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14 CFR Part 121

Aircraft and Proposed Advisory Circular on Ground Deicing and Anti-Icing Program; Interim Final Rule and Notice

DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

14 CFR Part 121

[Docket No. 26930; Amendment No. 121-231]

RIN 2120-AE51

Aircraft Ground Deicing and Anti-icing Program

AGENCY: Federal Aviation Administration (FAA), DOT.

ACTION: Interim final rule; request for comments.

SUMMARY: This amendment establishes a requirement for part 121 certificate holders to develop an FAA-approved ground deicing/anti-icing program.

This rule is necessary because several accidents and the 1992 International Conference on Airplane Ground Deicing indicate that, under present procedures, the pilot in command may be unable to effectively determine whether the aircraft's critical surfaces are free of all frost, ice, or snow prior to attempting a takeoff.

The rule is intended to provide an added level of safety to flight operations in adverse weather conditions. This rule and associated airport and air traffic control procedures will provide enhanced procedures for safe takeoffs during adverse weather conditions.

DATES: This interim final rule is effective November 1, 1992. Additional comments must be received not later than April 15, 1993.

ADDRESSES: Comments on this interim final rule should be mailed, in triplicate, to: Federal Aviation Administration, Office of the Chief Counsel, Attention: Rules Docket (AGC-10), Docket No. 26930, 800 Independence Ave., SW., Washington, DC 20591. Comments delivered must be marked Docket No. 26930. Comments may be examined in room 915G weekdays between 8:30 a.m. and 5 p.m., except on Federal holidays.

FOR FURTHER INFORMATION CONTACT: Larry Youngblut, Flight Standards Service, Regulations Branch, AFS-240, Federal Aviation Administration, 800 Independence Avenue, SW., Washington, DC 20591, telephone (202) 267-3755.

SUPPLEMENTARY INFORMATION:

Background

On July 23, 1992 (47 FR 32846) the FAA published a Notice of Proposed Rulemaking that would establish requirements for part 121 certificate holders to develop and comply with an FAA-approved ground deicing/anti-icing program. The proposed rule was developed in response to a number of airplane accidents caused in part by icing and to recommendations from an international conference on deicing/anti-icing that considered measures that could be taken to prevent such accidents.

Section 121.629(a) of the Federal Aviation Regulations (14 CFR 121.629(a)) states, in pertinent part, that no person may dispatch or release an aircraft when, in the opinion of the pilot in command or aircraft dispatcher, icing conditions are expected or met that might adversely affect the safety of flight. Section 121.629(b) states, in pertinent part, that no person may take off an aircraft when frost, ice, or snow is adhering to the wings, control surfaces, or propellers of the aircraft. These requirements, which have been virtually unchanged for over 40 years, are based on what is commonly referred to as the "clean aircraft concept." The basis of this concept is that the presence of even minute amounts of frost, ice, or snow (referred to as "contamintion") on particular aircraft surfaces, can cause degradation of aircraft performance and changes in aircraft flight characteristics.

Under the Federal Aviation Regulations, in icing conditions, as in all other conditions, ultimate responsibility for determining whether the aircraft is free of contamination—which is necessary for the aircraft to be airworthy—resets with the pilot in command. When conditions conducive to the formation of frost, ice, or snow or aircraft surfaces exist at the time of takeoff, or it is suspected that these contaminants are adhering to aircraft surfaces, common practice developed by the North American and European aviation communities over many years of operational experience is to deice and/or anti-ice the aircraft before takeoff.

Deicing is a procedure by which frost, ice, or snow is removed from the aircraft in order to provide clean surfaces. Anti-icing is a precautionary procedure which provides protection against the formation of frost or ice and accumulation of snow to treated surfaces of the aircraft for a limited period of time. Two principal types of deicing/anti-icing fluids are used. Type I fluids are unthickened fluids that are normally applied as a mixture of glycol and water. These fluids mainly provide protection against refreezing when no delays or only short delays occur between deicing and takeoff. Type II fluids are thickened fluids. They provide protection against refreezing for longer periods and can be used when longer delays can be anticipated. Type II fluid is used extensively in Canada and Europe, but is used less often in the United States. Type II fluid provides longer holdover times. Holdover time is the estimated time deicing/anti-icing fluid will prevent the formation of frost or ice and the accumulation of snow on the protected surfaces of an aircraft.

According to the National Transportation Safety Board (NTSB), in the last 23 years there have been 15 accidents related to the failure to deice aircraft adequately before takeoff. In all of these accidents, contamination on the aircraft surfaces during takeoff was the cause or a contributing cause of the accident. On March 22, 1992, USAir flight 405 crashed on takeoff from La Guardia Airport in a snowstorm during nighttime operations. While the NTSB has not yet issued a probable cause finding for this accident, the FAA has proceeded on the assumption that the accident was caused, at least in part, by icing. The airplane had been deiced approximately 35 minutes before takeoff.

As a result of this and earlier accidents, the FAA mounted a sharply focused effort to address the issues surrounding ground deicing before the winter of 1992/1993. On May 28 and 29, 1992, the FAA held the International Conference on Airplane Ground Deicing in Reston, Virginia. The conference brought together leading experts from all over the world to share information on ground deicing/anti-icing of transport category airplanes and to recommend actions for preventing accidents caused by icing, and for continuing improvement of flight safety under adverse weather conditions.

The two-day conference was attended by representatives from air carriers and air carrier associations, crewmember associations, manufacturers and manufacturing associations, airport operators, and air traffic controllers and other FAA personnel, as well as by scientific experts on weather, deicing fluids, and deicing equipment. Over 800 people attended the conference. Areas covered by working groups at the conference were aircraft design; ground deicing and anti-icing systems; air traffic control and sequencing; deicing personnel, procedures, and training; and ice detection, recognition, and crew training.

Two major recommendations, which support this rulemaking, made by the working groups are: (1) Critical aircraft surfaces must be kept free of frost, ice, and snow; and (2) Each air carrier should have an approved aircraft deicing program that will ensure full

compliance with the clean aircraft concept. The program should include ground deicing procedures, a comprehensive training program for flight crewmembers, holdover timetables to be used as guidelines, and criteria for determining if a pretakeoff check after deicing is needed.

The FAA based the proposed rule on these recommendations and accident history. As proposed, the rule would require part 121 certificate holders to develop and comply with an FAA-approved ground deicing/anti-icing program that includes procedures that must be followed whenever ground conditions exist that might result in frost, ice, or snow adhering to the aircraft surfaces, unless it uses the alternate check procedures described below under "Implementation of Program." The program is intended to provide the pilot in command with more complete information, training procedures, and ground support, which he or she needs for deciding if takeoff can be safely accomplished. Each program would include a detailed description of how the certificate holder determines that ground deicing/anti-icing procedures must be in effect, who is responsible for deciding that such procedures must be in effect, the operational procedures for implementing ground deicing, and the specific duties and responsibilities of each operational position or group responsible for getting the aircraft safely airborne while such procedures are in effect.

To be approved, each ground deicing/anti-icing program would have to cover at least the following areas:

(1) Ground training and testing requirements for all flight crewmembers and qualification requirements for all other personnel the certificate holder uses in implementing the approved ground deicing/anti-icing program.

(2) Procedures for the use of holdover times.

(3) Deicing/anti-icing and accompanying checking procedures.

Differences between the proposed rule and the final rule involve pretakeoff check requirements, short term training and qualification/testing requirements, implementation plans, use of holdover timetables, definitional changes, and flight with underwing frost under certain conditions. These changes are discussed in the "Discussion of Comments" section of this preamble.

This rule, when implemented, will ensure that the FAA and part 121 certificate holders have taken every practical step possible to improve safety in icing conditions before the 1992/1993 winter season. In this regard, the FAA is aware that part 121 certificate holders have already, under the leadership of the ATA, taken steps to develop a standard model industry training program that would meet the goals of this rulemaking.

NTSB Recommendations

As a result of accident investigations, the NTSB has issued 30 safety recommendations that address issues involving aircraft ground icing and deicing.

These recommendations cover such subjects as informing operators about the characteristics of deicing/anti-icing fluids; informing flight crews about ice formation after deicing; reviewing information that air carrier operators provide to flight crews on runway contamination and engine anti-ice during ground operations; requiring flight crew checks before takeoff if takeoff is delayed following deicing; emphasizing to air carrier maintenance departments the importance of maintaining ground support equipment; and requiring air carrier training programs to cover the effect of wing leading edge contamination on aerodynamic performance.

This final rule as well as previous FAA actions address these recommendations. Previous actions included dissemination of advisory circulars, bulletins, memoranda, informative articles, and notices related to winter operations, as well as publishing Air Carrier Operations Bulletins, Maintenance Bulletins, and Maintenance Action Notices. These materials were intended to impress upon operators the dangers of aircraft wing and control surface contamination and the need to assist the pilot in determining if the aircraft is free of contamination before takeoff.

Long-Term FAA Actions

The problem of airplane ground deicing/anti-icing is much broader than just the issue of the last-minute decision of a pilot in command on whether to attempt a takeoff. Airport and air traffic control procedures, airplane design, pilot awareness training, airplane performance characteristics, and other factors have been considered in NTSB recommendations, and many of them were addressed at the Reston conference. The FAA and the aviation industry are continuing their efforts to address these and other related issues. Efforts in some areas, such as airport and air traffic control procedures, are already underway and will continue during this rulemaking. Other issues, such as the effects of airplane design and their interaction with wing contamination and pilot flying technique, for example, require research. The potential value of aircraft type specific pilot training on procedures for use during ground icing conditions will also be studied, either by the FAA alone or as joint government/industry projects. Many aspects of aircraft design, performance characteristics, handling qualities, and flying technique must be examined along with their interactions, in order to fully understand why the accident history appears to reflect an imbalance among accident rates experienced by different aircraft designs.

Discussion of Comments

Additional Comment Period

A number of commenters object to the 15-day comment period and the rush to place this rule in effect before the 1992–1993 winter season. As discussed elsewhere in this preamble and as was discussed in the NPRM, the FAA has determined that it is in the interest of aviation safety to establish additional ground deicing/anti-icing rules before this winter. The International Conference on Airplane Ground Deicing in general supports the FAA's decision. Nevertheless, the FAA recognizes that less than four months have elapsed between the International Conference and this final rule and that the general public had only 15 days to comment on the NPRM. Therefore, the FAA has determined that it is in the public interest to make this an interim final rule and provide an additional comment period to obtain comments on the actual implementation of this rule this winter. All comments received before April 15, 1993 will be carefully considered. If warranted, the FAA will make changes to the rule before the next winter season.

Comments should identify the regulatory docket number to the Rules Docket address specified above. Commenters wishing the FAA to acknowledge receipt of their comments must include a preaddressed, stamped postcard on which the following statement is made: "Comments to Docket No. 26930." The postcard will be date stamped and mailed to the commenter.

General

Over 40 comments were submitted by associations representing airlines, pilots, and dispatchers and by parts 121 and 135 certificate holders, the NTSB, and other interested individuals. While most of the commenters generally favor FAA action to improve aviation safety in potential icing conditions, virtually all of

the commenters make recommendations in specific areas, and a number of commenters express concern that the FAA's short timetable could lead to less than the most effective regulatory action. As indicated, several commenters asked that the comment period be extended. The FAA has carefully considered all of the comments received and has modified the proposal in some instances. A full discussion of comments and FAA responses follows.

Applicability and Justification

Several commenters questioned the applicability of the proposed rule to part 121 certificate holders. A number of commenters (including the National Transportation Safety Board) state that the proposed requirements should also apply to operations under parts 125 and 135. These commenters state that icing conditions apply equally to smaller aircraft and larger aircraft, and that there should be no difference in the level of safety required. One commenter states that since all aircraft are required to comply with the clean aircraft concept, the required deicing program should apply to operations under parts 91, 125, and 135. Several commenters stated that the supporting data cited by the FAA justifies the proposed rule's applicability to turbojet aircraft but not to turbopropeller aircraft, and one commenter states that most jet or turbine powered aircraft have operated safely under current rules and recommends that the proposed rule should only address specific aircraft types that have a history of icing related problems. A few commenters suggest that the proposed rule is an overreaction by FAA, since the accidents cited in the supporting data can be explained and distinguished in a way that could lead the FAA to conclude that better monitoring of compliance with existing regulations would address any problems that exist.

Several commenters state that it is unfair to U.S. carriers for the proposed rule not to apply to foreign air carriers. One foreign air carrier states that it and other foreign operators that use Type II fluids could be adversely affected, apparently on the assumption that its takeoff could be delayed to allow the takeoff of a U.S. aircraft that must take off within five minutes after the aircraft has been determined to be free of frost, ice, and snow (see § 121.629 (c)(4) and (d)).

FAA Response

The intent of this interim final rule is to put in place before this winter a rule to improve safety during icing conditions. The FAA determined that limiting the rule's application to operations under part 121 would have the most far-reaching impact. The FAA will continue to study part 125 and 135 operations to determine if future rulemaking is required. Although most icing related accidents have involved turbojet aircraft, the FAA believes part 121 turbopropeller aircraft should be included in this rule since the very real potential for problems in icing conditions exists and there does not appear to be any technical reason for saying that turbopropeller aircraft are immune from wing contamination related icing accidents. The FAA believes, as stated in the preamble to the proposed rule, that this rule is needed based on the accidents discussed and on the recommendations of the Reston Conference described previously in this preamble. These recommendations were not limited to specific aircraft types.

As to the comments that part 129 foreign air carriers will have an unfair advantage, while the FAA does not believe that foreign air carriers will have any significant competitive advantage, the FAA, as stated in the NPRM, will request that the ICAO initiate a review of deicing and anti-icing procedures used by all air carriers. The FAA will continue to work aggressively with other nations' civil aviation authorities to learn from their safety regulatory experiences and to share those of the U.S. so that we all may develop and adopt the most effective and efficient regulations to improve the safety of all aircraft during icing conditions.

The FAA does not envision a situation in which a foreign operator would be adversely affected by a U.S. operator who is subject to this rule because, in the circumstances described above, normal air traffic control procedures would be observed.

In any case, the FAA solicits continued information from anyone who sees specific instances in which a competitive advantage has been obtained by any air carrier as a result of the application of this rule. The competitive effect of the FAA's rules is an important consideration, and, if there is an adverse result on competition, the FAA would consider amendments that do not degrade the overall level of safety achieved by this rule.

Note on Terminology Change

(1) The notice of proposed rulemaking provided alternative conditions for taking off after expiration of a holdover time. One condition was that a takeoff could occur after a "pretakeoff inspection" determines that the aircraft is clean. This procedure is more properly called a "check," since airworthiness related "inspections" are usually performed by certified mechanics, and this procedure will in most instances be performed by the flight crew. Therefore, throughout this document the term "pretakeoff contamination check" is used, even when referring to the NPRM.

(2) The notice of proposed rulemaking in proposed § 121.629(d) provided an alternative procedure for certificate holders that do not have an approved anti-icing/deicing program. Throughout this document the paragraph (d) procedure is referred to as an "outside-the-aircraft check."

In addition, this document uses two terms "aircraft deicing/anti-icing procedure" and "pretakeoff check", which were not used in the NPRM. These terms are discussed and explained later in this section of the preamble.

The Use of Holdover Times

Over half of the commenters to the NPRM address the issue of the use of holdover times. The majority of these comments concern the following issues: (1) appropriateness of holdover times being specific either to a certificate holder or to an aircraft type; (2) use of holdover times as mandatory rather than as guidelines; (3) determining or changing holdover times.

General Discussion of Holdover Times

This rule requires certificate holders to develop holdover times with data acceptable to the Administrator. The only holdover time date currently readily available to the industry and acceptable to the FAA is that developed by the Society of Automotive Engineers (SAE) and the International Organization for Standardization (ISO). Certificate holders may develop other tables; however, certificate holders should be aware that the FAA may need considerable time to verify the acceptability of newly developed tables.

Holdover times developed by the SAE/ISO have been compiled into tables that are specific to fluid type, Type I or Type II, rather than being specific to any particular aircraft type. The tables use outside air temperature (OAT) ranges, fluid concentrations or freezing point (FP) limitations, and the general type of contamination existing, (i.e., frost, freezing fog, snow, freezing rain, and rain on a cold soaked wing) to determine an approximate holdover time range. See figure 1 reproduced from the draft FAA advisory circular, "*Pilots Guide to Large Aircraft Ground Deicing.*"

specifically state that "the ...bility for the application of ...ta remains with the user". The ...ation they are for use in ...re planning only and shall be ...conjunction with pretakeoff ...procedures. These tables only ...approximate time ranges and are subject to individual interpretation. The FAA has determined that takeoff after exceeding any maximum holdover time in a certificate holder's table, for the existing weather conditions, is permitted only when other actions are taken.

It should be noted that the FAA and the SAE have initiated studies to develop more precise holdover timetables and as new data becomes available new tables will be developed and made available to the industry.

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Table 1. Guideline for Holdover Times Anticipated by SAE Type II and ISO Type II Fluid Mixtures as a Function of Weather Conditions and OAT.

CAUTION! THIS TABLE IS FOR USE IN DEPARTURE PLANNING ONLY. IT SHOULD BE USED IN CONJUNCTION WITH PRE-TAKEOFF CHECK PROCEDURES.

