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Advisory Circular

Subject: Operator Requirements for
Incorporation of Fuel Tank
Flammability Reduction
Requirements

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FOREWORD

On July 21, 2008 the Federal Aviation Administration (FAA) published the 2008 Fuel Tank Flammability Reduction (FTFR) rule, Reduction of Fuel Tank Flammability in Transport Category Airplanes. The rule became effective on December 26, 2008 and it included amendments to Title 14 of the Code of Federal Regulations (14 CFR) parts 25, 26, 121, 125, and 129. The new rules require manufacturers and operators of certain transport category airplanes to take steps that in combination with the required ignition reduction rule that was previously enacted 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 the flammability in fuel tanks that are most at risk. The rules include requirements to incorporate either Flammability Reduction Means (FRM) such as nitrogen inerting or Ignition Mitigation Means (IMM) such as polyurethane foam, into airplanes with high flammability fuel tanks to prevent fuel tank explosions.

ORIGINAL SIGNED by
Chester Dalbey for

John M. Allen
Director, Flight Standards Service

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CHAPTER 1. GENERAL

1-1. PURPOSE. This advisory circular (AC) provides information and describes an acceptable means of compliance for operators to comply with the fuel tank flammability safety requirements of Title 14 of the Code of Federal Regulations (14 CFR) parts 121, 125, 129 and 14 CFR as amended by the 2008 Fuel Tank Flammability Reduction (FTFR) rule.

a. Regulatory Basis of the AC. The rule requires the design approval holder (DAH) to develop the Flammability Reduction Means (FRM) or Ignition Mitigation Means (IMM). It requires Boeing to incorporate FRM or IMM on newly produced passenger and cargo airplanes through a new requirement that affects U.S. Production Certificate holders. It also prohibits operation of airplanes with high flammability tanks that are produced after December 27, 2010, unless those airplanes incorporate FRM or IMM. This has the effect of requiring Airbus airplanes produced after that date to incorporate FRM or IMM before they can be operated under parts 121, 125, or 129. The operating rules also require operators of certain existing passenger airplanes to incorporate FRM or IMM through a retrofit program. Additionally, the rule requires a Flammability Exposure Analysis and an Impact Assessment of auxiliary fuel tanks be performed by the DAH for certain transport category airplanes. This AC specifically addresses the requirements in the FTFR rule that are included in the amendments to parts 121, 125, and 129, and describes acceptable means of compliance accordingly. AC 25.981-2A, Fuel Tank Flammability Reduction Means provides guidance for compliance with the amendments to parts 25 and 26 that are contained in the FTFR rule.

b. Compliance. This material is neither mandatory nor regulatory in nature and does not constitute a regulation. It describes acceptable means, but not the only means, for demonstrating compliance with the applicable regulations. The FAA (we) 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. On the other hand, if we become aware of circumstances that convince us that following this AC would not result in compliance with the applicable regulations, we will not be bound by the terms of this AC, and we may require additional substantiation or design changes as a basis for finding compliance.

c. Change. This material does not change or create any additional regulatory requirements nor does it authorize changes in or permit deviations from existing regulatory requirements.

d. Applicability. 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.

e. Requirements. The requirements stated in the FTFR rule and emphasized here improve Fuel Tank Safety (FTS) by incorporating either FRM such as nitrogen inerting or IMM such as polyurethane foam, into airplanes with high flammability fuel tanks to prevent fuel tank explosions. The fuel tank flammability safety standards in 14 CFR part 26 subpart D, require DAHs to conduct flammability assessments and develop service instructions for those airplanes with high flammability fuel tanks. The DAH for auxiliary fuel tanks in the 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 improvements. Any adverse effects must be mitigated by design changes defined as Flammability Impact Mitigation Means (FIMM).

f. High Flammability Fuel Tanks. Operators of certain large U.S.-registered airplanes with high flammability fuel tanks are required by the operational rules to incorporate FRM or IMM and any FIMM into their existing fleet if those design changes are required by part 26, subpart D. Newly manufactured airplanes added to an operator's fleet must also meet the new fuel tank safety standards contained in part 26, § 26.33, Holders of type certificates: Fuel tank flammability. Information included here assists operators in complying with the operational requirements for newly produced airplanes as well as retrofitting existing airplanes.

g. Maintenance/Inspection Tasks. In addition to incorporating either the FRM or IMM system into their airplanes, the operators must incorporate all the related FAA Oversight Office (engineering-approved) maintenance/inspection tasks hereby referred to as instructions for continued airworthiness (ICA) into their respective maintenance/inspection programs for newly purchased airplanes, and for retrofitted airplane installations. All of these ICA will be identified in the manufacturer's respective Airworthiness Limitation Section (ALS). There is some additional ICA outside the ALS, located in respective Maintenance Review Board Report (MRBR) documents that are not FAA Oversight Office-approved, and are not necessarily mandated to be operator incorporated. These ICA that are in some MRBR revisions, and reflected in associated Maintenance Planning Document (MPD) revisions, are to be handled by the operators as are other revisions. Specifically, new entrant operators must incorporate MRBR revisions; however existing operators are encouraged to incorporate them, but are not mandated to incorporate them.

h. Auxiliary Fuel Tanks Installed by a Field Approval. If an operator has auxiliary fuel tanks installed on any of their transport category airplanes by a field approval, they are the DAH for such installations and they are required by § 26.35, Changes to type certificates affecting fuel tank flammability, to perform a Flammability Exposure Analysis and an Impact Assessment, develop design-required changes, and revise the ICA, as appropriate.

1-2. APPLICABILITY. This AC is directed to parts 121, 125, and 129 operators of certain large transport airplanes with high flammability fuel tanks (part 91 and part 135 operators are not included). Operators must incorporate FRM, IMM, or FIMM into their fleets of applicable airplanes by the dates specified in the applicable rule.

a. Flammability Requirements. The part 26 fuel tank flammability requirements (referred to as DAH requirements in this AC) are intended to ensure service instructions needed by operators to comply with the associated fuel tank flammability safety rules in parts 121, 125 and 129 are provided in a timely manner. These DAH requirements apply to type certificate (TC) holders, Supplemental Type Certificate (STC) holders, and operators of certain larger transport category airplanes with field approvals for auxiliary fuel tanks. The provisions of part 26 require the affected DAH for large transport airplanes, as described below, to develop compliance plans and conduct fuel tank flammability assessments for the airplane fuel tanks, including auxiliary fuel tanks. TC holders must develop service instructions for all fuel tanks that are determined to be high flammability. DAHs for auxiliary fuel tanks installed by STC and field approvals must develop service instructions for auxiliary fuel tanks installed that adversely impact an FRM or

IMM installed to meet the flammability requirements. As with other part 26 regulations, DAHs must develop compliance plans that are submitted and approved by the Federal Aviation Administration (FAA) so that timely availability of service instructions needed by the operators to comply with the operational requirements is achievable. The related documents section includes separate ACs that provide details of specific compliance processes for part 26 regulations.

b. Affected Airplane Models. For an airplane to be affected by the operational fuel tank flammability regulations, the following must apply:

(1) Large transport airplane with a passenger capacity of 30 passengers or more, or a maximum payload of 7,500 pounds or more, and

(2) Original Airworthiness Certificate issued on or after January 1, 1992, and

(3) Have fuel tank(s) determined to be high flammability, based upon a flammability assessment as defined in the applicable sections of part 26.

c. Impact Assessment. The DAH for any fuel tank intended to be normally emptied that is approved for installation on any airplane models shown in Table 1 by an STC or a field approval before December 26, 2008 (and applicants for new STCs for fuel tanks intended to be normally emptied) must conduct an Impact Assessment of their design changes to determine if the tank installation compromises any critical design configuration control limitations (CDCCL) developed by the TC holder. If it is determined that the auxiliary fuel tank installation has an adverse impact, then design modifications named FIMM must be developed.

TABLE 1. DAH—NORMALLY EMPTIED

Boeing	Airbus
747 Series	A318, A319, A320, A321 Series
737 Series (except -100/200)	A300, A310 Series
777 Series	A330, A340 Series
767 Series	
757 Series	

d. Determining Applicability for Specific Airplanes Within Operator's Fleet.

(1) The operational rules do not require modification of older airplanes certificated prior to January 1, 1992 unless they are operated in passenger service beyond 2017. The need to incorporate FRM or IMM into specific airplanes within an operator's fleet depends upon the date of issuance of the original Certificate of Airworthiness. Operators may determine if individual airplanes in their fleet received an original Certificate of Airworthiness on or after January 1, 1992, by checking with the manufacturer, or via the Web at

<http://registry.faa.gov/aircraftinquiry/>. At the Web site, simply enter the airplane N number, or serial number, and refer to the block labeled “A/W Date.”

