Deicing Manual

Manual Number 335

FAA APPROVAL

KERRY T KINSER

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Principal Operations Inspector, Phoenix CMO, WP37

Revision 27

11/03/23

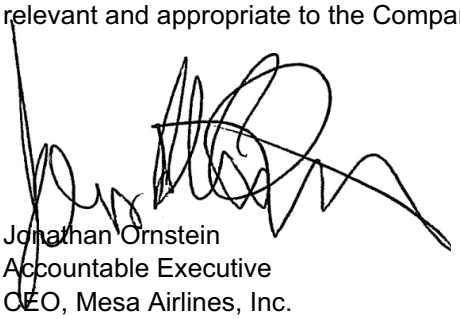
Mesa Airlines, Inc. Safety Policy Statement

The Accountable Executive of Mesa Airlines, Inc. recognizes that an effective Safety Management System (SMS) is vital to the success and longevity of the Company. Therefore the Accountable Executive is committed to implementing and maintaining a fully functional SMS and to the continuous improvement of the level of safety throughout Mesa Airlines, Inc.

- The Accountable Executive of Mesa Airlines, Inc. is committed to establishing and fulfilling specific safety-related objectives and will publish and distribute to all employees those objectives and plans annually.
- These safety objectives will be monitored, measured, and tracked to ensure overall corporate safety objectives are met. All employees and individuals in the Company have the responsibility to perform their duties and activities in the safest practical manner.
- The Mesa Airlines, Inc. Accountable Executive is committed to providing the necessary financial, personnel, and other resources to implement and maintain a fully functional SMS.
- The Mesa Airlines, Inc. Accountable Executive is dedicated to establishing a confidential employee reporting system to report all hazards, accidents, incidents, and safety issues without fear of reprisal.
- Activities involving intentional disregard for FAA regulations, Company policies and procedures, illegal activities, and/or drugs or alcohol may be subject to disciplinary action.
- As a component of the SMS, the Mesa Airlines, Inc. Accountable Executive is committed to establishing, maintaining, and annually exercising an emergency response procedure and plan that provides for the safe transition from normal to emergency operations.
- The Safety Policy in its entirety can be found within the Mesa Airlines, Inc. *Safety Management System Manual* (Manual #550).

The Accountable Executive will convey this expectation to all employees through postings, intranet site, Company newsletter, and any other means to ensure all employees are aware of the Company's SMS, their duties and responsibilities, and our safety policy.

This safety policy will be reviewed annually by the Accountable Executive to ensure it remains relevant and appropriate to the Company.



Jonathan Ornstein
Accountable Executive
CEO, Mesa Airlines, Inc.

Summary of Changes

Changes included with this revision are listed in the table below:

Page	Description
F.12	Replaced: Mixture/Temperature Freezing Point Table section with Table C-1 (SRA 913)

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List of Temporary Revisions

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List of Bulletins

Bulletins are issued on an as needed basis to convey timely information. Bulletin information may supersede current information found in this manual or introduce new procedures due to changes in the regulatory or operating environment. Bulletins are inserted after the Bulletins tab.

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Chapter 1: Program Administration

Chapter 1: Program Administration

1.1 Purpose

14 CFR: 119.43 119.5
OPSPECS: A023

This federally approved manual describes the procedures, equipment and approved materials for the removal, and prevention, of frozen accumulations on Mesa Airlines, Inc. aircraft while on the ground. The procedures as described in the Mesa Airlines, Inc. *Deicing Manual* must be complied with in accordance with Operations Specifications A023 and FAR 119.5(g) and (l). The provisions of this manual apply to all Mesa Airlines, Inc. employed and contract personnel responsible for deicing Mesa Airlines, Inc. aircraft.

1.2 General

14 CFR: 121.629

FAR 121.629 governs the operation of Mesa Airlines, Inc. aircraft while operating in icing conditions, and prohibits takeoff when contamination is adhering to critical surfaces of an aircraft. This regulation requires:

A. No aircraft may take off when frost, ice or snow is adhering to the wings, control surfaces, engine inlets or other critical surfaces of the aircraft.

B. No person may dispatch or release an aircraft, continue to operate an aircraft enroute or land an aircraft when, in the opinion of the PIC or the aircraft dispatcher, icing conditions are expected or met that adversely affect the safety of flight.

1.2.1 Objective/Responsibility

A. The objective of effective deicing and anti-icing is to remove all accumulated solidified moisture from aircraft surfaces and critical components, to prevent re-accumulation of snow, ice, slush and frost by leaving a film of deicing fluid (glycol/water mixture) and/or anti-icing fluid on the aircraft until the aircraft has been cleared for takeoff.

B. The PIC is primarily and ultimately responsible for deciding when an aircraft is suitable for takeoff. Ground support personnel are responsible for performing the necessary operations to ensure that the aircraft is in a properly de/anti-iced condition.

C. Deicing and anti-icing involves the removal and temporary prevention of all solidified moisture (snow, ice, slush and frost) from adhering to aircraft surfaces or components. Deicing is accomplished by a variety or combination of different methods, including: the manual removal of snow, ice, slush and frost utilizing various tools designed and/or approved for such use as described in this manual; application of deicing fluid (glycol/water mixture); application of heated water with an immediate application of anti-icing fluid to prevent melted snow and ice from refreezing on aircraft surfaces.

D. While compliance with the Mesa Airlines, Inc. De/Anti-Ice Program is mandated, situations requiring deviations may arise. Except when permitted by this manual, such deviations may not be approved locally.

1. All requests for deviation from this program shall be made to the Manager of Airport Operations & Safety Assurance, who will consult with Flight Operations, Maintenance and System Operations Control, and will have such deviations approved by FAA Certificate Management Office (CMO). Such approvals may be communicated in writing or verbally and then confirmed in writing. The deviation request should identify the current manual procedures, the proposed policy deviation and an explanation of the need for the deviation. Such approvals may be communicated in writing or verbally via the Manager of Airport Operations & Safety Assurance at 602-685-4000. Deviations shall not be practiced until a written confirmation of acceptance has been approved by the Mesa Airlines, Inc. Manager of Airport Operations & Safety Assurance. The Manager of Airport Operations & Safety Assurance will track this information at the Mesa Airlines, Inc. corporate headquarters. Deviation requests can be emailed to Station-Compliance@mesa-air.com, mailed to Mesa Airlines, Inc. at 410 N. 44th Street, Phoenix, AZ 85008 or faxed to 602-685-4548.
2. In emergencies where an immediate response is required, the request for approval may be communicated to the Manager of Airport Operations & Safety Assurance through System Operations Control or directly via telephone. When emergency deviations to this FAA-approved material are made, Mesa Airlines, Inc. shall notify the FAA Principal Operations Inspector POI of the deviation at the earliest practical opportunity (preferably the first working day after the action). Such approvals may be communicated verbally and then confirmed in writing.

NOTE

As part of the Mesa Airlines. Inc. Safety Management System (SMS) process, all safety and or security concerns must be reported to the Mesa Airlines, Inc. Vice President of Safety and Security and the Maintenance and System Operations Control at Station-Compliance@mesa-air.com.

E. Stations are required to be prepared for the established winter season by October 1st of each year and will implement the components of the Mesa Airlines, Inc. De/Anti-Ice Program throughout the entire deice season, which is from October 1st of the current year through April 15th of the following year.

NOTE

Some locations may experience icing conditions prior to or after the established winter season dates. In such cases, the Mesa Airlines, Inc. De/Anti-Ice Program will be implemented or remain in effect during such conditions to ensure the integrity of the Clean Aircraft Concept. When such conditions exist outside of the established winter season, the Station Manager must advise System Operations Control of the existence of icing conditions at the location. At United Express Stations, Mesa Airlines, Inc. will accept the station readiness dates and deice exempt stations determined by United Airlines for the deice season.

F. Station Deice Exemptions

1. Some stations do not regularly experience cold weather conditions throughout the year that would necessitate de/anti-icing, as required by this manual. Several of these stations, assessed on a case-by-case basis, have been designated by the Manager of Airport Operations & Safety Assurance as being exempt from the requirements of de/anti-ice preparedness, training and documentation.
2. Stations that are designated as exempt will be added to the station deice exempt list when service begins and the determination has been made by the Manager of Airport Operations & Safety Assurance. The list will be reviewed annually by the Manager of Airport Operations & Safety Assurance to ensure relevant stations remain and that the stations on the list still meet the standard for exempt stations.
3. The Station Deice Exempt List will be maintained on the Mesa Airlines, Inc. P: Drive server under P:\Stations\Deice Exempt List. Access will be provided to all personnel that require it for normal operations. Request for access may be made by contacting the Manager of Airport Operations & Safety Assurance.
4. Stations on the deice exempt list are exempt, specifically, from:
    a. Preparation and training requirements for the annual de/anti-icing season.
    b. Activities and documentation required by this manual in support of de/anti-icing operations.
5. Stations that are considered exempt and experience isolated icing conditions must rely on natural ambient conditions to remove contamination (ex. natural sunlight, rising temperature) in compliance with the Clean Aircraft Concept.
6. Any station that is considered exempt may request to remove this designation and participate in the Mesa Airlines, Inc. Deice Program. Any station that would like to move from exempt to non-exempt must provide notice to the Manager of Airport Operations & Safety Assurance at least 30 days prior to the start of the deice season for that year. Once this change is made, the station is no longer considered exempt and must be compliant with all the requirements listed in this manual.

G. Interfaces

1. Each Mesa Airlines, Inc. station must maintain current Mesa Airlines, Inc. manuals as well as manuals pertaining to the Business Partner procedures where applicable. Manuals must be available to employees and Business Partners during all hours of operation. These manuals may be maintained in paper or electronic form. All required manuals can be accessed online at Mesa Tech Pubs (http://mesanet.mesaair.com/TechPubs/).
2. All manuals referenced herein are understood to be those published and controlled by Mesa Airlines, Inc. unless otherwise noted.

3. Where Mesa Airlines, Inc. contracts services, Mesa Airlines, Inc. will ensure a contract exists through agreements and/or appropriate third-party vendors that specifies details for compliance with the operating standards contained in this manual. Compliance with the standards of this manual is expected for all personnel employed by or working on behalf of Mesa Airlines, Inc.
4. For detailed manual interface procedures, refer to the *Technical Publications Procedures Manual* (Manual #430).

H. Controls are incorporated throughout the manual with processes and procedures to make sure:

1. Adherence to procedures, design, and manuals, etc.
2. Personnel meet the requirements (e.g., trained and qualified)
3. Inputs for this program meet the requirements (e.g., equipment, services, and information)
4. Outputs meet the requirements and standards, etc.
5. Hand-offs and interfaces do not create problems

1.3 Definitions

MISC: AC120-60B

1.3.1 General

A. Anti-icing is a procedure used to provide protection against the formation of frost or ice and accumulation of snow or slush on clean surfaces of the aircraft for a limited period of time (Holdover Time). Anti-icing fluids are normally applied unheated on clean aircraft surfaces, but may be applied heated.

B. Deicing is a procedure used to remove frost, ice, slush or snow from the aircraft in order to provide clean surfaces. The procedure can be accomplished using fluids, mechanical means or by heating the aircraft. Deicing fluid is usually applied heated to assure maximum deicing efficiency.

C. Frozen contaminants, as used in this manual, include light freezing rain, freezing rain, freezing drizzle, frost, ice pellets, snow, snow grains and slush.

D. Holdover Time (HOT) is the estimated time that de/anti-icing fluid will prevent the formation of frost or ice and the accumulation of snow on the critical surfaces of an aircraft. HOT begins when the final application of de/anti-icing fluid commences and expires when the de/anti-icing fluid loses its effectiveness.

E. Pre-takeoff Check is a check of the aircraft's wings for frozen contaminants. This check is conducted within the aircraft's HOT and may be made by observing wings from the flight deck, cabin or outside the aircraft, as described in this manual.

F. Post Deicing Check is a check, after deicing application, to ensure all aircraft surfaces are free of frozen contaminants.

1.3.1.1 Representative Surfaces

A. Representative surfaces are intended to be used as a tool in gauging the contaminated state of critical surfaces on an aircraft after having used deicing and anti-icing fluids to clean the aircraft and then protect the aircraft from the freezing precipitation occurring during ground icing conditions.

B. An aircraft's representative surface is a portion of the aircraft that can be readily and clearly observed by the flight crew from inside the aircraft and is used to judge whether the surface has become contaminated. By determining the state of representative surface, it can then be reasonably expected that other critical surfaces will be in the same or better condition.

C. Representative Surface Selection Guidelines:

1. The choice of representative surfaces should first consider any recommendations made by the aircraft manufacturer. In the absence of manufacturer recommendations, operational and other pertinent experience is helpful.
2. Representative surfaces will normally be located on a critical surface of the aircraft.
3. The surface chosen should not be heated.
4. The surface should be clearly visible and close enough for the viewer to determine that it is free of contamination.
5. The representative surface should not be located in an area where the fluid tends to pool during anti-icing procedures. This fluid pooling would not result in the area being representative of the critical surfaces of the aircraft.
6. Representative surfaces should be designated for both sides of the aircraft in the event that weather and wind conditions are such that contamination is more likely to form on one side of the aircraft than on the other side of the aircraft.
7. Research has indicated that fluid failure occurs last at the mid-chord sections of wings. Therefore, whether painted or not, areas located at mid-chord sections of wings and previously used for checking fluid conditions are not suitable alone for evaluating fluid failure and should not be used exclusively as representative surfaces. Portions of the leading and trailing edges of the wings should be included.
8. Pre-takeoff contamination checks should concentrate on the leading edge in conjunction with the trailing edge of the wing. Dependent upon aircraft configuration, wing spoilers may also be used to provide an indication of fluid condition.

1.3.2 Clean Aircraft Concept

The Mesa Airlines, Inc. De/Anti-Ice Program uses the clean aircraft concept, which means that an aircraft may not takeoff when frost, ice or snow is adhering to the wings, control surfaces, engine inlets and/or other critical surfaces of the aircraft.

1.3.3 Seasons

A. The DEICE SEASON is defined as the period when de/anti-icing operations may take place.

B. The WINTER SEASON is defined as the time period when operational forms must be retained.

C. The LOCAL WINTER SEASON is the period when de/anti-icing conditions may affect a station before and/or beyond the normal winter season. The Local Winter Season is determined by the United Airlines Ground Deice Program (GDP), which Mesa Airlines, Inc. accepts. The local station manager and/or Winter Operations Coordinator will monitor forecasted weather conditions and adjust assets (personnel and equipment) and/or vendor instructions to prepare for potential deicing operations outside the normal winter season.

1.3.4 Abbreviations

Table 1-1: Abbreviations

Abbreviation	Meaning
ATCT	Air Traffic Control Tower
C	Celsius
F	Fahrenheit
FP	Freezing Point
HOT	Holdover Time
ISO	International Standards Organization
MSDS	Materials Safety Data Sheets
OCC	Operations Control Center
OAL	Other Airline
OAT	Outside Air Temperature
PIC	Pilot-in-Command
SAE	Society of Automotive Engineers

1.3.4.1 Fluid Terms

A. Deicing Fluids are heated water and glycol mixtures. These include: mixtures of heated water and SAE/ISO/AEA Type I fluid, mixtures of heated water and SAE/ISO/AEA Type II fluid, undiluted or mixtures of heated water and SAE/ISO/AEA Type III fluid, mixtures of heated water and SAE/ISO/AEA Type IV fluid.

B. The LOUT is the lowest temperature at which a fluid has been determined to flow off aircraft critical surfaces in an aerodynamically acceptable manner while maintaining the required freezing point buffer.

C. Anti-icing Fluids are mixtures of heated water and SAE/ISO/AEA Type I fluid, undiluted SAE/ISO/AEA Type II, Type III or Type IV fluid, mixtures of heated or unheated water and SAE/ISO/AEA Type II, Type III or Type IV fluid.

D. Type I Fluids are thin fluids and are primarily used as deicing agents only. They form a very thin wetting film on aircraft surfaces and typically contain a minimum of 40% glycol. Type I fluids are diluted with water (unless purchased as a pre-diluted solution) and heated prior to application. This fluid provides very limited Holdover protection during frozen precipitant conditions. This fluid is orange or clear in color.

E. Type II Fluids are thickened fluids and are primarily used as anti-icing agents following an application of heated water or deicing fluid solution. This fluid is high in viscosity and its use is limited to aircraft with minimum rotation speeds of 85 knots. They contain about 50% glycol, the remaining consisting of thickening agents and water. Type II fluids are usually applied undiluted and unheated and provide much longer Holdover Times (HOTs) than that provided by Type I fluid. This fluid is clear or pale straw in color.

F. Type III is a thickened fluid which has properties that lie between Types I and II. Therefore it provides a longer Holdover Time than Type I, but less than Type II. Type III fluid is designed primarily for aircraft with low rotation/takeoff speeds, although it works equally well on aircraft with higher rotation/takeoff speeds and offers substantial improvements in anti-icing performance when compared to Type I fluid. Also, it does not require specialized, low-shear application and transfer equipment. This particular fluid was designed to be used in Type I storage tanks and application equipment, either diluted or undiluted for deicing and for anti-icing. Type III fluids can be applied heated or unheated for anti-icing.

G. Type IV Fluids are enhanced performance fluids with characteristics similar to Type II fluids. However, Type IV fluids offer greater thermal and shear stability which allow its use as both an anti-icing fluid and as a high performance deicing fluid which can be used diluted with water and heated. During the application of heated Types II and IV fluids in the one-step procedure, questions have arisen regarding the anticipated HOT performance of these fluids, (a) In prior advisory information, the FAA indicated that maximum anti-icing effectiveness could be achieved from the application of unheated (cold) Type II fluids to deiced aircraft surfaces. (b) HOT performance of heated 60 °C (140 °F) Types II and IV fluids was found to equal or exceed the HOT performance of unheated Types II and IV fluids for the same fluid concentrations, temperatures, and precipitation conditions. When used in 100% concentration during certain weather conditions, their anti-icing effectiveness is superior to Type II fluids and HOT is increased by a significant factor under most conditions. This fluid remains stable when heated and has the lowest freezing point of any other anti-icing fluid. Type IV fluids can be used in equipment normally used for deicing that are equipped with transfer systems with low-shear or air pressure pumps (i.e., diaphragm or progressive-cavity pumps). The fluid shows minimal degradation when passed through a low-shear centrifugal pump; however, fluid cycling should be limited. Do not use high-shear centrifugal pumps unless approved by the anti-icing fluid or equipment manufacturer.

H. Non-SAE/ISO/AEA Approved Fluids: Not all deicing and anti-icing fluids meet SAE/ISO/AEA certification requirements including some military fluids. Type I, II, III and IV fluids that do not meet SAE/ISO/AEA specifications will not be used on Mesa Airlines, Inc. aircraft. Never use deicing or anti-icing fluids that can't be identified via exterior label or proper shipping paperwork from the manufacturer.

I. Refer to Chapter 3: "Approved Fluids" for approved fluid types.

1.3.5 Weather Conditions Conducive to Aircraft Icing on the Ground

A. Freezing precipitation: Snow, ice pellets (including sleet and small hail), freezing rain, drizzle or hail which adheres to aircraft surfaces.

B. Frost: A crystallized deposit formed from water vapor condensing on surfaces which are at or below 32°F.

C. Snow: Precipitation in the form of small ice crystals or flakes which may accumulate on aircraft surfaces.

D. Freezing rain: Water condensed from atmospheric vapor falling to earth in super cooled drops forming ice on objects.

E. Freezing drizzle: Fairly uniform precipitation composed exclusively of fine drops very close together. Drizzle appears to float while following air currents. Unlike fog, it falls to the ground and freezes on impact.

F. Rain or high humidity (on cold soaked wings): Water forming ice or frost on wing surfaces when the temperature of those surfaces is at or below 32°F.

G. Fog: Condensed water vapor in cloud-like masses lying close to the ground and limiting visibility to 1 kilometer (3,300 ft) or less.

H. Freezing Fog: Clouds of super cooled water droplets that form a deposit of ice on objects in cold weather conditions.

I. Snow Grains: Precipitation in the form of very small, white and opaque grains of ice. Snow grains are treated the same as snow when determining Holdover Time.

J. Ice Pellets: Precipitation in the form of transparent or translucent pellets of ice, which are round or irregular in shape. They have a diameter of 0.2 inches (5 mm) or less. They are classified into two main types: hard grains of ice consisting of frozen rain drops or largely melted and refrozen snowflakes; pellets of snow encased in a thin layer of ice, which have formed from the freezing of droplets intercepted by pellets or water resulting from the partial melting of pellets. It is reported as “PL” on the METAR.

1.3.6 Cold Soaked Wings

The condition of cold soaked wings is observed on aircraft that land with fuel in wing tanks that has been chilled to very low temperatures which prevail at higher altitudes. Aircraft designed with tanks that allow the fuel to wet the upper wing skin are of particular concern. In conditions of rain, drizzle, fog or high humidity when condensation forms on wing surfaces, clear ice may form on the wing upper surface, as well as underwing. This presents a particularly insidious hazard as it may occur while outside temperatures are above freezing and therefore unexpected. This condition typically produces a clear ice film that is very difficult to identify, especially during precipitation. Frost may also be produced by these conditions.

NOTE

There is a substantial risk that a thick layer of ice may form, be dislodged during takeoff and be ingested by rear-mounted engines.

1.3.7 Frost

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

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

B. Frost Formation: Frost forms whenever the exposed surface temperature cools below the OAT to or below the frost point (not the dew point).

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

D. Dew Point and Frost Point: The dew point is the temperature at a given atmospheric pressure to which air must be cooled to cause saturation. The dew point can occur below or above 0°C (32°F). The frost point is the temperature, at or below 0°C (32°F), at which moisture in the air will undergo deposition as a layer of frost on an exposed surface. The frost point occurs between the OAT and the dew point. The Aviation Routine Weather Report (METAR) does not report frost point; however, it does report dew point. The frost point is higher (warmer) than the dew point for a given humidity level in the air. The frost point and the dew point are the same at 0°C; at a dew point of -40°C, the frost point is 3.2°C warmer (-36.8°C). The following table provides further examples of the correlation between dew point and frost point.

Table 1-2: Dew Point and Frost Point Correlations

DEW POINT TEMPERATURE (°C)	FROST POINT TEMPERATURE (°C)
0	0
-5	-4.4
-10	-8.9
-15	-13.5
-20	-18.0
-25	-22.7
-30	-27.3
-35	-32.1
-40	-36.8

E. Frost HOTs: Frost HOTs are for active frost conditions in which frost is forming. This phenomenon occurs when aircraft surfaces are at or below 0°C (32°F) and at or below the frost point. Frost typically forms on cold nights with clear skies.

NOTE

Changes in OAT over the course of longer frost HOT can be up to 10°C or more, therefore the pilot should shorten the HOT based on decreases in OAT that may have occurred following the de/anti-icing treatment. Changes in OAT over the course of longer frost HOT can be significant; the appropriate HOT to use is the HOT provided for the coldest OAT that has occurred in the time between the de/anti-icing fluid application and takeoff.

1.4 Management Plan

14 CFR: 121.629
MISC AC120-60B

1.4.1 General

In order to exercise operational control (when conditions at an airport are such that frost, ice, snow or freezing precipitation may reasonably be expected to adhere to the aircraft), Mesa Airlines, Inc. has developed a management plan to ensure proper execution of its approved de/anti-icing program.

1.4.2 Responsibilities

The Mesa Airlines, Inc. De/Anti-Ice Program requires coordinated efforts between personnel from various branches of the airline. The responsibilities of those directly involved in the oversight and operation of this program are outlined below:

1.4.2.1 Manager of Airport Operations & Safety Assurance

The Manager of Airport Operations & Safety Assurance is responsible for the Mesa Airlines, Inc. *Deicing Manual* and has the authority to establish and/or modify the policies, procedures, instructions and information for the deicing process and program. The Manager of Airport Operations & Safety Assurance will ensure that sufficient competent personnel and adequate facilities and equipment are available at each airport where operations are expected to be conducted under icing conditions for the proper deicing and anti-icing of Mesa Airlines, Inc. aircraft. The Manager of Airport Operations & Safety Assurance is responsible for:

A. The quality of the deicing process and program.

B. An annual administrative review of the content of this manual.

C. An annual administrative review of the content of any other De/Anti-Ice Programs used in lieu of the Mesa Airlines, Inc. De/Anti-Ice Program for the de/anti-icing of Mesa Airlines, Inc. aircraft. This is accomplished prior to the established deice season. Mesa Airlines, Inc. participates annually in all deice task force meetings to ensure each program meets or exceeds the policies and procedures outlined in the Mesa Airlines, Inc. *Deicing Manual*.

NOTE

Administrative reviews ensure that the programs utilized remain compliant with applicable FAR guidelines and represent a safe and comprehensive means to achieve the Clean Aircraft Concept. Any changes to this manual, which affect another department, will be coordinated with the head of that department and approved by the FAA prior to revision or implementation.

D. Assessing the effect of changes made to the controls of this program.

E. Ensuring the contractual agreements for the provision of de/anti-icing services by other parties not already contracted by Mesa Airlines, Inc. contain applicable requirements necessary to comply with the state of registry.

F. Ensures Instructors and/or De/Anti-Ice Designated Trainers are available for station personnel and provide training oversight for contract personnel.

G. The Manager of Airport Operations & Safety Assurance will ensure each station is adequately prepared for the established winter season prior to October 1 of each year or the applicable codeshare partners' readiness date. This can be accomplished by requesting a letter of readiness from the applicable codeshare partner or by reviewing the winter ops portal of the respective codeshare to confirm readiness by the assigned date.

1.4.2.2 Chief Pilot

The Chief Pilot is responsible for ensuring that all flight deck crews adhere to the procedures identified in this manual and respond to any operational concerns for Flight Operations.

1.4.2.3 Director of System Operations Control

The Director of System Operations Control will be responsible for ensuring that all Dispatch personnel are trained and qualified in cold weather operations in accordance with the Mesa Airlines, Inc. *General Operations Manual*.

1.4.2.4 Station Manager

The Station Manager at each Mesa Airlines, Inc. managed location is responsible for ensuring the station is equipped and prepared to administer the winter servicing items outlined below prior to the start of the established winter season (some or all of these responsibilities may be delegated):

A. All equipment has been serviced, winterized and is operational.

B. All deicing materials and supplies have been ordered and are available on site.

C. Training for ground personnel involved in cold weather operations has been accomplished.

D. Ensure that all contract personnel at the location involved in the de/anti-icing of Mesa Airlines, Inc. aircraft follow the procedures described in this manual.

E. Coordinate the implementation of the Mesa Airlines, Inc. De/Anti-Ice Program with the local airport authority by ensuring the proper deice pad and/or facilities and storage area have been allocated.

F. Notify System Operations Control and all personnel at the station when icing conditions exist.

G. Ensure that all required testing of glycol fluids has been accomplished.

H. Ensure proper de/anti-icing information is being communicated to flight deck crews.

I. Ensure the completion of all de/anti-icing paperwork and record-keeping.

J. Ensure safety is practiced and enforced by personnel involved in de/anti-icing activities including personnel contracted to perform these activities.

K. The Station Manager will serve as the Winter Operations Coordinator unless delegated to another deice qualified employee. The WOC will monitor forecast weather conditions and adjust assets (personnel and equipment) and/or vendor instructions to prepare for potential deicing operations.

L. For DHL stations, this position is referred to as the “Snowman”, as referenced in the GSAM Section C309.1. For DHL stations that Mesa Airlines, Inc. operates to, a “Snowman” is required.

1.4.2.5 Flight Deck Crews

A. The PIC is responsible for determining the Holdover Time by consulting the Mesa Airlines, Inc. *General Operations Manual* and has the final responsibility to ensure that the aircraft is ready for flight. The first officer will perform duties assigned by the PIC.

B. Prior to each takeoff in icing conditions, and when the aircraft has been de/anti-iced, flight crews are required to conducted a Pre-Takeoff Check.

1.4.2.6 Trained De/Anti-Ice Personnel

Trained De/Anti-Ice Personnel are responsible to de/anti-ice aircraft, perform a post deice check and communicate with the flight deck crew as detailed in this program. De/Anti-Ice Personnel will defer to the authority of the PIC when additional de/anti-ice services are requested.

1.4.3 Station Preparedness

At stations where primary or backup deicing services are provided by a contract vendor, the Station Manager must inspect and verify the vendor is also in a state of preparedness to the level required by Mesa Airlines, Inc. With the forecast of possible deicing conditions, the Station Manager or qualified designee will:

A. Ensure a qualified deice team is assigned.

B. Ensure the deicing equipment is filled and tested.

C. Ensure viscosity checks for Types II, III, and IV fluids, are performed at the beginning of the icing season, periodically throughout the winter, and any time fluid contamination or damage is suspected or after major deicing truck pumping and spraying system maintenance. These checks should include samples obtained through the spray nozzles of application equipment.

D. Determine deice methods to be used.

E. Monitor the changing weather conditions, forecast and update field conditions, as necessary.

F. Record and reorder glycol supplies, as necessary.

G. Ensure that Mesa Airlines, Inc. System Operations Control is notified whenever changes occur causing unforeseen or differing weather conditions which were previously not dispensed via NOTAM or weather report. As conditions in the northeast frequently change without any warning, conditions such as rain changing to ice pellets (including sleet & small hail) or snow, accumulations of snow, ice, freezing drizzle or even large puddles of deice fluids may present dangerous taxiing conditions, which will precipitate notification of Mesa Airlines, Inc. System Operations Control.

1.4.4 Deicing Forms

The Station Manager or qualified designee is responsible for assuring that the forms in Appendix E of this manual are properly filled out according to the instructions for each log below and retained by the station for the indicated period of time:

1.4.4.1 Glycol Storage Tank Fill Log (Form #M502)

A. Each time a Glycol shipment is received, fill in the date, fluid manufacturer and type on the first available line.

B. Next, fill in the Glycol concentrations (e.g., 50/50 or 100%) and quantity of new Glycol added.

C. If water was added to obtain a desired mixture, indicate how much, if applicable.

D. Perform a final freeze point test after receiving fluid and performing any adjustments.

E. The individual who accepted the fluid will print their name or employee number on the box to the right.

F. Form #M502 shall be retained on file until at least April 30 and until the end of the local deice season.

NOTE

An employee who is trained by another carrier's deicing program that falls under the guidelines of AC 120-60B (as revised) may use a form from that carrier's approved FAA deicing program. A non-airline deice vendor who is not trained on another airline's FAA approved deicing program, may use an equivalent form containing the same required fields, but must follow the retention policies of the Mesa Airlines, Inc. Deicing Program. Mesa Airlines, Inc. will provide the Glycol Storage Tank Fill Log for ground handlers upon request.

1.4.4.2 Aircraft Deicing/Anti-icing Record (Form #M504)

A. Write in the station name and the company providing the deicing services (e.g., SkyWest, DGS) at the top of the form.

B. Fill in the Type I Fluid freeze point from the deicing unit daily when deicing conditions are in affect.

C. Each time an aircraft is deiced, fill in the date, flight number and aircraft identification number in the same line that the refractometer results were recorded.

D. Indicate what fluid was last applied, what fluid was applied in the final process and the local start time of the final fluid application.

E. If the PIC required the ground handler to perform an additional aircraft specific check, indicate "pre-taxi" or "none" in the appropriate box.

F. Indicate a Pass or Fail reading from the refractometer calibration test.

G. Once the person performing the deicing services has verified that the aircraft is free of contaminants, print the name or employee number in the farthest column on the right.

H. Form #M504 shall be retained on file until at least April 30 and until the end of the local deice season.

NOTE

An employee who is trained by another carrier's deicing program that falls under the guidelines of AC 120-60B (as revised) may use a form from that carrier's approved FAA deicing program. A non-airline deice vendor who is not trained on another airline's FAA approved deicing program, may use an equivalent form containing the same required fields, but must follow the retention policies of the Mesa Airlines, Inc. deicing program. Mesa Airlines, Inc. will provide the Deice Event Log (Form #M504) for ground handlers upon request.

1.4.4.3 Daily Deicing Equipment Inspection Checklist (Form #M506D)

A. A Daily Deicing Equipment Inspection Checklist (Form #M506D) will be completed for all Mesa Airlines, Inc. deicing equipment at the beginning of each day during the deicing season (October 1 – April 30).

B. All discrepancies identified will be annotated and action will be taken to correct noted discrepancies as soon as possible.

C. The Daily Deicing Equipment Inspection Checklist will be retained for 30 days.

D. The Daily Deicing Equipment Inspection Checklist is designed to be used for the full deicing season.

E. A sample form that may be used is contained in Appendix E.

NOTE

Vendors or contractors, using an equivalent record, which accounts for the same information required by this form, may use such a form, however, the retention requirement will be adhered to.

1.5 Surveillance

A. Mesa Airlines, Inc. will audit the deice program to ensure compliance with the policies and procedures that are set forth in this manual.

B. Except as noted in this section, the Manager of Airport Operations & Safety Assurance is responsible to ensure that a deice audit is conducted at locations where Mesa Airlines, Inc. operates scheduled service prior to the commencement of scheduled flight operations at that location. Audits of this nature are required only when new stations are scheduled to commence flight operations during the established winter season.

C. Except as noted in this section, the Manager of Airport Operations & Safety Assurance, or designee, is responsible to ensure that a deice audit is conducted at all stations biennially, where Mesa Airlines, Inc. operates. This audit will not include those stations which are considered deice exempt. The audit results, along with a letter explaining the deficiencies according to the audit checklist in Appendix E or one approved by the Manager of Airport Operations & Safety Assurance, will be forwarded to the Station Manager, along with the Regional Manager. All audit results will be used by the Manager of Airport Operations & Safety Assurance during his or her administrative review for the sole means of improving the Mesa Airlines, Inc. De/Anti-icing Program.

D. Stations servicing Mesa Airlines, Inc. operating as DHL can be audited using the methods and means prescribed by the Mesa Airlines, Inc. *Deicing Manual*. Such deicing audits of the DHL codeshare flights will be carried out by the Manager of Cargo Operations or authorized designee.

E. While it will be the responsibility of the Station Manager to resolve individual audit discrepancies, a seasonal evaluation of audit results will primarily be used by the Manager of Airport Operations & Safety Assurance to identify and resolve systemic trends. The Manager of Airport Operations & Safety Assurance may share the results of this seasonal evaluation with other department heads as appropriate. The data collected during the audit process will be used to measure the effectiveness of the Mesa Airlines, Inc. training program to identify areas where personnel received inadequate or improper de/anti-ice training.

F. Mesa Airlines, Inc. representatives conducting audits under the Internal Evaluation Program have the authority to conduct evaluations of the De/Anti-Ice Program in accordance with the Mesa Airlines, Inc. *Safety Program Manual* (Manual #530). The intent of such evaluations is to obtain an objective observation of the integrity of the program, the program's application, consistency, impact with other departments and to provide a secondary means of review to ensure compliance with applicable Mesa Airlines, Inc. standards.

G. At locations where Mesa provides deicing service, Mesa Airlines, Inc. may outsource deice audits to third party vendors. These vendors will be trained as Designated De/Anti-Ice Trainers as per the policies in the training chapter and procedures in this program and documented on the Designated Trainer Certification (Form #S102). The Manager of Airport Operations & Safety Assurance will schedule, have authority over, be responsible for and be accountable for the quality and content of all outsourced auditing. The Manager of Airport Operations & Safety Assurance will ensure that audits of third party vendors are not contracted to the same vendor providing the service.

1.6 Loss of Deicing Vendor

When a deicing vendor contracted by Mesa Airlines, Inc. goes out of business, cancels their contract or is deemed unsuitable, Mesa Airlines, Inc. will secure a new deicing vendor as soon as possible. The local Station Manager will notify the Manager of Airport Operations & Safety Assurance via email (Station-Compliance@mesa-air.com), mail (Manager of Airport Operations & Safety Assurance, Mesa Airlines, Inc., 410 N. 44th Street, Phoenix, AZ 85008), fax (602-685-4548) or phone (602-685-4000). During the period of time in which no deicing services are available, any Mesa Airlines, Inc. aircraft with frozen contamination will remain parked until such frozen contamination has naturally melted or dissipated from the aircraft. Mesa Airlines, Inc. aircraft must meet the Clean Aircraft Concept at all times.

1.7 Codeshare Partner Manuals

A. Mesa Airlines, Inc. has reviewed and approved their codeshare partners deicing programs to validate the programs meet or exceed the requirements of this manual. While Mesa Airlines, Inc. employees and flight crewmembers should only use this and accompanying flight manuals for deicing operations, deice vendor personnel for codeshare operations should refer to the respective manual, as identified below, for all forms, station duties and responsibilities, and policies related to the specific codeshare operation.