OAT		Type II Fluid Concentration Neat-Fluid /Water (% by Volume)	Approximate Holdover Times Anticipated Under Various Weather Conditions (hours: minutes)				
°C	°F		FROST	FREEZING FOG	SNOW	FREEZING RAIN	RAIN ON COLD SOAKED WING
0 and above	32 and above	100/0	12:00	1:15-3:00	0:25-1:00	0:08-0:20	0:24-1:00
		75/25	6:00	0:50-2:00	0:20-0:45	0:04-0:10	0:18-0:45
		50/50	4:00	0:35-1:30	0:15-0:30	0:02-0:05	0:12-0:30
below 0 to -7	below 32 to 19	100/0	8:00	0:35-1:30	0:20-0:45	0:08-0:20	CAUTION! clear ice may require touch for confirmation
		75/25	5:00	0:25-1:00	0:15-0:30	0:04-0:10	
		50/50	3:00	0:20-0:45	0:05-0:15	0:01-0:03	
below -7 to -14	below 19 to 7	100/0	8:00	0:35-1:30	0:20-0:45	List of Symbols °C = Celsius °F = Fahrenheit Vol = Volume OAT = Outside Air Temp.	
		75/25	5:00	0:25-1:00	0:15-0:30		
below -14 to -25	below 7 to -13	100/0	8:00	0:35-1:30	0:20-0:45		
below -25	below -13	100/0 if 7°C(13°F) Buffer is maintained	A buffer of at least 7°C(13°F) must be maintained for Type II used for anti-icing at OAT below -25°C(-13°F). Consider use of Type I fluids where SAE or ISO Type II cannot be used.				

THIS TABLE DOES NOT APPLY TO OTHER THAN SAE OR ISO TYPE II FPD FLUIDS.

THE RESPONSIBILITY FOR THE APPLICATION OF THESE DATA REMAINS WITH THE USER.

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Table 2. Guideline for Holdover Times Anticipated by SAE Type I, and ISO Type I Fluid Mixtures as a Function of Weather Conditions and OAT.

CAUTION! THIS TABLE IS FOR USE IN DEPARTURE PLANNING ONLY. IT SHOULD BE USED IN CONJUNCTION WITH PRE-TAKEOFF CHECK PROCEDURES.

Freezing Point of Type I fluid mixture used must be at least 10°C(18°F) below OAT.

Outside Air Temperature		Approximate Holdover Times Anticipated Under Various Weather Conditions (hours:minutes)				
°C	°F	FROST	FREEZING FOG	SNOW	FREEZING RAIN	RAIN ON COLD SOAKED WING
0 & above	32 & above	0:18-0:45	0:12-0:30	0:06-0:15	0:02-0:05	0:06-0:15
below 0 to -7	below 32 to 19	0:18-0:45	0:06-0:15	0:06-0:15	0:01-0:03	CAUTION! Clear ice may require touch for confirmation
below -7	below 19	0:12-0:30	0:06-0:15	0:06-0:15		

THIS TABLE DOES NOT APPLY TO OTHER THAN SAE OR ISO TYPE I FPD FLUIDS.

THE RESPONSIBILITY FOR THE APPLICATION OF THESE DATA REMAINS WITH THE USER.

A specific discussion of comments on the three major issues and FAA responses follows.

• *Certificate Holder or Aircraft Specific Holdover Times*

Several commenters object to the proposed language of § 121.629(c)(3) which states that an approved deicing program must include "the certificate holder's holdover times, specific to each aircraft type * * *." These commenters state that holdover time should not be aircraft type specific. Most of these commenters also believe that holdover times should be standard for all certificate holders. One commenter states that holdover times, while not aircraft type specific, are specific to the type of fluid used and that the FAA should establish "not to exceed" times when aircraft are dependent on Type I fluids.

FAA Response

As previously stated, the only holdover timetables readily available to the industry and acceptable to the FAA are those developed by the SAE/ISO and these holdover times are not aircraft type specific. Because holdover times are generally given as acceptable ranges, however, it is quite conceivable that a rational analysis could lead to an acceptable deicing program in which type-specific holdover times are provided within the ranges of acceptable holdover times given in the SAE/ISO tables. The language in the final rule, therefore, does not prohibit the use of type-specific holdover times, but they are not required.

• *Mandatory vs. Guideline Holdover Times*

Several commenters state that holdover times were developed to be used as guidelines and not as mandatory times. One commenter states that the holdover time guidance provided in current and proposed advisory circulars is too general to be of real use, and that the FAA should immediately commission SAE to "recalibrate" its charts to match standard National Weather Service reporting criteria.

FAA Response

As stated above, each certificate holder must develop its own holdover times with data acceptable to the Administrator and if the maximum holdover time developed by the certificate holder is exceeded, other actions must be accomplished before the aircraft can take off. The FAA will continue to work with the National Weather Service to enhance reporting criteria in order to provide flight crewmembers with current information required in the use of holdover timetables.

• *Determining or Changing Holdover Times*

Two commenters (the Airline Dispatchers Federation and an individual dispatcher) state that the proposed rule does not adequately reflect the role of the dispatcher under existing part 121 rules. These commenters recommend that the dispatcher's role be reflected in the rule language and that the dispatcher and pilot in command must work together in determining holdover times. One suggests that the dispatcher is in a better position to enforce holdover times than is the pilot in command. Several commenters suggest that the proposed rule language places an unreasonable burden on the pilot in command, particularly in a case where a pilot in command would be expected to

increase or decrease the determined holdover time based on changing conditions. Commenters suggest that it would be better to establish at each airport one central agency to determine and revise as appropriate holdover times for all certificate holders operating at that airport.

FAA Response

The information required to determine or change the proper holdover time includes outside air temperature, type and concentration of fluid, weather conditions, and time the last application of fluid began. This information is most readily available to the pilot in command, allowing him or her to determine quickly from the holdover timetable the appropriate holdover time. The certificate holder's program may include holdover time coordination with the dispatcher; however, the information required to determine or change the proper holdover time may be available only to the pilot in command.

Type I and Type II Fluids

A number of commenters expressed views on the potential uses of Types I and II fluids under the proposed rule. Several commenters recommend that the FAA mandate or at least encourage the use of Type II fluids. Others raised questions about the use of Type II fluids, ranging from potential environmental problems (dealt with elsewhere in this preamble) to higher cost and limited availability for the 1992/1993 winter. One commenter questions whether Type II fluids are better in most situations and states that Type II usage in Europe is declining.

FAA Response

Each specific certificate holder determines the type of fluids used in its operations. As stated in the NPRM and in this preamble, each type fluid has its benefits and intended usage. All the information presently available to the FAA indicates that there is no availability problem associated with Type II fluids and that their use continues to grow in Europe and Canada.

Pretakeoff Contamination Check

A number of commenters raise questions concerning the proposed pretakeoff contamination check defined in proposed § 121.629(c)(4) and the optional outside the aircraft check in proposed § 129.629(d). The most frequently raised concern is that the proposed five-minute limitation in § 121.629(c)(4) and (d) is impractical because most airports do not now have a facility at a location near enough to the end of the takeoff runway to perform these checks.

Other concerns are: (1) Pretakeoff contamination checks with the engines running (particularly propeller driven aircraft) are inherently unsafe; (2) a pretakeoff contamination check should be required following ground operations in all icing condition operations, not just when holdover times are exceeded; (3) checks from within the aircraft should be allowed in all cases according to some commenters and should never be allowed according to others.

FAA Response

Section 121.629(c)(3) and (c)(4) of the proposed rule would allow a takeoff after the expiration of a holdover time if a check conducted within five minutes prior to takeoff determines that the wings, control surfaces, and other critical surfaces are free of frost, ice, or snow, and if the check is "accomplished from outside the aircraft unless the program specifies otherwise." Section 121.629(d) of the proposed rule would also allow for a check that must be conducted within five minutes prior to takeoff as an optional alternative for a certificate holder who does not have a deicing program but this check must be accomplished from outside the aircraft.

Some commenters have confused the pretakeoff contamination check referenced in proposed § 121.629(c)(3) and (c)(4) with the outside-the-aircraft check that is required by § 121.629(d). The following describes the different procedures, and checks contained in the final rule. (See Figure 2)

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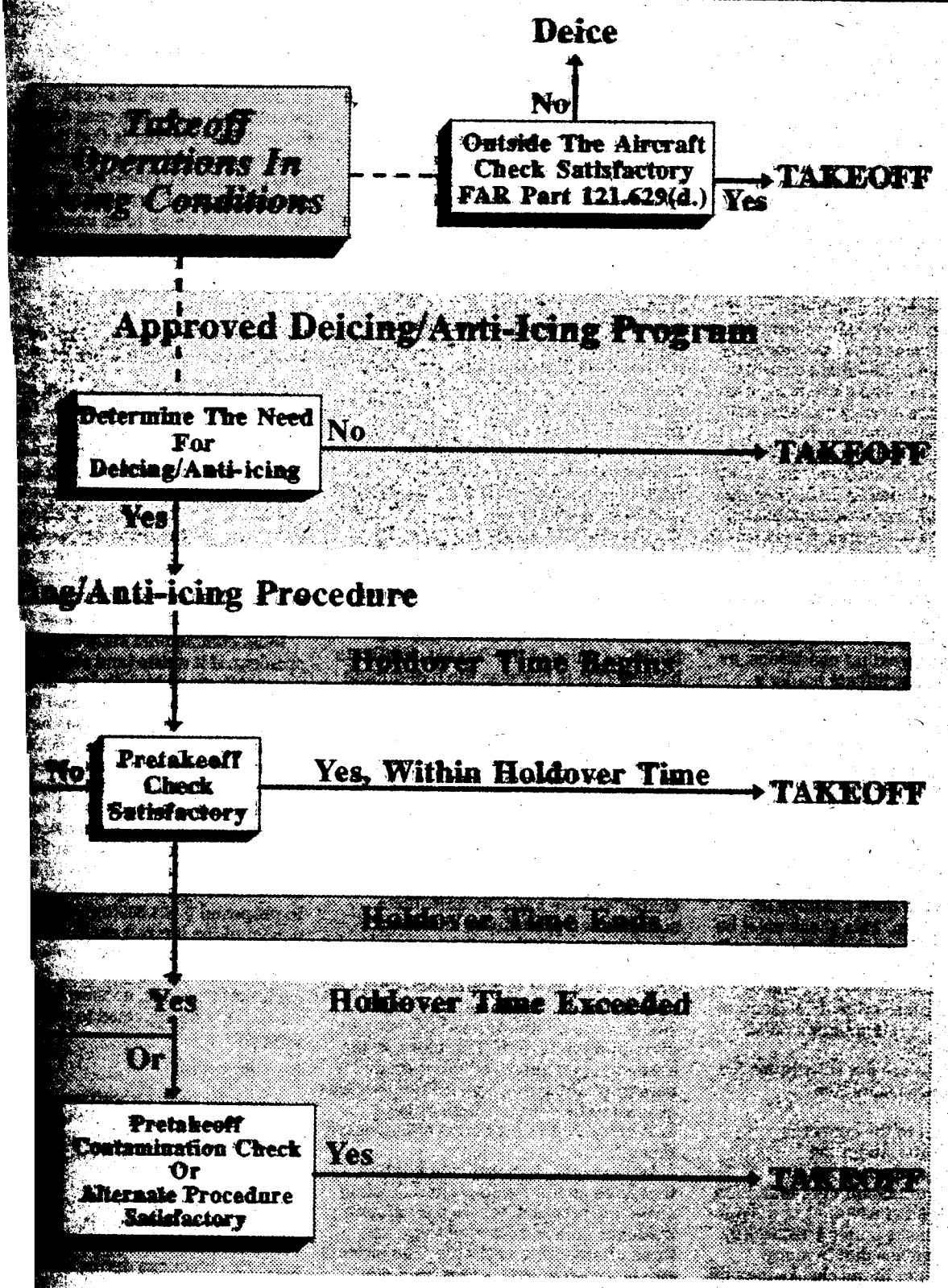
Deice
No
Takeoff Operations In Icing Conditions
Outside The Aircraft Check Satisfactory FAR Part 121.629(d.)
Yes
TAKEOFF
Approved Deicing/Anti-Icing Program
Determine The Need For Deicing/Anti-icing
No
TAKEOFF
Yes
Anti-icing Procedure
Holdover Time Begins
No
Pretakeoff Check Satisfactory
Yes, Within Holdover Time
TAKEOFF
Holdover Time Ends
Yes
Holdover Time Exceeded
Or
Pretakeoff Contamination Check Or Alternate Procedure Satisfactory
Yes
TAKEOFF

(1) *Aircraft deicing/anti-icing procedure.* This procedure is completed by ground personnel. The procedure includes checking wings, control surfaces, propellers, engine inlets, and other critical surfaces as defined in the aircraft manufacturer's maintenance manual or Advisory Circular (AC) 121-XXX Aircraft Ground Deicing and Anti-Icing Program and is an integral part of the deicing process. It is referenced in the beginning of § 121.629(c)(4).

(2) *Pretakeoff check.* This check is completed any time the aircraft is deiced or anti-iced and is integral to the use of holdover times. It is accomplished within the holdover time, and normally is accomplished by the flight crew from inside the aircraft. The aircraft's wings or representative aircraft surfaces are checked for contamination. For clarification, and to be consistent with the intended use of holdover timetables, this check is included in § 121.629(c)(4).

(3) *Pretakeoff contamination check.* This check is to determine the condition of an aircraft after the maximum holdover time has been exceeded. This check may be performed from either the inside or the outside of the aircraft depending upon type of aircraft, lighting conditions, and weather conditions, as specified in the certificate holder's approved program. When the pretakeoff contamination check is used, it must be accomplished within five minutes of beginning the takeoff. The aircraft's wings, control surfaces, and other critical surfaces, as defined in the certificate holder's program, must be checked.

(4) *Part 121.629(d) outside-the-aircraft check.* This check is required only if a certificate holder does not have an approved program. This check must be accomplished from outside the aircraft within five minutes of beginning the takeoff. The aircraft's wings, control surfaces, and other critical surfaces, as defined in the manufacturer's AFM, must be checked.

These checks are not substitutes for an Airworthiness Directive requirements.

With respect to the concerns commenters raise about the practicability of the five minute limitation on pretakeoff contamination checks under § 121.629(c)(4) or outside-the-aircraft checks under § 121.629(d), the FAA recognizes that in many situations neither of the checks may be viable at certain airports, at certain peak departure times, and during certain weather conditions. Over the long term, as airport remote deicing and checking facilities are built or expanded, those checks may become more feasible. However, the FAA points out that the five minute limitation arises only in two situations. One is when a certificate holder does not have an approved ground deicing/anti-icing program. The other is after a maximum holdover time is exceeded.

The FAA assumes that a certificate holder will elect not to have an approved ground deicing/anti-icing program only if it concludes that it would be more cost effective to operate without such a program. In electing not to have an approved program the certificate holder has taken into consideration the possibility that it would have to delay or even cancel flights in icing conditions. As a practical matter, the FAA does not expect that such a certificate holder's operations under this rule will differ significantly from its past operations.

The outside-the-aircraft check conducted within five minutes of beginning takeoff is the only alternative means of operating in icing conditions in the absence of an approved program under paragraph (c). That is, even if a certificate holder was to use the deicing facilities of another certificate holder who has an approved program, the first certificate holder could not use the holdover times of the deicing certificate holder. This is because the five-minute limitation under § 121.629(d) recognizes that pilots who operate without an operator approved program, as compared to pilots who operate under an approved program, may lack proper training and the knowledge to effectively determine whether the aircraft is free of contamination prior to takeoff. Proper training includes reviewing precipitation categories, fluid characteristics and concentrations, coordination procedures and check requirements. Without the proper training provided under an approved program the pilot in command who is in possession of a holdover time could easily make an uninformed decision in attempting to takeoff. Therefore, in the absence of an approved program under paragraph (c), paragraph (d) requires the aircraft to be checked from outside the aircraft within five minutes of beginning takeoff.

With respect to certificate holders that have an approved ground deicing/anti-icing program, where a maximum holdover time is exceeded there are three alternatives available. The aircraft can be redeiced and a new holdover time established. The aircraft can takeoff if the certificate holder has obtained approval of an alternate procedure (e.g. a new technology) that is capable of determining that the wings, etc., are clean. The third alternative is to accomplish a pretakeoff contamination check and begin the takeoff within five minutes of completing the check. Thus, if the takeoff could not be initiated within the five minute limitation, and if no alternate procedure has been established, the worse case scenario for the certificate holder is that the aircraft must be redeiced and a new holdover time established. Given the goals of this rulemaking, the FAA does not consider the potential delay to be unacceptable given the risks of taking off when there would be considerable uncertainty about the possibility of aircraft surface contamination.

Inspections for Specific Airplane Types by Airworthiness Directive (AD)

The NPRM preamble pointed out that the FAA had previously issued ADs requiring a tactile inspection any time ground icing conditions might exist for certain airplanes without wing leading edge devices (i.e., airplanes commonly referred to as "hard wing"). FAA invited comments on the need for a similar mandatory requirement for any other airplane types. Several commenters address this request, but none recommend additional airplane types.

Most commenters state that this problem, if it exists (and some believe it does not), should be dealt with by the FAA as it has been in the past by issuance of an AD when warranted. One commenter states that the FAA's belief that non-slatted wings are more susceptible to loss of lift than wings with leading edge slats is not supported by any known aerodynamic data. One commenter recommends that the significance of airplane design be recognized by adding "or on an aircraft" to proposed § 121.639(c)(1)(i) since the design of the aircraft could make it susceptible to contamination while conditions at the airport may not be such that frost, ice, or snow may reasonably be expected to adhere to the aircraft.

FAA Response

As in the past, aircraft specific requirements will be dealt with by the issuance of ADs. Commenters did not indicate any additional aircraft types that warrant a mandatory tactile inspection at this time. Any manufacturer that does not agree that an AD is warranted when proposed may state its objections during the course of that rulemaking.

