U.S. Department of Transportation
Federal Aviation Administration

Advisory Circular

Subject: Operator Information for Incorporating Fuel Tank Flammability Reduction Requirements into a Maintenance and/or Inspection Program

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On July 21, 2008, the Federal Aviation Administration (FAA) published the Reduction of Fuel Tank Flammability in Transport Category Airplanes final rule. It is referred to as the Fuel Tank Flammability Reduction (FTFR) rule. This rule amends Title 14 of the Code of Federal Regulations (14 CFR) parts 25, 26, 121, 125, and 129, § 129.14 U.S.-registered airplanes. The FTFR rule requires manufacturers and operators of certain transport category airplanes to take steps that in combination with the Transport Airplane Fuel Tank System Design Review, Flammability Reduction, and Maintenance and Inspection Requirements (Special Federal Aviation Regulation (SFAR) 88, Fuel Tank System Fault Tolerance Evaluation Requirements) will greatly reduce the chances of a catastrophic fuel tank explosion. The purpose of these rules is to help ensure the continued safety of transport category airplanes by reducing fuel tank ignition sources and the flammability exposure in fuel tanks that are most at risk. The FTFR rule requires either a flammability reduction means (FRM), such as nitrogen inerting, or an ignition mitigation means (IMM), like polyurethane foam, be incorporated into airplanes with high flammability fuel tanks to prevent fuel tank explosions.

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CHAPTER 1. GENERAL

1.1 Purpose of This Advisory Circular (AC). This AC provides information and describes an acceptable means of compliance (AMC) with the Reduction of Fuel Tank Flammability in Transport Category Airplanes final rule. It is commonly called the Fuel Tank Flammability Reduction (FTFR) rule. This AC describes acceptable means, but not the only means, for demonstrating compliance with the applicable regulations. The Federal Aviation Administration (FAA) will consider other methods of demonstrating compliance that an applicant may elect to present. While these guidelines are not mandatory, they are derived from extensive FAA and industry experience in determining compliance with the relevant regulations. If the FAA becomes aware of circumstances that convince us that following this AC would not result in compliance with the applicable regulations, the FAA may require additional substantiation or design changes as a basis for finding compliance. This material does not change or create any additional regulatory requirements, nor does it authorize changes in or permit deviations from existing regulatory requirements.

Note 1: Terms such as "will" or "must" are used in this AC only in the sense of ensuring applicability of this particular method of compliance when the acceptable method of compliance described here is used.

Note 2: This is a guidance document. Its content is not legally binding in its own right and will not be relied upon by the Department as a separate basis for affirmative enforcement action or other administrative penalty. Conformity with the guidance document is voluntary only. Nonconformity will not affect rights and obligations under existing statutes and regulations.

1.2 Audience. This AC applies to operators of transport-category turbine-powered airplanes with a type certificate (TC) issued after January 1, 1958, that as a result of original type certification or later increase in capacity, have a maximum type certificated passenger capacity of 30 or more, or a maximum payload capacity of 7,500 pounds or more. In addition, this AC applies to operators of transport-category airplanes of any size that include Title 14 of the Code of Federal Regulations (14 CFR) § 25.981, Amendment 25-102, or later in the original certification basis of the airplane or in the certification basis of modifications to the airplane.

1.3 Where You Can Find This AC. You can find this AC on the FAA's website at https://www.faa.gov/regulations_policies/advisory_circulars and the Dynamic Regulatory System (DRS) at https://drs.faa.gov.

1.4 What This AC Cancels. AC 120-98A, Operator Information for Incorporating Fuel Tank Flammability Reduction Requirements into a Maintenance or Inspection Program, dated April 11, 2017, is canceled.

1.5 Background.

1.5.1 Accident. Since 1959, there have been 18 fuel tank explosions on transport category airplanes. Most notably, on July 17, 1996, a 25-year-old Boeing 747-100 series airplane,

operating as TWA Flight 800, was involved in an in-flight breakup after takeoff from Kennedy International Airport in New York, resulting in 230 fatalities. The National Transportation Safety Board (NTSB) determined the probable cause of the TWA Flight 800 accident was an explosion of the center wing fuel tank (CWT) due to ignition of the flammable fuel vapor and air mixture in the tank. The source of ignition energy for the explosion could not be determined conclusively, though the NTSB determined the most likely cause was a combination of failures involving the fuel quantity indicating system (FQIS). In addition, the accident report concluded that "a fuel tank design and certification philosophy that relies solely on elimination of all ignition sources, while accepting the existence of fuel tank flammability, is fundamentally flawed because experience has demonstrated that all possible ignition sources cannot be predicted and reliably eliminated."

1.5.2 Fuel Tank Safety (FTS) Rule. On June 6, 2001, the Transport Airplane Fuel Tank System Design Review, Flammability Reduction, and Maintenance and Inspection Requirements rule became effective. It is referred to as the 2001 FTS rule. It amended 14 CFR part 21 and created Special Federal Aviation Regulation (SFAR) 88, Fuel Tank System Fault Tolerance Evaluation Requirements. SFAR 88 is in 14 CFR part 21 and was the only change made by the 2001 FTS rule to 14 CFR part 21. SFAR 88 required TC and Supplemental Type Certificate (STC) holders to conduct a safety review of the applicable airplanes identified in the rule to determine if their design meets the FTS ignition prevention requirements described in 14 CFR §§ 25.901 and 25.981(a) and (b) and develop service information necessary for the FAA to issue Airworthiness Directives (AD) to correct unsafe conditions identified by the reviews.