   1. For United Express codeshare operations, the United Aircraft Deice/Anti-ice Program manual, accessible via https://ft.ual.com/webregs/airport-operations/aircraft-deicing-anti-icing-program using your UA vendor login credentials.

   2. For DHL codeshare operations, deice training will be completed using the United Airlines Aircraft Deicing/Anti-Icing Program supplemented with the appropriate differences training, or complete deice training instructed by Mesa Airlines as outlined within this manual. The *Global SOP Aviation Manual* (GSAM or GSOP) should be referenced and is accessible via https://qpulseglobal.dhl.com/qpulse.

B. The contents within each of these publications is reviewed by the Manager of Airport Operations & Safety Assurance, at a minimum, during the annual program review to ensure the contents of each program interface with the program described herein for Mesa Airlines, Inc. aircraft. The Manager of Airport Operations & Safety Assurance will also review all revisions, updates or temporary revisions to the codeshare deice programs throughout the year to ensure Mesa Airlines, Inc. policies and procedures are represented in the respective program and that there are no interface issues. For all changes identified that impact Mesa Airlines, Inc. operation, the Manager of Airport Operations & Safety Assurance will take the steps to revise the program, or work with respective departments or codeshare entities, to align the programs, in accordance with procedures within the *Technical Publications Procedure Manual* (Manual #430) and the *Safety Management System Manual* (Manual #550).

1.8 United Airlines Aircraft Deicing/Anti-Icing Manual

Stations operating as United Express will comply with the provisions of the United Airlines *Aircraft Deicing/Anti-Icing Manual*. The United Airlines *Aircraft Deicing/Anti-Icing Manual* is independent of the Mesa Airlines, Inc. *Deicing Manual* but is accepted as part of the Mesa Airlines, Inc. manual system. An updated United Airlines *Aircraft Deicing/Anti-Icing Manual* must remain on hand at stations operating United Express flights.

NOTE

Only an updated United Airlines *Aircraft Deicing/Anti-Icing Manual* must remain on hand at stations operating United Express flights. For deicing at Canadian locations, United Airlines has accepted the training and procedures as outlined in the Standardized International Aircraft Ground Deice Program (SIAGDP) with respect to international ground deicing provisions of Part 121 operator-approved programs.

1.8.1 Development

The United Airlines *Aircraft Deicing/Anti-Icing Manual* has been developed through a cooperative partnership with the FAA Eastern Region, FAA Certificate Holding District Offices and United Express carriers, including Mesa Airlines, Inc. The United Airlines *Aircraft Deicing/Anti-Icing Manual* mandates ground deicing procedures. Flight crew procedures are contained in the Mesa Airlines, Inc. *General Operations Manual* and Company Flight Manuals.

1.8.2 Responsibilities

The Manager of Airport Operations & Safety Assurance is responsible for ensuring that the content of the United Airlines *Aircraft Deicing/Anti-Icing Manual* is applicable and compliant with the specific fleet types operated by Mesa Airlines, Inc. by reviewing all proposed changes. All revision requests are distributed to participating partners through the Deicing Task Force Committee. The Manager of Airport Operations & Safety Assurance may initiate changes to the manuals by following the procedures contained in the United Airlines *Aircraft Deicing/Anti-Icing Manual*. The Deicing Task force is comprised of members from the Eastern Region Flight Standards Division, the participating FAA Certificate Management Offices and the participating United Express carriers, including the Mesa Airlines, Inc. *Deicing Manual*, reviewing change requests and revising the manual.

1.8.3 Control, Changes/Revisions and Distribution

The control of the United Airlines *Aircraft Deicing/Anti-Icing Manual* rests with the Manager of Airport Operations & Safety Assurance. Revisions to the United Airlines *Aircraft Deicing/Anti-Icing Manual* are a function of the deicing Task Force. The Task Force approves the content of the manual as delineated in the United Airlines *Aircraft Deicing/Anti-Icing Manual*. Recommended changes may be submitted, in writing (electronic or paper), by the FAA or Mesa Airlines, Inc. in accordance with the procedures outlined in the United Airlines *Aircraft Deicing/Anti-Icing Manual*. The distribution of the United Airlines *Aircraft Deicing/Anti-Icing Manual* will be overseen by the Senior Vice President Airport Operations. Approved revisions will be distributed through United eDocs and WebRegs.

END

Chapter 2: Operating in Icing Conditions

Chapter 2: Operating in Icing Conditions

2.1 Effects of Snow, Ice, Slush and Frost on Aircraft

Operating aircraft in cold weather conditions present unique problems due to the effects of snow, ice and frost. Accumulations of these substances on aircraft surfaces greatly affect an aircraft's aerodynamic ability to operate effectively and safely. The formation of these substances disturbs the normal airflow over the air foil (wings) surfaces and can alter the weight distribution of the aircraft. Ice, snow and frost may cause the following problems in various combinations:

A. Alterations of airflow over critical aircraft surfaces resulting in an increase in drag and a reduction in lift. Wind tunnel and flight tests indicate that ice, frost and snow formations on the leading edge and upper surface of a wing, having a thickness and surface roughness similar to medium or coarse sandpaper, can reduce wing lift by as much as 30% and increase drag by 40%.

B. Increased weight, possibly exceeding maximum allowable weight limitations.

C. Severe center-of-gravity problems caused by uneven weight distribution.

D. Restrictive or total loss of aircraft controls; such as rudders, elevators, ailerons and trim tabs caused by ice deposits in hinge areas.

E. Errors in, or loss of critical instrument readings resulting from ice or snow blocking sensing devices; such as pitot probes, static ports, engine pressure sensing probes and other inlets.

F. Offset balance of fan blades caused by the accumulation of ice and frost.

G. As described, the effects of even a slight amount of solidified moisture adhering to aircraft surfaces may greatly affect aircraft performance and the crew's ability to control the aircraft, thus resulting in a hazardous flight condition.

2.2 Health and Safety

Two basic compounds are used to de/anti-ice aircraft: propylene glycol and ethylene glycol. Ethylene glycol is slightly more toxic than propylene glycol; however, both are considered safe for industrial and consumer use and OSHA does not regulate employee exposures to either of these compounds in a de/anti-icing environment. Consult the Material Data Safety Sheet (MSDS) for additional health information.

2.2.1 Personal Protection

All deicing personnel must adhere to suitable protective clothing and other precautions as stated on the appropriate MSDS.

A. Fall Protection

Employees working in an open deicing bucket lift platform or tower unit must wear a full body harness, which must be connected by a lanyard to the connection point provided. Persons working in an enclosed bucket must wear a seatbelt.

B. Eye and Face Protection

Employees must wear a face shield or goggles when spraying fluid.

C. Respiratory Protection

Tests consistently conclude that employees are not overexposed to glycol when deicing and personal respirators are not required. However, glycol can be irritating to mucous membranes, including the mouth, throat and lungs. This irritating effect varies from person to person; therefore, disposable dust/mist particulate filtering masks are provided at the employee's request.

D. Protective Clothing

Employees must wear protective gloves. Other protective clothing such as rain suits and protective boots are recommended.

2.2.2 Other Precautions

The following safety precautions must be observed during any deicing operation:

WARNING

Heated deicing fluid is hot and can cause serious injury.

A. Spraying up wind should be avoided. Do not put any part of your body in front of a spray gun/ nozzle or point it at anyone.

B. Do not operate deicing equipment if there are leaks in the hose.

C. During strong, windy conditions, position yourself so that you are high enough to spray down onto the aircraft surfaces and with the direction of the wind.

D. Grasp the spray gun/nozzle firmly before commencing spray and exercise care and caution in its handling.

E. When using boom-type deicing units and work stands/platforms, the safety bar, chain or other device must be securely latched across the opening. A full body harness must be worn and properly secured to the deicing unit.

F. Personnel will not be positioned on a boom-type deicing unit while in tow, unless securely harnessed or in an enclosed cab with the safety belt attached.

G. Under no circumstances will de/anti-icing be performed while passengers are boarding or deplaning any Mesa Airlines, Inc. aircraft.

H. Passengers should not be allowed to walk through de/anti-icing fluid on the ramp. Aircraft boarding stairs must be cleared of all de/anti-icing fluid prior to passenger boarding.

I. Passengers and crewmembers should be shielded from all fluid vapors by closing engine bleeds and packs (flight crew function) during the deicing and/or anti-icing process. Exposure to vapors of any fluids may cause transitory irritation of the eyes. Exposure to ethylene glycol vapors in poorly ventilated areas may cause nose and throat irritations, headaches, nausea, vomiting and dizziness.

END

Chapter 3: Fluid Testing and Storage

Chapter 3: Fluid Testing and Storage

3.1 Approved Fluids

3.1.1 Type I Deicing Fluids (Unthickened)

The deicing fluids meet one or more of the following specifications that the FAA has adopted as a standard for Type I deicing fluid performance. The Holdover Time Tables (refer to Appendix F) apply only to fluids meeting these specifications. These fluids are approved for deicing Mesa Airlines, Inc. aircraft as indicated. Any Type I fluid meeting the specifications below may be used on Mesa Airlines, Inc. equipment even though not listed below.

A. SAE AMS 1424.

B. ISO 11075.

C. AEA Type I.

3.1.2 Type II and Type IV Fluids

The FAA has adopted the following specifications as a standard for Type II and Type IV anti-icing fluid performance. The Holdover Time Tables (refer to Appendix F) apply only to fluids meeting these specifications. These fluids are approved for deicing and/or anti-icing the Mesa Airlines, Inc. aircraft as indicated. Type II and IV fluids should not be applied by equipment designed to spray Type I fluids unless these fluids have been tested and approved for use in such equipment by both the equipment and fluid manufacturer.

A. SAE AMS 1428.

B. ISO 11078.

C. AEA Type II or IV general information.

3.1.3 Type III Deicing Fluids

The deicing fluids meet one or more of the following specifications that the FAA has adopted as a standard for Type III deicing fluid performance. The Holdover Time Tables (refer to Appendix F) apply only to fluids meeting the specifications below. These fluids are approved for deicing Mesa Airlines, Inc. aircraft as indicated. Any Type III fluid meeting specifications below may be used on Mesa Airlines, Inc. equipment even though not listed below.

A. SAE AMS 1428.

B. ISO 14025.

C. AEA Type III.

3.2 Storing, Preparation and Mixing of De/Anti-icing Fluids

3.2.1 Mixing Precautions/Storage

3.2.1.1 Mixing

A. Do not mix ethylene glycol and propylene glycol based fluids. Mixing these fluids will cause inaccurate glycol tester readings.

B. Do not mix Type I, Type II, Type III and Type IV fluids together. They may not be compatible and mixing can cause a degradation of Type II and Type IV fluids.

C. Do not mix different brands of Type II or Type IV fluids. They may not be compatible and mixing will cause degradation in fluid performance.

3.2.1.2 Storage

A. Storage tanks should remain sealed/closed when not in use. Prior to, and after, filling the deicing vehicle, the agent will ensure that the storage tanks are sealed and closed when not in use.

B. Type II/IV Storage tanks should be examined annually for corrosion and/or contamination. For drum or tote storage, only one container per lot number needs to be tested. Complete a Refractive Index and Fluid appearance check as it provides the tank corrosion check. Fluid discoloration and particle content indicates corrosion and/or contamination. If corrosion or contamination is evident, notify the Mesa Airlines, Inc. Manager of Airport Operations & Safety Assurance via email (Station-Compliance@mesa-air.com), mail (Manager of Airport Operations & Safety Assurance, Mesa Airlines, Inc., 410 N. 44th Street, Phoenix, AZ 85008), fax (602-685-4548) or verbally by phone (602-685-4000). Notification shall be made by the Station Manager or designee and may be made verbally or in written form.

NOTE

Although de/anti-icing fluids are generally non-corrosive, their vapor can be corrosive. To minimize corrosion at the liquid/vapor interface and in the vapor space, a high liquid level in the tanks is recommended.

1. Anti-icing Failed Fluid Procedures

   a. If a fluid fails, the fluid storage shall be quarantined and an inoperative equipment tag attached. Tag shall be attached until the Manager of Airport Operations & Safety Assurance approves appropriate action. Such action may be retesting with new equipment, testing by the supplier, conversion to Type I fluid only use, disposal or removal by supplier.

b. If time allows, the station should request confirmation and perform a re-sampling. There are several reasons to expect different results from the re-sample. Sometimes the sampling itself was inadequate; sample must be taken from the middle of the storage to be representative, it may have been taken at the surface, where special behavior occurs, or taken out of a spraying nozzle.

c. In case of confirmed fluid failure, the station should request replacement by the supplier if the initial delivery is less than two years old and appropriate storage precautions were in place.

d. Failed anti-icing fluid may be readily converted to deicing fluid by gradual mixing with Type I fluid currently available at the station if both fluids contain the same glycol base (both PG or both EG). The dominant color must remain that of Type I fluid.

1) Check Freezing Point of failed Type II or IV fluid with usual Type I fluid check method described in section 6.1.5.1 Freezing Point of pure Type II or IV is generally close to a 50/50 mix of a Type I fluid (high concentrate). Therefore, it is recommended to perform the addition of failed Type II or IV fluid to a diluted Type I fluid (at least 50/50) in order to avoid “weakening” the glycol content by the addition. If the fluid is heated and circulated, continue circulation for at least one minute after the boiler burners have shut down. This will prevent boiler tube damage due to burned fluid thickener attached to the coil inner wall.

e. Disposal of failed Type II or IV fluid, which cannot be converted, must be performed in compliance with local waste effluent regulation.

C. Tanks and transfer systems should be dedicated and conspicuously labeled for a specific type of fluid to avoid contamination with other fluids.

D. Type II and Type IV fluids should be stored in a stainless steel, fiberglass container or other material compatible as specified by the fluid manufacturer.

E. Storage temperature limits for the fluid shall comply with manufacturers requirements.

3.2.2 Type I Fluid (Deicing Fluid)

3.2.2.1 General

Type I fluid is a deicing fluid and contains a high glycol content, and is relatively low in viscosity, except at very cold temperatures. This fluid is mixed with a predetermined percentage of water based on prevailing or expected temperatures and current or local forecast weather conditions at the time of deicing. To melt snow, ice and frost from aircraft surfaces, the deicing fluid must be applied to the aircraft heated. The desirable temperature range is 140° to 180°F as outlined in the applicable HOT Chart. Fluid temperatures of less than 140°F may also work effectively but generally will require longer deicing times and excessive fluid. Cold Type I fluid (glycol/water mixtures) will not melt snow, ice or frost but after deicing is accomplished, may provide limited protection against moisture refreezing to aircraft surfaces depending on the current weather conditions.

3.2.2.2 Preparation (Mixing Procedures)

A. Deicing solution mixing requirements change with corresponding changes in ambient temperatures and weather conditions. To attain the most efficient and effective utilization of deicing fluid at the specified ambient temperatures and weather conditions, the mix ratios of glycol and water specified in this chapter must be observed. Deicing personnel should be aware that even when mixed as specified for the anticipated weather condition and ambient temperature, the deicing fluid solution effectiveness may be reduced by such factors as:

1. Solution dilution from melting ice, snow, frost or freezing rain.
2. Run-off from deiced aircraft surfaces.
3. Lowering of ambient (outside) temperatures.
4. Lower aircraft surface temperature.
5. Blow-off from other aircraft engine exhaust blasts.

B. Upon receiving deicing fluid from the distributor, review the label affixed to the barrel or container and determine if the fluid has been delivered premixed or as a concentrate. If the fluid is premixed with water, additional dilution may not be necessary.

NOTE

Type I fluid containing at least 80% glycol is considered a concentrate and future dilution with water may be required prior to application.

C. If the dispensing vehicle (deicer) is used for stowage of deicing solution during winter operations and uncertain weather conditions exist, a standard mix ratio of one part Type I glycol (50% by volume) to one part water (50% by volume) should be maintained.

D. It is not recommended to fill the dispensing vehicle to more than 70% capacity as expansion room may be required if the 50/50 mixture is not appropriate for the current deicing task.

E. When Type I fluid is being used for both deicing and limited anti-icing protection, care must be taken to assure that the glycol to water ratio is mixed to a proportion that provides a deicing fluid freezing point that is at least 18°F below the prevailing or expected outside ambient temperature. This degree of difference will allow for air temperature, other weather condition changes, the variation between the ambient air temperature and the aircraft's external surface temperature.

F. When filling manual-mix (premix) vehicles, use the proper ratio of Type I fluid to water using the instructions below. Ensure that the solution is thoroughly circulated or mixed prior to testing or application by mixing with a long handled paddle or other device.

1. Deicing Vehicle Empty

   Uncertain weather conditions normally use a standard mix ratio of 50/50. This ratio will allow for a fluid freezing temperature of -7°F to -24°F depending on the manufacturer and specific type of fluid. If the anticipated ambient temperature is expected to drop lower than 0°F, adjust the mixture to protect against freezing. For known weather conditions, use the mix ratio as specified using Table 3-2: "Type I Fluid Mixing Adjustments" for the anticipated weather conditions and ambient temperature.

2. Deicing Vehicle Partially Filled

   The following mixing options ensure adequate solution concentration when filling vehicles that are partially filled. Select the appropriate mixing option after first determining the mix ratio of the existing solution using a Misco 7084VP or 7086VP Glycol Tester.

   a. Uncertain Weather Conditions

      Standard mix ratio procedures: Determine the freezing point of the existing solution. Using Table 3-2: "Type I Fluid Mixing Adjustments", determine the ratio of Type I fluid and water required to obtain a standard 50/50 mix solution with a 25% total standby capacity. Ensure that the solution is thoroughly mixed and recheck the solution freezing point.

   b. Known Weather Conditions

      Mix ratio change procedure: Determine the mix ratio of existing solution. If the ratio of the existing solution is determined to be the same as the mix ratio required for the anticipated ambient temperature and weather condition, use Table 3-1: "Type I Fluid Mixing Ratios" for that temperature. If the mix ratio of the existing solution is determined to be for a higher or lower freezing point than that required for the anticipated ambient temperature, the freezing point of the solution should be adjusted for the anticipated ambient temperature using the steps provided in Table 3-2: "Type I Fluid Mixing Adjustments".

   c. Portable Type Deicing Units

      Stations utilizing portable, manual-pump, hand-held or back-strap type deicing units that do not contain internal electrical immersion heating elements should use heated tap water when mixing deicing fluid solution. Normal heated tap water temperatures can range from 110°F to 150°F at the point the water is drawn from the spigot. Stations having deicing units of this type should mix and apply the deicing fluid as close to departure as possible while the mixture is still heated. However, allow enough time to successfully deice the aircraft without creating a delay.

Table 3-1: Type I Fluid Mixing Ratios

FLUID FREEZE POINTS OF PREDILUTED DE/ANTI-ICING FLUIDS	
Type of Fluid	**Fluid Freeze Point**
OCTAFLO RTU premix	-30°F (-34°C)
UCAR ADF 50/50 premix	-22°F (-30°C)
UCAR ADF XL-54 premix	-45°F (-43°C)
Clariant Safewing MPI 1938 premix	-26°F (-32°C)
Inland Duragly P premix	-31°F (-35°C)

FLUID FREEZE POINTS OF MIXTURE RATIOS OF DE/ANTI-ICING FLUIDS					
Type of Fluid	**Mixture Ratio (Fluid/Water) and Fluid Freeze Point**				
	20/80	30/70	40/60	50/50	60/40
ARCO Plus	+20°F (-7°C)	+11°F (-12°C)	-2°F (-19°C)	-18°F (-28°C)	-41°F (-41°C)
OCTAFLO	+20°F (-7°C)	+11°F (-12°C)	-2°F (-19°C)	-18°F (-28°C)	-41°F (-41°C)
Kilfrost DF	+21°F (-6°C)	+15°F (-9.5°C)	+6°F (-14.5°C)	-7°F (-21.5°C)	-22°F (-30°C)
Safewing DGI 1937	+23°F (-5°C)	+14°F (-10°C)	-16°F (+3°C)	-23°F (-9°C)	-26°F (-32°C)
DEGree	+23°F (-5°C)	+16°F (-9°C)	+6°F (-14°C)	-9°F (-23°C)	+31°F (-35°C)
Safetemp	+24°F (-5°C)	+18°F (-8°C)	+2°F (-17°C)	-18°F (-28°C)	-40°F (-40°C)
1000 TF	+20°F (-7°C)	+13°F (-10.5°C)	0°F (-18°C)	-18°F (-28°C)	-51°F (-46°C)
SPCA DE-950	+23°F (-5°C)	+14°F (-10°C)	0°F (-18°C)	-13°F (-25°C)	-27°F (-33°C)
UCAR PG ADF	+20°F (-7°C)	+9°F (-13°C)	-6°F (-21°C)	-24°F (-31°C)	-49°F (-45°C)
Kilfrost DF Plus (88)	+20°F (-6.5°C)	+12°F (11°C)	+1°F (-17°C)	-13°F (-25°C)	-35°F (-37°C)
OCTAFLO EF	+21°F (-6°C)	+11°F (-12°C)	-2°F (-19°C)	-18°F (-28°C)	-40°F (-40°C)

G. These temperature ranges allow for some dilution of the de/anti-icing fluids when applied during wet conditions to deice aircraft during freezing temperatures. Care must be taken to assure that the fluid is mixed at a ratio that will allow a fluid freezing point that is at least 18°F below the ambient air temperature.

H. It is not recommended to apply propylene glycol based Type I fluids undiluted. Propylene glycol, having a strength of about 88% glycol is quite viscous (especially at very cold temperatures) and has been found to cause deterioration of aerodynamic performance.

I. It is not recommended to apply ethylene glycol based Type I fluids undiluted. The freezing point of some undiluted ethylene glycols is actually higher (around 8°F) than that diluted with water and can cause deterioration of aerodynamic performance.

J. These cautions do not apply to premixed fluids since they are already diluted with water.

K. Type I Fluid Mixing Adjustments

This calculation can be used when it is necessary to change the freezing point of an existing mixed solution in order to match the anticipated ambient temperature.

Table 3-2: Type I Fluid Mixing Adjustments

FLUID MIX RATIO ADJUSTMENT TABLE FOR TYPE 1 FLUID					
STEP 1					
Mixture Ratio Needed		X	Tank Capacity	=	Tank Gallons of Fluid Needed
60% Glycol / 40% Water	.60	X	250	=	150 Gallons
STEP 2					
Existing Mixture Ratio		X	Gallons of Existing Solution	=	Total Gallons of Existing Fluid
50/50	.50	X	100	=	50 Gallons
STEP 3					
Total Gallons of Fluid Needed		-	Total Gallons of Existing Fluid	=	Gallons of Fluid Add to Vehicle
150	150	-	50	=	100 Gallons
STEP 4					
Total Tank Capacity		-	Gallons of Existing Solution	=	Gallons of Mixed Solution Needed to Fill Vehicle
250	250	-	100	=	150 Gallons
STEP 5					
Gallons of Mixed Solution Needed to Fill Vehicle		-	Gallons of Fluid to Add to Vehicle	=	Gallons of Water to Add to Vehicle
150	150	-	100	=	50 Gallons

3.2.2.3 Deicing and Anti-icing Fluid Freeze Test

A. Type I Fluid

Type I fluid mix ratio requirements change with corresponding changes in ambient temperatures and other weather conditions. If the fluid is used for both deicing and limited anti-icing protection, the freeze point buffer must be at least 18°F below the OAT. If the fluid is used for deicing only to be followed with anti-icing fluid, the deicing fluid mix must have a freeze point no higher than 5°F above the OAT. To assure that proper deicing fluid concentration ratios are being used for the current de/anti-icing task, a fluid freeze test must be conducted:

1. After partially or completely filling the deicing truck/cart.
2. Immediately prior to the first deicing operation each day.
3. Deicing crew change (truck or cart).

4. Performing the Test

   a. Mesa Airlines, Inc. uses the Misco Glycol Tester (Model 7084VP and 7086VP (orange in color) to measure the approximate freezing point of the mixture for all Type I fluids. Other glycol testing instruments may be used provided the device can accurately gauge the fluid as determined by either the fluid manufacturer or manufacturer of the device.

   b. A refractometer is required to determine the freezing point of diethylene glycol based fluid. Do not use the Misco glycol testers for this product.

   c. Prior to conducting the test, the deicing fluid mixture should be well blended to ensure accurate readings.

   d. Determine whether the fluid is ethylene or propylene based.

   e. Ensure the measuring glass and prism are clean and dry.

   f. Place several drops of fluid on the glass and close the prism.

   g. If not equipped with a View Point Illuminator, point the device toward a light source and view the appropriate ethylene or propylene scale and determine the mixture freezing point.

B. Type II and IV Fluid

It is Mesa Airlines, Inc. standard procedure not to dilute Type II and IV fluids; therefore, testing the freezing point of this fluid is not necessary. If however, Type II & IV fluid is applied to Mesa Airlines, Inc. aircraft diluted with water to be used as either a heated deicing agent or an anti-icing agent following deicing, the mixture fluid freezing point must be determined. A refractometer is used to determine the freezing point of the mixture. Some Type II and IV fluids require the use of a refractometer in combination with a fluid refractive index in order to determine the freezing point of the mixture. Refer to the applicable fluid specification sheet for testing procedures. The Misco glycol tester does not accurately determine the mixture freezing point of all Type II and IV fluids.

C. Type III Fluid

A fluid (fluorescent yellow) ready to use as a one step for deicing and anti-icing. The fluid is stored, handled, heated and sprayed like a Type I Fluid. Type III has longer Holdover Times than Type I. Type III Fluid can be applied with centrifugal pumps used for spraying Type I Fluid. A positive displacement pump used to apply Type I Fluid is not required. Type III Fluid is applied to Mesa Airlines, Inc. aircraft diluted with water to be used as either a heated deicing agent or an anti-icing agent following deicing; the mixture fluid freezing point must be determined.

NOTE

When Type II, III, or IV fluids are diluted to other than the standard published 100/0, 75/25, or 50/50 dilutions, the more conservative HOT and lowest operational use temperature (LOUT) associated with either the dilution above or below the selected dilution are applicable.

D. Refractometer and Glycol Tester Check

Refractometers and glycol testers shall be checked daily by the station manager or designee when de/anti-icing conditions are forecast or in effect prior to de/anti-icing the aircraft. This will be documented on the Aircraft Deicing/Anti-icing Record (Form #M504), or equivalent, from October 1 through April 30, or until the end of the local deicing season, using following steps:

1. Use distilled water as the reference test fluid.
2. Open the cover and carefully wipe the prism and cover clean with soft, clean tissue.
3. Place a few drops distilled water on the prism and close the cover.
4. 7064VP+ glycol testers should read 0°C. Misco 7084VP+ glycol testers should read 32°F.
5. Misco Brix refractometers should read 0° Brix and Kilfrost and equivalent refractometers should read 1.333.
6. The Kilfrost and equivalent refractometers are not temperature compensated and should be tested when the devices are near room temperature.
7. If the refractometer or glycol tester does not give the correct reading for distilled water, clean the prism and cover and repeat the test. If it fails again, do not use.

E. Refractometers are sealed units and do not have moving parts associated with obtaining the freeze point and/or refractive index. Misco refractometers do not require calibration by the manufacturer unless the unit does not pass the water test check. Other units may need calibration as required by the manufacturer. Refractometers that do not show 32°F when testing the calibration of the refractometer should be returned to the factory for repair. The Regional Manager should be contacted if this occurs.

F. Hydrometer - Ethylene Glycol

1. Draw a sample of the fluid from below the surface into the hydrometer.

NOTE

Compare the eutectic (freezing) point found in either procedure above with the temperature range found in the Guidelines for the Application of SAE Type I Fluid (Appendix F of this manual). At no time can the ambient temp range indicate a mixture of less than 40/60 in seasonable climates (climates that do not drop below +14°F).

G. Refractometer and Glycol Tester Calibration: May need calibration as recommended by manufacturer or if it does not pass the calibration test as recommended by the manufacturer.

3.3 Deicing Fluid Effectiveness and Holdover Times

3.3.1 De/Anti-icing Fluid Effectiveness

A. Many variables can influence the period of effectiveness and/or protection of de/anti-icing fluid applied to aircraft surfaces including; temperature, wind, amount and type of precipitation, fluid mixture concentration, distance from the nozzle to the surface, etc.

B. Deicing during snow or freezing rain may require several applications before the aircraft departs. The continuous melting of snow and ice on the aircraft surface dilutes the deicing fluid mixture, decreasing its effectiveness.

C. If the deicing fluid mixture along with the melted snow and ice accumulations are refreezing to the aircraft surface prior to running off the aircraft, a stronger deicing fluid mixture is needed to complete the deicing process.

D. The consensus of the aviation community and the conclusion reached by the FAA is that the only method of assuring flight safety following ground operations in conditions conducive to aircraft icing, is by close inspection prior to takeoff.

3.3.2 Holdover Times (HOTs)

A. HOT is the estimated time de/anti-icing fluid will prevent the formation of frost or ice and the accumulation of snow on the critical surfaces of an aircraft. HOT starts at the beginning of the application with one-step de/anti-icing and with the beginning of the anti-icing process with two-step de/anti-icing.

B. The starting time is provided by the ground deicing crew once the de/anti-icing has been completed and the aircraft has received a post de/anti-icing check. HOT ends when fluid applied to the aircraft loses its effectiveness or when maximum time taken from the Holdover Time Tables elapses, whichever occurs first.

3.3.3 Holdover Time (HOT) Tables

Refer to Appendix F of this manual or the Mesa Airlines, Inc. *General Operations Manual* #410 for Holdover Time (HOT) Tables.

3.3.4 Flight Crew Responsibilities

A. The determination of the Holdover Time is the responsibility of the PIC.

B. The PIC has the final responsibility to ensure that the aircraft is ready for flight. The first officer will perform duties as assigned by the PIC.

C. A member of the flight crew shall be responsible for, and trained in accordance with, this manual and the applicable flight crew manuals to ensure that the aircraft is properly de/anti-iced and checked after de/anti-icing during ground operations. Pilots will apply Holdover Time procedures in accordance with the de/anti-icing fluids and deicing methods in the Mesa Airlines, Inc. *General Operations Manual*.

3.4 Fluid Data Information

A. The Holdover Time Tables are only applicable for the specific commercially available fluid in use.

B. Data on SAE composite (which can be used in all cases) and specific commercially available fluids can be found in the list that follows:

1. Transport Canada Holdover Time (HOT) Guidelines, website http://www.tc.gc.ca/eng/civilaviation/standards/commerce-holdovertime-menu-1877.htm
2. The equivalent documents issued by local aviation authority.
3. The generic SAE composite Holdover Time Tables found in Appendix F of this manual.
4. http://www.faa.gov/other_visit/aviation_industry/airline_operators/airline_safety/deicing/

END

Chapter 4: Contamination Removal and Fluid Application

Chapter 4: Contamination Removal and Fluid Application

4.1 Aircraft Parking

Several precautions should be exercised to protect aircraft and ease the deicing process when parking aircraft in cold adverse weather conditions or when such conditions are forecast such as; frost, snow and freezing rain. Observe as many of the following precautions as possible.

4.1.1 Overnight or Long-Turn Aircraft

A. Position the aircraft in a hangar (if available).

B. Clear the area where the aircraft will be parked of snow, ice and slush. If this is impracticable, clear the area around the landing gear to reduce the possibility of tires freezing to the ground.

C. If possible, park the aircraft into the wind. Install all plugs and covers, if available.

D. Drain the galley water containers or remove if the aircraft cabin temperature is expected to fall below freezing. When draining potable water, use a bucket of sufficient size to capture the water. Do not allow water to drain onto ramp during icing conditions as it could freeze on the surface and create slip and fall hazards for ground personnel.

E. On snow, ice and slush, aircraft should be taxied instead of towed to a parking position whenever possible.

F. If towing is required, ensure the aircraft is loaded as lightly as possible. Remove large accumulations of loose ice, snow and slush from overnight aircraft manually.

G. Do not use Type I and Type III deicing fluid for overnight applications. The deicing fluid will melt the fresh snow, ice and frost and could refreeze overnight as an adhering coat of ice.

H. When weather conditions warrant, the use of Type II and IV anti-icing fluid can be used to protect the aircraft. If an aircraft is treated, then it must be deiced the next morning with deicing fluid regardless of precipitation during the night.

I. To prevent parking brakes from freezing, the flight deck crew may not apply the parking brake, therefore, aircraft chocks will be required for both main and the nose landing gear.

4.1.2 Short-Turn or Through Aircraft

Clear the area where the aircraft will be parked of snow, ice and slush. If this is impracticable, clear the area around the landing gear to reduce the possibility of tires freezing to the ground. Park the aircraft into the wind, if practical.

4.2 General Procedures

4.2.1 Precautions

The following precautions must be observed during any deicing operation:

A. Passengers should not be allowed to walk through de/anti-icing fluid on the ramp.

B. Aircraft boarding stairs must be cleared of all de/anti-icing fluid prior to passenger boarding.

C. Ethylene/Diethylene based de/anti-icing fluid is toxic. Contact with skin and eyes should be avoided. Adequate protective clothing will be worn by all deicing personnel (i.e., protective gloves, safety goggles, face shield and mask).

D. Spraying up wind should be avoided.

E. Heated deicing fluid is hot and can cause serious injury.

F. Do not put any part of your body in front of spray gun/nozzle or point it at anyone.

G. Do not operate deicing equipment if there are leaks in the hose.

H. During strong, windy conditions, position yourself so that you are high enough to spray down onto the aircraft surfaces and with the direction of the wind.

I. Grasp the spray gun/nozzle firmly before commencing spray and exercise care and caution in its handling.

J. Before beginning any deicing operation, ensure all ground equipment and other obstacles are out of the deicing path.

K. Deicing units are not to be used to de-ice ground equipment.

L. Ensure the tow vehicle’s brakes are set.

M. Deicing unit brakes must be set.

N. Do not spray while the deicing unit is in tow; as the over spray, mist and steam may limit the driver’s visibility.

O. When using boom-type deicing units and work stands/platforms, the safety bar, chain or other device must be securely latched across the opening and the safety belt or harness should be worn.

P. Personnel will not be positioned on a boom-type deicing unit while in tow, unless in an enclosed cab with safety belt on or wearing a properly secured full body safety harness.

Q. Under no circumstances will de/anti-icing be performed while passengers are boarding or deplaning any Mesa Airlines, Inc. aircraft.

4.2.2 Procedures

A. The primary method of removing frozen precipitation from the aircraft is to apply heated water or a water/glycol mixture in sufficient amounts to melt the existing accumulation. However, if heavy accumulations are present on the aircraft, it is more economical to remove manually using long-handled brooms and brushes. This method helps to reserve expensive deicing fluid for final applications to melt residual and adhering accumulations and to help prevent the refreezing of melted snow, ice and frost.

B. Heated water can only be used when the air temperature is -3°C (27°F) and above and must be immediately followed by anti-icing fluid application. When the air temperature is below -3°C (27°F), heated water must be mixed with glycol with a freezing point of no more than 3°C (5°F) above outside air temperature. Heated water can not be used in a one-step method.

4.3 Pre-Deicing Operation Checks and Planning

Prior to commencing any deicing operation, certain checks should be performed on the deicing equipment and deicing fluid mixture. This equipment will be checked prior to use as recommended by the equipment manufacturer (but not less than once daily) using the pre-operational equipment checklist as provided by the equipment manufacturer. This pre-operational checklist will be maintained at/on or near the unit and confirmation of the required pre-operational check will be documented on the GSE Daily Inspection Record.

4.3.1 Equipment

A. Check the approximate freezing point of the deicing fluid mixture.

B. Check the deicing fluid temperature. For maximum effectiveness, minimum consumption and in order to utilize the Type I, II and III Holdover Time Tables, the deicing unit must be capable of heating the deicing fluid to a temperature of at least 140°F at the nozzle (do not exceed 200°F).

C. The deicing fluid mixture level should be checked to ensure an adequate amount is available to complete the deicing operation.

D. Check the undiluted deicing fluid level to ensure an adequate amount is available.

E. Check deicer engine oil level.

F. Ensure the engine gasoline tank is full.

G. Check deicer pump, hoses and spray gun/nozzle for leaks and proper operation.

H. On boom-type deicing units, ensure all bolts, nuts and other fasteners are tight.

I. If utilizing ladders or portable stairs, ensure all bolts, nuts and other fasteners are tight.

J. Check for overall sturdiness and stability.

K. Disconnect all electrical cords before moving deicer unit.

4.3.2 Overnight or Long-Turn Aircraft

When an aircraft has been parked (unprotected) either overnight or for a long period of time and frost, snow or ice is present on the aircraft surface, deicing should be accomplished as close to departure as possible to prevent the deicing process from having to be repeated. However, allow sufficient time to successfully deice the aircraft to avoid any departure delays, taking into account:

A. Type and Size of Aircraft

Larger aircraft will take longer to deice than smaller aircraft.

