NOTICE

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

N 8900.326

National Policy

Effective Date:
9/15/15

Cancellation Date:
9/15/16

SUBJ: Revised FAA-Approved Deicing Program Updates, Winter 2015-2016

1. Purpose of This Notice. This notice provides inspectors with information on holdover times (HOT) and recommendations on various other ground deicing/anti-icing issues.

2. Audience. The primary audience for this notice is Flight Standards District Office (FSDO) principal operations inspectors (POI) responsible for approving an air carrier's deicing program. The secondary audience includes Flight Standards Service (AFS) personnel in FSDOs, branches, and divisions in the regions and at headquarters (HQ).

3. Where You Can Find This Notice. You can find this notice on the MyFAA employee Web site at https://employees.faa.gov/tools_resources/orders_notices. Inspectors can access this notice through the Flight Standards Information Management System (FSIMS) at http://fsims.avs.faa.gov. Operators can find this notice on the Federal Aviation Administration's (FAA) Web site at http://fsims.faa.gov. This notice is available to the public at http://www.faa.gov/regulations_policies/orders_notices.

> **Note:** The Official FAA Holdover Time Tables for 2015-2016 and related tables referenced in this document can be found on the Air Transportation Division's (AFS-200) Aircraft Ground Deicing Web site at http://www.faa.gov/other_visit/aviation_industry/airline_operators/airline_safety/deicing.

4. Cancellation. This notice cancels N 8900.275, Revised FAA-Approved Deicing Program Updates, Winter 2014-2015, dated 10/17/2014.

5. Background. Title 14 of the Code of Federal Regulations (14 CFR) part 121, § 121.629(c) requires that part 121 certificate holders have an approved ground deicing/anti-icing program. An alternative to complying with § 121.629(c) would be to comply with § 121.629(d). The current edition of Advisory Circular (AC) 120-60, Ground Deicing and Anti-Icing Program, provides guidance for obtaining approval of a ground deicing/anti-icing program and discusses the use of HOTs. Title 14 CFR part 125, § 125.221 and 14 CFR part 135, § 135.227(b)(3) allow both kinds of certificate holders to comply with a part 121-approved program.

6. Changes (Additions, Updates, and Deletions).

a. Flaps and Slats. Continuing research on HOT and allowance time degradation caused by increased angles of flaps and/or slats when extended to takeoff configuration prior to anti-icing is addressed in the 2015-2016 HOTs and allowance times. When flaps and/or slats are extended to the takeoff configuration prior to anti-icing fluid application and remain in that configuration while taxiing to takeoff, specific HOT and allowance time tables identified as "FAA 90 Percent Adjusted" must be used. This procedure, introduced for the 2014-2015 HOTs and to be continued for the 2015-2016 HOTs, is an interim measure. Research on this issue is continuing, and final procedures will be determined when research and analysis are completed.

b. Type III Fluid-Specific HOT Tables. Fluid-specific, application temperature-specific, and aircraft rotation speed profile-specific HOT tables have been added for Type III fluids. The Type III generic HOT table has been removed due to the different application temperature requirements of the two available Type III fluids and resulting inability to calculate generic Type III HOTs. Users must therefore know which fluid brand is being used when using Type III fluid and use the appropriate Type III fluid-specific HOT table.

c. Harmonization Initiative. The FAA and Transport Canada (TC) have undertaken an initiative to harmonize their HOT guidelines documents. This has resulted in some changes to the FAA document for winter 2015-16, including: reordering of some tables/content, minor changes to notes and cautions, minor changes to table names, and merging of fluid characteristic information into one table (Table 8, List of Fluids Tested for Anti-Icing Performance and Aerodynamic Acceptance).

7. Generic and Minimum HOT Values. The FAA Type II (Table 2-Generic. Type II Holdover Time Guidelines for SAE Type II Fluids) and Type IV (Table 4-Generic. Type IV Holdover Time Guidelines for SAE Type IV Fluids) generic HOT guidelines comprise the generic HOT values which are derived from the minimum (worst case) HOT values for all fluids for a specific precipitation condition, precipitation rate, temperature range, and fluid mixture concentration. An analysis of all available Type II and Type IV fluids is done annually to determine these values. Air carriers may only use the fluid-specific HOT guidelines (Tables 2A–2J and Tables 4A–4N) when these specific fluids are used during the anti-icing process. If a carrier cannot positively determine which specific Type II or IV fluid was used, it must use the generic HOTs from Table 2 or Table 4, as appropriate.

> **Note:** The lowest on-wing viscosity (LOWV) of the fluid being used must always be respected, even when the generic Type II or Type IV HOTs are used.
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> **Note:** When flaps and/or slats are extended to the takeoff configuration prior to anti-icing fluid application and remain in that configuration while taxiing to takeoff, the 90 percent adjusted tables must be used. This includes the Type II (Table 2-Generic-90%) and Type IV (Table 4-Generic-90%) generic tables.

8. Fluid Characteristics, Associated HOTs, and Other Related Information. FAA-approved SAE guidelines for the application of these deicing/anti-icing fluids are contained in the FAA HOT Guidelines document.

a. Type I Fluid Characteristics. Type I fluids are Newtonian, non-thickened fluids used primarily for deicing, but may also be used for anti-icing with associated HOTs. They are thin in appearance, and if colored, orange. Newtonian fluids tend to flow regardless of the forces acting on them, as evidenced by these fluids readily flowing off nonmoving aircraft surfaces.

(1) Type I Guidelines. The Type I HOT table is divided into two tables:

- Table 1A, Holdover Time Guidelines for SAE Type I Fluid on Critical Aircraft Surfaces Composed Predominantly of Aluminum; and
- Table 1C, Holdover Time Guidelines for SAE Type I Fluid on Critical Aircraft Surfaces Composed Predominantly of Composites, for aircraft with composite wing surfaces.

Note: The Type I fluid HOTs for composite surfaces (refer to Table 1C) must be applied to aircraft with all critical surfaces that are predominantly or entirely constructed of composite materials. However, the Type I fluid HOTs for composite surfaces do not need to be applied to aircraft that are currently in service, have a demonstrated safe operating history using Type I fluid aluminum structure HOTs, and have critical surfaces only partially constructed of composite material. If there is any doubt, consult with the aircraft manufacturer to determine whether aluminum or composite HOTs are appropriate for the specific aircraft.

(a) Type I fluid dilutes rapidly under precipitation conditions; however, the heat absorbed by aircraft surfaces will tend to keep the temperature of the diluted fluid above its freezing point for a limited time, which is considerably longer for metallic structures than for composite material structures since composites do not transfer heat very efficiently. Within practical limits, the more heat an aircraft surface absorbs, the longer the surface temperature will remain above the freezing point of the fluid. Thus, the thermal characteristics of an aircraft's surface affect HOTs, with metallic structures serving as better heat conductors.

(b) Theoretically, when the temperature of the surface equals the freezing point of the fluid, the fluid is considered to have failed. Because structural mass varies throughout an aircraft with a corresponding variation in absorbed heat, the fluid will tend to fail first in:

- Structurally thin areas; and
- Areas with minimal substructure, such as trailing edges, leading edges, and wing tips.

Note: FAA Type I HOT guidelines are not approved for use with unheated Type I fluid mixtures.

(2) Effectiveness of Heated Type I Fluids. The heating requirements for Type I fluids are located in the FAA Type I fluid application table (Table 9, Guidelines for the Application of SAE Type I Fluid Mixture Minimum Concentrations as a Function of Outside Air Temperature).

(a) As previously stated, Type I HOTs are heavily dependent on the heating of aircraft surfaces. Unlike Types II, III, and IV fluids, which contain thickeners to keep these fluids on

aircraft surfaces, Type I fluids are not thickened and flow off relatively soon after application; therefore, the heating of aircraft surfaces during the Type I fluid deicing and anti-icing process contributes to the HOT by elevating the surface temperature above the freezing point of the residual fluid.

