TO: All Flight Crewmembers

FROM: Rex Gunning, Manager, Flight Operations Compliance

SUBJECT: Summary of Changes and Guidance for 2014/2015 Winter Season.

ABX Air has distributed Flight Operations Manual, Appendix 2, Revision 30 which contains the 2014/2015 winter season guidance and the Official FAA Holdover Time Tables.
There are some major changes to the FAA winter operations guidance and tables you need to be aware of.

SNOWFALL VISIBILITY TABLE.
Snowfall Intensities as a Function of Prevailing Visibility is unchanged for 2014/2015. However, since **Very Light Snow** is being added to some of the Type II and Type IV Holdover (HOT) Tables, and since the METAR and the associated ATIS do not report **Very Light Snow**, FAA guidance has allowed a METAR reported visibility of 2.5 miles or greater to be used as an indication that the snowfall intensity is very light.

SURFACE VISIBILITY.
Some METARS contain tower visibility as well as surface visibility. Whenever surface visibility is available from an official source, such as a METAR, in either the main body of the METAR or in the Remarks ("RMK") section, the preferred action is to use the surface visibility value.

USE OF RUNWAY VISUAL RANGE (RVR).
The use of runway visual range (RVR) is not permitted for determining visibility used with the Holdover Time Tables.

EARLY FLUID FAILURE ON EXTENDED SLATS AND FLAPS.
This is a major change from years past and includes the introduction of additional Holdover Time Tables.
Research has determined that anti-ice fluid degradation is accelerated by the steeper angles of the slats/flaps in the takeoff configuration when being deiced/anti-iced. The degree of potential degradation is significantly affected by the specific aircraft design.
For the winter of 2014/2015, additional Holdover Time Tables have been published which include 90% adjusted holdover/allowance times for slats and flaps extended during deicing/anti-icing.
The 90% adjusted Holdover Time Tables provide holdover/allowance times that must be used when slats and flaps are deployed prior to deicing/anti-icing.
If the aircraft is deiced/anti-iced with slats and flaps retracted, the Standard Holdover Table allowance times can be used. Currently ABX Air procedures are to leave

slats/flaps retracted during deicing/anti-icing. Please reference AOM Chapter 4, Section 2, Page 44, sub-paragraph **Airframe Deicing** for aircraft configuration during deicing/anti-icing. After aircraft deicing/anti-icing, the Captain at his/her discretion may elect to delay flap extension and the Before Take-Off Checklist until nearing the departure runway**. If the flap extension is delayed the Take-Off Checklist must also be delayed to prevent a take-off attempt with the flaps not properly set.**

ICE PELLET AND SMALL HAIL ALLOWANCE TIMES.

Research has been conducted to provide guidance for aircraft operations during ice pellet conditions when operating with Type III undiluted (100/0) fluid applied unheated. A separate ice pellet allowance time table has been developed for Type III fluids. Small hail has been added to the allowance time tables as it has been determined to be meteorologically equivalent to moderate ice pellets. It has also been added to the titles of the allowance time guidance section and Holdover Time Tables.

Research has indicated that Type IV propylene glycol (PG) fluids are removed less effectively during take-off when contaminated with moderate ice pellets at temperatures below -16 °C. Therefore operations in these conditions are not recommended and no allowance times exist for PG fluids in conditions of moderate ice pellets at temperatures below -16 °C, irrespective of aircraft rotation speed.

Research has provided data to support a new Type IV allowance time of 7 minutes for light ice pellets mixed with moderate snow at temperatures below -5 to -10 °C.

KILFROST TYPE IV HOLDOVER TABLES.

ABX Air will again have a manufacture specific **(Kilfrost)** Type IV Holdover Tables included in the group of HOT tables found in the Flight Operations Manual Appendix 2. This specific anti-icing fluid was added last year at the request of DHL to take advantage of the increased Holdover Times over the generic Type IV fluid charts. DHL and their deicing vendor IDS have assured us that Kilfrost Type IV fluid will again be used for anti-icing during this winter season in KCVG. The Kilfrost Type IV anti-icing fluid Holdover Table and the associated extended Holdover Times can be used at any airport if the deicing vendor can provide evidence (Deice/Anti-ice Report) that specific Type IV anti-icing fluid is being used.

As always, if there are any questions in regards to the contents of this letter, please contact the Chief Pilot’s office or Rex Gunning.

REVISION NOTICE

Attached is Revision No. **30** For the **Flight Operations Manual (Appendix 2)**

Revision Control Date: **10-10-14** By: **Chief Pilots Office**

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REMOVE PAGES	INSERT PAGES
Appendix 2, Record of Revision, Pages 1-2	Appendix 2, Record of Revision, Pages 1-2
Appendix 2, LEP/Contents, Pages 1-2	Appendix 2, LEP/Contents, Pages 1-2
Appendix 2, TOC, Pages i-ii	Appendix 2, TOC, Pages i-ii
Appendix 2, Pages 1-38	Appendix 2, Pages 1-50

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NOTE: IF YOU WISH TO RETAIN THE ABOVE REMOVE/INSERT INFORMATION TO FILE IN YOUR MANUAL, YOU MAY TEAR OFF AND RETURN ONLY THE BOTTOM PORTION OF THIS PAGE BELOW THE DOUBLE UNDERLINE.

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Flight Operations Manual, Appendix 2, Revision #30

Please print name, employee number, and date, and return this page to ABX Air Publications, Carolyn Click, Mail Code 2061-I, CC7@abxair.com.

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RECORD OF REVISIONS - APPENDIX 2

REV. NO.	DATE ENTERED	INITIALS
6	06/01/99	RSG
7	10/20/99	RSG
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APPENDIX 2: Deicing/Anti-Icing Plan

ABX Air, Inc.'s Aircraft Deicing/Anti-icing program is developed to provide satisfactory and specific means by which to fulfill the requirements of ensuring the "clean aircraft concept" is uniformly and judiciously exercised in all our flight operations. This program provides definition and necessary guidance to fulfill the requirements set forth in FAR Part 121.629 and Operational Specification A023 [GRH 4.2.1, 4.2.2]. (IOSA Audit Ground Handling Reference for Deicing/Anti-Icing.)

This program is organized into the following areas:

- Organizational Responsibilities
- Definitions
- Types of Frozen Contaminants
- Effects of Frost, Ice, Snow and Slush on Aircraft Performance
- Deice Operational Procedures
- Deicing/Anti-icing Personnel Qualifications
- Deice Communications
- Procedures Flow Chart and Text
- Holdover Charts

1. Organization Responsibilities

A. **Vice President of Flight Operations** - Responsible for developing the Deicing/Anti-icing Program to comply with FAR 121.629, ensuring company personnel are properly trained and company manuals provide guidance to personnel involved during operations in icing conditions.

B. **Director of Flight Operations** - Responsible for the overall deice/anti-ice operation.

C. **Manager of Flight Standards & Training** - Responsible for providing Deice/Anti-ice Training for all Flight Crewmembers and Dispatchers.

D. **Manager, Flight Operations Compliance** - Responsible for ensuring compliance of the Deice/Anti-ice Training for Flight Crews and Dispatchers is accomplished.

E. **Director of Line Maintenance** - Responsible for providing/arranging aircraft deicing for all stations with/without ABX Air Maintenance Deice Personnel.

F. **Deice Operations Manager** - Responsible for overseeing ABX deicing operations. Obtains Contract Deicing Vendors, where required. Recommends distribution of ABX Air Deicing/Anti-Icing Training. Reports to Director of Line Maintenance.

G. **Deicing Training Designee** - Responsible for Deice Personnel training and records. Reports to Director of Line Maintenance.

H. **Dispatch Shift Supervisor** - Responsible for reviewing weather conditions at outstations, and alerting appropriate personnel when conditions are conducive to icing.

I. **Pilot-in-Command** - Responsible for safety of the flight, crew, cargo, and aircraft. In addition, PIC is responsible for:

(1) Ensuring that the preflight inspection **(Preflight External Icing Check)** of the aircraft's critical surfaces has been accomplished.

(2) Insuring that the aircraft's critical surfaces are free from adhering frost, snow, ice, or any adhering frozen contamination. (Crew Deice Report)

(3) Overseeing the deicing/anti-icing process at stations without ABX Air Qualified Deice Personnel, including determining the type, kind, and mixture of the deicing fluid and when the anti-ice application was started.

(4) Ensuring that a **Pretakeoff Check** is accomplished by a Flight Crewmember or, if necessary, Qualified Deice Personnel (remote operations or tactile inspections) after the deicing/anti-icing process.

(5) Ensuring that a **Pretakeoff Contamination Check** is accomplished by a Flight Crewmember or, if necessary, by Qualified Deice Personnel (remote operations or tactile inspections) if the holdover times has expired.

Note: **Pretakeoff and Pretakeoff Contamination Checks are normally accomplished by the Flight Crew.**

2. Definitions

A. Definitions

(1) **ADF**

Aircraft **D**eicing **F**luid

(2) **Aerodynamically Quiet Areas**

Where there is little or no airflow to cause fluid shear to take place, deicing fluid remains on the aircraft in what are called aerodynamically quiet areas. These areas are generally wing roots flap wells, balance bays, rear spar areas or crevices.

(3) **Anti-icing**

A precautionary procedure by which the application of anti-icing fluids provides protection against the formation of frost, ice, snow and/or slush on clean surfaces of the aircraft for a period of time (holdover time). Anti-Icing fluids are most often Type I, Type II, Type III, or Type IV.

(4) **ASOS**

Automated Surface Observing System (ASOS) detects significant changes, disseminating hourly and special observations via the networks. Additionally, ASOS routinely and automatically provides computer-generated voice observations directly to aircraft in the vicinity of airports, using FAA ground-to-air radio. These messages are also available via a telephone dial-in port. ASOS observes, formats, archives and transmits observations automatically. ASOS transmits a special report when conditions exceed preselected weather element thresholds.

B. Crew Deice Report

A verbal or written report by Deicing Personnel to the operating Flight Crew of the type, kind, mixture of fluid/water, time the anti-ice application began and that the aircraft's critical surfaces are free of frozen contaminants. (i.e. "Type IV, 100%, Anti-ice time 03:27, Aircraft is clean").

C. Critical Surfaces

Those surfaces on the aircraft designated to be free of adhering snow, ice, frost or other frozen contamination prior to initiating takeoff.

D. Deice Pad

Deicing pad is a central deice facility that the aircraft will taxi to for deice/anti-ice. Typically the used deice fluid is collected and treated or recycled to continue to improve storm water runoff from the airport.

E. Deicing

A procedure in which frost, ice or snow is removed from the aircraft to ensure clean aircraft surfaces for the purpose of flight and to comply with the "clean aircraft concept". In general, this process uses hot fluid such as Type I deicing fluid.

F. ERD (Engine Running Deice)

Deicing/anti-icing an aircraft with the engines running.

G. FADS Forced Air Deicing System

A high speed airstream that will blow off dry snow. FADS also can have type 1 deicing injected into the airstream.

H. FPD

Freeze Point Depressent Deice Fluids.

I. Holdover Charts

(1) Charts that can be developed by the carrier for different weather conditions for determining holdover times.

(2) The charts developed by the carrier cannot be less restrictive than the SAE developed charts the FAA has adopted.

J. HOT/Holdover Times

(1) Estimated time that the application of anti-icing fluid can reasonably be expected to prevent the reformation of frost, ice and the accumulation of snow on the treated surface of an aircraft.

(2) Holdover times begin when the application of anti-icing fluid begins and expires when the time shown on holdover chart has elapsed.

K. (LOUT) Lowest Operational Use Temperature

Lowest Operational Use Temperature

L. Mechanical Method

The removal of snow and ice from an aircraft using equipment such as a snowbroom, squeegee, rope or other approved economical method.

M. (OAT) Outside Air Temperature

Ambient outside temperature commonly measured in fahrenheit or celsius.

N. Post Deicing Check

An inspection normally performed by Qualified Deicing Personnel after the deicing process to determine that the aircraft is free of frozen contaminants prior to beginning the anti-icing application.

O. Pre-Treating

The removal of snow and ice from an aircraft prior to departure usually by the application of hot deicing fluid as required followed by the application of anti-icing fluid in anticipation of a cold weather icing event.

P. Pretakeoff Check

(1) A visual inspection by the Flight Crew or when necessary, Qualified Deicing Personnel (remote operations or tactile inspections), of the representative surfaces of an aircraft after the application of deicing/anti-icing fluids to ensure that the representative surfaces are free from frozen contamination.

(2) Performed before the Holdover Time has expired to ensure the clean aircraft concept and as near as practical prior to taking the active runway.

Q. Pretakeoff Contamination Check

A visual inspection of the representive surfaces by Flight Crew or when necessary, Qualified Deicing Personnel (remote operations or tactile inspections), after the holdover time has expired and prior to taking the active runway to determine if the critical surfaces of the aircraft are free from frozen contamination. This check must be completed within 5 minutes prior to the beginning of takeoff or another Pretakeoff Contamination Check must be accomplished.

A Pretakeoff Contamination Check must be accomplished prior to takeoff during heavy snow conditions using only Type IV Anti-icing Fluid in 100% form.

Note: Pretakeoff and Pretakeoff Contamination Checks are normally accomplished by the Flight Crew.