(2) Some specific airplanes of certain model types listed in Table 1, such as certain A320, A330, 767 and 777 airplanes, do not have center wing fuel tanks (CWT) installed. The operator’s retrofit service information for the FRM/IMM should only include the airplanes identified in Table 1 that have CWT that require FRM or IMM, and received their original Certificate of Airworthiness on or after January 1, 1992.

1-3. BACKGROUND.

a. Explosions. Fuel tank explosions have been a threat with serious aviation safety implications for many years. Since 1959, 18 fuel tank explosions have occurred on transport category airplanes. Most notably, on July 17, 1996, a Boeing 747-100 series airplane, operating as TWA Flight 800, broke up in-flight 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 CWT due to ignition of the flammable fuel and air mixture in the tank. The source of ignition energy for the explosion could not be determined conclusively, though the most likely cause was determined to be a wiring failure outside the CWT, between the fuel quantity indicator system (FQIS) wires and another airplane circuit that carried high electrical energy, and a second wiring failure inside the tank that created a potential arc gap between the two FQIS circuits. Such a failure outside the CWT could have allowed excessive electrical energy to enter the CWT through electrical FQIS wiring and create the spark that ignited the flammable vapors inside the fuel tank. This accident, in particular, prompted the FAA to examine the underlying safety issues surrounding fuel tank explosions, the adequacy of existing regulations, the service history of airplanes certificated to these regulations, and existing fuel tank system maintenance practices.

b. Design Review. On May 7, 2001, the FAA published the 2001 Fuel Tank Safety (FTS) rule, Transport Airplane Fuel Tank System Design Review, Flammability Reduction and Maintenance and Inspection Requirements. It required operators to incorporate design changes and instructions for maintenance and inspection of the fuel tank systems of certain airplanes, specifically targeting potential fuel tank system ignition sources. AC 120-97, Incorporation of Fuel Tank System Instructions for Continued Airworthiness into Operator Maintenance or Inspection Programs, dated June 18, 2008, specifically addresses the ignition source prevention aspect of the FTS objective.

c. Fuel Tank Flammability Reduction Rule. On July 21, 2008, the FAA published the 2008 FTFR rule, Reduction of Fuel Tank Flammability in Transport Category Airplanes. The FTFR rule contains new requirements for DAHs and operators of larger transport airplanes adopted by amendments to parts 25, 26, 121, 125, and 129. In general, the DAH requirements do not apply to operators unless they have STCs or field approvals for the installation of auxiliary fuel tanks in the applicable airplanes. Operators, however, should be aware of the DAH requirements since they rely on the DAHs (airplane TC and auxiliary fuel tank STC holders) to support compliance with the operational requirements. A summary of the DAH requirements as they relate to operators, as well as the operational requirements is detailed herein.

d. Mandate. The FTFR rule requires manufacturers and operators of certain transport category airplanes to take steps that, in combination with the fuel tank ignition source reduction required by the 2001 FTS rule, should greatly reduce the chances of a catastrophic fuel tank explosion. 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 this final rule mitigate the effects of such flammability exposure and limit it to acceptable levels by mandating the installation of either an FRM or an IMM for fuel tanks that are most at risk. As stated in the rule preamble, the FRM final rule does not direct the adoption of any specific inerting technology either by manufacturers or operators. Instead, it establishes a performance-based set of requirements that set acceptable flammability exposure values for tanks most prone to explosion.

1-4. RELATED 14 CFR REGULATIONS.

a. Part 25:

- Section 25.5, Incorporations by reference.
- Section 25.981, Fuel tank ignition prevention.
- Appendix M to Part 25—Fuel Tank System Flammability Reduction Means.
- Appendix N to Part 25—Fuel Tank Flammability Exposure and Reliability Analysis

b. Part 26:

- Section 26.5, Applicability Table.
- Section 26.31, Definitions.
- Section 26.33, Holders of type certificates: Fuel tank flammability.
- Section 26.35, Changes to type certificates affecting fuel tank flammability.
- Section 26.37, Pending type certification projects: Fuel tank flammability.
- Section 26.39, Newly produced airplanes: Fuel tank flammability.

c. Part 121, § 121.1117, Flammability reduction means.

d. Part 125, § 125.509, Flammability reduction means.

e. Part 129, § 129.117, Flammability reduction means.

1-5. RELATED READING MATERIAL.

a. Obtain a Copy of the Final Rule. An electronic copy of the final rule can be downloaded from the Internet at <http://www.airweb.faa.gov/rgl>. A paper copy may be ordered from the U.S. Department of Transportation, Subsequent Distribution Office, M-30, Ardmore East Business Center, 3341 Q 75th Avenue, Landover, MD 20795. The docket file for the rulemaking, that contains comments and pertinent information, can be accessed on the Internet at <http://www.regulations.gov>. Select simple search and enter the docket number for the rulemaking, 22997.

b. Advisory Circulars. The ACs listed below also provide information that may support the method of compliance established here. An electronic copy of the following ACs can be downloaded from the Internet at <http://fsims.faa.gov/>. The Regulatory and Guidance Library (RGL) is a set of searchable databases that contain regulatory, guidance, and aviation product information. The RGL contains certain CFRs and Special Federal Aviation Regulations (SFARs) from 14 CFR in their current version as well as historical versions. A paper copy may be ordered from the U.S. Department of Transportation, Subsequent Distribution Office, M-30, Ardmore East Business Center, 3341 Q 75th Avenue, Landover, MD 20795.

- AC 25-8, Auxiliary Fuel System Installations.
- AC 25.981-2A, Fuel Tank Flammability Reduction Means.
- AC 26-1, Part 26, Continued Airworthiness and Safety Improvements
- AC 120-97, Incorporation of Fuel Tank System Instructions for Continued Airworthiness into Operator Maintenance or Inspection Programs.

c. FAA Orders. Order 8110.104, Responsibilities and Requirements for Implementing Part 26 Safety Initiatives, effective December 3, 2007.

d. FAA Policy Statements. An electronic copy of the following Policy Statements can be downloaded from the Internet at <http://www.airweb.faa.gov/rgl>. A paper copy may be ordered from the Federal Aviation Administration, Transport Airplane Directorate, Transport Standards Staff, Standardization Branch, ANM-113, 1601 Lind Avenue SW., Renton, WA 98057-3356.

(1) PS-ANM112-05-001, Process for Developing SFAR 88-related Instructions for Maintenance and Inspection of Fuel Tank Systems, October 6, 2004.

(2) PS-ANM110-7-12-2005, Safety—A Shared Responsibility—New Direction for Addressing Airworthiness Issues for Transport Airplanes, issued July 6, 2005, effective July 12, 2005.

e. Manufacturer's Service Letters. Boeing Service Letter SL-21-007, dated May 5, 2000.

CHAPTER 2. REDUCTION OF FUEL TANK FLAMMABILITY—OPERATOR

2-1. REQUIREMENTS OVERVIEW. This AC provides information to support operators' compliance with the fuel tank flammability rule. The operational rules contained in 14 CFR part 121, § 121.1117, part 125, § 125.509, and part 129, § 129.117 require operators to comply with the following:

a. New Production Airplanes. Upon delivery of new production airplanes with FRM/IMM installed, incorporate into their maintenance program all applicable FAA Oversight Office-approved airworthiness limitation items (ALI) and ICA after being submitted to the principal maintenance inspector (PMI) for review and approval.

b. Field-Approved Auxiliary Fuel Tanks. If installed, perform a Flammability Exposure Analysis for field-approved auxiliary fuel tanks on all Transport Category Airplanes and provide the data to the FAA Oversight Office for review and approval. If the tank affects the flammability of a fuel tank in which FRM or IMM are installed, develop and implement FIMM.

c. Retrofit Schedules. Install an FAA-approved FRM/IMM system into the applicable airplanes in accordance with (IAW) one of the two retrofit schedules provided in the rule.

d. Incorporation into Maintenance Program. Upon the commencement of the retrofit installations, incorporate into their maintenance program all applicable FAA Oversight Office-approved ALI and ICA after being submitted to the PMI for review and approval via newly developed operations specifications (OpSpecs).