Deicing programs for aircraft not covered by an AD may voluntarily include a tactile inspection of an aircraft's wing; this could be done immediately after deicing is accomplished or to determine if deicing

necessary. Certificate holders especially in their deicing/anti-icing and intended use of tactile As to adding "or on an to § 121.629(c)(1)(i), the FAA determined that the words "at an should be deleted so that the paragraph includes any conditions frost, ice, or snow may reasonably be expected to adhere to the aft.

Decision

Several commenters express concern nothing in the proposed rulemaking would change the existing policy that the ultimate responsibility for a takeoff on the pilot in command. Two commenters believe that the dispatcher's role in releasing an aircraft, possibly including the determination of delayover times jointly with the pilot in command, should be spelled out in the final rule language.

FAA Response

The FAA agrees that nothing in this rule changes § 91.3(a) which states that "the pilot in command of an aircraft is directly responsible for, and is the final authority as to, the operation of that aircraft." As stated in the preamble to the NPRM, the new approach taken by this rulemaking is to give the pilot in command additional guidance and certificate holder-developed procedures and, under certain conditions, ground personnel support, in determining the aircraft's airworthiness in potential icing conditions. While this rule will ensure that the pilot in command and supporting personnel receive additional training and that the certificate holder establishes additional procedures for potential icing situations, the ultimate authority and responsibility for the operation of the aircraft remain with the pilot in command.

The FAA does not agree that the role of the dispatcher needs to be further addressed in § 121.629(c). Paragraph (c) states clearly that "no person may dispatch * * * an aircraft any time conditions are such that frost, ice, or snow may reasonably be expected to adhere to the aircraft, unless the certificate holder has an approved deicing program and unless the dispatch, release, and takeoff comply with that program." Thus, the dispatcher is part of the team that will initially determine whether it is safe for a flight to be dispatched in existing and anticipated icing conditions. As discussed elsewhere in this preamble, a dispatcher might not have all or the most current icing and weather information that becomes available to the pilot in command, and that is used by the pilot in command in initially determining and possibly changing a holdover time.

Training of Flight Crewmembers and Other Personnel

A number of commenters express concerns with the proposed training provisions of the certificate holder's approved deicing program. The most significant concerns deal with the short time available to train and qualify affected personnel, training requirements for ground personnel employed by contractors rather than by certificate holders, and the need to ensure that FAA's principal operations inspectors are themselves trained. Commenters also make a few specific training recommendations. Each of these areas and others are specifically addressed below.

- *Training and Qualification Deadline*

Several commenters state that it is impractical to train and complete testing or qualification before November 1, 1992, particularly for ground personnel who work for contractors and not directly for the certificate holder. Suggested solutions are: to require only written notice of new procedures to affected persons before November 1, 1992; to require training only, with testing or qualification delayed until the next scheduled recurrent training program; and to develop a universal training program that could be used for all ground personnel.

One commenter stated its concern that FAA's principal operations inspectors are themselves in need of more effective training if they are to determine the adequacy of a proposed program.

FAA Response

The FAA agrees that it would be impractical to complete both formal training and testing for flight crewmembers and formal training and qualification for other affected personnel before November 1, 1992. Therefore, in order to complete flight crewmember training and testing and training and qualification for other affected personnel for this first year, the FAA will allow certificate holders maximum flexibility in providing the required training and testing/qualifications (e.g., take home brochures, video tapes, self-grading quizzes, or other appropriate review materials). With respect to the training and qualification of persons who work for contractors, the FAA believes that certificate holders must be held responsible for these personnel as they are for their own employees. For those contract personnel who do not normally provide deicing/anti-icing service to the certificate holder, proper deicing/anti-icing procedures and supervision must be assured by a trained flight crewmember, mechanic, or other person employed by the certificate holder using the procedures authorized in their approved program. While training of FAA principal operations inspectors is addressed later in this preamble under the "Program Implementation" section, FAA agrees that thorough and better training of all personnel in government and industry is vital to reducing the incidence of icing-related accidents.

Certificate holders who cannot complete training and qualification of their personnel before the effective date of this rule have the option of using the alternative procedure in § 121.629(d).

- *Dispatcher Training*

The Airline Dispatchers Federation recommends that dispatchers be specifically included in § 121.629(c)(2)(iii) to ensure that dispatchers are trained so that they can carry out with the pilot in command and with Air Traffic Control (ATC), the duties imposed by §§ 121.99, 121.533(c)(d), and 121.535(c)(d).

FAA Response

Section 121.629(c)(2) specifically identifies "aircraft dispatchers" as one of the groups of personnel covered by the term "all other affected personnel." It is not, therefore, necessary to identify dispatchers specifically in the list of areas to be covered under § 121.629(c)(2).

- *Training Program Content*

The Airline Pilots Association (ALPA) states that Advisory Circular (AC) 20-117 has not been as widely distributed to pilots or incorporated into specific training programs as the FAA originally intended, and recommends that approved deicing training programs mandate that all pertinent advisory circulars become an integral part of the training program. Fokker Aircraft recommends that pilot training programs emphasize again the effect of airframe icing on the aircraft's ability to fly. Fokker recommends that training programs include a takeoff technique, recommended by it and other aircraft manufacturers that during ground icing conditions pilots should use a slower rate of rotation to a lower pitch angle. Fokker also recommends that an air carrier's ground deicing program address the advantages of Type II fluids and the disadvantage of Type I fluids in detail.

FAA Response

One of the major areas included in this rule is training of all those personnel involved in the ground deicing/anti-icing process. Each certificate holder in its approved program must include all the applicable material and guidance regarding deicing/anti-icing operations to ensure its personnel are properly trained. The FAA is developing a new Advisory Circular to provide additional guidance to certificate holders. In addition, the following documents are excellent sources for obtaining guidance material:

Advisory Circular 20-117, "Hazards Following Ground Deicing and Ground Operations in Conditions Conducive to Aircraft Icing"

International Standard Organization (ISO) 11075, "Aircraft Deicing/Anti-icing Newtonian Fluids ISO Type I"

ISO 11076, "Aircraft Deicing/Anti-icing Methods with Fluids"

ISO 11077, "Deicing/Anti-icing Self-Propelled Vehicles—Functional Requirements"

ISO 11078, "Aircraft Deicing/Anti-icing Non-Newtonian Fluids ISO Type II"

Society of Automotive Engineers (SAE) Aerospace Recommended Practice (ARP) 4737, "Aircraft Deicing/Anti-icing Methods with Fluids, for Large Transport Aircraft"

FAA Order 8400.10, Air Transportation Operations Inspector's Handbook, Volume 4, chapter 8, Sections 1 and 2.

The FAA also agrees that pilot training for ground icing conditions should include recognition of changes in aircraft handling characteristics and instruction on the takeoff techniques to use, such as decreasing the rotation rate and reducing the angle of rotation of different aircraft types. The FAA plans to work with aircraft manufacturers and industry associations to develop appropriate training material as early as possible.

Airport/ATC Roles

Two commenters state that deicing/anti-icing programs should be jointly developed and implemented by air carriers and airports to ensure fair and uniform procedures and to reduce the burden on air carriers. One commenter discusses a number of airport responsibilities that relate to deicing, for example, ensuring that any materials used will not cause harm or endanger aircraft or their systems, and ensuring that these materials are disposed of properly. This commenter recommends that airports meet with air carriers in developing sound deicing programs.

Other commenters say that the role of ATC must be fully coordinated with that of the air carriers and airports to ensure the proper use of holdover times, to prevent delays after deicing, and to ensure a smooth traffic flow during icing conditions. ATC should also be aware of the differences related to deicing procedures for Part 121 and 135 operations and ensure that both types of operations are treated fairly.

One commenter states that many airports are already developing deicing/anti-icing programs and that these may not be compatible with the proposed rule or part 121 programs under development. Another commenter states that if airports, air carriers, and ATC were to coordinate their efforts, it would be difficult to implement any programs before the November 1, 1992 deadline.

Some commenters provide specific recommendations for airports and ATC in implementing deicing programs. One commenter says that airports should make provisions for end-of-the-runway deicing to reduce delays. Another says that the FAA should review ATC responsibilities related to flow times, take-off and landing sequencing in adverse weather conditions.

FAA Response

The FAA agrees that involvement of airport operators and ATC is essential to increasing aviation safety in potential icing conditions. Officials in FAA's Flight Standards Service have been working with ATC and FAA's airport offices throughout the course of this rulemaking. This effort is short term to ensure the maximum possible effort for this winter and long term to deal with actions that cannot be accomplished quickly. The FAA also agrees that certificate holders should coordinate their deicing/anti-icing programs with the operators of each specific airport where they will be using their deicing program.

Prevention of Delays

Some commenters express concern about delays resulting from deicing, checking, and re-deicing. This could create gridlock in air traffic flow and be extremely costly to airlines and inconvenient for passengers. Commenters also argue that the proposed rule poses a disadvantage to domestic carriers who would face delays from checking requirements while foreign carriers will be able to depart without such delays; this, it is suggested, would create competitive inequality for U.S. carriers and lead to an erosion of revenue for these carriers. Alternatively, one commenter says that the proposal would force foreign airports to deal with disruption to traffic flows due to U.S. carrier deicing and check requirements; this could result in discrimination against U.S. carriers.

Two commenters recommend utilizing gate-hold procedures to reduce delays between deicing and takeoff. In addition, one commenter recommends that the FAA re-examine the Enroute Spacing Program to allow aircraft to be released immediately when cleared.

One commenter recommends that to reduce competitive inequality the FAA should hold discussions with Joint Airworthiness authorities about compatible standards and practices.

FAA Response

The FAA recognizes that there may be some additional delays resulting from this rule if airplanes return for redeicing or if a pretakeoff contamination check is accomplished. However, most weather-related delays already occur under the existing rule and, as discussed under the "Economic Evaluation" section of this preamble, the FAA does not believe that the delay costs associated with this amendment will be significant. As discussed in the preamble to the proposed rule, while this rule does not directly affect operations of foreign air carriers, the FAA will continue to work aggressively with other nations' civil aviation authorities and will request that ICAO initiate a review of pretakeoff deicing and checking procedures used by all air carriers. In the meantime, as discussed more fully under "International Trade Impact Statement" the FAA does not believe that the competitive disadvantage to U.S. operators is significant.

Underwing Frost

Several commenters express concern that the proposed rule language could lead to rescinding previous FAA policy that allows takeoffs with a small amount of frost on the underside of the wing in the area of fuel tanks when it is consistent with the aircraft manufacturer's operating and service instructions.

FAA Response

The FAA does not intend to change policy of permitting takeoff with small amounts of frost on the underwings of airplanes caused by cold soaked fuel within aircraft manufacturer established limits accepted by FAA aircraft certification offices and stated in aircraft maintenance manuals and aircraft flight manuals. Language has been added to the final rule to make clear that takeoffs with frost under the wing in the area of the fuel tanks is

authorized by the ...ator. Affected certificate ...ould include the type of ...olved and justification for ...ations, including ...arer supplied data showing ...operations are safely ...ed, as part of their proposed ...program.

...Implementation

...commenters state that ...ntation of deicing programs ...be done by a central ...tion to ensure uniform ...ds. One supports an industry-...ation, rather than delegating the ...val of each program to the local ...One commenter states that the ...vides too much discretion to ...FAA offices in approving deicing ...which could cause operational ...ancies among carriers and ...orts. This commenter recommends ...the FAA provide comprehensive ...ance to local offices in developing ...ing programs. Another commenter ...s that, because the timeline for ...pliance is so short, implementation ...uld be flexible and determined ...ally.

Another commenter recommends that ...FAA monitor implementation of ...FAA-approved deicing programs this ...ter. In addition, the FAA should ...ntinue to address actions designed to ...uce the time that airplanes are ...posed to icing conditions between ...deicing/anti-icing and takeoff (e.g., ...aircraft design, deicing/anti-icing ...chnology, air traffic control).

Another commenter recommends that ...FAA provide inspectors for post-...deicing checks and this could be funded ...by the aviation trust fund. One ...commenter is against locating deicing ...program requirements in current ...operations specifications; minor ...modifications to deicing practices will ...require specifications amendments, ...resulting in delays. This commenter ...recommends that FAR 121.629 mandate ...that air carriers have approved ...programs in place and follow these ...programs (which would be monitored by ...each carrier's principal operations ...inspector). Details of an approved ...deicing program should be outlined in ...an Advisory Circular that facilitates ...getting as much implemented as ...possible by November 1, 1992. Several ...other commenters support using an ...advisory circular either in addition to or ...instead of a rule.

One commenter discusses the safety problems for passengers who must walk through deicing fluid in ramp areas to board aircraft; this could also damage the interior of the aircraft.

Two commenters discuss their products related to deicing and express interest in collaborating with the FAA in using these products. One product is a detection system for overwing clear ice or measurement of contamination on the surface. Another product is an anti-icing product. This latter commenter also maintains that the proposed rule could adversely affect its patent as well as its ability to compete with foreign producers of Type II fluids; and that the FAA should shape the rule so as not to diminish the value of the patent nor impede the marketing of the product.

FAA Response

The FAA has conducted and continues to provide training in this area for all principal operations inspectors and principal maintenance inspectors. In addition to this training to facilitate the review of certificate holder programs, the FAA has appointed regional coordinators who will assist local inspectors and who will forward issues to the FAA Headquarters that cannot be resolved locally. The FAA, besides developing Inspector Handbook guidance, is also developing an Advisory Circular that provides guidance to certificate holders and principal inspectors.

The FAA will be closely monitoring the implementation of this rule and, as stated previously, will continue to work with all involved parties to smoothly implement the requirements of this rule.

As previously stated in this preamble, it is ultimately the responsibility of each pilot in command to determine whether his or her aircraft is free of contamination and thus airworthy. The responsibility for checks after deicing cannot be delegated to the FAA. Each certificate holder's operations specifications should refer to the specific locations in the certificate holder's manuals that contain its approved deicing/anti-icing program. The whole program does not have to be physically included with the certificate holder's operations specifications. Finally, ACs provide examples and one method of complying with regulations. They are not mandatory.

The ramp area safety issues mentioned should be addressed in each certificate holder's program.

The FAA encourages innovation to solve the problem of identifying contamination on the aircraft surface and § 121.629(c)(3)(ii) provides an alternate procedure for obtaining approval by the Administrator of an appropriate innovative approach. Also, the FAA does not recommend which type of fluid a certificate holder should use, Type I or Type II, and does not recommend any particular company's product in this rule.

As stated previously in the "Applicability and Justification" section of this preamble, the FAA has determined that all part 121 turboprop aircraft should be included in this rulemaking and will continue to analyze operations under other parts to determine if future rulemaking is required.

Miscellaneous

Other general comments about the proposed rule include discussions of the accidents cited in the NPRM. One commenter says that NTSB accident statistics related to icing problems do not address the thousands of successful takeoffs made annually during icing conditions. Another commenter says that the NTSB investigation of the 1982 Air Florida accident shows that improper engine thrust was the main cause and that perhaps icing problems alone were not the problem. Another commenter says that in the section of the NPRM entitled "Part 121 Passenger Carrier Benefits Section," paragraph (2) should clarify that the five mentioned accidents involved large passenger-carrying air carriers.

One commenter says that the FAA should include in the docket any studies that it relied upon to reach its conclusions in the NPRM, such as the conclusion that non-slatted wing aircraft are more susceptible to lift loss than slatted aircraft.

FAA Response

The NTSB's recommendations are based on its accident investigations and its other studies and thus do, in effect, consider successful operations. Also the NTSB in its investigation of the Air Florida accident cites as one of the probable causes the flight crew's decision to take off with snow and ice on the aircraft's airfoil surfaces.

The FAA has included in the docket a summary of wind tunnel tests of hard leading edge wings and slatted leading edge wings completed by the NASA Lewis Research Center, though the difference in accident history of these designs may not be fully explained by design differences. Pilot techniques, including rotation rates and angles, are also important factors to be considered in assessing stall propensity, along with the rotation speed and the initially computed climb speed. One factor alone has not been isolated as the major explanation for differences in accident rates which have been experienced.

Cost

The comments in this section are separated into subject categories: Delay costs, deicing fluid costs, international trade impact, training and personnel costs, and other costs.

Comments on Delay Costs

One commenter states that the cost of implementing the proposed rule should be calculated including input from the part 121 air carriers and should include estimated delay costs using air carrier data and input.

Another commenter states that checking the upper surfaces of a B-747 would be impractical, would cause delays, and would impose severe restrictions on the departing aircraft flow. The commenter also states that such a requirement would preclude their ad hoc charter operations from many airports during adverse weather, thus imposing a severe economic penalty on them.

Another commenter states that some elements of the proposed rule, as confirmed by the FAA in the NPRM, may not be amenable to accurate cost analysis. The impact on flight delays is difficult to project on short notice, and would require a study beyond the range of the 15-day comment period provided by FAA. The commenter describes a worse case scenario in which approved deicing programs are not completed, and numerous carriers at a large airport are attempting to perform external checks on a 5-minute cycle. This would effectively close the airport under conditions which were previously negotiable. The expense of airport closures is extremely high, as passengers have to be accommodated over a period of a day or more, and airport and crew rotations have to be unscrambled.

A commenter states that they are unable to provide cost data related to specific provisions of the rule in the time permitted for comments. They point out the differences between passenger carriers and integrated express carriers such as UPS. A single aircraft missing the national sort requires them to charter up to thirty executive jets to make their service commitment. In light of the nature of the business, they believe the FAA cost estimates are grossly understated.

