methods for aircraft maintenance will create large reductions in lead times to perform certain 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, a best practice would be to maintain legacy methods as the default failover, and when possible, schedule tasks using RFID so there is enough recovery time if a system failure occurs.

5.8 Advantages of RFID. 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, an advantage to operators. This AC informs operators and RFID suppliers of the degree of technical diligence needed to produce reliable and auditable data for an effective RFID system.

6 APPLICATIONS. This AC addresses, without being limited to, the following known aviation applications:

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

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

6.3 Oxygen Generators. Periodic inspection of presence and date of life limit of oxygen passenger service units (PSU), chemically-generated and non-chemical oxygen canisters, or pressurized gas canisters.

6.4 Miscellaneous Cabin Safety Equipment. As required, based on the as-delivered configuration of the aircraft. Refer to §§ 121.605 and 121.803.

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

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

6.7 Repairable Exchange Components. Identification and verification of components and their serviceable status.

7 TECHNOLOGY SELECTION AND INSTALLATION.

7.1 RFID Tag Selection. Taking into account SAE AS5678, 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 in-operation aircraft exposure do not take into consideration the component overhaul environments, which can be much more severe.

7.2 Tag Preservation. When selecting RFID tags, operators should 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, or have an RFID tag replacement procedure according to paragraph 9.6.1. Actions may include a mechanical installation for tag removal or covering the tag with a protective material, as required.

8 AIRWORTHINESS CONSIDERATIONS.

An RFID system design should account for the system's environment and conditions. FAA airworthiness approval guidance is in AC 20-162. Considerations for system design and installation include:

1. For ancillary part marking using RFID tags, it is a good practice for aircraft operators to include, in human readable characters, the identity of its associated aircraft part. If the RFID tag's host equipment is too small to print a human readable label, then the aircraft operator should document the equipment that is too small and does not have a human readable label.
2. An aircraft part should be matched to its associated tag, without physically separating the part from the tag. There may be cases where RFID tag read performance is affected by installing the RFID tag directly on the host equipment (e.g., host equipment is too small to adhere tag, metal surfaces or surroundings affect radio frequency emissions, etc.). Aircraft operators should document these cases and possess engineering drawings and processes ensuring proper location and repeatable installation to optimize RFID tag read capability.
3. The RFID tag should not interfere with the operation of other adjacent systems or equipment.

8.1 Data Integrity, Emergency Equipment Configuration, and Safety of Flight. RFID data used for the purpose of data integrity, emergency equipment configuration, and safety of flight should be highly reliable and current to the as-flying configuration. When these inspections are performed at aircraft maintenance stations, RFID systems should eventually be wirelessly connected or hard-wired to an operating system server to

complete the task. The aircraft operator should document this procedure to ensure inspection task completion.

8.2 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 and used in the maintenance processes. See paragraph 9.7 for additional guidance.

8.3 Changing Birth Record Data. Once installed, operators should not be able to change birth record data on the RFID tag. However, an operator, or delegated entity, may need to write additional part or updated maintenance 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.

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

8.5 Security-Enabled RFID Tags on Life Preservers. When the RFID system includes the substitution of RFID-enabled security seals, otherwise referred to as "tamper evident" tags, for the original non-RFID security seals, it is necessary to ensure that the introduction of the alternate tag will not hamper in any way the access to the life preserver by the passenger. A life preserver access test procedure should be performed to verify that, after the installation of the RFID-enabled security seals, the life preservers remain accessible in accordance with Technical Standard Order (TSO)-C127b, Rotorcraft, Transport Airplane, and Small Airplane Seating Systems, appendix 1, table 2, section 3.

8.6 RFID Tag Life Cycle vs. Component Life Cycle. Passive RFID tags do not have a predefined serviceable life and therefore should be removed and replaced according to the aircraft operator's accepted procedure. Active RFID tags used for the purposes described within this AC should be designed such that they either exceed the life of the part on which they are attached or exceed the intervals between component overhaul. The tag manufacturer's information regarding accelerated life-cycle testing and limitations of serviceability should be considered when selecting the appropriate tag for each application.

8.7 Toxic Fumes or Smoke. RFID tags installed on aircraft parts should not emit toxic fumes or smoke at the highest operating temperature of that part. In addition, RFID tags should be SAE AS5678- or AS6023-qualified for their operating environment.

9 OPERATIONAL CONSIDERATIONS.

9.1 Human Factors. Operators should consider human factors in the design of an RFID system to ensure effective and optimum performance.

9.2 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.

9.3 Deployment Tracking Program. Operators should develop a master phasing schedule to track RFID system installation and deployment on each of its aircraft.

9.4 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.

9.5 System Failure Procedure. Operators must default to manual procedures if an RFID system fails. Refer to § 43.5(b).

9.6 Maintaining System Hardware. Operators should consider developing procedures for:

9.6.1 RFID Tag Expiration and Replacement. If RFID tags have serviceability limitations, 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 considering the acceptable materials, surface finishes, and surface shapes for the parts and equipment that host the RFID tag.

9.6.2 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 a life preserver, is replaced with a non-RFID-tagged component, the RFID-based inspection procedure remains in place and the non-RFID-tagged component should be inspected visually and reported manually, or a tag has to be applied according to the operator's retrofit procedure.

9.6.3 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.

9.7 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:

9.7.1 Revision-Controlled Data. Operators and their delegated entities 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.

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

9.7.3 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 that may be exchanged for new or overhauled OEM rotable components.

9.7.4 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.

9.8 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.

9.9 RFID Tag Installation Location. Operators should consider the implications of the location, position, and method of RFID tag installation. The RFID tag should 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 should be installed in such a manner as to not prevent the deployment of the oxygen masks.

10 HOW TO OBTAIN REFERENCED DOCUMENTS.

10.1 ACs. You can find all current ACs at https://www.faa.gov/regulations_policies/advisory_circulars.

10.2 Title 14 CFR Documents. You can find the current regulations at https://www.ecfr.gov.

10.3 SAE Documents. You may order SAE documents via telephone at (724) 776-4970, fax at (724) 776-0790, or online at https://www.sae.org. You may also order documents by mail from:

SAE International
400 Commonwealth Drive
Warrendale, PA 15096-0001

10.4 RTCA Documents. You may order RTCA documents via telephone at (202) 833-9339, fax at (202) 833-9434, or online at https://www.rtca.org. You may also order documents by mail from:

RTCA, Inc.
1150 18th Street NW, Suite 910
Washington, DC 20036

11 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.

Robert C. Carty
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-AFB-120-Directives@faa.gov.

Subject: AC 119-2A, 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.)

_____

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☐ Other comments:

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_____

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

Submitted by: _____ Date: _____