1.5.3 Fuel Tank Flammability Reduction (FTFR) Rule. On July 21, 2008, the FAA published the Reduction of Fuel Tank Flammability in Transport Category Airplanes final rule. It is referred to as the FTFR rule. The FTFR rule contains new requirements for design approval holders (DAH) and operators of certain transport airplanes. Given that ignition sources have and will continue to develop in spite of the effort of the FTS rule to mitigate the risk, the chances of a fuel tank explosion naturally correlate with the exposure of the tank to flammable vapors. The requirements in FTFR rule mitigate the effects of such flammability exposure and limit it to acceptable levels by mandating the installation of either a flammability reduction means (FRM) or an ignition mitigation means (IMM) for fuel tanks that are most at risk. The design and operational requirements in these rules, in combination, should greatly reduce the chances of a catastrophic fuel tank explosion.

1.6 Related CFRs. DRS is a searchable database that contains regulatory, guidance, and aviation product information. DRS contains the Codes of Federal Regulations (CFR) and SFARs from 14 CFR in their current version, as well as historical versions. The following sections of 14 CFR apply:

- Part 21, Special Federal Aviation Regulation (SFAR) 88, Fuel Tank System Fault Tolerance Evaluation Requirements.
- Section 25.981, Fuel Tank Explosion Prevention.
- Section 25.1529, Instructions for Continued Airworthiness.

- Part 25 Appendix H, Instructions for Continued Airworthiness.
- Part 26, Continued Airworthiness and Safety Improvements for Transport Category Airplanes.
- Section 43.13, Performance Rules (General).
- Section 43.16, Airworthiness Limitations.
- Section 91.403(c), General.
- Section 121.1113, Fuel Tank System Maintenance Program.
- Section 125.507, Fuel Tank System Inspection Program.
- Section 129.113, Fuel Tank System Maintenance Program.

1.7 Related Reading Materials (current editions).

1.7.1 ACs. You can find these ACs on the FAA's website at https://www.faa.gov/regulations_policies/advisory_circulars/.

- AC 25-8, Auxiliary Fuel System Installations.
- AC 25.981-1, Fuel Tank Ignition Source Prevention Guidelines.
- AC 25.981-2, Fuel Tank Flammability Reduction Means.
- AC 120-16, Air Carrier Maintenance Programs.
- AC 120-97, Incorporation of Fuel Tank System Instructions for Continued Airworthiness into Operator Maintenance and/or Inspection Programs.
- AC 120-102, Incorporation of Electrical Wiring Interconnection Systems Instructions for Continued Airworthiness into an Operator's Maintenance Program.
- AC 121-22, Maintenance Review Boards, Maintenance Type Boards, and Original Equipment Manufacturer/Type Certificate Holder Recommended Maintenance Procedures.

1.7.2 FAA Policy Statements. An electronic copy of the following Policy Statements can be downloaded at https://drs.faa.gov.

- PS-ANM112-05-001, Process for Developing SFAR 88-related Instructions for Maintenance and Inspection of Fuel Tank Systems, October 6, 2004.
- PS-ANM110-7-12-2005, Safety—A Shared Responsibility—New Direction for Addressing Airworthiness Issues for Transport Airplanes, July 12, 2005.

1.7.3 Industry Reference. Refer to the Airlines for America (A4A), Maintenance Steering Group – 3rd Task Force/4th Task Force (MSG-3/MSG-4): Operator/Manufacturer Scheduled Maintenance Development.

1.8 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.

CHAPTER 2. FTFR RULE REQUIREMENTS

2.1 Design Approval Holder (DAH) Requirements. The Fuel Tank Flammability Reduction (FTFR) rule requires DAHs and operators to increase the level of safety of certain fuel tanks. It accomplishes this by requiring the incorporation of either flammability reduction means (FRM), such as nitrogen inerting, or ignition mitigation means (IMM), such as polyurethane foam, to reduce the fuel tank explosion risk to an acceptable level. The fuel tank flammability safety standards in Title 14 of the Code of Federal Regulations (14 CFR) part 26 subpart D require DAHs to conduct flammability assessments, incorporate FRM or IMM designs in new production airplanes, and develop service instructions for retrofit installation of FRM or IMM for those affected airplane models with high flammability exposure time fuel tanks.

2.1.1 Possible Adverse Effects on the Design Approval. The DAHs for auxiliary fuel tanks in airplanes where FRM or IMM are required must assess any possible adverse effects of their design approval on the effectiveness of the fuel tank safety (FTS) improvements. If an operator installed an auxiliary fuel tank pursuant to a field approval in an airplane affected by 14 CFR § 26.33, the operator is the auxiliary fuel tank DAH. Any adverse effects on the DAH's approved design must be mitigated by design changes and service instructions (refer to 14 CFR § 26.35(d)) identified as Flammability Impact Mitigation Means (FIMM). FIMM are modifications developed by the DAH for auxiliary fuel tanks when a flammability exposure analysis per 14 CFR § 26.35 determines that an auxiliary fuel tank installed by the Supplemental Type Certificate (STC) or field approval could have an adverse impact on the performance of existing fuel system FRM or IMM of other tanks.

2.1.2 Example of FIMM. The center wing fuel tank (CWT) vent system is part of the type design of the airplane. The installation of an auxiliary fuel tank, such as in the forward cargo compartment, may reduce the effectiveness of the Nitrogen Gas System, resulting in an increase in flammability exposure of the CWT. The Nitrogen Gas System installation is designed to provide the proper level of nitrogen to the CWT in order to reduce the flammability exposure time to levels required by the certification regulations. Auxiliary fuel tank installations typically transfer fuel and ullage gases to and from the CWT. The concern here is that the auxiliary fuel tank that allows transfer of ullage directly to or from the CWT might increase the flammability exposure time of the CWT above the certification limits. Therefore, the DAH for the auxiliary fuel tank system must comply with 14 CFR § 26.35 and determine if the auxiliary fuel tank system reduces the effectiveness of the Nitrogen Gas System resulting in an increase in flammability exposure of the CWT and therefore, FIMM is necessary.