B. Condition of Aircraft

Heavy accumulations of loose snow and ice will need to be removed manually prior to applying deicing fluid. A thick coat of adhering ice will take longer to dissipate.

C. Current Weather Conditions

Cold temperatures, wind, icing conditions and other weather conditions can make the deicing process more difficult.

D. Type of Deicing Equipment Available

The time required to effectively deice an aircraft is greatly dependent on the type of deicing equipment to be utilized. Coordinate your station deicing plan based on available equipment.

E. Manpower Available

The manpower needed to deice an aircraft is dependent on the size, type and condition of the aircraft and the available deicing equipment. Those individuals designated in the stations local deicing plan should coordinate procedures for deicing aircraft parked overnight when snow, frost or ice is present on the aircraft. It is not necessary for the flight deck crew to be present to begin deicing. Aircraft dispatched from a hangar should receive a coating of de/anti-icing fluid immediately upon exiting during periods of weather conditions conducive to ground icing. This reduces the possibility of snow and freezing rain from refreezing and adhering onto the aircraft as it melts from landing on the warmer aircraft surface.

4.4 Aircraft De/Anti-icing Procedures

4.4.1 Precautions

A. Apply sufficient fluid to ensure any remaining diluted fluid on the deice surfaces (as a result of the deicing process) is displaced by a fluid with a freezing point of at least 18°F (10°C) below the OAT if anti-icing with Type I fluid. In the cases of Types II, III and IV fluids, ensure they are applied in the temperature ranges for undiluted or diluted as shown in the HOTs and that quantities are sufficient to displace deicing fluid. If applied according to the respective HOTs, the freezing point buffer requirement of at least 13°F (7°C) below the OAT will be met. To determine this check the refractive index/Brix (refer to the manufacturer's information).

B. The effectiveness of Type II and IV fluids is highly dependent on the training and skills of the individual applying the fluids. When these fluids are used, ground personnel should insure that hey are evenly applied so that all critical surfaces, especially the leading edge of the wings, are covered with fluid. In addition an insufficient amount of anti-icing fluid, especially in the second step of a two step process procedure, may result reduced HOT because of the uneven application of the second-step fluid.

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

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

E. It is acceptable to de/anti-ice the aircraft while the main engines are operating in the idle position; however, all personnel and equipment must stay completely out of the aircraft engine danger zone without exception.

F. The running of engines must not in any way inhibit the complete de/anti-icing process or aircraft inspection procedures. If it is not possible to completely deice and inspect the aircraft without entering the engine danger zone, then the engines must be shut down.

G. Under no circumstances will de/anti-icing be performed while passengers are boarding or deplaning any Mesa Airlines, Inc. aircraft.

H. Passenger boarding, cargo and all other service doors must be closed (except for passenger boarding doors connected to jet bridge).

I. Do not apply de/anti-icing fluid to any aircraft access stairs.

J. Flight deck crews will configure the flight controls and APU for de/anti-icing. Flaps and spoilers should be retracted. If the aircraft is in a different configuration, inspect and clear all hinges and mechanisms of frozen deposits before advising the flight deck crew to alter the configuration.

K. Ensure that ice and/or snow is not forced into areas around flight controls during ice and snow removal.

L. Remove all ice and snow around passenger and cargo door areas before closing.

M. Closing of these doors by force when ice or snow accumulations are present can damage door seals and tracking devices. Manually apply a small amount of deicing fluid to lower door sills and bottom edge of door prior to closing doors for flight (if necessary).

N. Do not spray heated deicing fluid directly on cold windows.

O. To minimize the loss of fluid effectiveness, while maintaining a safe distance between equipment and aircraft surfaces, apply hot fluid with the nozzle as close to the aircraft surface as possible without damaging aircraft surfaces. Avoid using high-pressure spray to “batter” ice and snow from aircraft surfaces. Thin skinned or composite surfaces can be damaged easily. Apply deicing fluids at low angles while ensuring that the fluid is directed under layers of snow and ice causing the snow and ice to lift up in sheets.

P. Cover the entire aircraft surface directly during deicing (except windows or other area where a direct spray is not recommended). Do not rely on fluid overflow to melt and or remove frozen accumulations. Heavy accumulations of snow and loose ice should first be removed by using manual methods. These procedures will provide a greater assurance that no frozen precipitation remains under the deicing fluid.

Q. Do not try to scrape, chip or break adhering ice from the aircraft surface. Some aircraft's exterior areas are constructed of composite metals and can be damaged easily.

R. Do not spray deicing fluid directly into engine intake and exhaust areas, APU, vents, cabin air intake ducts, drains, pitot tubes, TAT probes, static ports, etc.

S. De/anti-icing fluid sprayed into the engine compressor inlet cannot be removed and will result in reduced engine performance, including loss of power and subsequent replacement.

T. Cabin/cockpit Windows and Wipers: Never spray fluid directly on cabin or cockpit windows unless specifically requested to do so by the PIC. This could cause window crazing. Methods for removing snow and ice accumulation include brooming excess snow off prior to deicing, using a rubber water bottle filled with glycol to spray the window or using a low angle and low pressure fan spray setting on the deice hose nozzle to clear contamination. Remove ice accumulation from wiper blades using the same methods.

U. When driving a deicing unit to the aircraft, never exceed a speed of 4 mph. Upon approaching or maneuvering around the aircraft never exceed a speed equal to that of a normal walking pace.

V. Do not attempt to break ice from aircraft surfaces by moving aircraft controls.

W. Do not attempt to move an aircraft when the tires are frozen to the ground. Ensure all wheels rotate when the aircraft is moved.

X. When mixed with water and used as specified, de/anti-icing fluids do not present a fire hazard; however, fluid should not be allowed to come in contact with hot brakes or other hot surfaces such as APU exhaust ducts and main engine exhaust areas.

Y. When removing snow and ice mechanically or with the de/anti-icing spray nozzle, move frozen accumulations away from any surface openings.

Z. When removing snow and ice from wing and tail surfaces, use caution to avoid damaging vortex generators.

AA. To minimize the possibility of toxic fumes entering the cabin or cockpit, take extreme care to prevent excessive use of the de/anti-icing fluid solution around the cabin and cockpit heater and/or ventilator air intake ducts. Advise the crew to shut down air conditioning packs prior to de/anti-icing.

AB. Do not allow fluid to contact hot brake units. When large accumulations of snow, ice or slush are present on wheels and brakes, spray heated de/anti-icing fluid sparingly to retard ice formation and build-up.

AC. Landing gear doors, latches (up and down), steering cables, alternate extension cables, springs, actuators and indicating switches must be cleared of ice and snow accumulation.

AD. De/anti-icing fluid may be applied to aid removal and prevent additional build-up.

AE. Care must be exercised when spraying de/anti-icing fluids to prevent washing out lubricants from exposed bearings and joints.

AF. It is acceptable to de-ice/anti-ice the aircraft while the APU and/or main engines are operating at idle; however, verify with the flight deck crew that the bleed air valve is in the proper configuration. Do not spray deicing fluid into the air intake or exhaust.

4.4.2 Anti-icing Protection for Overnight/Layover Aircraft

NOTE

Critical surfaces must be free of contaminants prior to applying anti-icing fluids.

A. Stations using Type II and IV fluid may anti-ice overnight/layover aircraft if frozen precipitation is forecast. This process helps decrease the amount of time and fluid needed to prepare the aircraft for an upcoming departure. When anti-icing fluids remain on the aircraft for long periods of time, the fluid properties can change impacting the shearing properties of the fluid.

B. When Type II or IV fluids are applied to overnight/layover aircraft, whether precipitation occurs or not, the aircraft must be deiced with deicing fluid prior to flight departure. Should it become necessary to re-protect an aircraft prior to departure, surfaces must be deiced before applying an additional coating of anti-icing fluid. Under no circumstances can an aircraft that has been anti-iced with Type II or IV fluid receive another coating of anti-icing fluid directly on top of the existing fluid.

4.4.3 Manual Methods

A. Heavy accumulations of dry snow and loose ice are more cost efficiently removed manually by using brooms and/or brushes followed by an application of heated deicing or anti-icing fluid. Manual removal of snow and loose ice also helps to prevent these accumulations from refreezing on the aircraft after being melted by heated deicing fluid. While deicing aircraft manually, it is permissible to encroach on the 5-foot equipment clearance requirement. Extreme care will be taken to ensure that damage to equipment and aircraft does not occur.

B. Do not stand on any part of the aircraft surface while manually deicing. Do not rest or lean any ladders or platforms against the aircraft while manually deicing. Under no circumstances will aircraft be manually deiced while the main engines are operating. Using a ladder or platform to gain access to the affected areas, pull the loose snow and ice off the critical surfaces of the aircraft. Critical aircraft surfaces are identified as:

1. Wings.
2. Windshields.

3. Stabilizers.
4. Fuselage.
5. All control surfaces.
6. Angle-of-Attack vanes.
7. Pitot probes.
8. Engine and APU air intakes.
9. Static ports.

4.4.3.1 Snow/Loose Ice Removal from Fuselage

Areas that are accessible and easily reached with a long handled broom or brush may be brushed free of loose snow and ice. Any exposed metal surfaces on the broom, including attaching hardware, must be padded to prevent damage to the aircraft surface.

4.4.3.2 Snow/Loose Ice Removal from Wings, Wing Struts and Tail Surfaces

Loose snow and ice can best be removed from the wings and control surfaces using long handled brooms and brushes. Personnel sweeping loose snow and ice from the wings or tail surfaces should work from a stand placed in close proximity to but not touching the aircraft. Use extreme caution not to damage vortex generators.

4.4.3.3 Landing Gear

If the landing gear needs deicing, brush off loose accumulations of snow with a brush. Stubborn deposits may be removed by using a rag soaked in deicing fluid. Do not allow fluid to directly contact hot brake units. All landing gear and door lock mechanisms should be free of snow, slush, etc. and lightly coated with deicing fluid, if necessary.

4.4.3.4 Engine Intakes

Occasionally snow or ice accumulation may occur in the engine intakes during layovers or overnights. Although the best method of removing ice from the inlet is heat, this is generally not possible. An attempt should be made to brush out the snow by hand. Do not spray de/anti-icing fluid in the engine inlets. Indirect application of deicing fluid may be authorized per the instructions in the Mesa Airlines, Inc. *Deicing Manual* and Training Program.

A. With the engines completely shutdown, closely inspect the engine intakes for accumulations of snow or ice and remove manually.

B. If not removed, damage to the engine will occur during the initial start attempt (bent blades, etc.). A careful, close inspection of each engine intake and fan assembly is the only way to verify inlet condition.

C. The best method is to simply brush the snow out of the intake by hand while very carefully and slowly rotating the fan to ensure free, unrestricted rotation. If the fan does not rotate freely and with no restrictions, contact the PIC.

WARNING

Fingers can easily get caught in the fan assembly while spinning, causing injury.

D. If there is any indication that contamination has penetrated past the forward fan blades or through the Tail Pipe (aft engine exhaust area), contact the PIC immediately.

E. This procedure should be accomplished using a ladder or from an elevated surface.

4.4.4 Deicing with De/Anti-icing Fluid

A. Critical aircraft surfaces will require deicing with fluid in order to remove ice and snow that may still be adhering to the aircraft after manual deicing. The PIC is responsible for ensuring that the aircraft is in a proper configuration for deicing operations with fluid in accordance with the procedures as provided in their applicable operating manual/handbook.

B. Always apply fluid to the aircraft high points first with wide sweeping motions. Make several sweeping motions and let the fluid run over the surface. Do not hold the spray nozzle in one place waiting for the snow to dissipate.

C. To minimize the loss of fluid effectiveness, while maintaining a safe distance between equipment and aircraft surfaces, apply hot fluid with the nozzle as close to the aircraft surface as possible without damaging aircraft surfaces. Avoid using high-pressure spray to “batter” ice and snow from aircraft and apply deicing fluids at low angles while ensuring that the fluid is directed under layers of snow and ice causing the snow and ice to lift up in sheets. Do not rely on fluid overflow to melt and or remove frozen accumulations, cover the entire aircraft surface directly during deicing (except windows or other area where a direct spray is not recommended). Do not direct a solid fluid stream exactly perpendicular to the aircraft skin. Many aircraft have composite surfaces, which can be easily damaged. Apply only enough fluid to remove the ice or snow and allow a light coating of fluid to remain on the aircraft. While applying deicing fluid with a mop, broom or brush, wait for accumulations to dissipate or loosen. The separated accumulations may then be swept off the surface. Extreme caution should be exercised when operating ground equipment in the vicinity of an aircraft. Equipment used in the deicing process should be operated at a speed equal to that of a normal walking pace not to exceed 4 mph.

4.4.4.1 Suggested Application Sequence for Deicing

Apply the hot water or heated water/glycol solution to the aircraft in the following sequence. Do not spray fluid directly at the caution areas.

A. Begin at the outboard left wing from leading to trailing edge and continue inboard to the left fuselage.

B. Continue to the nose section of the aircraft applying fluid to the bottom surfaces of the fuselage, wings, landing gear doors and undercarriage. Use caution when deicing the landing gear.

C. Continue clockwise of the aircraft to the outboard right wing from leading to trailing edge and continue inboard to the right fuselage.

D. Carefully deice the engine nacelles using caution not to direct fluid into engine intake or exhaust.

NOTE

For aircraft with wing-mounted engines, deice the engine nacelles when deicing the respective aircraft wing and forward fuselage areas.

E. Continue around the aircraft at the right aft fuselage, engine nacelle using caution not to direct fluid into engine intake or exhaust. Deice the right side of the horizontal and vertical stabilizer starting on the upper surface working downward along the vertical stabilizer.

F. Move to the left aft and deice left aft fuselage, engine nacelle using caution not to direct fluid into engine intake or exhaust. Deice the left side of the horizontal and vertical stabilizer starting on the upper surface working downward along the vertical stabilizer.

G. Inspect the entire aircraft and apply additional fluid as required to completely remove all frozen accumulations.

H. If, for any reason, the deicing process is interrupted while frozen precipitation is falling and adhering to the aircraft, the entire aircraft must be inspected and deiced again as necessary.

4.4.5 Anti-icing

During periods of frozen precipitation, anti-icing fluid should be applied to the aircraft surface immediately following deicing if possible (generally within 3 minutes). This procedure will provide limited protection against the formation of frost, snow and ice.

NOTE

Critical surfaces must be free of contaminants prior to applying anti-icing fluids.

4.4.5.1 Residual Fluid Buildup

A. Type II and IV anti-icing fluids are considered to be “thickened” and are designed to be less “thickened” as the fluid is blown off of the aircraft during takeoff. This action is referred to as being “sheared” off as the forces of wind remove the fluid from the aircraft as it reaches high speeds. However, there are areas on the surface of an aircraft that are considered to be “aerodynamically quiet” meaning that these areas are not affected by the wind blowing across the aircraft as it moves at speed.

B. In these aerodynamically quiet areas, any fluid that collects may not shear off and can stick to the aircraft. This fluid, if not cleaned off, can gel, dry out and eventually become a powder. There have been cases reported where this gel or powder rehydrated during later anti-icing procedures and rain/snow conditions, then refroze as ice during flight interfering with flight controls and airframe vibration.

C. In order to ensure that Type II and IV anti-icing fluid contamination is not present on our aircraft, de/anti-icing agents performing de/anti-icing operations shall follow the procedures indicated below. To prevent any residual buildup contamination from occurring, the aircraft must be washed with hot water or a diluted Type I fluid prior to every application of Type II or IV fluid. Both the top and bottom surfaces of wings, stabilizers and flight controls must be cleaned, with particular attention being paid to flight control hinge points.

D. This can be easily accomplished as part of a two-step de/anti-icing procedure when using hot water or diluted Type I fluid to deice the aircraft. To detect residual buildup (gel or powder) during de/anti-icing operations, inspections must be conducted of the wing rear spar and hinge lines and leading edges of ailerons, flaps, elevators and spoilers for abnormal fluid thickening and appearance. Type II and IV residue as a result of fluid dry-out must be removed from the aircraft prior to flight dispatch.

4.4.5.2 Procedure

A. Upper surfaces of the wings - Start at the leading edge of the wing tip and work toward the wing edge and toward the wing root.

B. Upper surfaces of the horizontal stabilizers - Start at the leading edge and work toward the trailing edge.

C. Vertical stabilizer - Start at the top and work down.

D. Fuselage - Upper 1/3 of surface area as necessary.

E. Anti-icing operations must not be initiated if any frozen accumulation is present on the section being treated. If accumulation does exist, perform a complete deicing operation before anti-icing.

F. Continuously check the application of the fluid. Discontinue applying fluid once it begins to drop off of the leading and trailing edges.

4.4.5.3 Type II and Type IV Fluid Restrictions

A. Ensure aircraft is approved for Type II or Type IV fluids.

B. Anti-icing operations should not be initiated if any frozen accumulation exists on the aircraft. If accumulation does exist, perform a complete deicing operation before anti-icing.

C. Type II and Type IV fluid should be applied in a manner so as to remove residual Type I fluid if possible. Mixing the two fluids will reduce the Holdover effectiveness of Type II and Type IV fluid.

D. Do not apply Type II or Type IV fluid to:

1. Fuselage in front of the forward flight deck windows including the radome, cockpit windows, pitot tubes and angle of attack.
2. Static ports.
3. Cabin windows.
4. Engine inlets and exhaust.
5. Control surface cavities, the radome or nose.

4.4.6 Movement of Deicing Equipment

4.4.6.1 General

The procedures and precautions outlined in this subsection must be followed to ensure safe movement around Mesa Airlines, Inc. aircraft. It's recommended to divide the aircraft into four distinct work areas when moving de/anti-icing equipment around the aircraft.

A. Left wing and forward left fuselage.

B. Right wing and forward right fuselage.

C. Right aft fuselage and right side of the horizontal and vertical stabilizer.

D. Left aft fuselage and left side of the horizontal and vertical stabilizer.

E. The movement of the de/anti-icing equipment around the aircraft may vary depending on the type and number of deicing equipment being utilized to perform the de/anti-icing event. All precautions must be followed as outlined in this chapter. Approach paths and movement of the equipment is outlined in Figures 4.1 - 4.4. De/Anti-icing an aircraft requires close coordination of the deicing crew to ensure safety. Attempt to remove heavy accumulations from critical aircraft surfaces manually prior to the deicing with fluid.

NOTE

At some airports, the preferred application sequence may not be possible due to local airport procedures or instructions. If this condition exists, the ground crew must hold a briefing with the PIC to determine the appropriate course.

4.4.6.2 Portable Type De/Anti-Icing Equipment

The movement around the aircraft while utilizing portable equipment requires close coordination between the spotter/deicing agent and the tug operator to ensure safe movement around the aircraft. Portable deicing equipment must maintain a 5 ft. clearance from the aircraft. The spotter/deicing agent is responsible for ensuring proper clearance of the portable equipment movement around the aircraft. The driver must follow the spotter/deicing agent's instructions. It is necessary that the driver and spotter/deicing agent have a briefing before starting the operation to discuss the different terms that they will be using.

4.4.6.3 Single Vehicle

NOTE

Refer to Figure 4-1.

The movement around the aircraft while utilizing a single vehicle requires close coordination between the bucket operator and the truck operator to ensure safe movement around the aircraft. The bucket operator is responsible for the trucks movement around the aircraft. The driver must follow the bucket operator's instructions. It is necessary that the driver and bucket operator have a briefing before starting the operation to discuss the different terms that they will be using during the event. The deicing vehicle should maintain a 10 ft. clearance from the aircraft while the distance of the basket/closed cab should not come to within 4 ft. Do not exceed 4 mph while maneuvering around the aircraft. Maintain a distance of at least 5 ft. between the deicing nozzle and the aircraft. This will reduce the possibility of damage to the aircraft surface being deiced. Wings should be anti-iced first; this offers the best vantage point for the flight crew to perform the cabin check and extend hold over time if needed. The use of headsets or other means of communication (i.e., portable radio) must be utilized during the de/anti-icing event to ensure clear communication between the driver and bucket operator.

4.4.6.4 Dual Vehicle

NOTE

Refer to Figure 4-2.

De/anti-icing in areas that utilize two vehicles simultaneously requires close coordination between the two vehicle and bucket operators. Both vehicles should begin the de/anti-icing at the same time. In the absence of a Pad Commander the vehicle positioned on the left wing is designated as the lead vehicle and will coordinate the event. The lead vehicle will begin at the left wing (wing tip to wing root) continuing up the left fuselage, and then to the rear fuselage just aft of the wing continuing to the left side of the horizontal and vertical stabilizer. The secondary vehicle will begin at the right wing (wing tip to wing root) continuing up the right fuselage, and then to the rear fuselage just aft of the wing continuing to the right side of the horizontal and vertical stabilizer.

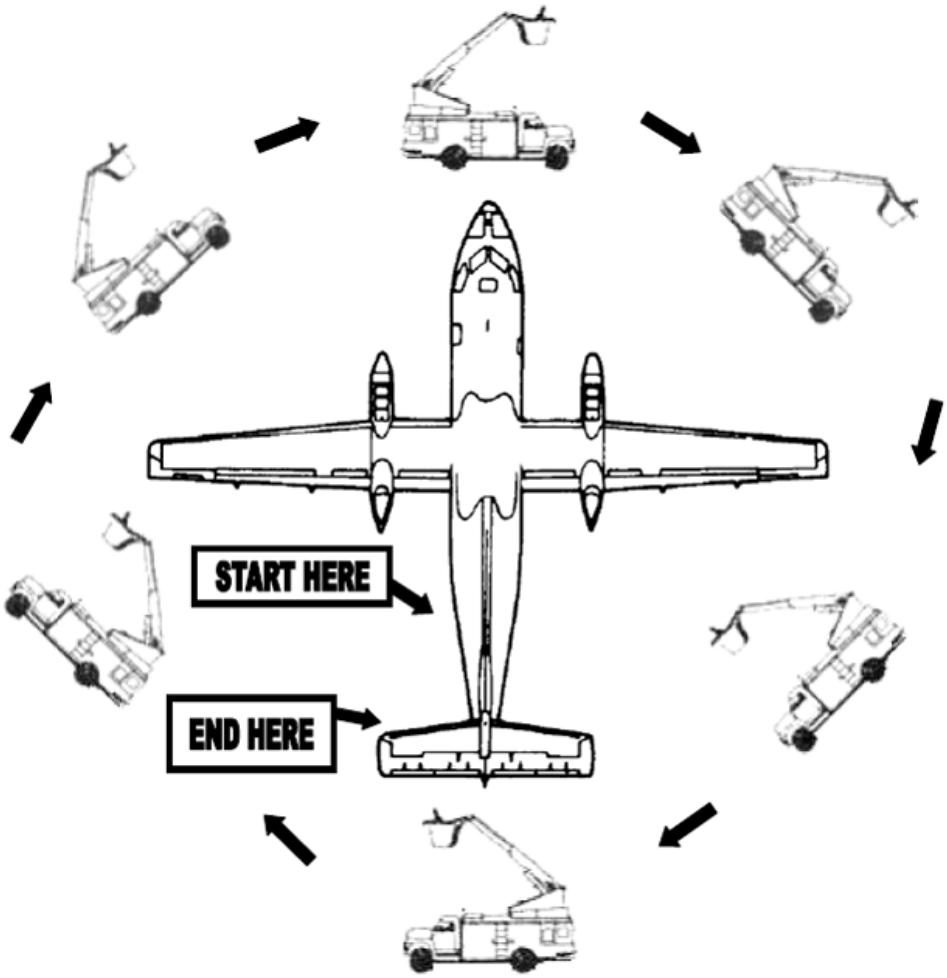


Figure 4-1: Single Vehicle Application Sequence (Not Aircraft Specific)

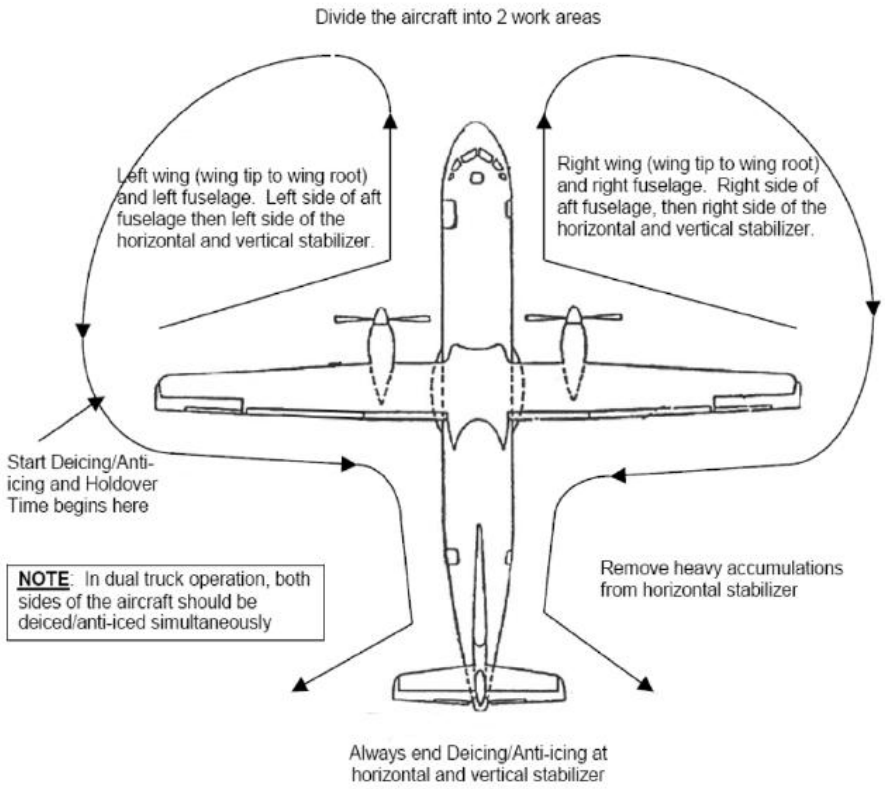


Figure 4-2: Two-Vehicle Application Sequence (Not Aircraft Specific)

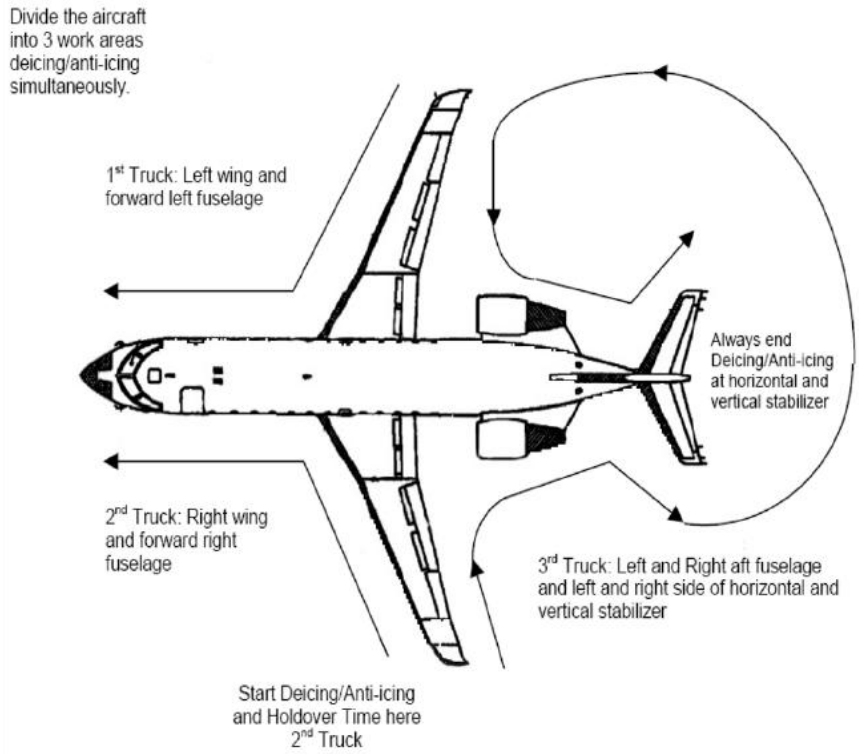


Figure 4-3: Three-Vehicle Application Sequence (Not Aircraft Specific)

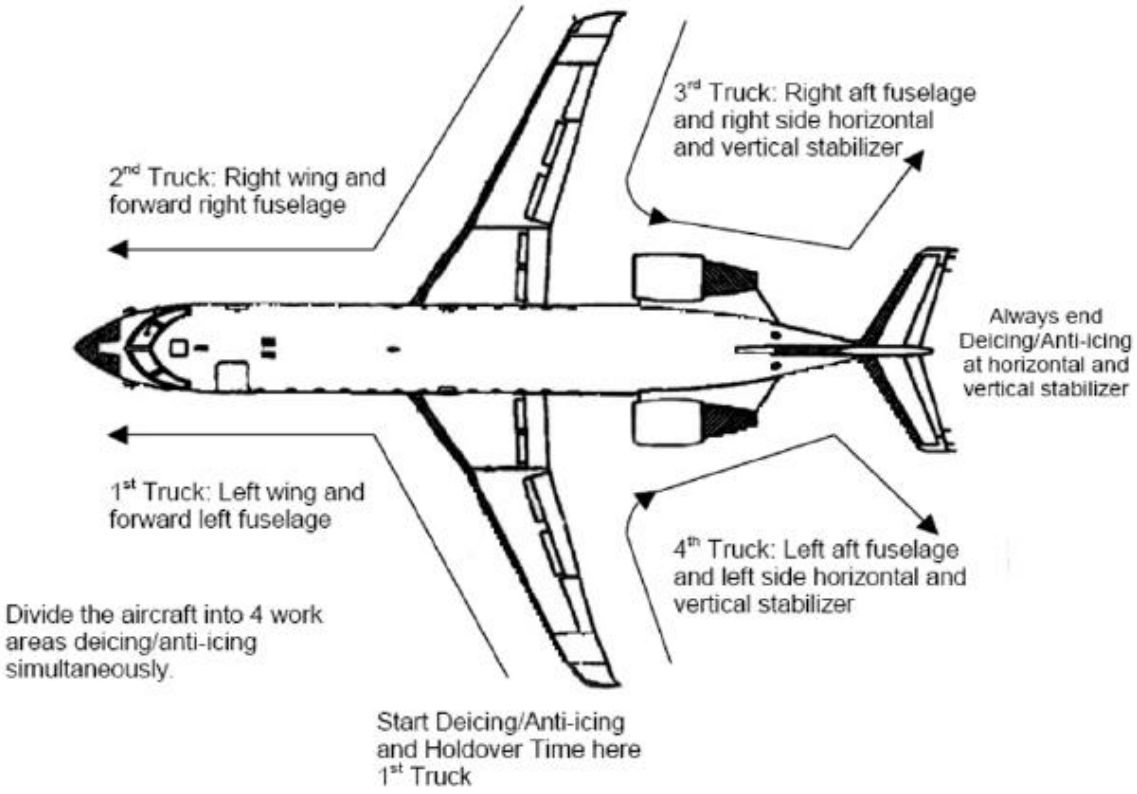


Figure 4-4: Four-Vehicle Application Sequence (Not Aircraft Specific)

4.4.7 Infrared Deicing Facility Methods

4.4.7.1 General Requirements

Ice, slush, snow and frost shall be removed from aircraft critical surfaces prior to dispatch from the facility or prior to anti-icing. A post de/anti-icing check must be performed prior to taxi or takeoff. Facility requirements must comply with publications listed in Society of Automotive Engineers (SAE) Aerospace Recommended Practice (ARP) 4737, Section 2.

4.4.7.2 Deicing

Deicing using infrared energy is accomplished through heat that breaks the bond of frozen contaminants adhering to the aircraft. Wet surfaces require an application of heated deicing fluids to prevent re-freezing after removal of infrared energy source. When required, for operations other than frost or leading edge ice removal and when OAT is at or below 32°F (0°C), an additional application of hot deicing fluid shall be performed within the facility to prevent re-freezing of water which may remain in hidden areas.

4.4.7.3 Anti-icing

If anti-icing is required, it shall be accomplished in accordance with this manual. If anti-icing is performed inside the facility, infrared power levels must be adjusted as required during the anti-icing process to prevent the re-accumulation of frozen contamination due to the effect of blowing snow and to maintain fluid integrity for the time the aircraft is in the facility. Dehydration of the fluid can negatively impact the fluid performance.

NOTE

If the aircraft requires deicing, and de/anti-icing fluids have been applied before flight, conventional de/anti-icing with fluids shall be performed.

4.4.7.4 Deicing with Forced Air

A. Background - Forced Air Systems have been used over the last 40 years to aid in the removal of frozen contaminants from aircraft surfaces. Frozen contaminants are removed using an air stream with or without fluid. Forced air can be used in conjunction with heated or unheated fluid in the air stream for removal of denser frozen contamination. Forced air could also assist in the application of anti-icing fluids if approved by the manufacturer.

B. Safety Concerns - Due to increased noise levels by the introduction of forced air, hearing protection should be utilized when the decibel level exceeds 85. It is the responsibility of the user to determine what personal protective equipment is needed based on the hazardous chemicals that may make up certain Type I, II, III, IV de/anti-ice fluids.

C. Aircraft Safety Concerns - The person in charge of applying the forced air should be vigilant at all times to ensure that loose debris is not impacting other personnel, other aircraft surfaces or engine intakes.

D. Forced Air Application Procedures as referenced by SAE ARD50102:

1. Forced Air may not remove all contaminants, thus requiring the use of traditional deicing fluids.
2. Always consult aircraft manufacturer’s limitations for maximum air pressures.
3. Forced air should not be directed into engines, auxiliary power intakes/exhausts or the orifices of pitot heads, static vents or directly onto air stream direction indicators (e.g., AOA sensors).
4. Remove snow from the landing gears using extreme caution to prevent damage to critical parts on the gear assembly.
5. When removing ice, snow or slush from aircraft surfaces, care should be taken to prevent contaminants from entering and accumulating in aerodynamically quiet areas, such as control surface hinge areas, or engine inlet, as the need for additional inspections may occur.
6. After utilizing forced air deicing, the process must be followed by a post application check.
7. When using forced air, Holdover guidelines shall not be followed unless followed by an application of deicing and anti-icing fluid without forced air.

4.5 CRJ 550/CRJ 900 Aircraft Specific Procedures and Precautions

4.5.1 Job Set-Up

A. Remove the snow, frost and ice from the area around the aircraft.

B. Apply electrical power to the aircraft as follows:

1. For external electrical power source, connect and energize the external AC power.
2. For internal electrical power source, start the Auxiliary Power Unit (APU).

C. Prepare the aircraft as follows:

1. Use a broom and carefully remove the snow from the flap and the slat control surfaces.

CAUTION

Make sure that persons and equipment are not near the flight control surfaces. Flight control movement can cause injury to persons and damage to the equipment.

CAUTION

Make sure that all of the flap system components move freely. the components must not catch on the structure when the flaps are extended or retracted. You can cause damage to the components or the structure.

2. Request the flight crew to perform the following:
   a. On the center pedestal, set the SLATS/FLAPS control lever to the 45° position. Make sure the flaps and slats extend correctly.

4.5.2 Procedure

A. Make sure the snow and ice are removed from around the nose and main landing gear as follows:

CAUTION

If the tires are frozen to the ground, do not move the aircraft. The tires must turn freely when you move the aircraft. you can cause damage to the equipment.

CAUTION

When you release frozen tires, do not use salt or other materials that can cause corrosion. You can cause damage to the aircraft.

1. If the tires are frozen to the ground, release the tires as follows:
   a. If you use warm air, use forced warm air to heat the ground and tire.

b. If you use deicing fluid, use warm deicing fluid to heat the ground around the tires. Make sure you remove all the unwanted deicing fluid from the area. The deicing fluid can freeze when the temperature decreases or precipitation falls.

B. Ground Service Agents may use a broom to carefully remove all the snow, frost and ice from the aircraft components that follow:

1. Total air temperature (TAT) probes.
2. Static pressure ports.
3. Angle-of-attack (AOA) sensors.
4. Antennas.
5. Door sills and surrounds.
6. Fuselage.
7. Top and bottom wing surfaces.
8. Upper and lower horizontal stabilizer surfaces.
9. Vertical stabilizer surfaces.
10. Winglets.
11. Leading edges of the wings.
12. Slats.
13. Flight controls.
14. Flight control hinges.
15. Flaps.
16. Engine intake and exhaust ports.
17. Fuel drains.
18. NACA vent scoops.
19. Landing gears.
20. Landing gear doors.
21. Landing gear bays.
22. Waste water and condensation drains.
23. Ram air intake.
24. Auxiliary Power Unit (APU) inlet and exhaust areas.