(b) When establishing compliance with the temperature requirement of 60º C (140º F) at the nozzle, as stated in Table 9, the FAA does not intend for air carriers or deicing operators to continually measure the fluid temperature at the nozzle. The FAA deems that establishing the temperature drop (at nominal flow rates) between the last temperature-monitored point in the plumbing chain and the nozzle is sufficient. Manufacturers of ground vehicle-based deicing equipment have indicated a temperature drop of 10º C (18° F) or less. Some manufacturers producing equipment using instant-on heat or last bypass heaters have indicated a temperature drop of 5º C (9° F) or less. Ensuring that the drop in fluid temperature from the last measured point in the plumbing chain to the nozzle does not result in a fluid temperature of less than 60º C (140º F) at the nozzle is sufficient.

(3) Freezing Point of Type I Fluids. There is a note under the Type I HOT tables (Tables 1A and 1C) that reads, "...freezing point of the mixture is at least 10º C (18º F) below outside air temperature." The difference between the freezing point of the fluid and the outside air temperature (OAT) is known as the temperature or freezing point buffer. In this case, the buffer is 10º C (18º F), which you can interpret as the freezing point of the fluid being 10º C (18º F) below the OAT. The 10º C (18º F) temperature buffer is used to accommodate inaccuracies and impreciseness in determining the many variables that affect the freezing point of a fluid mixture. Some of these variables include:

- OAT measurements.
- Refractometer freezing point measurements.
- Temperature of applied fluid/water mixture.
- Inaccuracies in freezing point depressant (FPD) fluid/water mixtures volumes.
- Differences between OAT and aircraft surface temperatures.
- Changes in OAT following fluid application.
- Differences in aircraft surface materials.
- Degradation of FPD fluid strength due to aging.
- Degradation of FPD fluid strength due to pumping equipment.
- Wind effects.
- Solar radiation.

Note: For example, if the OAT is -3º C (27º F), the freezing point of the Type I fluid mixture should be -13º C (9º F) or lower, and the mixture applied at a minimum temperature of 60º C (140º F) at the nozzle before the HOT guidelines information in Tables 1A and 1C can be used.

b. Types II, III, and IV Fluids Characteristics. Types II, III, and IV fluids are thickened, non-Newtonian fluids. A non-Newtonian fluid is one whereby the viscosity (thickness) decreases when a shearing force is applied, such as the airflow over aircraft surfaces on takeoff. When applied to aircraft surfaces, these fluids form an anti-icing thickness layer which absorbs freezing

or frozen contamination with the exception of ice pellets and small hail. Although thickened, Type III fluid is much thinner than Types II or IV fluids, a characteristic making it suitable for lower rotation speed aircraft as well as those with sufficient rotation speeds to use Types II or IV fluids.

(1) The HOTs for Types II, III, and IV fluids are primarily a function of the OAT, precipitation type and intensity, and percent fluid concentration applied. The icing precipitation condition (e.g., frost, freezing fog, snow, freezing drizzle, light freezing rain, and rain on a cold soaked wing) applies solely to active meteorological conditions.

(2) For Types II, III, and IV fluids, the fluid concentration (percent mixture) is the amount of undiluted (neat) fluid in water. Therefore, a 75/25 mixture is 75 percent FPD fluid and 25 percent water.

(3) Most FPD fluids are ethylene glycol-based or propylene glycol-based. Under precipitation conditions, chemical additives improve the performance of Types II, III, and IV fluids when used for anti-icing. These additives thicken and provide the fluid with non-Newtonian flow characteristics. Thickening enhances fluid HOT performance, and the non-Newtonian behavior results in fluid viscosity rapidly decreasing during the takeoff roll, which allows the fluid to flow off the critical wing surfaces prior to liftoff. This same characteristic makes Types II and IV fluids sensitive to viscosity degradation via shearing when being pumped or sprayed. Type III fluid is less sensitive, as it has a much lower viscosity.

(4) Tables dealing with Types II and IV fluids have a footnote that states, “No holdover time guidelines exist for this condition below -10° C (14° F).” This statement informs the user that, although the temperature range is below -3° C (27° F) to -14° C (7° F), the FAA does not consider HOT values valid below -10° C (14° F) for freezing drizzle and light freezing rain. These conditions usually do not occur at temperatures below -10° C (14° F).

(5) During the application of heated Types II and IV fluids in the one-step procedure, questions have arisen regarding the anticipated HOT performance of these fluids.

(a) In prior advisory information, the FAA indicated that maximum anti-icing effectiveness could be achieved from the application of unheated (cold) Type II fluids to deiced aircraft surfaces. This was based upon observations of the performance of Type II fluids in production at that time. The rationale was that a cold, unheated fluid would produce a thicker protective layer on aircraft surfaces, thus providing longer protection than a heated fluid presumably applied in a thinner layer.

(b) During tests conducted by APS Aviation for the FAA and TC using the existing test protocol, HOT performance of heated 60° C (140° F) Types II and IV fluids was found to equal or exceed the HOT performance of unheated Types II and IV fluids for the same fluid concentrations, temperatures, and precipitation conditions. Therefore, these and other test results have indicated that there is no basis for reducing the current HOT guideline values for Types II and IV fluids or using the Type I fluid HOT guidelines when heated Types II and IV fluids are properly applied.

c. Differences between Type I and Types II, III, and IV Fluids HOT Guidelines Usage.

(1) A Percent Fluid Concentration column appears in all tables dealing with Types II, III, and IV fluids, but not tables dealing with Type I fluids because:

- Type I fluids are applied to maintain at least a 10º C (18° F) buffer between the OAT and the freezing point of the fluid/water mix.
- Types II, III, and IV fluids are used in concentrations of 100/0, 75/25, or 50/50 in the anti-icing application. The freezing point buffer for these fluids will be at least 7° C (13° F) when used according to the dilutions and temperatures shown on their corresponding HOT tables.

Note: HOT tests are conducted using the 10º C (18º F) buffer for Type I fluids and the appropriate fluid/water concentration (100/0, 75/25, or 50/50) for Types II, III, and IV fluids to maintain a minimum 7° C (13° F) buffer.

(2) The HOT for a Type I fluid is considerably less than that for Types II, III, or IV fluids. The amount of heat absorbed by aircraft surfaces during the deicing/anti-icing operations heavily influences the degree of protection provided by Type I fluid. To use the Type I HOT guidelines, the fluid must be applied heated to deiced surfaces with a minimum temperature of 60º C (140º F) at the nozzle and applied at a rate of at least 1 liter per square meter (approximately 2 gallons per 100 square feet). Since composite surfaces conduct heat poorly, the composite surfaces HOTs are shorter.

(3) Although Type I fluids are normally considered deicing fluids, and Types II, III, and IV fluids are considered anti-icing fluids, all types have been used as both deicing and anti-icing agents. However, the performance of Type I fluid when used as an anti-icing agent is inferior to that of Types II, III, and IV fluids. Also, heated and diluted Types II and IV fluids are being used for deicing and anti-icing operations. This is a common practice among many of the European airlines and in use at some foreign airports by U.S. air carriers.

Note: The use of HOT guidelines is associated with anti-icing procedures and does not apply to deicing.

d. Precipitation Intensity. In all cells of the HOT tables where two values of time are provided, except for light and very light snow, freezing drizzle, and freezing rain, the precipitation intensity is light to moderate. For the Very Light Snow and Light Snow columns, HOTs should be considered in terms of their respective rates. Very light snow has a liquid equivalent snowfall rate of 0.3 to 0.4 millimeters per hour (mm/h), and light snow has a rate of 0.4 to 1.0 mm/h. (For reference, moderate snow has a liquid equivalent rate of 1.0 to 2.5 mm/h, and heavy snow is greater than 2.5 mm/h.) The longer times for very light snow would correspond to the lesser rate, whereas the shorter times would correspond to higher rates. For freezing rain, the range is confined to light freezing rain, which can be up to 2.5 mm/h. Except for freezing drizzle, heavy precipitation conditions are not considered in any HOT guidelines.