R. Preflight External Aircraft Icing Check

An inspection during the external walkaround by the Flight Crew to determine if the aircraft's critical surfaces are free from any adhering frozen contamination and if deicing/anti-icing is required.

S. Qualified Deicing Personnel (Person)

A qualified person or personnel may be an ABX Air Ground or Maintenance Representative or a Contract Deice Provider who has satisfactorily completed ABX Air Deice Training for the purpose of unsupervised deicing/anti-icing.

T. Refractometer

Refractometer is an instrument use to measure the freeze point or Refractive Index of Deicing or Anti-icing fluids.

U. Remote Deice

Deicing aircraft out of gate, taxiing or tow an aircraft to a central deice pad or end of runway scenario.

V. Representative Surfaces

A surface which may be checked by the Flight Crew or when necessary Qualified Deicing Personnel (remote operations or tactile inspections) for frozen contamination during Pretakeoff and Pretakeoff Contamination Checks and is representative of the aircraft's critical surfaces.

W. SAE

SAE International is a leading organization for Technical Standards for the aerospace industry. Aerospace SAE Standards are ISO equivalent.

X. Shear

Thickened anti-ice fluids will shear or breakdown when force is applied such as the movement of air over the aircraft's surfaces.

Y. Tactile Inspection

A hands on inspection by Qualified Deicing Personnel or by Flight Crew by actually touching the treated surface to confirm the surface is free of frozen contaminants.

Z. Type I Fluids

Type I Fluid is a glycol-based fluid used for aircraft deicing and anti-icing. Type I fluid is heated to a minimum of 140°F/60°C to remove frozen contamination from the aircraft surfaces. Type I can be used for anti-ice on events such as Frost.

Note: Do not spray hot Type I fluid on the windshield of the aircraft. The hot fluid could crack or craze the windshield.

AA. **Type II Fluid**

Type II fluids are “pseudoplastic”, which means they contain a polymeric thickening agent to prevent their immediate flow off aircraft surfaces. Typically the fluid film will remain in place until the aircraft attains 100 knots or so (almost 200 km/h), at which point the viscosity breaks down due to shear stress. The high speeds required for viscosity breakdown means that this type of fluid is useful only for larger aircraft. The use of type II fluids is diminishing in favour of type IV. Type II fluids are generally light yellow in color.

AB. **Type III Fluid**

Type III fluids can be thought of as a compromise between type I and type II fluids. They are intended for use on slower aircraft, with a rotation speed of less than 100 knots. Type III fluids are gaining acceptance in the regional and business aviation markets. Type III fluids are generally light yellow in color.

AC. **Type IV Fluid**

Type IV fluids meet the same AMS standards as type II fluids, but they provide a longer holdover time. They are typically dyed green to aid in the application of a consistent layer of fluid.

3. Icing Conditions

A. Airframe icing conditions are considered to be present when the aircraft’s skin temperature is below freezing and high humidity or visible moisture is present.

B. Engine icing conditions are considered to be present when the temperature is less than 10°C (50°F) or below for the B-767 and either:

(1) Temperature/ dew point spread is less than 3° C (5°F)

or

(2) Visible moisture is present -(falling precipitation)

B-767 (visibility less than 1 mile)

B-767 (RVR less than 5000 ft.)

or

(3) Wet Ramps, Taxiways, and/or Runways

4. Types of Frozen Contaminants

A. Dry Snow

(1) Snow with limited water content that will fly into a cloud and dissipate rapidly when kicked.

(2) Outside air temperatures is usually below -2° C, but dry snow will become “wet” when exposed to bright sun.

B. Wet Snow

(1) Snow with enough water content that it will pack when stamped with foot, but does not splash.

(2) If snow splashes when stamped with foot, consider it slush.

C. Snow Grains

Precipitation of very small white and opaque grains of ice. These grains are fairly flat or elongated; their diameter is less than 1 mm (0.04 in.). When the grains hit hard ground, they do not bounce or shatter.

D. Ice Pellets & Small Hail

Precipitation of transparent or translucent pellets of ice, which are round or irregular, rarely conical, and which have a diameter of 0.2 inch (5 mm), or less.

Guidance on Hail and Small Hail. The meteorological conditions “hail” and “small hail” are not equivalent. No holdover times exist for either of these conditions; however, it has been determined that small hail is meteorologically equivalent to moderate ice pellets and therefore moderate ice pellet allowance times can be used in small hail conditions.

E. Slush

(1) Partially melted snow with high water content.

(2) Will splash when stamped with foot or if a vehicle runs though it.

F. Frost

(1) Forms near the surface in clear stable air with light winds with temperatures less than 0° C.

(2) Does not change the basic aerodynamic shape of the airfoil, but causes drag and up to a 5 to 10% increase in stall speed.

G. Freezing Rain/Drizzle

(1) Supercooled water droplets that freeze upon impact with aircraft surfaces.

(2) Can form rapidly, forming clear ice that increases drag and decreases lift.

H. Freezing Fog

Supercooled water vapor that will freeze to aircraft surfaces as the airfoil moves through the air and disturbs the water vapor.

I. Rain On A Cold Soaked Wing

(1) Ice may form on wing due to supercooled fuel from aircraft operations at high altitudes.

(2) Ice can form at temperatures as high as 21° C in high humidity.

J. Unknown Precipitation.

Precipitation type that is reported if the automated station (ASOS) detects the occurrence of light precipitation but the precipitation discriminator cannot recognize the type.

5. Effects of Frost, Ice, Snow and Slush on Aircraft Performance

Icing contamination in the form of frost, snow, or ice on the critical surfaces can have disastrous effects on control of the aircraft. These effects include:

A. Increased drag and weight.

B. Rapid pitch up or wing roll off on rotation.

C. Loss of lift.

D. Stall at lower than normal angle of attack.

E. Wing buffet or stall before stall warning activation.

F. Decreased effectiveness of flight controls.

G. Engine foreign object damage (FOD).

H. Ram air intakes.

I. Instrument pickup points.

6. Deice Operational Procedures

The Dispatch Supervisor will evaluate weather conditions, sequences, and forecasts at all stations of operation to determine the possible need for deicing.

A. Icing Conditions

(1) Whenever conditions exist which may be conducive to aircraft icing during ground operation, the aircraft must be prepared for flight in accordance with the FAA Approved ABX Air, Inc. Deicing Plan. (Operational Specification A023)

(2) Should an aircraft be contaminated with snow, ice or frost and icing conditions no longer exist, the aircraft may be deiced, in

accordance with the guidelines of this deice program, without requiring the application of holdover times. The aircraft must, however, receive a Post Deicing Check to ensure the "clean aircraft concept" is adhered to.

B. Determine the Need For Deicing/Anti-Icing (Preflight External Icing Check)

(1) During winter operations when snow, ice and/or freezing precipitation is present, allow extra time to complete a more extensive walk-around inspection at originating points and intermediate stops. Call any need for deicing to the attention of deicing personnel as soon as possible as to avoid delay.

(2) During a cold weather walk around inspection, check the general areas of the aircraft. Flight crews should reference the B767 AOM for Cold Weather Operation Specifics.
   (a) Inspect airplane for accumulations of snow, frost, ice on wings, tail and fuselage, and control surfaces.
   (b) Operate the flight control surfaces, tabs and flaps, where practicable.
   (c) Check landing gear struts, actuating cylinders, locking mechanism, wheels and brakes, gear cover doors, etc. for freedom from ice, snow, slush and mud.
   (d) Check landing gear micro-switches for freedom from ice.
   (e) Check nose wheel rims for ice accumulation which could cause imbalance and nosewheel shimmy on takeoff.
   (f) Check tires and struts for proper inflation and insure that the tires are not frozen to the ground or to the chocks.
   (g) If ice or snow accumulations are found in the wheel well and/ or landing gear areas, flight crews should contact maintenance for deicing support.

Note: After landing in icing conditions, leave the flaps extended for inspection of the flap hinges, actuators, and tracks as applicable.

(3) Frost must be removed from all critical surfaces, except for the fuselage and up to 1/8" frost on the lower wing surfaces.

(4) A thin layer (up to 1/8") of underwing frost generally does not influence aircraft performance and will not require removal.

(5) In very cold conditions (generally below -10 to -15° C (14 to 5° F) or colder) dry snow can fall onto cold aircraft wings. Under these conditions, dry snow will swirl as it blows across the wings, making it evident the snow is not adhering. But, if snow has accumulated on the surface of the wings, it has to be removed before takeoff. It cannot be assumed that accumulations of snow will blow off during takeoff.

(6) Except as noted, all ice, frost, or snow accumulations must be removed from all lifting and control surfaces.

(7) Check for ice, snowy or slush accumulations on:

(a) slat and flap tracks, fairings and channels.
(b) blocked pitot tubes and static ports.
(c) landing gear doors and struts, wheel wells, and Ground/Flight mechanisms.
(d) wheel rims (ice or slush accumulations may cause out-of-balance condition).
(e) engine inlets and exhausts.

Note: Any snow accumulations should be removed from the aircraft nose as the snow may blow onto the windshield during takeoff, causing loss of visibility.

(8) Inspect all control surfaces for ice and snow accumulations that could interfere with control surface movement and actuate all control surfaces and trim tabs to full throw.

(9) After refueling, recheck the upper wing surfaces as loading warm fuel into a wing with snow accumulations could melt the snow which would then refreeze as a clear sheet of ice.

(10) If the fuel temperature is below freezing when it is pumped into a relatively warm, wet wing, it can cause the moisture to freeze and may easily be mistaken for liquid droplets.

C. Aircraft Critical Surfaces

In general, the following items must be free from snow, ice, frost, or frozen contamination and will require a close inspection:

(1) Wing leading edges and upper surfaces

Note: ABX Air aircraft may be released for flight with up to 1/8" of frost on the wing lower surfaces caused by super cooled fuel in the wings.

(2) Ailerons, including trim and control tabs
(3) Horizontal and vertical stabilizers
(4) Elevators, including trim and control tabs
(5) Rudder, including trim and control tabs
(6) Pitot tubes and static ports
(7) Engine inlets
(8) Flaps and their associated hinges and tracks
(9) Main and nose gear up/down lock mechanisms

D. 767 Specific Areas

In addition to the critical surfaces, inspect the following aircraft specific items to ensure that they are free from any adhering frozen contamination:

(1) Wing leading edge slats

(2) Spoiler panels
(3) Angle of attach vanes
(4) Fuel tank vent
(5) Wheel well and landing gear areas

E. Deice Operations With ABX Air Deice Personnel

(1) If deicing will be required at stations with ABX Air Deice Personnel or Qualified Deice Individuals:

The Dispatch Shift Supervisor will notify Maintenance Control, who will then contact the ABX Air Deice Representative.

(2) Upon receiving a “Deice Alert”, the ABX Air Qualified Deice Personnel are responsible to:

(a) Ensure the company deice equipment is prepared and serviced.

(b) Ensure that the mixture of anti-icing fluid in the company equipment is checked for protection to at least 10°C degrees below ambient temperature as reported by ATIS or local weather observations.

(c) Coordinate deicing needs with the Captain.

(d) Review any special provisions applicable to that specific airport.

(e) Coordinate the anticipated needs to the deice vendor if ABX Air deice equipment is not available. This is to include ensuring remote deice vendors are kept informed as to departure times, especially when changes to the scheduled departure time occur.

(f) Supervise deice vendor procedures when an ABX Air Deice/ Anti-ice approved and trained vendor is unavailable.

(g) Contact Maintenance Control if any deice equipment problems or environmental changes are encountered which could affect the deicing requirements.

F. Deice Operations Without ABX Air Qualified Deice Provider

(1) At stations without an ABX Air Qualified Deice Provider, the Captain or otherwise ABX Air Qualified Deicing/Anti-Icing Personnel is responsible to coordinate the deicing/anti-icing needs with the company selected local deice provider upon arrival at that Station. The Captain or ABX Air Qualified Deice/Anti-Ice Personnel will coordinate and oversee the deice/anti-ice process and ensure any special requirements are met for that airport. He will cover the following with the Deice Personnel:

(a) Review critical surfaces with the deice provider.

(b) Review required inspections (Post Deice Check).

(c) Review the required “Crew Deice Report” with the deice provider.

(d) Review tactile check requirement (as applicable).

(2) The Captain will also be responsible for:

(a) Determining the type, kind and mixture of the fluid.

(b) Supervising the deicing/anti-icing application.

(c) Ensuring a Post Deicing Check is accomplished to determine the aircraft surfaces are “clean”. (Crew Deice Report)

(d) Noting the time the anti-ice application began. (Crew Deice Report)

G. Deicing/Anti-Icing Personnel Qualifications

Deicing/anti-icing may be accomplished by the following personnel:

(1) ABX Air employees who have successfully completed the initial and continued qualification training as established in the ABX Air FAA Approved Deicing/Anti-icing Training Program.

(2) The employee of a Contract Deicing Vendor who has successfully completed the initial and continued qualification training as established in the ABX Air FAA Approved Deicing/Anti-icing Training Program.