CAUTION

Operations should be suspended during continuous heavy snow since the hot is extremely short and the inspection of surfaces cannot guarantee safety.

4.5.3 Precautions and Standard Practices

A. Obey the precautions and standard practices that follow when performing de/anti-icing procedures:

1. It is recommended that the application of de/anti-icing fluid be carried out in the following progression. Step #1 is most preferred. Step #3 is least preferred, due to the potential of de/anti-icing fluid in the engine or APU intakes.
   a. Step #1: With the GPU connected and the APU and engine off.
   b. Step #2: With the engine running and the APU off.
   c. Step #3: With the engine off and the APU running.
2. If it is necessary to operate the engines or the APU while performing de/anti-icing procedures, obey the precautions that follow:
   a. Make sure that the engines are at idle speed.
   b. Keep the de/anti-icing fluid that goes into the engines to a minimum.
   c. Make sure that all bleed air valves are closed.
   d. Make sure the valves for the air conditioning unit are off.

CAUTION

If the engines or the APU are in operation during the de/anti-icing procedure, make sure that all bleed air sources are closed. Damage can be caused to the components. Deicing fluid can cause the APU speed to be out of control. This can cause injury to persons and damage to equipment.

3. When deicing the control surfaces, make sure that the ice/snow is not pushed between the leading edge of the control surface and its adjacent structure.
4. Remove the snow, frost or ice from door sills and the door surrounds before the doors are closed.
5. Do not point the spray of de/anti-icing fluid directly into the areas that follow:
   a. Windshields
   b. Side windows
   c. Passenger compartment windows
   d. Pitot/static probes
   e. Total air temperature (TAT)
   f. Angle of attack (AOA) sensors
   g. Static pressure ports
   h. Antennas
   i. Engine intake and exhaust ports

j. Engine thrust reversers
k. Fuel drains
l. Wheels and brakes
m. Waste water and condensation drains
n. Ram air intake
o. APU inlet and exhaust areas
p. Emergency door handles
q. Door and window seals
r. Landing gear

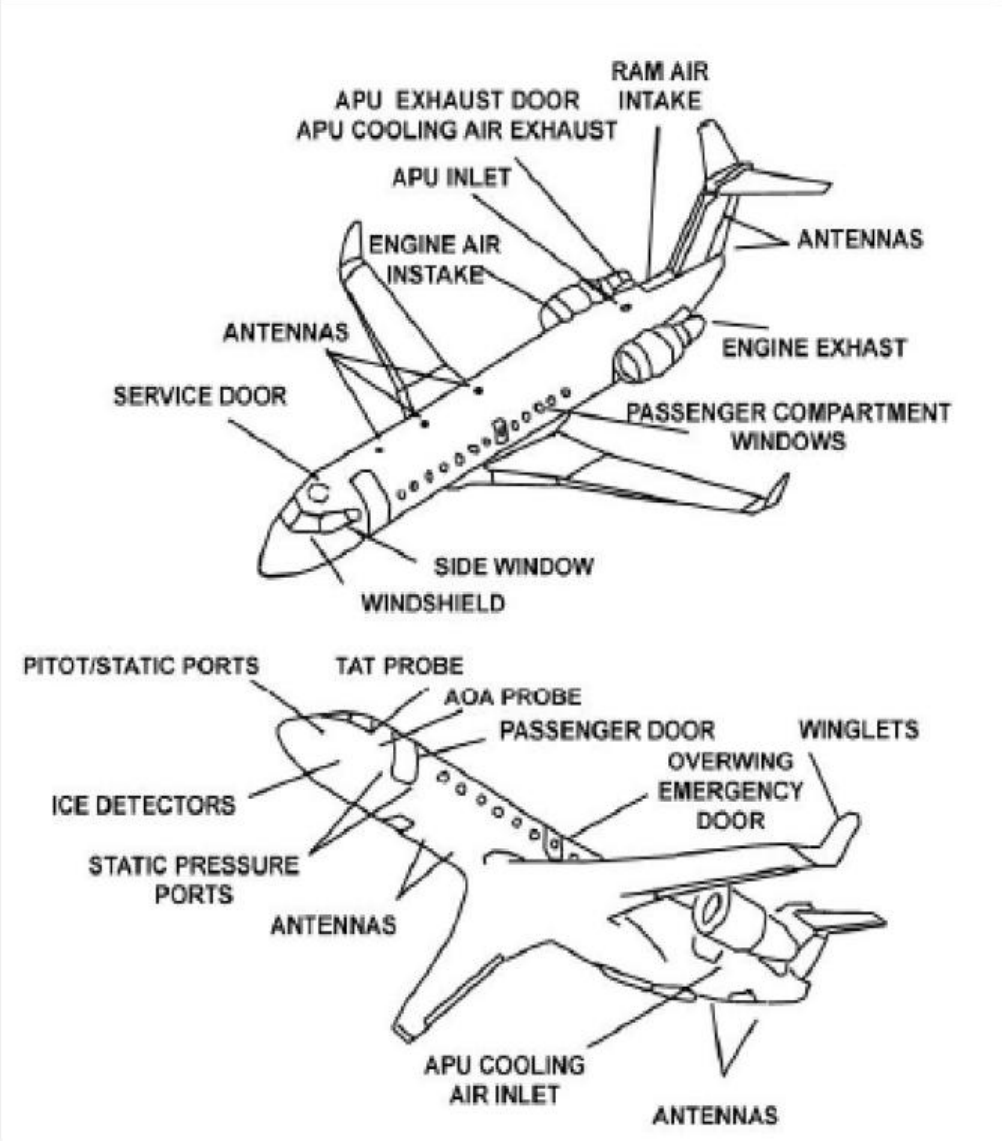


Figure 4-5: CRJ 550/CRJ 900 Caution Areas

4.5.4 Critical Surfaces of the CRJ 550/CRJ 900

A. The critical surface areas are those which must be free from contaminants prior to takeoff. These areas are areas which need to be inspected during the post-deicing check. The critical surfaces of the CRJ 550/CRJ 900 are:

1. Wings from leading edge to trailing edge, flaps and ailerons.
2. Horizontal stabilizer and elevator.
3. Vertical stabilizer and both sides of the rudder.
4. Engine Inlets.
5. Although the upper fuselage is not defined as a critical surface, it must nonetheless be deiced to remove contamination, other than allowable frost, anytime the wing and tail surfaces require deicing. When departing Canada the upper surface of the fuselage will be considered a critical surface and will also require anti-icing.

B. The following areas need to be free from any contamination, but may not be directly sprayed with deicing fluid:

1. Windshields.
2. Stall vanes, pitot heads, static ports.
3. Ram air intakes and any other probes or sensors.
4. Engine Inlets.

C. Accumulations on the underside of the wing fuel tank area are permissible that follow:

1. Maximum 1/8 inches (3 mm) layer of frost or
2. Maximum 1/16 inches (1.5 mm) layer of ice.

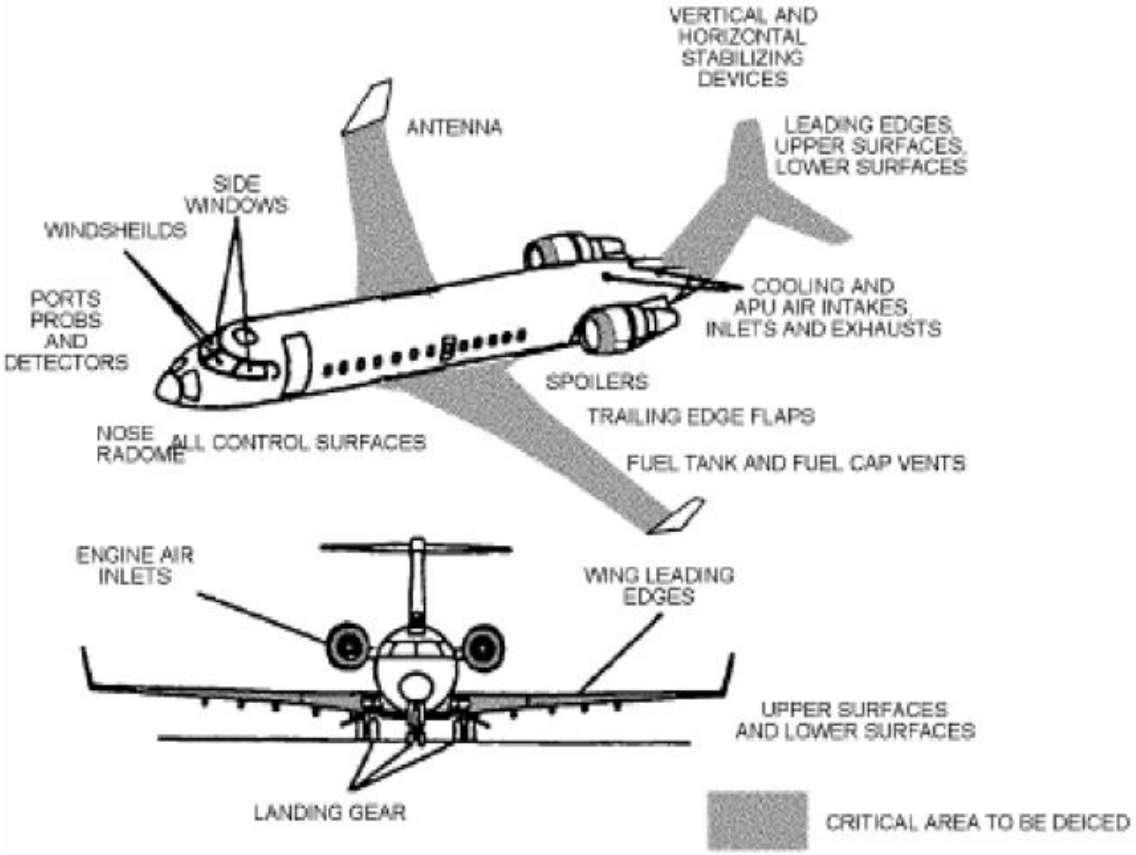


Figure 4-6: CRJ 550/CRJ 900 Areas to Deice

4.6 E-175 Aircraft Specific Procedures and Precautions

4.6.1 Procedures

Remove the snow from the aircraft with a broom or with compressed air as follows:

A. Manually remove all the snow that has collected on the components/areas that follow:

1. Pitot/static probes.
2. Total air temperature (TAT) probes.
3. Static ports.
4. Antennas.
5. Door sills and surrounds.
6. Fuselage.
7. Fuel drains.
8. Upper and lower wing surfaces.
9. Leading edge of the wings.
10. Flight control shrouds.
11. Flight control hinges.
12. Engine air intake and exhaust areas.
13. Landing gear.
14. Landing gear doors.
15. Landing gear bays.
16. RAM air intake.
17. APU inlet and exhaust areas.
18. Waste water and condensation drains.

CAUTION

Operations should be suspended during continuous heavy snow since the hot is extremely short and the inspection of surfaces cannot guarantee safety.

B. Electrically extend the flaps (request flight crew to perform this function).

C. Do a visual examination of the flap leading edge and the wing trailing edge components and manually remove any snow from the components of the wing that follow:

1. Trailing edge of the wings.
2. Flight control shrouds.

3. Flight control hinges.
4. Flaps.

D. If the flap leading edge, flap shroud and the wing trailing edge components are free of snow, electrically retract the flaps (request flight crew to perform this function).

E. Make sure that the flap, slats and spoilers are fully retracted during deicing conditions. If you need these surfaces operated by the flight crew, look for ice or snow accretion on them, to make sure that the surfaces are not blocked by ice or snow before they are actuated.

F. If necessary, do the de/anti-icing procedures to remove any snow, frost or ice that remains on the aircraft as noted in this section.

CAUTION

Type I fluids must not be used as anti-icing fluid during heavy snow conditions.

4.6.2 Precautions and Standard Practices

Obey the precautions and standard practices that follow when performing the de/anti-icing procedures:

A. It is recommended that the application of de/anti-icing fluid be carried out in the following progression. Step #1 is most preferred. Step #3 is least preferred due to the potential of de/anti-icing fluid in engine or APU intakes.

1. Step #1: With the GPU connected; APU and engines off.
2. Step #2: With the engines running and the APU off.
3. Step #3: With the engines off and the APU running.

B. If it is necessary to operate the engines or the APU while the de/anti-icing procedures are done, obey the precautions that follow:

1. Make sure that the engines are at idle speed.
2. Keep the de/anti-icing fluid that goes into the engines to a minimum.
3. Make sure that all bleed air valves are closed.
4. Make sure that all the external lights in the de/anti-icing area are off.
5. Make sure that the valves for the air conditioning unit are off and pack valves are closed.

CAUTION

Wait one minute to use the APU bleed valve and three minutes to use the pack valves after the deicing and anti-icing procedures are complete. The vapor from the deicing and anti-icing fluid can go into the air conditioning system when the APU is in operation. This can cause damage to the air conditioning system.

CAUTION

If the engines or the APU are in operation when the de/anti-icing procedure is done, make sure that all bleed air sources are closed, otherwise components can be damaged. Deicing fluid can cause the APU speed to be out of control; this can cause injury to persons and damage to equipment.

4.6.3 Policy Regarding De/Anti-icing with Engines Operating

A. To prevent costly APU damage, it is preferred that aircraft will operate with engines operating and APU off during a deice event.

B. Alternately, if the preferred method of de/anti-icing with the engines operating cannot be achieved due to station constraints, the following methods can be used (in order or most preferred to least preferred):

1. Alternating engines.
2. With the GPU connected to provide power and the APU and engines off.
3. As a last choice: with the engines off and the APU running.

NOTE

Some airports do not allow aircraft engines to operate during deicing events. In these situations, the preferred method is a GPU connected to the aircraft. If a GPU is not available or is inoperative, the APU can be operated to avoid a cancellation. At the station's discretion, aircraft may be de/anti-iced with one (preferred) or both engines running from an open bucket when ramp conditions permit.

C. Application of these procedures must not jeopardize the safety of ground personnel or risk damage to ground equipment or aircraft.

4.6.4 Procedures for De/Anti-icing with Engines Operating

When de/anti-icing with the engines running, the following special precautions should be taken:

A. The flight crew makes the determination that engines will or will not be operated during de/anti-icing taking into account local airport procedures.

B. Idle thrust or power must be set.

C. The parking brake must be set and radio communications established between the flight crew and the qualified deicing personnel.

D. The flight crew will signal the deice crew when the parking brake has been set.

E. After the “parking brake set” signal has been given and verified via hand signals or via aircraft intercom, deicing/anti-icing will be conducted in accordance with the Mesa Airlines, Inc. *Deicing Manual*.

4.6.5 De/Anti-icing Fluid Application Sequence

The application of the de/anti-icing fluid mixture should follow the sequence that follows. A thin layer of hoar frost on the upper surface of the fuselage is acceptable, provided all vents and ports are clear/not obstructed and markings/details are visible.

A. Accumulations on the underside of the wing fuel tank area are permissible that follow:

   1. Maximum 1/8 inches (3 mm) layer of frost.

B. Make sure that the de/anti-icing fluid mixture is applied equally and symmetrically to both sides of the aircraft.

C. The critical surfaces of the aircraft include all areas of the wings and tail surfaces and their related control surfaces.

D. Spray the Wing and Horizontal Stabilizers

   1. Apply the spray compound from tip inboard to root, from the highest point of surface camber to the lowest.

E. Spray the Vertical Stabilizer/Dorsal Fin/Rudder

   1. Start at the top and then work down.

F. Spray the Fuselage

   1. Apply the spray compound along the top centerline and then outboard, letting the fluid cascade down and across the windows.
   2. A thin layer of hoarfrost on the top of the fuselage is permitted as long as you can see the aircraft markings on the aircraft. Otherwise deice/anti-ice fluid must be applied.

NOTE

Do not spray deicing fluid directly to the passenger/service doors seals and window transparencies, mainly when the transparencies are cold. Do not apply hot deicing fluid or hot water directly on the windshield and on the direct vision windows.

NOTE

The windshield forward region must be clear of deicing fluid before aircraft departure, in order to prevent the deicing fluid flowing on the windshield during taxiing and takeoff.

WARNING

Do not spray deicing fluid directly on the APU inlets, exhaust, engine thrust reverser, probes, scoops, vents, drains or static ports.

G. Spray nose radome area, Windows and Windshields

1. Nose radome and adjacent areas must be clear of ice and snow to prevent the ice and snow from blowing back to the windshield, thus degrading the pilots' vision during taxiing and takeoff.
2. Do not apply fluid directly on the cockpit windshields. The fluid on the windshields must be fully removed before the aircraft takes off. The fluids can cause blurred vision for the crewmembers and damage to the windshields and wipers.
3. Remove the deposits of snow, ice, moisture and frost on the windshield, blade wipers, side windows, adjacent structures and travel areas.

CAUTION

Do not apply hot fluid directly on cold windshields and windows. The hot fluid can cause damage to the windows.

H. Do not spray fluid directly into the wind.

I. Spray from the highest point to allow the hot fluid to work down the surface.

J. Keep the spray distance as short as possible; but not closer to the aircraft than approximately 10 feet (3 m) to make sure that the direct spray does not damage the aircraft or components.

CAUTION

Repeated application of Type II and/or Type IV anti-ice fluids may lead to buildup of residue in aerodynamically quiet areas such as the flight control hinge lines. The residue may block or impede critical flight controls. Frequently examine these areas (such as the wing rear spar area) for residue. Any residue must be removed before further flight.

K. When deicing the control surfaces, make sure that the ice/snow is not pushed between the leading edge of the control surface and its adjacent shroud.

L. The following areas need to be free from any contamination. Only an indirect fluid application must be used and allowed to run down the aircraft to remove contamination.

1. Smart probes, static port, TAT.
2. Engines and APU inlets/outlets.
3. Scoops.
4. Vents.
5. NACA air intakes.

6. Landing gear, including: harness, lubricating points/movable parts, proximity sensors. (DO NOT SPRAY HOT BRAKES).
7. Drains.
8. Air conditioning rams air intakes.
9. Antennas.
10. Wheels and brakes.
11. Door and window handles and seals.
12. Emergency exit door handles and seals.
13. Rear fuselage door.
14. Windows and windshields.
15. Thrust Reversers.

NOTE

Direct spray occurs when the fluid stream hits the aircraft or component, but does not touch another object first. A spray trajectory of more than 10 feet (3 m) is recommended to make sure that the direct spray does not damage the aircraft or components.

M. Use a lint-free cloth to clean the fluid from any aircraft components where protection is not wanted, as necessary. This is especially important for the components identified below.

1. Horizontal stabilizer actuator.
2. Electrical harnesses.
3. Hydraulic lines.
4. Fire-extinguisher tubing.
5. Bleed valve.
6. Service light.

CAUTION

Do not fully retract the flaps until all of the wet snow is removed from the flap leading edge and the wing trailing edge components. Damage to the aircraft can occur.

4.6.6 Landing Approach in Icing Conditions or Landing/Taxiing in Wet Snow

If the aircraft made a landing approach in icing conditions or the aircraft was landed or taxied in wet snow, ensure the following areas are free of contamination by deicing or by using a manual method (manual methods include broom, compressed air, etc.):

A. Examine leading edges, air intakes, engine air inlets, flaps, ailerons, rudder, elevators, water drains, and skin panels for collected ice.

B. Examine the landing-gear wheel well areas for ice, slush or snow accretion and packing.

C. Examine the free-fall control cables on the landing gear region for ice that has collected.

D. Examine the parts of the NLG and MLG for ice/snow and, if applicable, remove the ice/snow.

E. Make sure that there is not a layer of ice or snow on the proximity sensor units and targets.

F. Before the application of anti-ice fluid, ensure the flap leading edge and the wing trailing edge components are free of ice, snow or frost.

4.6.7 Job Close-Up

Do the checks that follow:

A. Make sure that the nose radome and adjacent area is clear of ice and snow.

B. Make sure that the flight control surfaces are clear from icing contamination.

C. Make sure that the engine, APU, air conditioning, vent, and NACA air inlets are clear.

D. Make sure that the landing gear doors and locks, the proximity sensors, the free- fall device, the brakes and the auxiliary brace structure are free from ice or snow accumulation.

E. Make sure that the Smart Probes, Pressurization Static Ports, TAT Sensors and Ice Detectors have no ice or snow collection or obstructions or deicing/anti-icing fluid or fluid residues.

F. Make sure that the FWD passenger door, aft passenger door and escape hatches have no ice or snow collected.

G. Make sure that all drains are clear.

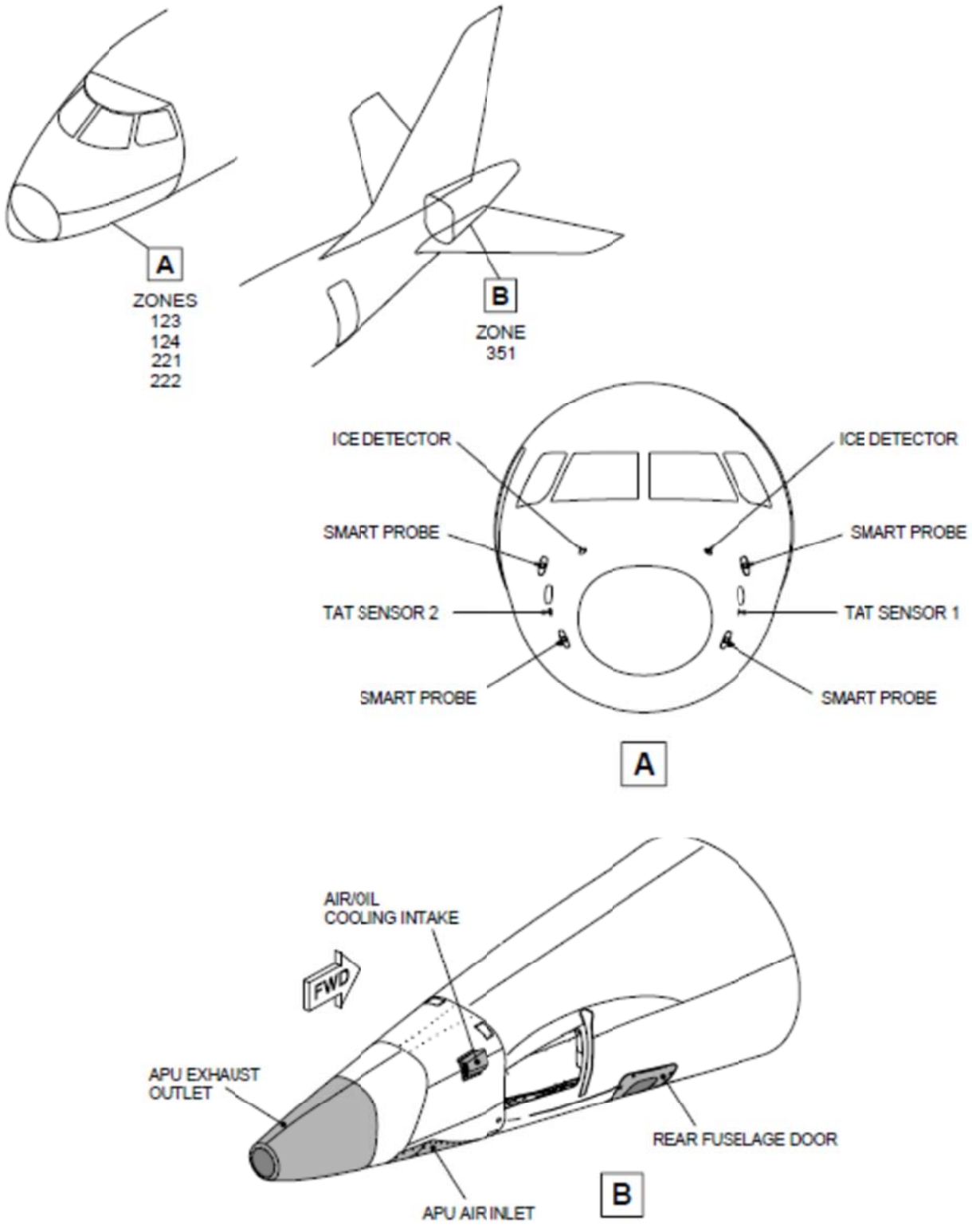


Figure 4-7: E-175 Caution / No Spray Area

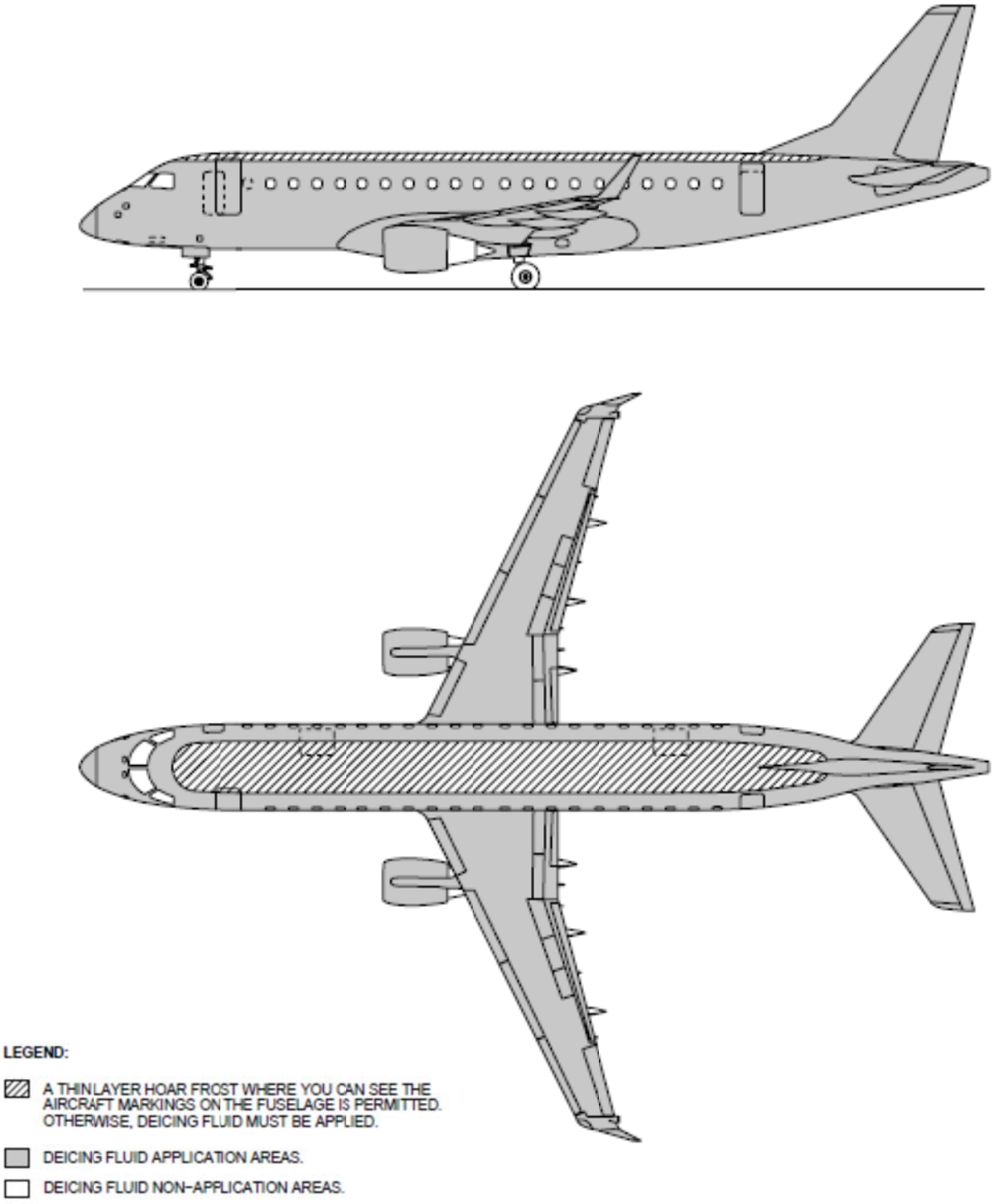
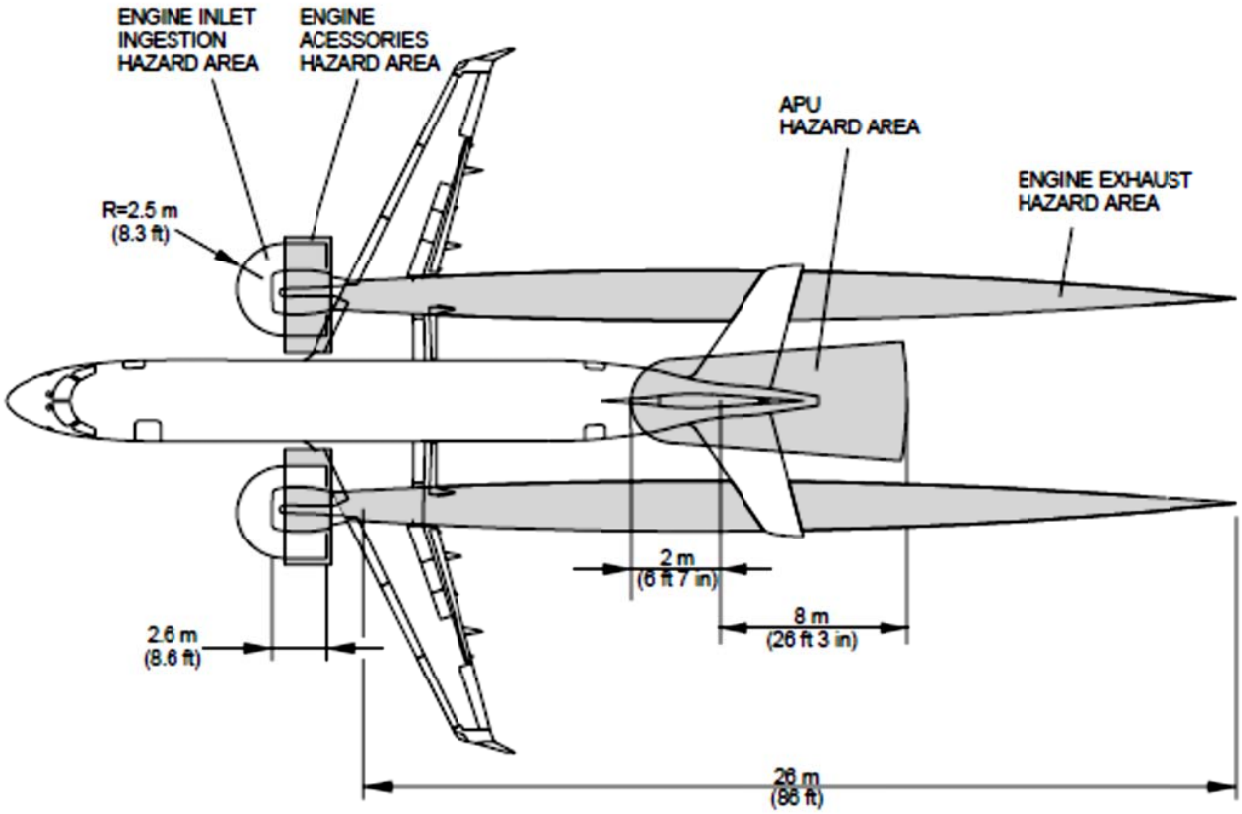


Figure 4-8: E-175 Deicing Fluid Application/Non-Application Areas

Figure 4-9: E-175 Anti-icing Fluid Application/Non-Application Areas



NOTES:

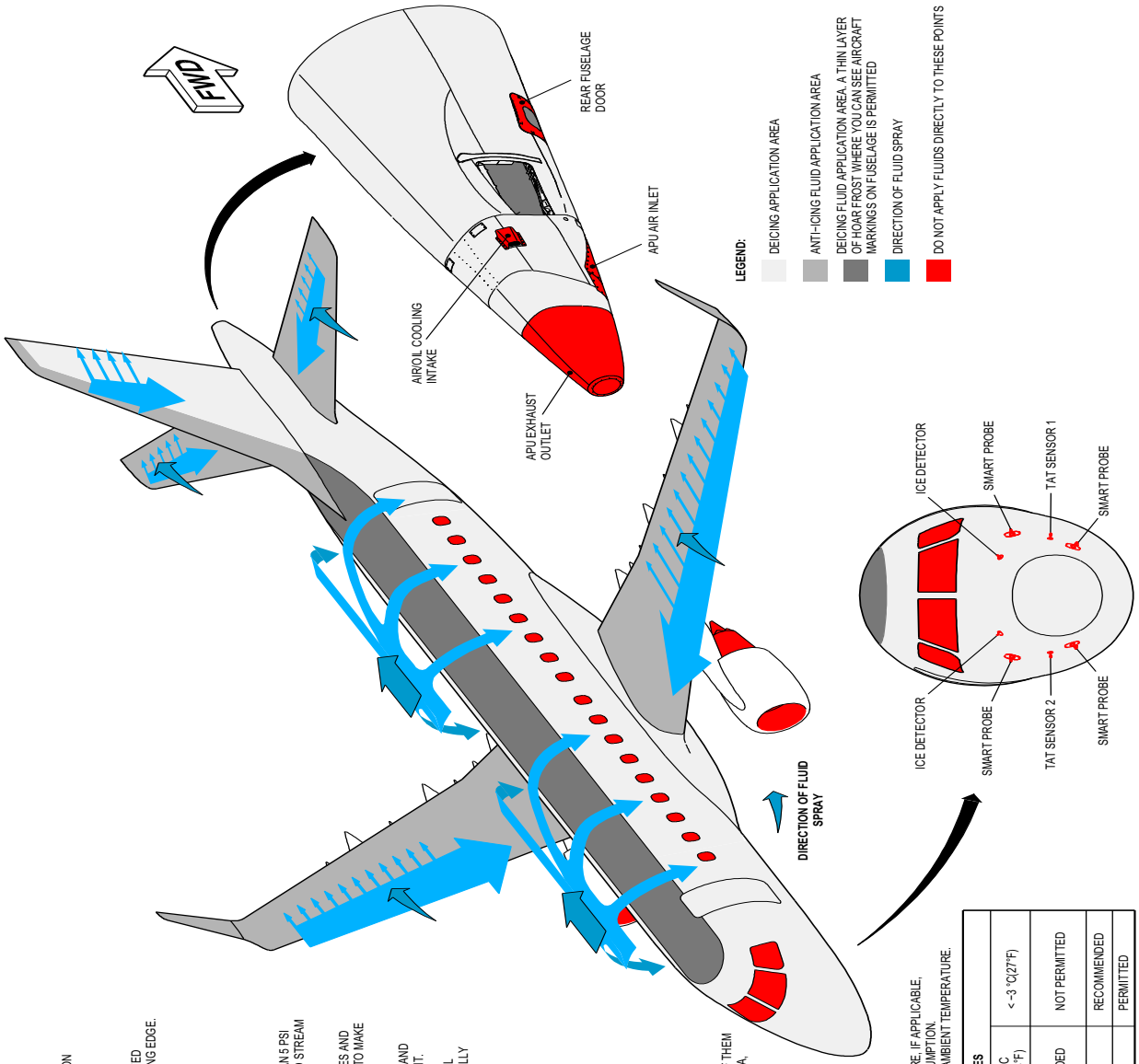
ENGINE INLET HAZARD AREA INCLUDES WORST CASE 20 KNOTS HEADWIND/CROSSWIND/TAILWIND BASED ON 40 ft/sec CRITICAL VELOCITY WITH 3 ft CONTINGENCY FACTOR.

ENGINE EXHAUST HAZARD AREA VELOCITY = 65 MPH (29.0 m/sec).

EXHAUST HAZARD AREA INCLUDES WORST CASE 20 KNOTS HEADWIND WITH GROUND EFFECTS.

GROUND IDLE, SEA LEVEL, Tamb = ISA + 16.7° C, FNIN1 = 379 DAN (3785 N).

Figure 4-10: E-175 Hazard Areas



FLUID APPLICATION
ALWAYS APPLY FLUID BACKWARD. THIS IS TO PREVENT FLUID ACCUMULATION IN AERODYNAMICALLY QUIET AREAS.

WINGS AND TAIL
SPRAY FROM TIP TO ROOT.
NOTE: THE ANTI-ICING FLUID AMOUNT REQUIRED WILL BE VISUALLY INDICATED BY THE FLUID JUST BEGINNING TO DRIP OFF THE LEADING EDGE AND TRAILING EDGE.

VERTICAL SURFACES
START AT THE TOP AND THEN WORK DOWN.

FUSELAGE
SPRAY ALONG TOP CENTERLINE AND THEN OUTBOARD, LETTING THE FLUID CASCADE DOWN AND ACROSS THE WINDOWS.