Note: The FAA does not approve takeoff in conditions of moderate or heavy freezing rain and hail. The FAA has developed allowance times and associated

limitations for takeoff in light or moderate ice pellets, light ice pellets mixed with other forms of precipitation, and small hail, as listed in the Ice Pellet and Small Hail Allowance Times tables (Table 6, Ice Pellet and Small Hail Allowance Times for SAE Type III Fluids, and Table 7, Ice Pellet and Small Hail Allowance Times for SAE Type IV Fluids). Additionally, takeoff in heavy snow may be accomplished if the requirements for operating in this condition, described in the FAA HOT Guidelines document, are met.

Note: In addition to following the operations in heavy snow guidance in the FAA HOT Guidelines document, the FAA Engine and Propeller Directorate has issued the following statement, "Turbine engine power run-up procedures are defined in the Aircraft Flight Manual (AFM)." The FAA Engine and Propeller Directorate recommends that operators consider performing more frequent engine power run-ups when operating in heavy snow conditions.

(1) Example: In Table 1A, under the Degrees Celsius column, below -3º C to -6º C for freezing drizzle, the HOT is 0:05 to 0:09, which is interpreted as a HOT from 0 hours and 5 minutes to 0 hours and 9 minutes. Depending on the freezing drizzle intensity, the approximate time of protection expected could be:

- As short as 5 minutes for a moderate or heavy freezing drizzle intensity, or
- As long as 9 minutes for light freezing drizzle conditions.

(2) Snow Conditions.

(a) The Type I, Type III and most Type II and Type IV fluid-specific HOT guidelines include three separate snow columns representing very light snow, light snow, and moderate snow conditions. Recent surveys and analysis of worldwide snow conditions have revealed that more than 75 percent of snow occurrences fall into the light and very light snow category. Values in the Very Light, Light, and Moderate Snow columns are based on extensive tests conducted by APS Aviation of Montreal, Canada, the National Center for Atmospheric Research (NCAR) of Boulder, Colorado, and the Anti-icing Materials International Laboratory (AMIL) of the University of Quebec at Chicoutimi, Canada. These tests were conducted on behalf of the FAA and TC.

(b) Type I HOT values for liquid equivalent snowfall rates between 0.4 and 1 mm/h (0.02 and 0.04 inches per hour (in/h), and 4 and 10 grams per decimeter squared per hour ($g/dm^2/h$) are selected for the Light Snow column and HOT values for liquid equivalent snowfall rates between 0.3 and 0.4 mm/h (0.01 and 0.02 in/h, and 3 and 4 $g/dm^2/h$) are selected for the Very Light Snow column. Overall, these selections were based upon a number of factors, including:

- Snow intensity reporting and measurement inaccuracies for light conditions of less than 0.5 mm/h.
- Potential wind effects.
- Light snow variability.
- Possible safety concerns associated with pretakeoff checks.

(3) Frost Conditions. Only one HOT value is provided in each cell of the FAA frost holdover time table (Table 0, Holdover Time Guidelines for SAE Type I, Type II, Type III, and Type IV Fluids in Active Frost). Frost intensities or accumulations are low in comparison to other precipitation conditions and decrease at colder temperatures. This usually results in HOTs for frost being considerably longer in comparison to HOTs for other precipitation conditions. The longer HOTs should accommodate most aircraft ground operational requirements. HOTs are for active frost conditions in which frost is forming. This phenomenon occurs when aircraft surfaces are at or below 0° C (32° F) and at or below the frost point. Frost typically forms on cold nights with clear skies.

e. General.

(1) The FAA emphasizes that air carriers should read and understand all notes and cautions in the FAA HOT Guidelines document, such as the reference to the 10º C (18º F) buffer for Type I fluids to preclude improper usage of fluids.

(2) Table 8 includes lowest operational use temperature (LOUT) information for each fluid, which is based on aerodynamic performance (i.e., the fluid's ability to flow off the wing during takeoff) and the fluid's freezing point depression capabilities.

(3) All HOT values (except for snow) are determined in a laboratory under no wind conditions. Snow testing is conducted outdoors and may or may not involve varying winds. This can have varying effects on the test results.

9. Operations in Small Hail.

a. Background.

(1) The World Meteorological Organization (WMO) states that the Aviation Routine Weather Report (METAR) code GS is used for two meteorological conditions, "snow pellets" and "small hail." In the U.S. and most other countries, weather observers report the METAR code GS in snow pellets and in small hail conditions, as recommended by the WMO. In Canada, weather observers only report GS in snow pellets; small hail is reported as SHGS with remarks.

(2) Different HOTs/allowance times apply in these two weather conditions that may be prevailing when the METAR code GS is reported. If the weather condition is snow pellets, the snow HOTs are applicable. If the weather condition is small hail, the ice pellets and small hail allowance times are applicable. If it is unknown which of the two weather conditions is prevailing, the ice pellets and small hail allowance times are applicable, as these are more restrictive than the snow HOTs.

(3) In the U.S. and most other countries, no intensity is reported with small hail. In some countries (e.g., Japan), an intensity is reported with small hail.

(4) Hail, METAR code GR, is not the same meteorological condition as small hail, as the individual pellets are larger. There are no HOTs or allowance times for GR.

b. Operations Guidance. The following guidance should be used to ensure the correct HOTs/allowance times are used with METAR code GS:

(1) If operating in the U.S. and METAR code GS is reported, the appropriate ice pellet and small hail allowance times should be used.

(2) If operating in Canada and METAR code GS is reported, snow HOTs can be used. If operating in Canada and METAR code SHGS is reported, ice pellet and small hail allowance times should be used.

(3) If operating in any other country and METAR code GS is reported, use the appropriate ice pellet and small hail allowance times unless additional information is provided with the METAR that makes clear the weather condition is snow pellets and not small hail, in which case the snow HOTs can be used.

(4) If no intensity is reported with small hail, the moderate ice pellet allowance times should be used. If an intensity is reported with small hail, the allowance times for the ice pellet condition with the equivalent intensity should be used (e.g., light small hail = light ice pellets, and moderate small hail = moderate ice pellets).

10. Frost and Freezing Fog.

a. Frost Overview. Frost occurs frequently during winter operating conditions. Frost due to radiation cooling is a uniform thin, white deposit of fine crystalline texture which forms on exposed surfaces that are below freezing, generally on calm, cloudless nights where the air at the surface is close to saturation. When the deposit is thin enough for surface features underneath such as paint lines, markings, and lettering to be distinguished, it is often referred to as hoarfrost. Frost can also form on the upper or lower surfaces of the wing due to cold-soaked fuel.

(1) Frost Characteristics. Frost has the appearance of being a minor contaminant and does not display the same obvious danger signal as do other types of contamination, such as snow or ice. However, frost is a serious threat to the safety of aircraft operations because it always adheres to the aircraft surface, is rough, and causes significant lift degradation and increased drag.

(2) Frost Formation. Frost forms whenever the exposed surface temperature cools below the OAT to or below the frost point (not the dewpoint).

(3) Active Frost. Active frost is a condition when frost is forming. During active frost conditions, frost will form on an unprotected surface or re-form on a surface protected with anti-icing fluid where the HOT has expired. If the exposed surface temperature is equal to or below the frost point, frost will begin to accrete on the surface. Once formed, residual accreted frost may remain after the active frost phase if the exposed surface temperature remains below freezing.

(4) Dewpoint and Frost Point. The dewpoint is the temperature at a given atmospheric pressure to which air must be cooled to cause saturation. The dewpoint can occur below or above 0° C (32° F). The frost point is the temperature, at or below 0° C (32° F), at which moisture in

the air will undergo deposition as a layer of frost on an exposed surface. The frost point occurs between the OAT and the dewpoint. The METAR does not report frost point; however, it does report dewpoint. The frost point is higher (warmer) than the dewpoint for a given humidity level in the air. The frost point and the dewpoint are the same at 0º C; at a dewpoint of -40º C, the frost point is 3.2º C warmer (-36.8º C). The following table provides further examples of the correlation between dewpoint and frost point.