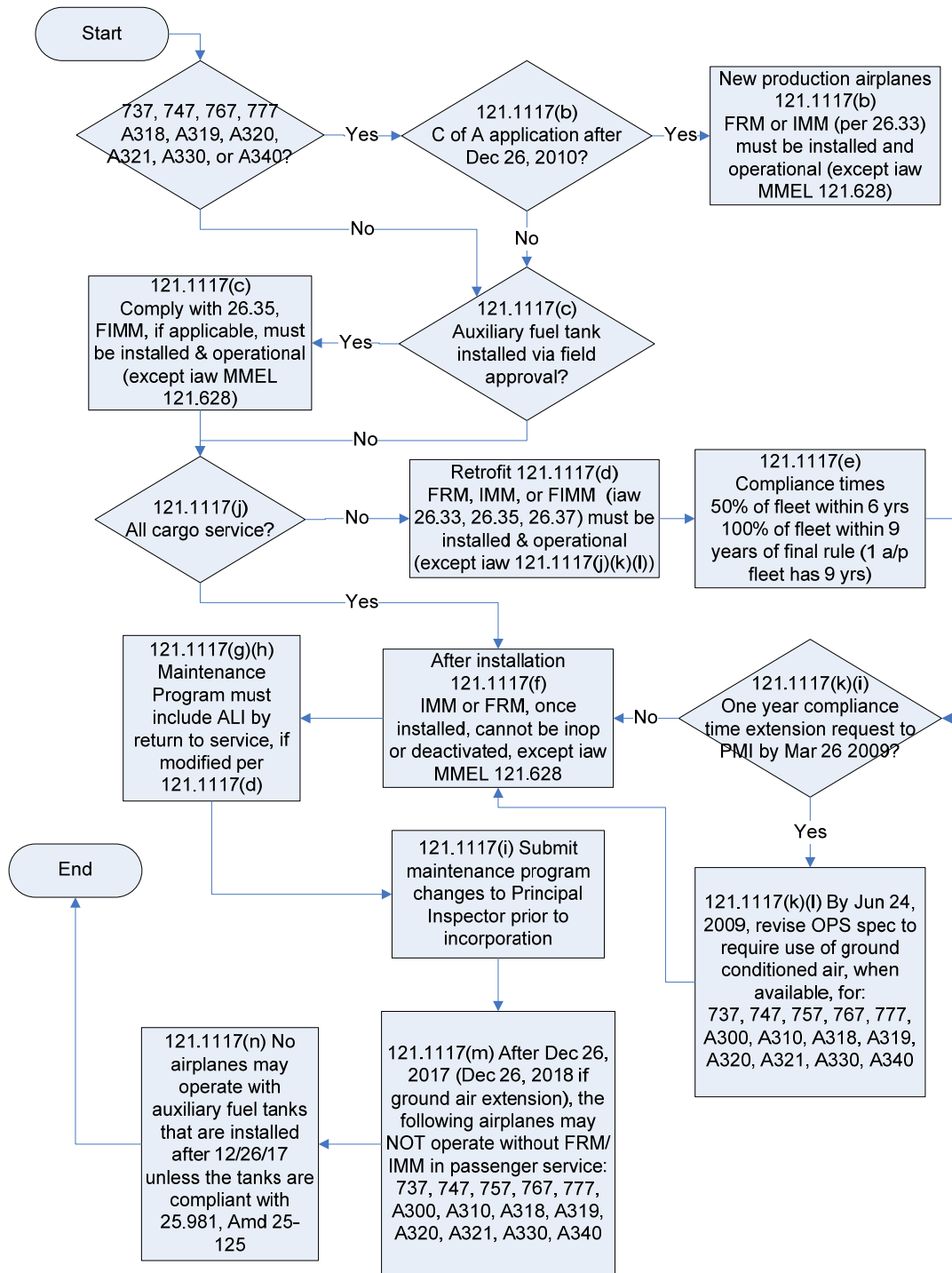
e. STC Auxiliary Fuel Tanks. If STC auxiliary fuel tanks are installed, incorporate into their maintenance program all applicable FAA Oversight Office-approved ALI and ICA after being submitted to the PMI for review and approval via newly developed OpSpecs.

NOTE: Operators are ultimately responsible for complying with the requirements for FRM, IMM, and FIMM for affected airplanes in their fleet. For fuel tanks installed by field approval, where the operator is the DAH, or in the unlikely situation where the DAH does not provide service instructions and the associated analyses, the operator must show compliance to the operational requirements. Operators are encouraged to contact DAH for the airplane and any auxiliary fuel tanks installed on their airplanes affected by the new regulations to verify that all necessary analyses and design modifications are developed in time to support the operational compliance dates.

NOTE: The flowchart below provides operators with a compliance overview.

1. FUEL TANK SAFETY OPERATIONAL RULES 121.1117

Fuel Tank Safety Operational Rules 121.1117



Recommendations:

- 1) If operator has an STC for an auxiliary fuel tank, contact the STC holder as soon as possible
- 2) If operator has Airbus airplanes scheduled for delivery after Dec 26, 2010, contact Airbus to ensure deliveries will be compliant

Note: Part 125 is the same as this Part 121 process except that the one year extension is not available for Part 125

2-2. NEW PRODUCTION AIRPLANES—FRM/IMM INSTALLATION.

a. Incorporate ICA into Maintenance Program. Operators who take delivery of newly produced airplanes that have either FRM or IMM installed must incorporate the related FAA Oversight Office-approved ICA into their maintenance program. These approved ICA include ALI located in the respective manufacturer's ALS document. These ALS consist of mandatory repetitive maintenance/inspection tasks at specific frequencies, as well as CDCCL items.

b. Example. The Boeing Airplane Company is currently installing an FRM into their newly produced B-737 airplane models. This system is a nitrogen generation system referred to as an Inert Gas System (Air Transport Association of America (ATA) Chapter 47). All of the ICA for the maintenance and inspection of this system are located in their respective Maintenance Planning Data (MPD) Documents section 9, which is their FAA-approved ALS. It is the operator's responsibility to incorporate all these ICA into their respective maintenance program. In order to accomplish this task the operator must submit their proposed FRM/IMM program to the PMI for review and approval.

2-3. EXISTING AIRPLANES—FRM/IMM RETROFIT INSTALLATION.

a. Operational Compliance Time Line—Baseline.

(1) Operators of passenger airplanes, if FRM or IMM are required by §§ 26.33, 26.35, or 26.37, must incorporate FRM or IMM into those airplanes within 9 years after the effective date of the rule. The incorporation of the modifications to the operator's fleet is intended to be phased into their fleets over a 9-year period so that all airplanes in an operator's fleet will meet the new fuel tank safety standards. To achieve this result an interim compliance date is included in the operational rules. Fifty percent of the airplanes must be retrofitted within 6 years of the effective date of the rule. Once FRM/IMM is installed into a particular airplane, it must remain installed, and be operational, except IAW the applicable Master Minimum Equipment List (MMEL) conditions and limitations.

(2) In addition to incorporating the FRM/IMM system into the airplanes IAW the time line, the operators must, before returning each airplane to service after the retrofit, incorporate into their maintenance program all applicable FAA Oversight Office-approved ALI after being submitted to the PMI for review and approval.

NOTE: Parts 121 and 129 U.S. operators may choose to extend the compliance times (interim and final date) by 1 year if they adopt ground-conditioned air use for the airplanes that are required to incorporate FRM or IMM. (See paragraph 202b for details.)

(3) Existing all-cargo configured airplanes are excluded from the part 26 FRM/IMM retrofit requirements. However, newly manufactured Boeing and Airbus airplanes, both passenger and cargo, that have an original airworthiness certificate issued after December 27, 2010 that are added to an operator's fleet must have the CWT FRM/IMM installed to meet the requirements of § 26.39. These airplanes are not included when determining compliance with the operator's 50 percent interim requirement. If a registered passenger use

airplane that has had FRM/IMM retrofitted is converted to a cargo use airplane, the FRM/IMM system must remain operational.

(4) In accordance with the operational rules in §§ 121.1117(e)(1), 125.509(e)(1), and 129.117(e)(1) the operators are required to comply with the interim compliance dates to retrofit CWT FRM or IMM into 50 percent of their affected airplanes (those with high flammability CWT) by December 26, 2014. The 50 percent figure is to be determined based on all airplanes in an operator's fleet that are required to be modified under this rule and that are being operated by an operator 6 years after the effective date of this rule, i.e., the percentage is determined at the end of the 6-year period. Newly delivered airplanes that received an airworthiness certificate 24 months after the effective date of the rule are not included in the calculation of the percentage of airplanes in the operator's fleet that must be modified to meet the interim 50 percent requirement. The 50 percent figure is based on all airplanes that have high flammability CWT required to be modified that are on their OpSpecs 6 years after the effective date of this rule (pre-January 1, 1992 airplanes are not included). Any applicable airplanes with high flammability fuel tanks transferred or added to the fleet prior to the interim date, requiring retrofit before the 9-year end date, would be included in the operator's fleet at the interim compliance date. The regulation also requires that once an FRM is installed and in use it must remain installed and be operational except IAW the provisions of the applicable MMEL. Retrofit of the remainder of the fleet must be achieved prior to the final compliance date. However, operators may add other airplanes to their OpSpecs with high flammability fuel tanks after the 6-year interim compliance date, such that the percentage of airplanes with high flammability fuel tanks rises above the 50 percent value, provided they meet 100 percent at the final compliance date.