FLUID APPLICATION REMARKS
ADJUST THE FLUID STREAM TO A PRESSURE THAT WILL NOT BE HIGHER THAN 5 PSI IN AN AREA OF 25 IN² (161.3 CM²) ON THE AIRCRAFT SURFACE. LARGER FLUID STREAM PRESSURES CAN CAUSE DAMAGE TO THE AIRCRAFT SURFACES.

ANTI-ICING FLUIDS MAY NOT FLOW UNIFORMLY ON THE WING LEADING EDGES AND THE HORIZONTAL AND VERTICAL STABILIZERS. MONITOR THESE SURFACES TO MAKE SURE THAT THEY ARE CORRECTLY COATED WITH FLUID.

THE AIRCRAFT SHOULD BE TREATED SYMMETRICALLY, THAT IS, LEFT-HAND AND RIGHT-HAND SIDES SHOULD RECEIVE THE SAME AND COMPLETE TREATMENT.

NO AIRCRAFT CAN BE DISPATCHED OR TAKEN OFF WHEN THE WINGS OR TAIL SURFACES HAVE AN ADHERING LAYER OF ICE, SNOW, OR FROST. BE SPECIALLY CAREFUL WITH THE WING AND HORIZONTAL STABILIZER LEADING EDGES. HOWEVER, TAKEOFF WITH FROST UNDER THE WING SURFACES IS PERMITTED, PROVIDED IT DOES NOT EXCEED 3 MM (1/8 IN).

DEICING
APPLY ONLY THE NECESSARY QUANTITY OF FLUID (HOT WATER OR AMS 1424 TYPE I) TO REMOVE THE ICE OR SNOW AND LET A LIGHT COATING OF FLUID STAY ON AIRCRAFT.

ANTI-ICING
DO THE TWO-STEP PROCEDURE WHENEVER POSSIBLE TO PREVENT FLUID RESIDUE ACCUMULATION.

TWO-STEP PROCEDURE:

1. DO THE DEICING TREATMENT AS OUTLINED ABOVE.

2. APPLY AN OVERSPRAY OF A DEICING/ANTI-ICING FLUID OR A MIXTURE OF THEM WITH HEATED WATER. DO THIS TASK TYPICALLY WITHIN 3 MIN. AREA BY AREA, TO AVOID LIQUID FROM FREEZING AGAIN OVER THE AIRCRAFT SURFACE.

ONE-STEP PROCEDURE:

APPLY AMS 1428 TYPE –II, TYPE–III OR –IV FLUID TO DEICE AND PROTECT AIRCRAFT FROM REFREEZING.

NOTE:
REFER TO THE FLUID MANUFACTURER'S SPECIFICATIONS FOR FLUID MIXTURE, IF APPLICABLE, AND HOLDOVER TIMES FOR MAXIMUM EFFECTIVENESS AND MINIMUM CONSUMPTION.
REFER TO THE TABLE BELOW TO CHECK THE METHODS AS A FUNCTION OF AMBIENT TEMPERATURE.

METHOD	GUIDELINES		
	≥ 1°C (34°F)[1]	-3 °C ≤ T <1°C (27°F ≤ T <34°F)	< –3 °C(27°F)
HOT WATER 82°–93°C (180°–200°F) FOLLOWED BY ANTI-ICING FLUID APPLICATION[2]	PERMITTED	RECOMMENDED	NOT PERMITTED
DEICING FLUID[2]	NOT NECESSARY[3]	PERMITTED	RECOMMENDED
ANTI-ICING FLUID[2]	NOT NECESSARY[3]	PERMITTED	PERMITTED

[1] TEMPERATURE STABLE OR AT THE INCREASE.
[2] COMPLY WITH THE FLUID MANUFACTURER'S RECOMMENDATIONS.
[3] USE OF COSTLY FLUID ABOVE FREEZING POINT NOT JUSTIFIED.

Figure 4-11: E-175 Fluid Application

4.7 B-737-400F/800F Aircraft Specific Procedures and Precautions

4.7.1 Procedures

A. If possible, manually remove the snow that has collected on the components/areas of the aircraft with a broom or with air as follows:

1. Pitot/static probes.
2. Total air temperature (TAT) probes.
3. Static ports.
4. Antennas.
5. Door sills and surrounds.
6. Fuselage.
7. Fuel drains.
8. Upper and lower wing surfaces.
9. Leading edge of the wings.
10. Flight control shrouds.
11. Flight control hinges.
12. Engine air intake and exhaust areas.
13. Landing gear.
14. Landing gear doors.
15. Landing gear bays.
16. RAM air intake.
17. APU inlet and exhaust areas.
18. Waste water and condensation drains.

CAUTION

Operations should be suspended during continuous heavy snow since the HOT is extremely short and the inspection of surfaces cannot guarantee safety.

B. Electrically extend the flaps (request flight crew to perform this function).

C. Do a visual examination of the flap leading edge and the wing trailing edge components and manually remove any snow from the components of the wing that follow:

1. Trailing edge of the wings.
2. Flight control shrouds.

3. Flight control hinges.
4. Flaps.

D. If the flap leading edge, flap shroud and the wing trailing edge components are free of snow, electrically retract the flaps (request flight crew to perform this function).

E. Make sure that the flap, slats and spoilers are fully retracted during deicing conditions. If you need these surfaces operated by the flight crew, look for ice or snow accretion on them, to make sure that the surfaces are not blocked by ice or snow before they are actuated.

F. If necessary, do the de/anti-icing procedures to remove any snow, frost or ice that remains on the aircraft as noted in this section.

CAUTION

Type I fluids must not be used as anti-icing fluid during heavy snow conditions.

4.7.2 Precautions and Standard Practices

Obey the precautions and standard practices that follow when performing the de/anti-icing procedures:

A. To prevent costly APU damage, it is recommended that the application of de/anti-icing fluid be carried out in the following progression. Step #1 is most preferred. Step #3 is least preferred due to the potential of de/anti-icing fluid in engine or APU intakes.

1. Step #1: With the GPU connected; APU and engines off.
2. Step #2: With the engines running and the APU off.
3. Step #3: With the engines off and the APU running.

NOTE

Step #2 can also use alternating engines if deicing with both engines operating cannot be achieved due to station constraints.

CAUTION

Some airports do not allow aircraft engines to operate during deicing events. In these situations, the preferred method is a GPU connected to the aircraft. If a GPU is not available or is inoperative, the APU can be operated to avoid a cancellation. At the station's discretion, aircraft may be de/anti-iced with one (preferred) or both engines running from an open bucket when ramp conditions permit.

B. If it is necessary to operate the engines or the APU while the de/anti-icing procedures are done, obey the precautions that follow:

1. Make sure that the engines are at idle speed.
2. Keep the de/anti-icing fluid that goes into the engines to a minimum.

3. Make sure that all bleed air valves are closed.
4. Make sure that all the external lights in the de/anti-icing area are off.
5. Make sure that the valves for the air conditioning unit are off and pack valves are closed.

CAUTION

Wait one minute to use the APU bleed valve and three minutes to use the pack valves after the deicing and anti-icing procedures are complete. The vapor from the deicing and anti-icing fluid can go into the air conditioning system when the APU is in operation. This can cause damage to the air conditioning system.

CAUTION

If the engines or the APU are in operation when the de/anti-icing procedure is done, make sure that all bleed air sources are closed, otherwise components can be damaged. Deicing fluid can cause the APU speed to be out of control; this can cause injury to persons and damage to equipment.

4.7.3 Procedures for De/Anti-icing with Engines Operating

When de/anti-icing with the engines running, the following special precautions should be taken:

A. The flight crew makes the determination that engines will or will not be operated during de/anti-icing taking into account local airport procedures.

B. Idle thrust or power must be set.

C. The parking brake must be set and radio communications established between the flight crew and the qualified deicing personnel.

D. The flight crew will signal the deice crew when the parking brake has been set.

E. After the “parking brake set” signal has been given and verified via hand signals or via aircraft intercom, deicing/anti-icing will be conducted in accordance with the Mesa Airlines, Inc. *Deicing Manual*.

4.7.4 De/Anti-icing Fluid Application Sequence

The application of the de/anti-icing fluid mixture should follow the sequence that follows. A thin layer of hoar frost on the upper surface of the fuselage is acceptable, provided all vents and ports are clear/not obstructed and markings/details are visible.

A. Accumulations on the underside of the wing fuel tank area are permissible that follow:

   1. Maximum 1/8 inches (3 mm) layer of frost.

B. Make sure that the de/anti-icing fluid mixture is applied equally and symmetrically to both sides of the aircraft.

C. The critical surfaces of the aircraft include all areas of the wings and tail surfaces and their related control surfaces. Refer to section 4.8.7.

D. Spray the Wing and Horizontal Stabilizers

   1. Apply the spray compound from tip inboard to root, from the highest point of surface camber to the lowest.

E. Spray the Vertical Stabilizer/Dorsal Fin/Rudder

   1. Start at the top and then work down.

F. Spray the Fuselage

   1. Apply the spray compound along the top centerline and then outboard, letting the fluid cascade down and across the windows.
   2. A thin layer of hoar frost on the top of the fuselage is permitted as long as you can see the aircraft markings on the aircraft. Otherwise deice/anti-ice fluid must be applied.

NOTE

Do not spray deicing fluid directly to the service doors seals and window transparencies, mainly when the transparencies are cold. Do not apply hot deicing fluid or hot water directly on the windshield and on the direct vision windows.

NOTE

The windshield forward region must be clear of deicing fluid before aircraft departure, in order to prevent the deicing fluid flowing on the windshield during taxiing and takeoff.

WARNING

Do not spray deicing fluid directly on the APU inlets, exhaust, engine thrust reverser, probes, scoops, vents, drains or static ports.

G. Spray nose radome area, Windows and Windshields

1. Nose radome and adjacent areas must be clear of ice and snow to prevent the ice and snow from blowing back to the windshield, thus degrading the pilots' vision during taxiing and takeoff.
2. Do not apply fluid directly on the cockpit windshields. The fluid on the windshields must be fully removed before the aircraft takes off. The fluids can cause blurred vision for the crewmembers and damage to the windshields and wipers.
3. Remove the deposits of snow, ice, moisture and frost on the windshield, blade wipers, side windows, adjacent structures and travel areas.

CAUTION

Do not apply hot fluid directly on cold windshields and windows. The hot fluid can cause damage to the windows.

H. Do not spray fluid directly into the wind.

I. Spray from the highest point to allow the hot fluid to work down the surface.

J. Keep the spray distance as short as possible; but not closer to the aircraft than approximately 10 feet (3 m) to make sure that the direct spray does not damage the aircraft or components.

CAUTION

Repeated application of Type II and/or Type IV anti-ice fluids may lead to buildup of residue in aerodynamically quiet areas such as the flight control hinge lines. The residue may block or impede critical flight controls. Frequently examine these areas (such as the wing rear spar area) for residue. Any residue must be removed before further flight.

K. When deicing the control surfaces, make sure that the ice/snow is not pushed between the leading edge of the control surface and its adjacent shroud.

L. The following areas need to be free from any contamination. Only an indirect fluid application must be used and allowed to run down the aircraft to remove contamination.

1. Smart probes, static port, TAT.
2. Engines and APU inlets/outlets.
3. Scoops.
4. Vents.
5. NACA air intakes.
6. Landing gear, including: harness, lubricating points/movable parts, proximity sensors. (DO NOT SPRAY HOT BRAKES).
7. Drains.
8. Air conditioning rams air intakes.

9. Antennas.
10. Wheels and brakes.
11. Door and window handles and seals.
12. Emergency exit door handles and seals.
13. Rear fuselage door.
14. Windows and windshields.
15. Thrust Reversers.

NOTE

Direct spray occurs when the fluid stream hits the aircraft or component, but does not touch another object first. A spray trajectory of more than 10 feet (3 m) is recommended to make sure that the direct spray does not damage the aircraft or components.

M. Use a lint-free cloth to clean the fluid from any aircraft components where protection is not wanted, as necessary. This is especially important for the components identified below.

1. Horizontal stabilizer actuator.
2. Electrical harnesses.
3. Hydraulic lines.
4. Fire-extinguisher tubing.
5. Bleed valve.
6. Service light.

CAUTION

Do not fully retract the flaps until all of the wet snow is removed from the flap leading edge and the wing trailing edge components. Damage to the aircraft can occur.

4.7.5 Job Close-Up

A. Do not allow fluid or slush to accumulate in balance panel bay.

B. Do not spray any fluid into the elevator feel system pitot probes that are located on each side of the vertical stabilizer.

C. Conduct deicing/anti-icing from the forward side of the stabilizer to minimize liquids that might enter the tail cone area.

D. Remove the ice from the Vortex generator on the APU inlet door when the APU is not in operation.

4.7.6 B-737-400F/800F Critical Aircraft Surfaces

Table 4-1: B-737-400F/800F Critical Aircraft Surfaces

Wings	Fuselage	Empennage	Landing Gear
Ailerons	Wing to Fuselage Fillets	Horizontal Stabilizer	Centering Cylinders
T.E. Flaps	Static Source Apertures	Vertical Stabilizer	Uplock Mechanism
Spoilers	Pitot Masts	Elevators	Shock Strut Pistons
L.E. Flaps	Temperature Probes	Rudder	Actuator Pistons
Fuel Tank Vents and Dump Nozzles	Exterior Doors (Cargo & Passenger)	Pitot Probes	Door Actuating Mechanisms
Flap Jackscrews	Ice Detector	Balance Panels	Trucks
Engine Inlets	Top of Fuselage		
Winglets (if installed)	Radome		
Balance Panels	APU Inlet NOTE: Should the APU Inlet door area require direct deicing, the APU must be shut down and the door closed in order to protect the APU from Glycol ingestion.		

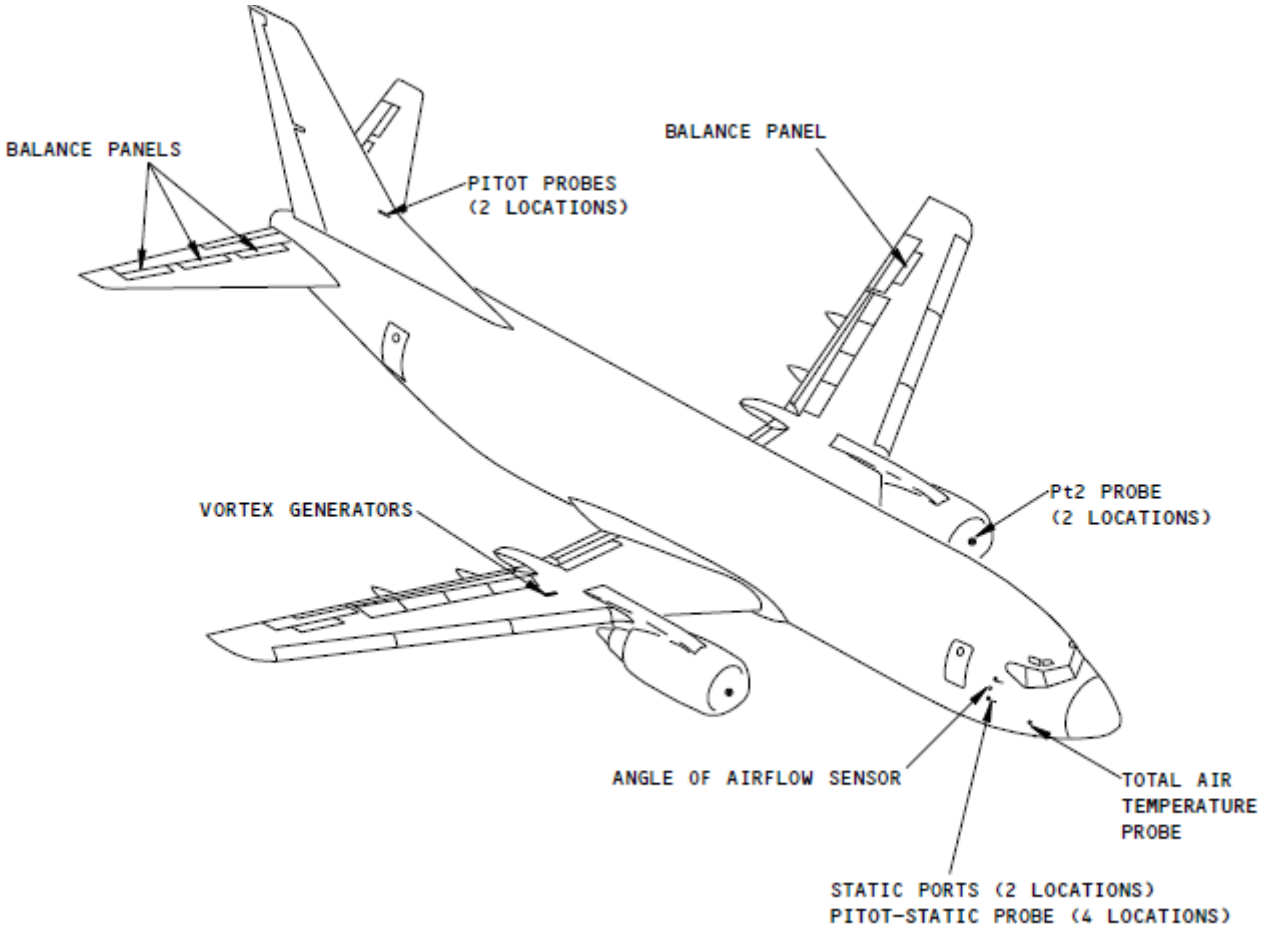


Figure 4-12: B-737-400F/800F Aircraft

4.7.6.1 B-737-400F/800F Spray Areas

A. Type I Deicing Fluid

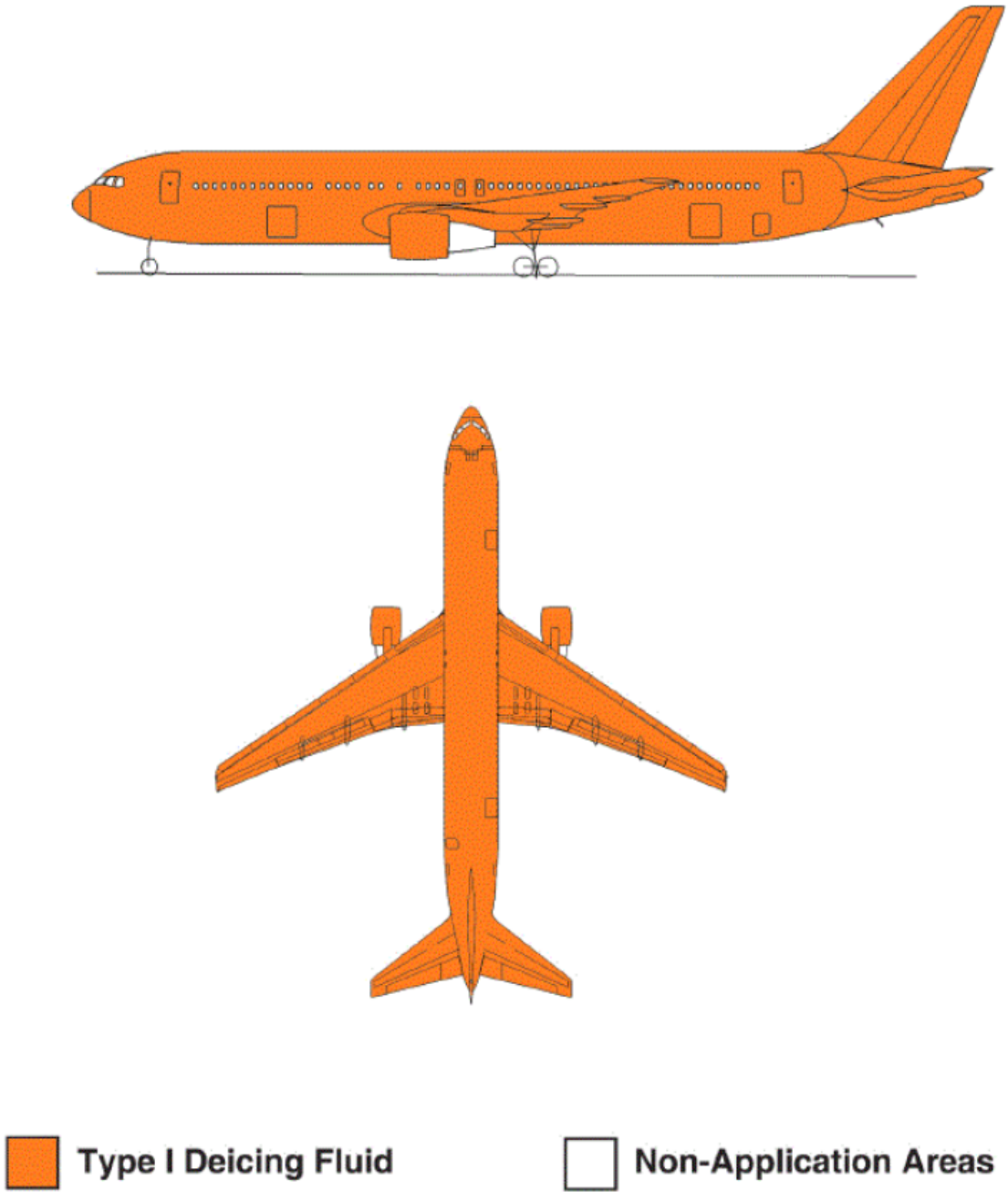


Figure 4-13: B-737-400F/800F Type I Deice Fluid Spray Area

B. Type IV Anti-icing Fluid

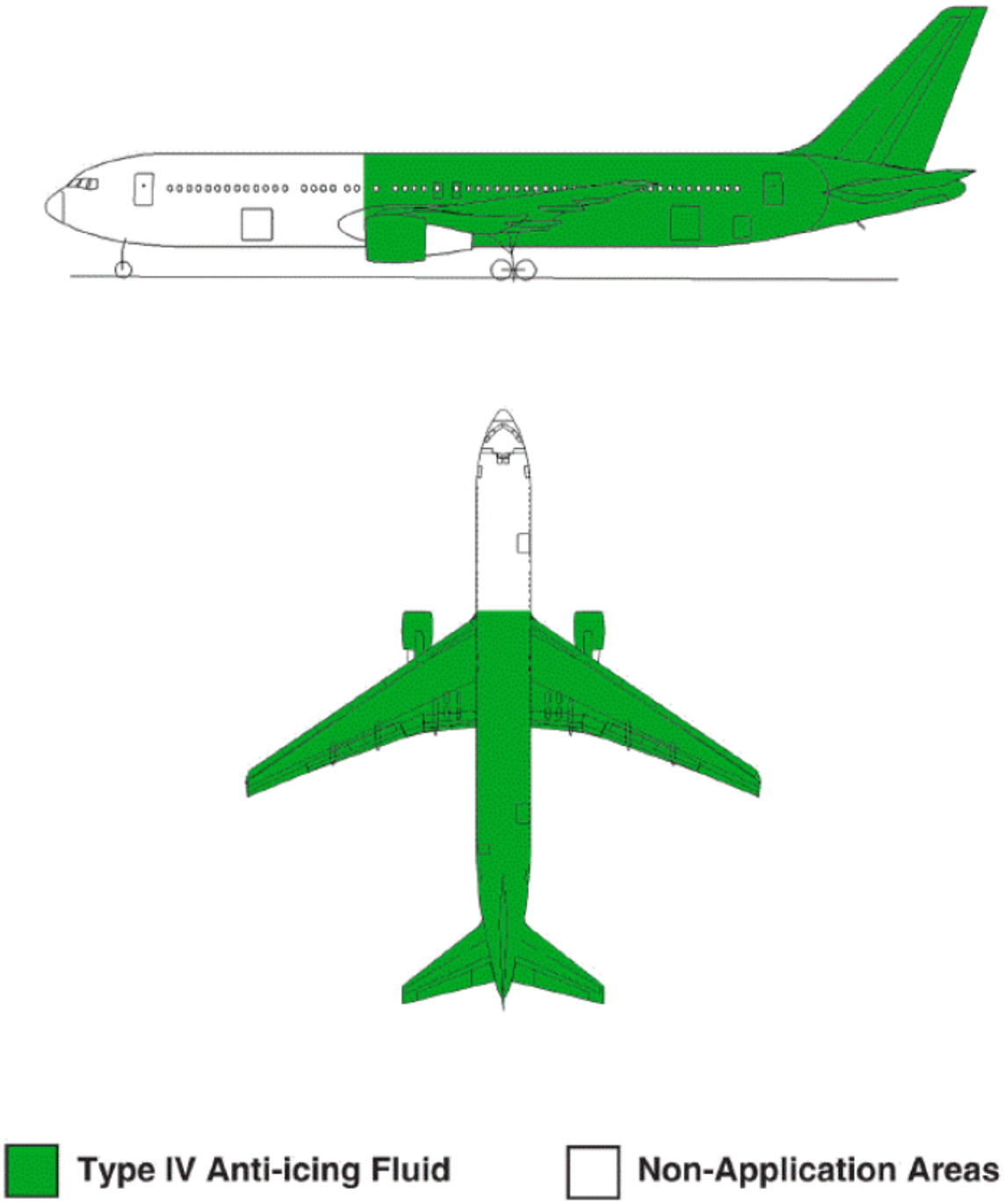


Figure 4-14: B-737-400F/800F Type IV Anti-icing Fluid Spray Area

4.7.7 B-737-400F/800F Areas to be Inspected

Table 4-2: B-737-400F/800F Areas to be Inspected

Area	Check
Protective covers	Removed
Wings: Ailerons, TE and LE Flaps, Spoilers, Winglets (if installed)	Free of frost, snow, and ice NOTE: Accumulations on the underside of the wing fuel tank area are permissible to a maximum 1/8 inches (3 mm) layer of frost
Empennage: Horizontal and Vertical Stabilizers, Elevators and Rudder	Free of slush, snow, and ice
Flight control and flap well cavities, hinges, tracks, jackscrews, and actuators	Free of slush, snow, and ice
Fuel tank vents and dump nozzle	Clear
Fuselage: Pitot masts, static ports, ice detectors, temperature probes, exterior doors (Cargo and Passenger), wing to fuselage fillets and top of fuselage.	Clear of frost, snow, and ice NOTE: A thin hoar frost is permitted on the top surface of the fuselage provided all the vents and ports are clear.
Area in front of engines	Clear of frost, snow, and ice
Engine/APU Inlets	Clear of frost, snow, ice, and engine fan turns freely
Air conditioning inlets and exhausts	Clear of snow and ice
Landing Gear: Centering cylinders, uplock mechanism, shock strut pistons, actuator pistons, door actuator mechanisms, and trucks	Unobstructed and clear of ice, slush, frost, and snow
Radome, nose forward of the windshields, and the windshields	Free of frost, snow, and ice

END

Chapter 5: Inspection and Communication

Chapter 5: Inspection and Communication

5.1 Aircraft Inspection

It is important to understand that de/anti-icing fluids do not provide any protection from contamination once the aircraft is airborne; therefore, both during and upon completion of each de/anti-icing operation, the aircraft must be thoroughly inspected. The aircraft should also be continually monitored between de/anti-icing and departure to ensure no further ice or snow accumulations have occurred. Deice again or otherwise remove all ice, snow, slush and frost where necessary to ensure that the aircraft is “CLEAN.”

5.1.1 Post De/Anti-icing Check

The deicing agent or other qualified person immediately following the ground de/anti-icing process must perform a post deicing check. All critical aircraft surfaces and caution areas must be closely checked for accumulation and deposits of ice, snow and other frozen contaminants. This check will be performed from outside the aircraft using stairs, booms or other available equipment that provides sufficient visibility of all critical aircraft surfaces and caution areas.

5.1.1.1 Performing the Check (Critical Surfaces/Components)

This procedure will not be conducted while the main engines are operating unless it can be performed from a position well away from the aircraft engine danger areas. Ensure that the wings, tail and all other control surfaces are clear of snow, slush, ice and frost.

A. Check the leading edges, upper surfaces and lower surfaces of the wings and the side panels of the vertical stabilizer.

B. Frost is not allowed on critical control surfaces of the aircraft. If detected, the aircraft must be deiced.

EXCEPTION

A thin layer of hoarfrost on the fuselage is permissible. Accumulations of frost up to 1/8 inch (3mm) are allowed on the underside of the wing.

NOTE

The condition of cold-soaked wings is observed on aircraft that land with fuel in wing tanks that has been chilled to very low temperatures which prevail at higher altitudes. Aircraft designed with tanks that allow the fuel to wet the upper wing skin are of particular concern. In conditions of rain, drizzle or fog, or high humidity when condensation forms on wing surfaces, clear ice may form on the wing upper surfaces, as well as underwing. This presents a particularly insidious hazard as it may occur while outside air temperatures are above freezing and therefore is unexpected. The condition typically produces a clear ice film that is very difficult to identify, especially during precipitation. Frost may also be produced by these conditions.

There is a substantial risk that a thick layer of ice may form, be dislodged during takeoff and be ingested by rear-mounted engines.

C. Ensure that all hinge gaps and control surface cavity areas are free from deposits/ accumulations of ice, snow and slush.

D. Ensure engine intake and exhaust area is clear.

E. Ensure that the fuselage is clear of all ice, snow and frost.

F. Check to ensure that the aircraft windshield and upper surface of the radome/nose is clear of accumulations of de/anti-icing fluid.

G. Check landing gear and wheel wells for ice or snow accumulation/deposits.

H. Ensure that the pitot tubes, angle-of-attack and side-slip sensors, static ports/discharge wicks, TAT probes, antennas and other externally mounted instruments are free from ice and snow accumulations.

I. Check the entry door, cargo door(s) and emergency exits to ensure they are free from ice and snow.

J. Once it has been determined through a post de/anti-icing check that the aircraft is clean and adequately protected, the aircraft should be ready for immediate departure. This is especially important in conditions of precipitation or high humidity. The results of this check are relayed to the PIC as defined by the procedures detailed in this chapter.

5.1.1.2 Identifying Contamination

A. Both flight deck and ground deicing personnel must be able to recognize indications of loss of fluid effectiveness and contamination on critical or representative aircraft surfaces as applicable. During checks, look for the following indications:

1. Aircraft treated with de/anti-icing fluids should appear glossy, smooth and wet. If the aircraft's surface color or texture begins to change to gray, appears milky or takes on an orange peel texture, this is an indication that the fluid is beginning to crystallize.
2. Snow particles or falling frozen precipitation is no longer melting completely and is adhering to the surface or forming slush.
3. Light reflections become diffused.
4. Crystallization and small round ice formations.
5. Small streams of ice formations.
6. Dull gray textured slush.
7. Aircraft placards should be visible through a coating of deicing fluid.

B. To detect residual buildup (gel or powder) during de/anti-icing operations, inspections must be conducted of the wing rear spar and hinge lines and leading edges of ailerons, flaps, elevators and spoilers for abnormal fluid thickening and appearance. Type II and IV residue as a result of fluid dry-out must be removed from the aircraft prior to flight dispatch.

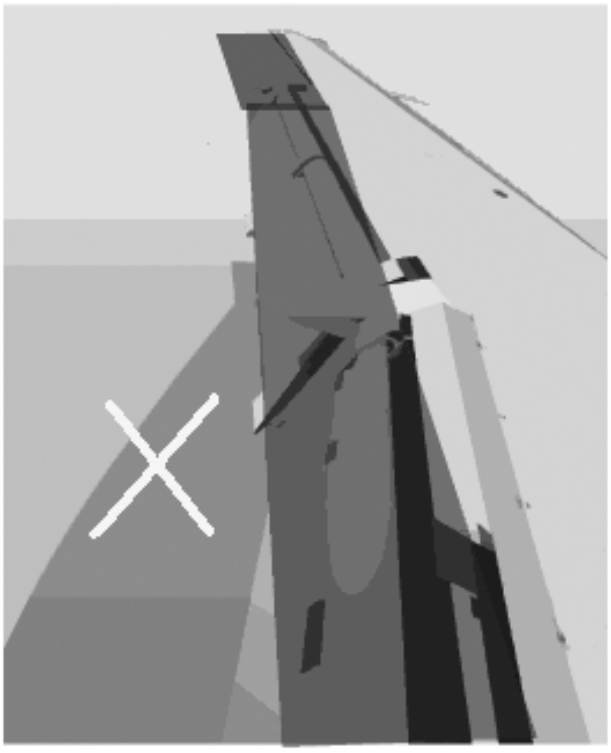
5.1.1.3 External Tactile Procedures

Hard wing aircraft with rear mounted engines are susceptible to frozen contamination on the leading edge surface of the wing which can be ingested in to the engine. When required by this manual, external tactile procedures will be accomplished as follows:

A. A tactile check must be accomplished from outside of the aircraft by qualified ground personnel. This is performed by running a gloved hand across the wing leading edge, wing forward upper surface and wing rear upper surface to determine that the wing is free from frost, ice, snow or slush. When performing the tactile check, wing seams should be felt where two pieces of metal are joined or screw/rivet heads. If the differences cannot be felt on these surfaces, it is an indication that ice may be present and additional deicing is required.

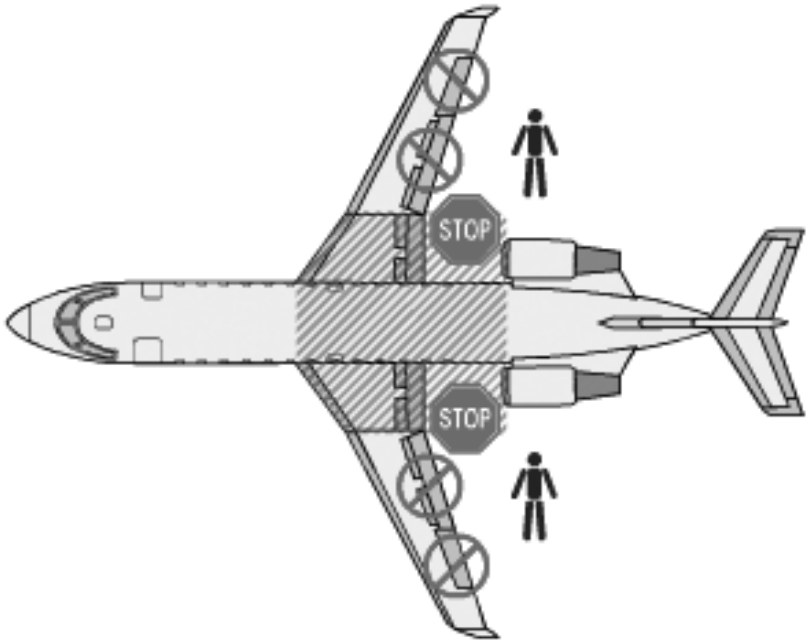
CAUTION

When performing a tactile inspection of the wings rear upper surface, the inspecting agent should not touch the area between the extended flaps or aileron and the wing surface.



CAUTION

The tactile inspection should be of the center area, not around the edges of the flaps or ailerons. These areas are extremely dangerous and only require a visual inspection.



CAUTION

During inspection of the wings rear upper surface, it is important that the inspecting agent stay clear of the engine intake danger area.

B. If this check cannot be accomplished because the agent performing the check cannot satisfactorily reach the area, the aircraft should not be dispatched. Another qualified agent should be contacted to perform the check and/or suitable ladders may be required.

5.1.2 Pre-Takeoff Check

This check is required anytime that ground-icing conditions exist and the aircraft has been de/anti-iced and a HOT established. It is accomplished within HOT range and normally can be accomplished by the flight crew from inside the cockpit. The aircraft's wings are checked for contamination within 5 minutes prior to takeoff. The pre-takeoff check is integral to the use of HOTs. Because of the variables involved in the determination of HOTs, it is necessary for the flight crew to look outside the aircraft to assess current weather conditions and the aircraft condition, and not rely on the HOT as the sole determinate that the aircraft is free of contaminates.

A. When performing a "Pre-Takeoff Check" the flight crew will use critical surfaces or the unheated representative surfaces, as applicable, to make a reasonable determination that the aircraft is clear of contamination.

B. The "Pre-Takeoff Check" can be conducted from the cockpit, or cabin, visually inspect the wing leading edge for signs of contamination.

5.1.3 Conducting Pre-Takeoff Checks During Light Freezing Rain or Freezing Drizzle Weather Conditions

When conducting a “Pre-Takeoff Check” during light freezing rain or freezing drizzle weather conditions following deicing with Type I or Type III fluid, the aircraft must receive a tactile check of the wings at the last possible safe point prior to takeoff, or anti-iced using a Type II or Type IV fluid. Some stations may elect to deice and then anti-ice the aircraft again due to safety or operational concerns instead of performing a tactile check. An external visual check is not authorized for the purpose of extending the HOT during freezing drizzle and light freezing rain when the aircraft has not been anti-iced with Type II or IV fluid. Take off during moderate or heavy freezing rain is not permitted.