Dewpoint Temperature (°C)	Frost Point Temperature (°C)
0	0
-5	-4.4
-10	-8.9
-15	-13.5
-20	-18.0
-25	-22.7
-30	-27.3
-35	-32.1
-40	-36.8

b. Freezing Fog. The freezing fog condition is best confirmed by observation. If there is accumulation in the deicing area, then the condition is active and freezing fog accumulation will tend to increase with increasing wind speed. The least accumulation occurs with zero wind. The measured deposition rate of freezing fog at 1 and 2.5 meters/second wind speeds are 0.2 and 0.5 mm/h (2 and 5 g/dm²/h), respectively. Higher accumulations are possible with higher wind speeds. Freezing fog can accumulate on aircraft surfaces during taxi since taxi speed has a similar effect as wind speed.

11. Alternative Deicing Systems—Forced Air Systems (FAS).

a. General. FAS are designed to remove frozen contamination by the use of forced air and/or forced air augmented with Type I fluid injected into or sprayed over a high-speed airstream, or to apply Types II, III, or IV fluids over the airstream as an anti-icing process. In the case of Type I fluids, aircraft surfaces must be anti-iced with heated Type I fluid without using forced air if Type I HOTs are to be used. Depending on the specific system, the operator may be able to select from several FAS modes, including:

- Forced air alone.
- Forced air augmented with Type I fluid.
- Types II, III, or IV fluids applied over the forced air stream.

b. Possible Concerns with FAS.

(1) Testing has indicated that the viscosity of Types II and IV fluids can degrade when applied by FAS. This degradation is influenced by the velocity and pressure of the forced airstream and the distance between the forced air nozzle and surface being anti-iced. Additionally, FAS-applied fluid mixtures may be unduly aerated, as evidenced by an overly foamy, milky-white, or frothy appearance. This may result in lower than published HOTs for Types II, III, and IV fluids. FAS dispensing Types II, III, and IV fluids must be viscosity tested.

(2) Another factor that may reduce HOTs is the apparent tendency of the high-speed airstream to thin out the fluid film as it is being applied. Therefore, operators must ensure that surfaces to be anti-iced are covered adequately in order to use the published Types II, III, and IV HOTs. The operator must ensure that an adequate coating of fluid is applied to aircraft surfaces, a procedure that may require several passes of the fluid spray over the area being protected. This usually means applying fluid in such quantities whereby the Type I deicing fluid is displaced, and the Type II, III, or IV fluid is running off in considerable amounts on sloped surfaces and running off flat surfaces as well.

(3) Before using Type II, III, or IV fluid-specific or generic HOTs, each operator must demonstrate, by spraying and viscosity testing, that its equipment, or equipment operated by other parties to deice/anti-ice the operator's aircraft, is capable of applying these fluids without excessive shearing, such that they would no longer meet LOWV requirements. The lowest acceptable delivered viscosity can be determined by multiplying the LOWV by the ratio of the fluid viscosity in the storage device divided by the fluid viscosity from the forced air spray sample recovered from the wing, and for Types II and IV fluids, rounded up to the nearest 500 milliPascal seconds (mPa·s).

> **Note:** Use the manufacturer's viscosity test method from Table 8 in the FAA HOT Guidelines document while conducting these or similar tests.

> **Note:** The APS Aviation test procedure "Test Program – Forced Air Systems – Type II/III/IV Fluid Applied Over the Forced Air Stream" provides an example of how these tests can be conducted and the calculations required to determine the lowest acceptable delivered viscosity of a fluid intended to be used with an FAS.

(4) The FAA recommends that nozzles be kept at a low angle to the surface of the aircraft to avoid excessive fluid shear damage, aircraft surface damage, and foaming. Fluid applied by forced air should not contain excessive foam, as evidenced by an overly foamy, milky-white, or frothy appearance, and should be applied in an even coverage coating, which may require several passes over the area on the aircraft being anti-iced. The coating should be similar in thickness to a coating of fluid applied by conventional means (using a nozzle designed to apply thickened fluids, usually at a reduced flow setting).

> **Note:** Except for application equipment and fluids that have been tested, and using fluid of sufficient viscosity to meet LOWV requirements in the air assist mode, published HOT guidelines (including generic) must not be used when using forced air unless followed by the application of anti-icing fluid without forced air.

(5) Adhere to airframe manufacturer cautions when operating FAS. For example, do not exceed the airframe manufacturer's limits regarding surface temperature and impact pressure on aircraft surfaces. This information is usually found in the Aircraft Maintenance Manual (AMM).

c. Additional Precautions for FAS.

(1) Ear protection is required when noise levels exceed 85 decibels (dB).

(2) Exercise caution around ground personnel. The potential for blowing ice chunks that may strike ground personnel, and restricted visibility due to blowing loose snow, are possible problems.

(3) Exercise caution to avoid the following:

- Directing forced air into sensitive aircraft areas (e.g., pitot tubes, static ports, vents).
- Blowing snow or slush into landing gear and wheel wells.
- Blowing ice, snow, and slush into aircraft engine inlets, auxiliary power unit (APU) inlets, and control surface hinges.
- Allowing loose debris to impact other aircraft surfaces.

Note: Information regarding a specific system can be obtained from the manufacturer's technical literature. SAE document AIR6284, Forced Air or Forced Air/Fluid Equipment for Removal of Frozen Contaminants, provides some information on FAS usage, limitations, and precautions. This document is available at http://standards.sae.org/air6284.

12. Fluid Quality Control (QC). QC checks of all stored fluids should be performed before the start of the deicing season. At a minimum, the checks for all fluid types should include visual inspections of the fluid and the containers for contamination and separation, refractive index measurements, and pH measurements. All values must be within the limits recommended for the manufacturer's specific fluid type and brand.

a. Types II, III, and IV Fluids Viscosity Check. In addition, for Types II, III, and IV fluids, viscosity checks should be performed at the beginning of the icing season, periodically throughout the winter, and any time fluid contamination or damage is suspected or after major deicing truck pumping and spraying system maintenance. These checks should include samples obtained through the spray nozzles of application equipment. The checks must be conducted using one of the measurement methods (manufacturer method or SAE AS9968 method, Laboratory Viscosity Measurement of Thickened Aircraft Deicing/Anti-icing Fluids with the Brookfield LV Viscometer) provided for the specific fluid brand/product and dilution in Table 8, List of Fluids Tested for Anti-icing Performance and Aerodynamic Acceptance. The viscosities obtained during these checks should be compared to the LOWV values provided in Table 8; fluid samples with viscosities below the stated LOWV cannot be used with the HOT tables, as they may not provide the HOT protection stated in the tables. Viscosity measurement methods and values for dilutions of Types II, III, and IV fluids are included in Table 8 to facilitate fluid

viscosity checks in locations where thickened fluids are diluted before applying and, in some cases, may be stored diluted.

(1) Nozzle samples should be collected from suitable, clean surfaces such as aluminum plates or plastic sheets laid on a flat surface, or the upper surface of an aircraft wing. The fluid should be sprayed in a similar manner as that used in an actual anti-icing operation. A small squeegee can be used to move the fluid to the edge of the sheet or wing so it can be collected in a clean, nonmetallic, wide-mouthed sample bottle.

(2) Nozzle samples may also be sprayed into clean containers such as a large trash can or containers with clean plastic liners such as trash bags.

(3) With all of these collection methods, samples should be sprayed onto the wing/sheet or into the container at a similar distance from the nozzle and at the same flow rate and nozzle pattern setting as that used in the actual anti-icing operation.

b. Loss of Water Content. Prolonged or repeated heating of fluids may result in loss of water content, which can lead to performance degradation of the fluid. Deicing/anti-icing fluids should not be heated to application temperatures until necessary for application, if possible, and cycling the fluid to application temperatures and back to ambient temperatures should be avoided. For Type I fluids, the water loss caused by prolonged/repeated heating may cause undesirable aerodynamic effects at low ambient temperatures. For Types II, III, and IV fluids, the thermal exposure and/or water loss may cause a reduction in fluid viscosity, leading to earlier failure of the fluid and therefore invalidate the applicable HOT.