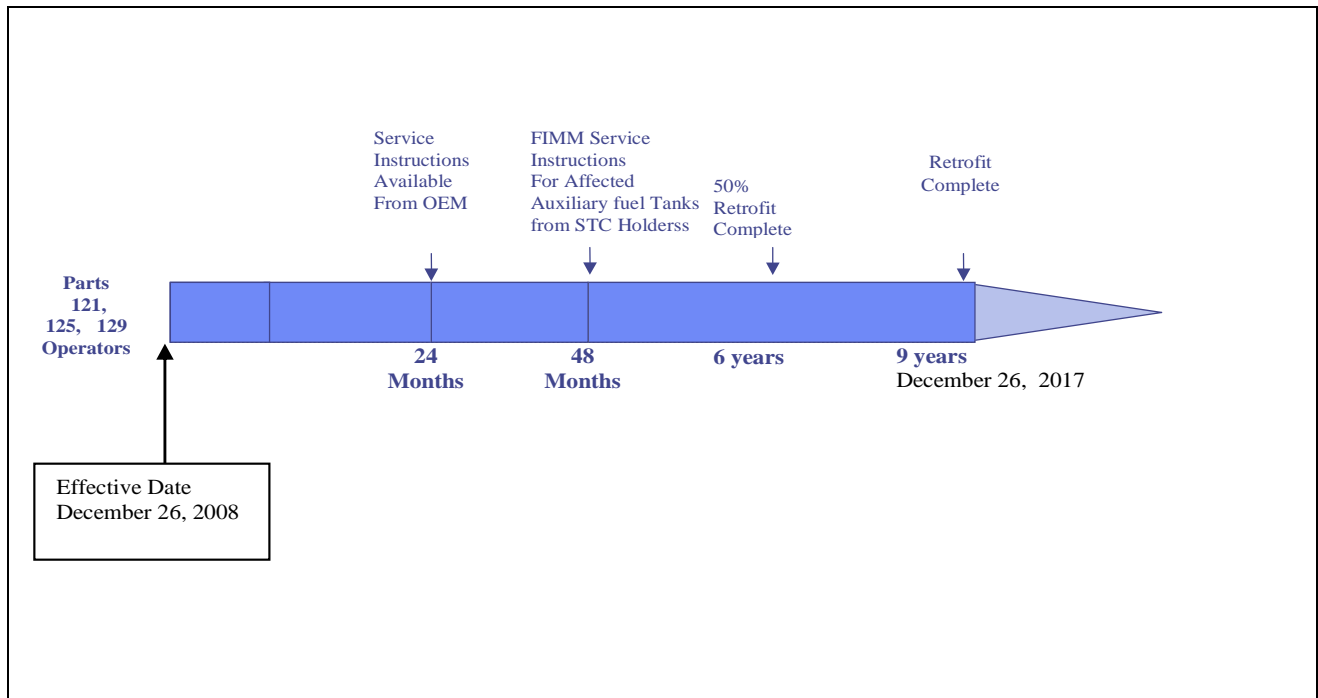
(5) As stated in the rules, newly manufactured airplanes are not to be included in the operator's 50 percent retrofit count. The 50 percent retrofit only includes those airplanes currently in the operator's fleet that must be modified. New production airplanes with original Certificates of Airworthiness issued after December 2010 must meet the flammability requirements at delivery and are not to be included as part of the 50 percent of the existing fleet which must meet this requirement. For example, if as of December 26, 2014 the operator has 50 airplanes with high flammability fuel tanks that were issued an original airworthiness between January 1, 1992, and December 27, 2010, 25 airplanes within the total operator's fleet would be required to have FRM or IMM prior to December 26, 2014 (December 26, 2015 if the ground air use option is selected by the operator).

(6) In 2006, Boeing began installing provisions for FRM into their production lines for their 737 and 747 airplanes. The provisions included wiring, structural mounting points, and in-tank tubing. The intent of these provisions was to reduce airplane downtime for operator-incorporated FRM. Installation of the in-tank hardware may eliminate the need for tank entry, so installation of an FRM should require significantly less downtime on those particular airplanes. Operators that have taken delivery of such airplanes should contact Boeing to determine if a particular airplane had the provisions installed. This information could affect the operator's retrofit schedule and help minimize the downtime of the respective airplanes.

(7) The interim compliance date requirement does not apply to operators that have only one airplane requiring modification. That airplane must be modified by December 26, 2017.

NOTE: To avoid interruption and achieve timely retrofit compliance, operators should consider providing their FAA Flight Standards certificate-holding district office (CHDO) a matrix that contains, by N-registration number and fleet type, a listing of what airplanes in their fleet will require the retrofit installation of FRM or IMM. An agreement between the operator and CHDO should be made as to how ongoing compliance with the retrofit installation will be communicated and tracked.

2. OPERATIONAL COMPLIANCE TIME LINE—BASELINE



b. Operator Compliance Time Line—Ground-Conditioned Air Use Option.

(1) The operational requirements of parts 121 and 129 allow a one-year extension for retrofit of the operator's fleet if the operator elects to create a Ground-Conditioned Air Program that ensures the use of ground-conditioned air for all airplanes on their FRM/IMM retrofit list. Specifically, the use of ground-conditioned air in lieu of using the high temperature auxiliary power unit's (APU) pneumatic air to operate the air conditioning packs will reduce the heat input into the CWT. The use of ground-conditioned air would then be required for any airplane on the list where actual gate times exceed 30 minutes, where ground-conditioned air is available at the gate and is operational, and the ambient temperature exceeds 60 degrees F.

(2) This optional provision of the rules is in response to requests for more time to retrofit FRM while providing compensating risk reduction by use of ground-conditioned air, which reduces flammability for airplanes during ground and initial flight operations. It is important to note that the ground-conditioned air provision in this rule is not a new procedure that was written by the FAA for the purposes of this rule. This proviso is adopted from a Boeing Service Letter that was released to the industry in May, 2000 to mitigate the risk associated with

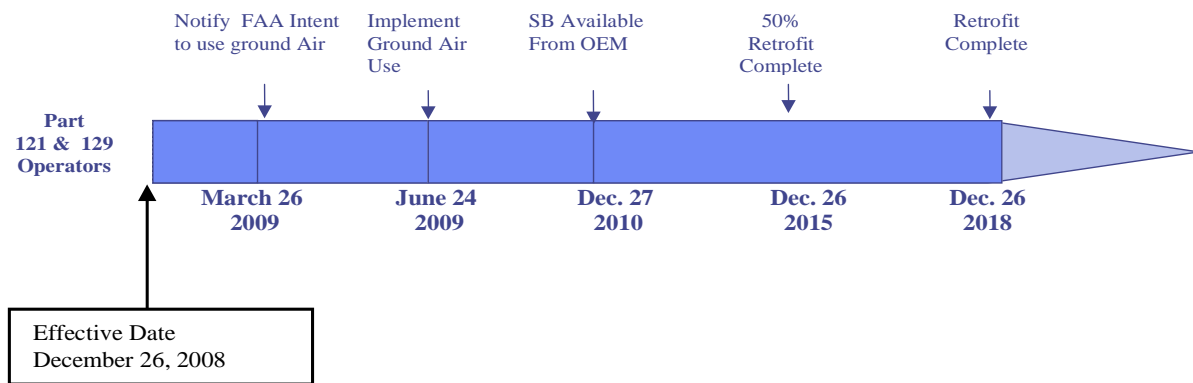
the heated center tank problem. Additionally, the FAA corresponded with the NTSB on May 17, 2000 and indicated the FAA’s commitment to advocate the industry use of ground-conditioned air (see Appendix 4). To date, the FAA has only received one comment from industry indicating the use of ground-conditioned air is not practical. Therefore the FAA, along with Boeing, continues to advocate this policy and recommend it for use in this rule.

(3) This compliance date extension provision is not included in part 125 because these airplanes are typically not parked at gates where ground-conditioned air is available. Also, these operators typically only operate one or very few airplanes subject to this rule, so they will not encounter the difficulties that ATA identified in scheduling large fleets of airplanes for modifications. These operators are encouraged to use ground-conditioned air when available.

(4) For purposes of this provision, actual gate time is the time when the airplane is parked at a gate for servicing and passenger egress and ingress, and ambient temperature is the official National Weather Service temperature at the airport.