One commenter stated that airports will experience various degrees of gridlock from airplanes requiring external checks or returning to be deiced. The increase in delays is estimated to be ten fold during freezing precipitation. During 1991/1992, the commenter claims it suffered 802 deicing delays. It estimated that 700 of these occurred during periods of precipitation. They believe that this could explode to 7,000 delays in 1992/1993. These delays could produce external checking and equipment costs of $30 million.

FAA's Response

The NPRM requested cost information, including estimated delay costs, from part 121 air carriers. Reliable information from commenters is considered in this evaluation.

The proposed rule could increase delays by requiring longer and more detailed inspections of airplane surfaces. However, it would provide flexibility by allowing either the use of an approved deicing program or an outside check five minutes before takeoff. In some instances, the proposed rule could decrease delays. For example, if the pilot decides to return for re-deicing, an outside check could reveal that the airplane surface is actually clear of ice, thereby avoiding a needless deicing.

There are two types of delays: (1) Delays due to the existing rule and (2) delays due to the proposed rule. In either case, an airplane may not take off if its surface is contaminated. The cost information that the commenter provided does not differentiate between these two types of delays, nor does the commenter explain how it arrived at these estimates.

Consequently, the FAA is not able to respond to the specific cost estimates provided by the commenters. However, the FAA does agree with the commenters to the extent that their estimates demonstrate that delay costs could increase.

Deicing Fluid Costs

One commenter believes that the costs are very conservative and do not present a true total, and that, regardless of the cost, the traveling public will ultimately pay for it. The commenter indicates that delays are the same regardless of the type of fluid since delays could result from weather, staff, equipment failure, etc." Also, the type fluid used does not matter because ground holdover times can expire with either fluid. Type II fluids may be beneficial for long term/overnight requirements, but is very costly and impractical for the average ground time of a turn-around type operation that is less than 3-4 hours on the ground.

Another commenter states that carriers have committed from $1-5 million each for plans to acquire new anti-icing equipment and convert old deicing equipment for application of Type II fluids. In addition, the total cost of Type II fluids applied is 3-4 times th cost of Type I fluids. The commenter also states that of the two glycols (ethylene and propylene glycol), ethylene glycol appears to be the most cost effective product due to the fact that there are more suppliers of ethyle glycol; therefore, the competitive influences in the marketplace dictate lower cost. Ethylene glycol is an inherently less costly molecule to manufacture than propylene glycol. Consequently, by focusing on overall cost effectiveness, and because the possibility exists that propylene glyco may be applied in undiluted form in circumstances where it is not recommended by the aircraft manufacturer, economic and safety considerations give ethylene glycol a preference.

One commenter believes that the FA concludes erroneously that this is not major rule. This commenter believes that the shift from Type I to Type II fluids will increase airline unit fluid costs by the difference in price betwe Type II and Type I fluids, and may al result in a requirement for increased fluid volume. Competition will be lessened because the FAA's encouragement of the use of Type II fluid will likely inhibit and possibly preclude this commenter's entry into airline market, thereby negating the competitive restraint which Type I an adhesion Airborne 99 would otherwi have on Type II pricing.

In addition to the above problems, commenter states that the NPRM doe not fully address the potential adver effects specified in 5 U.S.C. 601 whic specifies the following additional concerns: Employment, investment, productivity innovation, and the abil of U.S. based enterprises to compete with foreign-based enterprises in domestic or foreign export markets. example, some deicing fluids have t potential to improve airport produc by providing prolonged anti-icing protection through prevention of ice adhesion. In the event that aircraft delayed on the taxiway beyond the nonformation holdover time of their Type II fluids, they would presumab have to be brought back to the de facility for another treatment.

The commenter also states that i FAA promulgates the proposed rul will effectively define anti-icing as use of Type II thickened fluids. Th create a major barrier both to the existing alternative anti-icing syst like Airborne 99 and to the develo of innovative new anti-icing technologies. Also, the commente that if the proposed regulation is

unnecessarily impedes the [illegible] of the commenter's products, [illegible] suppliers of Type II fluids will [illegible] an improper benefit from the [illegible] domestic investment.

FAA's Response

The FAA disagrees with the commenters for several reasons. First, the rule does not mandate the usage of Type II fluid. Second, the holdover tables of the final rule do not differ from the current industry standards enough to cause a significant shift in deicing fluid usage. Third, the FAA recognizes the increasing acceptance of Type II fluid among U.S. carriers. This acceptance is the result of an already wide acceptance by European and Canadian carriers. One of the advantages of using Type II fluid is its longer holdover time. Another advantage is that less fluid is required than Type I fluid.

International Trade Impact

A commenter states that unlike the reasonably uniform levels of safety and economic cost sharing between domestic and foreign air carriers in the aircraft security program, no such attempt has been made with this program. This virtually assures inequalities in airline costs not to mention foreign government cooperation. This issue will pose significant problems for U.S. supplemental air carriers attempting to take advantage of opportunity markets. Accordingly, alternatives must be found to prevent U.S. carriers from suffering even further from regulations of this type.

The commenter further argues that in the International Trade Impact discussion of the docket, a case is made that average costs would increase approximately 4 cents per round trip ticket. Although this might be true for a carrier operating to a scheduled location where ongoing training would be possible, this is not true for operators taking advantage of unscheduled opportunities. In these instances the costs could be prohibitive. As an example, a typical round trip cost between the East Coast and Europe might be $36,000. If it were possible, and enough lead time given, an individual could be sent ahead of the aircraft, conduct training, and assure compliance with the current NPRM. The cost of compliance would be approximately $2,500, or approximately a 14 percent increase. This increase would pose a significant economic burden on a carrier that might operate to a particular location once every 2–5 years. This seems unreasonable and contrary to the assurances that a "competitive disadvantage" is remote as stated in the NPRM.

Another commenter questions the reasoning that domestic carriers should bear the training and equipment costs of the proposed rule, while foreign carriers do not.

Another commenter states that the FAA misunderstands the competitive issues involved in a rule exempting foreign carriers. As suggested above, pretakeoff contamination checking requirements imposed by the rule could introduce serious delays for U.S. carriers. If, under these circumstances, foreign carriers could depart from the same airport without the delays and confusion, passengers and shippers would rush to those carriers if consistent with their travel or shipping needs.

They go on to say that it is not the out-of-pocket costs of the proposed rule which make the most significant difference in international competition; it is the potential perception by laymen that foreign carriers can safely depart without delay under conditions requiring domestic carriers to take delays. The unfair bias will apply under the proposal both at domestic origins as well as foreign ones. The FAA must not create this inequality leading to erosion of U.S. carrier revenues.

FAA's Response

While it is true that foreign air carriers would not incur costs imposed by the proposed rule, they would hardly have a competitive advantage. This is because the cost of compliance incurred by U.S. air carriers is expected to be offset by an increase in aviation safety both real and perceived by the flying public. The expected increase of 4 cents in cost of an average international round trip ticket would not be high enough to lower the demand of travel from U.S. and foreign consumers. The United States has always been perceived as pioneers in aeronautical engineering and especially aviation safety. The rule continues that track record.

In addressing another comment, any air carrier engaged in non-scheduled services does not compete in the same market as scheduled air carriers. Therefore, no adverse impact is expected to be incurred by U.S. scheduled air carriers.

Training and Personnel Costs

One commenter argues that during winter months, they visit 50 cities in North America that are subjected to severe, moderate, or light winter conditions. They argue that the cost per day to send a qualified person to verify that each deicing contractor meets the requirements of the proposed rule is at or above $500 per day not including travel expense.

One commenter states that their flight crewmembers receive ground training on the subjects of deicing/anti-icing and the effects of ice, snow and frost on aircraft performance. These subjects are included in all of the initial and recurrent courses in their approved training program.

A commenter states that up to 20,000 personnel would be covered by the training and qualification testing requirement at the larger companies. This commenter also questions the FAA estimate of training costs. The proposed rule could require initial and recurrent training and qualification costs for over 100,000 employees. A first estimate is one-half day of training for each employee each year, which would indicate over $20 million per year. The present value of 10 years training costs at this rate would exceed FAA's estimate of total cost.

One commenter estimates the annual cost of additional training for flight crewmembers and other affected personnel, as required by the rule, to be $2.5 million.

FAA's Response

The NPRM does not require that each air carrier send a qualified person to verify that each deicing contractor meets the requirements of the proposed rule, therefore, the air carrier would not be required to incur this cost.

Information available to the FAA indicates that air carriers already provide initial and recurrent training in the subject areas of ground deicing and anti-icing. The FAA calculated the incremental cost of added training associated with the requirements of the proposed rule.

The FAA has calculated an initial cost of training for the proposed rule. In subsequent years, however, the added training should be incorporated as a part of the current training that is already taking place. The FAA does not expect any additional future training cost because air carrier employees are routinely provided on-going training to keep them up to date on a number of aviation related issues and practices. The additional procedures required by this rule will likely be a continuation of existing training.

Other Cost Comments

A commenter argues that gate returns for re-deicing will be extremely costly as equipment needed for re-deicing will be in use. This same commenter questions whether the FAA considered a percentage factor of accidents to actual

take-offs made in the 15 year time frame involving ice, snow, and frost or freezing conditions.

Another commenter argues that the FAA has clouded the main issue of deicing/anti-icing costs with cost diagnostics, international trade impact, etc. They argue that these issues are very small contributory items and should not be the concern of the FAA.

One commenter believes that it will cost at least $450 million "to deal with space and environmental issues at the 30 airports required by the FAA to submit de-icing plans."

FAA's Response

The cost of any airplane returning for another re-deicing is not a cost of the current rule since it mandates that no aircraft may take off if ice, snow, or frost is adhering to the surfaces. The FAA recognizes that the proposed rule could result in more airplanes being redeiced due to improved detection procedures. However, the cost of these additional redeicings is difficult to estimate.

There may be some costs associated with dealing with space and environmental issues. The FAA is not convinced that these estimates would be considered reasonable because many variables will affect the final cost outcome. For example, some air carriers are already shifting to Type II fluids and would have switched regardless of the final rule. In addition, flow control procedures at some airports might negate the need for additional space. That is, airplanes as a result of this final rule may line up in queue at the gate instead of the taxiway.

Finally, the FAA is required by mandates from Congress, the President, and the Office of Management and Budget to address the impact that FAA regulations have on small businesses and on international trade. Thus, these topics are very much the concern of the FAA.

Rule Language Changes

The following is a paragraph by paragraph description of significant changes in the final rule language that have been discussed in this preamble. In addition minor editorial changes have been made.

In § 121.629(b) the following sentence has been added: "Takeoffs with frost under the wing in the area of the fuel tanks may be authorized by the Administrator."

In § 121.629(c) the following changes are made:

In paragraph (c)(1)(i) the words "at an airport" are deleted.

In the introductory paragraph of paragraph (c)(3) the words "times, specific to each aircraft type" are deleted and the word "timetables" inserted; the words "the final application of" are added to the description of holdover times; and the words "wings, control surfaces, propellers, engine inlets, and other critical surfaces" are deleted.

In § 121.629 (c)(3)(i) the word "inspection" is replaced by "contamination check" and in § 121.629(c) (3)(i) and (ii) the phrase "as defined in the certificate holder's program" is inserted after "critical surfaces." In § 121.629(c)(3) (i), (ii), and (iii) the words "propellers, engine inlets" are deleted.

In § 121.629(c)(4) the term "pretakeoff check" and the following definition of this term are added: "A pretakeoff check is a check of the aircraft's wings or representative aircraft surfaces for frost, ice, or snow within the aircraft's holdover time." In addition in paragraph (c)(4) the term "pretakeoff inspection" is changed to "pretakeoff contamination check."

Environmental Analysis

This rule is a federal action that is subject to the National Environmental Policy Act (NEPA). Under applicable guidelines of the President's Council on Environmental Quality and agency procedures implementing NEPA, the FAA normally prepares an environmental assessment (EA) to determine the need for an environmental impact statement (EIS) or whether a finding of no significant impact (FONSI) would be appropriate. (40 CFR 1501.3; FAA Order 1050.1D appendix 7. par. 3(a)). In the NPRM the FAA invited comments on any environmental issues associated with the proposed rule, and specifically requested comments on the following: (1) Whether the proposed rule will increase the use of Type I deicing fluid, (2) whether the proposed rule will encourage the use of Type II deicing fluid, (3) the impact, if any, of using these deicing fluids on taxiways "just prior to takeoff," and (4) containment methods currently used that can be adapted to other locations on an airport. Only a few commenters address these environmental issues and most of these commenters focus more on the effect of Federal, State, and local environmental requirements and the lack of local facilities, than on the questions of the potential environmental impact of deicing fluids. A summary of the comments received, the FAA's response and the findings of the FAA's Environmental Assessment follow.

Some commenters say that both Type I and Type II fluids cause environmental problems. One commenter says that the rule would require increased use of Type I fluids to clean aircraft wings prior to Type II application, and that this combination is environmentally hazardous.

One commenter questions what it characterizes as discussions in the United States that Type II fluids are less environmentally acceptable than Type I fluids since, as this commenter points out, both are based on glycols.

Another commenter questions whether airports have the facilities to collect and recycle deicing fluids at takeoff points.

Two commenters believe that environmental constraints will inhibit the operation of remote deicing facilities and recommend that the FAA seek relief from EPA reporting requirements for remote facilities for one to two years. Alternatively, one commenter recommends that the FAA petition the EPA to raise the reportable quantity of ethylene glycol (Type I) from one pound to 1,000 pounds or to exempt the airline industry from all ethylene glycol reporting due to critical safety requirements.

Other commenters also recommend that air carriers be exempt from state and local environmental regulations, which may be even more restrictive than EPA regulations.

One commenter recommends that current environmental constraints be reviewed and additional flexibility for deicing operations be provided in order for the rule's objectives to be met.

One commenter provides recommendations to reduce the discharge of deicing fluids into streams and states that an environmental impact statement should be required where such discharge seems likely.

FAA Response

An Environmental Assessment (EA) that supports a Finding of No Significant Impact (FONSI) is included in the docket for this rulemaking. The EA discusses in detail the potential effect of this rule and addresses in general terms the issues raised by the comments summarized above. The following discussion addresses the major issues raised by commenters.

Presently § 121.629(b) states that no person may takeoff an aircraft when frost, snow, or ice is adhering to the wings, control surfaces, or propellers of the aircraft. As the NPRM preamble, this preamble, and the EA point out, this rule is necessary because several accidents, and recommendations of the 1992

Conference on Airplane Ground Deicing, which was held as a result of these accidents, indicate that under present procedures, the pilot in command may be unable to determine effectively whether the aircraft's critical surfaces are free of all frost, ice, or snow prior to attempting a takeoff. This rule addresses this problem by requiring increased training of appropriate personnel, the use of holdover times, and additional checks of the aircraft's surfaces, all of which are to ensure that an aircraft does not take off if critical aircraft surfaces are contaminated. In essence, this interim final rule, which is necessary before the winter of 1992–1993, requires certain certificate holders to develop a program that will provide the pilot in command with more complete information which he or she needs for deciding whether takeoff can be safely accomplished. Concern with the environmental impacts of this rule emanate principally from the chemical composition of deicing fluids e.g. ethylene glycol has been listed as a hazardous air pollutant under Title III of the Clean Air Act Amendments of 1990. While this rule does not mandate additional use of either Type I or Type II fluids, it could accelerate somewhat the existing trend for U.S. air carriers to follow the European and Canadian practice of increased use of Type II fluids because of the longer holdover times associated with Type II fluids. However, although Type II fluid has a higher biochemical oxygen demand (BOD) that impacts surface water and the fish and other marine life than Type I fluid, it requires approximately 50% less fluid to effectively deice and anti-ice a typical aircraft. Also the use of Type II fluids will significantly reduce the number of redeicings that would be required if Type I fluids were used. These factors along with improved ATC and airport procedures should reduce the use of deicing/anti-icing fluids over the long term.

With respect to the potential environmental effects of both type fluids, as the EA discusses, because of their low volatilities, low ecotoxicities, low toxicity to humans, and biodegradibility, no additional impacts are expected over those already experienced for deicing/anti-icing operations carried out under the current regulations.

With respect to the issues of reporting requirements, relief from state and local environmental requirements, and the availability of collection/recycling facilities, certificate holders that presently use deicing fluids and the operators of airports at which these fluids are used must already comply with all of these requirements when they are applicable. Since this rule requires no additional use of fluids than currently required under the existing clean aircraft requirement, if there are increases in the use of fluids that trigger environmental requirements, those requirements must be met by the airport operator, certificate holder, or other appropriate party, as they would under the present rule. If any of these requirements, or the lack of facilities limit the use of deicing/anti-icing fluids, the result would be that the certificate holder would have to find another means of ensuring that the critical aircraft surfaces are clean before a takeoff is attempted or discontinue operations. Nonetheless, as part of its long term efforts, the FAA will work with certificate holders and with airport operators to monitor the actual and potential environmental effects of this rule and help address any problems that might arise.

Paperwork Reduction Act

Information collection requirements in the amendment to § 121.629 have been approved by the Office of Management and Budget (OMB) under the provisions of the Paperwork Reduction Act of 1980 (Pub. L. 96–511) and have been assigned OMB Control Number 2120–0567.

Regulatory Evaluation Summary

This section summarizes the regulatory evaluation prepared by the FAA. The regulatory evaluation provides more detailed information on estimates of the potential economic consequences of this rule. This summary and the evaluation quantify, to the extent practicable, the estimated costs of the rule to the private sector, consumers, and Federal, State, and local governments, and also the anticipated benefits.