(3) The employee of a Deicing Vendor who has not received the ABX Air FAA approved deicing/anti-icing training, but has received the vendor’s training on deicing/anti-icing, if they are directly supervised by an ABX Air employee who has successfully completed the initial and continued qualification training as established in the ABX Air FAA Approved Deicing/Anti-Icing Training Program.

Contract Vendor Designated Trainers (DT) who are employed by a 121 airline with an FAA approved Deice/Anti-ice program are requested to complete the ABX Air, Inc. online differences deice training material. This material is focused on ABX Air’s Boeing 767 aircraft.

H. Accomplish Deicing/Anti-icing Procedure

Deicing/Anti-icing is a two step process that consist of:

(1) Step 1. Deicing with a fluid mixture of water/glycol heated to at least 60°C (140°F) at the applying nozzle.

(2) Step 2. An anti-ice application of either heated Type I or Type III with a freeze point of at least 10°C below the OAT, or non heated Type II or IV.

I. Satisfactory Post Deicing Check

(1) **Post Deicing Check** is normally accomplished by the Qualified Deice Personnel performing the deicing.

(2) It includes the inspection of all the critical surfaces of the aircraft and is the basis from which the Flight Crew is assured that all frozen contaminants are removed from the aircraft prior to the beginning of the anti-ice application.

(3) The satisfactory **Post Deice Check** is communicated to the Flight Crew as a part of the Crew Deice Report, i.e. “Aircraft is clean”, which signifies all critical surfaces are free of frozen contaminants. This is not a Pretakeoff Check.

J. Crew Deice Report

A verbal or written report by Deicing Personnel to the operating Flight Crew of the type, kind, mixture of fluid/water, time the anti-ice application began and that the aircraft’s critical surfaces are free of frozen contaminants.

K. Holdover Time Begins

Holdover time begins at the time the application of anti-icing fluid is initiated (end of deicing, beginning of anti-icing).

(1) Holdover times will be determined from the approved holdover time chart for the appropriate fluid type and the prevailing meteorlogical conditions.

(2) Holdover times are to be used as guidance. When conditions are changing or variable, appropriate adjustments may be made; however, adjustments cannot be less restrictive than the times on the Holdover Charts.

L. Pre-Takeoff Check

(1) Any time deicing/anti-icing fluids have been applied in conditions conducive to aircraft icing, a Pretakeoff Check must be accomplished to ensure the representative surfaces are free of frozen contaminants. This check may be accomplished by:

(a) A Qualified Flight Crewmember

(b) Qualified Deice Personnel (remote operations or Tactile Inspections)

(2) This Pretakeoff Check may be accomplished any time after the completion of anti-icing and prior to the expiration of the applicable holdover time to ensure the clean aircraft concept. It will normally be accomplished by the Flight Crew as near the beginning of takeoff as practical. When a Pretakeoff or Pretakeoff Contamination Check is satisfactorily completed, the Deice block on the M-1A Logbook will be checked.

(3) B-767 Aircraft

Flight crew will open the #2 cockpit window(s) after parking brake is set and check a sufficient portion of the wing leading edges and upper surfaces to be representative of the critical surfaces.

CAUTION: DO NOT UTILIZE THE MAIN ENTRY DOOR ON THE B-767.

Note: Use wing leading edge flood lights and nacelle lights at night to illuminate the representative surfaces.

Upon satisfactory completion of the Pretakeoff or Pretakeoff Contamination Check and prior to the beginning of takeoff, the “Deice Block” of the M-1A aircraft log must be checked to signify the Pretakeoff or Pretakeoff Contamination Check was satisfactorily completed.

The anti-iced surfaces should retain their glossy appearance and there should be no evidence of snow or ice accumulation for a satisfactory check.

A satisfactory completion of the Pretakeoff Check is the basis to proceed with the takeoff within the limitations of the applicable holdover time.

M. Pre-Takeoff Contamination Check

If the takeoff has not been initiated within the limits of the applicable holdover time, takeoff may be initiated if a Pretakeoff Contamination Check is successfully completed within 5 minutes prior of the initiation of takeoff. The Pretakeoff Contamination Check is identical to the Pretakeoff Check except it is conducted after the expiration of the applicable holdover time AND within 5 minutes of the beginning of takeoff.

CAUTION: THE HOLDOVER TIME FOR ICE PELLETS CANNOT BE EXTENDED BY A PRETAKEOFF CONTAMINATION CHECK.

An unsatisfactory Pretakeoff Check or Pretakeoff Contamination Check requires the aircraft be redeiced/anti-iced prior to initiating takeoff. A new holdover time must be established and a satisfactory Pretakeoff/

Pretakeoff Contamination Check, as applicable, must be accomplished prior to initiating the takeoff.

7. Deice Communications

A. Crew Deice Report

The Crew Deice Report can be given verbally, by radio, intercom, or by a piece of paper, but it must include:

(1) The type and kind of fluid.

(2) The mixture of the fluid (except Type I).

(3) The time the anti-ice application began.

(4) A statement that the aircraft is clean. (Post Deicing Check)

B. Remote Deice Operation

(1) Communication must be established prior to entering a remote deice operation or deice pad.

(2) A Crew Deice Report must be given upon completion of Deicing/ Anti-icing at the remote location.

(3) After deicing/anti-icing the aircraft must not be moved until clearance from Deice Control is received.

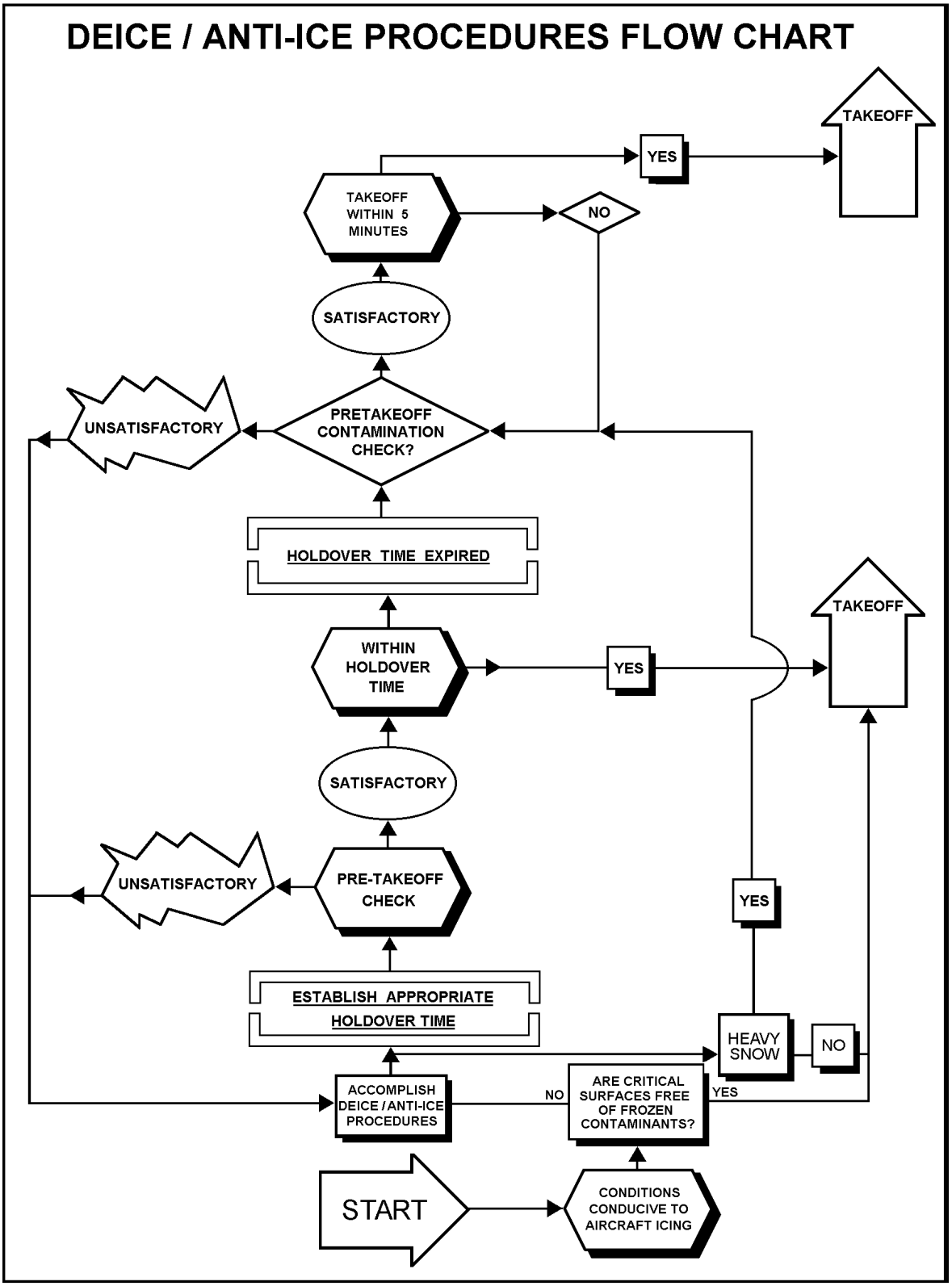
DEICE / ANTI-ICE PROCEDURES FLOW CHART
TAKEOFF
YES
TAKEOFF WITHIN 5 MINUTES
NO
SATISFACTORY
UNSATISFACTORY
PRETAKEOFF CONTAMINATION CHECK?
HOLDOVER TIME EXPIRED
TAKEOFF
WITHIN HOLDOVER TIME
YES
SATISFACTORY
UNSATISFACTORY
PRE-TAKEOFF CHECK
YES
ESTABLISH APPROPRIATE HOLDOVER TIME
HEAVY SNOW
NO
ACCOMPLISH DEICE / ANTI-ICE PROCEDURES
NO
ARE CRITICAL SURFACES FREE OF FROZEN CONTAMINANTS?
YES
START
CONDITIONS CONDUCIVE TO AIRCRAFT ICING
FLOWICE/09-20-11

Figure 2-1

8. Deice/Anti-ice Procedures Flow Chart (See Figure 2-1 on page 16.)

A. The Procedures flow chart is a logical flow for airframe deicing procedures.

B. Conditions Conducive To Aircraft Icing

Airframe icing conditions are considered to be present when the aircraft's skin temperature is below freezing and high humidity or visible moisture is present.

C. Are Critical Surfaces Free Of Frozen Contaminants - Yes

(1) The Pilot-in-Command will base the decision to deice on the actual aircraft condition determined during the exterior preflight.

(2) If the aircraft is found to be free of any frozen contamination during the **Preflight, External Aircraft Icing Check,** the aircraft may depart without deicing.

D. Are Critical Surfaces Free Of Frozen Contaminants - No

If the aircraft is found to be contaminated with any frozen contamination, the aircraft must be deice/anti-iced.

Note: **Fuselage frost and up to 1/8" of underwing frost does not need to be removed.**

E. Establish Appropriate Holdover Time

The holdover time starts when the anti-ice application begins.

CAUTION: **NO HOLDOVER TIME GUIDELINES EXIST FOR SNOW PELLETS, HEAVY SNOW OR MODERATE OR HEAVY FREEZING RAIN AND HAIL. TAKEOFFS ARE NOT AUTHORIZED IN MODERATE OR HEAVY FREEZING RAIN OR SNOW PELLETS. THE AIRCRAFT MUST BE ANTI-ICED WITH UNDILUTE TYPE IV FLUID FOR HEAVY SNOW CONDITIONS. PRIOR TO TAKEOFF IN HEAVY SNOW, ACCOMPLISH A PRETAKEOFF CONTAMINATION CHECK(S).**

F. Pretakeoff Check - Satisfactory

(1) The **Pretakeoff Check** will be performed after the deicing/anti-icing procedure, but before the holdover time expires.

(2) The **Pretakeoff Check** is normally performed by the Flight Crew from the cockpit windows or, if necessary, can be performed by a Qualified Deice Personnel during remote operations or Tactile Inspections.

(3) For the Pretakeoff Check the Flight Crew will inspect the **representative surfaces** of the aircraft to ensure that the anti-ice fluid is still effective.

(4) The **representative surfaces** that may be viewed will include the wing leading edges and upper surfaces.

(5) Use wing leading edge flood lights and nacelle lights at night to illuminate the **representative surfaces**.

(6) Anti-iced surfaces should retain their glossy appearance with no accumulation of snow or ice apparent.

G. Within Holdover Time - Yes - Takeoff

Provided that the holdover time has not expired, the aircraft may depart without any further inspections.

H. Pretakeoff Check - Unsatisfactory

If the aircraft is found to have any frozen contamination adhering to the aircraft, the aircraft must be deiced and anti-iced again.

I. Holdover Time Expired

If holdover time has expired, the Flight Crew must perform a **Pretakeoff Contamination Check** to ensure that the representative surfaces are free of any frozen contamination.

Note: **If the holdover time has expired, the aircraft does not necessarily need to be redeiced. The Pretakeoff Contamination Check will determine the need for additional deicing/anti-icing.**

CAUTION: **THE HOLDOVER TIME FOR ICE PELLETS CANNOT BE EXTENDED BY A PRETAKEOFF CONTAMINATION CHECK.**

J. Pretakeoff Contamination Check - Satisfactory

(1) The Flight Crew will inspect the **representative surfaces** of the aircraft to ensure that the anti-ice fluid is still effective.