(5) If scheduled gate time is 30 minutes or less, but departure is delayed so that the airplane is parked for more than 30 minutes, the use of ground-conditioned air is required for any period longer than 30 minutes, if the ambient temperature exceeds 60 degrees F. This ensures that heating of tanks (and resulting increased flammability) is limited. “Available” in this context means installed at the gate. “Operational” means that the system is working, so that an operator is not in violation simply because ground-conditioned air is out of service for maintenance.

3. OPERATIONAL COMPLIANCE TIME LINE—GROUND-CONDITIONED AIR USE OPTION



2-4. COMPLIANCE DATE EXTENSION PROCEDURES FOR GROUND-CONDITIONED AIR USE.

a. Notification and Submission of Program. This provision requires part 121/129 U.S.-registered aircraft operators to notify their FAA Flight Standards CHDO in writing, no later than March 26, 2009, of their intention to institute a Ground Conditioned Air Program for use on the airplanes that will require FRM or IMM retrofit. No later than June 24, 2009, the part 121/129 U.S.-registered aircraft operators must submit their proposed program, including all applicable manual instructions, to the CHDO for review and approval. Upon approval, a new OpSpec paragraph from the operations specifications data base will be issued and signed.

b. Aircraft Listing. The operator's proposed program should include a listing, by N-registration number and fleet type, of those airplanes in the operator's fleet that their Ground Conditioned Air Program would apply to. That listing should match the operator's FRM/IMM retrofit listing that is provided to the CHDO. (As airplanes are retrofitted they may be removed from the list.)

c. Manual Inclusion. The operator's proposed program should be detailed within their respective manual(s), and should include the programs' policy, procedures, roles and responsibilities necessary to ensure program compliance at all stations where the equipment is available and operational.

d. Commitment to Maintenance. The operator's program should include a commitment to ensure all available ground-conditioned air units at their gates, system wide, are maintained and operational to the extent possible.

e. Operator's Policy and Procedures. Operators who choose to incorporate a Ground-Conditioned Air Program must be committed to establishing and using the program that embodies the criteria described in this paragraph. The operator's program, including pertinent policy and procedures, should be detailed in their respective manuals and presented to the CHDO for review and approval.

f. Failure to Use. Operators who choose to incorporate a Ground-Conditioned Air Program but fail to use the program as detailed in their respective manuals are subject to forfeiting the one year extension for the 50 percent retrofit schedule, and the final compliance date. They may also be subject to enforcement for violation of their OpSpecs.

2-5. OPERATIONAL COMPLIANCE WITH PRE-1992 AIRPLANES.

a. Older Airplanes. Transport airplanes used in passenger service have historically been retired after 25 years of service or converted to all-cargo operations, so few older airplanes should be affected by the operational rules. If, however, an operator wishes to operate in passenger service a pre-1992 airplane listed in Table 2 of § 121.1117 past the December 26, 2017 date (December 26, 2018 if the ground air use option is selected by the operator), they must incorporate FRM or IMM that meets the requirements of § 26.33(c) before that date.

b. Airplanes Not Included. Part 26 does not require the DAH to develop service instructions for older airplanes with high flammability fuel tanks if there are no airplanes of the model that were produced on or after January 1, 1992. Therefore the DAH requirements do not include the following airplane models that have high flammability fuel tanks:

TABLE 2. AIRPLANE MODELS EXCLUDED FROM DAH REQUIREMENTS

Model	Date of Last Delivery
737-100/200	August 1988
747-200	November 1991
747-300	September 1990

NOTE: For these airplanes, if an operator wishes to operate them after December 26, 2017, modifications may be developed through business arrangements with the original DAH or with other vendors who may develop an STC.

c. Excluded Models. The applicability of the rule includes only airplane models that have airplanes that were issued a Certificate of Airworthiness on or after January 1, 1992. The airplane models identified in Table 3 are excluded from the applicability of this rule because no airplanes of the model type were issued an initial airworthiness certificate after January 1, 1992. The DAH is not required to develop service instructions for these airplane models and other airplane models that are shown to not have high flammability fuel tanks. For example models such as the Boeing 717 and MD-80 have airplanes that were delivered on or after January 1, 1992 so these models are included in the applicability of the DAH rule. However, if the DAH determines these airplanes do not have any fuel tanks that are considered high flammability, no service instructions must be developed by the DAH and no modifications would be required by the operator of the affected airplanes. As noted in paragraph 2-6 below, if the operator is the holder of a field approval or STC for an auxiliary fuel tank installed in an applicable airplane, e.g., an auxiliary tank installed in a B-717 with an airworthiness certificate issued after January 1, 1992, they are responsible for compliance with § 26.35.

TABLE 3. EXCLUDED AIRPLANE MODELS

Model	Year of last delivery
L-1011	1984
DC-10	1990
737-100/200	1988
727-	1984
DC-9	1982
747-200	1991
747-300	1990

2-6. STC AND FIELD-APPROVED AUXILIARY FUEL TANKS APPROVED BEFORE DECEMBER 26, 2008. STC holders are the DAHs for several existing fuel tanks designed to be Normally Emptied, which are auxiliary fuel tank installations approved before December 26, 2008. At present, the FAA is not aware of any specific operators that have field-approved auxiliary fuel tanks designed to be Normally Emptied in their airplanes. If there are such installations, those operators are the DAHs for those fuel tank installations. As such, these DAHs are required to comply with certain provisions of § 26.35. Because field approvals are not likely to occur in the future due to FAA Order 8900.1, Volume 4, Chapter 9, Selected Field Approvals guidance, especially in the part 121 arena, § 26.35 does not include requirements for pending or future field-approved auxiliary fuel tank installations. These DAHs are described under the applicability subparagraph § 26.35(a)(1). There is no requirement to install an FRM or IMM in these particular tanks, however these DAHs must conduct a Flammability Exposure Analysis and an Impact Assessment. Depending on the outcome of the Impact Assessment, certain of these DAHs may be required to develop design changes and service instructions if their designs compromise CDCCLs developed by the TC holders. If design changes are required they must also perform a flammability exposure analysis of the fuel tank after incorporation of these design changes. These requirements are further discussed below.

a. Flammability Exposure Analysis. Section 26.35(b)(1) requires these DAHs to perform a flammability analysis IAW appendix N to part 25, amendment 25-125, of any of their Normally Emptied fuel tanks that are eligible for installation in any transport category airplane that is subject to § 26.33(a). As the DAH, they are required to submit their analysis for approval to the appropriate FAA Oversight Office within 12 months after December 26, 2008. (See Appendix 3 for listing of FAA Oversight Offices.)

b. Impact Assessment. If any of these auxiliary fuel tanks are eligible for installation in any airplanes listed in Table 1 of § 26.35 (also listed in Table 1 of this AC), the DAH is required by § 26.35(c) to perform an Impact Assessment. The Impact Assessment is to identify any features of their design change that compromise any CDCCL for any airplane on which the fuel tank is eligible for installation. This requirement is necessary to ensure the auxiliary fuel tank does not adversely impact any FRM or IMM developed for those airplanes. For example, if fuel was transferred from an auxiliary fuel tank to a Normally Emptied CWT using air pressure in the auxiliary fuel tank, air could be introduced into the CWT. If that CWT was required by § 26.33 to incorporate an FRM, and the FRM design lowered the oxygen concentration of the fuel tank ullage, the air flow from the auxiliary fuel tank could cause the oxygen concentration to increase above that required by the FRM design. This auxiliary fuel tank design would then compromise the CDCCL required by the FRM installation.

c. Design Changes and Service Instructions. Section 26.35(d) requires these DAHs to develop design changes and service instructions if the impact assessment identified any features of the auxiliary fuel tank installation that compromised any CDCCLs. The design changes are referred to as FIMM. The FIMM are required to bring the auxiliary fuel tank installation into compliance with the airplane CDCCL. The DAH is also required by § 26.35(d) to perform a flammability assessment of the auxiliary fuel tank as modified by the FIMM. The DAH is required to submit the FIMM design changes and service instructions to the FAA Oversight Office for approval. Section 26.35(e) requires the DAH to submit the design changes and service information to the FAA Oversight Office by December 26, 2012.

d. Compliance Planning. Section 26.35(f) contains compliance planning requirements for DAHs of auxiliary fuel tank installations, approved by STC and Field Approval before December 26, 2008. These compliance planning requirements include specific dates that certain compliance plans are required to be submitted to the FAA Oversight Office. This includes compliance plans for the flammability exposure analysis, the impact assessment, any required design changes and service instructions for FIMM, ICA, including CDCCLs, for those auxiliary fuel tanks that require design changes, and for providing the data to the FAA Oversight Office for review and approval (same FAA Oversight Office). The compliance plan for the ICAs includes providing a proposal for how the DAH would provide the FAA-approved ICA and FIMM procedures and any necessary parts to any operators that have the respective STC fuel tanks installed in their airplanes. This is necessary so those operators can incorporate those ICA and FIMM into their airplanes and respective maintenance programs. In order to accomplish this task, the operator should submit their proposed program to the PI, who will compare the program to the FAA Oversight Office-approved requirements and approve operator implementation into their program. Operators must install any necessary FIMM and incorporate the associated ICA into their maintenance program IAW the same retrofit schedule used for their FRM or IMM installation.

e. Approval Under § 26.35(f). Section 26.35(g) requires that each person subject to § 26.35 must implement the compliance plans, or later revisions, that were approved under § 26.35(f). The compliance plan requirements and § 26.35(f) provide a method to document the progress of the DAH in meeting the requirements of § 26.35 that would be used if the FAA determined enforcement action were necessary to ensure compliance with this section.