Executive Order 12291, dated February 17, 1981, directs Federal agencies to promulgate new regulations or modify existing regulations only if potential benefits to society for each regulatory change outweigh potential costs. The order also requires the preparation of a Regulatory Impact Analysis of all "major" rules except those responding to emergency situations or other narrowly defined exigencies. A " major" rule is one that is likely to result in an annual effect on the economy of $100 million or more, a major increase in consumer costs, or a significant adverse effect on competition.

The FAA has determined that this rule is not "major" as defined in the executive order. Therefore, a full regulatory impact analysis, which includes the identification and evaluation of cost-reducing alternatives to the rule, has not been prepared. Instead, the agency has prepared a more concise document termed a "regulatory evaluation," which analyzes only this rule without identifying alternatives. In addition to a summary of the regulatory evaluation, this section also contains a final regulatory flexibility determination required by the 1980 Regulatory Flexibility Act (Pub. L. 96–354) and an international trade impact assessment. If the reader desires more detailed economic information than this summary contains, then he or she should consult the regulatory evaluation contained in the docket.

Costs

This rule will increase costs to the industry and to society in five ways. First, airlines will have to develop a deicing program and the FAA will have to approve it. Second, flight and ground crews will have to be trained for and tested in the new procedures. Third, pretakeoff contamination check procedures will have to be implemented. Fourth, airlines, as an option, could purchase additional deicing equipment to deice closer to the takeoff point. Finally, air carriers and passengers could experience an increase in delays.

The total costs are separated into two categories—small and large air carriers. This was done because this rule will impact small carriers differently than it will large carriers.

Small and Large Part 121 Air Carriers

Small carriers are defined as those that own or operate nine or fewer aircraft under part 121. FAA information indicates that of the 53 part 121 air carriers, 31 are large and 22 are small. Of the 4,151 airplanes that are operated under part 121, small air carriers operate approximately 114 or 2.7 percent and large air carriers operate 4,037 or 97.3 percent.

The number of employees at large and small part 121 air carriers was estimated by allocating the total number of employees based on the number of airplanes that these carriers operate. Based upon information provided by the Airline Transport Association (ATA), approximately 20,000 pilots, 20,000 copilots, 10,000 engineers, and 20,000 mechanics work for part 121 air carriers. If the number of employees at large and small carriers is directly related to the number of airplanes that air carriers operate, then large part 121 carriers have 97.3 percent of the total number of

employees in each category and small carriers have 2.7 percent.

Deicing Program

The FAA expects that the industry will develop a generic deicing program as a normal course of business. This generic industry program is expected to have an initial development cost of $7,200. After the program is developed, each air carrier will likely modify the program for its own operations. The initial cost of the program refinement to all 31 large air carriers will be $224,000 and $5,100 to all 22 small air carriers.

Each air carrier's program will have to be approved and reviewed by the principal operations inspectors assigned to each of the air carriers. The FAA estimates that its initial or first year cost will be $15,300 for the review of all programs.

Training and Qualification Testing

Each certification operator that has a deicing program will be required to provide training for all personnel involved with deicing. The FAA estimates that the initial cost of training will be $8.04 million for large air carriers and $80,400 for small air carriers for a total of $8.1 million. Recurrent training is also required. However, the incremental cost of recurring training will be minimal because the air carrier employees are routinely provided on-going training and materials to keep them up to date on a number of aviation related issues and practices.

This final rule also requires testing for flight crewmembers and qualification for all other personnel concerning the specific requirements of the program and each person's responsibilities and duties under it. The recurrent qualification testing will require an additional 15 minutes per individual. The total annual cost will be $2.03 million ($2.01 million to large firms plus $20,109 to small firms). The initial cost associated with qualification testing is expected to be minimal.

Pretakeoff Contamination Checks

Pretakeoff contamination checks will be implemented under this rule. The program must provide that takeoff after the expiration of the holdover time will be permitted only when one of several conditions such as a pretakeoff contamination check takes place. For purposes of this analysis, the check will be made by individuals who operate the additional deicing equipment that will be purchased for redeicing airplanes at the runway. Thus, the cost of a check is incorporated in the labor costs associated with the additional deicing equipment.

Additional Deicing Equipment

Another cost component associated with the rule is deicing equipment, which consists of the capital equipment, operating and maintenance costs, and labor costs. The total one-time cost of the deicing equipment for all affected airports is estimated to be $10,720,000 to provide 67 portable deicing stations at 28 airports. The total recurring annual maintenance and operating costs at all affected airports will be $1,286,400. The FAA estimates the total recurring annual labor cost at all affected airports to be approximately $139,500.

The total undiscounted cost associated with deicing equipment over the next 10 years will be $25 million. This 10 year-cost is comprised of a one time cost of $10,720,000 for capital equipment, $12,864,000 maintenance and operating costs, and $1,395,000 in labor costs.

Delay Costs

In the NPRM, the FAA stated that delays could not be reliably estimated at that time. The Agency then presented a general step-by-step procedure to estimate potential delay costs. Comments from the industry were not useful in calculating these costs. Even though no additional data have been made available, the FAA has made an estimate of potential delay costs imposed by this rule. This estimate, however, as will be discussed later, should be viewed with its limitations.

As stated previously, after a holdover time has been exceeded a pretakeoff contamination check is one of the options available under this rule. Hence, the rule could increase air carrier delays during ice and snow conditions. Increased delays will increase costs to air carrier operators and passengers.

The FAA expects the pretakeoff contamination check to require between 5 to 15 minutes to complete. The regulatory evaluation assumes for the purposes of this estimate a delay of 10 minutes. The value of passenger time is estimated at $39 per passenger per hour and air carrier operating costs at $1,800 per hour. The delay cost estimate was based on 49 of the largest U.S. airports, for which the FAA had both icing and departure data. These 49 airports account for approximately two-thirds of part 121 operations.

The FAA has estimated a range of air carrier delay costs based on different assumptions about the number of aircraft receiving a pretakeoff contamination check. These estimates are based on data from the past three winters on delays that occurred during snow and ice conditions at U.S. airports. The lower of the two estimates measures delay costs to air carrier operators and passengers who were delayed 20 minutes or more due to snow and ice conditions. By looking only at departures with snow and ice delays of 20 or more minutes, the FAA tried to estimate those airplanes that exceeded their holdover times and would then undergo a 10 minute pretakeoff contamination check. The higher estimate assumes that all departures during snow and icing conditions experience a 10 minute pretakeoff contamination check delay.

Scenario One: This scenario represents the low end of the delay cost estimate. It measures delay costs to air carrier operators and passengers when all part 121 airplane departures that are delayed 20 minutes or more due to snow and ice conditions conduct a pretakeoff contamination check. Each pretakeoff contamination check is assumed to take 10 minutes. The 10-year discounted air carrier delay cost, assuming all aircraft experiencing a 20 minute delay during snow and ice conditions receive a pretakeoff check, is $15 million (discounted).

Scenario Two: The second scenario represents the high cost estimate. It measures delay costs to air carrier operators and passengers due to 10-minute pretakeoff checks for all part 121 departures during icing or snowing conditions. This estimate of the incremental air carrier delay costs is $41 million (discounted).

These estimates omit three critical factors that are needed to determine the total impact of the rule. First is the potential system impacts or "ripple effect" on air carrier delays. The FAA attempted to estimate the cost of this effect; however, it was unsuccessful due to the extreme complexity. Second, the potential decrease in delays due to a shift towards Type II deicing fluids is difficult to estimate because the data is not available to make this estimate. The third factor omitted from the delay cost estimate is the delays due to ice adhering to the surfaces of the aircraft. The estimated number of existing delays represents delays that occurred due to snow and ice (e.g., runway closures, poor braking action, etc.). The presence of delays due to snow and ice does not necessarily mean that snow or ice was adhering to the surfaces of the aircraft.

Re-deicing Delay Costs

The costs and benefits of this rule, as a result of the increased checking for and detection of ice adhering to the surface of an airplane. This increased detection could result in additional

delays due to redeicing, though redeicing of contaminated airplanes is already a result of the existing rule. The exact number of delays that occurs as a result of having to return for redeicing cannot be determined at this time due to lack of data. The data needed to measure this cost would be the number of air carriers that have taken off with ice contamination. The FAA has no such measure. However, since Scenario Two above assumes that all future departures for part 121 airplanes will be delayed due to the new procedures of this rule, some of the potential re-deicing costs have been accounted for. In short, this scenario assumes that there would be delays due to pretakeoff contamination checks for all departures during ice and snow conditions. This is a worst case scenario for three reasons. First, not all airplanes would undergo such pretakeoff contamination checks because they would depart before their respective holdover times expire. Second, some airplanes would have alternate procedures to determine if the aircraft is free of contamination. Third, some aircraft would return for redeicing/anti-icing rather than accomplish a pretakeoff contamination check.

The total cost of the final rule is estimated to be between $52 million and $78 million (discounted). Of this total, air carriers would incur non-delay costs of $37 million and delay costs of between $15 million and $41 million.

Benefits

The benefit of the rule is enhanced safety. This safety will be achieved by ensuring that airplanes do not take off with contamination on the surfaces. The analytical approach employed to estimate the potential monetary benefits (safety) of achieving this goal focuses on two existing practices. First, the final rule will implement procedures (pretakeoff contamination checks) that will help prevent airplanes from taking off with ice on surfaces of the aircraft. Second, the final rule will ensure that aircraft that need deicing are actually deiced. Most of the benefits would come from the improved checking procedures (i.e., a formalized deicing/anti-icing procedure that includes standardized holdover tables). Under the current rule, the pilot would perform a visual contamination check before departure. Under this rule, the pilot will spend more time with better information to correctly ascertain whether ice is or is not on the surfaces of that aircraft. The remaining benefits will be derived from deicings due to contamination detected at the time of the check. The FAA cannot estimate the frequency of these occurrences.

The FAA expects the rule to generate total potential safety benefits over the next ten years estimated at $218 million ($1991). On a discounted basis, total potential benefits will amount to an estimated $131 million. This discounted total estimate of benefits is comprised of $125 million for significantly reducing the likelihood of ice-related accidents for passenger-carrying part 121 airplanes and $6 million for part 121 cargo airplanes.

Part 121 Passenger Carrier Benefits

Under the current rule, it is the responsibility of the pilot to decide whether ice, frost, or snow has accumulated on the structure of an airplane. This decision can be very difficult to make, especially when the airplane is sitting at the end of a runway waiting to take off during inclement weather. It is at these times that the likelihood of the pilot making the wrong decision is greatest. The benefits of the rule will come from reducing the likelihood of a pilot making the wrong decision.

Over the past 15 years, there have been five passenger-carrying air carrier accidents where ice, frost, or snow accumulations on the airplane was the primary factor. These accidents resulted in 135 fatalities and 66 serious injuries. In addition, four of the airplanes were destroyed and the other sustained substantial damage.

Based on historical accident and casualty rates, the FAA expects that over the next 10 years, approximately 4 accidents would occur, with 131 fatalities and 64 serious injuries. The present value dollar benefits of preventing these accidents and casualties is estimated to be $166 million (discounted 10 years, 10 percent).

The FAA has attempted to develop a rule that will be effective in preventing all accidents by incorporating program development, training, testing, capital equipment, maintenance, etc. There is some uncertainty, however, as to how effective these components will be. It is conceivable that some aircraft could pass through the system due, in part, to human error and adverse whether conditions, thereby, reducing the effectiveness of the rule. While the actual effectiveness rate would be lower than 100 percent, the FAA estimates that a rate of 75 percent would reflect the reality of correcting a problem that is influenced by a multitude of factors (whether, human error, etc.). Multiplying the $166 million benefits by the 75 percent effectiveness rate results in adjusted benefits of $125 million ($166 million × .75).

Part 121 Cargo Carrier Benefits

The rule will also potentially reduce accidents among large part 121 cargo aircraft. Over the past eight years, there have been three accidents involving large cargo aircraft. These three accidents resulted in two facilities and two serious injuries. Two of the aircraft were substantially damaged and one was destroyed.

Based on these rates the FAA estimates that over the next ten years, there will be approximately 2 accidents, 1 fatality, and 1 serious injury. The estimated value of preventing these accidents is estimated to be $8.4 million (discounted). Multiplying the $8.4 million in cargo benefits by the 75 percent effectiveness rate results in adjusted benefits of $6 million ($8.4 million × .75).

Summary of Benefits

In conclusion, the rule will enhance air carrier safety under conditions of ground icing. The rule will reduce pilot error related to taking off with ice on the airframe by using holdover times and pretakeoff contamination checks. The rule is expected to generate potential total part 121 passenger and cargo carrier benefits of $131 million ($125 million + $6 million).

Benefit-Cost Comparison

The present value cost of the rule, which now includes delay costs, is estimated to range between $52 million and $78 million over the next 10 years. These costs also include program development, training, qualification testing, and capital expenditures. These estimates also do not include the cost of overseas operations.

The benefits of the rule are estimated to be $131 million (discounted) over the next decade. These benefits are derived from preventing accidents due to reduced risk during ground icing conditions.

While the FAA has estimated the cost of delays, it was not able to estimate the ripple effect of those delays nor the effect of increased usage of Type II fluids. However, if the present value cost of the ripple effect of delays ranges between $53 million and $79 million, this rule will still be cost beneficial.

International Trade Impact

The rule is not expected to have a significant incremental impact on international trade. This assessment is based on the belief that while U.S. part 121 operators are expected to incur total

compliance costs of $122 million (undiscounted), they will not be placed at a competitive trade disadvantage.

The average cost of an international round trip airplane ticket is approximately $650. With a potential average cost increase of 4 cents per round trip ticket representing less than one-hundredth of a percent of the total cost of a ticket (without consideration of potential delay costs), the likelihood of U.S. air carriers being placed at a competitive trade disadvantage becomes extremely remote. For a now detailed analysis, the reader is referred to the full international trade impact assessment contained in the docket.

Final Regulatory Flexibility Determination

The Regulatory Flexibility Act of 1980 (RFA) was enacted by Congress to ensure that small entities (small business and small not-for-profit organizations that are independently owned and operated, and small government jurisdictions) are not unnecessarily and disproportionately burdened by Federal regulations. The RFA requires regulatory agencies to review rules that may have "a significant economic impact on a substantial number of small entities." A substantial number of small entities means a number that is not less than eleven and that is more than one-third of the small entities subject to a proposed or existing rule.

The final rule potentially impacts operators of an aircraft for hire with nine aircraft owned but not necessarily operated. Of the 53 active U.S. commercial domestic carriers, the FAA has identified 22 that own or operate nine or fewer aircraft under part 121. The FAA has determined that this is a substantial number since all 22 of these small entities are expected to be affected by the final rule.

To determine whether there is a significant cost impact on small part 121 operators, the annualized cost of the rule must exceed the annualized cost threshold established by FAA Order 2100.14A. The threshold established by the Order for scheduled operators of aircraft for hire falls under two categories. The first category is scheduled operators whose entire fleet has a seating capacity of over 60. The cost threshold for these operators is $112,600. The second category is other scheduled operators with seating capacities less than 60. Their cost threshold is $62,900.

The FAA estimated the annualized cost of the rule to an individual small operator to be $20,800. This number was derived by first summing the undiscounted costs for small operators. These costs are:

Initial Program Development	$5,145
Initial Training	80,436
Qualification Testing	180,981
Initial Capital	289,440
Recurring Maintenance & Operating Costs	384,990
Potential Delay Costs ($69,265,870 x .027)	1,870,178
Total Undiscounted Costs	$2,811,170

The delay costs for small entities were estimated by multiplying the potential $70 million in undiscounted delay costs (high end of cost range) by the 2.7 percent of part 121 carriers that are small. This gives a cost of $1.9 million ($69,265,870 x .027).

The total undiscounted cost, $2.8 million, is then divided by the 22 small operators to get a $127,780 average undiscounted cost for any single small operator. This number is then multiplied by a capital recovery factor of .16275 (10% interest rate for 10 years) to give an annualized cost of $20,800.

The $20,800 annualized cost does not exceed the $62,900 cost threshold prescribed above. Thus, the final rule will not impose a significant cost on a substantial number of small part 121 operators.

Federalism Implications

The regulations herein will not have substantial direct effects on the states, on the relationship between the national government and the states, or on the distribution of power and responsibilities among the various levels of government. Therefore, in accordance with Executive Order 12612, it is determined that this regulation will not have sufficient federalism implications to warrant the preparation of a Federalism Assessment.

Conclusion

For the reasons discussed in the preamble, and based on the findings in the Regulatory Flexibility Determination and the International Trade Impact Analysis, the FAA has determined that this regulation is not major under Executive Order 12291. In addition, the FAA certifies that this regulation will not have a significant economic impact, positive or negative, on a substantial number of small entities under the criteria of the Regulatory Flexibility Act. This regulation is considered significant under DOT Regulatory Policies and Procedures (44 FR 11034; February 26, 1979). A final regulatory evaluation of the regulation, including a final Regulatory Flexibility Determination and International Trade Impact Analysis, has been placed in the docket. A copy may be obtained by contacting the person identified under **"FOR FURTHER INFORMATION CONTACT."**

List of Subjects in 14 CFR Part 121

Air carriers, Air safety, Air transportation, Aircraft, Airmen, Aviation safety, Charter flights, Safety, Transportation.

The Amendment

In consideration of the foregoing, the Federal Aviation Administration amends part 121 of the Federal Aviation Regulations (14 CFR part 121) as follows:

PART 121—CERTIFICATION AND OPERATIONS: DOMESTIC, FLAG, AND SUPPLEMENTAL AIR CARRIERS AND COMMERCIAL OPERATORS OF LARGE AIRCRAFT

1. The authority citation for part 121 continues to read as follows:

Authority: 49 U.S.C. App. 1354(a), 1355, 1356, 1357, 1401, 1421–1430, 1472, 1485, and 1502; 49 U.S.C. 106(g).