2.1.3 Field Approval Auxiliary Fuel Tanks. Title 14 CFR § 121.1117(c) and similar provisions in 14 CFR parts 125 and 129 require that, after the applicable date stated in 14 CFR § 121.1117(e), no operator may operate any airplane subject to 14 CFR § 26.33 that has an auxiliary fuel tank installed by a field approval unless that operator complies with 14 CFR § 26.35 by the applicable date specified in that section and, if required, installs an FIMM approved by the Federal Aviation Administration (FAA) Oversight Office. The

operator may also choose to deactivate or remove the auxiliary fuel tank, but must use FAA Oversight Office-approved data to accomplish that.

2.2 Excluded Models. The airplane models listed under Exclusions in 14 CFR §§ 121.1117(o), 125.509(m), and 129.117(o) of the FTFR rules are excluded from the retrofit requirements. All the airplanes produced for these models were issued an original Certificate of Airworthiness (C of A) before January 1, 1992. These are also airplane models that because of their advanced age and small numbers would likely make compliance economically impractical even if used in passenger service beyond the 100 percent retrofit compliance dates.

2.3 Operator Requirements – New Production. For 14 CFR §§ 121.1117, 125.509, and 129.117, no operator may operate a new production airplane identified in Table 2-1, Title 14 CFR §§ 121.1117, 125.509, and 129.117 Table 1, below (including all-cargo airplanes), for which the State of Manufacture issued the original C of A or export airworthiness approval after December 27, 2010, unless an FRM or IMM meeting the requirements of 14 CFR § 26.33 is operational. Table 2-1 contains current production airplanes at the time the FTFR rule was issued.

Note 1: Title 14 CFR § 26.37 requires affected pending new transport airplane type certification projects to comply with the 14 CFR § 25.981 fuel tank flammability type certification requirements adopted by the FTFR rule.

Note 2: Table 2-1 does not include the Boeing 757 or Airbus A300 or A310 because they were out of production when the FTFR rule was adopted.

Table 2-1. Title 14 CFR §§ 121.1117, 125.509, and 129.117 Table 1

Model—Boeing	Model—Airbus
747 Series	A318, A319, A320, A321 Series
737 Series	A330, A340 Series
777 Series	
767 Series	

2.4 FTFR Rule Exclusions. The FTFR rule does not apply to any airplane for which the State of Manufacture issued the original C of A or export airworthiness approval before January 1, 1992, unless they are operated in passenger service beyond the date by which the operator is required to modify 100 percent of its affected fleet. After that date, all pre-January 1, 1992, airplanes listed in Table 2-2, Title 14 CFR §§ 121.1117, 125.509, and 129.117 Table 2, that will still operate in passenger service will have to be 14 CFR § 26.33(c) compliant. The 100 percent retrofit date is contingent on whether the operator is using the ground-conditioned air provision identified in paragraph 2.10 of this chapter.

Note: The retrofit requirements of the FTFR rule do not apply to airplanes designed solely for all-cargo operations (14 CFR § 26.33(a)).

2.5 Operator Requirements – Retrofit. Title 14 CFR § 121.1117(d), (e), and (m) and similar provisions in 14 CFR parts 125 and 129 require that if FRM, IMM, or FIMM is required by 14 CFR § 26.33 or § 26.35, each operator must complete the FAA Oversight Office-approved installation of FRM, IMM, or FIMM. The retrofit compliance dates require each operator to complete retrofit on a percentage of its fleet by specific dates. The DAH is required by 14 CFR § 26.33 or § 26.35 to develop retrofit service instructions for the airplane models manufactured on or after January 1, 1992, if those 14 CFR part 26 regulations require FRM, IMM, or FIMM.

2.6 Operator Requirements – Pre-1992 Airplane. If an operator wishes to operate in passenger service a pre-1992 airplane listed in Table 2-2 past their 100 percent fleet retrofit compliance date, 14 CFR § 121.1117(m) and similar requirements in 14 CFR §§ 125.509 and 129.117 require the operator modify the airplane to comply with 14 CFR § 26.33(c) before that date. However, there is no requirement in 14 CFR § 26.33 or § 26.35 for DAHs to develop retrofit service information for pre-1992 airplanes. Therefore, the operator of pre-1992 airplanes must comply with the 14 CFR part 26 requirements.

Table 2-2. Title 14 CFR §§ 121.1117, 125.509, and 129.117 Table 2

Model—Boeing	Model—Airbus
747 Series	A318, A319, A320, A321 Series
737 Series	A300, A310 Series
777 Series	A330, A340 Series
767 Series	
757 Series	

2.7 Models Excepted From the FTFR Rule. Table 2-2 does not include the airplane models listed in Table 2-3, Airplane Models Excepted from the Fuel Tank Flammability Reduction (FTFR) Rule, which is not included in the FTFR operating rules. These models are not listed under Exclusions in 14 CFR §§ 121.1117(o), 125.509(m), and 129.117(o) of the FTFR operating rules either. However, they were issued the original C of A or export airworthiness approval before January 1, 1992. They also do not include high flammability exposure fuel tanks that would require FRM or IMM in order to comply with 14 CFR § 26.33(c). Therefore, they are not required to comply with 14 CFR § 26.33(c) or the retrofit requirements in the FTFR rule even if an airplane listed in the Table 2-3 below were to operate in passenger service past the 100 percent retrofit compliance date.

Note: Table 2-3 contains airplane models excluded from the FTFR rule.

Table 2-3. Airplane Models Excepted From the Fuel Tank Flammability Reduction (FTFR) Rule

Model	Year of Last Delivery
L-1011	1984
DC-10	1990
B-727	1984
DC-9	1982

2.8 Operator Retrofit Compliance Times. Title 14 CFR § 121.1117(e) and (m) and similar provisions in 14 CFR parts 125 and 129 require the retrofit installations be phased in over the period specified in the rules. Below is a summary of the retrofit compliance date requirements.

2.8.1 Fifty Percent. Fifty percent of each operator's fleet must be modified no later than December 26, 2014. A one-year extension may have been granted by using the ground conditioned air provision in 14 CFR § 121.1117(k) or § 129.117(k). There is no similar provision in 14 CFR § 125.509.