2-7. CONDUCTING A FLAMMABILITY ANALYSIS AND IMPACT ASSESSMENT FOR AN AUX TANK IF STC HOLDER DOES NOT PROVIDE THE REQUIRED ANALYSIS.

a. Special Circumstances of DAH. The FAA recognizes that there may be some occasions where the DAH is unwilling or unable to comply with the part 26 regulations. There may also be cases where the DAH no longer exists. Under these circumstances the operator is still obligated to comply with the operational rules. The FAA realizes that those occasions may significantly complicate the operator's effort to show compliance with the operational rules. The FAA recommends the affected operators contact their DAHs early in the compliance process period to ensure their intent to comply. Operators should also familiarize themselves with the regulations and the associated guidance information contained in the relevant ACs and policy so they can determine the best way to obtain necessary data and documents in the event a DAH is unwilling or unable to support the compliance activity. Affected operators are also encouraged to collaborate with other operators, who may also be affected by lack of support on the means for compliance.

b. STC Data. Some STC holders have surrendered their STCs rather than comply with the DAH requirements. In this case, unless the STC holder agrees to make the data public, the data from the STC remains the property of the STC holder even though the STC has been surrendered. If an operator desires the data from the STC holder, they would need to make financial arrangements with the owner of the STC for access to the data.

NOTE: To avoid interruption and achieve timely compliance, operators should consider providing their FAA Flight Standards CHDO a matrix that contains, by N-registration number and fleet type, a listing of what airplanes in their fleet have auxiliary fuel tanks installed, of which FIMM installation may be required. An agreement between the operator and CHDO should be made as to how ongoing compliance with FIMM installation will be communicated and tracked.

NOTE: In the event an operator chooses to deactivate or remove an STC or field-approved installed auxiliary fuel tank rather than comply with the part 26 requirements, such action can only be accomplished using FAA-approved data.

2-8. TC AND AMENDED TC AUXILIARY FUEL TANKS. In the event that a TC holder such as Boeing or Airbus installs an auxiliary fuel tank as part of the type design, they are required to comply with the provisions of § 26.33. This is because the requirements of § 26.33 apply to all fuel tanks defined in the type design, as well as all design variations approved under the type certificate (e.g., amended TC) for all those airplanes affected by § 26.33. Therefore, there could be a requirement to install an FRM or IMM in these particular tanks. Specifically, these TC holders are required to do a Flammability Exposure Analysis and determine if the subject tanks are highly flammable. If highly flammable, the TC holder would be responsible for design modifications to install FRM or IMM.

CHAPTER 3. FRM/IMM MAINTENANCE AND INSPECTION PROGRAM

3-1. AIRWORTHINESS LIMITATIONS.

a. Mandatory Maintenance and Inspection Actions. Fuel tank system airworthiness limitations (AL) include mandatory maintenance and inspection actions to ensure that unsafe conditions identified by the DAH do not occur or are not introduced into the affected fuel tank that could ultimately affect the fuel tank system. These ALs related to ignition prevention are developed IAW § 25.981, amendment 25-102, for designs developed after June 6, 2001. These AL are also required to be established under § 25.981, amendment 25-125, and part 26, amendment 26-2, to prevent development of fuel tank flammability increases above the required limits as a result of configuration changes, repairs, alterations, or deficiencies in the maintenance program throughout the operational life of the airplane. A fuel tank system AL related to FTFR may be a specific repetitive inspection or maintenance action, or a CDCCL.

(1) A CDCCL is any information necessary to maintain those design features that have been defined in the original type design as needed to preclude development of ignition sources and provide a means to minimize the development of flammable vapors. The purpose of the CDCCL in the context of the FTFR rule is to provide instructions to retain the critical flammability reduction features during configuration changes that may be caused by alterations, repairs, or maintenance actions.

(2) A critical flammability reduction feature may exist in the fuel system and its related installation that, if a failure happens, could interact with the fuel system, resulting in an unsafe condition without this limitation. Therefore, ALs, including CDCCLs, must be included in the manufacturer's ALS and subsequently be incorporated into the operator's maintenance program.

(3) CDCCLs are the primary means of managing and controlling the configuration of the ignition source prevention features and the designed means to reduce flammable vapors in the airplane's fuel tank system.

(4) CDCCLs are not inspections, maintenance actions, or life-limited items and therefore do not have a specific task or interval associated with them. They are simply stated, specific instructions that are designed to ensure whenever maintenance actions, repairs, or design changes occur, the critical configuration is not compromised.

(5) Appendix H to part 25 was revised by amendment 25-102 to add a requirement to provide that each mandatory fuel tank system replacement time, inspections interval, related inspection procedure, and all CDCCLs approved under § 25.981 for the fuel tank systems are contained in the ALS of the ICA. Both fuel system ALs and CDCCLs will normally be found in the airplane manufacturer's maintenance data or other documents which are specifically approved by the FAA.

NOTE: In addition to developing CDCCLs, to comply with the requirements of § 25.1529 to prepare ICAs, DAHs must develop new, or revise existing ICAs to reflect the restrictions imposed in the CDCCLs. For example, if a CDCCL prohibits locating heat sources near a fuel tank equipped with FRM, the DAH would have to revise ICA that would be used in conjunction with

installing such heat sources to reference this prohibition. This supporting information would be contained in appropriate manuals, such as wiring diagram manuals (WDM), manufacturer's Airplane Maintenance Manual (AMM), the standard wiring practices manual (SWPM), or the component maintenance manual (CMM), which would cross-reference the relevant CDCCLs. For changes to the CDCCL's, operators must submit their request through the PMI, who may add comments and then send it to the appropriate FAA Oversight Office. With concurrence from the FAA Oversight Office, the PMI may approve the incorporation into the operator's program. In addition to operators' including CDCCLs in their maintenance or inspection program, CDCCL instructions should be included in the operator's maintenance manual and in their job cards. Any request for change must be submitted for approval to the PMI who may coordinate the change with the appropriate FAA Oversight Office.

(6) The following tables are examples of how two fuel tank system ALs are identified; Table 4 is an ALI that is an inspection procedure, and Table 5 is an ALI that is a CDCCL. Table 4 identifies an AL in ATA chapter 47 for the Nitrogen Generation System. The task is an ALI with an assigned interval, airplane applicability, and a description of the AL task to be performed. Table 5 identifies an AL with the task being a CDCCL. There is no assigned interval because a CDCCL is not an inspection. It refers to information for maintenance personnel to follow when performing maintenance, to protect the critical design features of the fuel tank system.

TABLE 4. AIRWORTHINESS LIMITATION ITEM WITH AN ASSIGNED INTERVAL

AWL Number	Task	Interval	Applicability	Description
47-AWL- 03	ALI	1200 FH	All Airplanes L/N 1820 and 1831	Nitrogen Generation System (NGS)– Functional Check Performance Inspection Concern: Latent failure of the hollow fiber membranes that make up the air separation modules will reduce the percentage of nitrogen-enriched air entering the CWT.

TABLE 5. CDCCL

AWL Number	Task	Interval	Applicability	Description
47-AWL- 02	CDCCL	N/A	All Airplanes L/N 1820, 1831, 2517, 2620, and on.	The addition of an auxiliary fuel tank system via STC may reduce the effectiveness of the NGS, resulting in an increase in flammability exposure of the center tank. All STC tank installations must be reviewed and approved by the FAA Seattle Aircraft Certification Office (ACO).

b. Required Markings and Tank Paint Color.

(1) Installation of an FRM or IMM may require markings or placards, such as those needed to identify the reduced oxygen levels when nitrogen inerting is used for the FRM. The maintenance instructions must identify these markings as required markings, so that the markings are properly maintained and in place throughout the operational life of the airplane.