(2) The **representative surfaces** that may be viewed will include the wing leading edges and upper surfaces.

(3) Use wing leading edge flood lights and nacelle lights at night to illuminate the **representative surfaces**.

(4) Anti-iced surfaces should retain their glossy appearance with no accumulation of snow or ice apparent.

K. Pretakeoff Contamination Check - Unsatisfactory

(1) If a **Pretakeoff Contamination Check** is unsatisfactory, the aircraft **must** be deiced/anti-iced again before the aircraft may takeoff.

(2) After subsequent deicing/anti-icing, a new holdover time must be established and a **Pretakeoff Check** must be accomplished before takeoff.

L. Takeoff Within 5 Minutes - Yes

If the **Pretakeoff Contamination Check** is satisfactory, the aircraft must depart within 5 minutes to avoid having to perform additional checks.

M. Takeoff Within 5 Minutes - No

If the aircraft does not takeoff within 5 minutes, another **Pretakeoff Contamination Check** must be accomplished.

Note: **With the exception of the holdover time for ice pellets, there is no limit to the number of Pretakeoff Contamination Checks that may be performed, as long as the Pretakeoff Contamination Checks are satisfactory (representative surfaces remain clear of any frozen contamination).**

Note: **Pretakeoff Contamination Checks must be performed for heavy snow conditions since there are no holdover times for those conditions.**

9. Snowfall Intensity - Visibility Table

Because the FAA Snow Intensity Table uses visibility to determine snowfall intensities and if the visibility is being reduced by snow along with other forms of obscuration such as fog, haze, smoke, and etc., the FAA Snow Intensity Table need not be used to estimate the snow fall intensity for holdover time determination. 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 ASOS may be used.

This table presents critical information on the variability of snowfall intensities as a function of prevailing visibilities. This table presents temperature correlation information, which more accurately relates wet snow and dry snow intensities to visibilities.

Holdover times for snow are based on the water content of the snow. **The Snowfall Intensity-Visibility Table is only to be used for determining snowfall intensity for the purpose of snow holdover times.** Take prevailing visibility, OAT and day or night conditions and convert it in the **Snowfall Intensity-Visibility Table** to determine the intensity of snowfall before entering the holdover chart for snow.

2014-2015 SNOWFALL INTENSITIES AS A FUNCTION OF PREVAILING VISIBILITY

Time of Day	Temp.		Visibility in Statute Miles (Meters)									
	Degrees Celsius	Degrees Fahrenheit	≥ 2 1/2 (≥ 4000)	2 (3200)	1 3/4 (2800)	1 1/2 (2400)	1 1/4 (2000)	1 (1600)	3/4 (1200)	1/2 (800)	≤ 1/4 (≤ 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

During snow conditions alone, the use of this Table 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.

Because the FAA Snow Intensity Table, like the FMH-1 Table, uses visibility to determine snowfall intensities, and if the visibility is being reduced by snow along with other forms of obscuration such as fog, haze, smoke, etc., the FAA Snow Intensity Table does not need to be used to estimate the snow fall intensity for HOT determination. 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 service observing system (ASOS), from the FMH-1 Table may be used.

Operations in Heavy Snow

1. Tactile and Visual Checks of Aircraft. No holdover times (HOT) exist for heavy snow conditions in the current HOT tables. Review of existing data from past testing has indicated takeoffs may be safely conducted with proper tactile and/or visual checks, as appropriate for the aircraft, and a determination that the fluid has not failed. A tactile and/or visual check in heavy snow conditions must be accomplished in a manner that provides an assessment that can be accurately accomplished. Anti-icing fluids dissolve the snow and absorb the resulting moisture into the fluid. When the fluid begins to fail it starts to change in appearance (e.g., less glossy and more opaque) and the snow starts to accumulate on and in the fluid. At this stage, the fluid has failed and takeoff is not authorized.
2. Takeoff in Heavy Snow Conditions. ABX Air aircraft will be allowed to takeoff in heavy snow conditions subject to the following restrictions:
   A. The aircraft must be anti-iced with undiluted Type IV fluid.
   B. The aircraft critical surfaces must be free of contaminants, or the aircraft must be properly deiced before the application of the anti-icing fluid.

C. When appropriate, Flight Crewmember or, if necessary, qualified Deice Personnel must accomplish an approved tactile and/or visual check of the aircraft critical surfaces within 5 minutes of takeoff.

D. If this check is accomplished visually from within the aircraft, the view must be such that it is not obscured by de/anti-icing fluid, dirt, or fogging. If the critical surfaces cannot be seen due to snowfall, distance from the viewing position, or inadequate lighting, or for any other reason, the check must be a visual or tactile check conducted from outside the aircraft.

E. If a definitive fluid failure determination cannot be made using the checks prescribed, takeoff is not authorized. The aircraft must be completely deiced, and if precipitation is still present, anti-iced again before a subsequent takeoff.

NOTE: Current aircraft certification standards only require testing of flight instrument sensing devices and engine anti-icing systems in moderate snow levels. Ground operations in heavy snow conditions may exceed the capabilities or limitations of these system and devices to adequately provide anti-icing.

10. General

A. Various deicing charts/tables are provided to allow for quick interpretation of deicing information.

B. The following charts/tables will be utilized for applying the correct information during icing conditions.

(1) Snowfall Intensity - Visibility Table
(2) Holdover Charts Type I Fluid
(3) Holdover Charts Type II Fluid
(4) Holdover Charts Type III Fluid
(5) Holdover Charts Type IV Fluid
(6) Ice Pellet and Small Hail Allowance Times

C. Early Fluid Failure on Extended Slats and Flaps

Research has determined that fluid degradation is accelerated by the steeper angles of the flaps/slats in the takeoff configuration. The degree of potential degradation is significantly affected by the specific aircraft design. For the winter of 2014-2015, holdover time and allowance time tables have been published which include 90% adjusted holdover/ allowance times. The 90% adjusted times were obtained by multiplying the standard holdover/allowance times by 90% and rounding the result to the nearest minute.

NOTE: Times of 5 minutes and less do not change as the 10% reduction is less than required to reduce the time by one minute. Additionally, the 90% adjustment was applied to the uncapped snow holdover times. In some cases, this leads to adjusted snow holdover times which are longer than 90% of the standard (capped) holdover time.

(1) Included with the standard Holdover Charts are additional 90% adjusted tables to provide holdover/allowance times that must be used when flaps and slats are deployed prior to de/anti-icing. Standard holdover/allowance times can be used if flaps and slats are deployed as close to departure as safety allows.

11. Holdover Chart Usage

When deicing/anti-icing fluids have been applied to the critical surfaces of an aircraft and icing conditions exist, the limitations of the applicable holdover time charts must be applied.

The holdover time is time, obtained from the approved holdover time chart, that one may reasonably expect the anti-icing fluid to provide protection from the reforming of frozen contamination on the critical surfaces of the aircraft. The holdover time begins when the application of the anti-icing fluid begins and expires when the time obtained from the appropriate holdover chart has passed.

Holdover times are not published for snow pellets, heavy snow, moderate or heavy freezing rain or hail.

It is the responsibility of the Captain to obtain the beginning time at which the application of anti-icing fluid was applied to the critical surfaces, the fluid kind, type, and the mixture ratio. With this information, the appropriate holdover chart will be used to determine the applicable holdover time.

Care must be taken to ensure the proper holdover chart is used in determining the applicable time.

A. Holdover Charts Type I Fluid

All Type I holdover time charts are based on a mixture which will provide a freezing point buffer of 10°C. To ensure the proper protection is available, the qualified deice personnel are responsible for checking and insuring the mixture of the Type I Fluid being applied is adequate for the OAT.

Note: Mixtures greater than the minimum percentage of glycol are acceptable and provide greater buffers.

Mixtures of either ethylene or propylene glycol greater than 60/40 should not be used, as their freezing point becomes “non-defined” and the mixture will form into a glassy substance before typical crystalline formations occur at very cold temperatures.

B. Holdover Charts Type II, Type III and Type IV Fluids

Type II, Type III and Type IV holdover charts are similar to Type I charts, but are separated by mixture.

There are three different mixtures on Type II, Type III and Type IV fluid charts.

(1) 100% mixture

(2) 75% mixture

(3) 50% mixture

To use the chart, determine the mixture of the Type II, Type III or Type IV fluid in use, as well as the prevailing weather conditions and ambient temperatures.

12. Holdover Charts Type I Fluid

A. The Type I holdover charts are used to determine how long Type I deicing/anti-icing fluid can reasonably be expected to prevent the reformation of ice, snow, and frost on the aircraft's surface.

(1) These times are very conservative, and can be interpreted to be the minimum amount of time that the deice/anti-ice fluid will be effective.

(2) The holdover time begins when the anti-ice application begins.

B. The Type I holdover charts apply to both ethylene glycol and propylene glycol solution. The qualified deice person is responsible for determining that the mixture of Type I Fluid will be adequate for the OAT.

C. To use the chart, determine the prevailing conditions and the ambient temperature.

This information can be obtained from the ATIS frequency in the weather sequences of the departure airport.

D. The chart is based on prevailing conditions, and will also list ambient temperatures and either temperature/dew point spread, rates of snow fall, classification of precipitation, or visibility.

E. For example, to find the holdover time for Type I fluid with freezing fog, use the FREEZING FOG column on the holdover chart.

(1) Determine the ambient temperature.

(2) The holdover time for freezing fog can now be referenced.

CAUTION: **HOLDOVER CHARTS/TABLES ARE FOR DEPARTURE PLANNING ONLY AND SHOULD BE USED IN CONJUNCTION WITH PRE-TAKEOFF CHECK PROCEDURES.**

CAUTION: **TYPE I DEICING FLUID MUST BE HEATED TO A MINIMUM OF 140° F BUT MUST NOT EXCEED 200° F BEFORE DEICE/ANTI-ICE CAN BEGIN.**

CAUTION: **DO NOT USE TYPE I FLUID HOLDOVER TIME GUIDELINES WHEN USING THE FORCED AIR AND GLYCOL MODE WHICH IS FOR DEICING ONLY. TO USE THE TYPE I HOLDOVER TIMES, THE AIRCRAFT MUST BE ANTI-ICED USING THE CONVENTIONAL TRUCK AND FLUID MUST BE HOT AND USED IN SUFFICIENT QUANTITY TO HEAT THE WINGS.**

List of Fluids Tested for Anti-Icing Performance and Aerodynamic Acceptance (2014-2015)
Type I Deicing/Anti-Icing Fluids[1]

Company Name	Fluid Name
ABAX Industries	DE-950
ABAX Industries	DE-950 Colorless
AllClear Systems LLC	Lift-Off P-88
AllClear Systems LLC	Lift-Off E-188
Arcton Ltd.	Arctica DG Ready to Use
Arcton Ltd.	Arctica DG 91 Concentrate
Aviation Shaanxi High-Tech Physical Co. Ltd.	Cleanwing I
Aviation Xi'an High-Tech	KHF-1
Baltic Ground Services	DEFROSOL ADF
Beijing Phoenix Air Traffic Product Development and Trading Co.	CBSX-1
Beijing Wangye Aviation Chem. Prod. Co.	KLA-1
Beijing Yadilite Aviation Chemical Product Co. Ltd	YD-101 Type I
CHEMCO Inc.	CHEMR EG I
CHEMCO Inc.	CHEMR REG I
Clariant GmbH	EcoFlo Concentrate
Clariant GmbH	EcoFlo 2 Concentrate
Clariant GmbH	Octaflo EF Concentrate
Clariant GmbH	Octaflo EF 80
Clariant GmbH	Octaflo EG Concentrate
Clariant GmbH	Octaflo Lyod
Clariant GmbH	Safewing MP I 1938 ECO (80)
Clariant GmbH	Safewing MP I 1938 ECO (80) Premix 55% i.g. ready-to-use
Clariant GmbH	Safewing MP I 1938 ECO
Clariant GmbH	Safewing EG I 1996
Clariant GmbH	Safewing EG I 1996 (88)
Clariant GmbH	Safewing MP I ECO PLUS (80)
Cryotech Deicing Technology	Polar Plus® Concentrate
Cryotech Deicing Technology	Polar Plus® LT
Cryotech Deicing Technology	Polar Plus® (80)
Deicing Solutions LLC	Safetemp® ES Plus
Dow Chemical Company	UCAR™ ADF Concentrate
Dow Chemical Company	UCAR™ ADF XL-54
Dow Chemical Company	UCAR™ PG ADF Concentrate
Dow Chemical Company	UCAR™ PG ADF Dilute 55/45
Heilongjiang Hangjie Aero-chemical Technology Co. Ltd. *(formerly Harbin Aeroclean Aviation Tech Co. Ltd.)*	HJF-1
HOC Industries	SafeTemp® ES Plus
Hokkaido NOF Corporation	Fever Snow AG
Inland Technologies	Duragly-E Concentrate
Inland Technologies	Duragly-P Concentrate
Kilfrost	Kilfrost DF PLUS
Kilfrost	Kilfrost DF PLUS (80)
Kilfrost	Kilfrost DF PLUS (88)
Kilfrost	Kilfrost DF^{sustain}™
LNT Solutions	E188
LNT Solutions	P180
LNT Solutions	P188

Company Name	Fluid Name
Newave Aerochemical Co. Ltd.	FCY-1A
Newave Aerochemical Co. Ltd.	FCY-1Bio^{+}
Shanxi Cleanway Aviation Chemical Co., Ltd.	Cleansurface I
Shanxi Cleanway Aviation Chemical Co., Ltd.	Cleansurface I-BIO

NOTE 1: This table lists fluids that have been tested with respect to anti-icing performance requirements according to SAE AMS 1424, Paragraph 3.5.2 and aerodynamic performance according to SAE AMS 1424, Paragraph 3.5.3 only by the Anti-Icing Materials International Laboratory at the University of Quebec at Chicoutimi, Canada, web site: www.uqac.ca/amil. The end user is responsible for confirming that other SAE AMS 1424 technical requirement tests, such as materials compatibility, and stability, etc, have been performed by contacting the fluid manufacturer.