Note: Adding water to Types II, III, and IV fluids will not repair the damage caused by the previously mentioned conditions.

c. Other Types of Fluid Degradation. Other types of fluid degradation may result from chemical contamination, or in the case of Types II and IV fluids, excessive mechanical shearing attributed to the use of improper equipment/systems such as pumps, control valves, or nozzles.

13. Fluid Application.

a. Type I Fluid Application Table (Table 9). Table 9 states, “Fluids must only be used at temperatures at or above their lowest operational use temperature (LOUT).”

(1) The LOUT is the lowest temperature at which a fluid has been determined in a wind tunnel to flow off an aircraft in an aerodynamically acceptable manner while maintaining the required freezing point buffer, which is 10° C (18° F) for Type I fluids.

(2) For example, if a Type I fluid is aerodynamically acceptable to -30° C (-22° F), but the freezing point is -35° C (-31° F), the limiting factor (LOUT) would be the freezing point plus the required 10° C (18° F) buffer or -25° C (-13° F). In another example, if a different Type I fluid was aerodynamically acceptable to -30° C (-22° F) and the freezing point was -42° C (-44° F), the LOUT would be limited by the aerodynamic performance, and the LOUT would be -30° C (-22° F), since the 10° C (18° F) buffer requirement is met at -32° C (-26° F).

(3) At colder temperatures, FPD fluids become too thick to flow off the aircraft properly during takeoff and/or their freezing point temperature is reached and they are no longer able to keep aircraft surfaces from freezing in the presence of active precipitation.

b. Types II, III, and IV Fluids Application Table (Table 10).

(1) As in Table 9, the same note in Table 10, Guidelines for the Application of SAE Type II, Type III, and Type IV Fluid Mixtures Minimum Concentrations as a Function of Outside Air Temperature, states, “Fluids must only be used at temperatures at or above their lowest operational use temperature (LOUT).” The only difference is that the freezing point buffer for Types II, III, and IV fluids is 7° C (13° F).

(2) An example of a LOUT for these fluids would be if a specific Type IV fluid is aerodynamically acceptable down to -33° C (-27° F) with a freezing point of -36° C (-33° F), the limiting factor would be the freezing point when the 7° C (13° F) buffer is factored in, giving a resulting LOUT of -29° C (-20° F).

14. Concerns/Conditions.

a. Flightcrew Awareness of Conditions Affecting the Aircraft Anti-Icing Treatment Following Deicing and Anti-Icing Operations. The operator’s deicing plan must provide a process that informs the captain of the time of the deicing/anti-icing treatment and conditions that have affected the aircraft anti-icing treatment since that time. If the flightcrew is not present at the time of the deicing/anti-icing application, the crew will review this information before calculating the HOT.

b. Early Fluid Failure on Extended Slats and Flaps. Research has determined that fluid degradation (via increased flow off) may be accelerated by the steeper angles of the flaps/slats in the takeoff configuration. This is reflected in the 90 Percent Adjusted Holdover Time and Allowance Time Tables (Table 0-90%, 90 Percent Adjusted Holdover Time Guidelines for SAE Type I, Type II, Type III, and Type IV Fluids in Active Frost through Table 7-90%, 90 Percent Adjusted Ice Pellet and Small Hail Allowance Times for SAE Type IV Fluids). The degree of potential degradation is significantly affected by the specific aircraft design. Further research is anticipated to characterize the extent of the effect on the HOTs and allowance times. The FAA advises all air operators to review their policies and procedures in light of this information to ensure appropriate consideration.

c. Aircraft Failure to Rotate when Anti-Iced with Type II or IV Fluid.

(1) The FAA has become aware of some instances where aircraft failed to rotate after being anti-iced with Type IV fluid. This situation has been confined mostly to slower rotation speed turboprop aircraft; however, one occurrence involved a small corporate jet. Typically, these aircraft have non-powered flight controls that rely on aerodynamic forces to achieve rotation.

(2) When excessive amounts of Type IV fluids are sprayed on the tail surfaces, the gap between the horizontal stabilizer and the elevator can become blocked with fluid and restrict the airflow needed for proper deflection of the elevator, resulting in difficulties with rotation, including high stick forces being encountered by pilots. Operators are cautioned to avoid

spraying these aircraft tail areas from the rear, and should always apply fluid in the direction of airflow, from front to rear. Although they should be completely covered, these aft areas should not be flooded with excessive amounts of Type IV fluids.

Note: These concerns apply equally to applications of Type II fluids.

d. Possible Effects of Runway Deicer on Thickened Aircraft Anti-Icing Fluids.

(1) Most current runway deicing/anti-icing material contains organic salts that are not compatible with thickened aircraft anti-icing fluids. These salts cause the thickening agents within the aircraft deicing fluids to break down, reducing the viscosity of the anti-icing fluid and causing it to flow off the airframe more quickly. This reduction in the amount of anti-icing fluid will have an impact on the length of time that the anti-icing fluid will continue to provide adequate anti-icing protection.

(2) During landing, if runway deicing fluid is expected to have been splashed or blown up onto a critical surface, those surfaces should be thoroughly washed with deicing fluid or hot water (if temperature appropriate) prior to applying anti-icing fluids. This is normally accomplished during a routine two-step deicing/anti-icing process; however, during a preventive anti-icing fluid application, this cleansing step is often not accomplished. During taxi operation for takeoff on taxiways that have been deiced/anti-iced, flightcrews should be conscious of the effects of having the runway deicing fluid blown up onto the aircraft by preceding aircraft jet blast.

e. Inspection of Single-Engine, High Wing Turboprop Aircraft.

(1) In recent years, there has been a disproportionate number of ground icing accidents associated with improper checking/inspection of single-engine, high wing turboprop aircraft employed in commercial service. This is especially true of such aircraft operated from remote locations with minimum facilities. In several of these accidents, it could not be determined whether the aircraft had been inspected/checked by the operator/pilot prior to departure. HOTs were not an issue because, at the time of attempted departure, there was no active precipitation. Typically, these accidents occurred during the first flight of the day following a freezing precipitation event that had occurred earlier.

(2) For these types of operations, the single pilot/operator was usually the final person to perform the pretakeoff check. On one aircraft in particular, it has been shown that it is difficult to see clear frozen contamination from a glancing view of the upper wing surface area (looking rearward from the wing’s leading edge) when the pilot uses the wing strut/step to see the aft portion of the wing. Visual inspections can best be achieved by using inspection ladders or deicing ladders to achieve a higher vantage point to view the aft upper wing surface area. A number of ladder manufacturers provide wing inspection ladders that are ideal for this task. POIs are encouraged to discuss these observations with their operators and to ensure that operators employ adequate means to allow a pilot to clearly see the entire upper wing surface from a suitable height above the wing.

f. Tactile Inspection of Hard Wing Airplanes (No Leading Edge Devices/Slats) With Aft-Mounted Turbine Powered Engines. The following guidance is provided for tactile

inspection clarification for part 121 operators of hard wing airplanes with an approved § 121.629(c) deicing program. There are three possible times that a tactile check should be accomplished in this type of operation:

(1) The conditions are such that frost or ice might be adhering to the aircraft, such as 10° C (50° F) or colder and high humidity or cold-soaked wings, all without active precipitation. Under this condition, a tactile check should be performed as part of the cold weather preflight requirements.

(2) If the aircraft is deiced, the post deicing check to confirm that all the contaminants have been removed from the critical surfaces should be accomplished through the use of a visual and tactile check.

(3) If the aircraft has been anti-iced with anti-icing fluids and the prescribed HOTs have been exceeded, the required pretakeoff contamination check required within 5 minutes before takeoff must be accomplished through a visual and tactile check of the critical surfaces.

g. Fluid Dry-Out.