(2) Even if not a CDCCL item, markings and placard information will be in the manufacturer's respective manuals. Operators should ensure this area is contained in their manuals and their maintenance program for their applicable airplanes.

3-2. EXCEPTIONAL SHORT-TERM EXTENSIONS OF AIRWORTHINESS

LIMITATIONS. The manufacturer's FAA-approved ALS that contains the FRM/IMM data does not include the provision for operators to gain exceptional short term extensions. Therefore operators must perform the task on or before the published intervals.

3-3. FRM/IMM SYSTEM AWARENESS TRAINING. There is no regulatory requirement mandating specific training, however, the new rule has introduced new requirements and new aircraft systems that affect DAHs and operators.

a. Philosophical Approach and Knowledge Level. To fully realize the objectives of the FRM/IMM installation goal, operators need to address their current philosophical approach and knowledge level pertinent to installing, maintaining, inspecting, and altering these systems. This approach has begun at the airplane manufacturers with maintenance program enhancements that address FTFR. It is incumbent that the operators include these TC and STC holder fuel tank system maintenance program enhancements into their respective programs. Furthermore, they should commit to training their maintenance and inspection work force to understand the new flammability reduction systems, and in particular to gain insight as to the additional cautions and procedures regarding fuel tank entry.

b. Example. The aviation community's maintenance and inspection workforce currently understands that airplane fuel tanks are a hazardous atmosphere. The Occupational Safety and Health Administration (OSHA) defines fuel tanks as confined spaces, and entry requires special procedures and equipment. The addition of an FRM system based upon reducing the oxygen

concentration in the fuel tank does not change this classification or the fuel tank entry requirements. However, the addition of FRM emphasizes the need for strict adherence to the OSHA tank entry requirements. The FAA feels strongly that applicable maintenance manuals, task cards, and employee training should be updated to include awareness of the addition of FRM and special emphasis to mechanics on fuel tank entry and the hazards associated with fuel tank entry. The addition of FRM may also result in reduced oxygen levels in spaces adjacent to the FRM equipment that have not traditionally been classified as confined spaces. Due to these considerations, operators should include added emphasis on the hazards and the need to strictly follow maintenance procedures in their training programs and maintenance instructions.

c. Additional Items. In addition to CDCCLs, there will be new maintenance manual and job card procedures, inspection devices, graphical information showing required tasks, or changes in tasks. Operators should provide training to maintenance, inspection, and engineering personnel, including persons who write and edit job cards and engineering orders. Heightened awareness of these critical areas is needed. Additionally, operators must have procedures in place that ensure maintenance record entries for complying with a CDCCL are consistent with §§ 43.9, 43.11, or IAW the applicable provisions of the part 121 or 129 certificate-holder's manual.

d. Understanding Systems. Maintenance and engineering personnel can better ensure that the FTFR system Airworthiness Limitation ICA are properly performed throughout the operational life of the airplane by having a thorough understanding of the systems installed in the airplanes.

e. Manufacturer Training Programs. Operators should take advantage of any airplane manufacturer-developed training programs that address the new FTFR systems.

3-4. OPERATOR'S CONTINUOUS AIRWORTHINESS MAINTENANCE PROGRAM APPROVAL UNDER §§ 121.1117, 125.509 AND 129.117.

Parts 121, 125, and 129 U.S.-registered aircraft operators will be issued newly developed OpSpecs from the OPSS database to implement FTS requirements. The operators must first submit their proposed FRM/IMM program to their PMI, who will compare the operator's proposed program to the TC/STC holder's Airworthiness Limitation ICA, and approve operator incorporation with the new OpSpecs.

3-5. OPERATOR'S INSPECTION PROGRAM APPROVAL UNDER § 125.509. Part 125 operators who are currently authorized to conduct operations IAW a Letter of Deviation Authority (LODA A125) will be issued a FRM/IMM letter of authorization (LOA), from the 125M OPSS data base. The operators must first submit their proposed FRM/IMM program to their PMI, who will compare the operator's proposed program to the TC/STC holder's Airworthiness Limitation ICA, and approve operator incorporation within the OpSpecs database.

APPENDIX 1. ACRONYMS

14 CFR	Title 14 of the Code of Federal Regulations
AC	Advisory Circular
ACO	Aircraft Certification Office
AEG	Aircraft Evaluation Group
AFM	Aircraft Flight Manual
AFS	Flight Standards Service
AL	Airworthiness Limitation
ALI	Airworthiness Limitation Item
ALS	Airworthiness Limitations Section
AMM	Aircraft Maintenance Manual
APU	Auxiliary Power Unit
ARAC	Aviation Rulemaking Advisory Committee
ASI	Aviation Safety Inspector
ASTM	American Society for Testing and Materials
ATA	Air Transport Association of America
CAMP	Continuous Airworthiness Maintenance Program
CDCCL	Critical Design Configuration Control Limitation
CFR	Code of Federal Regulations
CHDO	Certificate-Holding District Office
CMM	Component Maintenance Manual
CWT	Center Wing Fuel Tank
DAH	Design Approval Holder
FAA	Federal Aviation Administration
FIMM	Flammability Impact Mitigation Means
FQIS	Fuel Quantity Indicator System
FRM	Flammability Reduction Means
FTFR	Fuel Tank Flammability Reduction
FTHWG	Fuel Tank Harmonization Working Group
FTS	Fuel Tank Safety
IAW	In Accordance With
ICA	Instructions for Continued Airworthiness

IMM	Ignition Mitigation Means
LOA	Letter of Authorization
LODA	Letter of Deviation Authority
METAR	Aviation Routine Weather Report
MMEL	Master Minimum Equipment List
MPD	Maintenance Planning Document
MRB	Maintenance Review Board
MSG-3	Maintenance Steering Group–3rd Task Force
MSI	Maintenance Significant Items
NGS	Nitrogen Generation System
NTSB	National Transportation Safety Board
OpSpec	Operations Specification
OPSS	Automated Operations Safety System
OSHA	Occupational Safety and Health Administration
PI	Principal Inspector (This may include any or all of the affected Airworthiness or Operations)
PMI	Principal Maintenance Inspector
RGL	Regulatory and Guidance Library
SEA-AEG	Seattle Aircraft Evaluation Group
SFAR	Special Federal Aviation Regulations
SPECI	Aviation Selected Special Weather Report
STC	Supplemental Type Certificate
SWPM	Standard Wiring Practices Manual
TAD	Transport Airplane Directorate
TC	Type Certificate
TCDS	Type Certificate Data Sheet
TSO	Technical Standard Order
VFR	Visual Flight Rules
WDM	Wiring Diagram Manuals

APPENDIX 2. DEFINITIONS

a. Aircraft Evaluation Group (AEG). The FAA Flight Standards Service 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 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.

b. 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.

c. 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.)

d. Auxiliary Fuel Tank. Fuel tank installed to make additional fuel available for increasing the flight range of that airplane. The term auxiliary means that the tank is secondary to the airplane's main fuel tanks, i.e., 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. Auxiliary tanks are usually intended to be emptied of usable fuel during flight and have been installed in various locations including center wing structure, horizontal stabilizers, wings, and cargo compartments. Auxiliary fuel tanks are Normally Emptied fuel tanks as defined below.

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

f. Airport Ambient Temperature. The official National Weather Service temperature at the airport.

g. Airworthiness Limitations (ALs). In terms of this AC, mandatory maintenance of the fuel system that can include 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.

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

i. Civil Aviation Authority (CAA). The aviation authority responsible for the certification and continued airworthiness of those airplanes having U.S. TC within its state of design as established IAW agreements with the United States.

j. 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.

k. 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.

l. Critical Design Configuration Control Limitations (CDCCL). An AL that preserves a critical feature of the airplane needed for the FRM or 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.

m. Design Approval Holder (DAH). The holder of any design approval, including TC, amended TC, STC, amended STC, parts manufacturer approval, Technical Standard Order (TSO) authorization, letter of TSO design approval, and field approvals. In particular contexts, the term DAH may also refer to applicants for design approvals.

n. FAA Oversight Office. The aircraft certification office or office of the Transport Airplane Directorate having oversight responsibility for the relevant TC or STC, as determined by the Administrator. (See Appendix 3 for listing of appropriate offices.)

o. 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. We approve these major repairs or alterations by either examining data only or by physically inspecting, demonstrating, or testing the product.

p. Flammability Impact Mitigation Means (FIMM). Modifications developed by DAH for auxiliary fuel tanks that are required by 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.

q. Flammable (With Respect to a Fluid or Gas). Susceptible to igniting readily or to exploding (14 CFR part 1, Definitions and Abbreviations). 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.

r. 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.

s. 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.

t. Flight Standards Service Offices. FAA headquarters offices responsible for developing guidance and policy applicable to transport category airplanes for AEG personnel

and AFS field personnel (Airworthiness and Operations ASIs) in the conduct of their responsibilities.

u. 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 Specification D1655-99, Standard Specification for Aviation Turbine Fuels.

v. 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.