FAA HOLDOVER TIME GUIDELINES FOR SAE TYPE I, TYPE II, TYPE III, AND TYPE IV FLUIDS IN ACTIVE FROST

Outside Air Temperature[1,2]		Approximate Holdover Times (hours:minutes)
Degrees Celsius	Degrees Fahrenheit	Active Frost
		Type I
-1 and above	30 and above	0:45
below -1 to -3	below 30 to 27	
below -3 to -10	below 27 to 14	
below -10 to -14	below 14 to 7	
below -14 to -21	below 7 to -6	
below -21 to LOUT	below -6 to LOUT	

Outside Air Temperature[2]		Concentration Neat Fluid/Water (Volume %/ Volume %)	Approximate Holdover Times (hours:minutes)		
Degrees Celsius	Degrees Fahrenheit		Active Frost		
			Type II	Type III	Type IV
-1 and above	30 and above	100/0	8:00	2:00	12:00
		75/25	5:00	1:00	5:00
		50/50	3:00	0:30	3:00
below -1 to -3	below 30 to 27	100/0	8:00	2:00	12:00
		75/25	5:00	1:00	5:00
		50/50	1:30	0:30	3:00
below -3 to -10	below 27 to 14	100/0	8:00	2:00	10:00
		75/25	5:00	1:00	5:00
below -10 to -14	below 14 to 7	100/0	6:00	2:00	6:00
		75/25	1:00	1:00	1:00
below -14 to -21	below 7 to -6	100/0	6:00	2:00	6:00
below -21 to -25	below -6 to -13	100/0	2:00	2:00	4:00
Below -25	Below -13	No holdover time guidelines exist			

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

1 Type I Fluid / Water Mixture must be selected so that the freezing point of the mixture is at least 10 °C (18 °F) below outside air temperature.
2 Ensure that the lowest operational use temperature (LOUT) of the fluid is respected.

CAUTIONS:

- FLUIDS USED DURING GROUND DE/ANTI-ICING DO NOT PROVIDE IN-FLIGHT ICING PROTECTION.
- THIS TABLE IS FOR DEPARTURE PLANNING ONLY AND SHOULD BE USED IN CONJUNCTION WITH PRETAKEOFF CHECK PROCEDURES.

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING

FAA 90 PERCENT ADJUSTED HOLDOVER TIME GUIDELINES FOR

SAE TYPE I, TYPE II, TYPE III, AND TYPE IV FLUIDS IN ACTIVE FROST

Outside Air Temperature[1,2]		Approximate Holdover Times (hours:minutes)
Degrees Celsius	Degrees Fahrenheit	Active Frost
		Type I
-1 and above	30 and above	0:41
below -1 to -3	below 30 to 27	
below -3 to -10	below 27 to 14	
below -10 to -14	below 14 to 7	
below -14 to -21	below 7 to -6	
below -21 to LOUT	below -6 to LOUT	

Outside Air Temperature[2]		Concentration Neat Fluid/Water (Volume %/ Volume %)	Approximate Holdover Times (hours:minutes)		
Degrees Celsius	Degrees Fahrenheit		Active Frost		
			Type II	Type III	Type IV
-1 and above	30 and above	100/0	7:12	1:48	10:48
		75/25	4:30	0:54	4:30
		50/50	2:42	0:27	2:42
below -1 to -3	below 30 to 27	100/0	7:12	1:48	10:48
		75/25	4:30	0:54	4:30
		50/50	1:21	0:27	2:42
below -3 to -10	below 27 to 14	100/0	7:12	1:48	9:00
		75/25	4:30	0:54	4:30
below -10 to -14	below 14 to 7	100/0	5:24	1:48	5:24
		75/25	0:54	0:54	0:54
below -14 to -21	below 7 to -6	100/0	5:24	1:48	5:24
below -21 to -25	below -6 to -13	100/0	1:48	1:48	3:36
Below -25	Below -13	No holdover time guidelines exist			

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

1 Type I Fluid / Water Mixture must be selected so that the freezing point of the mixture is at least 10 °C (18 °F) below outside air temperature.
2 Ensure that the lowest operational use temperature (LOUT) of the fluid is respected.

CAUTIONS:

- FLUIDS USED DURING GROUND DE/ANTI-ICING DO NOT PROVIDE IN-FLIGHT ICING PROTECTION.
- THIS TABLE IS FOR DEPARTURE PLANNING ONLY AND SHOULD BE USED IN CONJUNCTION WITH PRETAKEOFF CHECK PROCEDURES.

FAA HOLDOVER TIME GUIDELINES FOR SAE TYPE I FLUID ON CRITICAL AIRCRAFT SURFACES COMPOSED PREDOMINANTLY OF ALUMINUM

Outside Air Temperature[1,2]		Wing Surface	Approximate Holdover Times Under Various Weather Conditions (hours: minutes)							
Degrees Celsius	Degrees Fahrenheit		Freezing Fog or Ice Crystals	Snow, Snow Grains or Snow Pellets[3]			Freezing Drizzle[5]	Light Freezing Rain	Rain on Cold Soaked Wing[6]	Other[7]
				Very Light[4]	Light[4]	Moderate				
-3 and above	27 and above	Aluminum	0:11-0:17	0:18-0:22	0:11-0:18	0:06-0:11	0:09-0:13	0:02-0:05	0:02-0:05	
below -3 to -6	below 27 to 21	Aluminum	0:08-0:13	0:14-0:17	0:08-0:14	0:05-0:08	0:05-0:09	0:02-0:05	CAUTION: No holdover time guidelines exist	
below -6 to -10	below 21 to 14	Aluminum	0:06-0:10	0:11-0:13	0:06-0:11	0:04-0:06	0:04-0:07	0:02-0:05		
Below -10	below 14	Aluminum	0:05-0:09	0:07-0:08	0:04-0:07	0:02-0:04				

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

1 Type I fluid / water mixture must be selected so that the freezing point of the mixture is at least 10 °C (18 °F) below outside air temperature.
2 Ensure that the lowest operational use temperature (LOUT) of the fluid is respected.
3 To determine snowfall intensity, the SNOWFALL INTENSITIES AS A FUNCTION OF PREVAILING VISIBILITY table is required.
4 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain.
5 Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
6 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
7 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.

CAUTIONS:

- THE TIME OF PROTECTION WILL BE SHORTENED IN HEAVY WEATHER CONDITIONS. HEAVY PRECIPITATION RATES OR HIGH MOISTURE CONTENT, HIGH WIND VELOCITY, OR JET BLAST MAY REDUCE HOLDOVER TIME BELOW THE LOWEST TIME STATED IN THE RANGE. HOLDOVER TIME MAY BE REDUCED WHEN AIRCRAFT SKIN TEMPERATURE IS LOWER THAN OAT.
- SAE TYPE I FLUID USED DURING GROUND DE/ANTI-ICING IS NOT INTENDED FOR AND DOES NOT PROVIDE PROTECTION DURING FLIGHT.
- THIS TABLE IS FOR DEPARTURE PLANNING ONLY AND SHOULD BE USED IN CONJUNCTION WITH PRETAKEOFF CHECK PROCEDURES.

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING

FAA 90 PERCENT ADJUSTED HOLDOVER TIME GUIDELINES FOR SAE TYPE I FLUID ON CRITICAL AIRCRAFT SURFACES COMPOSED PREDOMINANTLY OF ALUMINUM

Outside Air Temperature[1,2]		Wing Surface	Approximate Holdover Times Under Various Weather Conditions (hours: minutes)							
Degrees Celsius	Degrees Fahrenheit		Freezing Fog or Ice Crystals	Snow, Snow Grains or Snow Pellets[3]			Freezing Drizzle[5]	Light Freezing Rain	Rain on Cold Soaked Wing[6]	Other[7]
				Very Light[4]	Light[4]	Moderate				
-3 and above	27 and above	Aluminum	0:10-0:15	0:16-0:20	0:10-0:16	0:05-0:10	0:08-0:12	0:02-0:05	0:02-0:05	
below -3 to -6	below 27 to 21	Aluminum	0:07-0:12	0:13-0:15	0:07-0:13	0:05-0:07	0:05-0:08	0:02-0:05	CAUTION: No holdover time guidelines exist	
below -6 to -10	below 21 to 14	Aluminum	0:05-0:09	0:10-0:12	0:05-0:10	0:04-0:05	0:04-0:06	0:02-0:05		
Below -10	below 14	Aluminum	0:05-0:08	0:06-0:07	0:04-0:06	0:02-0:04				

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

1 Type I fluid / water mixture must be selected so that the freezing point of the mixture is at least 10 °C (18 °F) below outside air temperature.
2 Ensure that the lowest operational use temperature (LOUT) of the fluid is respected.
3 To determine snowfall intensity, the SNOWFALL INTENSITIES AS A FUNCTION OF PREVAILING VISIBILITY table is required.
4 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain.
5 Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
6 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
7 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.

CAUTIONS:

- THE TIME OF PROTECTION WILL BE SHORTENED IN HEAVY WEATHER CONDITIONS. HEAVY PRECIPITATION RATES OR HIGH MOISTURE CONTENT, HIGH WIND VELOCITY, OR JET BLAST MAY REDUCE HOLDOVER TIME BELOW THE LOWEST TIME STATED IN THE RANGE. HOLDOVER TIME MAY BE REDUCED WHEN AIRCRAFT SKIN TEMPERATURE IS LOWER THAN OAT.
- SAE TYPE I FLUID USED DURING GROUND DE/ANTI-ICING IS NOT INTENDED FOR AND DOES NOT PROVIDE PROTECTION DURING FLIGHT.
- THIS TABLE IS FOR DEPARTURE PLANNING ONLY AND SHOULD BE USED IN CONJUNCTION WITH PRETAKEOFF CHECK PROCEDURES.

13. Holdover Charts Type II Fluid

A. Type II holdover charts are similar to Type I charts, but are separated by mixture.

B. There are three different mixtures on Type II fluid charts:

(1) 100% mixture

(2) 75% mixture

(3) 50% mixture

C. To use the chart, determine the mixture of the Type II fluid in use, as well as the prevailing weather conditions and ambient temperatures.

This information can be obtained from the ATIS Frequency and Weather Sequences of the departure airport.

SAE Type II Fluid may be used below -25°C provided the freeze point of the fluid is at least 7°C below the OAT and the aerodynamic acceptance criteria are met. Consider use of SAE Type I Fluids when SAE Type II cannot be used.

D. Each chart is based on prevailing conditions, and will also list ambient temperatures and either temperature/dew point spread, rates of snow fall, classification of precipitation, or visibility.

E. For example, to find the holdover time for 75% Type II fluid with light snow and ambient temperature of -6° C, reference the Snowfall Intensity-Visibility Table to determine the rate of snowfall and use the 75/25 TYPE II SNOW column on the holdover chart.

(1) Find the temperature range that includes -6° C on the left side of the chart, and go to the right to the proper Snowfall Rate column.

(2) The holdover time for snow can now be referenced.

CAUTION: HOLDOVER CHARTS/TABLES ARE FOR DEPARTURE PLANNING ONLY AND SHOULD BE USED IN CONJUNCTION WITH PRE-TAKEOFF CHECK PROCEDURES.

List of Fluids Tested for Anti-Icing Performance and Aerodynamic Acceptance (2014-2015)

Type II Deicing/Anti-Icing Fluids[2]

Company Name	Fluid Name
ABAX Industries	Ecowing 26
Aviation Shaanxi Hi-Tech Physical Chemical Co., Ltd.	Cleanwing II
Clariant GmbH	Safewing MP II 1951
Clariant GmbH	Safewing MP II FLIGHT
Clariant GmbH	Safewing MP II FLIGHT PLUS
Cryotech Deicing Technology	Polar Guard II
Kilfrost	ABC-3
Kilfrost	ABC-K PLUS
LNT Solutions	P250
Newave Aerochemical Co Ltd.	FCY-2

2. This table lists Types II, III, or IV fluids that have been tested with respect to anti-icing performance requirements according to SAE AMS 1428, Paragraph 3.2.4 and aerodynamic performance according to SAE AMS 1428, Paragraph 3.2.5 only by the Anti-Icing Materials International Laboratory at the University of Quebec at Chicoutimi, Canada, web site: www.uqac.ca/amil. The end user is responsible for confirming that other SAE AMS 1428 technical requirement tests, such as materials compatibility, and stability, etc, have been performed by contacting the fluid manufacturer.