(1) Reported incidents of restricted movement of flight control surfaces while in flight attributed to fluid dry-out have continued. Testing has shown that diluted Type II and IV fluids can produce more residual gel than neat fluids. This is primarily due to the practice in some geographic locations of using diluted, heated Types II and IV fluids for deicing and anti-icing. Operators should be aware of the potential for fluid residue on their aircraft when operating to locations in Europe or other locations where deicing and anti-icing is conducted with diluted Type II or Type IV fluids.

Note: Changing from Type IV fluid to Type II fluid will not necessarily reduce fluid dry-out problems.

(2) Such events may occur with repeated use of Types II and IV fluids without prior application of hot water or Type I fluid mixtures. This can result in fluid collecting in aerodynamically quiet areas or crevices, which does not flow off the wing during the takeoff ground roll. These accumulations can dry to a gel-like or powdery substance. Such residues can rehydrate and expand under certain atmospheric conditions such as high humidity or rain. Subsequently, the residues freeze, typically during flight at higher altitudes. Rehydrated fluid gels have been found in and around gaps between stabilizers, elevators, tabs, and hinges. This especially can be a problem with non-powered controls. Some pilots reported that they have descended to a lower altitude until the frozen residue melted, which restored flight control movement.

(3) Some European air carriers have reported this condition in which the first (deicing) step was performed using diluted, heated Types II or IV fluids followed by Types II or IV fluids as the second (anti-icing) step, or by using these heated, thickened fluids in a one-step deicing/anti-icing process. To date, North American air carriers have not reported such occurrences. Typically, North American air carriers use a two-step deicing/anti-icing procedure in which the first step is generally a heated Type I fluid mixture.

(4) Operators should check aircraft surfaces, quiet areas, and crevices for abnormal fluid thickening, appearance, or failure before flight dispatch if Types II or IV fluids are used exclusively to deice/anti-ice their aircraft. If an operator suspects residue as a result of fluid dry-out, an acceptable solution is to spray the area with water from a spray bottle and wait 10 minutes. Residue will rehydrate in a few minutes and be easier to identify. This residue may require removal before takeoff.

(5) If aircraft are exposed to deicing/anti-icing procedures likely to result in dehydrated fluid buildup, clean the aircraft in accordance with the aircraft manufacturers' recommendations. This cleaning should be accomplished with hot Type I fluid and/or water mix, or other aircraft manufacturer recommended cleaning agents. These cleaning procedures may require subsequent lubrication of affected areas. If evidence of fluid dry-out is present, an increase in the frequency of inspection of flight control bays and actuators may be necessary.

15. Holdover Times Determination Systems (HOTDS). HOTDS have been in development for a number of years. These systems convert snowfall data and other types of winter precipitation data into liquid water equivalent (LWE) data, which are then used to develop an HOT. The precipitation rate determined by these devices is matched with HOT data developed when fluids are tested in natural snow conditions, and artificial conditions for other precipitation types, to determine an HOT for a particular fluid type in the case of Type I fluids, and for a specific fluid name brand and type for Types II, III, and IV fluids. The FAA is has published AC 120-112, Use of Liquid Water Equivalent System to Determine Holdover Times or Check Times for Anti-Icing Fluids, describing the approval process for using these devices to determine HOTs. Currently, an FAA Operations Demonstration is being used as the approved method for an air carrier to implement HOTDS.

16. Wingtip Devices Identified as Critical Surfaces. Wingtip devices have various names, including winglets, strakes, sharklets, or raked wingtips. The guidance below applies for these devices.

a. Without Split Scimitars or Strakes (Winglets, Sharklets, Etc.). These devices must be confirmed to be free of frozen contamination as part of the pretakeoff check. Current practices include a visual scan or the use of an approved representative surface, as specified in the operator's FAA-approved ground deicing program.

b. With Split Scimitars, Strakes, or Similar Devices. A new wingtip device element, the strake, has been introduced and is part of the split scimitar. The strake is installed outboard of the vertical component of the wingtip device and extends downward and therefore cannot be observed from inside the aircraft. Manufacturers may designate the upper inboard surface of the vertical element of the wingtip device as a representative surface to assure no frozen contamination is present. The anti-icing procedures specified require this inboard surface to be anti-iced first starting at the top and working downward. The strake is anti-iced after the inboard surface application is completed. A visual scan of the designated representative surface (upper inboard surface of the vertical element of both wingtips) is required prior to takeoff as part of the pretakeoff check. This paragraph applies only to aircraft with split scimitar wingtip devices. This guidance will be revised when new wingtip types become available.

17. Action.

a. Distribution. POIs must distribute the HOTs to all parts 121, 125, and 135 certificate holders who have an approved part 121 deicing/anti-icing program. They also should distribute HOT and application guidelines to operators who are not required to have an approved program, but who deice or anti-ice with fluids and use these guidelines during winter weather operations. The attached HOT and application guidelines supersede all previously approved HOT and application guidelines for application of deicing/anti-icing fluid mixtures.

b. HOT Guidelines. POIs must inform their certificate holders of the approved HOT guidelines and application procedures attached to this notice. POIs should recommend that these HOT tables and application guidelines be incorporated into the certificate holder's procedures or programs. Certificate holders should use these tables and application guidelines or the data contained in them to develop tables and guidelines that are acceptable to the Administrator.

c. Information for Deicing/Anti-Icing Updates. POIs must provide the carriers with the following information, which should be incorporated into their approved ground deicing/anti-icing updates for the 2015-2016 winter season:

(1) Fluid Application.

(a) During previous seasons, surveillance of deicing/anti-icing operations has indicated several problems in fluid application. These findings include:

- Instances when fluid was applied in the reverse order of company-approved procedures (e.g., approved procedure being wing tip to wing root).
- Insufficient fluid temperature buffers.
- Incomplete removal of contamination.

(b) Frozen contamination on wing surfaces at altitude has been reported.

(c) To minimize such occurrences, when performing a deicing/anti-icing procedure, accomplish the first step (deicing) by applying the hot fluid with the nozzle as close to the surface as possible without damaging aircraft surfaces. Increasing the distance from the nozzle to the surface results in progressively greater loss of fluid heat and deicing capability. This condition is aggravated as the fluid application pattern is adjusted toward a spray mode. Also, maintain a safe distance between deicing equipment and aircraft surfaces to avoid contact.

(d) Additionally, cover the entire aircraft surface directly by the deicing operation (except windows or other areas where a direct spray is not recommended) rather than relying on fluid flow-back over contaminated areas. This will provide greater assurance that no frozen precipitation remains under the deicing fluid.

(e) As a final precautionary step, apply sufficient fluid to ensure that any remaining diluted fluid on the deiced surfaces (as a result of the deicing process) is displaced by a fluid with a freezing point of at least 10° C (18° F) below the OAT if anti-icing with Type I fluid. In the case of Types II, III, and IV fluids, ensure they are applied in the temperature ranges for undiluted or diluted, as shown in the HOTs, and that quantities are sufficient to displace deicing

fluid. This can be indicated by these anti-icing fluids running off in considerable quantities on sloped surfaces and running off flat surfaces also. If applied according to the respective HOTs, the freezing point buffer requirement of at least 7° C (13° F) below the OAT will be met. Determine this by checking the refractive index/Brix (refer to the manufacturer's information).

> **Note:** The freezing point of 10° C (18° F) below the OAT refers only to a Type I fluid. Historically, Types I, II, and IV fluids application guidelines have recommended a minimum fluid temperature of 60° C (140° F) at the nozzle for deicing. Field testing using properly functioning deicing equipment has shown that fluid temperatures of 60° C (140° F) at the nozzle are readily obtained and usually 10° C (18° F) higher.

(f) The effectiveness of Types II, III and IV fluids is highly dependent on the training and skill of the individual applying the fluids. When these fluids are used, ground personnel should ensure that they are evenly applied so that all critical surfaces, especially the leading edge of the wings, are covered with fluid. In addition, an insufficient amount of anti-icing fluid, especially in the second step of a two-step procedure, may cause reduced HOT because of the uneven application of the second-step fluid.