2. Section 121.629 is amended by revising paragraph (b) and by adding new paragraphs (c) and (d) to read as follows:

§ 121.629 Operation in icing conditions.

* * * * *

(b) No person may take off an aircraft when frost, ice, or snow is adhering to the wings, control surfaces, propellers, engine inlets, or other critical surfaces of the aircraft or when the takeoff would not be in compliance with paragraph (c) of this section. Takeoffs with frost under the wing in the area of the fuel tanks may be authorized by the Administrator.

(c) Except as provided in paragraph (d) of this section, no person may dispatch, release, or take off an aircraft any time conditions are such that frost, ice, or snow may reasonably be expected to adhere to the aircraft, unless the certificate holder has an approved ground deicing/anti-icing program in its operations specifications and unless the dispatch, release, and takeoff comply with that program. The approved ground deicing/anti-icing program must include at least the following items:

(1) A detailed description of—

(i) How the certificate holder determines that conditions are such that frost, ice, or snow may reasonably be expected to adhere to the aircraft and that ground deicing/anti-icing

operational procedures must be in effect;

(ii) Who is responsible for deciding that ground deicing/anti-icing operational procedures must be in effect;

(iii) The procedures for implementing ground deicing/anti-icing operational procedures;

(iv) The specific duties and responsibilities of each operational position or group responsible for getting the aircraft safely airborne while ground deicing/anti-icing operational procedures are in effect.

(2) Initial and annual recurrent ground training and testing for flight crewmembers and qualification for all other affected personnel (e.g., aircraft dispatchers, ground crews, contract personnel) concerning the specific requirements of the approved program and each person's responsibilities and duties under the approved program, specifically covering the following areas:

(i) The use of holdover times.

(ii) Aircraft deicing/anti-icing procedures, including inspection and check procedures and responsibilities.

(iii) Communications procedures.

(iv) Aircraft surface contamination (i.e., adherence of frost, ice, or snow) and critical area identification, and how contamination adversely affects aircraft performance and flight characteristics.

(v) Types and characteristics of deicing/anti-icing fluids.

(vi) Cold weather preflight inspection procedures.

(vii) Techniques for recognizing contamination on the aircraft.

(3) The certificate holder's holdover timetables and the procedures for the use of these tables by the certificate holder's personnel. Holdover time is the estimated time deicing/anti-icing fluid will prevent the formation of frost or ice and the accumulation of snow on the protected surfaces of an aircraft. Holdover time begins when the final application of deicing/anti-icing fluid commences and expires when the deicing/anti-icing fluid applied to the aircraft loses its effectiveness. The holdover times must be supported by data acceptable to the Administrator. The certificate holder's program must include procedures for flight crewmembers to increase or decrease the determined holdover time in changing conditions. The program must provide that takeoff after exceeding any maximum holdover time in the certificate holder's holdover timetable is permitted only when at least one of the following conditions exists:

(i) A pretakeoff contamination check, as defined in paragraph (c)(4) of this section, determines that the wings, control surfaces, and other critical surfaces, as defined in the certificate holder's program, are free of frost, ice, or snow.

(ii) It is otherwise determined by an alternate procedure approved by the Administrator in accordance with the certificate holder's approved program that the wings, control surfaces, and other critical surfaces, as defined in the certificate holder's program, are free of frost, ice, or snow.

(iii) The wings, control surfaces, and other critical surfaces are redeiced and a new holdover time is determined.

(4) Aircraft deicing/anti-icing procedures and responsibilities, pretakeoff check procedures and responsibilities, and pretakeoff contamination check procedures and responsibilities. A pretakeoff check is a check of the aircraft's wings or representative aircraft surfaces for frost, ice, or snow within the aircraft's holdover time. A pretakeoff contamination check is a check to make sure the wings, control surfaces, and other critical surfaces, as defined in the certificate holder's program, are free of frost, ice, and snow. It must be conducted within five minutes prior to beginning take off. This check must be accomplished from outside the aircraft unless the program specifies otherwise.

(d) A certificate holder may continue to operate under this section without a program as required in paragraph (c) of this section, if it includes in its operations specifications a requirement that, any time conditions are such that frost, ice, or snow may reasonably be expected to adhere to the aircraft, no aircraft will take off unless it has been checked to ensure that the wings, control surfaces, and other critical surfaces are free of frost, ice, and snow. The check must occur within five minutes prior to beginning takeoff. This check must be accomplished from outside the aircraft.

Issued in Washington, DC on September 24, 1992.

Thomas C. Richards,

Administrator.

[FR Doc. 92-23053 Filed 9-25-92; 11:12 am]

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DEPARTMENT OF TRANSPORTATION

Federal Aviation Administration

[AC No. 121-XX]

Proposed Advisory Circular on Ground Deicing and Anti-Icing Program

AGENCY: Federal Aviation Administration, DOT.

ACTION: Request for comments on proposed advisory circular.

SUMMARY: Proposed advisory circular (AC) 121-xx Ground Deicing and Anti-Icing Program, provides guidance about the program elements that should be incorporated in an air carrier's approved ground deicing and anti-icing program. This AC would provide guidance about one method of complying with the requirements of revised Federal Aviation Regulation (FAR) section 121.629.

DATES: Comments must be received on or before October 14, 1992.

ADDRESSES: Written comments are invited on all aspects of the proposed AC. Commenters must identify the number AC 121-xx, Ground Deicing and Anti-Icing Program. Send all comments on the proposed AC to the following location: Federal Aviation Administration, Flight Standards Service, Air Carrier Branch (Attention: AFS-220), 800 Independence Avenue, SW., Washington, DC 20591.

FOR FURTHER INFORMATION CONTACT: Katherine Hakala, Flight Standards Service, Air Carrier Branch, AFS-220, 800 Independence Avenue, SW., Washington, DC 20591; telephone: (202) 267-3762 (8 a.m. to 4:30 p.m. e.s.t.).

SUPPLEMENTARY INFORMATION: The guidance in this AC provides one method, but not the only method, of complying with the requirements of revised FAR 121.629. This guidance material supplements the interim final rule, FAR 121.629 published elsewhere in this issue of the Federal Register, 14 CFR 121.629. Due to the impending winter season and the critical safety nature of this proposed AC, it is published in its entirety in order to allow commenters expedient access to the document.

Issued in Washington, DC, on September 23, 1992.

William J. White,

Deputy Director, Flight Standards Service.

Ground Deicing and Anti-Icing Program
AC No: 121-XX

1. Purpose.

This advisory circular (AC) provides one means, but not the only means, for obtaining approval of a Ground Deicing and Anti-Icing Program, and for ensuring compliance with Federal Aviation Regulations (FAR) Section 121.629.

2. Related FAR Sections.

121.105, 121.107, 121.123, 121.125, 121.127, 121.135, 121.283(b), 121.285, 121.287, 121.289, 121.375, 121.383(a)(2), 121.401, 121.403, 121.405, 121.415, 121.418, 121.419, 121.422, 121.427, 121.433, 121.463, 121.535, 121.537, 121.539, 121.629, and Special Federal Aviation Regulation (SFAR) No. 58.

3. Background.

a. Accidents Related to Icing.

According to information received in 1992 from the National Transportation Safety Board (NTSB), in the last 23 years there have been 15 accidents related to the failure to deice and/or anti-ice aircraft adequately before takeoff. On March 22, 1992, a U.S. air carrier crashed on takeoff from LaGuardia Airport in a snowstorm during nighttime operations. While the NTSB has not yet issued a probable cause finding for this accident, the FAA has proceeded on the assumption that the accident was caused, at least in part, by icing.

b. Reassessment of Icing Procedures.

Prior to the LaGuardia accident, the FAA and the aviation community in general had placed priority on emphasizing the need during icing conditions for the pilot-in-command (PIC) to ensure a "clean aircraft" before takeoff. The FAA believed that pilot education appeared key to combatting the threat of wing icing. Although the FAA still believes the PIC must ultimately make the decision on whether or not to take off, based on a thorough understanding of factors involved in aircraft icing, the FAA believes that certificate holders who conduct their operations under FAR part 121 must provide their PIC's with pertinent information and operator-developed procedures and criteria in order to make a proper decision.

c. Content of this AC.

Accordingly, this AC provides guidance about the program elements that should be incorporated in an air carrier's approved ground deicing and anti-icing program and provides guidance and suggestions about one method, but not the only method, of complying with all pertinent regulations.

4. Definitions

The terms used in this AC are not defined in FAR part 1, but are defined herein for better understanding of this material as follows:

a. *Holdover Time* is defined as the estimated time the application of deicing or anti-icing fluid will prevent the formation of frost or ice, and the accumulation of snow on the treated surfaces of an aircraft. Holdover time begins when the final application of deicing/anti-icing fluid commences, and it expires when the deicing/anti-icing fluid applied to the aircraft loses its effectiveness.

b. *Deicing* is a procedure by which frost, ice, or snow is removed from the aircraft in order to provide clean surfaces.

c. *Anti-Icing* is a precautionary procedure that provides protection against the formation of frost or ice and accumulation of snow on treated surfaces of the aircraft for a limited period of time.

5. Related Reading Material

The following material should be useful in developing training program subject material and instructions and procedures for incorporation in the certificate holder's manuals: AC 20-117, "Hazards Following Ground Deicing and Operations in Conditions Conducive to Aircraft Icing"; FAA publication, "Winter Operations Guidance for Air Carriers and Other Adverse Weather Topics"; and the following publications of the Society of Automotive Engineers (SAE): AMS 1424, "Deicing/Anti-Icing Fluid, Aircraft, Newtonian—SAE Type I"; AMS 1428, "Fluid, Aircraft Deicing/

Anti-Icing, Non-Newtonian, Pseudo-Plastic, SAE Type II"; and ARP 4737, "Aircraft Deicing/Anti-Icing Methods with Fluids, for Large Transport Aircraft"; AC 120–XX, "Pilot Guide—Large Aircraft Ground Deicing"; International Standards Organization (ISO) publications: ISO 11075, "Aerospace—Aircraft de-icing/anti-icing newtonian fluids ISO type I"; ISO 11076, "Aerospace—Aircraft de-icing/anti-icing methods with fluids"; ISO 11077, "Aerospace—De-icing/anti-icing self propelled vehicles—Functional requirements"; ISO 11078, "Aerospace—Aircraft de-icing/anti-icing non-newtonian fluids ISO type II."

6. Program Elements

A certificate holder's ground deicing and anti-icing program, as approved under FAR 121.629(c), should encompass at least the elements that follow (see paragraph 7 and following for detailed discussion of these elements):

a. Management plan detailing operational responsibilities and procedures.

b. Holdover timetables and procedures for their use.

c. Aircraft deicing/anti-icing procedures and responsibilities, pretakeoff check procedures and responsibilities, and pretakeoff contamination check procedures and responsibilities.

d. Initial and recurrent ground training and testing for flight crewmembers and qualification for all other affected personnel.

7. Management Plan

FAR 121.533, 121.535, and 121.537 state, respectively, that each domestic, flag, and supplemental air carrier and commercial operator is responsible for operational control. In order to properly exercise operational control (when conditions at an airport are such that frost, ice, or snow may reasonably be expected to adhere to its aircraft) the certificate holder should develop, coordinate with other affected parties, implement, and use a management plan to ensure proper execution of its approved deicing/anti-icing program. An operator's management plan should identify the manager responsible for the overall deicing/anti-icing program, identify each subordinate manager, and describe each manager's functions and responsibilities under the applicable FAR which are needed to properly manage the certificate holder's deicing/anti-icing program. The plan should encompass at least the elements discussed in the following paragraphs:

a. Operations

Determine the management position responsible for ensuring that all necessary elements of the management plan and the deicing/anti-icing program have been developed, properly integrated, and coordinated; that the plan and program have been disseminated to all those persons who have duties, responsibilities and functions to perform in accordance with them; and that adequate management oversight of the program continues to be maintained. The following actions should be taken:

(1) Determine who (position description) will be responsible, at each airport where operations are expected to be conducted in conditions conducive to ground icing, for deciding that ground deicing/anti-icing operational procedures are to be executed and when.

(2) Detail the functions, duties, responsibilities, instructions, and procedures to be used by flight crewmembers, aircraft dispatchers, and management personnel for safely dispatching or releasing the particular type aircraft used in its operations while ground deicing/anti-icing operational procedures are in effect. The program should contain a detailed description of how the certificate holder determines that the conditions at an airport are such that frost, ice, or snow may reasonably be expected to adhere to the aircraft; and that ground deicing/anti-icing operational procedures must be in effect.

(3) Determine who (position description) will be responsible for coordinating the applicable portions of the management plan and the deicing/anti-icing program with the managers of the air traffic control tower (ATCT) and the airport.

(4) Determine who (position description) will be authorized to enter into agreements with the manager of the ATCT at each airport regarding particular gate hold procedures during icing conditions; and with the airport manager at each airport regarding aircraft secondary deicing/anti-icing locations and aircraft pretakeoff checking locations.

(5) Ensure that a detailed description of the deicing/anti-icing program is incorporated in the certificate holder's manuals (for the use and guidance of flight, ground operations, and management personnel) in conducting its operations under icing conditions.

b. Maintenance.

Determine who is responsible for ensuring that sufficient competent personnel and adequate facilities and equipment are available (at each airport where operations are expected to be conducted under conditions conducive to ground icing) for the proper deicing and anti-icing of the certificate holder's aircraft. The following actions should be taken:

(1) Ensure that all necessary maintenance elements of the management plan and the deicing/anti-icing program have been developed, properly integrated, and coordinated; that the maintenance plan and program have been disseminated to all those persons who have duties, responsibilities, and functions to perform in accordance with them; and that adequate management oversight of the program continues to be maintained.

(2) Detail the functions, duties, responsibilities, instructions, and procedures to be used by its ground personnel, maintenance personnel, and management personnel for safely dispatching or releasing the particular type aircraft used in its operations while ground deicing/anti-icing operational procedures are in effect.

(3) Ensure that a detailed description of the maintenance portion of the deicing/anti-icing program is incorporated in the certificate holder's manuals (for the use and guidance of maintenance, ground, and management personnel) in conducting its operations under icing conditions.

8. Holdover Timetables and Procedures for Their Use.

FAR 121.629(c)(3) requires that the deicing/anti-icing program include holdover timetables and the procedures for the use of these tables by the certificate holder's personnel. The program should also include procedures to be followed in the event that the certificate holder's established maximum holdover times are exceeded. Each of these areas is discussed in the following paragraphs and illustrated in figure 1.

Note: Use of the holdover timetables requires a pretakeoff check by the flightcrew. These holdover timetables must be available for use of the flightcrew in the cockpit.

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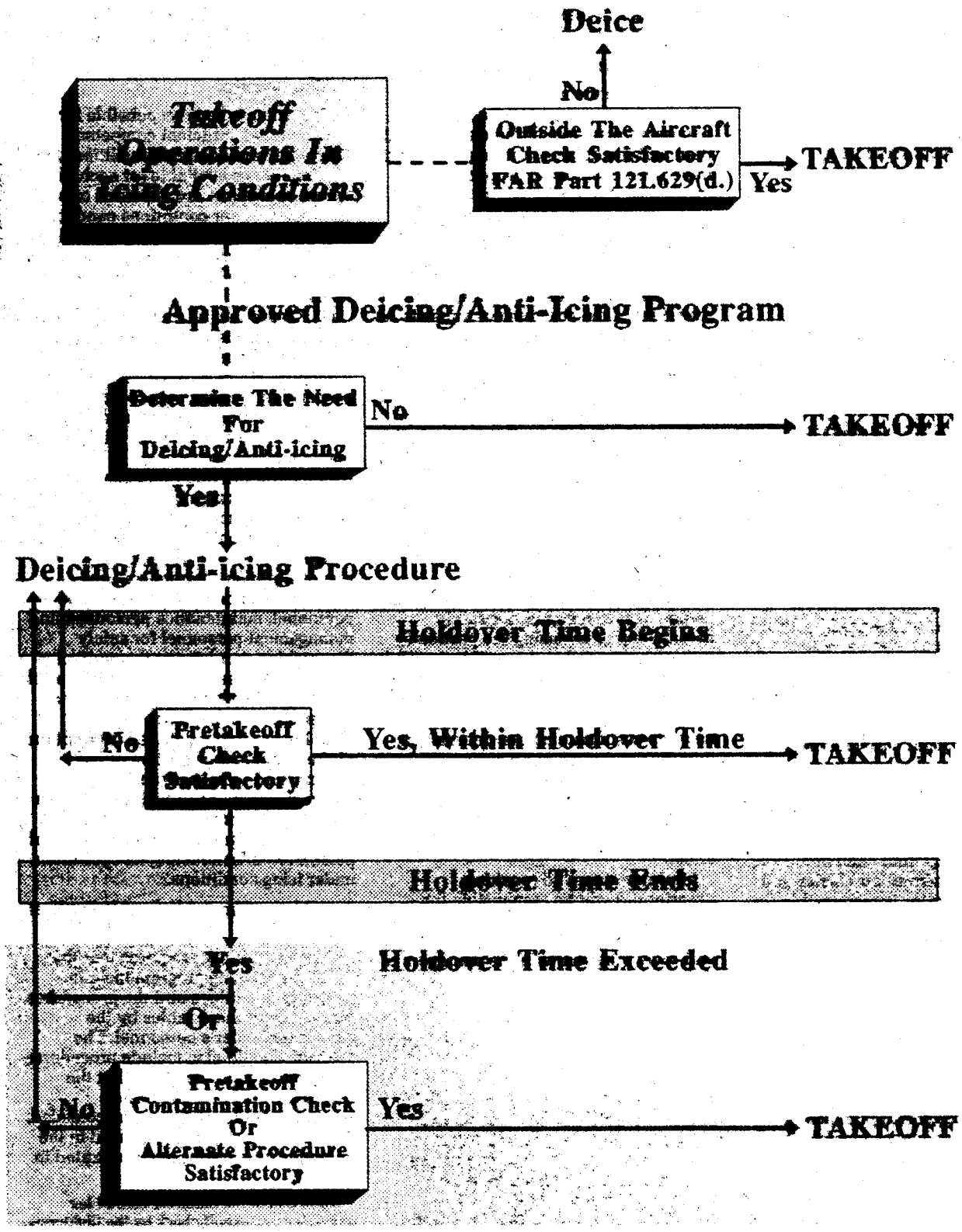

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a. Responsibilities and Procedures.