2.8.2 One Hundred Percent. One hundred percent of each operator's fleet must be modified no later than December 26, 2017, unless a one-year extension has been granted by using the ground conditioned air provision in the FTFR rule.

2.8.3 One Airplane Fleet. For those operators that have only one airplane of a model identified in Table 2-1 in 14 CFR § 121.1117(b) (new production airplanes) in their affected fleet, the airplane must be modified no later than December 26, 2017.

2.8.4 Compliance Plan. The operator should work with the principal inspector (PI) to develop a compliance plan for the 50 percent and 100 percent retrofit requirements in 14 CFR § 121.1117(e) and the similar provisions in 14 CFR parts 125 and 129. The compliance plan should contain a complete list/schedule of airplanes that require retrofit. The list should be updated as airplanes are added/completed. The operator should apprise the PI of any delays, addition, or deletion of airplanes from the list/schedule. Operators that have only one airplane must modify that airplane no later than December 26, 2017.

2.9 An Operator's Airplane Retrofit Fleet Defined. For the purposes of the FTFR rule, an operator's airplane retrofit fleet is defined as the total number of affected airplanes of all affected model types listed on Operations Specification (OpSpec)/Letter of Authorization (LOA) D085, Aircraft Listing, on the retrofit compliance dates.

Note: New production airplanes that are FRM compliant (14 CFR § 121.1117(b)) manufactured either on or prior to December 27, 2010, or those manufactured after December 27, 2010, cannot be counted as part of the 50 percent or 100 percent retrofit mix.

2.9.1 Retrofit Mix Example. For example, an operator has a fleet comprised of Boeing 737 and Airbus A320 airplanes. The "affected fleet" is the total number of the affected Boeing 737 airplanes plus the total number of affected Airbus A320 airplanes. The operating rules require the operator retrofit 50 percent of its "affected fleet" of airplanes by the 50 percent retrofit compliance date of December 26, 2014. Airplanes in long-term storage and listed on OpSpec D106, Aircraft in Long-Term Maintenance or Storage, cannot not be counted in the 50 percent or 100 percent retrofit mix for the purposes of the FTFR rule. However, any airplane(s) brought back into service from storage and added to OpSpec/LOA D085 become part of the operator's 50 percent or 100 percent retrofit mix. The operator must recalculate the retrofit mix based on the number of airplanes added to OpSpec/LOA D085. In addition, any newly acquired airplanes added to the operator's fleet that are not FTFR retrofit compliant and added to OpSpec/LOA D085 become part of the operator's 50 percent or 100 percent retrofit mix. If an operator has more than one affected airplane listed on its OpSpec/LOA D085 on the 50 percent retrofit compliance date, they are required to have retrofitted 50 percent of those airplanes by that date.

2.9.2 Retrofit Mix Adjustment. The 50 percent or 100 percent retrofit mix can be adjusted by the operator to suit its operational needs. The operator can change the retrofit mix of airplanes at will and at any time as long as the retrofit percentages and dates are complied with. For instance, an operator has 50 airplanes that need to be FTFR retrofit compliant by December 26, 2014. The operator sells or puts in storage 25 of those airplanes and purchases 25 that are FTFR retrofit compliant (not new production airplanes). The operator's 50 percent retrofit requirement remains the same, but now 25 are retrofit compliant and only 25 of the original 50 percent fleet need to be retrofitted to meet its 50 percent requirement by December 26, 2014. The fact that the operator purchased 25 FTFR retrofit-compliant airplanes rather than retrofitting them itself has no bearing on its original 50 percent retrofit requirement. For the purposes of the FTFR, the operator would meet the 50 percent requirement. This also applies to the operator's 100 percent mix.

2.10 Use of Ground-Conditioned Air.

2.10.1 One-Year Extension. In order to give the operators additional time to incorporate FRM at a time other than during a heavy check, the FTFR rule has a provision in 14 CFR §§ 121.1117(k) and 129.117(k) to allow a one-year extension to the retrofit requirements in 14 CFR §§ 121.1117(e) and 129.117(e) if the operator uses ground conditioned air for all airplanes with high flammability tanks for actual gate times exceeding 30 minutes when ground air is available at the gate and operational and the ambient temperature exceeds 60 degrees Fahrenheit. Operators were required to apply for amendment to their OpSpec no later than March 26, 2009, in order to obtain this one-year extension. This provision does not apply to 14 CFR § 125.507 because these airplanes are not typically parked at gates where ground-conditioned air is available. In addition, these operators have few airplanes subject to this rule.

Table 2-4. Airplanes Authorized By OpSpec A570 to Use Ground-Conditioned Air

Boeing	Airbus
747 Series	A300, A310 Series
737 Series	A318, A319, A320, A321 Series
777 Series	A330, A340 Series
767 Series	
757 Series	

2.10.2 OpSpec A570 Authorized Airplanes. If the operator applied for the ground conditioned air provision, it is controlled on OpSpec A570, One Year Extension of Compliance Times in Section 121.1117(e). The operator's manual must contain any applicable airplanes in Table 2-4 that are authorized on OpSpec A570 to use ground conditioned air. This must include a listing by N registration number and fleet type of airplanes that require retrofit with FRM or IMM. As airplanes are retrofitted, they should be removed from the list. The OpSpec A570 authorization terminates on December 26, 2018, or when all of the operator's airplanes listed in its manual are retrofitted, whichever occurs first.

2.11 Service Instructions.

2.11.1 Install FRM or IMM. In order for the operators to install FRM or IMM, the DAHs are required to develop airplane model specific design change service instructions (Service Bulletins (SB)) that are FAA Oversight Office-approved. Operators will use these service instructions along with installation kits to install FRM or IMM. The FAA Oversight Office-approved FRM/IMM SBs are part of the airplane type design. Therefore, certain changes must be FAA Oversight Office-approved in accordance with the following procedures.