(g) In very cold conditions (generally below -10° to -15° C (14° to 5° F) or colder), dry snow or ice crystals can fall onto cold aircraft wings. Under these conditions, these forms of precipitation will swirl as they blow across the wings, making it evident they are not adhering. But, if either has accumulated on the surface of the wings and it cannot be adequately demonstrated that they are not adhering to any portion of the wing, they have to be removed before takeoff. It cannot be assumed that these accumulations will blow off during takeoff.

(h) The aircraft operator will need to test multiple areas along the entire length and width of both wings, and should take into consideration the location of heat-releasing components in the fuel tanks such as hydraulic fluid heat exchangers. The testing should be accomplished after refueling. Factors that could affect adherence must be taken into consideration. These would include, weather, temperature, aircraft parking location, (i.e., one wing in the sun), and potentially other factors.

(2) Communication.

(a) Communication among all personnel involved in the deicing/anti-icing of an air carrier's aircraft is critical to ensure that the pilot has the information needed to make the final determination that the aircraft is free of adhering contamination before flight. Approved programs should emphasize that all personnel (e.g., management personnel, dispatchers, ground personnel, and flightcrew members) who perform duties, as outlined in the approved program, clearly and concisely communicate essential information to ensure that no frozen contaminants are adhering to any critical surfaces of the aircraft. Some airports have introduced electronic signs to aid in the transmission of critical information to the flightcrews. This includes aircraft ground control information at the deicing pad and information on the ongoing deicing/anti-icing procedure and fluid application. Long-range plans are underway to employ Aircraft Communications Addressing and Reporting System (ACARS) data link systems of aircraft to relay deicing information to the flightcrews.

(b) Specifically, review approved programs to determine whether the ground personnel accomplishing the deicing/anti-icing procedure communicate the following information to the pilot:

- The Type fluid used (for Types II, III, and IV fluids, the specific manufacturer name and Type fluid, or SAE Type II, SAE Type III, or SAE Type IV).
- The percentage of fluid within the fluid/water mixture (for Types II, III, and IV fluids only (not necessary for Type I fluid)).
- The local time the final deicing/anti-icing began.
- The results of the post-deicing/anti-icing check, unless the approved program has other procedures for ensuring this information is conveyed to the pilot.

(c) Although reporting the results of the post-deicing/anti-icing check may be redundant in some cases, it confirms to the pilot that all contamination has been removed from the aircraft.

(3) First Areas of Fluid Failure. Aircraft testing has indicated that the first fluid failures on test aircraft occur on the leading and/or trailing edges rather than the midchord section of the wing. Tests have also indicated that fluid failures may be difficult to visually identify. Where possible, representative surfaces should:

- Include a portion of the wing leading edge; and
- Be visible by the pilot from within the aircraft.

(4) Devices. For aircraft with wingtip devices, current practice used to assure no frozen contamination is present at takeoff is incorporated in the pretakeoff check. This incorporates a visual scan or using representative surface(s).

d. Operations During Light Freezing Rain/Freezing Drizzle.

(1) POIs should inform air carriers electing to operate in light freezing rain or freezing drizzle weather conditions to use Types II, III, or IV anti-icing fluids. Approved programs should clearly state that deicing/anti-icing fluids do not provide any protection from contamination once the aircraft is airborne.

(2) Air carriers not electing to use Types II, III, or IV anti-icing fluids while operating during light freezing rain or freezing drizzle conditions should develop and use special procedures. Examples of special procedures include:

- An approved external pretakeoff contamination check.
- A remote deicing capability.
- Other special means of enhancing the safety of operation during these conditions (such as the use of advanced wide area optical technology capable of detecting aircraft contamination).

(3) POIs should use special emphasis surveillance during periods of light freezing rain and freezing drizzle. Surveillance should affirm that approved checks or other special

procedures, as stated above, are effective and conducted in accordance with the air carrier's approved deicing/anti-icing program.

> **Note:** Exercise care in examining engine air inlets for clear ice. Such frozen contamination can be dislodged and drawn into engines after startup. High rear-mounted engines may be difficult to inspect. The problem is compounded because clear ice may be difficult to detect visually and require tactile examination. Additionally, wide-area Ground Ice Detection Systems (GIDS) have been shown to be very effective in locating ice lodged in the air inlets of turbojet engines.

18. Other Conditions for Which HOTs or Allowance Times Do Not Exist (Heavy Ice Pellets, Moderate and Heavy Freezing Rain, and Hail).

a. General. HOTs and/or allowance times have not been established for heavy ice pellets, moderate and heavy freezing rain, and hail. Therefore, this notice does not provide HOTs or other forms of relief for dispatch in these conditions.

b. Regulations. The regulations clearly state, "No person may take off an aircraft when frost, ice, or snow is adhering to the wings…" (§ 121.629(b)) and "…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…" (§ 121.629(c)). Under some conditions, the aircraft critical surfaces may be considered free of contaminants when a cold, dry aircraft has not had deicing and/or anti-icing fluids applied, and ice pellets/snow pellets are not adhering and are not expected to adhere to the aircraft critical surfaces. Refueling with fuel warmer than the wing skin temperature may create a condition whereby previously non-adhering contaminants may adhere to the wing surfaces.

19. Guidelines for Pilot Assessments of Precipitation Intensity Procedures.

a. Pilot Discretion. Pilots may act based on their own assessment of precipitation intensity only in those cases where the officially reported meteorological precipitation intensity is grossly different from that which is obviously occurring (e.g., precipitation is reported when there is no actual precipitation occurring). As always, if, in the pilot's judgment, the intensity is greater, or a different form of precipitation exists than that being reported, then the appropriate course of action and applicable HOTs/allowance times for the higher intensity or different form of precipitation must be applied (e.g., precipitation is being reported as light ice pellets and the pilot assessment is that it is moderate ice pellets, then the pilot must apply the allowance time for moderate ice pellets).

b. Reporting New Observation. Before a pilot takes action on his or her own precipitation intensity assessment, he or she will request that a new observation be taken. A pilot must not take action based on his or her own precipitation intensity assessment unless either a new observation is not taken and reported, or the new precipitation intensity officially reported remains grossly different from that which is obviously occurring.

c. Use of Company Coordination Procedures. The company's approved deicing program, in accordance with § 121.629, must contain the required company coordination procedures for a

pilot when he or she chooses to take actions that are based on his or her precipitation intensity assessment that is less than the precipitation intensity that is being officially reported (e.g., the official weather report is moderate freezing rain, and the pilot's assessment is that there is no liquid precipitation; or the reported weather is moderate snow and light ice pellets, and by the pilot's assessment there is light snow and no ice pellets). These procedures require coordination with the company before the pilot takes such action, or if the approved company program allows, a report of action taken after the pilot has opted to exercise this option.

d. Pretakeoff Contamination Check. When a pilot acts based on his or her own assessment that precipitation intensity levels are lower than the official reported intensity level, a check at least as comprehensive as the operator's pretakeoff contamination check (when HOTs have been exceeded) per the approved procedure for the applicable aircraft is required within 5 minutes of beginning the takeoff.

> **Note:** Unlike other forms of precipitation, individual ice pellets may be seen, if viewed close up or felt, embedded in the fluid since they are not readily absorbed into the anti-icing fluid like other forms of precipitation. Under ice pellet conditions and within the appropriate allowance times, if ice pellets are visible they should appear as individual pellets and not form a slushy consistency indicating fluid failure. This distinction is very difficult to make from inside the aircraft. If through an internal or external visual check or a tactile check (as appropriate for the aircraft) the ice pellets mixed with the anti-icing fluid form a slushy consistency or are adhering to the aircraft surface, then the intensity level that the pilot based the allowance time on was not accurate and the takeoff should not be conducted.

e. Permissible Use of Pilot Assessment of Precipitation Intensity. Under the following conditions, a pilot may act based on his or her own assessment of precipitation intensity levels that are less than that being officially reported. Pilot assessment of precipitation intensity levels may only be used when sufficient natural sunlight or artificial lighting is available to provide adequate exterior visibility. The snowfall intensity table provided in Table 5, Snowfall Intensities as a Function of Prevailing Visibility, is based on prevailing visibility, and allowances are made in the table for the effects of night (darkness) conditions.