The certificate holder's program should define operational responsibilities and contain procedures for the flightcrew, aircraft dispatchers or flight followers, and maintenance and ground personnel applicable to the use of holdover times and resultant actions if the certificate holder's maximum holdover time is exceeded. These procedures should include gate procedures, communication between ground crew and flightcrew to establish the start of holdover time and to relay other pertinent information regarding the deicing/anti-icing process, flight crewmember use of the pertinent holdover timetables, and coordination with air traffic control (ATC).

b. Development of Holdover Timetables.

Each certificate holder is required under FAR 121.629(c)(3) to develop holdover timetables for use by its personnel. These timetables are required to be supported by data acceptable to the Administrator. Currently, the only acceptable data is that developed by the Society of Automotive Engineers (SAE) and the International Standards Organization (ISO). ARP 4737, "Aircraft Deicing/Anti-icing Methods with Fluids, for Large Transport Aircraft," and ISO 11076, "Aerospace—Aircraft deicing/anti-icing methods with fluids," contain the tables that are currently considered acceptable for use by the certificate holders to develop their holdover timetables. Holdover times in excess of those specified in the current editions of the SAE/ISO holdover timetables are not acceptable; however, the certificate holder may require the use of more conservative times than those specified in the SAE/ISO tables. Appendix A of this AC contains the holdover timetables extracted from the current SAE/ISO documents.

c. Use of Holdover Timetables

Holdover times are only an estimate of the time of effectiveness for deicing/anti-icing fluids and are based on a number of variables. FAR section 121.629(c)(4) requires a pretakeoff check of the wings or representative surfaces to be completed by the flightcrew prior to takeoff and within the holdover time range. Air carrier manuals should contain detailed procedures regarding the use of the timetables in their operations. FAR section 121.629(c)(3) requires that the certificate holder's program contain procedures for flight crewmembers to increase or decrease the determined holdover time in changing conditions. Weather conditions that could result in a change to the determined holdover times include, but are not limited to, a significant rise in the ambient temperature to well above freezing, the end of precipitation, or other changes in temperature or precipitation type or intensity. Procedures should consider the certificate holder's capability to disseminate information, in real time, concerning changing weather conditions. Additional guidance regarding holdover timetables is contained in AC 20-117, "Hazards Following Ground Deicing and Ground Operations in Conditions Conducive to Aircraft Icing"; AC 120-XX, "Pilot Guide—Large Aircraft Ground Deicing"; SAE ARP 4737, "Aircraft Deicing/Anti-icing Methods with Fluids, for Large Transport Aircraft"; and ISO 11076, "Aerospace—Aircraft de-icing/anti-icing methods with fluids."

d. Takeoff After the Holdover Time is Exceeded

Under FAR § 121.629(c), takeoff after the maximum holdover time has been exceeded is permitted only if one or more of the following actions has been taken. The certificate holder's program should detail actions to be accomplished if the holdover time is exceeded.

(1) A pretakeoff contamination check is made to ensure that wings, control surfaces and other critical surfaces, as defined in the certificate holder's program, are free of frost, ice or snow. The operator's program should include detailed guidelines and criteria for flightcrew and ground personnel to follow to accomplish this checking requirement. This check is accomplished within five minutes before beginning takeoff and is generally conducted from outside the aircraft, unless the program specifies otherwise. Factors determining whether or not the check can be accomplished from within the aircraft include the ability of the flightcrew to see aircraft surfaces, lighting conditions, weather conditions and other factors which determine the ability to assess the condition of the aircraft; or

(2) It is otherwise determined by an alternate procedure, that wings, control surfaces, and other critical surfaces (as defined in the certificate holder's program) are free of frost, ice, or snow. Other means or determinations consist of procedures, techniques or equipment (such as wing icing sensors) to establish that critical surfaces are not contaminated. These means or determinations should be detailed and approved in the operator's program; or

(3) The wings, control surfaces, and other critical surfaces have been re-deiced and a new holdover time has been established. Coordination procedures should be detailed for the accomplishment of this re-deicing.

9. Aircraft Deicing Anti-icing Procedures and Responsibilities, Pretakeoff Check Procedures and Responsibilities, and Pretakeoff Contamination Check Procedures and Responsibilities

Certificate holders' manuals should contain detailed procedures for the deicing and anti-icing process specific to each aircraft type. Certificate holders should have aircraft-specific instructions and checking guidelines and procedures for the use of their flight crewmembers and other personnel to determine whether or not aircraft critical surfaces are free of contaminants.

a. Identification of Critical Aircraft Surfaces

The critical aircraft surfaces which should be clear of contaminants before takeoff should be described in the aircraft manufacturers' maintenance manual or other manufacturer-developed documents, such as service or operations bulletins.

(1) Generally, the following should be considered to be critical aircraft surfaces, if the aircraft manufacturer information is not available:

(a) Before engine start, pitot heads, static ports, ram-air intakes for engine control and flight instruments, other kinds of instrument sensor pickup points, fuel vents, propellers and engine inlets.

(b) Wings, empennage, and control surfaces.

(c) Fuselage upper surfaces on center-engine aircraft.

(2) Certificate holders should list in the flight manual or the operations manual, for each type of aircraft used in their operations, the critical surfaces which should be checked on flight-crewmember-conducted, external-aircraft, preflight inspections and pretakeoff checks or pretakeoff contamination checks.

(3) Critical surfaces should be defined for the use of ground personnel for the conduct of required checks following deicing/anti-icing and the pretakeoff contamination check, when required.

b. Identification of Representative Aircraft Surfaces

Certificate holders should list in the flight manual or the operations manual, for each type of aircraft used in their operations, the representative surfaces which may be checked, in lieu of the critical aircraft surfaces, by flight

crewmembers in the conduct of pretakeoff checks.

(1) Some aircraft manufacturers have identified certain aircraft surfaces which the flightcrew can readily observe during day and night operations to determine whether or not ice, frost or snow is accumulating or forming on that surface, and, by using it as a representative surface, can make a reasoned judgement regarding whether or not ice is adhering to other aircraft surfaces. Certificate-holder operational experience can also be used to define representative surfaces. In the absence of this information, the following guidelines should be considered in identifying a representative aircraft surface:

(a) The surface can be clearly seen from inside the cockpit, and it is close enough to the viewer to be able to determine whether or not ice, frost, or snow is forming or accumulating on the surface.

(b) The surface should be unheated.

(c) The surface should have been treated with deicing/anti-icing fluid during the time that fluid was applied to the other aircraft surfaces; however, it is recognized that it is industry practice not to apply Type II fluid forward of the leading edge of the wings, and that Type I fluid may be applied only to the wing surfaces, without being applied to areas visible from the cockpit. Designation of representative surfaces is not limited to treated surfaces.

(d) Surfaces such as propeller spinners and windshield wipers should also be considered.

c. Techniques for Recognizing Contamination on Aircraft Critical or Representative Surfaces.

Certificate holders should have aircraft-specific techniques for the use of their flight crewmembers and other personnel to recognize contamination on critical or representative aircraft surfaces when the certificate holder has procedures for the conduct of preflight external aircraft icing checks, inside- and outside-the-aircraft pretakeoff checks, and pretakeoff contamination checks. Some indications for loss of effectiveness of deicing/anti-icing fluid or contamination on aircraft surfaces include progressive surface freezing or snow accumulation, or random snow accumulation or dulling of surface reflectivity (loss of gloss) caused by the gradual deterioration of the fluid to slush. Deicing/anti-icing fluid manufacturers should also be consulted for information on the fluid characteristics and indications that the fluid is losing its effectiveness.

d. Types of Icing Checks

FAR 121.629 identifies three different icing checks or procedures (to follow ground deicing/anti-icing) which may be required to be accomplished under an opertor's approved deicing/anti-icing program:

(1) *Aircraft deicing/anti-icing procedure.* Certificate holders should have procedures which ensure that, following aircraft deicing and anti-icing fluid application, a preflight external-aircraft icing check of the critical aircraft surfaces has been conducted by qualified ground personnel; this check determines whether or not the critical surfaces are free of frost, ice or snow before push-back or taxi; and the results of the check are communicated to the PIC by an acceptable means.

(2) *Pretakeoff check.* This check is required under FAR 121.629(c)(4) any time that ground icing conditions exist and the aircraft has been deiced/anti-iced and a holdover time is established. It is accomplished within the holdover time range, and normally is accomplished by the flightcrew from inside the cockpit. The aircraft's wings or representative aircraft surfaces are checked for contamination prior to takeoff. The surfaces to be checked are determined by manufacturer data, carrier operational experience, or guidance contained in this AC. The pretakeoff check is integral to the use of holdover times. Because of the variables involved in the determination of holdover times, it is necessary for the flightcrew to look outside the aircraft to assess current weather or other situational conditions, and the aircraft condition, and not rely on the holdover times as the sole determinant that the aircraft is free of contaminants.

(3) *Pretakeoff contamination check.* FAR 121.629(c)(3)(i) requires that certificate holders must have aircraft-specific procedures for use by flight crewmembers and qualified ground personnel to ensure that the aircraft wings, control surfaces, and other critical surfaces remain free of frost, ice, or snow when a holdover time has been exceeded. The pretakeoff contamination check, conducted within 5 minutes of takeoff, is one of three alternative actions to be taken if a holdover time is exceeded. The following should be considered in the development of the procedures.

(a) Certificate holders who operate hardwing airplanes with aft, fuselage-mounted, turbine-powered engines (excluding turbo-propeller-powered engines) should conduct this pretakeoff contamination check from outside the airplane. Because of the difficulty in detecting contaminants on these airplanes, the pretakeoff contamination check should include a physical (tactile) check of selected portions of the wing leading edges and the upper wing surfaces.

(b) Operators of other aircraft may conduct this check from inside or outside the aircraft as specified in the certificate holder's program. Certificate holders should consider the following in the development of guidelines to be used in conjunction with the techniques for flight crewmember recognition of contamination of critical aircraft surfaces and the procedures for conducting pretakeoff contamination checks inside the aircraft.

1. Can enough of the critical surfaces be seen to accurately determine whether or not they are free of contaminants? This determination should consider the aircraft type, the method of conducting the check—that is, from the cockpit or cabin; lighting; and atmospheric conditions.

2. Does the certificate holder have procedures to recognize, and have flight crewmembers been properly trained to recognize changes in weather conditions to allow the PIC to ascertain whether or not the critical aircraft surfaces could reasonably be expected to remain free of contaminates?

10. Initial and Recurrent Ground Training, Testing and Qualification

a. General/All Personnel.

The operator's training program should include initial and annual recurrent ground training, testing for flight crewmembers and qualification for all affected personnel concerning the specific requirements of the program and the duties, responsibilities, and functions detailed in the program. The effective date of FAR section 121.629 requires that initial program training, testing and qualification be completed prior to November 1, 1992. The FAA will allow maximum flexibility in providing the required training, testing, and qualification for this first winter season. Initial training and testing can be accomplished through the issue of bulletins, manual revisions, self-grading quizzes or other review materials. Receipt of training documents will satisfy the testing requirement for this initial winter season. Formal testing will be accomplished in the next recurrent training cycle. On-the-job qualification for ground personnel should include those elements specific to the final deicing/anti-icing rule to include use of holdover times, fluid application, and checking procedures.

b. Operations Ground Training

The following represents the recommended content for a certificate holder's operations ground training program in accordance with the general requirements of FAR section 121.415. Flight crewmembers and other operations personnel should receive training on at least the following subjects:

(1) *The use of holdover times.* Holdover times are a range of times derived from an analysis of airline service experience and the laboratory testing results of the freeze points of particular types of fluids (currently Type I and Type II) under various temperatures, fluid concentrations, and humidity conditions. A discussion of holdover times should include the following:

(a) Source of holdover time data.

(b) Precipitation category (for example, fog, drizzle, rain, snow).

1. Precipitation intensity.

2. Duration of precipitation.

3. Relationship of precipitation change to holdover time.

(c) Relationship of holdover time to particular fluid concentrations for both Type I and Type II fluids.

(d) Identification of when holdover time begins and ends.

(e) Communication procedures reference holdover times.

1. Communication between ground personnel and the flightcrew to determine the start of holdover time, and the particular holdover timetable to be used. Communications from the ground crew to the cockpit crew should consist of the following information:

(aa) Fluid type (for example, Type I or Type II).

(bb) Fluid/water mix ratio.

(cc) Start time of final fluid application/beginning of holdover time.

(dd) Accomplishment of post-deicing/anti-icing check.

2. ATC Coordination.

3. Dispatch or flight following coordination.

4. Means for obtaining most current weather information.

(f) Use of holdover times for the cockpit crew. A pretakeoff check is an integral part of the use of holdover times.

(g) Procedures when holdover time is exceeded.

1. Pretakeoff contamination check.

2. Alternate means to determine whether or not surfaces are free of frost, ice or snow.

3. Re-deice and establish new holdover time.

(2) *Aircraft deicing/anti-icing procedures including checks to detect contaminated surfaces, and responsibilities.*—(a) *Deicing* is a procedure by which frost, ice, or snow is removed from the aircraft in order to provide clean surfaces. The procedure can be accomplished by the use of fluids or mechanical means.

(b) *Anti-icing* is a procedure by which the application of certain types of anti-icing fluids provides protection against the formation of frost or ice and accumulation of snow on treated surfaces of the aircraft for a limited period of time (holdover time).

(c) *Deicing/Anti-icing* is a combination of the two procedures above. It can be performed in one or two steps.

1. One-step deicing/anti-icing is carried out with an anti-icing fluid. The fluid used to deice the aircraft remains on aircraft surfaces to provide limited anti-ice capability.

2. Two-step deicing/anti-icing consists of two distinct steps. The first step (deicing) is followed by the second step (anti-icing) as a separate fluid application. Anti-icing fluid is applied to protect the relevant surfaces, thus providing maximum possible anti-ice capability (holdover time).

(d) Safety requirements during fluid application.

(e) Deicing/anti-icing fluid application procedures.

(f) Remote deicing procedures. 1. Aircraft-specific considerations.

2. Location-specific procedures.

(g) *Contractor Deicing.* Many certificate holders will utilize contract services, such as aircraft servicing vendors, fixed base operators, or other air carriers to perform deicing/anti-icing. Operations training should include flightcrew supervisory responsibilities for certificate holders who engage in supplemental operations, who employ contractor deicing/anti-icing services, and who are unable to arrange for the training and qualification of the contractor personnel in advance of operations into airports where these contractor services are to be performed.

(h) *Deicing/Anti-icing Checking Procedures and Responsibilities.* The training program should have aircraft-specific surface contamination checking guidelines to include the following:

1. *Types of Checks Required.* Each certificate holder should detail the types of checks required and the methods for accomplishing these checks. This will include procedural steps for the conduct of the check as well as the location, and personnel, deicing equipment, and lighting, if applicable, required to accomplish the check.

(aa) Flightcrew preflight inspection/cold weather preflight inspection procedures. This is the normal walk-around preflight inspection conducted by the flightcrew. This inspection should be used to note any aircraft surface contamination and direct any required deicing/anti-icing operations.

(bb) Aircraft deicing/anti-icing procedures include a check performed by qualified ground personnel after the deicing/anti-icing fluid application as an integral part of that process.

(cc) A pretakeoff check is performed prior to takeoff and within the holdover time. This is a check normally conducted from inside the cockpit. Identification of representative surfaces and continual assessment of environmental and other situational conditions should be included in the operator's program.

(dd) Pretakeoff contamination check. Check accomplished after the holdover time has been exceeded and within 5 minutes prior to takeoff. Each carrier will define the content of the pretakeoff contamination check. The check could be conducted from inside or outside the aircraft, depending upon such factors as atmospheric condition, lighting conditions, aircraft type and ability of the crew to see the relevant aircraft surfaces.

(ee) PIC responsibility. The PIC's responsibility is to make the decision on whether or not to make the takeoff based on operator developed guidance and procedures.

2. Identification of critical surfaces or representative surfaces to be checked/inspected during each type of check.

3. Techniques for recognizing contamination on the aircraft.

4. Communications procedures to include communications between ground personnel and the flightcrew, and communications with ATC and company station personnel to coordinate requirements for aircraft pretakeoff contamination check.

(3) *Aircraft surface contamination and critical area identification, and how contamination adversely affects aircraft performance and flight characteristics.*—(a) *Aircraft Ground Icing Conditions.* Certificate holders should ensure that a description of the following conditions is incorporated in the procedures for implementing ground deicing/anti-icing operational procedures. Also, certificate holders should ensure that those persons who have responsibilities under the deicing/anti-icing program for determining whether or not ground deicing/anti-icing procedures should be in effect, understand that under at least the following conditions, frost, ice, or snow

may reasonably be expected to adhere to the aircraft.