2.11.2 Deviation/Changes to FAA Oversight Office-Approved FRM SBs. The retrofit requirements contained in 14 CFR § 121.1117 require installation of an IMM or FRM, if required by 14 CFR § 26.33, § 26.35, or § 26.37, that is "approved by the FAA Oversight Office." Unlike an Airworthiness Directive (AD) that typically requires accomplishment of corrective actions "in accordance with" a manufacturer's SB, 14 CFR § 121.1117 does not require strict adherence ("in accordance with") to the manufacturer's SB. As with any SB that implements a change to type design, the manufacturer's SBs for the Nitrogen Gas System have been FAA-approved. Although the entire SB is identified as approved, only the technical data (type design) associated with the SB is FAA-approved. Therefore, deviations to the SBs that revise the technical data contained within the SB would have to be approved. Major changes to the technical data include, but are not limited to, any deviation/change to the SB that could affect the performance/reliability/operation of the Nitrogen Gas System. Minor deviations/changes to non-AD FAA-approved SBs should be handled in accordance with the procedures in the operator's manual acceptable to the PI. Operators should refer to AC 120-77, Performance Rules: Provisions Contained in an

Operator Manual Under § 43.13(c), for guidance regarding considerations in making major/minor decisions and the needed analysis or justification.

2.11.2.1 Proposed Deviations. Operators should have coordinated with the PI of their FAA certificate management office (CMO) or the responsible Flight Standards office in requesting and implementing approval of major deviations/revisions directly by the FAA Oversight Office to the FRM SBs.

2.11.2.2 Procedures That Address Major and Minor Changes. The operator must have procedures in its manual that address both major and minor changes to FAA Oversight Office-approved FRM/IMM service instructions/bulletins.

2.12 Airworthiness Limitations.

2.12.1 DAH-Developed Airworthiness Limitations. The DAH is required to develop FAA Oversight Office-approved airworthiness limitations which include critical design configuration control limitations (CDCCL), inspections, or other procedures to prevent increasing the flammability exposure of any tanks equipped with FRM or FIMM above the certification limits, or to prevent degradation of the performance of any IMM installed throughout the operational life of the airplane. The DAH is required to include these airworthiness limitations in the Airworthiness Limitations Section (ALS) of the instructions for continued airworthiness (ICA). These airworthiness limitations are part of the type design of the modified airplane. This requirement is similar to that contained in 14 CFR § 25.571. Airplane fuel tank system airworthiness limitations are intended to be treated the same as airplane structure airworthiness limitations. Title 14 CFR part 25 Appendix H, requires including fuel tank system airworthiness limitations in the airworthiness limitations of the ICA.

2.12.1.1 Title 14 CFR §§ 26.33 and 26.35 require the DAH to develop airworthiness limitations to prevent increasing the flammability exposure of any tanks equipped with FRM or FIMM and to prevent degradation of the performance of any IMM.

2.12.1.2 Title 14 CFR § 121.1117 and similar provisions in 14 CFR parts 125 and 129 require the operator to incorporate the airworthiness limitations required by 14 CFR §§ 26.33 and 26.35, if required, into their maintenance or inspection program.

2.12.2 Types of FRM/IMM Limitations. There are three types of fuel system airworthiness limitations.

2.12.2.1 An airworthiness limitation item (ALI) inspection which has a specific task and interval, such as 10 years.

2.12.2.2 An ALI procedure that could have specific task intervals.

2.12.2.3 A CDCCL which has no interval but establishes configuration limitations to maintain and to protect the critical design feature identified in the CDCCL.

CDCCLs can also include requirements to have placards on the airplane with information about critical features. (Refer to AC 25.981-1, Fuel Tank Ignition Source Prevention Guidelines, or AC 25.981-2, Fuel Tank Flammability Reduction Means, for additional information on CDCCLs.)

Figure 2-1. Example of an FRM/IMM CDCCL

Title: Center Fuel Tank Vent System – Auxiliary Tanks

The Concern: The addition of an auxiliary fuel tank system via a Supplemental Type Certificate (STC) may reduce the effectiveness of the Nitrogen Gas System resulting in an increase in flammability exposure of the center tank.

Reason for Concern: The Nitrogen Gas System installation is designed to provide the proper level of nitrogen to the center wing fuel tank (CWT) in order to reduce the fleet wide average flammability exposure to levels equal to that of wing fuel tanks. Auxiliary fuel tank installations typically transfer fuel and ullage gases to and from the CWT.

The Critical Design Feature: Any auxiliary fuel tank system that allows transfer of ullage directly to or from the CWT must not significantly affect the performance of the Nitrogen Gas System.

2.12.3 Critical Design Feature. Title 14 CFR § 121.1117 and similar provisions in 14 CFR parts 125 and 129 require the operator to incorporate the airworthiness limitations required by 14 CFR §§ 26.33 and 26.35, if required, into their maintenance or inspection program. The FAA Oversight Office-approved FTFR airworthiness limitations make the CDCCL the primary source for the critical design feature information. While the critical design feature may also be in the Aircraft Maintenance Manual (AMM) reference, it is not to be used as the primary source of information for the CDCCL critical design feature. The primary source is the CDCCL.

2.13 Operator Maintenance/Inspection Program Requirements.

2.13.1 Procedures for Development Personnel. Operators must have procedures in their maintenance/inspection program/manual that include all information from the fuel system airworthiness limitations. The operator's maintenance/inspection program/manual shall state that personnel who edit maintenance manuals, job/task cards, and Engineering Orders (EO) must include the entire text of the airworthiness limitations, including the AMM standard wiring practice manual (SWPM) text that is required to be followed. (Merely referencing the AMM, SWPM, etc. is not acceptable.)