5.2 Communications

Communication among all personnel involved in the deicing/anti-icing of an aircraft is critical to ensure that the pilot has the information needed to make the final determination that the aircraft is free of adhering contamination before flight. ALL personnel who perform duties as outlined in the Mesa Airlines, Inc. approved deice program must clearly and concisely communicate essential information to ensure that no frozen contaminants are adhering to any critical surfaces of the aircraft.

5.3 Flight Crew Communications

5.3.1 Briefings

It is recommended that, prior to the de/anti-icing of company aircraft with the flight crew present, ground personnel and flight crewmembers should hold a briefing to ensure that all participants in the de/anti-icing activity fully understand the following provisions of the activity:

A. Where the aircraft will be de/anti-iced.

B. What special procedures or methods will be utilized dependent upon the location for de/anti-icing and/or the restrictions for de/anti-icing imposed by the airport authority at this location.

C. What communications methods will be used (e.g., face-to-face, VHF radio, hand signals).

D. How the flight deck will signal ground personnel to immediately cease de/anti-icing activities should there be an emergency.

E. How ground personnel will ensure the flight deck is notified that all equipment and ground personnel are clear of the area prior to taxi away from centralized/remote deicing locations.

F. What location the aircraft will return to if there is a need for additional de/anti-icing (should the holdover time be exceeded), as applicable.

5.3.2 Communication with the Flight Deck

The primary means of communication with the flight deck will be via interphone or VHF radio when available. Should the interphone system or VHF radio not be available, the information will be communicated verbally (face-to-face), in writing or visually (using a written communication device such as dry erase board, grease board, etc.). When using the visual method, the flight deck will indicate that the information has been received. The individual who performs the de/anti-icing procedures and certifies the aircraft is clean and ready for departure, or the supervisor of the ground deicing activity (or designee) will provide the following information to the flight deck crew:

A. Fluid type.

B. Fluid manufacturer name.

C. Mixture percentage for Type II, III and IV fluid.

D. The start time of the final de/anti-ice application.

NOTE

If this cannot be communicated via interphone, radio or verbally, from the ramp, the qualified lineman will indicate to the flight deck crew the start time of the final de/anti-ice application by pointing to his or her wrist.

E. Verification that the post deice check has been completed and that the aircraft is “clean and ready” for departure.

NOTE

If this cannot be communicated via interphone, radio or verbally, a “thumbs up” from the ramp to the qualified lineman will indicate to the flight deck crew that the post application check has been completed and the aircraft is clean and ready for departure.

F. Communication that equipment and ground personnel are clear of the area and the aircraft is clear to depart.

5.3.3 Communications for One-Step Deicing Process

5.3.3.1 Prior to Deicing

Before commencing the application of de/anti-icing fluid, the personnel who perform the de/anti-icing should confirm with the flight crew that the aircraft is configured for deicing.

EXAMPLE

Ground: “Captain, is your aircraft ready for de/anti-icing?”

Flight Crew: “Mesa 920LR is configured and ready for Type I fluid on the wings and tail.”

5.3.3.2 Post Deicing

After deicing is complete and the aircraft post deice check is complete, communicate the following to the PIC:

A. Fluid type.

B. Fluid manufacturer name.

C. The start time of the final de/anti-ice application.

D. Verification that post-deice check is complete.

E. Any change in conditions that have affected the aircraft anti-icing treatment since the application.

F. Communication that equipment and ground personnel are clear of the area and the aircraft is clear to depart.

EXAMPLE

Ground: “Mesa 920LR, Safewing, Type I deicing is complete, start time of final fluid application was (military time), post-deice check complete.”

Flight Crew: “920LR, understand post-deice check complete.”

Ground: “Equipment and ground personnel are clear of the area and the aircraft is clear to depart.”

5.3.4 Communications for Two-Step Deicing Process

5.3.4.1 Prior to Deicing

Before commencing the application of de/anti-icing fluid, the personnel who perform the de/anti-icing should confirm with the flight crew that the aircraft is configured for deicing.

EXAMPLE

Ground: “Captain, is your aircraft ready for de/anti-icing?”

Flight Crew: “Mesa 920LR is configured and ready for Type I fluid on the wings and tail.”

5.3.4.2 Post Deicing

After deicing is complete and the aircraft post-deice check is complete, communicate the following to the PIC:

A. Fluid type.

B. Fluid manufacturer name.

C. Mixture percentage for Type II, III and IV fluids.

D. The start time of the final de/anti-ice application.

E. Verification that post-deice check is complete.

F. Any change in conditions that have affected the aircraft anti-icing treatment since the application.

G. Communication that equipment and ground personnel are clear of the area and the aircraft is clear to depart.

EXAMPLE

Ground: “Mesa 920LR, anti-icing is complete, Safewing, Type IV fluid was used with at a 100% mixture, start time of final fluid application was (military time), post-deice check complete.”

Flight Crew: “920LR, understand post-deice check complete.”

Ground: “Equipment and ground personnel are clear of the area and the aircraft is clear to depart.”

END

Chapter 6: Training

Chapter 6: Training

6.1 Responsibilities

6.1.1 Station Managers

Station Managers will coordinate annual de/anti-ice training at their station for all personnel assigned de/anti-icing responsibilities. The De/Anti-ice Designated Trainer will conduct annual training and must complete mandatory De/Anti-ice Train-the-Trainer Training prior to any instruction of local station personnel.

6.1.2 Corporate Instructors

Instructors facilitate the training of, and are responsible for designating, Designated Trainers at each location and maintain a territory of stations, as assigned by the Manager of Airport Operations & Safety Assurance, in order to ensure training compliance. Instructors assist with operational audits and work directly with Station Managers and Regional Managers to resolve issues of non-compliance in training and standards.

6.1.3 De/Anti-ice Designated Trainer(s)

The Station Manager is responsible for ensuring that the De/Anti-ice Designated Trainer(s) accomplish the training for their station:

A. The De/Anti-ice Designated Trainer(s) must attend the annual De/Anti-icing Train-the-Trainer session in order to train individuals at their station. The De/Anti-ice Designated Trainer is not qualified to conduct De/Anti-ice Training if the session is not attended.

B. Individuals that have qualified as De/Anti-ice Designated Trainers will be issued a Designated Trainer Certification (Form #S102). A copy of this record must remain on file at the station of employment for as long as the individual named herein provides service on behalf of Mesa Airlines, Inc.

C. The primary responsibilities of the De/Anti-ice Designated Trainer are:

1. Train station personnel at their station who have not received current classroom and/or practical training from the information received in the Train-the-Trainer session.
2. Ensure that current year de/anti-icing procedures are followed by observations of de/anti-icing.
3. Ensure that de/anti-icing personnel conserve fluid by using proper spray angles and nozzle settings.
4. Monitor compliance with FAR 121.629 and report any incidents of non-compliance to the Station Manager.
5. Ensure local deicing training is accomplished. This training, conducted prior to the start of the established winter season on October 1, will be valid until November 30 of the following year, or until the end of icing conditions at the station, whichever is greater.

6.2 Requirements

6.2.1 General

Stations are permitted to train only as many personnel as needed per day, per shift, for the de/anti-icing of Mesa Airlines, Inc. aircraft, as determined by the Station Manager; however, no person may participate in the de/anti-icing of Mesa Airlines, Inc. aircraft if they have not been trained within the last 12 months, in accordance with this manual, or received differences instruction, when applicable.

NOTE

Annual deicing training will include a comprehensive learning assessment or test. A score of 75% graded to 100% is required. A score of less than 75% will require the employee to complete annual training again.

NOTE

All personnel attending in-house training must be certified as having successfully completed this training by the De/Anti-ice Designated Trainer and the Station Manager.

6.2.2 Mesa Airlines, Inc. Employees

Mesa Airlines, Inc. employees that are not trained in accordance with an accepted training program must complete annual training provided by a Mesa Airlines, Inc. de/anti-ice designated trainer or receive training from a Mesa Airlines, Inc. corporate instructor.

6.2.3 Contract Vendors

A. Contract Vendor Trained by an Air Carrier with an Approved FAA Deice Program:

Following the completion of the air carrier's FAA approved deice program, personnel must be provided with, and acknowledge receipt and understanding of, Mesa Airlines, Inc. Differences Instruction, if the carrier does not have a like aircraft type as outlined in AC 120-60B. Contractors who have attended a codeshare carrier's deice class (e.g., USX or UAX) and were trained on a joint carrier training program are not required to have differences instruction completed by Mesa Airlines, Inc.

B. Contract Vendors not Trained by an Air Carrier with an Approved Deicing Program:

Vendors, such as DGS, Globe Ground, ASIG, etc., will adhere to the prescribed Mesa Airlines, Inc. Deice Program, unless they have been trained and certified as outlined in C(1). Contract recurrent training must be completed by October 1.

6.3 Documentation

A. A roster of Mesa Airlines, Inc. Deice/Anti-Ice Qualified Personnel (Form #S105) validating the completion of one of the following learning activities must be on file at the station for all individuals participating in the process to de/anti-ice aircraft operated by Mesa Airlines, Inc. This document must remain on file at the station for the duration of the established winter season or until icing conditions are no longer a factor at the station, whichever is greater. The Station Manager must certify this document upon completion.

1. Mesa Airlines, Inc. De/Anti-ice Course (Annual Training).
2. Mesa Airlines, Inc. De/Anti-ice Differences Instruction.

B. Tests completed by individuals participating in the Mesa Airlines, Inc. De/Anti-ice course will be reviewed by the Instructor or De/Anti-ice Designated Trainer for compliance with this chapter and may be destroyed after validating an individual has scored a minimum of 75% graded to 100%.

1. Documentation of Approved Joint Carrier Deice Training

   Each carrier has recognized and included Mesa Airlines, Inc. aircraft in their training material. Employees who are certified on an accepted joint carrier training program are certified to deice Mesa Airlines, Inc. aircraft. The FAA, corporate training instructors, Mesa Airlines, Inc. internal auditors, Regional Directors/Managers, etc. should expect to review training records for Mesa Airlines, Inc. or contract employees via the following approved systems:

   a. Local station paper record.

   b. Electronically through a carrier's approved documentation system (e.g., TNQ/LN, Pathlore, Oracle, ATMs, etc.).

6.4 Accepted Training Programs

The Manager of Airport Operations & Safety Assurance is responsible for the review and acceptance of training programs listed in this section. The Manager of Airport Operations & Safety Assurance will review these programs on an annual basis, prior to the start of the established deice season, to ensure that the content of these training programs are sufficient for the training of de/anti-ice personnel and that there are no significant differences related to the training provided and the policies and procedures of Mesa Airlines, Inc. for the de/anti-icing of Mesa Airlines, Inc. aircraft. When a difference arises within the deice season, the respective codeshare partner will notify all contract cities of the additional difference and the information will be included in the next deice training curriculum revised. Only those programs which appear in this section are accepted unless the Manager of Airport Operations & Safety Assurance determines another program is sufficient and approves. Only personnel who have successfully completed training in one of these programs are exempted from additional training required by this chapter.

6.4.1 United/United Express Aircraft De/Anti-icing Training Program

Mesa Airlines, Inc. has participated in the development of the United/United Express Aircraft De/Anti-icing Training Program and has ensured that the training provided is equivalent to the training provided by Mesa Airlines, Inc. and that the training reflects the intent of the policies and procedures utilized by Mesa Airlines, Inc. to meet the requirements of the Clean Aircraft Concept. Mesa Airlines, Inc. accepts this training program for the training of de/anti-ice personnel in lieu of training required by this section. Personnel completing this program are authorized to de/anti-ice Mesa Airlines, Inc. aircraft. Documentation must be available throughout the established winter season which validates an individual's successful completion of this program. This documentation may be maintained electronically, but must be made available during normal operational hours for inspection.

6.4.2 DHL Cargo Only Deicing

As stated in the "United/United Express Aircraft De/Anti-icing Training Program" section above, Mesa Airlines, Inc. has participated in the development of the United/United Express Aircraft De/Anti-icing Training Program and has ensured that the training provided is equivalent to the training provided by Mesa Airlines, Inc. Mesa Airlines will provide differences training for those Mesa Airlines, Inc. flights operated as DHL. This differences training will meet the requirements of the Clean Aircraft Concept. Personnel completing this differences training is authorized to de/anti-ice Mesa Airlines, Inc. aircraft. Documentation must be available throughout the established winter season which validates an individual's successful completion of this program. This documentation may be maintained electronically, but must be made available during normal operational hours for inspection.

6.4.3 Standardized International Aircraft Ground Deice Program (SIAGDP)

For deicing at Canadian locations, Mesa Airlines, Inc. has accepted the training and procedures as outlined in the International *De/Anti-icing Manual* with respect to international ground deicing provisions of Part 121 operator-approved programs. The International *De/Anti-icing Manual* can be found at: http://www.faa.gov/other_visit/aviation_industry/airline_operators/airline_safety/deicing/media/standardized_international_ground_deice_program.pdfe

6.5 Mesa Airlines, Inc. De/Anti-icing Curriculum

MISC AC 120-60b

Mesa Airlines, Inc. will conduct annual training for flight crews, ground crews and dispatchers and will ensure that all such personnel obtain and retain a thorough knowledge of aircraft ground de/anti-icing policies and procedures. The specific requirements of training (as well as information on training facilities, training aids and materials, instructors, testing, record keeping, training forms, etc.) are covered in the Mesa Airlines, Inc. *Flight Operations Training Manual–Volume 1* and *Flight Operations Training Manual–Volume 3,* and *Deicing Manual*. The Mesa Airlines, Inc. de/anti-icing curriculum consists of the following subjects. Not all subjects are required to be completed by all personnel involved in the ground de/anti-icing of company aircraft, rather, specific courses are required for personnel identified as flight crew (F), dispatcher (D) or ground personnel (G) - Flight Crewmember and Dispatcher Training.

A. Effects of Frozen Contaminants on Aircraft Surfaces

Provide an understanding of the critical effect the presence of minute amounts of frost, ice or snow has on flight surfaces. This discussion should include, but is not limited to:

1. Loss of lift.
2. Increased drag and weight.
3. Decreased control.
4. Tendency for rapid pitch-up and roll-off during rotation (F/D only).
5. Stall occurs at lower-than-normal angle of attack (F/D only).
6. Buffet or stall occurs before activation of stall warning (F/D only).
7. Aircraft specific areas:
    a. Engine foreign object damage potential.
    b. Ram air intakes.
    c. Instrument pickup points.
    d. Leading edge device (LED) aircraft (aircraft that have slats or leading edge flaps) and non-LED aircraft.
    e. Airworthiness Directives/Specific inspections.
    f. Winglets.

B. Aircraft Ground Icing Conditions

Describe conditions that cause implementation of de/anti-icing procedures (F/D/G).

1. In-flight Ice Accumulation. Certificate holders should have procedures for flight crews on arriving flights to report occurrences of in-flight icing to the personnel responsible for executing the certificate holder's de/anti-icing program. In-flight ice accumulation could result in a ground-deicing situation when flights are scheduled for short turnaround times (i.e., for 30 minutes or less and when ambient temperatures on the ground are at or below freezing).
2. Frost, including hoarfrost.
3. Freezing precipitation (snow, freezing rain, freezing drizzle or hail, which could adhere to aircraft surfaces).
4. Freezing fog.
5. Rain or high humidity on cold soaked wing.
6. Rain or high humidity on cold soaked wing fuel tanks.
7. Under-wing frost (may not require de/anti-icing within certain limits).
8. Fluid failure identification.

C. Location specific de/anti-icing procedures (F/D and/or G, as appropriate).

D. Communications procedures between the flight crew, ground personnel, ATC and company station personnel (F/D/G).

1. Communication procedures must include ground crew confirmation to the flight crew after the deicing and anti-icing process is completed that all personnel and equipment are clear before reconfiguring or moving the aircraft.

E. Means for obtaining most current weather information (F/D/G).

F. Characteristics and capabilities of fluids used (F/D/G).

1. General fluid descriptions.
2. Composition and appearance.
3. Differences between Type I, Type III and Type II/IV de/anti-icing fluids.
4. Purpose for each type.
5. Deicing fluids.
6. Anti-icing fluids.
7. De/anti-icing fluids capabilities.
8. Approved de/anti-icing fluids for use (SAE, ISO, etc.).
9. Fluid-specific information provided by fluid or aircraft manufacturer (F/D and/or G as appropriate).
10. Fluid temperature requirements (Hot vs. Cold).
11. Properties associated with infrared de/anti-icing.

G. Fluid Storage and Handling (G)

1. Fluid storage.
2. Fluid handling.
3. Fluid sampling.
4. Fluid testing.

H. De/Anti-icing Facilities and Equipment Operation Procedures (G)

This portion of the training is intended to provide an understanding of the capabilities of the de/anti-icing equipment and the qualifications for operation of the equipment. The equipment portion of the training program should include the following:

1. Description of Various Equipment Types:
    a. De/anti-icing vehicles.
    b. Infrared facilities.
    c. Hard stands.
2. Operation of the equipment.
3. Emergency procedures.

I. Health, Safety and First Aid (F/D/G).

J. Environmental Considerations (G).

K. Fluid Selection (F/D/G).

L. Methods/Procedures (F/D/G)

1. Inspection of critical surfaces.
2. Clear ice precautions.
3. Flight crew/ground crew preflight check requirement.
4. De/anti-ice determination.
5. De/anti-ice location.
6. Communication before de/anti-icing.
7. General de/anti-ice precautions.
8. Aircraft specific requirements.
9. Deicing:
    a. Requirements.
    b. Effective removal of frost, snow and ice (G).

10. Anti-icing:
    a. Requirements.
    b. Preventative anti-icing (G).
    c. Application (G).
11. De/Anti-icing:
    a. One-step.
    b. Two-step.
12. Guidelines for the application of de/anti-icing fluids.
13. Post de/anti-icing checks requirement.
14. Flight control check.
15. Communications after de/anti-icing.
16. Use of the de/anti-icing log.

M. Use of HOTs (F/D/G)
1. Definition of HOT.
2. When HOT begins and ends.
3. Limitations and cautions associated with the use of HOTs.
4. Source of HOT data.
5. Relationship of HOT to particular fluid concentrations and for different types of fluids.
6. Precipitation category (e.g., fog, drizzle, rain or snow).
7. Precipitation intensity.
8. How to determine a specific HOT from the HOT range that accounts for moderate or light weather conditions (F/D).
9. Adjusting HOT for changing weather conditions (F/D).

NOTE

Ground personnel should receive familiarization training on determining a specific HOT from the HOT range and adjusting the HOT for changing weather conditions.

N. Pre-takeoff Check Requirement (F/D). Identification of representative surfaces.

O. Communications (F/D/G).

P. Aircraft Surface Contamination Recognition (F/D/G).

6.6 Differences Instruction

Differences instruction shall be provided to, and receipt and understanding acknowledged by, ground personnel whenever those personnel have been qualified by another FAR Part 121 air carrier, but are unfamiliar with the policies and procedures of Mesa Airlines, Inc. for the de/anti-icing of Mesa Airlines, Inc. aircraft. Differences Instruction is not required for those persons who have successfully completed training in an Accepted Training Program outlined in this chapter.

A. Specific De/Anti-icing Procedures for Mesa Airlines, Inc. Aircraft

1. Wings, tail section, all control surfaces and flaps shall be clear of snow, frost and ice before releasing the aircraft for takeoff.
2. Preparation
    a. Make certain all windows, doors and emergency exists are closed.
    b. Remove accumulated snow and ice from the landing gear.

B. Deicing Spray Sequence - General

All aircraft will be deiced in the same manner. The Mesa Airlines, Inc. fluid application pattern will be adhered to. Deviations from this pattern may only be approved by the PIC for a specific flight.

NOTE

Specific information on each aircraft as to the location of the air intakes, static ports, pitot tubes and other cautions areas can be found in Chapter 4: "Contamination Removal and Fluid Application" of this manual.

C. Critical Areas to Spray - All Aircraft

1. Thoroughly deice tail and elevator areas, to include the slots between elevator and vertical tail assembly and elevator spring tab.
2. Leading edge, all wing areas and forward fuselage.
3. Spinners.

NOTE

Spray from side to avoid spraying deicing fluid into engine air intake.

4. Landing gear and gear doors.

CAUTION

Do not spray deicing fluid on hot brakes.

5. Aileron area.

D. Caution Areas (Avoid Direct Spray) - All Aircraft

1. Engine air intake.
2. Static ports and pitot tubes.

CAUTION

Deicing fluids in these areas could cause improper cockpit instrument readings.

3. Main landing gear proximity switches.
4. Fresh air vents.
5. Air conditioning inlets.
6. Engine/APU exhaust area.
7. All doors and emergency exits.
8. Refueling panels.
9. All windows.
10. APU air intake.

E. Aircraft Inspections

1. Post Deice Check

   All critical surfaces of the aircraft must receive a visual or tactile inspection (when required) before an aircraft is released for departure during icing conditions or when de/anti-icing has been completed. The inspection is to be performed from an elevated piece of equipment offering sufficient visibility of these parts. The aircraft must meet the Clean Aircraft Concept before being cleared to depart. Aircraft critical surfaces to inspect include:

   a. Wings, tail and control surfaces.
   b. Pitot heads, static ports and angle of attack (AOA) sensors.
   c. Engine inlets and intakes.
   d. Air conditioning inlets and exhausts.
   e. Landing gear and gear doors.
   f. Fuel tank vents.

F. Communications to the Flight Deck Crew

1. The deice agent will communicate to the flight crew the following information which is necessary for the “Holdover Time” computation:

   a. Type of fluid used.

   NOTE

   When using Type II, Type III or Type IV fluid, the fluid manufacturer and fluid name must also be communicated to the flight crew.

b. Percentage of fluid concentration with water.

c. Start time of the final de/anti-ice application.

2. The information necessary for Holdover Time computation is transmitted to the flight crew via one of the following:

   a. Aircraft interphone.

   b. VHF radio.

   c. In person.

   d. In writing (dry erase board, grease board, etc.).

   e. If none of the direct means of communication listed above are available, the start time of the final de/anti-ice application will be communicated and acknowledged by hand signal as follows:

      1) The deicing agent will point to his/her wrist with his/her opposite hand.

      2) The flight crew must note the present time as the start time of the final de/anti-ice application.

      3) The flight crew will acknowledge by giving the deicing agent the “thumbs up” signal.

3. Post Deice Check

   a. After completing the final application of deice or anti-ice fluid, the deice agent will perform the Post Deice Check.

   b. The deice agent shall communicate the results of the Post Deice Check to the flight crew. If the Post Deice Check is unsatisfactory, the flight shall not depart. If direct communication is not available, hand signals shall be used as follows:

      1) Satisfactory Post Deice Check results are communicated to the flight crew with the “thumbs up” hand signal. The flight crew will acknowledge by giving the deice agent the “thumbs up” signal.

      2) Unsatisfactory Post Deice Check results must be communicated to the flight crew using the “thumbs down” signal. The flight crew will acknowledge by giving the deice agent the “thumbs down” signal.

4. Stations will maintain a log of the deicing services provided for Mesa Airlines, Inc. Forms equivalent to the Mesa Airlines, Inc. Aircraft Deicing/Anti-icing Record (Form #M504), which can be found in this manual, may be used when such equivalent forms contain the same basic information.

G. Deicing Overnight Aircraft

When an aircraft has been parked outside overnight and heavy frost, snow or ice is present on the critical surfaces and there is no falling precipitation, deicing should be done as soon as practical. If snow or freezing rain is falling, or if frost conditions exist, deicing and anti-icing should be accomplished as close to departure time as possible.

H. Through or Turn-Around Aircraft

The PIC shall be consulted before beginning any de/anti-ice operation. The PIC may request the aircraft be sprayed with de/anti-icing fluid if the temperature is at or below the freezing point and the aircraft will be subjected to rain or icing conditions between ramp departure and takeoff.

I. De/Anti-icing with Engines Operating

It is the policy of Mesa Airlines, Inc. that aircraft will normally be de/anti-iced with a ground power unit connected or engines running. During de/anti-icing operations with the engines operating, the engines will be idled. The flight deck crew will jointly make the determination with the deice crew whether the engines will or will not be operated during de/anti-icing.

CAUTION

Prior to approaching an aircraft with engines running, check the operation of the lift device and ensure that emergency signals have been established between the driver and the lift operator to be used in case of danger or equipment malfunction.

J. Procedures for De/Anti-icing with Engines Operating

The flight crew and deice crew will make the determination that engines will or will not be operated during de/anti-icing. After repositioning to the deice pad, the engines are idled, as appropriate to the situation. If de/anti-icing is to be accomplished with the engines running, the parking brakes must be set. In either case, the flight crew will signal the deice crew that the parking brakes have been set. After the “brakes set” signal has been given, de/anti-icing jointly will be conducted in accordance with this manual except that the wing having an operating engine will be deiced from behind the wing.

K. Alternate Deicing Procedure

When braking action on the deice pad is reported as poor, additional safety precautions will be implemented. At the discretion of the ground deicing supervisor, deicing will be conducted only on the side of the aircraft without an operating engine. The process is completed by alternating the operating engine after the first half of the aircraft is deiced. Coordination between ground and flight personnel must be accomplished before this procedure is used.

CAUTION

The PIC requesting deicing is the final authority. Should there be a disagreement with the ground deicing crew, the PIC must contact the station manager (if available) and Mesa Airlines, Inc. System Operations Control to resolve a disagreement.

6.7 Outsourced Training

Mesa Airlines, Inc. may outsource station training to third party entities. The Manager of Airport Operations & Safety Assurance will schedule, have authority over, be responsible for and be accountable for the quality and content of all outsourced training. All outsourced trainers will be trained and documented per 6.2: "Requirements" and 6.3: "Documentation" in this chapter. All training events will be completed in accordance with the procedures outlined in this manual. The Manager of Airport Operations & Safety Assurance will ensure that audits of contractors are not contracted to the same contractor providing the service.

END

Chapter 7: Contract Deicing Vendors

Chapter 7: Contract Deicing Vendors

7.1 Responsibility and Authority

A. It is the responsibility of all contract deicing vendors to conduct their operation in accordance with this manual and accepted industry standards, and to do so in a safe manner. The Manager of Airport Operations & Safety Assurance will ensure oversight of the vendor through the deice audit process.

B. In cases where vendor practices deviate or are in conflict with this manual, a request for deviation must be requested, as required in Chapter 1: "General" of this manual.

C. Vendors may use their own forms to keep the following records as long as the forms are at least of the same scope and detail as the equivalent Mesa Airlines, Inc. forms. Refer to Chapter 1: "Deicing Forms" in this manual for guidelines on the forms used in the Mesa Airlines, Inc. deicing program:

1. Glycol Storage Tank Fill Log (Form #M502).
2. Aircraft Deicing/Anti-icing Record (Form #M504).
3. Daily Deicing Equipment Inspection Checklist (Form #M506D).

D. Each vendor must keep on file the appropriate Mesa Airlines, Inc. approved Certificate of Training for each designated trainer and roster of all trained deicing operators allowed to deice Mesa Airlines, Inc. aircraft.

7.2 Surveillance

A. Mesa Airlines, Inc. participates in and accepts audits performed by the Regional Shared Audit Program (RSAP) which shares the audit responsibility and audit standards with other regional flying partners under the American Airlines, United Airlines and Delta Airlines codeshare operations. These audits include interviews, document sampling and observations of above-the-wing, below-the-wing, deice and cargo/HazMat operations at stations. RSAP audits will be performed in accordance with the *Regional Shared Audit Program Manual* (RSAPM) and the contents of said manual have been reviewed to meet and/or exceed the requirements of Mesa Airlines, Inc. The RSAP audit checklist has references to all codeshare partners and the particular aircraft they operate. This is done as to ensure all participating carriers are using the same audit checklists and ensure the same procedures are used by all participating carriers. Except as noted in this section, Mesa Airlines, Inc. will use the RSAP audit checklist as shown in Appendix E, Form #M508 for all United Express operations. Mesa Airlines, Inc. will use the Cargo Deicing Audit as shown in Appendix E, Form #M509 for all DHL operations.

B. The Manager of Airport Operations & Safety Assurance is responsible to ensure that a deice audit is conducted at a location where Mesa Airlines, Inc. operates scheduled flights. New stations, those that do not have currently scheduled flights, must have an audit conducted within the last 24 months or else an audit must be completed prior to start of service by a Regional Manager.

C. The Manager of Airport Operations & Safety Assurance is responsible to ensure that a biennial deice audit is conducted at all stations where Mesa Airlines, Inc. operates as United Express. For DHL stations, this audit will be conducted annually. This audit will not include those stations which are considered deice exempt.

D. While it will be the responsibility of the Station Manager to resolve individual discrepancies, the seasonal evaluation will primarily be used by the Manager of Airport Operations & Safety Assurance to identify and resolve systemic trends. The Manager of Airport Operations & Safety Assurance may share the results of this seasonal evaluation with other department heads as appropriate.

E. Mesa Airlines, Inc. representatives conducting audits under the Internal Evaluation Program have the authority to conduct evaluations of the De/Anti-Ice Program in accordance with the Mesa Airlines, Inc. *Safety Program Manual* (Manual #530). The intent of such evaluations is to obtain an objective observation of the integrity of the program, the program's application, consistency and impact with other departments, and to provide a secondary means of review to ensure compliance with applicable Mesa Airlines, Inc. standards.

F. At locations where Mesa provides deicing service, Mesa Airlines, Inc. may outsource deice audits to third party vendors. These vendors will be trained as designated de/anti-ice trainers, as per the guidelines in Chapter 6: "Training" and policies in this manual, and documented on the Designated Trainer Certification (Form #S102). The Manager of Airport Operations & Safety Assurance will schedule, have authority over, be responsible for and be accountable for the quality and content of all outsourced auditing. The Manager of Airport Operations & Safety Assurance will ensure that audits of third party vendors are not contracted to the same vendor providing the service.

END

Appendix A: Wind Chill Chart

Appendix A: Wind Chill Chart

A.1 Wind Chill Chart

ESTIMATED
WIND SPEED
MPH
⇓

LOCAL TEMPERATURE °F

	32	23	14	5	4	-13	-22	-31	-40	-49	-58
Calm	32	23	14	5	-4	-13	-22	-31	-40	-49	-58
5	29	20	10	1	-9	-18	-28	-37	-47	-56	-65
10	18	7	-4	-15	-26	-37	-48	-59	-70	-81	-92
15	13	-1	-13	-25	-37	-49	-61	-73	-85	-97	-109
20	7	-6	-19	-32	-44	-57	-70	-83	-96	-109	-121
25	3	-10	-24	-37	-50	-64	-77	-90	-104	-117	-130
30	1	-13	-27	-41	-54	-68	-82	-97	-109	-123	-137
35	-1	-15	-29	-43	-57	-71	-85	-99	-113	-127	-142
40	-3	-17	-31	-45	-59	-74	-87	-102	-116	-131	-145
45	-3	-18	-32	-46	-61	-75	-89	-104	-118	-132	-147
50	-4	-18	-33	-47	-62	-76	-91	-105	-120	-134	-148
LITTLE DANGER FOR PROPERLY CLOTHED PERSONS			CONSIDERABLE DANGER			VERY GREAT DANGER					
			DANGER FROM FREEZING OF EXPOSED FLESH								

To use the chart, find the estimated or actual wind speed in the left-hand column and the actual temperature in degrees Fahrenheit in the top row. The equivalent temperature is found where these two intersect. For example, with a wind speed of 10 mph and a temperature of 4°F, equivalent temperature is -26°F. This lies within the “CONSIDERABLE DANGER” zone and protective measures should be taken.

NOTE

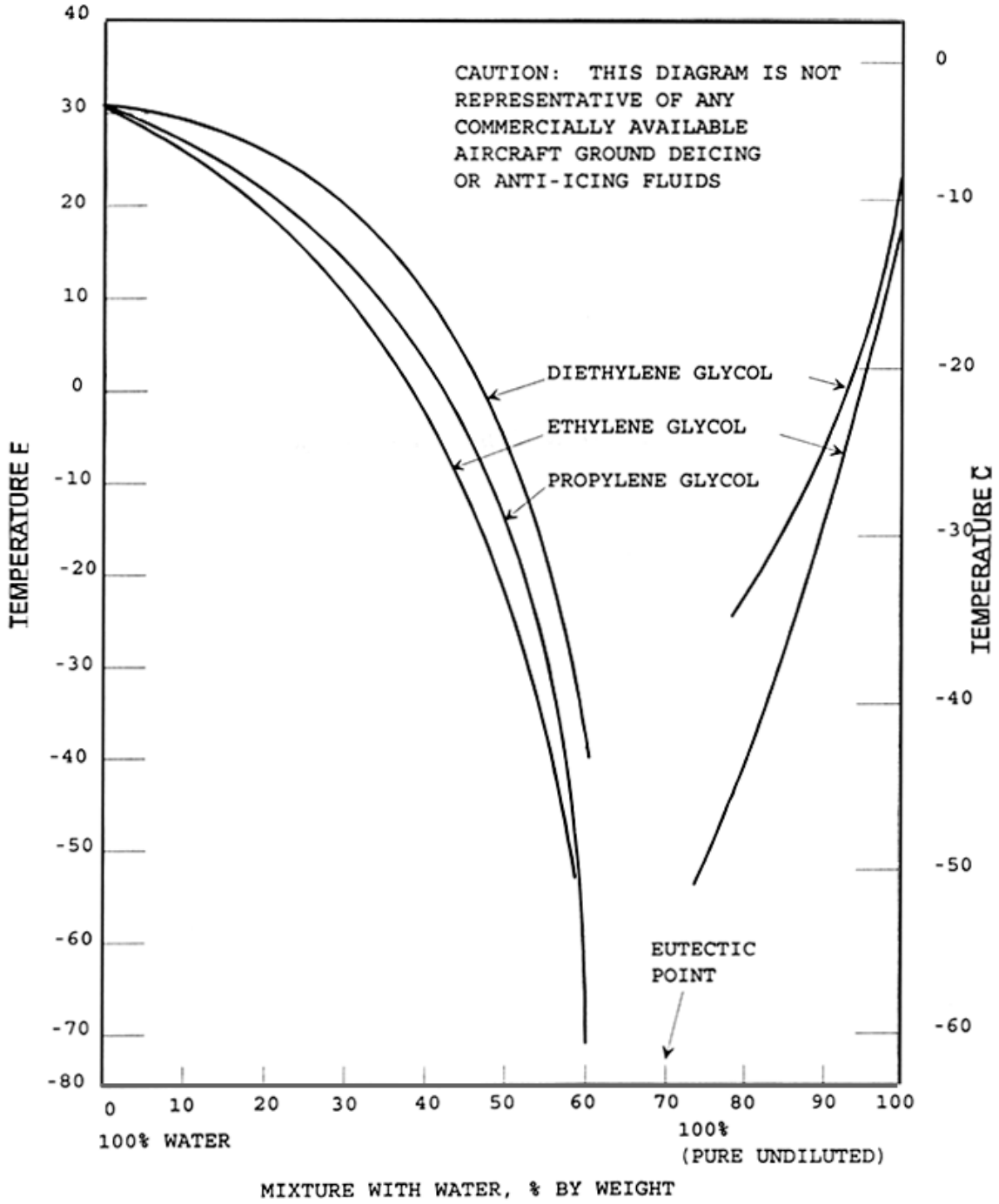
Wind chill temperatures DO NOT affect mechanical units. Wind chill charts are only applicable to life forms (humans, animals, etc.) that produce their own body heat.

END

Appendix B: Phase Diagram of Aqueous Glycol Solutions

Appendix B: Phase Diagram of Aqueous Glycol Solutions

B.1 Phase Diagram of Aqueous Glycol Solutions



END

Appendix C: Deicing Test and Training Forms

Appendix C: Deicing Test and Training Forms

C.1 Deicing Test

Mesa Airlines, Inc.
Deicing Test

Name:		Company:	
Employee ID:		Position:	
Station:		Date:	
Test Score:			

1. The station manager can activate the Mesa Airlines, Inc. Ground De/Anti-Icing Program in coordination with SOC.
   a. True
   b. False
2. Recommended protective personal items for Ground Service Agents when working on the ramp during inclement weather include:
   a. Eye and face protection (face shield or goggles)
   b. Respiratory protection (filtering masks provided at employee request)
   c. Protective clothing such as gloves, rain suits and boots
   d. All of the above
3. It is permissible to spray hot brakes:
   a. With Type I fluid
   b. With hot water only
   c. When ice has accumulated
   d. Never
4. The deicing vehicle should:
   a. Get as close as possible so nothing is missed
   b. Maintain a 15 ft. clearance from the aircraft while the distance of the basket/closed cab should not come to within 10 ft.
   c. Maintain a 10 ft. clearance from the aircraft while the distance of the basket/closed cab should not come to within 4 ft.