(1) Ice Pellets. When ice pellets are being reported, the following chart information extracted from the Federal Meteorological Handbook No. 1 (FMH-1), Surface Weather Observations and Reports, must be used to assess their actual intensity rate:

(a) Light-Scattered pellets that do not completely cover an exposed surface regardless of duration.

(b) Moderate-Slow accumulation on ground.

(c) Heavy-Rapid accumulation on ground.

(2) Drizzle/Freezing Drizzle and Rain/Freezing Rain. The differentiations between these various conditions are based on droplet size and require careful observation. Therefore, when drizzle/freezing drizzle or rain/freezing rain is being reported, a pilot must use both visual and

physical (feel) cues in determining the presence of precipitation. If precipitation is present to any degree by visual or physical cues, the official reported precipitation type and intensity must be used for determining the appropriate course of action and applicable HOTs. If the pilot determines no precipitation is present, the aircraft should be deiced if necessary and consideration given to treating the aircraft with anti-icing fluid as a precaution for encountering the reported precipitation on taxi-out. As always, if in the pilot's judgment the intensity is greater, or a different form of precipitation exists, than that being reported, then the appropriate course of action and applicable HOTs/allowance times for the higher intensity or different form of precipitation must be applied.

(3) Snow. The snowfall visibility table, Table 5, has previously been published with the annual FAA HOT tables for use in determining snow intensity rates based on prevailing visibility and must be used in place of official reported intensities. Thus, this table should be used for pilot assessment of snowfall intensity rates unless snow and an obscuration (fog, smoke, haze, etc.) are reported.

Table 5. Snowfall Intensities as a Function of Prevailing Visibility

Time of Day	Temp.		Visibility in Statute Miles (Meters)									
	Degrees Celsius	Degrees Fahrenheit	≥ 2 ½ (≥ 4000)	2 (3200)	1 ¾ (2800)	1 ½ (2400)	1 ¼ (2000)	1 (1600)	¾ (1200)	½ (800)	≤ ¼ (≤ 400)	
Day	colder/equal -1	colder/equal 30	Very Light	Very Light	Very Light	Light	Light	Light	Moderate	Moderate	**Heavy**	**Snowfall Intensity**
	warmer than -1	warmer than 30	Very Light	Light	Light	Light	Light	Moderate	Moderate	**Heavy**	**Heavy**	
Night	colder/equal -1	colder/equal 30	Very Light	Light	Light	Moderate	Moderate	Moderate	Moderate	**Heavy**	**Heavy**	
	warmer than -1	warmer than 30	Very Light	Light	Moderate	Moderate	Moderate	Moderate	**Heavy**	**Heavy**	**Heavy**	

NOTE 1: This table is for estimating snowfall intensity. It is based upon the technical report, "The Estimation of Snowfall Rate Using Visibility," Rasmussen, et al., Journal of Applied Meteorology, October 1999 and additional in situ data.

NOTE 2: This table is to be used with Type I, II, III, and IV fluid guidelines.

NOTE 3: If visibility from a source other than the METAR is used, round to the nearest visibility in the table, rounding down if it is right in between two values. For example, .6 and .625 (5/8) would both be rounded to .5 (1/2).

HEAVY = Caution No Holdover Time Guidelines Exist

Note: During snow conditions alone, the use of Table 5 in determining snowfall intensities does not require pilot company coordination or company reporting procedures since this table is more conservative than the visibility table used by official weather observers in determining snowfall intensities.

Note: Because the FAA Snowfall Intensities Table, like the FMH-1 Table, uses visibility to determine snowfall intensities, if the visibility is being reduced by snow along with other forms of obscuration such as fog, haze, smoke, etc., the FAA Snowfall Intensities Table does not need to be used to estimate the snowfall intensity for HOT determination during the presence of these obscurations. Use of the FAA Snow Intensity Table under these conditions may needlessly overestimate the actual snowfall intensity and therefore the snowfall intensity being reported by the weather observer or automated surface observing system (ASOS) from the FMH-1 Table may be used.

(4) Training Requirements. Pilots who are limited in their precipitation intensity assessments to determining whether or not precipitation is falling will only be required to have instruction on how that assessment should be made (e.g., how and where to perform the physical feel cues to determine if precipitation is present).

(a) Pilots who determine precipitation intensity will be required to be trained on their company's pilot precipitation intensity assessment procedures. These pilots will need training on the methods used by weather observers to determine precipitation types and intensities and on how to conduct their own assessment under the different precipitation conditions. The FMH-1 and Table 5 must be used as the source documents for this training.

(b) Additionally, § 121.629 requires anti-icing fluid failure recognition training under the various precipitation conditions for pilots and all other persons responsible for conducting pretakeoff contamination checks if anti-icing fluids are used.

20. Program Tracking and Reporting Subsystem (PTRS) Input. POIs of 14 CFR parts 91 subpart K (part 91K), 125, and 129 certificate holders must make a PTRS entry to record the actions directed by this notice with each of their operators.

21. Air Transportation Oversight System (ATOS) and Safety Assurance System (SAS) Action. Within 30 days of receiving this notice, POIs will ensure that the Director of Safety (DOS) of his or her assigned air carrier is aware of it.

a. Recommendations. The POI must assess the air carrier's response to the recommendation. An air carrier's failure to implement these recommendations into its existing program could result in an increase in risk in several areas.

b. Additional Surveillance and Action. The POI must determine if additional surveillance is required or further air carrier action is necessary to address the potential increased risk. Possible additional actions may include retargeting the Comprehensive Assessment Plan (CAP) to include accomplishing appropriate Design or Performance Assessments, convening a System Analysis Team (SAT), or re-evaluating air carrier approvals or programs.

22. Reporting Systems.

a. ATOS Reporting. POIs will make an ATOS entry using the "Other Observation DOR" functionality to record the actions directed by this notice. The POI will access the "Create DOR" option on their ATOS homepage, select the "Other Observation" tab, and:

- Select System: 3.0 Flight Operations.
- Select Subsystem: 3.1 Air Carrier Programs and Procedures.
- Select the appropriate air carrier from the drop-down menu.
- Select "1381" from the "PTRS Activity Number" drop-down menu.
- Enter the date the activity was started and completed.
- Enter the location where the activity was performed.
- Enter the appropriate notice number in the "Local/Regional/National Use" field.

- Use the “Comments” field to record any comments reflecting interaction with the air carrier and the air carrier’s response to the recommendation.
- Input any actions taken in the “Reporting Inspector Action Taken” field.
- Select the “Save” button after all entries have been made.

b. SAS Reporting. POIs will make a SAS entry using the “Other DOR” functionality to record the actions directed by this notice. From the “SAS Menu,” the POI will select “Create DCTs,” then select “Dynamic Observation Report,” then check the “No Applicable Questions” box, and select 6.2.3: (OP) Deicing Program and then click “Complete DOR.”

- Under the “Enter Common Data Fields” tab, enter the start/end date, the location where the activity was performed, and the appropriate notice number in the “Local/Regional/National Use” field.
- Under the “Preform DCT” tab, record any comments reflecting interaction with the air carrier and the air carrier’s response to the recommendation. Also, enter any actions taken.
- Check and submit the Data Collection Tool (DCT).

23. Disposition. We will incorporate the information in this notice into FAA Order 8900.1, Flight Standards Information Management System (FSIMS), before this notice expires. Direct questions concerning this notice to the Part 121 Air Carrier Operations Branch (AFS-220) at 202-267-8166.



John Barbagallo
Deputy Director, Flight Standards Service