2.13.2 CDCCL Incorporation. Operators must ensure that the CDCCL critical design features are incorporated into the maintenance/inspection program/manual and are adhered to as written. Any proposed operator changes must be approved by the FAA Oversight Office. The CDCCL critical design feature identified above is just one of many that are included in the airworthiness limitations for the airplane. The CDCCLs critical design features must be included on the operators' EOs and job/task cards.

2.13.3 Airplanes With FRM or IMM Installed. Operators who have taken delivery of new production airplanes (14 CFR § 121.1117(b)), manufactured either on or prior to December 27, 2010, or manufactured after December 27, 2010 that have either FRM or IMM installed must have FAA Oversight Office-approved airworthiness limitations (i.e., CDCCLs, inspections, or other procedures) from the ICA incorporated into their maintenance/inspection program/manual prior to putting the airplane into service.

2.13.4 Retrofitted Airplane Fleets. Operators who retrofit their fleet must incorporate the FAA Oversight Office-approved airworthiness limitations (i.e., CDCCLs, inspections, or other procedures) from the ICA into their maintenance/inspection program/manual prior to putting the airplane back into service.

2.13.5 Procedures to Maintain Placards. Operators must have procedures in their maintenance/inspection program/manual to maintain placards that have information about critical design features on the airplane as required by the airworthiness limitations.

2.13.6 Airworthiness Limitations With Approved CDCCLs. Airworthiness limitations that included FAA Oversight Office-approved CDCCLs, inspections, and other procedures are part of the airplane type design and, therefore, any changes must be approved by the FAA Oversight Office. Operators must have procedures in their maintenance/inspection program/manual that address any changes to airworthiness limitations. The procedures must include notification and be acceptable to the PI.

2.14 Maintenance/Inspection Program Revisions After Alterations.

2.14.1 Before Return to Service. Title 14 CFR § 121.1117(h) and similar provisions in 14 CFR parts 125 and 129 state, in part, after the maintenance/inspection program is revised before returning an airplane to service after any alteration for which airworthiness limitations are required, the operator must revise the maintenance/inspection program for the airplane to include those airworthiness limitations prior to putting the airplane back in service.

2.14.2 Incorporate Type Certificate Holder (TCH)-Developed Revisions. The operator must have incorporated the TCH-developed Maintenance Review Board Report (MRBR) or Maintenance Implementation Document (MID) revisions and/or other FAA Oversight Office-approved fuel tank system airworthiness limitations (i.e., CDCCLs, inspections, and other procedures) into its maintenance/inspection program. The operator will submit to the PI for review the revisions to their maintenance/inspection program incorporating the MRBR, MID, and/or FAA Oversight Office-approved airworthiness limitations changes. The PI review ensures that the operator's maintenance/inspection programs are in compliance with the fuel tank system and Aging Aircraft Program rules. When the review is complete, the PI will issue or amend OpSpec/Management Specification (MSpec)/LOA D097, Aging Aircraft Programs.

2.14.3 Operators That are Authorized OpSpec/MSpec/LOA D097. The issuance of this OpSpec signifies the FAA has reviewed the operator/certificate holder (CH)/program manager's policy and procedures incorporated into their maintenance/inspection programs for

compliance with the Aging Aircraft Program rules. OpSpec/MSpec/LOA D097, Table 1, Aging Aircraft Maintenance Programs, will consist of three columns that list:

- The Aging Aircraft Program rules;
- The manual and section where the policy and procedures are located for the applicable Aging Aircraft Program; and
- The date of the manual and section where the current policy and procedures are located for the applicable Aging Aircraft Program.

Note: Table 2-5 below illustrates a sample OpSpec D097 Table 1 that lists the various 14 CFR part rules. The operator/CH/program manager will have a specific OpSpec D097 template for their operation.

Table 2-5. Sample OpSpec D097, Table 1 – Aging Aircraft Maintenance Programs

Aging Aircraft Program Rules	Operator/Certificate Holder/Program Manager's Maintenance and/or Inspection Program Procedures (Manual and Section)	Date
Repairs Assessment for Pressurized Fuselages — § 91.1505, § 121.1107, § 125.505, § 129.107		
Supplemental Inspections — § 121.1109, § 129.109		
Electrical Wiring Interconnection Systems (EWIS) Maintenance Program — § 121.1111, § 129.111		
Fuel Tank System Maintenance Program — § 121.1113, § 129.113		
Flammability Reduction Means — § 121.1117, § 125.509, § 129.117		
Fuel Tank System Inspection Program — § 91.1507, § 125.507		

2.14.3.1 Initial submission and any later revisions to the operator/CH/program manager's maintenance/inspection program policy and procedures must be submitted to the PI for review for compliance with the Aging Aircraft Program rules.

2.14.3.2 Any proposed revisions or deletions of FAA Oversight Office (Aircraft Certification Service office)-approved ICAs must be coordinated with the PI for review and concurrence. The PI will then forward the proposed revisions or deletions to the responsible Aircraft Certification Service office for

approval prior to implementation or incorporation into the maintenance/inspection program.

2.14.3.3 An operator/CH/program manager must have procedures to ensure that ICAs are incorporated into their maintenance/inspection program.