10/24/12 Page 1 of 5

Mesa Airlines, Inc.
Deicing Test

5. Single truck de/anti-icing should start at what point on the aircraft and should continue in what direction?

   a. Right wing tip, continuing toward nose to tail

   b. Aft of left wing, continuing toward nose to tail

   c. Nose, continuing toward main cabin door to tail

   d. Tail, continuing toward right wing tip to nose

6. It is important to ensure the critical flight surfaces are clear of all accumulation because:

   a. It could cause inaccurate instrument readings

   b. The passengers may see it

   c. Even small amounts of accumulation can adversely affect lift characteristics

   d. The ramp will become slick and hazardous

7. The four items provided to the flight crew following a de/anti-icing effort are:

   a. Fluid Type; Mixture ratio for Type II, III and IV fluid; start time of the final deice/anti-ice application; verification that the aircraft is “clean and ready” for departure.

   b. Fluid Type; Temperature of fluid used; estimated time of departure; weather update.

   c. Type of Fluid used; Equipment safety check-off list; start time of the final deice/anti-ice application; updated departure time.

   d. Type of Fluid used; start time of the final deice/anti-ice application; verification that the aircraft will be ready in time for departure; name of agent providing deice/anti-ice application.

8. What deice communication methods are acceptable when communicating information to the flight crew?

   a. Face-to-Face

   b. VHF radio

   c. Hand signals

   d. All of the above

Mesa Airlines, Inc.
Deicing Test

9. Who determines whether an aircraft has been properly deiced?
   a. Agent in charge of spraying the aircraft
   b. Agent performing final inspection
   c. PIC
   d. Station Manager
10. The “Clean Aircraft Concept” is best described as “all critical flight surfaces (wings and control surfaces) are free from ice, snow, frost and other frozen precipitation.”
   a. True
   b. False
11. Wearing of a Full Body fall restraint device is optional when spraying from an open bucket/basket.
   a. True
   b. False
12. The deicing nozzle must maintain a distance of at least 5 ft. between the nozzle and the aircraft.
   a. True
   b. False
13. Prior to use, refractometers and glycol testers should be checked daily when de/anti-icing conditions are forecasted or in effect.
   a. True
   b. False
14. A broom used for snow removal may also be used to sweep the operations office floors during the winter?
   a. True
   b. False
15. Holdover Time (HOT) is the estimated time that de/anti-icing fluid will prevent the formation of frost or ice and the accumulation of snow on the critical surfaces of an aircraft.
   a. True
   b. False

Mesa Airlines, Inc.
Deicing Test

16. Originating flights should be deiced (if necessary) without waiting for the PIC to request such services.

    a. True

    b. False

17. In order to get ice off the engine intakes, it is permissible to spray fluid directly into the intake.

    a. True

    b. False

18. The PIC should be consulted before deicing Through or Turn-Around aircraft.

    a. True

    b. False

19. When spraying the critical surfaces, the direction of the spray should be kept flowing from the leading edge to the trailing edge.

    a. True

    b. False

20. When deicing Mesa Airlines, Inc. aircraft, all doors and emergency exits should be sprayed directly with full force.

    a. True

    b. False

21. Do not spray heated deicing fluid directly on cold windows.

    a. True

    b. False

22. De/anti-icing is to be completed whenever requested by the PIC.

    a. True

    b. False

Mesa Airlines, Inc.
Deicing Test

23. When an aircraft has been parked outside overnight and heavy frost, snow or ice is present on the critical surfaces and there is no falling precipitation, deicing is not required.

    a. True

    b. False

24. If snow or freezing rain is falling, or if frost conditions exist, deicing and anti-icing should be accomplished as close to departure time as possible.

    a. True

    b. False

25. A GPU may be used during deicing operations.

    a. True

    b. False

Once this test has been graded, the test score must be recorded on Form #S105.
The test may then be destroyed. The answer key may be requested in writing from the Mesa Airlines, Inc. Training Department by fax at 602-685-4563 or via email at station-training@mesa-air.com.

C.2 Designated Trainer Certification (Form #S102)

MESA AIRLINES, INC.

DESIGNATED TRAINER CERTIFICATION

DEICE/ANTI-ICE

NAME EMPLOYEE ID

COMPANY STATION

The individual named on this form has satisfactorily completed Deice/Anti-Ice training in Mesa Airlines, Inc. policies and procedures and is qualified to train others in accordance with the Mesa Airlines, Inc Deicing Manual. Certification to train other personnel in this subject area will expire on the date noted in accordance with the policies and procedures of Mesa Airlines, Inc. Training provided by this individual after the date certification expires will be invalid.

DATE COMPLETED	INITIAL or RECURRENT (IF APPLICABLE)	CERTIFICATION TO TRAIN EXPIRES ON	DESIGNATED DEICE/ANTI-ICE TRAINER SIGNATURE	INSTRUCTOR SIGNATURE and ID

DISTRIBUTION

- A copy of this record must remain on file at the station of employment for as long as the individual named herein provides service on behalf of Mesa Airlines, Inc.
- A copy of this record must be forwarded to the Manager of Regulatory Compliance at Mesa Airlines, Inc. Corporate Headquarters, 410 N. 44th Street, Suite 700, Phoenix, AZ, 85008 or by fax at (602) 685-4563 or by electronic mail to STATION-TRAINING@MESA-AIR.COM

FORM S102 *Revised 06/15/2018*

C.3 Deice/Anti-Ice Qualified Personnel (Form #S105)

Mesa Airlines, Inc. Station Training Program

Deice/Anti-Ice Qualified Personnel

GENERAL INFORMATION

STATION: _____ COMPANY EMPLOYING INDIVIDUALS BELOW: _____

TRAINING TYPE: (CHECK ONE) ☐ Mesa Airlines, Inc. Deice/Anti-Ice Course ☐ Differences Instruction*
(If checked, please complete section below)

DIFFERENCES TRAINING INFORMATION

List the name of the FAR Part 121 Air Carrier providing deice/anti-ice training for the individuals below: _____

List the location at this station where records of that training can be found: _____

"Agents who sign for Differences Instruction indicate by their signature that they have received and understand all differences instruction provided regarding the deicing/anti-icing of Mesa Airlines, Inc. operated aircraft and agree to abide by the policies and procedures of the same."

AGENT NAME/ID	DATE	Test Score (not required for differences)	AGENT SIGNATURE	TRAINER ID/INITIALS (not required for differences)
				/
				/
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				/

REQUIRED CERTIFICATION

Individuals may not participate in unsupervised deicing/anti-icing activities on behalf of Mesa Airlines, Inc. until the Station or Vendor Manager or Designee (e.g. Assistant Manager, Supervisor) has reviewed and certified this record.

STATION/VENDOR MANAGER SIGNATURE: _____ ID: _____

DATE OF CERTIFICATION: _____

FORM S105 REVISED 09/25/2015

END

Appendix D: Reserved

Appendix D: Reserved

Appendix E: Operational Forms

Appendix E: Operational Forms

E.1 Glycol Storage Tank Fill Log (Form #M502)

BULK STORAGE

Glycol Storage Tank Fill Log

Mesa Airlines, Inc. Form # M502

Station:_____ Tank Number_____

Date	Fluid Manufacturer & Type	Concentration of Fluid Received	Quantity of New Glycol added	Quantity of water added (if appliacable)	Freeze Point Verification	Individual Accepting Fluid

Mesa Airlines, Inc.

Revision: 09/25/2015

E.2 Aircraft Deicing/Anti-icing Record (Form #M504)

MESA AIRLINES

Aircraft Deicing / Anti-icing Record
Form #M504

Station:______________
Deicing Provider:______________

Date	Flight Number	Aircraft Identification Number	Final Step Type Fluid Used (Type I, II, III or IV) or Process	**A**- Type I or III Fluid Mixture and Type **or** **B**- Type II or IV Enter Percent of mixture	Specify local start time of FINAL fluid application	Aircraft Specific checks. Enter: "none" or "pre-taxi"	Refractometer Water Test: Indicate Pass/Fail	Type 1 Fluid Refractometer reading in degrees farenheight	Type IV Fluid Refractive Index	Name or Employee number of the person confirming that the aircraft is free of contaminents and that a post deicing check was complete.

*Notes: -Retain for entire Deice Season. Mesa Airlines, Inc. Deicing Manual # 335
-Type II/IV Fluids must be checked every 90 days during season

Revision: **09/25/2015**

E.3 Daily Deicing Equipment Inspection Checklist (Form #M506D)

Daily Deicing Equipment Inspection Checklist

The items that you will be checking can be divided into four basic components, please check the shaded box when completed.

1. Transmission items including Brakes, hydraulics, oils and fluids.		Checked	
2. Electrical items including horns, lights.		Checked	
3. Body/Frame items including Glass, booms, wheels and Operational Placards.		Checked	
4. De-icing Fluid Heater/Nozzle ground gun function.		Checked	
Refractometer user check. # of unit: _____ Employee #: _____		Pass/Fail	
Daily Harness User Check	Unit #: _____ Employee#: _____	Pass/Fail/NA	
Daily Landyard User Check	Unit #: _____ Employee#: _____	Pass/Fail/NA	

If any of the above items are not serviceable, red tag and remove from service.

Notify station leadership immediately.

Any issues with deicer unit not described above:

Brand Name	Min	Max		Brand Name	Min	Max
Type II				**Type III**		
Ecowing 26	1.3905	1.3935		AeroClear MAX	1.3865	1.3895
Cleanwing II	1.3906	1.3936		**Type IV**		
Safewing MP II FLIGHT	1.389	1.392		Ecowing AD-49	1.3905	1.3935
Polar Guard II	1.390	1.393		CHEMR EG IV	1.385	1.392
ABC-K Plus	1.390	1.3930		Max Flight 04	1.3900	1.3935
FCY-2	1.3915	1.3945		SW MP IV LAUNCH	1.3895	1.3925
UCAR Endurance EG106 De/Anti-Icing Fluid	1.3820	1.3874		Polar Guard Advance	1.390	1.393
UCAR FlightGuard AD-49	1.3905	1.3935		Polar Guard Xtend	1.390	1.393
ECO-SHIELD	1.390	1.393		UCAR Endurance EG106	1.3820	1.3874
ABC-S Plus	1.390	1.3930		UCAR FlightGuard AD-49	1.3905	1.3935
FCY 9311	1.3919	0.0015		ECO-SHIELD	1.390	1.393
			Acceptable ranges for Type II,III and IV at 100%	ABC-S Plus	1.390	1.3930
				FCY 9311	1.3919	?.???

Form #M506D 06/15/23

Deicing/Anti Icing–Audit Checklist

8.0	De-Ice	Documentation Prompts	Compliant? YES,NO,N/A,N/O
8.1	Were deice agents able to access a current copy of the de/anti-icing manuals? □ Unable to access the UA ADAP □ Unable to access the DL ADM □ Unable to access AA AEGDM □ Unable to access the operating carriers' ground de/anti-icing program(s) □ Other: _____	Please explain the path you would use to access each applicable manual. Have the station provide manual revision numbers for each manual.	
8.2	Was the Aircraft Deicing/Anti-icing Record filled out correctly and complete? □ Form contains blanks/missing information □ Form includes incorrect information □ De/anti-ice event(s) not logged □ Other: _____	Please provide copies of most recent records.	
8.3	Were the Aircraft Deicing/Anti-icing Records properly retained? □ Form not retained electronically until the beginning of the next deice season (DL only) □ Form not retained for 30 days from last entry (AA & UA only) □ Other	How long is the Aircraft Deicing/Anti-icing Records properly retained?	
8.4	Was the Type II, III, & IV Fluid Record completed as required (starting with the pre-winter check) and retained as required? (N/A DL) □ No pre-winter test record available □ UA not recorded on daily GSE check (if used) □ AA mid-season nozzle test not completed □ AA trucks/open totes/tanks not checked monthly (Includes Type I and Type IV) □ Records not retained per carrier policy (AA - 2 months after end of season/UA – 2 years or other carrier policies –(state carrier difference) □ Form contains blanks/missing information □ Form includes incorrect information □ Fluid test event(s) not logged □ Other: _____	Please provide copies of most recent records.	
8.5	Were Fluid Acceptance Records filled out correctly and complete with applicable Certificates of Analysis? □ Form contains blanks/missing information □ Form includes incorrect information □ Fluid acceptance event(s) not logged □ Certificates of Analysis not retained □ Other: _____	Please provide copies of most recent records.	
8.6	Were samples of Type IV fluid (if unsealed) sent for testing prior to the de/anti-icing season? □ Sample testing not complete/documented □ Failed fluid not discarded/tagged-out/controlled and accessible for use □ No pre-winter test record □ Other: _____		

Deicing/Anti Icing–Audit Checklist

8.7	Was the Refractometer User Check filled out correctly? (Checks required AA/UA = daily; DL = monthly) (use of a whiteboard is permitted for UA) □ Form contains blanks/missing information □ Form includes incorrect information □ Form was not retained as required (AA 30 days/UA = 1 day; DL = until next deice season) □ Other: _____		
8.8	Were de/anti-ice storage containers labeled as required? □ Fluid type not labeled □ Glycol base not labeled □ Manufacturer name not labeled □ Other: _____	Please provide a photo(s) of labels.	
8.9	Were de/anti-icing trucks properly labeled and placarded? □ Fluid type not labeled □ Fuel type not labeled □ Other: _____	Please provide a photo(s) of labels and placards.	
8.12	Were the de/anti-icing vehicle(s) properly maintained? □ Tire(s) in need of repair □ Light(s) in need of repair □ Wiper(s) in need of repair □ Boom/bucket in need of repair □ Vehicle had fluid leaks □ Preseason boom inspection not completed/documented □ Fire suppression/extinguisher(s) inspections not maintained/current □ Other: _____		
8.13	UA Only - Was a qualified Service Provider Oversight (SPO) designated and available for de/anti-ice operations? □ SPO not designated □ SPO not available during de/anti-icing operations/conditions □ Other: _____	Explain the role of SPO.	
	De-Ice: Event Observation		
8.19	Did the bucket operator and driver establish appropriate communication between each other for the de/anti-ice operation? (NA for OO) □ Two-Way communication not established □ Face-to-face briefing not conducted (if two-way communication is unavailable) □ Other: _____	What methods of communication must take place prior to de/anti-icing?	
8.21	Was de/anti-icing performed with the aircraft doors closed? □ Aircraft was de/anti-iced with MCD open (AA/C5/OO/YX) □ Aircraft was de/anti-iced with MCD open without a PLB attached (YV) □ Aircraft was de/anti-iced with GSD/other service door(s) open □ Aircraft de/anti-iced with cargo service door(s) open □ Fluid sprayed in a manner than allowed fluid to enter the open door(s) □ Other: _____	*Not Applicable for remote audit.	

Deicing/Anti Icing–Audit Checklist

8.22	Was communication established with the flight deck crew before fluid was applied to the aircraft? (De/anti-icing with crew on board) □ Communication was used via VHF □ Communication was used via headset □ Communication took place face-to-face □ Communication was not established □ Other: _____	What are acceptable methods of communication?	
8.23	Did deice personnel confirm with the flight deck crew that the aircraft is properly configured for deicing prior to commencing de/anti-icing procedures?	Word this as a question. Before you start spraying the aircraft what must you confirm with the flight deck?	
8.24	Was deice fluid heated to the proper temperature? □ Fluid was below the minimum temperature of 140F at the nozzle □ Fluid was heated above the maximum temperature of 180F (200F for AA/YX) □ Other: _____	What is the proper temperature range?	
8.25	Were proper "starting point" and de/anti-icing route procedures followed? □ Improper starting point used □ Improper route around aircraft used □ Planned deviations to starting point/planned route not communicated to PIC prior to beginning □ Planned deviations did not conform to the operating carrier's de/anti-icing program □ Route Around A/C change with crew approval: _____ □ Route around A/C changed without crew approval □ Other: _____	Explain proper drive pattern?	
8.26	Was fluid applied correctly to the control surfaces and critical areas of the aircraft? □ Fluid not applied leading edge to trailing edge □ Fluid not applied symmetrically to the aircraft □ Type IV over sprayed by Type 1 □ Other: _____	Please identify the control surfaces and critical areas of the aircraft.	
8.27	Were all sensitive and no-spray areas kept from having fluid applied directly on them or in them? □ Windows □ Doors □ Engine Intakes □ APU Intake □ Engine Exhaust □ APU Exhaust □ Antennas □ Sensors/Ports/Switches □ Strakes □ Landing Gear □ Brakes □ Fresh Air Inlets □ Other: _____	Please identify all sensitive and no-spray areas.	

Deicing/Anti Icing–Audit Checklist

8.28	Were general safe driving procedures followed while de/anti-icing? □ Deice vehicle did not maintain minimum of 5 feet from aircraft (including bucket) □ Deice vehicle did not maintain a safe driving speed while maneuvering around the aircraft □ Bucket passed over top of wing, tail, fuselage, and/or propeller surfaces (excludes extended booms/hoses) □ Other:_____	Please name general safe driving procedures to include vehicle and bucket.	
8.30	If Type IV was used, was Type IV Fluid applied to the fuselage correctly? (EMB 135/145) □ Type IV was not applied to the fuselage □ Type IV was sprayed forward of the MCD □ Type IV was sprayed on/in the APU inlet □ Other:_____	Where is typed IV sprayed on the EMB 135/145?	
8.32	Did qualified personnel perform a post-application check? □ Post application check not completed □ Post application check not completed by qualified personnel □ Other:_____	Describe what is post-application is.	
8.33	Was a tactile check completed by qualified personnel after Type 1 application? (CRJ-200, EMB-135/145 only) □ Tactile check not completed □ Tactile conducted after Type IV application □ Tactile check not completed by qualified personnel □ Other:_____	Describe what a tactile check is.	
8.34	Were all deice elements communicated to the flight deck crew prior to clearing the flight to depart? □ Fluid type not communicated □ Start time of final application not communicated □ "Post de/anti-icing check complete" not communicated □ Other:_____	What information should be communicated prior to departure?	
8.36	Were critical aircraft surfaces free and clear of contamination after deicing/anti-icing? □ Wing surfaces not clear □ Tail surfaces not clear □ Control surfaces not clear □ Fuselage not clear □ Other:_____	What are the critical surfaces?	
	De-Ice Interview Questions		
8.37	Did agent(s) know the clean aircraft concept?		
8.41	Did agent(s) know the temperature range to which Type I fluid must be heated? □ Agent(s) did not know minimum temperature of 140F at the nozzle □ Agent(s) did not know maximum temperature of 180F (200F for AA/YX) □ Other:_____		
8.42	Were agent(s) able to correctly describe the deice fluid freeze point vs outside air temperature buffer (18F/10C)?		

Deicing/Anti Icing–Audit Checklist

8.44	Were agent(s) able to correctly identify the aircraft in the station that require a tactile inspection? □ Agent(s) did not know CRJ-200 requires tactile □ Agents did not know EMB-135/145 requires tactile □ Agent(s) incorrectly stated that aircraft other than CRJ-200 and/or EMB-135/145 require a tactile check □ Other: _____		
8.45	Were agent(s) able to correctly explain the direction fluid should be applied to the flight control surfaces of the aircraft? □ Agent(s) did not know direction from leading to trailing edge □ Agent(s) did not know direction from tip to root		
8.46	Were agent(s) able to correctly describe the technique used to deice sensitive areas of the aircraft? □ Agent(s) did not know to use a fan spray □ Agent(s) did not know to spray above and let it cascade down		
8.48	Did agent(s) correctly describe the items/elements required to be communicated to the flight crew after the final fluid application? □ Agent(s) did not know to communicate the start time of the final de/anti-icing step □ Agent(s) did not know to communicate the fluid type of the final application □ Agent(s) did not know to communicate that post deicing check for clean surfaces is complete □ Agent(s) incorrectly stated that Type I fluid percentage must be communicated □ Other: _____		
8.49	Were agent(s) able to correctly describe when Type I fluid must be tested using a refractometer? □ Agent(s) did not know fluid must be tested when fluid-to-water ratio has been changed (fluid added to deice vehicle) □ Agent(s) did not know fluid must be tested upon receipt □ Agent(s) did not know fluid must be tested any time a deice work shift begins □ Agents did not know fluid must be tested when fluids are moved from one container to another (OO only) □ Other: _____		
8.51	Were agent(s) able to demonstrate how to interpret and properly use a refractometer? □ Agent(s) could not correctly use or read results for a Type I refractometer (non-digital) □ Agent(s) could not correctly use or read results for a Type IV refractometer (non-digital) □ Agent(s) could not correctly use or read results for a digital refractometer □ Agent(s) did not clean the window of the refractometer before/after use □ Other: _____	*Not Applicable for remote audit.	
8.52	Did the agent(s) know what program/manual to follow when Deice/Anti-icing aircraft? □ Agent(s) did not know to follow the operating carrier's FAA approved de/anti-ice program □ Agent(s) did not know EGDM manual program used for all AA/Eagle coded flights □ Agent(s) did not know UA ADAP/DL ADM does not include aircraft specifics □ Other: _____		
8.53	(I) Which aircraft types require type IV on the fuselage if type IV is used? (N/A for DL) □ Agent(s) did not know Type IV is required to be applied to the fuselage of EMB 135/145 aircraft □ Other: _____		
8.999	Were all other observations made by the auditor during the De-ice compliant?		

Cargo Deicing Audit

SENSITIVE SECURITY INFORMATION

6.0	De-Ice	COMPLIANT?	COMMENTS
6.1	Were deice agent(s) able to access a current copy of the de/anti-icing manuals? ❑ Unable to access the operating carriers' ground de/anti-icing programs ❑ Other:		
6.2	Was the aircraft de/anti-icing record filled out correctly and complete? ❑ Form contains blanks/missing information ❑ Form includes incorrect information ❑ De/anti-ice event(s) not logged ❑ Other:		
6.3	Were the aircraft de/anti-icing records properly retained?		
6.4	Were fluid acceptance records filled out correctly and complete with applicable Certificates of Analysis? ❑ Form includes incorrect information ❑ Form contains blanks/missing information ❑ Fluid acceptance event(s) not logged ❑ Certificates of Analysis not retained ❑ Other:		
6.5	Were samples of Type IV fluid (if unsealed) sent for testing prior to the de/anti-icing seasons? ❑ Sample testing not complete/documented ❑ Failed fluid not discarded/tagged-out/controlled and accessible for use ❑ No pre-winter test record ❑ Other:		
6.6	Were de/anti-ice storage containers labeled as required? ❑ Fluid type not labeled ❑ Glycol base not labeled ❑ Manufacturer name not labeled ❑ Other:		

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Cargo Deicing Audit

SENSITIVE SECURITY INFORMATION

6.7	Were the de/anti-icing vehicle(s) properly maintained? ☐ Tire(s) in need of repair ☐ Light(s) in need of repair ☐ Wiper(s) in need of repair ☐ Boom/bucket in need of repair ☐ Vehicle had fluid leaks ☐ Preseason boom inspection not completed/documented ☐ Fire suppression/extinguisher(s) inspections not maintained/current ☐ Other:		
6.8	Were de/anti-icing trucks properly labeled and placarded? ☐ Fluid type not labeled ☐ Fuel type not labeled ☐ Other:		
	DE-ICE OBSERVATIONS		
6.9	Did the bucket operator and driver establish appropriate communication between each other for the de/anti-ice operation? ☐ Two-way communication not established ☐ Face-to-face briefing not conducted (if two-way communication unavailable) ☐ Other:		
6.10	Was de/anti-icing performed with the aircraft doors closed? ☐ Aircraft was de/anti-iced with MCD open without a PLB attached ☐ Aircraft was de/anti-iced with GSD/other service door(s) open ☐ Aircraft de/anti-iced with cargo service door(s) open ☐ Fluid sprayed in a manner that allowed fluid to enter the open door(s) ☐ Other:		
6.11	Was communication established with the flight deck crew before fluid was applied to the aircraft? (De/anti-icing with crew on board) ☐ Communication was used via VHF ☐ Communication was used via headset ☐ Communication took place face-to-face ☐ Communication was not established ☐ Other:		
6.12	Did deice personnel confirm with the flight deck crew that the aircraft is properly configured for deicing prior to commencing de/anti-icing procedures?		

Cargo Deicing Audit

SENSITIVE SECURITY INFORMATION

6.13	Was deice fluid heated to the proper temperature? ☐ Fluid was below the minimum temperature of 140F at the nozzle ☐ Fluid was heated above the max temperature of 180F ☐ Other:		
6.14	Were proper "starting point" and de/anti-icing route procedures followed? ☐ Improper starting point used ☐ Improper route around aircraft used ☐ Planned deviation to starting point/planned route not communicated to PIC prior to beginning ☐ Planned deviations did not conform to the operating carrier's de/anti-icing ☐ Route around A/C changed with crew approval ☐ Route around A/C changed without crew approval ☐ Other:		
6.15	Was fluid applied correctly to the control surfaces and critical areas of the aircraft? ☐ Fluid not applied leading edge to trailing edge ☐ Fluid not applied symmetrically to the aircraft ☐ Type IV oversprayed by Type 1 ☐ Other:		
6.16	Were all sensitive and no-spray areas kept from having fluid applied directly on them or in them? ☐ Windows ☐ APU Intake ☐ Strakes ☐ Fresh Air Inlets ☐ Doors ☐ Engine Exhaust ☐ Sensors/Ports/Switches ☐ Engine Intakes ☐ APU Exhaust ☐ Landing Gear ☐ Antennas ☐ Brakes ☐ Other:		
6.17	Were general safe driving procedures followed while de/anti-icing? ☐ Deice vehicle did not maintain minimum of 5ft from aircraft (inluding bucket) ☐ Deice vehicle did not maintain a safe driving speed while maneuvering around the aircraft ☐ Bucket passed over top of wing, tail, fuselage (excludes extended booms/hoses) ☐ Other:		

Cargo Deicing Audit

SENSITIVE SECURITY INFORMATION

6.18	Did qualified personnel perform a post-application check? ☐ Post application check not completed ☐ Post application check not completed by qualified personnel ☐ Other:		
6.19	Were all deice elements communicated to the flight deck crew prior to clearing the flight to depart? ☐ Fluid type not communicated ☐ Start time of final application not communicated ☐ Post "de/anti-icing check complete" not communicated ☐ Other:		
6.20	Were critical aircraft surfaces free and clear of contamination after deicing/anti-icing? ☐ Wing surfaces not clear ☐ Tail surfaces not clear ☐ Control surfaces not clear ☐ Fuselage not clear ☐ Other:		
	DE-ICE INTERVIEW QUESTIONS		
6.21	Did agent(s) know the clean aircraft concept?		
6.22	Did agent(s) know the temperature range to which Type I fluid must be heated? ☐ Agent(s) did not know min temperature of 140F at the nozzle ☐ Agent(s) did not know max temperature of 180F ☐ Other:		
6.23	Were agent(s) able to correctly describe the deice fluid freeze point vs outside air temperature buffer (18F/10C)?		
6.24	Were agent(s) able to correctly explain the direction fluid should be applied to the flight control surfaces of the aircraft? ☐ Agent(s) did not know direction from leading to trailing edge ☐ Agent(s) did not know direction from tip to root		

Cargo Deicing Audit

SENSITIVE SECURITY INFORMATION

6.25	Were agent(s) able to correctly describe the technique used to deice sensitive areas of the aircraft? ☐ Agent(s) did not know to use a fan spray ☐ Agent(s) did not know to spray above and let it cascade down		
6.26	Did agent(s) correctly describe the items/elements required to be communicated to the flight crew after the final fluid application? ☐ Agent(s) did not know to communicate the start time of the final step ☐ Agent(s) did not know to communicate the fluid type of the final application ☐ Agent(s) did not know to communicate the post deicing check for clean surfaces is complete ☐ Agent(s) incorrectly stated that Type I fluid percentage must be communicated ☐ Other:		
6.27	Were agent(s) able to correctly describe when Type I fluid must be tested using a refractometer? ☐ Agent(s) did not know fluid must be tested when fluid-to-water ration has been changed (fluid added to deice vehicle) ☐ Agent(s) did not know fluid must be tested upon receipt ☐ Agent(s) did not know fluid must be tested anytime a deice work shift begins ☐ Other:		
6.28	Were agent(s) able to demonstrate how to interpret and properly use a refractometer? ☐ Agent(s) could not correctly use or read results for a Type I refractometer (non-digital) ☐ Agent(s) could not correctly use or read results for a ☐ Agent(s) could not correctly use or read results for a digital refractometer ☐ Agent(s) did not clean the window of the refractometer before/after use ☐ Other:		

Cargo Deicing Audit

SENSITIVE SECURITY INFORMATION

6.29	Did the agent(s) know what program/manual to follow when de/anti-icing aircraft? ❒ Agent(s) did not know to follow the operating carrier's FAA approved de/anti-icing program ❒ Other:			
6.99	Were all other observations made by the auditor during the de-ice compliant?			

END

Appendix F: Charts and Tables

Appendix F: Charts and Tables

F.1 Cold Weather Operations Deicing

F.1.1 General

A. Mesa Airlines, Inc. relies on the “clean aircraft concept” to ensure aircraft are free of frost, ice or snow contamination. Even minute amounts of contamination on aircraft surfaces can cause a potentially dangerous degradation of aircraft performance and unexpected changes of in-flight characteristics.

B. Mesa Airlines, Inc. has developed, and the FAA has approved, the Mesa Airlines, Inc. *Deicing Manual*. The Mesa Airlines, Inc. *Deicing Manual* contains the policies and procedures to be observed and implemented to ensure that Mesa Airlines, Inc. maintains the highest level of safety during the winter months. These procedures include instructions for deicing the Mesa Airlines, Inc. aircraft fleet.

C. The winter season presents additional challenges to airplane operations resulting from low temperatures, the potentially hazardous effects of precipitation contaminating the airplane and the aircraft movement area. Removal of contaminants on runway surfaces, taxiways, aprons, holding bays and other areas is the responsibility of the administration of the airports concerned, based on flight safety and schedule considerations. However, it is the ultimate responsibility of the Pilot-in-Command to make sure that the airplane is in a condition for safe flight and to ensure that the aircraft is free from snow, ice or frost prior to each takeoff. Use of the ATIS or other means to acquire accurate ambient temperature and other pertinent meteorological conditions cannot be overemphasized. The indicated SAT on EFIS cannot be used before takeoff since the TAT probe gives inaccurate readings on the ground when the airplane is static or at low forward speed.

F.1.2 Policy

In pursuit of the “Clean Aircraft Concept,” the following policies will be observed during winter operations:

A. No aircraft will takeoff until the captain has visually inspected the aircraft and is satisfied that the aircraft is adequately deiced for a safe flight.

NOTE

For all CRJ, E-JET, and B-737 aircraft, takeoff with the following accumulation of frost, due to cold soaked fuel, on the underside (bottom) of the wing fuel tank area is permissible:

Maximum 1/8 inch layer of frost.

B. The captain is responsible to ensure the aircraft is free from snow, ice or frost contamination prior to each takeoff.

C. Only approved fluids and mixtures will be utilized to deice Mesa Airlines, Inc. aircraft.

D. Contract deice vendors will deice Mesa Airlines, Inc. aircraft in accordance with the policies and procedures established in the Mesa Airlines, Inc. *Deicing Manual*.

E. While compliance with the stated policy is expected, situations requiring deviations may arise. Such deviations **may not** be approved locally. All requests for deviations must be made to the Director of Operations, Director of Maintenance, Chief Pilot, Phoenix CMO or their designee. Also, the Manager of Airport Operations & Safety Assurance should be consulted. In emergencies where an immediate response is required, the request and approval may be accomplished over the telephone and must be followed up in writing.

F.1.3 Effects of Snow and Ice on Aircraft Performance and Operation

An aircraft is designed to be able to fly through moderate icing conditions for a limited period of time. Ice build-up inflight can be handled by the aircraft's deicing and anti-icing systems. Ice build-up inflight is of a different nature than ground accumulations, which can spread over the entire surface and have a greater impact on the aircraft's ability to fly.

A. The effects of snow, ice and frost include:

1. Increased Weight

   The accumulation on an aircraft of snow, ice or frost can greatly increase the weight of an aircraft. This could cause an aircraft to exceed its maximum allowable weight limitations or produce an excessive fuel burn, which may require an unscheduled landing. The distribution of weight on an aircraft may also be affected creating severe center-of-gravity (CG) problems.

2. Loss of Lift/Increased Drag

   Even a thin layer of snow, ice or frost on the leading edge and wing surfaces increases drag and reduces lift on the aircraft. These changes in lift and drag will increase the stall speed and cause reduced controllability, making flight difficult or impossible.

3. Loss of Control

   Ice deposits on control surfaces, such as the rudder, elevators, ailerons and trim tabs, can render the controls useless. Ice deposits in hinge areas may restrict or prohibit their movement.

4. Loss of Critical Sensing Devices

   Ice or snow blocking pitot probes, static port, engine pressure sensing probes and other inlets can cause errors in critical instrument readings.

5. Tendency for rapid pitch-up and roll-off during rotation.

6. Stall occurs at lower than normal angle of attack.

7. Buffet or stall occurs before activation or stall warning.

8. Offset balance of fan blades caused by the accumulation of ice and frost.

F.1.4 Effects of Winter to be Guarded Against and Eliminated

During operations in freezing rain and snow conditions, airplanes must be protected from the elements and undergo certain precautionary procedures to protect mechanical components. Special dispatching procedures must also be used. The effects of winter that must be guarded against and eliminated are:

A. Ice, snow and frost accumulation on aircraft.

B. Frozen control-surface hinges.

C. Snow or ice accumulations in the control surface air seal diaphragms.

D. Cold cockpit conditions impairing instrument operation.

E. Frozen batteries.

F. Frozen water and lavatory systems.

G. Ice, snow or frost adhering to any part of the pilot static system, angle of attack (AOA) or side slip sensor.

F.1.5 Deice Situations

The following are situations when ice forms on the aircraft on the ground, and/or precipitation causes the need to deice:

A. Freezing of any water which happens to be on the aircraft. This can affect the operation of control linkages and hinges which would make operation of the aircraft inadvisable before proper deicing takes place.

B. Ice forming on exposed surfaces during take, takeoff or landing, as a result of splashing water or mud which may be on the taxi way or runway. This can affect any exposed part of the aircraft, including the landing gear, flaps, brakes, control linkages and hinges, wings, tail surfaces, windshield, etc.

C. Glazing of the aircraft, if left outside during freezing precipitation.

D. Frost collecting on the upper surfaces of the aircraft wings and tail surfaces. Snow on any part of the aircraft can freeze and cause loss of control of the aircraft.

E. Icing conditions exist when the static air temperature (SAT) on the ground and for takeoff is 10°C (50°F) or below and visible moisture in any form is present (such as clouds, fog with visibility of one mile or less, rain, snow, sleet or ice crystals). Icing conditions also exist when the SAT on the grounds is 10°C (50°F) or below when operating on ramps, taxiways or runways where surface snow, ice, standing water or slush may be ingested by the engines or freeze on engines, nacelles or engine sensor probes.

F. Aircraft Failure to Rotate When Anti-Iced With Type II or IV Fluid. The FAA has become aware of some instances where aircraft failed to rotate after being anti-iced with Type IV fluid. This situation has been confined mostly to slower rotation speed turboprop aircraft where they have non-powered flight controls that rely on aerodynamic forces to achieve rotation. Therefore, this situation would not be encountered with the aircraft Mesa operates.

F.1.6 Passenger Safety

To ensure passenger safety:

A. Make sure all equipment is parked out of passenger walkways, including fueling hoses, ground cables, etc.

B. Avoid spraying deice fluid on passenger walkways.

C. Ensure the walkway to aircraft is clear of snow and ice. Urea may be utilized to control ice formation and improve traction. Only non-corrosive/airport safe ice melt should be used around the aircraft.

F.1.7 Unsafe Acts

Safety is always the main concern. During cold weather operations, extra care and vigilance should be observed. The following list highlights some actions that must be avoided.

A. Moving equipment to aircraft before engines are shut down.

B. Maneuvering equipment under and near the airplane in an unsafe manner (too fast for good control on wet/slippery ramp areas).

C. Driving equipment too close to aircraft.

D. Placing equipment under aircraft while deicing.

E. Failing to set brakes or chock equipment.

F. Maneuvering equipment in close quarters without a wing or tail guideman.

F.1.8 Purpose of Deicing

A. Deicing is performed to ensure that an aircraft is free from solid moisture.

B. Deicing involves the removal of all accumulated solid moisture (snow, ice or frost) from an aircraft.

WARNING

Deicing an aircraft is extremely important. If deicing is done poorly or not done at all, the safety of the passengers, crew and aircraft are at risk.