FAA HOLDOVER TIME GUIDELINES FOR
SAE TYPE II FLUIDS

Outside Air Temperature[1]		Type II Fluid Concentration Neat-Fluid/Water (Volume %/Volume %)	Approximate Holdover Times Under Various Weather Conditions (hours: minutes)					
Degrees Celsius	Degrees Fahrenheit		Freezing Fog or Ice Crystals	Snow, Snow Grains or Snow Pellets[2,3]	Freezing Drizzle[4]	Light Freezing Rain	Rain on Cold Soaked Wing[5]	Other[6]
-3 and above	27 and above	100/0	0:35-1:30	0:20-0:45	0:30-0:55	0:15-0:30	0:08-0:40	
		75/25	0:25-1:00	0:15-0:30	0:20-0:45	0:10-0:25	0:05-0:25	
		50/50	0:15-0:30	0:05-0:15	0:08-0:15	0:05-0:09	CAUTION: No holdover time guidelines exist	
below -3 to -14	below 27 to 7	100/0	0:20-1:05	0:15-0:30	0:20-0:45[7]	0:10-0:20[7]		
		75/25	0:25-0:50	0:10-0:20	0:15-0:30[7]	0:08-0:15[7]		
Below -14 to -25 or LOUT	Below 7 to -13 or LOUT	100/0	0:15-0:35	0:15-0:30				

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

1 Ensure that the lowest operational use temperature (LOUT) of the fluid is respected. Consider use of Type I fluid when Type II fluid cannot be used.
2 To determine snowfall intensity, the SNOWFALL INTENSITIES AS A FUNCTION OF PREVAILING VISIBILITY table is required.
3 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain.
4 Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
5 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
6 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
7 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS:

- THE TIME OF PROTECTION WILL BE SHORTENED IN HEAVY WEATHER CONDITIONS. HEAVY PRECIPITATION RATES OR HIGH MOISTURE CONTENT, HIGH WIND VELOCITY, OR JET BLAST MAY REDUCE HOLDOVER TIME BELOW THE LOWEST TIME STATED IN THE RANGE. HOLDOVER TIME MAY BE REDUCED WHEN AIRCRAFT SKIN TEMPERATURE IS LOWER THAN OAT.
- SAE TYPE II FLUID USED DURING GROUND DE/ANTI-ICING IS NOT INTENDED FOR AND DOES NOT PROVIDE PROTECTION DURING FLIGHT.
- THIS TABLE IS FOR DEPARTURE PLANNING ONLY AND SHOULD BE USED IN CONJUNCTION WITH PRETAKEOFF CHECK PROCEDURES.

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING

FAA 90 PERCENT ADJUSTED HOLDOVER TIME GUIDELINES FOR SAE TYPE II FLUID

Outside Air Temperature[1]		Type II Fluid Concentration Neat-Fluid/Water (Volume %/Volume %)	Approximate Holdover Times Under Various Weather Conditions (hours: minutes)					
Degrees Celsius	Degrees Fahrenheit		Freezing Fog or Ice Crystals	Snow, Snow Grains or Snow Pellets[2,3]	Freezing Drizzle[4]	Light Freezing Rain	Rain on Cold Soaked Wing[5]	Other[6]
-3 and above	27 and above	100/0	0:32-1:21	0:18-0:41	0:27-0:50	0:14-0:27	0:07-0:36	
		75/25	0:23-0:54	0:14-0:27	0:18-0:41	0:09-0:23	0:05-0:23	
		50/50	0:14-0:27	0:05-0:14	0:07-0:14	0:05-0:08	CAUTION: No holdover time guidelines exist	
below -3 to -14	below 27 to 7	100/0	0:18-0:59	0:14-0:27	0:18-0:41[7]	0:09-0:18[7]		
		75/25	0:23-0:45	0:09-0:18	0:14-0:27[7]	0:07-0:14[7]		
Below -14 to -25 or LOUT	Below 7 to -13 or LOUT	100/0	0:14-0:32	0:14-0:27				

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

1 Ensure that the lowest operational use temperature (LOUT) of the fluid is respected. Consider use of Type I fluid when Type II fluid cannot be used.
2 To determine snowfall intensity, the SNOWFALL INTENSITIES AS A FUNCTION OF PREVAILING VISIBILITY table is required.
3 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain.
4 Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
5 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
6 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
7 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS:

- THE TIME OF PROTECTION WILL BE SHORTENED IN HEAVY WEATHER CONDITIONS. HEAVY PRECIPITATION RATES OR HIGH MOISTURE CONTENT, HIGH WIND VELOCITY, OR JET BLAST MAY REDUCE HOLDOVER TIME BELOW THE LOWEST TIME STATED IN THE RANGE. HOLDOVER TIME MAY BE REDUCED WHEN AIRCRAFT SKIN TEMPERATURE IS LOWER THAN OAT.
- SAE TYPE II FLUID USED DURING GROUND DE/ANTI-ICING IS NOT INTENDED FOR AND DOES NOT PROVIDE PROTECTION DURING FLIGHT.
- THIS TABLE IS FOR DEPARTURE PLANNING ONLY AND SHOULD BE USED IN CONJUNCTION WITH PRETAKEOFF CHECK PROCEDURES.

14. Holdover Charts Type III Fluid

A. Type III holdover charts are similar to Type II charts, and are separated by mixture.

B. There are three different mixtures on Type III fluid charts:

(1) 100% mixture

(2) 75% mixture

(3) 50% mixture

C. To use the chart, determine the mixture of the Type III fluid in use, as well as the prevailing weather conditions and ambient temperatures.

This information can be obtained from the ATIS Frequency and Weather Sequences of the departure airport.

SAE Type III Fluid may be used below -10°C provided the freeze point of the fluid is at least 7°C below the OAT and the aerodynamic acceptance criteria are met. Consider use of SAE Type I Fluids when SAE Type III cannot be used.

D. Each chart is based on prevailing conditions, and will also list ambient temperatures and either temperature/dew point spread, rates of snow fall, classification of precipitation, or visibility.

E. For example, to find the holdover time for 75% Type III fluid with light snow and ambient temperature of -6° C, reference the Snowfall Intensity-Visibility Table to determine the rate of snowfall and use the 75/25 TYPE III SNOW column on the holdover chart.

(1) Find the temperature range that includes -6° C on the left side of the chart, and go to the right to the proper Snowfall Rate column.

(2) The holdover time for snow can now be referenced.

CAUTION: HOLDOVER CHARTS/TABLES ARE FOR DEPARTURE PLANNING ONLY AND SHOULD BE USED IN CONJUNCTION WITH PRE-TAKEOFF CHECK PROCEDURES.

List of Fluids Tested for Anti-Icing Performance and Aerodynamic Acceptance (2014-2015)
Type III Deicing/Anti-Icing Fluids[2]

Company Name	Fluid Name
Clariant GmbH	Safewing MP III 2031 ECO

2. This table lists Types II, III, or IV fluids that have been tested with respect to anti-icing performance requirements according to SAE AMS 1428, Paragraph 3.2.4 and aerodynamic performance according to SAE AMS 1428, Paragraph 3.2.5 only by the Anti-Icing Materials International Laboratory at the University of Quebec at Chicoutimi, Canada, web site: www.uqac.ca/amil. The end user is responsible for confirming that other SAE AMS 1428 technical requirement tests, such as materials compatibility, and stability, etc, have been performed by contacting the fluid manufacturer.

FAA HOLDOVER TIME GUIDELINES FOR
SAE TYPE III FLUIDS[1]

Outside Air Temperature[2]		Approximate Holdover Times Under Various Weather Conditions (hours: minutes)								
Degrees Celsius	Degrees Fahrenheit	Type III Fluid Concentration Neat Fluid/Water (Volume %/Volume %)	Freezing Fog or Ice Crystals	Snow, Snow Grains or Snow Pellets[3]			Freezing Drizzle[5]	Light Freezing Rain	Rain on Cold Soaked Wing[6]	Other[7]
				Very Light[4]	Light[4]	Moderate				
-3 and above	27 and above	100/0	0:20-0:40	0:35-0:40	0:20-0:35	0:10-0:20	0:10-0:20	0:08-0:10	0:06-0:20	
		75/25	0:15-0:30	0:25-0:35	0:15-0:25	0:08-0:15	0:08-0:15	0:06-0:10	0:02-0:10	
		50/50	0:10-0:20	0:15-0:20	0:08-0:15	0:04-0:08	0:05-0:09	0:04-0:06	CAUTION: No holdover time guidelines exist	
below -3 to -10	below 27 to 14	100/0	0:20-0:40	0:30-0:35	0:15-0:30	0:09-0:15	0:10-0:20	0:08-0:10		
		75/25	0:15-0:30	0:25-0:30	0:10-0:25	0:07-0:10	0:09-0:12	0:06-0:09		
below -10	below 14	100/0	0:20-0:40	0:30-0:35	0:15-0:30	0:08-0:15				

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

1 Fluid must be applied unheated to use these holdover times. No holdover times exist for Type III fluid applied heated.
2 Ensure that the lowest operational use temperature (LOUT) of the fluid is respected. Consider use of Type I fluid when Type III fluid cannot be used.
3 To determine snowfall intensity, the SNOWFALL INTENSITIES AS A FUNCTION OF PREVAILING VISIBILITY table is required.
4 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain.
5 Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
6 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
7 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (See table that provides allowance times for ice pellets and small hail).

CAUTIONS:

- THE TIME OF PROTECTION WILL BE SHORTENED IN HEAVY WEATHER CONDITIONS. HEAVY PRECIPITATION RATES OR HIGH MOISTURE CONTENT, HIGH WIND VELOCITY, OR JET BLAST WILL REDUCE HOLDOVER TIME BELOW THE LOWEST TIME STATED IN THE RANGE. HOLDOVER TIME MAY BE REDUCED WHEN AIRCRAFT SKIN TEMPERATURE IS LOWER THAN OAT.
- SAE TYPE III FLUID USED DURING GROUND DE/ANTI-ICING IS NOT INTENDED FOR AND DOES NOT PROVIDE PROTECTION DURING FLIGHT.
- THIS TABLE IS FOR DEPARTURE PLANNING ONLY AND SHOULD BE USED IN CONJUNCTION WITH PRETAKEOFF CHECK PROCEDURES.

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING

FAA 90 PERCENT ADJUSTED HOLDOVER TIME GUIDELINES FOR SAE TYPE III FLUIDS[1]

Outside Air Temperature[2]		Approximate Holdover Times Under Various Weather Conditions (hours: minutes)								
Degrees Celsius	Degrees Fahrenheit	Type III Fluid Concentration Neat Fluid/Water (Volume %/Volume %)	Freezing Fog or Ice Crystals	Snow, Snow Grains or Snow Pellets[3]			Freezing Drizzle[5]	Light Freezing Rain	Rain on Cold Soaked Wing[6]	Other[7]
				Very Light[4]	Light[4]	Moderate				
-3 and above	27 and above	100/0	0:18-0:36	0:32-0:36	0:18-0:32	0:09-0:18	0:09-0:18	0:07-0:09	0:05-0:18	
		75/25	0:14-0:27	0:23-0:32	0:14-0:23	0:07-0:14	0:07-0:14	0:05-0:09	0:02-0:09	
		50/50	0:09-0:18	0:14-0:18	0:07-0:14	0:04-0:07	0:05-0:08	0:04-0:05	CAUTION: No holdover time guidelines exist	
below -3 to -10	below 27 to 14	100/0	0:18-0:36	0:27-0:32	0:14-0:27	0:08-0:14	0:09-0:18	0:07-0:09		
		75/25	0:14-0:27	0:23-0:27	0:09-0:23	0:06-0:09	0:08-0:11	0:05-0:08		
below -10	below 14	100/0	0:18-0:36	0:27-0:32	0:14-0:27	0:07-0:14				

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

1 Fluid must be applied unheated to use these holdover times. No holdover times exist for Type III fluid applied heated.
2 Ensure that the lowest operational use temperature (LOUT) of the fluid is respected. Consider use of Type I fluid when Type III fluid cannot be used.
3 To determine snowfall intensity, the SNOWFALL INTENSITIES AS A FUNCTION OF PREVAILING VISIBILITY table is required.
4 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain.
5 Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
6 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
7 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (See table that provides allowance times for ice pellets and small hail).

CAUTIONS:

- THE TIME OF PROTECTION WILL BE SHORTENED IN HEAVY WEATHER CONDITIONS. HEAVY PRECIPITATION RATES OR HIGH MOISTURE CONTENT, HIGH WIND VELOCITY, OR JET BLAST WILL REDUCE HOLDOVER TIME BELOW THE LOWEST TIME STATED IN THE RANGE. HOLDOVER TIME MAY BE REDUCED WHEN AIRCRAFT SKIN TEMPERATURE IS LOWER THAN OAT.
- SAE TYPE III FLUID USED DURING GROUND DE/ANTI-ICING IS NOT INTENDED FOR AND DOES NOT PROVIDE PROTECTION DURING FLIGHT.
- THIS TABLE IS FOR DEPARTURE PLANNING ONLY AND SHOULD BE USED IN CONJUNCTION WITH PRETAKEOFF CHECK PROCEDURES.