APPENDIX A. ACRONYMS

A4A	Airlines for America
AC	Advisory Circular
AD	Airworthiness Directive
AED	Aircraft Evaluation Division
AFM	Aircraft Flight Manual
ALI	Airworthiness Limitation Item
ALS	Airworthiness Limitation Section
AMM	Aircraft Maintenance Manual
APU	Auxiliary Power Unit
ASI	Aviation Safety Inspector
C of A	Certificate of Airworthiness
CDCCL	Critical Design Configuration Control Limitation
CFR	Code of Federal Regulations
CH	Certificate Holder
CMO	Certificate Management Office
CWT	Center Wing Fuel Tank
DAH	Design Approval Holder
DRS	Dynamic Regulatory System
EO	Engineering Order
EWIS	Electrical Wiring Interconnection System
FAA	Federal Aviation Administration
FIMM	Flammability Impact Mitigation Means
FQIS	Fuel Quantity Indicating System
FRM	Flammability Reduction Means
FS	Flight Standards Service
FTFR	Fuel Tank Flammability Reduction
FTS	Fuel Tank Safety
ICA	Instructions for Continued Airworthiness
IMM	Ignition Mitigation Means
LOA	Letter of Authorization

MID	Maintenance Implementation Document
MRBR	Maintenance Review Board Report
MSG-3	Maintenance Steering Group – 3rd Task Force
MSI	Maintenance Significant Items
MSpec	Management Specification
MWG	Maintenance Working Group
NTSB	National Transportation Safety Board
NWS	National Weather Service
OpSpec	Operations Specification
PI	Principal Inspector (This may include any or all of the affected Airworthiness or Operations)
PMA	Parts Manufacturer Approval
SB	Service Bulletin
SFAR	Special Federal Aviation Regulations
STC	Supplemental Type Certificate
SWPM	Standard Wiring Practice Manual
TC	Type Certificate
TCH	Type Certificate Holder
TSOA	Technical Standard Order Authorization

APPENDIX B. DEFINITIONS

1. **Actual Gate Time.** The time that the airplane is parked at a gate for servicing and passenger egress and ingress.

2. **Aircraft Evaluation Division (AED).** The Federal Aviation Administration (FAA) Flight Standards Service (FS) representatives who know the operational and maintenance aspects of the certification project and are responsible for determining the operational acceptability and continuing airworthiness requirements of newly certified or modified aircraft, engines, and propellers intended to be operated under the provisions of the Code of Federal Regulations (CFR). This function includes providing the FAA Oversight Office support in the review and approval of the initial and subsequent changes to the type design.

3. **Aircraft Maintenance Manual (AMM).** A manual developed by the manufacturer of a particular airplane that contains information necessary for the continued airworthiness of that airplane.

4. **Airport Ambient Temperature.** The official National Weather Service (NWS) temperature at the airport.

5. **Airworthiness Limitations (AL).** In terms of this advisory circular (AC), mandatory maintenance of the fuel system that can include critical design configuration control limitation (CDCCL), inspections, or other procedures determined necessary to ensure that unsafe conditions do not occur and are not introduced into the fuel system as a result of maintenance actions, repairs, or alterations throughout the operational life of the airplane.

6. **Applicant.** In the context of this AC, an applicant is a person applying for design approval.

7. **Available.** In this AC, “available” relates to the requirement to use ground-conditioned air. In this regard, it means a ground-conditioned air hookup is installed and is operational at the gate. (Mobile ground-conditioned air carts are not required to be used.)

8. **Center Wing Fuel Tank (CWT).** A fuel tank located in the center of an airplane’s wing box. These tanks are typically located within the fuselage contour but may extend outside the fuselage contour into the wing.

9. **Continued Airworthiness.** Certified aircraft, engines, propellers, and appliances are safe to operate for the intended purpose; they are maintained safely throughout their service life; the product meets its type design and is in a condition for safe operation.

10. **Critical Design Configuration Control Limitations (CDCCL).** An AL that preserves a critical feature of the airplane needed for the flammability reduction means (FRM) or ignition mitigation means (IMM) to perform their intended function and prevent the occurrence of an unsafe condition. The purpose of the CDCCL is to provide instructions to ensure these critical features are present throughout the life of the airplane (e.g., when alterations, repairs, or maintenance actions occur).

11. **Design Approval Holder (DAH).** The holder of any design approval, including type certificate (TC), amended TC, Supplemental Type Certificate (STC), amended STC, Parts Manufacturer Approval (PMA), Technical Standard Order Authorization (TSOA), letter of TSO design approval, and field approvals. In particular contexts, the term DAH may also refer to applicants for design approvals.

12. **FAA Oversight Office.** The responsible Aircraft Certification Service office or office of the Transport Airplane Directorate having oversight responsibility for the relevant TC or STC, as determined by the Administrator. (See Appendix C, FAA Oversight Offices, for a listing of appropriate offices.)

13. **Field Approval.** A design approval of a major repair or major alteration of an individual aircraft, aircraft engine, propeller, or appliance by an aviation safety inspector (ASI). This is documented by completing and signing Block 3 of FAA Form 337, Major Repair and Alteration (Airframe, Powerplant, Propeller, or Appliance). We approve these major repairs or alterations by either examining data only or by physically inspecting, demonstrating, or testing the product.

14. **Flammability Impact Mitigation Means (FIMM).** Modifications developed by the DAH for auxiliary fuel tanks that are required by Title 14 of the Code of Federal Regulations (14 CFR) part 26 to have an FRM or IMM installed. FIMM are only needed when the DAH or operator has determined that an auxiliary fuel tank installed by STC or field approval could have an adverse impact on the performance of an FRM or IMM.

15. **Flammability Reduction Means (FRM).** Any system or feature intended and designed to reduce the flammability exposure of a fuel tank either by affecting oxygen levels or by affecting fuel vapor concentration levels.

16. **Flammable (With Respect to a Fluid or Gas).** Susceptible to igniting readily or to exploding (14 CFR part 1). A non-flammable ullage is one where the fuel-air vapor is too lean or too rich to burn or is inert as defined below. For this AC, a fuel tank vapor space is considered flammable when the bulk average fuel temperature within the tank is within the flammable range for the fuel type being used. For any fuel tank that is subdivided into sections by baffles or compartments, the tank is considered flammable when the bulk average fuel temperature within any section of the tank is within the flammable range for the fuel type being used.

17. **Flight Standards Service (FS) Offices.** FAA offices responsible for developing guidance and policy applicable to transport category airplanes for AED and FS personnel (Airworthiness and Operations ASIs) in the conduct of their responsibilities.