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

x. 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.

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

z. 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.

aa. Main Fuel Tank. Section 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.

bb. Maintenance Planning Data (MPD). Documents Data developed by the manufacturer of a particular airplane that contains the information each operator of that airplane needs to develop a customized, scheduled maintenance program.

cc. METAR. The international standard code format for hourly surface weather observations. METAR roughly translates from French as Aviation Routine Weather Report and is predominantly used by pilots in fulfillment of a part of a preflight weather briefing, and by meteorologists, who use aggregated METAR information to assist in weather forecasting. (See the National Weather Service Web site at <http://www.nws.noaa.gov/oso/oso1/oso12/faq.htm> for more information.)

dd. METAR Sources. Typically, airports generate reports once an hour; however, if conditions change significantly, they may be updated in special reports called Aviation Selected Special Weather Reports (SPECIs). Some reports are encoded by an Automated Surface Observing System located at airports, military bases, and other sites. Some locations still use augmented observations, which are recorded by digital sensors and encoded via software, but are reviewed by certified weather observers or forecasters prior to being transmitted. Observations may also be taken by trained observers or forecasters who manually observe and encode their observations prior to their being transmitted.

ee. 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 APUs, 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 (see 14 CFR part 25, appendix H, § 25.3(b)). (See appendix A of AC 26-1, Part 26, Continued Airworthiness and Safety Improvements for additional information.)

ff. Maintenance Review Board Report. 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 MRB report and its associated requirements to develop maintenance programs. See AC 121-22A, Maintenance Review Board Procedures, for additional information.

gg. Maintenance Significant Item (MSI). Under MSG-3, items identified by the design approval holder whose failure could cause one of the following effects:

- (1) It could affect safety on the ground or in flight,
- (2) It could be undetectable during operations,
- (3) It could have a significant impact on operations, or
- (4) It could have a significant economic impact.

(5) In terms of development of maintenance and inspection instructions, MSIs include systems, subsystems, modules, components, accessories, units, and parts.

hh. Maximum Payload Capacity. Section 119.3 defines as:

(1) For an aircraft for which a Maximum Zero Fuel Weight (MZFW) is prescribed in FAA technical specifications, the maximum zero fuel weight, less empty weight, less all justifiable aircraft equipment, and less the operating load (consisting of minimum flightcrew, foods and beverages, and supplies and equipment related to foods and beverages, but not including disposable fuel or oil).

(2) For all other aircraft, the maximum certificated takeoff weight of an aircraft, less the empty weight, less all justifiable aircraft equipment, and less the operating load (consisting of

minimum fuel load, oil, and flightcrew). The allowance for the weight of the crew, oil, and fuel is as follows:

Crew	For each crewmember required by the Federal aviation regulations	
Flight crewmember	190 lb	240 lb
Flight attendant	170 lb	210 lb
Male flight attendant	180 lb	220 lb
Female flight attendant	160 lb	200 lb
Crewmember roller bag	30 lb	NA
Pilot flight bag	20 lb	NA
Flight attendant kit	10 lb	NA
Oil	350 pounds or the oil capacity as specified on the Type Certificate Data Sheet (TCDS)	
Fuel	The minimum weight of fuel required by the applicable Federal aviation regulations for a flight between domestic points 174 nautical miles apart under visual flight rules (VFR) weather conditions that does not involve extended overwater operations	

ii. Maximum Zero Fuel Weight. The maximum permissible weight of an aircraft with no disposable fuel or oil. The zero fuel weight figure may be found in either the aircraft TCDS, the approved AFM, or both.

jj. Maintenance Steering Group-3 (MSG-3). A voluntary structured process developed by the industry and maintained by ATA to make decisions used to develop maintenance and inspection tasks and intervals for an airplane.

kk. 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.

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

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

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

oo. 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 3. FAA OVERSIGHT OFFICES

Airplane Manufacturer	FAA Oversight Office
Aerospatiale	Transport Airplane Directorate, International Branch, ANM-116
Airbus	Transport Airplane Directorate, International Branch, ANM-116
BAE	Transport Airplane Directorate, International Branch, ANM-116
Boeing	Seattle Aircraft Certification Office
Bombardier	New York Aircraft Certification Office
CASA	Transport Airplane Directorate, International Branch, ANM-116
deHavilland	New York Aircraft Certification Office
Dornier	Transport Airplane Directorate, International Branch, ANM-116
Embraer	Transport Airplane Directorate, International Branch, ANM-116
Fokker	Transport Airplane Directorate, International Branch, ANM-116
Lockheed	Atlanta Aircraft Certification Office
McDonnell-Douglas	Los Angeles Certification Office
SAAB	Transport Airplane Directorate, International Branch, ANM-116

**APPENDIX 4. FAA RECOMMENDATION TO AIRLINES TO VOLUNTARILY USE
GROUND-CONDITIONED AIR**

The following is from the May 17, 2000 FAA letter to the NTSB on the Fuel Tank Safety Recommendations:

A-96-175. “Require the development of and implementation of design or operational changes that will preclude the operation of transport-category airplanes with explosive fuel-air mixtures in the fuel tanks:

(b) Pending implementation of design modifications, require modifications in operational procedures to reduce the potential for explosive fuel-air mixtures in the fuel tanks of transport-category aircraft. In the B-747, consideration should be given to refueling the center wing fuel tank (CWT) before flight whenever possible from cooler ground fuel tanks, proper monitoring and management of the CWT fuel temperature, and maintaining an appropriate minimum fuel quantity in the CWT.”

FAA COMMENT. “During the recent discussions with the Board’s staff, it was proposed that the FAA reevaluate methods that could reduce the heating of CWT that have air conditioning packs located below the CWT. One method discussed in the meeting was the use of ground sources of conditioned air instead of using the air conditioning packs. The FAA evaluated this proposal and determined that an operational procedure that recommends the use of ground-conditioned air, also called preconditioned air, instead of running the packs on the ground would provide reduction in the exposure of those CWT to flammable vapors. The FAA has also determined that using ground-conditioned air would provide a greater reduction in flammability exposure than would modifying the fuel loading and management of the Boeing 747 so that cooler fuel would be added to the CWT before flight.

In the July 1998 report of the Aviation Rulemaking Advisory Committee (ARAC) Fuel Tank Harmonization Working Group (FTHWG), it was estimated that CWT on a large airplane with packs located below the CW’s would be flammable an average of 30 percent of the fleet operational time of the airplane. The FAA has performed a similar analysis that considered the results of fuel tank flammability research completed since the FTHWG issued its report. The FAA analysis estimates that the CWT would be flammable approximately 35 percent of the fleet operational time. Using the same analysis techniques, the FAA estimates that using ground-conditioned air on hot days (greater than 60 degrees Fahrenheit) would reduce the exposure to approximately 25 percent. Modifying the fuel loading and management of the Boeing 747 so that cooler fuel would be added to the CWT, as suggested as a possibility by the Board, would result in less of a reduction of the exposure to approximately 30 percent.

The FAA also analyzed a combination of both refueling the CWT and using ground-conditioned air. This combination did not result in any additional

reduction in the flammability exposure when compared to using ground-conditioned air alone.

The FAA has been working with industry representatives to establish a program that would recommend the use of ground-conditioned air for those airplanes with air conditioning packs located below CWT whenever an adequate source of ground-conditioned air is available. Boeing issued a service letter on May 5, 2000, that would be sent to all operators of Boeing airplanes with air conditioning packs located below CWT. The service letter recommended that operators use ground-conditioned air when available and practical, when ambient ground temperatures are greater than 60 degrees Fahrenheit. Analysis has shown that using ground-conditioned air provides little or no reduction in CWT flammability, which is already low, when ambient temperatures are below 60 degrees Fahrenheit. The service letter also recommends that operators evaluate opening the air conditioning pack bay doors to provide additional ventilation. The FAA will supplement the Boeing letter with an information bulletin to FAA representatives assigned to each air carrier encouraging application of the Boeing service letter. In addition, each FAA representative will discuss the recommended practice with each operator.

Operators have begun to install ground-conditioned air equipment at airport gates, and the recent increases in fuel prices should result in the installation of even more ground-conditioned air equipment.

I believe that the FAA has met the full intent of this safety recommendation, and I consider the FAA's action to be completed."