15. Holdover Charts Type IV Fluid

A. Type IV holdover charts are similar to type II charts, and are separated by mixture.

B. There are three different mixtures on Type IV fluid charts:

(1) 100% mixture

(2) 75% mixture

(3) 50% mixture

C. To use the chart, determine the mixture of the Type IV fluid in use as well as the prevailing weather conditions and ambient temperatures.

This information can be obtained from the ATIS Frequency and weather sequences of the departure airport.

SAE Type IV Fluid may be used below -25°C provided the freeze point of the fluid is at least 7°C below the OAT and the aerodynamic acceptance criteria are met. Consider use of SAE Type I Fluids when SAE Type IV cannot be used.

Each chart is based on prevailing conditions, and will also list ambient temperatures and either temperature/dew point spread, rates of snow fall, classification of precipitation, or visibility.

D. For example, to find the holdover time for 75% Type IV fluid with light snow and ambient temperature of -6° C, reference the Snowfall Intensity/Visibility Table to determine the rate of snowfall and use the 75/25 TYPE IV SNOW column on the holdover chart.

(1) Find the temperature range that includes -6° C on the left side of the chart, and go to the right to the proper Snowfall Rate column.

(2) The holdover time for snow can now be referenced.

CAUTION: HOLDOVER CHARTS/TABLES ARE FOR DEPARTURE PLANNING ONLY AND SHOULD BE USED IN CONJUNCTION WITH PRE-TAKEOFF CHECK PROCEDURES.

List of Fluids Tested for Anti-Icing Performance and Aerodynamic Acceptance (2014-2015)
Type IV Deicing/Anti-Icing Fluids[2]

Company Name	Fluid Name
ABAX Industries	AD-480
ABAX Industries	Ecowing AD-49
Clariant GmbH	Max Flight 04
Clariant GmbH	Max Flight Sneg
Clariant GmbH	Safewing MP IV LAUNCH
Clariant GmbH	Safewing MP IV LAUNCH PLUS
Cryotech Deicing Technology	Polar Guard
Cryotech Deicing Technology	Polar Guard Advance
Dow Chemical Company	UCAR™ Endurance EG106 De/Anti-icing Fluid
Dow Chemical Company	UCAR™ FlightGuard AD-480
Dow Chemical Company	UCAR™ FlightGuard AD-49
Kilfrost	ABC-S
Kilfrost	ABC-S Plus
LNT Solutions	E450
Newave Aerochemical	FCY 9311

2. This table lists Types II, III, or IV fluids that have been tested with respect to anti-icing performance requirements according to SAE AMS 1428, Paragraph 3.2.4 and aerodynamic performance according to SAE AMS 1428, Paragraph 3.2.5 only by the Anti-Icing Materials International Laboratory at the University of Quebec at Chicoutimi, Canada, web site: www.uqac.ca/amil. The end user is responsible for confirming that other SAE AMS 1428 technical requirement tests, such as materials compatibility, and stability, etc, have been performed by contacting the fluid manufacturer.

Information has been published by the FAA and Boeing about a phenomena concerning Type IV (and possibly Type II) anti-icing fluids called **fluid dry-out**.

Where there is little or no airflow to cause fluid shear to take place, the fluid remains on the aircraft in what are called **aerodynamically quiet areas**. These areas are generally wing roots, flap wells, balanced bays, rear spar areas, or crevices. Since these areas are **aerodynamically quiet areas**, the residual fluid left on the aircraft causes no performance degradation. It's not uncommon to see a certain amount of Type IV or Type II fluid dripping out of these **aerodynamically quiet areas** after the aircraft was anti-iced and then subsequently flown to its destination. When Type IV or Type II fluid eventually dries out, it will form a powdery looking substance that's easily washed or brushed off. This is referred to as **fluid dry-out**. When there are repeated dry surface applications of Type IV (or possibly Type II) fluids **without an intervening Type I deicing/anti-icing fluid or hot water application**, this powdery reside can accumulate in these **aerodynamically quiet areas**. Large amounts of this powdery residue have been know to rehydrate and expand under certain atmospheric conditions, such as high humidity or rain, and then subsequently freeze at high altitudes and extremely cold temperatures.

To increase awareness of this potential problem, all Deicing Personnel will be trained and instructed to pay close attention to the **aerodynamically quiet areas** of the aircraft.

FAA TYPE IV HOLDOVER TIME GUIDELINES FOR
KILFROST ABC-S PLUS

Outside Air Temperature[1]		Manufacturer Specific Type IV Fluid Concentration Neat-Fluid/Water (Volume %/Volume %)	Approximate Holdover Times Under Various Weather Conditions (hours: minutes)							
Degrees Celsius	Degrees Fahrenheit		Freezing Fog or Ice Crystals	Snow, Snow Grains or Snow Pellets[2]			Freezing Drizzle[4]	Light Freezing Rain	Rain on Cold Soaked Wing[5]	Other[6]
				Very Light[3]	Light[3]	Moderate				
-3 and above	27 and above	100/0	2:10-4:00	3:00-3:00	2:05-3:00	1:15-2:05	1:50-2:00	1:05-2:00	0:25-2:00	
		75/25	1:25-2:40	2:05-2:25	1:15-2:05	0:45-1:15	1:00-1:20	0:30-0:50	0:10-1:20	
		50/50	0:30-0:55	1:00-1:10	0:30-1:00	0:15-0:30	0:15-0:40	0:15-0:20	CAUTION: No holdover time guidelines exist	
below -3 to -14	below 27 to 7	100/0	0:55-3:30	2:55-3:00	1:45-2:55	1:00-1:45	0:25-1:35[7]	0:20-0:30[7]		
		75/25	0:45-1:50	1:45-2:00	1:00-1:45	0:35-1:00	0:20-1:10[7]	0:15-0:25[7]		
below -14 to -28	below 7 to -18.4	100/0	0:40-1:00	0:40-0:50	0:30-0:40	0:15-0:30				

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

1 Ensure that the lowest operational use temperature (LOUT) of the fluid is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 To determine snowfall intensity, the SNOWFALL INTENSITIES AS A FUNCTION OF PREVAILING VISIBILITY table is required.
3 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain.
4 Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
5 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
6 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (See table that provides allowance times for ice pellets and small hail).
7 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS:

- THE TIME OF PROTECTION WILL BE SHORTENED IN HEAVY WEATHER CONDITIONS. HEAVY PRECIPITATION RATES OR HIGH MOISTURE CONTENT, HIGH WIND VELOCITY, OR JET BLAST MAY REDUCE HOLDOVER TIME BELOW THE LOWEST TIME STATED IN THE RANGE. HOLDOVER TIME MAY BE REDUCED WHEN AIRCRAFT SKIN TEMPERATURE IS LOWER THAN OAT.
- KILFROST ABC-S PLUS TYPE IV FLUID USED DURING GROUND DE/ANTI-ICING IS NOT INTENDED FOR AND DOES NOT PROVIDE PROTECTION DURING FLIGHT.
- THIS TABLE IS FOR DEPARTURE PLANNING ONLY AND SHOULD BE USED IN CONJUNCTION WITH PRETAKEOFF CHECK PROCEDURES.

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING

FAA 90 PERCENT ADJUSTED TYPE IV HOLDOVER TIME GUIDELINES FOR KILFROST ABC-S PLUS

Outside Air Temperature[1]		Manufacturer Specific Type IV Fluid Concentration Neat-Fluid/Water (Volume %/Volume %)	Approximate Holdover Times Under Various Weather Conditions (hours: minutes)							
Degrees Celsius	Degrees Fahrenheit		Freezing Fog or Ice Crystals	Snow, Snow Grains or Snow Pellets[2]			Freezing Drizzle[4]	Light Freezing Rain	Rain on Cold Soaked Wing[5]	Other[6]
				Very Light[3]	Light[3]	Moderate				
-3 and above	27 and above	100/0	1:57-3:36	3:00-3:00	1:53-3:00	1:08-1:53	1:39-1:48	0:59-1:48	0:23-1:48	
		75/25	1:17-2:24	1:53-2:11	1:08-1:53	0:41-1:08	0:54-1:12	0:27-0:45	0:09-1:12	
		50/50	0:27-0:50	0:54-1:03	0:27-0:54	0:14-0:27	0:14-0:36	0:14-0:18	CAUTION: No holdover time guidelines exist	
below -3 to -14	below 27 to 7	100/0	0:50-3:09	2:38-3:00	1:35-2:38	0:54-1:35	0:23-1:26[7]	0:18-0:27[7]		
		75/25	0:41-1:39	1:35-1:48	0:54-1:35	0:32-0:54	0:18-1:03[7]	0:14-0:23[7]		
below -14 to -28	below 7 to -18.4	100/0	0:36-0:54	0:36-0:45	0:27-0:36	0:14-0:27				

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

1 Ensure that the lowest operational use temperature (LOUT) of the fluid is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 To determine snowfall intensity, the SNOWFALL INTENSITIES AS A FUNCTION OF PREVAILING VISIBILITY table is required.
3 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain.
4 Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
5 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
6 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (See Table that provides allowance times for ice pellets and small hail).
7 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS:

- THE TIME OF PROTECTION WILL BE SHORTENED IN HEAVY WEATHER CONDITIONS. HEAVY PRECIPITATION RATES OR HIGH MOISTURE CONTENT, HIGH WIND VELOCITY, OR JET BLAST MAY REDUCE HOLDOVER TIME BELOW THE LOWEST TIME STATED IN THE RANGE. HOLDOVER TIME MAY BE REDUCED WHEN AIRCRAFT SKIN TEMPERATURE IS LOWER THAN OAT.
- KILFROST ABC-S PLUS TYPE IV FLUID USED DURING GROUND DE/ANTI-ICING IS NOT INTENDED FOR AND DOES NOT PROVIDE PROTECTION DURING FLIGHT.
- THIS TABLE IS FOR DEPARTURE PLANNING ONLY AND SHOULD BE USED IN CONJUNCTION WITH PRETAKEOFF CHECK PROCEDURES.

FAA HOLDOVER TIME GUIDELINES FOR
SAE TYPE IV FLUIDS

Outside Air Temperature[1]		Type IV Fluid Concentration Neat-Fluid/Water (Volume %/Volume %)	Approximate Holdover Times Under Various Weather Conditions (hours: minutes)					
Degrees Celsius	Degrees Fahrenheit		Freezing Fog or Ice Crystals	Snow, Snow Grains or Snow Pellets[2,3]	Freezing Drizzle[4]	Light Freezing Rain	Rain on Cold Soaked Wing[5]	Other[6]
-3 and above	27 and above	100/0	1:50-2:55	0:35-1:10	0:50-1:30	0:35-0:55	0:10-1:15	
		75/25	1:05-1:45	0:30-0:55	0:45-1:10	0:30-0:45	0:09-0:50	
		50/50	0:20-0:35	0:07-0:15	0:15-0:20	0:08-0:10	CAUTION: No holdover time guidelines exist	
below -3 to -14	below 27 to 7	100/0	0:20-1:20	0:25-0:50	0:20-1:00[7]	0:10-0:25[7]		
		75/25[8]	0:25-0:50	0:20-0:40	0:15-1:05[7]	0:10-0:25[7]		
below -14 to -25 or LOUT	below 7 to -13 or LOUT	100/0[9]	0:15-0:40	0:15-0:30				

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

1 Ensure that the lowest operational use temperature (LOUT) of the fluid is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 To determine snowfall intensity, the SNOWFALL INTENSITIES AS A FUNCTION OF PREVAILING VISIBILITY table is required.
3 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain.
4 Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
5 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
6 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (See Table that provides allowance times for ice pellets and small hail).
7 No holdover time guidelines exist for this condition below -10 °C (14 °F).
8 For Cryotech Polar Guard temperature is limited to -5.5 °C (22 °F).
9 For Cryotech Polar Guard and Clariant Max Flight 04, temperature is limited to -23.5 °C (-10.3 °F). If the fluid specific brand is unknown, all of the temperature limitations in this and the preceding note apply.

CAUTIONS:

- THE TIME OF PROTECTION WILL BE SHORTENED IN HEAVY WEATHER CONDITIONS. HEAVY PRECIPITATION RATES OR HIGH MOISTURE CONTENT, HIGH WIND VELOCITY, OR JET BLAST MAY REDUCE HOLDOVER TIME BELOW THE LOWEST TIME STATED IN THE RANGE. HOLDOVER TIME MAY BE REDUCED WHEN AIRCRAFT SKIN TEMPERATURE IS LOWER THAN OAT.
- SAE TYPE IV FLUID USED DURING GROUND DE/ANTI-ICING IS NOT INTENDED FOR AND DOES NOT PROVIDE PROTECTION DURING FLIGHT.
- THIS TABLE IS FOR DEPARTURE PLANNING ONLY AND SHOULD BE USED IN CONJUNCTION WITH PRETAKEOFF CHECK PROCEDURES.