1. *In-flight Ice Accumulation.* Certificate holders should have procedures which ensure that the flightcrews of arriving flights report occurrences of in-flight icing to the person responsible for executing the certificate holder's deicing/anti-icing program at each airport where the certificate holder conducts its operations. This is a problem when flights are scheduled for short turnaround times—for example, for 30 minutes or less, and when ambient temperatures on the ground are at or below freezing.

2. *Freezing Precipitation.* Snow, sleet, freezing rain, drizzle, or hail which adheres to aircraft surfaces.

3. *Frost.* (including hoarfrost) is a crystallized deposit, formed from water vapor on surfaces which are at or below 0 °C (32 °F).

4. *Freezing Fog.* Clouds of supercooled water droplets that form a deposit of ice on objects in cold weather conditions.

5. *Snow.* Precipitation in the form of small ice crystals or flakes which may accumulate on or adhere to aircraft surfaces.

6. *Freezing Rain.* Water condensed from atmospheric vapor falling to earth in supercooled drops, forming ice on objects.

7. *Rain or High Humidity (on Cold-Soaked Wing).* Water forming ice or frost on the wing surface when the temperature of the aircraft wing surface is at or below 0 °C (32 °F). Certain aircraft, such as McDonnell Douglas Models DC–9–80 series and MD–88 series airplanes, are currently susceptible to the formation of frost or ice on their wings' upper surfaces when cold-soaked fuel is in the main wing fuel tanks, and the aircraft are exposed to conditions of high humidity, rain, drizzle, or fog at ambient temperatures well above freezing.

8. *Underwing Frost.* Takeoff with frost under the wing in the area of the fuel tanks (caused by cold-soaked fuel) within limits established by the aircraft manufacturer, accepted by FAA aircraft certification offices and stated in aircraft maintenance and flight manuals, may be permitted.

(b) *Critical Aircraft Surfaces.* Certificate holders should identify for each type of aircraft used in their operations, the critical surfaces which should be checked on flight-crewmember-conducted, preflight, external-aircraft icing checks and pretakeoff checks or pretakeoff contamination checks. Information from the aircraft manufacturer (or from this AC, if the subject information is not available from the aircraft manufacturer) should be used to determine the critical surfaces for each aircraft type.

(c) *Representative Aircraft Surfaces.* Certificate holders should identify for each type of aircraft used in their operations, the representative aircraft surfaces which should be checked on flight-crewmember-conducted pretakeoff checks. Information from the aircraft manufacturer, or information developed from carrier operating experience, should be used to determine representative surfaces. In the absence of such information, information from this AC can be used to determine representative aircraft surfaces.

(d) *Effects of Frost, Ice, Snow, and Slush on Aircraft Performance, Stability, and Control.* The certificate holder should obtain this information from the manufacturer of each type of aircraft it uses in its operations and should ensure that its flight crewmembers, aircraft dispatchers, and management personnel understand these effects. Accident data and NASA studies have confirmed some aircraft manufacturer data that the effects of wing contamination may be significantly more pronounced for hard-leading-edge (hard-wing) airplanes than for slatted-leading-edge (slatted-wing) airplanes. According to McDonnell Douglas, the presence of even minute amounts of ice or other contaminates (equivalent to medium grit sandpaper) on the leading edges or upper surfaces of the wings of a DC–9–10 series airplane results in significant loss of wing lift, which causes the airplane to stall at lower-than-normal angles of attack during takeoff. The discussion of these effects should include, but is not limited to, the following subjects:

1. Increased drag/weight.

2. Tendency for rapid pitch-up during rotation or wing roll off.

3. Loss of lift.

4. Stall occurs at lower-than-normal angle of attack.

5. Buffet or stall occurs before activation of stall warning.

6. Decreased effectiveness of flight controls.

(4) *Types, purpose, characteristics, and capabilities of deicing and anti-icing fluids.* Deicing and anti-icing fluids with differing characteristics and capabilities exist; they may undergo improvements, and new types of fluids may be developed. Certificate holders should ensure that their flight crewmembers, aircraft dispatchers, and management personnel generally understand the purpose and capabilities of the fluids used in the deicing/anti-icing program; and that their flight crewmembers are generally knowledgeable of the characteristics of each type of fluid. Certificate holders should refer to the following SAE publications for additional information on specific deicing and anti-icing methods and procedures and on fluid characteristics and capabilities: AMS 1424, "Deicing/Anti-Icing Fluid, Aircraft, Newtonian—SAE Type I"; AMS 1428, "Fluid, Aircraft Deicing/Anti-Icing, Non-Newtonian, Pseudo-Plastic, SAE Type II"; and ARP 4737, "Aircraft Deicing/Anti-Icing Methods with Fluids, for Large Transport Aircraft"; and the following ISO documents: ISO 11075, "Aerospace—Aircraft de-icing/Anti-icing newtonian fluids ISO type I"; ISO 11076,"Aerospace—Aircraft de-icing/anti-icing methods with fluids"; ISO 11077, "Aerospace—de-icing/anti-icing self propelled vehicles—Functional requirements"; ISO 11078, "Aerospace—Aircraft de-icing/anti-icing non-newtonian fluids ISO type II."

Certificate holders should ensure that at least the following subjects are discussed:

(a) Deicing fluids:

1. Heated water.

2. Newtonian fluid (SAE/ISO Type I) (see Caution).

3. Mixtures of water and SAE/ISO Type I fluid.

4. Mixtures of water and SAE/ISO Type II fluid.

Note: Deicing fluid should be applied heated to assure maximum efficiency.

(b) Anti-icing fluids:

1. Newtonian fluid (SAE/ISO Type I) (see Caution).

2. Mixtures of water and SAE/ISO Type I fluid.

3. Non-Newtonian fluid (SAE/ISO Type II).

4. Mixtures of water and SAE/ISO Type II fluid.

Note: SAE/ISO Type II anti-icing fluid is normally applied cold on clean aircraft surfaces, but may be applied heated. Cold SAE/ISO Type II fluid normally provides longer anti-icing protection. SAE/ISO Type I anti-icing fluid should be applied heated.

Caution: SAE/ISO Type I fluids supplied as concentrates for dilution with water prior to use should not be used undiluted. This is due to adverse aerodynamic effects of propylene glycol based fluids and the freeze point characteristics of ethylene glycol-based fluid.

(c) *Fluid Characteristics.*

1.*Type I Fluids.*

(aa) Unthickened.

(bb) Limited holdover time.

(cc) Applied to form thin liquid film on wing.

2. *Type II Fluids.*
(aa) Thickened.
(bb) Longer holdover times in comparison to those of Type I fluids.
(cc) Application results in a thick liquid film (a gel-like consistency) on wing.
(dd) Wind flow over the wing (shear) causes the fluid to progressively flow off the wing during takeoff.
3. *Deicing/Anti-Icing Fluids Handling/Performance Implications.* The type fluid used and how completely the fluid flows off the wing during takeoff determines the effects of the following handling/performance factors. The aircraft manufacturer may also provide performance information regarding the use of the different deicing/anti-icing fluids.
(aa) Increased rotation speeds/ increased field length.
(bb) Increased control (elevator) pressures on takeoff.
(cc) Increased stall speeds/reduced stall margins.
(dd) Lift loss at climbout/increased pitch attitude.
(ee) Increased drag during acceleration/increased field length.
(ff) Increased drag during climb.
(gg) For Type II fluids, fluid build-up on the runway takeoff end may significantly reduce runway coefficient of friction.

c. Maintenance and Ground Personnel Training

At least the following subjects for ground personnel (for example, maintenance mechanic, ramp agent, contractors) should be discussed.
(1) *Effects of frost, ice, snow, and slush on aircraft surfaces.* This discussion is intended to provide ground personnel with an understanding of the critical effect the presence of ice and snow on flight surfaces can have, and should include, but is not limited to, the following:
(a) Loss of Lift.
(b) Increased drag/weight.
(c) Decreased control.
(d) Aircraft-specific areas.
1. Engine foreign object damage (FOD) potential.
2. Pam-air intakes.
3. Instrument pickup points.
4. Leading edge device (LED) aircraft (slots, slats and flaps) and non-LED aircraft.
(2) *Fluid characteristics and capabilities.* Deicing/anti-icing fluids with differing properties exist and may continue to be developed. To the extent that they are being utilized by an air carrier, they should be addressed in training programs:
(a) General fluid descriptions.
(b) Composition and appearance.
(c) Health precautions/environmental considerations.
(d) Differences between Type I and Type II deicing/anti-icing fluids.
(e) Purpose for each type.
(f) Capabilities.
(g) Shearing characteristics in storage and handling.
(h) Fluid application methods.
(3) *Holdover times.* A discussion of holdover times should include the following:
(a) Source of holdover time data.
(b) Precipitation category.
1. Precipitation intensity.
2. Duration of precipitation.
3. Relationship of precipitation change to holdover time.
(c) Relationship of holdover time to particular fluid concentrations for Type I and Type II fluids.
(d) Identification of when holdover time begins and ends.
(e) Communication procedures between ground personnel and flightcrew to determine the start of holdover times.
(4) *Equipment.* An understanding of the capabilities of the deicing equipment and the qualifications for operation are necessary. The equipment portion of the training program should include the following:
(a) Description of various equipment types.
(b) Operation of the equipment.
(5) *Preflight check.* (a) In the pre-departure sequence, ground deicing may be initiated at one or more of the following times:
1. On overnight aircraft, if appropriate.
2. At the gate, following checking by the cockpit crew and a request for deicing.
3. After a normal preflight by ground personnel or the flightcrew and after the crew is on board the aircraft.
(b) In each case, the preflight and the decision on whether or not to deice/ anti-ice should be based on appropriate consideration of the circumstances and should include the following:
1. Weather conducive to ice formation or snow accumulation.
2. Aircraft critical areas (general and aircraft-specific).

Note: For aircraft-specific items, refer to the aircraft operating manual.

(6) *Deicing/anti-icing procedures.* Ground personnel should be knowledgeable of deicing and anti-icing application procedures:
(a) One-step deice and two-step deice/anti-ice process.
(b) Communications from the ground crew to the cockpit crew should provide the following information:
1. Fluid type.
2. Fluid/water mix ratio.
3. Start time of final deice/anti-ice application.
4. Post-application check accomplished.
(c) Safety requirements and emergency procedures.
(d) Deicing/anti-icing prior to aircrew arrival.
(e) Normal aircrew deicing procedures.
(f) Remote deicing procedures.
1. Aircraft-specific considerations.
2. Location-specific procedures.
3. Safety precautions.
(g) Post-application check. An integral part of a ground personnel training program is the check following deicing to determine that all critical surfaces have had snow, ice or frost removed.
(7) *Pretakeoff contamination check.* This check is accomplished when the holdover time has been exceeded and within 5 minutes of takeoff. Each carrier will define the content of the pretakeoff contamination check. The check could be conducted from inside the aircraft by the flightcrew or from outside the aircraft by qualified ground personnel. Training for ground personnel should include the following:
(a) When the check is required.
(b) The necessary resources, personnel, devices and standards to properly accomplish the check.
(c) Where the check will take place.
(8) *Contractor deicing.* Many certificate holders will utilize parties other than themselves to perform deicing. The second party with whom they reach an agreement to provide deicing services could be another carrier, a fixed-base operator or some other service provider at an airport. Training for deicing services from other than the carrier should include the following:
(a) An approved contract training program and application of standards that meet the carrier's own training and application criteria.
(b) Train-the-trainer program (the carrier trains the contract deicing personnel or designated trainer).
(c) Alternate airport procedures where contract service agreements are not present.
(d) Guidance that the cockpit crew will hold contractor to their own airline standards.
(9) *Ground Personnel Qualification/ Quality Assurance.* Air carrier ground deicing programs must have a set standard to judge a person's qualification as a ground deicing person and a quality assurance program to

monitor and maintain a high level of competence.

(a) The program should be tailored to the individual airline with each air carrier maintaining its own quality assurance responsibility.

(b) The program should have a tracking system that ensures that all required training has been satisfactorily completed and recorded for all ground personnel in the deicing process. Also, a name list of qualified deicing personnel should be made available to all managers responsible for deicing at their location.

(c) An ongoing review plan is needed to evaluate the effectiveness of the training received by the deicing personnel, and there must be an adequate number of people trained each year to foster the success of the program. Recurrent training will be a step in that process.

11. Outside-the-Aircraft Check in Lieu of an Approved Ground Deicing/Anti-Icing Program

A certificate holder may continue to operate without an approved ground deicing/anti-icing program if it has procedures and properly trained personnel for the conduct of an outside-the-aircraft check in accordance with FAR sections 121.629(d), 121.135(b)(2), 121.415(g), 121.195, and 121.123. The authorization for the conduct of this check in lieu of an approved program will be contained in the certificate holder's operations specifications (OpSpecs). As stated in FAR 121.629(d), this check is accomplished when conditions are such that frost, ice, or snow may reasonably be expected to adhere to the aircraft. Under FAR 121.629(d) the check is required to be completed within 5 minutes prior to beginning takeoff and is accomplished from outside the aircraft. Certificate holders' manuals and training programs should detail procedures for the conduct of this check.

Appendix A

Note: This appendix contains holdover timetable data extracted from "SAE Aerospace Recommended Practice"; ARP 4737, "Aircraft Deicing/Anti-Icing Methods with Fluids, for Large Transport Aircraft"; and ISO 11076, "Aerospace—Aircraft de-icing/anti-icing methods with fluids." These excerpts are included to provide the holdover times that are acceptable for use in developing a carrier's holdover timetables. The certificate holder should consult the referenced SAE and ISO documents for complete information for development of timetables and procedures for their use.

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Table 1. Guideline for Holdover Times Anticipated by SAE Type II and ISO Type II Fluid Mixtures as a Function of Weather Conditions and OAT.

CAUTION! THIS TABLE IS FOR USE IN DEPARTURE PLANNING ONLY. IT SHOULD BE USED IN CONJUNCTION WITH PRE-TAKEOFF CHECK PROCEDURES.

OAT		Type II Fluid Concentration Neat-Fluid /Water (% by Volume)	Approximate Holdover Times Anticipated Under Various Weather Conditions (hours: minutes)				
°C	°F		FROST	FREEZING FOG	SNOW	FREEZING RAIN	RAIN ON COLD SOAKED WING
0 and above	32 and above	100/0	12:00	1:15-3:00	0:25-1:00	0:08-0:20	0:24-1:00
		75/25	6:00	0:50-2:00	0:20-0:45	0:04-0:10	0:18-0:45
		50/50	4:00	0:35-1:30	0:15-0:30	0:02-0:05	0:12-0:30
below 0 to -7	below 32 to 19	100/0	8:00	0:35-1:30	0:20-0:45	0:08-0:20	CAUTION! clear ice may require touch for confirmation
		75/25	5:00	0:25-1:00	0:15-0:30	0:04-0:10	
		50/50	3:00	0:20-0:45	0:05-0:15	0:01-0:03	
below -7 to -14	below 19 to 7	100/0	8:00	0:35-1:30	0:20-0:45	List of Symbols °C = Celsius °F = Fahrenheit Vol = Volume OAT = Outside Air Temp.	
		75/25	5:00	0:25-1:00	0:15-0:30		
below -14 to -25	below 7 to -13	100/0	8:00	0:35-1:30	0:20-0:45		
below -25	below -13	100/0 if 7°C(13°F) Buffer is maintained	A buffer of at least 7°C(13°F) must be maintained for Type II used for anti-icing at OAT below -25°C(-13°F). Consider use of Type I fluids where SAE or ISO Type II cannot be used.				

THIS TABLE DOES NOT APPLY TO OTHER THAN SAE OR ISO TYPE II FPD FLUIDS.

THE RESPONSIBILITY FOR THE APPLICATION OF THESE DATA REMAINS WITH THE USER.

Table 2. Guideline for Holdover Times Anticipated by SAE Type I, and ISO Type I Fluid Mixtures as a Function of Weather Conditions and OAT.

CAUTION! THIS TABLE IS FOR USE IN DEPARTURE PLANNING ONLY. IT SHOULD BE USED IN CONJUNCTION WITH PRE-TAKEOFF CHECK PROCEDURES.

Freezing Point of Type I fluid mixture used must be at least 10°C(18°F) below OAT.

Outside Air Temperature		Approximate Holdover Times Anticipated Under Various Weather Conditions (hours:minutes)				
°C	°F	FROST	FREEZING FOG	SNOW	FREEZING RAIN	RAIN ON COLD SOAKED WING
0 & above	32 & above	0:18-0:45	0:12-0:30	0:06-0:15	0:02-0:05	0:06-0:15
below 0 to -7	below 32 to 19	0:18-0:45	0:06-0:15	0:06-0:15	0:01-0:03	CAUTION! Clear ice may require touch for confirmation
below -7	below 19	0:12-0:30	0:06-0:15	0:06-0:15		

THIS TABLE DOES NOT APPLY TO OTHER THAN SAE OR ISO TYPE I FPD FLUIDS.

THE RESPONSIBILITY FOR THE APPLICATION OF THESE DATA REMAINS WITH THE USER.

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Corrections

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Aircraft Ground Deicing and Anti-Icing Program

Correction

In rule document 92-23652 beginning on page 44924 in the issue of Tuesday, September 29, 1992, make the following correction:

On page 44932, in the first column, in the fifth paragraph, in the second line "an" should read "any".

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