18. **Fuel Types.** The Aircraft Flight Manual (AFM) lists the approved-for-use fuels for a given airplane type. Each fuel type has its own properties; those directly related to flammability are flash point and distillation characteristics. Property differences can occur in different batches of a given fuel type because of variations in the properties of the source crude oil and the refining process used to produce the fuel. The most widely used fuel types are JET-A/JET-A1 (with older airplanes approved for use of JET-B

(JP-4)), per ASTM International Specification D1655-11b, Standard Specification for Aviation Turbine Fuels.

19. **Hazardous Atmosphere.** An atmosphere that may expose maintenance personnel, passengers, or flightcrew to the risk of death, incapacitation, impairment of ability to self-rescue (escape unaided from a confined space), injury, or acute illness.

20. **Ignition Energy.** The minimum amount of energy required to ignite fuel vapors.

21. **Ignition Mitigation Means (IMM).** A system or feature intended and designed to prevent overpressure of a fuel tank following ignition of fuel or vapor in the tank.

22. **Inert.** When the bulk average oxygen concentration within each compartment of the fuel tank is 12 percent or less from sea level up to 10,000 feet altitude, then linearly increasing from 12 percent at 10,000 feet to 14.5 percent at 40,000 feet altitude, and extrapolated linearly above that altitude.

23. **Inerting.** A process where a noncombustible gas is introduced into the ullage of a fuel tank so that the ullage becomes non-flammable.

24. **Instructions for Continued Airworthiness (ICA).** Documentation that sets forth instructions and requirements for maintenance that is essential to the continued airworthiness of an aircraft, engine, or propeller.

25. **Main Fuel Tank.** Title 14 CFR § 25.981(b)(3)(iii) defines the main fuel tank as: "…a fuel tank that feeds fuel directly into one or more engines and holds required fuel reserves continually throughout each flight." The functions of the main tanks are immediately available and operate without immediate supervision by the flightcrew in the event of failure or inadvertent depletion of fuel in an auxiliary tank. Generally, main tanks are those dedicated to the feed of the engines during engine feed isolation.

26. **Maintenance Instructions.** Recommended periods for cleaning, inspection, adjustment, testing, lubrication, degree of inspection, applicable wear tolerances, and recommended work necessary for each part of the airplane and its engine auxiliary power units (APU), propellers, accessories, instruments, and equipment to provide for continued airworthiness of the airplane. Recommended overhaul periods and necessary cross-references to the ALS of the maintenance manual are also included (refer to 14 CFR part 25 appendix H and § 25.3(b); and AC 26-1, Part 26, Continued Airworthiness and Safety Improvements, Appendix A, Maintenance Instructions, for additional information).

27. **Maintenance Review Board Report (MRBR).** Document intended for use by air carriers. It contains the initial minimum scheduled maintenance and inspection requirements for a particular transport category aircraft and on-wing engine program. Air carriers use the MRBR and its associated requirements to develop maintenance programs. (Refer to AC 121-22, Maintenance Review Boards, Maintenance Type Boards, and Original Equipment Manufacturer/Type Certificate Holder Recommended Maintenance Procedures, for additional information.)

28. Maintenance Significant Items (MSI).

28.1 Under the Maintenance Steering Group – 3rd Task Force (MSG-3), MSI are items identified by the DAH whose failure could cause one of the following effects:

- It could affect safety on the ground or in flight,
- It could be undetectable during operations,
- It could have a significant impact on operations, or
- It could have a significant economic impact.

28.2 In terms of development of maintenance and inspection instructions, MSI include systems, subsystems, modules, components, accessories, units, and parts.

29. Maintenance Steering Group – 3rd Task Force/4th Task Force (MSG-3/MSG-4). A voluntary structured process developed by the industry and maintained by Airlines for America (A4A) to make decisions used to develop maintenance and inspection tasks and intervals for an airplane.

30. Maintenance Working Group (MWG). A working group of maintenance specialists from participating operators, the prime manufacturer, and the regulatory authority whose function is to develop airplane maintenance programs.

31. Maximum Payload Capacity. Is defined in 14 CFR part 119.

32. Normally Emptied. Defined in 14 CFR § 26.31(b) as "…a fuel tank other than a Main Fuel Tank." Main Fuel Tank is defined in 14 CFR § 25.981(b), and expanded above.

33. Operational. With regard to ground-conditioned air, operational means the ground air source is functional and has the capacity to provide air to the airplane.

34. Operator. Person who uses, causes, or authorizes another to use aircraft for air navigation, including piloting the aircraft.

35. Transport Category Airplanes. For the purposes of this AC, the group consists of turbine-powered transport category airplanes, provided that the TC for the airplane was issued after January 1, 1958, and that the airplane has either a maximum type certificated passenger capacity of 30 or more, or a maximum payload capacity of 7,500 pounds or more, resulting from the original certification of the airplane.

APPENDIX C. FAA OVERSIGHT OFFICES

Airplane Manufacturer	FAA Oversight Office
ATR – GIE Avions de Transport Régional	International Validation Branch (AIR-730)
Airbus	International Validation Branch (AIR-730)
BAE	International Validation Branch (AIR-730)
Boeing—Seattle Area	West Certification Branch (AIR-770) and/or Integrated Certificate Management Office (AIR-500)
Bombardier	East Certification Branch (AIR-750)
EADS CASA	International Validation Branch (AIR-730)
deHavilland	East Certification Branch (AIR-750)
Dornier	International Validation Branch (AIR-730)
Embraer	International Validation Branch (AIR-730)
Fokker	International Validation Branch (AIR-730)
Lockheed Martin	East Certification Branch (AIR-750)
Boeing—Long Beach (McDonnell-Douglas)	West Certification Branch (AIR-770) and/or Integrated Certificate Management Office (AIR-500)
SAAB	International Validation Branch (AIR-730)

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Subject: AC 120-98B, Operator Information for Incorporating Fuel Tank Flammability Reduction Requirements into a Maintenance and/or Inspection Program

Date: _____

Please mark 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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