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING

FAA 90 PERCENT ADJUSTED HOLDOVER TIME GUIDELINES FOR SAE TYPE IV FLUIDS

Outside Air Temperature[1]		Type IV Fluid Concentration Neat-Fluid/Water (Volume %/Volume %)	Approximate Holdover Times Under Various Weather Conditions (hours: minutes)					
Degrees Celsius	Degrees Fahrenheit		Freezing Fog or Ice Crystals	Snow, Snow Grains or Snow Pellets[2,3]	Freezing Drizzle[4]	Light Freezing Rain	Rain on Cold Soaked Wing[5]	Other[6]
-3 and above	27 and above	100/0	1:39-2:38	0:32-1:03	0:45-1:21	0:32-0:50	0:09-1:08	
		75/25	0:59-1:35	0:27-0:50	0:41-1:03	0:27-0:41	0:08-0:45	
		50/50	0:18-0:32	0:06-0:14	0:14-0:18	0:07-0:09	CAUTION: No holdover time guidelines exist	
below -3 to -14	below 27 to 7	100/0	0:18-1:12	0:23-0:45	0:18-0:54[7]	0:09-0:23[7]		
		75/25[8]	0:23-0:45	0:18-0:36	0:14-0:59[7]	0:09-0:23[7]		
below -14 to -25 or LOUT	below 7 to -13 or LOUT	100/0[9]	0:14-0:36	0:14-0:27				

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

1 Ensure that the lowest operational use temperature (LOUT) of the fluid is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 To determine snowfall intensity, the SNOWFALL INTENSITIES AS A FUNCTION OF PREVAILING VISIBILITY table is required.
3 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain.
4 Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
5 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
6 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (See Table that provides allowance times for ice pellets and small hail).
7 No holdover time guidelines exist for this condition below -10 °C (14 °F).
8 For Cryotech Polar Guard temperature is limited to -5.5 °C (22 °F).
9 For Cryotech Polar Guard and Clariant Max Flight 04, temperature is limited to -23.5 °C (-10.3 °F). If the fluid specific brand is unknown, all of the temperature limitations in this and the preceding note apply.

CAUTIONS:

- THE TIME OF PROTECTION WILL BE SHORTENED IN HEAVY WEATHER CONDITIONS. HEAVY PRECIPITATION RATES OR HIGH MOISTURE CONTENT, HIGH WIND VELOCITY, OR JET BLAST MAY REDUCE HOLDOVER TIME BELOW THE LOWEST TIME STATED IN THE RANGE. HOLDOVER TIME MAY BE REDUCED WHEN AIRCRAFT SKIN TEMPERATURE IS LOWER THAN OAT.
- SAE TYPE IV FLUID USED DURING GROUND DE/ANTI-ICING IS NOT INTENDED FOR AND DOES NOT PROVIDE PROTECTION DURING FLIGHT.
- THIS TABLE IS FOR DEPARTURE PLANNING ONLY AND SHOULD BE USED IN CONJUNCTION WITH PRETAKEOFF CHECK PROCEDURES.

16. Ice Pellet and Small Hail Allowance Times

ABX Air will be allowed, in the specified ice pellet and small hail conditions and corresponding outside air temperatures (OAT) listed in Ice Pellet and Small Hail Allowance Times table, up to the specific allowance time listed in Ice Pellet and Small Hail Allowance Times table after the start of the anti-icing fluid application to commence the takeoff with the following restrictions:

A. The aircraft critical surfaces must be free of contaminants before applying Type III or Type IV anti-icing fluid. If not, the aircraft must be properly deiced and checked to be free to contaminants before the application of Type III or Type IV anti-icing fluid.

B. The allowance time is valid only if the aircraft is anti-iced with undiluted Type III or Type IV fluid.

C. The Type III allowance times are only applicable for un-heated anti-icing fluid applications.

D. Due to the shearing qualities of Type III and Type IV fluids with imbedded ice pellets, this allowance is limited to aircraft with a rotation speed of 100 knots or greater or 115 knots as indicated in the Ice Pellet and Small Hail Allowance Times table.

E. If the takeoff is not accomplished within the applicable allowance time in the Ice Pellet and Small Hail Allowance Times table the aircraft must be completely deiced, and if precipitation is still present, anti-iced again prior to a subsequent takeoff. If the precipitation stops at or before the time limits of the applicable allowance time and does not restart, the aircraft may takeoff up to 90 minutes after the start of the application of the Type III or Type IV anti-icing fluid, however, the OAT must remain constant or increase during the 90 minute period under the following conditions:

   (1) light ice pellets mixed with light or moderate freezing drizzle;

   (2) light ice pellets mixed with light freezing rain;

   (3) light ice pellets mixed with light rain; and

   (4) light ice pellets mixed with moderate rain.

F. A pre-takeoff contamination check is not required. The allowance time cannot be extended by an internal or external check of the aircraft critical surfaces.

G. If ice pellet precipitation becomes heavier than moderate or if the light ice pellets mixed with other forms of allowable precipitation exceeds the listed intensities or temperature range, the allowance time cannot be used.

H. If the temperature decreases below the temperature on which the allowance time was based,

(1) and the new lower temperature has an associated allowance time for the precipitation condition and the present time is within the new allowance time, then that new time must be used as the allowance time limit.

(2) and the allowance time has expired (within the 90 minute post anti-icing window if the precipitation has stopped within the allowance time), the aircraft may not takeoff and must be completely deiced and, if applicable, anti-iced before a subsequent takeoff.

Ice Pellets – When ice pellets are being reported, the following chart information extracted from the Federal Meteorological Handbook shall be used to assess their actual intensity rate:

1. Light - Scattered pellets that do not completely cover an exposed surface regardless of duration.
2. Moderate - Slow accumulation on ground.
3. Heavy - Rapid accumulation on ground.

NOTE: Tests have shown that ice pellets generally remain in the frozen state imbedded in Type IV anti-icing fluid, and are not absorbed by the fluid in the same manner as other forms of precipitation. Using current guidelines for determining anti-icing fluid failure, the presence of a contaminant not absorbed by the fluid (remaining imbedded) would be an indication that the fluid has failed. These imbedded ice pellets are generally not detectable by the human eye during pre-takeoff contamination check procedures. Therefore, a visual pretakeoff contamination check in ice pellet conditions would not be of value and is not required.

FAA ICE PELLET AND SMALL HAIL ALLOWANCE TIMES FOR SAE TYPE III FLUIDS (2014-2015)

This table is for use with SAE Type III undiluted (100/0) fluids applied unheated only

Precipitation Type	Outside Air Temperature		
	-5°C and above	Below -5 to -10°C	Below -10°C[1]
Light Ice Pellets	10 minutes	10 minutes	**Caution: No allowance times currently exist**
Moderate Ice Pellets or Small Hail	5 minutes	5 minutes	
Light Ice Pellets Mixed with Light or Moderate Freezing Drizzle	7 minutes	5 minutes	
Light Ice Pellets Mixed with Light Freezing Rain	7 minutes	5 minutes	
Light Ice Pellets Mixed with Light Rain	7 minutes[2]		
Light Ice Pellets Mixed with Moderate Rain			
Light Ice Pellets Mixed with Light Snow	10 minutes	10 minutes	
Light Ice Pellets Mixed with Moderate Snow	10 minutes	10 minutes	

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

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected.

2 No allowance times exist in this condition for temperatures below 0°C; consider use of light ice pellets mixed with light freezing rain.

CAUTIONS:

- FLUIDS USED DURING GROUND DE/ANTI-ICING DO NOT PROVIDE IN-FLIGHT ICING PROTECTION.
- THIS TABLE IS FOR DEPARTURE PLANNING ONLY AND SHOULD BE USED IN CONJUNCTION WITH PRETAKEOFF CHECK PROCEDURES.

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING

FAA ICE PELLET AND SMALL HAIL 90 PERCENT ADJUSTED ALLOWANCE TIMES FOR SAE TYPE III FLUIDS (2014-2015)

This table is for use with SAE Type III undiluted (100/0) fluids applied unheated only

Precipitation Type	Outside Air Temperature		
	-5°C and above	Below -5 to -10°C	Below -10°C[1]
Light Ice Pellets	9 minutes	9 minutes	**Caution: No allowance times currently exist**
Moderate Ice Pellets or Small Hail	5 minutes	5 minutes	
Light Ice Pellets Mixed with Light or Moderate Freezing Drizzle	6 minutes	5 minutes	
Light Ice Pellets Mixed with Light Freezing Rain	6 minutes	5 minutes	
Light Ice Pellets Mixed with Light Rain	6 minutes[2]		
Light Ice Pellets Mixed with Moderate Rain			
Light Ice Pellets Mixed with Light Snow	9 minutes	9 minutes	
Light Ice Pellets Mixed with Moderate Snow	9 minutes	9 minutes	

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

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected.

2 No allowance times exist in this condition for temperatures below 0°C; consider use of light ice pellets mixed with light freezing rain.

CAUTIONS:

- FLUIDS USED DURING GROUND DE/ANTI-ICING DO NOT PROVIDE IN-FLIGHT ICING PROTECTION.
- THIS TABLE IS FOR DEPARTURE PLANNING ONLY AND SHOULD BE USED IN CONJUNCTION WITH PRETAKEOFF CHECK PROCEDURES.

FAA ICE PELLET AND SMALL HAIL ALLOWANCE TIMES FOR SAE TYPE IV FLUIDS (2014-2015)

This table is for use with SAE Type IV undiluted (100/0) fluids only.
All Type IV fluids are propylene glycol based with the exception of Dow EG106 and LNT E450 which are ethylene glycol based.

Precipitation Type	Outside Air Temperature		
	-5°C and above	Below -5 to -10°C	Below -10°C[1]
Light Ice Pellets	50 minutes	30 minutes	30 minutes[2]
Moderate Ice Pellets or Small Hail	25 minutes[3]	10 minutes	10 minutes[2,4]
Light Ice Pellets Mixed with Light or Moderate Freezing Drizzle	25 minutes	10 minutes	**Caution: No allowance times currently exist**
Light Ice Pellets Mixed with Light Freezing Rain	25 minutes	10 minutes	
Light Ice Pellets Mixed with Light Rain	25 minutes[5]		
Light Ice Pellets Mixed with Moderate Rain	25 minutes[6]		
Light Ice Pellets Mixed with Light Snow	25 minutes	15 minutes	
Light Ice Pellets Mixed with Moderate Snow	10 minutes	7 minutes	

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

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected.

2 No allowance times exist for propylene glycol (PG) fluids when used on aircraft with rotation speeds less than 115 knots. (For these aircraft, if the fluid type is not known, assume zero allowance time).

3 Allowance time is 15 minutes for propylene glycol (PG) fluids, or when the fluid type is unknown.

4 No allowance times exist for propylene glycol (PG) fluids in this condition for temperatures below -16°C.

5 No allowance times exist for this condition for temperatures below 0 °C; consider use of light ice pellets mixed with light freezing rain.

6 No allowance times exist in this condition for temperatures below 0 °C

CAUTIONS:

- FLUIDS USED DURING GROUND DE/ANTI-ICING DO NOT PROVIDE IN-FLIGHT ICING PROTECTION.
- THIS TABLE IS FOR DEPARTURE PLANNING ONLY AND SHOULD BE USED IN CONJUNCTION WITH PRETAKEOFF CHECK PROCEDURES.

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING

FAA ICE PELLET AND SMALL HAIL 90 PERCENT ADJUSTED ALLOWANCE TIMES FOR SAE TYPE IV FLUIDS (2014-2015)

This table is for use with SAE Type IV undiluted (100/0) fluids only.
All Type IV fluids are propylene glycol based with the exception of Dow EG106 and LNT E450 which are ethylene glycol based.

Precipitation Type	Outside Air Temperature		
	-5°C and above	Below -5 to -10°C	Below -10°C[1]
Light Ice Pellets	45 minutes	27 minutes	27 minutes[2]
Moderate Ice Pellets or Small Hail	23 minutes[3]	9 minutes	9 minutes[2,4]
Light Ice Pellets Mixed with Light or Moderate Freezing Drizzle	23 minutes	9 minutes	**Caution: No allowance times currently exist**
Light Ice Pellets Mixed with Light Freezing Rain	23 minutes	9 minutes	
Light Ice Pellets Mixed with Light Rain	23 minutes[5]		
Light Ice Pellets Mixed with Moderate Rain	23 minutes[6]		
Light Ice Pellets Mixed with Light Snow	23 minutes	14 minutes	
Light Ice Pellets Mixed with Moderate Snow	9 minutes	6 minutes	

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

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected.

2 No allowance times exist for propylene glycol (PG) fluids when used on aircraft with rotation speeds less than 115 knots. (For these aircraft, if the fluid type is not known, assume zero allowance time).

3 Allowance time is 15 minutes for propylene glycol (PG) fluids, or when the fluid type is unknown.

4 No allowance times exist for propylene glycol (PG) fluids in this condition for temperatures below -16°C.

5 No allowance times exist for this condition for temperatures below 0 °C; consider use of light ice pellets mixed with light freezing rain.

6 No allowance times exist in this condition for temperatures below 0 °C

CAUTIONS:

- FLUIDS USED DURING GROUND DE/ANTI-ICING DO NOT PROVIDE IN-FLIGHT ICING PROTECTION.
- THIS TABLE IS FOR DEPARTURE PLANNING ONLY AND SHOULD BE USED IN CONJUNCTION WITH PRETAKEOFF CHECK PROCEDURES.

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