Deice the aircraft completely and keep it clean.

C. The object is to remove all accumulated solids and leave a film of glycol/water on the surface to prevent refreezing of moisture before departing of the aircraft.

1. When conditions dictate, a more concentrated solution of glycol (of up to 60% Type I or of up to 100% Type II) may be applied to provide a more effective anti-icing film on the aircraft's surfaces. This change of concentration must be communicated to the flight crew so that proper holdover times may be utilized.

NOTE

Whenever referencing the percentage of glycol solution ALWAYS remember to refer to the glycol percentage first and the water percentage second.

EXAMPLE

50% (glycol)/50% (water).

F.1.9 Notes to Remember

A. Deicing the aircraft is one of the most expensive procedures relating to winter operation, as the fluid is not always reusable.

B. Deicing fluid is very expensive and usually runs in short supply, and it is up to each agent involved in deicing an aircraft to conserve as much fluid as possible. All mechanical means should be used to carefully remove snow from the aircraft prior to deicing in order to minimize the use of deicing fluid. The only material to be removed with deicing fluid is ice or frozen precipitation that has adhered to aircraft surfaces. Spray the aircraft; DO NOT wash it, but remove all snow, ice or frost from the aircraft before it leaves the gate.

C. Deice fluid is very slippery so extreme caution should be observed when walking on aircraft surfaces.

D. Servicing of the aircraft should be accomplished prior to deicing.

E. Some uncommon forms of ice accumulation are discussed below:

1. Thin layers of ice resulting from frost (overnighting under a clear sky and temperature just below freezing) or freezing fog may cause 'sandpiper' roughness on wings and horizontal tail surfaces. This roughness may cause deterioration of the aerodynamic properties of the wing and tail to such extent that a safe takeoff is not possible.

2. When the tanks contain sufficient fuel of sub-zero temperature, as may be the case after a long flight, wet snow, rain or water condensation can freeze on the wing upper surface during the ground stop or when taxiing out for takeoff (even if the outside air temperature (OAT) is well above freezing), forming a smooth ice layer that may not be visible from certain angles.

3. The top of this layer may appear wet, hiding the ice below. This form of ice may not be visible from a distance, in poor lighting conditions or at night. Absence of such contamination must be verified during the exterior inspection and prior to takeoff.

4. Not only will this ice seriously affect the aerodynamic properties of the wing, but it may also damage the engine if the ice becomes loose when the wing flexes during takeoff.
5. Relatively warm fuel, uplifted during a stop, may cause dry snow to melt on the wings.
6. This melted snow can refreeze when the temperature is below freezing, forming an invisible ice layer underneath the snow. Never assume snow will be blown off during the takeoff roll.
7. Snow falling on 'warm' leading edges will melt, but may refreeze under certain conditions, forming 'run-back' ice on wings and stabilizer.
8. The least accumulation of freezing fog occurs with zero wind.

F.2 De/Anti-icing Fluids and Deicing Methods

F.2.1 General

A. Mesa Airlines, Inc. may use different types of fluids for deicing and anti-icing aircraft. These fluids are designated as Type I, Type II, Type III or Type IV fluids. These fluids have very different characteristics.

B. Type I, Type II, Type III or Type IV fluids may never be mixed together.

C. Type I and certain Type II, Type III and Type IV fluids (in proper concentration) are approved for use on Mesa Airlines, Inc. aircraft.

D. Deicing fluid is a liquid which is generally applied heated and under pressure in order to remove all deposits of frost, ice or snow from aircraft surfaces.

E. Anti-icing is a liquid which is not required to be heated. This liquid is applied to aircraft surfaces to prevent the formation or accumulation of frost, ice or snow. Anti-icing fluid effectiveness covers a limited period of time.

F. Many factors influence the effectiveness and protection time provided by anti-icing fluids:

1. Temperature of aircraft surfaces and outside air.
2. Fluid type, amount, strength and application method.
3. Precipitation type and rate.
4. Wind velocity and direction.

G. Mesa Airlines, Inc. has approved the use of Type I, II and IV fluids on all of its aircraft which are listed in this section. The type of fluid applied will depend on the fluid and equipment available in each city. If it is unclear which fluid to use/order, contact supervisor.

F.2.2 Factors to Consider when Deicing

A. Factors to consider when deicing include wind force and direction, amount and type of precipitation, temperature and other activities taking place around the aircraft.

B. Never dispute the decision of the captain as to whether or not the deicing has been adequately completed. The PIC has the ultimate responsibility that the aircraft is in a condition safe for flight. If in doubt, Mesa Airlines, Inc. uses the more conservative opinion.

C. The deicer should be positioned so the spray goes downwind. Avoid spraying across great distances, which results in the fluid being dissipated and cooled, greatly reducing its effectiveness.

D. Spray the critical aircraft surfaces with enough fluid to wet these areas down. The heated deicing fluid will get under the snow, ice or frost and remove the loosened particles.

NOTE

Do not try to blast or wash all the snow, ice or frost off the wings and tail surfaces during the first application.

E. Do not waste deicing fluid. It is very expensive. Use as much as needed for each deicing operation, keeping in mind that all critical surfaces must be completely free of snow, ice and frost.

F. When spraying the critical surfaces, the direction of the spray should try to be kept flowing from leading edge to trailing edge. However, in order to ensure that the hinged areas of the tail and wings are completely free of ice, snow and frost, it may be necessary to direct the spray from the trailing edge toward the leading edge.

G. Deicing/anti-icing fluids should not be heated to application temperatures until necessary for application and cycling the fluid to application temperatures and back to ambient temperatures should be avoided. For Type I fluids, the water loss caused by prolonged/repeated heating may cause undesirable aerodynamic effects at low ambient temperatures. For Types II, III, and IV fluids, the thermal exposure and/or water loss may cause a reduction in fluid viscosity, leading to earlier failure of the fluid and therefore invalidating the applicable HOT.

F.2.3 General Precautions to be Observed During Deicing

The following precautions should be observed during any deicing operation:

A. Do not try to chip or break ice off any part of the aircraft. Ice should be removed by spraying it with heated deicing fluid.

B. It is important to be sure the fuselage is free of contaminants on all aircraft.

C. Do not spray deicing fluid into the intake or exhaust areas of the engines or auxiliary power units (APU).

D. Do not spray deicing fluid into cockpit windows unless specially requested to do so by the crew.

E. Do not spray deicing fluid directly onto the passenger doors or cargo doors as it may leak into the aircraft and drip onto passengers and/or baggage.

F. Do not spray deicing fluid directly into the engine nacelles, pitot tubes or static vents.

F.2.4 Policy Regarding De/Anti-icing with Engines Operating

A. To prevent costly APU damage, it is preferred that aircraft will operate with engines operating and APU off during a deice event.

B. Alternately, if the preferred method of de/anti-icing with the engines operating cannot be achieved due to station constraints, the following methods can be used (in order of most preferred to least preferred):

1. Alternating engines.
2. With the GPU connected to provide power and the APU and engine off.
3. As a last choice: with the engine off and the APU running.

NOTE

Some airports do not allow aircraft engines to operate during deicing events. In these situations, the preferred method is a GPU connected to the aircraft. If a GPU is not available or is inoperative, the APU can be operated to avoid a cancellation. At the station's discretion, aircraft may be de/anti-iced with one (preferred) or both engines running from an open bucket when ramp conditions permit.

C. Application of these procedures must not jeopardize the safety of ground personnel or risk damage to ground equipment or aircraft.

F.2.5 Procedures for De/Anti-Icing with Engines Operating

When deicing/anti-icing with the engines running, the following special precautions should be taken:

A. The flight crew makes the determination that engines will or will not be operated during de/anti-icing, taking into account local airport procedures.

B. Idle thrust or power must be set.

C. The parking brake must be set and radio communications established between the flight crew and the qualified deicing personnel.

D. The flight crew will signal the deice crew when the parking brake has been set.

E. After the "parking brake set" signal has been given and verified via hand signals or via aircraft intercom, deicing/anti-icing will be conducted in accordance with the Mesa Airlines, Inc. *Deicing Manual*.

F.2.6 Alternate Deicing Procedures

When braking action in the deice pad is determined to be no better than poor, additional safety precautions will be implemented. At the discretion of the ground supervisor, deicing will be conducted only on the side of the aircraft without an operating engine. The process is completed by alternating the operating engine after the first half of the aircraft is deiced. Coordination between ground and flight personnel must be accomplished before this procedure is used.

F.2.7 Approved Fluids

MISC NTSB A-88-135

F.2.7.1 Type I (Propylene Glycol/Water Mixture)

A. Type I fluids are Newtonian, non-thickened fluids used primarily for deicing, but may also be used for anti-icing with associated HOTs. Deicing fluid is a mixture of glycol and water. When glycol is mixed with water, the freezing point of the solution is lowered. As the percentage of glycol increases in the glycol/water mixture, the freezing point of the solution is lowered until the percentage of glycol reaches approximately 60% glycol. Above 60% glycol mixture, the freezing point of the solution will increase, making the mixture less effective against precipitation.

B. The appropriate percentage of glycol to water (when using Type I fluid) is determined by knowing the ambient (or current) outside temperature and by following the "Guidelines for the Application of SAE Type I Fluid" in this chapter.

C. Type I fluids are thin fluids and are primarily used as deicing agents only. They form a very thin wetting film on aircraft surfaces and typically contain a minimum of 40% glycol. Diluted with water and heated prior to application, they provide very limited holdover protection during frozen precipitant conditions. This fluid is orange or clear in color.

WARNING

Non-Glycol Deicing Fluids Containing Alkali Organic Salts (AOS).

There has been evidence that some non-glycol-based Type I fluids may pose a significant safety hazard when given their impact on anti-icing fluid. The use of any deicing fluid containing AOS should be avoided. In operational situations where this may not be possible, contact Mesa Airlines at Station-Compliance@mesa-air.com and special attention should be given to ensure that a sufficient amount of anti-icing fluid has been applied to ensure complete removal of this deicing fluid so that the anti-icing fluid will have the appropriate HOT.

F.2.7.2 Type II De/Anti-icing Fluid

A. Type II fluid is a special product having a glycol content of at least 50% plus a thickener system which forms a pseudo-plastic film on the aircraft surface. This film is shear sensitive to airstream flow and its performance depends on that property. During takeoff, the shearing force of the airstream causes the fluid viscosity to rapidly decrease at speeds above 30 knots. The thinning fluid then flows off the aircraft, leaving only a minimal residue, when sustained speeds above 80 knots and rotation speeds above 100 knots are attained.

B. SAE Type II deicing/anti-icing fluids (thickened type) provide protection against refreezing under falling precipitation. Fluids available in the United States that meet SAE Type II Category are SPCA AD 104 and Hoechst 1704LTV (DOW Chemical Flightguard 2000).

CAUTION

During handling (i.e., transfer from tank to tank), only approved pumps may be used.

C. Type II de/anti-icing fluid requires special spray equipment for application to the aircraft. The nozzles, lines, pumps and tanks for spraying Type I fluid must not, under any circumstances, be used for spraying Type II fluid (except in cases where equipment is designed to handle both fluids).

D. Anti-icing will normally be accomplished with 100% concentrate Type II fluid. When anti-icing is required, the minimum application will be to the wings and empennage (the tail assembly of the airplane, including the fin, rudder, elevator, etc.) of the aircraft. Application to the fuselage is restricted to aircraft departing Canada, overnight or extended holds only.

CAUTION

Under no circumstances can an aircraft that has been anti-iced, receive another coat of Type II/ IV fluid on top of the existing film of anti-ice fluid. Surfaces must be deiced with a hot deicing mixture of Type I fluid and water, before another application of Type II/IV fluid is made.

F.2.7.3 Type III Deicing/Anti-Icing Fluid

Type III is a thickened fluid which has properties that lie between Types I and II. Therefore, it provides a longer holdover time than Type I but less than Type II. On the basis of acceptance criteria, Type III fluid qualifies according to the annex B of AMS 1482D standard for use on large transport type jet aircraft in the following temperature ranges:

A. Above -30.5°C (-23°F) in the case of neat dilution.

B. Above -19°C (-2°F) in the case of the 75/25 dilution.

C. Above -10°C (-14°F) in the case of the 50/50 dilution.

F.2.7.4 Type IV Deicing/Anti-Icing Fluid – Technical Information

A. General

1. Type IV fluid is a special product having a glycol content of at least 50% plus a thickener system which forms a pseudo-plastic film on the aircraft surface. The fluid when delivered from the manufacturer has a 50% glycol concentrate content and is to be considered 100% for holdover calculations and therefore cannot be diluted with water. This film is shear sensitive to airstream flow and its performance depends on that property. During takeoff, the shearing force of the airstream causes the fluid viscosity to rapidly decrease at speeds above 30 knots. The thinning fluid then flows off the aircraft, leaving only minimal residue. Fluids with this characteristic are called non-Newtonian fluids.

2. Type IV fluids have been shown to have significantly better holdover times when compared to Type I and II fluids. These increased holdover time characteristics are attributable, in part, to the addition of thickeners and/or other additives which require a ticker application of the fluid.

B. Application

1. Anti-icing will normally be accomplished with 100% concentrate Type IV fluid. When anti-icing is required, the minimum application will be to the wings and empennage (the tail assembly of the airplane, including the fin, rudders, elevator, etc.) of the aircraft. Application to the fuselage is restricted to aircraft departing Canada, overnight or extended holds only.

NOTE

For CRJ 550/CRJ 900 aircraft departing Canada, anti-icing fluids applied during falling precipitation for wings and tail will now be required on the top portion of the fuselage to prevent any contamination from possibly being ingested into the engines. Anti-icing fluid should be applied to the top centerline portion of the fuselage that is not extremely sloped. The fluid should be applied from just behind the flight deck windows (before the main cabin door) to a point in line with the rear of the aircraft's engine.

CAUTION

Equal treatment of both sides (left and right) of the aircraft is mandatory (i.e., both wings, both sides of the horizontal stabilizer and both sides of the vertical stabilizer).

2. When applying the Type IV anti-icing fluid, apply fluid spray in a cascading application beginning from the leading edge of the airfoil and work toward the trailing edge until the entire airfoil is coated. Excessive runoff is not necessary and is undesirable. However, ensure full coverage of the entire aircraft surface directly during the deicing operation, and the use of sufficient fluid so that anti-icing fluids run off sloped surfaces and run off flat surfaces as well in considerable quantities.

C. Holdover Time

1. Holdover Time (HOT) is the estimated time de/anti-icing fluid will prevent the formation of frost or ice and the accumulation of snow on the critical surfaces of an aircraft. HOT starts at the beginning of the application with one-step de/anti-icing and with the beginning of the anti-icing process with two-step de/anti-icing.
2. This chapter contains the Holdover Time Table which is used as a guide in the selection of the anti-ice fluid to be used in the two-step deice/anti-ice operation.
3. Type IV fluids contain a pseudo-plastic, thickening agent, which enables the fluids to form a thicker liquid wetting film on external aircraft surfaces. This film provides a longer holdover time, especially in conditions of freezing precipitation.

CAUTION

The time of protection will be shortened in heavy weather conditions. High wind velocity and jet blast may cause a degradation of the protective film. If these conditions occur, the time of protection may be shortened considerably.

NOTE

Report problems in fluid application when fluid is applied in the reverse order of company-approved procedures (e.g., approved procedure being wing tip to wing root), and when insufficient fluid temperature buffers are used.

Table F-1: Guidelines for the Application of SAE Type I Fluid

Outside Air Temperature (OAT)[1]	One-Step Procedure De/Anti-icing[2]	Two-Step Procedure	
		First Step: Deicing	Second Step: Anti-icing[3]
0 °C (32 °F) and above	Fluid/water mixture heated to at least 60°C (140°F) at the nozzle with a freezing point of at least 10°C (18°F) below OAT	Heated water or a heated fluid/water mixture	Fluid/water mixture heated to at least 60°C (140°F) at the nozzle with a freezing point of at least 10°C (18°F) below OAT
Below 0 °C (32 °F) to LOUT		Heated fluid/water mixture with a freezing point at OAT or below	

NOTES

1 Fluids must not be used at temperatures below their lowest operational use temperature (LOUT).
2 When anti-icing using the one-step procedure, a minimum quantity of 1 litre/m^2 (~2 gal./100 sq. ft.) of Type I fluid mixture heated to at least 60°C (140°F) is required after all frozen contamination is removed. This is achieved using a continuous process. This application is necessary to heat the surfaces, as heat contributes significantly to the Type I fluid holdover times.
3 To be applied before first-step fluid freezes, typically within 3 minutes. This time may be higher than 3 minutes in some conditions, but potentially lower in heavy precipitation, colder temperatures, or for critical surfaces constructed of composite materials. If necessary, the second step shall be applied area by area (sectionally).

CAUTIONS

- This table is applicable for the use of Type I holdover time guidelines in all conditions, including active frost. If holdover times are not required, a temperature of 60 °C (140 °F) at the nozzle is desirable.
- If holdover times are required, the temperature of water or fluid/water mixtures shall be at least 60 °C (140 °F) at the nozzle. Upper temperature limit shall not exceed fluid and aircraft manufacturers' recommendations.
- To use Type I Holdover Times Guidelines in all conditions including active frost, an additional minimum of 1 liter/m^2 (~2 gal./100 sq. ft.) of heated Type I fluid mixture must be applied to the surfaces after all frozen contamination is removed. This application is necessary to heat the surfaces, as heat contributes significantly to the Type I fluid holdover times. The required protection can be provided using a 1-step method by applying more fluid than is strictly needed to just remove all of the frozen contamination (the same additional amount stated above is required).
- The lowest operational use temperature (LOUT) for a given Type I fluid is the higher (warmer) of:
  a) The lowest temperature at which the fluid meets the aerodynamic acceptance test for a given aircraft type; or
  b) The actual freezing point of the fluid plus a freezing point buffer of 10 °C (18 °F).
- Wing skin temperatures may be colder or warmer than the OAT. Causes can include: radiation cooling, cold-soaked wing, or hangar storage. Consult the appropriate guidance (HOT Tables and FAA Ground Deicing General Information Document, Winter 2023-2024") for the contaminant in question.
- When conducting aircraft deicing using a Type I fluid and not using the 10 °C/18 °F buffer, procedures must be developed and approved to ensure refreezing does not occur prior to takeoff.

F.2.8 Temperatures and Effectiveness

A. Many variables can influence the time of the effectiveness of deicing fluid that has been applied to an aircraft. This makes it impractical, if not impossible, to estimate the time following the deicing process that the fluid will remain effective.

B. Deicing snow or freezing rain may require more than one application. The continued melting of snow or freezing rain on an aircraft will dilute the deicing fluid, decreasing its effectiveness. The most effective deicing will be at the last possible point before takeoff.

C. The cold glycol/water mixture does not melt snow, ice or frost, like anti-freeze, it simply helps to prevent these substances from freezing and sticking to the aircraft surfaces.

D. In order to remove snow, ice or frost from the aircraft, this mixture should be heated. The maximum temperature is 180°F.

E. The effectiveness of the glycol mixture (deicing fluid) does not depend on the temperature of the fluid when applied. The higher the temperature of the fluid simply decreases the amount of the fluid and the time required to deice an aircraft. Fluid temperature of 140°F will do the same job as fluid temperature of 180°F, however it will take more fluid and a longer time to do it. Although a fluid temperature of 140° – 180°F is recommended, in some cities a hand held unit (or units) with electrical immersion heating elements are used. Since hand held units rely on a preheated glycol to water mixture, it is permissible that the glycol be of a temperature sufficient to melt any frozen precipitation on the aircraft. Units with electrical immersion heating systems which do not heat glycol to 140°F are acceptable when the glycol mixture is heated to approximately 130°F.

NOTE

When recommended heating temperatures are not obtainable, deicing may still be accomplished when the Clean Aircraft Concept has been strictly adhered to.

F. The following instructions are applicable when freezing temperatures exist or whenever snow and ice formations are (or forecasted to be) present at a station.

1. Cold Soaked (0°C and Below)

   a. Engines exposed to extreme temperatures (0°C and below) for prolonged periods are cold soaked to the point that the engines may fail to start. Further, controls may freeze and be immobile. The PIC will ensure that all engine controls are free and safe to operate prior to takeoff.

   b. Airplanes exposed to extreme cold temperatures (0°C and below) for prolonged periods are cold-soaked to the point that instrument operation may be impaired. The proper operation and functioning of all instruments will be the responsibility of the PIC.

G. The following procedures are to be strictly adhered to:

1. No aircraft will takeoff when the wings, control surfaces, engine inlets or other critical surfaces of the aircraft, have a coating of ice, snow or frost. All applicable special procedures mentioned in the preceding paragraphs must be accomplished.

   CAUTION

   Ensure that a layer of ice is not concealed by the snow.

2. No takeoff will be made with ice, snow or frost adhering to any part of the airplane structure which, in the opinion of the captain, might adversely affect performance.

3. Visual inspection may be accomplished in accordance with the "Holdover Time" criteria explained in this section. The visual inspection procedure will consist of the following:
   a. The flight crew (PIC and SIC) will look at respective wings (visible from the cockpit) and visually ensure the wing is free from contamination. If necessary, the PIC will turn on the ice lights to aid the check.
   b. If conditions exist where the wings are not visible from the cockpit, a flight crewmember will proceed into the cabin and illuminate the wing with a flashlight to determine if contamination exists.
   c. If visibility from inside the aircraft will not conclusively determine that wings and other critical surfaces are free from contamination, the aircraft will return to a designation location for additional deicing.

F.2.9 Approved By Aircraft Type – Use of Type I De/Anti-icing Fluid

1. CRJ 550/CRJ 900.
2. E-JET (E-175).
3. B-737-400F/800F.

F.2.10 Approved By Aircraft Type – Use of Type II De/Anti-icing Fluid

1. CRJ 550/CRJ 900.
2. E-JET (E-175).
3. B-737-400F/800F.

F.2.11 Approved By Aircraft Type – Use of Type III De/Anti-Icing Fluid

1. CRJ 550/CRJ 900.
2. E-JET (E-175).

F.2.12 Approved By Aircraft Type – Use of Type IV De/Anti-icing Fluid

1. CRJ 550/CRJ 900.
2. E-JET (E-175).
3. B-737-400F/800F.

F.2.13 Holdover Time

A. Definitions

1. Holdover Time

   The estimate time that deicing or anti-icing fluid will prevent the formation of frost or ice and the accumulation of snow on the protected surfaces of the aircraft. Holdover time begins when the final application of de/anti-icing fluid commences and expires when the de/anti-icing fluid applied to the aircraft loses its effectiveness.

2. Deicing

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

3. Anti-icing

   A precautionary procedure that provides protection against the formation of frost or ice and accumulation of snow on treated surfaces of the aircraft for limited periods of time.

4. Post Deice Check

   a. All critical surfaces of the aircraft must be visually inspected before an aircraft is released for departure during icing conditions or when de/anti-icing has been completed. The inspection is to be performed from an elevated piece of equipment when necessary, offering sufficient visibility to these parts. The aircraft's critical parts must meet the "Clean Aircraft Concept" before being cleared to depart.

      1) Wings, tail and control surfaces.
      2) Pitot heads, static ports and angle of attack sensors.
      3) Engine inlets.
      4) Air conditioning inlets, exhausts.
      5) Landing gear and landing gear doors.
      6) Fuel tank vents.
      7) Fuselage.
      8) Flight control check (a functional check of ailerons, elevators, rudder and flaps) may be necessary if the aircraft has been subjected to extreme ice or snow covering.

5. Pre-takeoff Check

   A check of the aircraft's wings for frost, ice or snow conducted within the aircraft's holdover time. This step is integral to the use of holdover times. This check can be performed by either the crew or by qualified deicing personnel.

B. The Holdover Time Tables for Type I, Type II and Type IV fluids are based on the guidelines provided by the SAE. Holdover time is a function of such variables as ambient temperature, surface temperature, wind conditions, fluid thickness and most importantly on the rate of precipitation, which adds moisture and dilutes the fluid. With any form of continuing precipitation, holdover will eventually run out, while ice and snow will begin to accumulate and adhere to the previously protected surfaces. Due to the many variables that can influence holdover time, these times should be used as guidelines for estimating the time of protection. The holdover time will be shortened considerably in heavy weather conditions. Also, extreme winds and jet blast can degrade the protective fluid film and shorten holdover times.

C. The objective is for the holdover time to be greater than the anticipated time between anti-icing and takeoff, based on existing conditions. Holdover time begins when the last application of the deicing/anti-icing coating is started.

D. The determination of the holdover time to use is the responsibility of the captain.

E. The deice agent will communicate to the flight crew the following information which is necessary for the holdover time computation:

1. Type of fluid used.

NOTE

When using Type II or Type IV fluid, the fluid manufacturer and fluid name must also be communicated to the flight crew.

2. Percentage of fluid concentration with water.
3. Start time of the final de/anti-ice application.

F. The information necessary for holdover time computation is transmitted to the flight crew via one of the following:

1. Aircraft Interphone.
2. VHF radio.
3. In person.
4. In writing (dry erase board, grease board, etc.).
5. If none of the direct means of communication listed above are available, the start time of the final deice/anti-ice application will be communicated and acknowledged by hand signal as follows:
   a. The deicing agent will point to his/her wrist with his/her opposite hand.
   b. The flight crew must note the present time as the start time of the final deice/anti-ice application.
   c. The flight crew will acknowledge by giving the deicing agent the “thumbs up” signal.

F.2.14 Post Deice Check

After completing the final application of deice or anti-ice fluid, the deice agent will perform the Post Deice Check. The deice agent shall communicate the results of Post Deice Check to the flight crew. If the Post Deice Check is unsatisfactory, the flight shall not depart. If direct communication is not available, hand signals shall be used as follows:

A. Satisfactory Post Deice Check results are communicated to the flight crew with the “thumbs up” signal. The flight crew will acknowledge by giving the deice agent the “thumbs up” signal.

B. Unsatisfactory Post Deice Check results must be communicated to the flight with the “thumbs down” signal. The flight crew will acknowledge by giving the deice agent the “thumbs down” signal.

F.2.15 Takeoff Operations in Icing Conditions Flow Chart

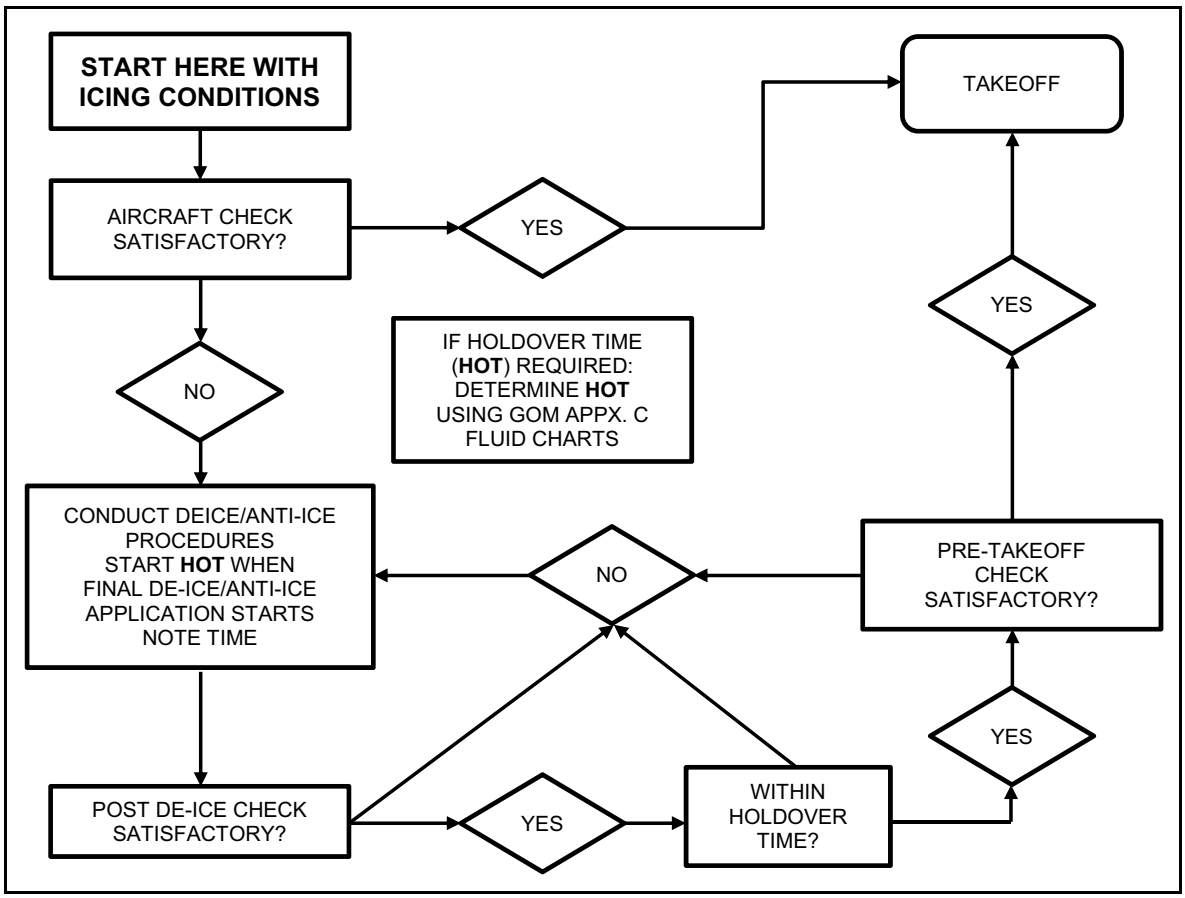

Figure F-1: Takeoff Operations in Icing Conditions Flow Chart

F.2.16 Flight Crew Responsibilities

A. The determination of the holdover time to use is the responsibility of the captain.

B. The captain has the final responsibility to ensure the aircraft is ready for flight. The first officer will perform duties as assigned by the captain.

C. A member of the flight crew shall be responsible for, and trained in accordance with, this manual and the applicable CFM to ensure that the aircraft is properly deiced/anti-iced and checked after deicing/anti-icing during ground operations. Pilots will apply holdover time procedures in accordance with the "De/Anti-icing Fluids and Deicing Methods" section in this chapter.

F.2.17 Takeoff Within a "Holdover Time"

If takeoff is conducted within the holdover time, at least one pre-takeoff check of the wings is to be completed by the flight crew within the holdover time range from inside the cockpit just before taking the runway. The pre-takeoff check requires the flight crew to check the aircraft's wings for contamination as well as to assess the current weather conditions or other situational conditions. The pre-takeoff check is integral to the use of holdover times.

NOTE

Any time that this check is not conclusive, the PIC will return to the deice pad for exterior inspection and deicing, as necessary.

F.2.18 Takeoff After the Holdover Time is Exceeded

Mesa Airlines, Inc. does not have a procedure for pre-takeoff contamination checks therefore when the holdover is exceeded a return for subsequent de/anti-icing is required.

NOTE

Pre-takeoff contamination checks (visual/tactile inspection after HOT is exceeded) are not authorized.

F.3 General Procedures

CAUTION

Avoid excessive or prolonged skin contact with the mixture. Rinse skin thoroughly after contact.

NOTE

At some airport locations, deicing can only take place on an approved "deicing pad." The station manager must ensure all local airport policies/procedures are adhered to.

A. These procedures contain instructions for removing ice, snow or heavy frost from the airplane surfaces. Also included are instructions to prevent the accumulation of ice or snow on airplane surfaces when freezing precipitation conditions are present. Finally, there are instructions which outline procedures to follow when there is no precipitation but slush (melting ice and snow) is on the ground and the possibility exists that these may be thrown into various airplane surfaces during taxi or takeoff operation.

B. Prior to every flight it will be necessary to check for and remove any ice adhering to the fuselage at the waste-water drains and static vent ports.

C. Where heated hangar facilities are available and an extensive amount of ice and snow is adhering to the airplane, place the airplane in the heated hangar if available and wash the ice and snow off with hoses using water. If hot water is used, its temperature must not be over 180°F.

D. If outside temperature is below freezing or if freezing precipitation exists, the airplane must receive one of the following treatments prior to its being taken from the hangar. If the heated hangar method is used:

1. The airplane must be dry before moving from the hangar, if outside temperatures are at freezing or below.
2. The airplane must be dry and cooled to outside temperatures prior to being moved from the hangar if dry snow is falling. If time or hangar conditions do not permit cool down, a coat of deicing solution must be applied.

E. Physical removal of icing conditions can be accomplished through the following means:

1. Removing Powdered Snow
   a. Ground Service Agents may use a broom. Be sure it is in good condition and has no sharp edges that might gouge the aircraft skin.

      CAUTION

      Care must be taken not to damage vortex generators on wings and stabilizers during snow sweeping.

   b. Remove snow from wings and horizontal stabilizer by:
      1) Starting at wing root and working outboard.
      2) Working from the leading edge to the trailing edge.
2. Removing Wet Snow
   a. Ground Service Agents may remove melted snow with a broom.
   b. Spray all upper surfaces with deicing fluid.
3. Freezing Rain or Slush
   a. Ground Service Agents may use a broom to remove melted snow and ice.
   b. Spray entire aircraft with deicing fluid. Give particular attention to hinge points and control surfaces.

F. Application Procedures

The preferred deicing sequence will normally begin on the left wing of the aircraft and work clockwise around the aircraft or as conditions or obstructions dictate. The last section of the aircraft to be deiced should be the tail.

NOTE

At some airports, the preferred application sequence may not be possible due to local airport procedures or obstructions. If this condition exists, the flight crew and ground crew should hold a briefing to determine the appropriate course.

G. There are circumstances when it is necessary to prevent the formation or to remove ice, snow or frost from the airplane with a deicing solution. If this is done, only an approved airplane deicing solution will be used.

1. In applying the deicing solution around openings on the airplane, care must be taken to limit the application to the amount required for anti-icing. Avoid directing the fluid stream into openings or the use of excess solution in ducting or appliances served by the openings.
   a. Fluid shall never be sprayed directly in or on engine or APU intakes.
   b. Fluid should never be sprayed directly on windows.
   c. If solution is used, hot temperatures shall never exceed 180°.
2. Control surface hinges may be freed of ice accumulations by careful application of the solution.
3. The elevators, rudder and horizontal stabilizer to fuselage seals must be free of snow and ice accumulation.
4. Plugs and covers will be removed following the application of deicing fluid, unless required for outdoor parking.

H. It is possible that during slushy weather, slush will adhere to landing gear doors and latches on takeoff and cause malfunction of the landing hear position indicators. To prevent this from happening, approved airplane deicing solution will be sprayed on the areas specified below. Followed by an application of anti-ice if available.

CAUTION

Avoid a direct prolonged spray of fluid onto wheel bearing areas. Prolonged application could contaminate the wheel bearings causing wheel bearing failure.

1. If the landing gear has frozen slush, snow or ice adhering to the doors and latches or if takeoff will be made under slush conditions, the frozen slush or snow must be removed with heated deicing solutions. Spray the uplatch hood and roller on the landing gear, the inside and outside of the landing gear doors, the downlatch and bungee springs and the splash area on wings and flaps.

2. Extend trailing edge flaps and check the gap areas between, if installed, the main flap sections and the aft flap section. Remove snow and slush using heated deicing solution.

NOTE

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. If flaps and slats are extended for de/anti-icing 76% holdover and allowance tables must be used.

F.4 Overnight Aircraft

A. When an aircraft has been parked outside overnight and frost, snow or ice is present on the critical surfaces, deicing may be performed prior to crew arrival if time permits. It is the flight crew's responsibility to determine if the aircraft meets the clean aircraft concept prior to takeoff. Deicing performed prior to the crew's arrival is not considered a deice event and cannot be used to calculate holdover time. The crew shall not hesitate to request additional deicing prior to takeoff if the clean aircraft concept has been comprised.

B. When snow or freezing rain is falling, deicing should be accomplished as close to departure as possible. If the aircraft is deiced too early, it may be necessary to repeat the entire procedure just before ramp departure.

NOTE

Under certain conditions (i.e., when freezing rain is still falling at departure time or when the first deicing occurred too early), it may be necessary to make an additional spraying after passengers have been boarded just prior to the aircraft leaving the gate.

C. When the overnight aircraft has been subjected to freezing rain and ice build-up is present on the fuselage as well as the critical surfaces, it may be necessary to deice the fuselage.

F.5 Through or Turn-Around Aircraft (If Icing Conditions Exist)

A. The captain should be consulted before beginning any deicing operations on any aircraft other than an overnight aircraft.

B. On inbound aircraft, ice may accumulate on the leading edge of the wings and tail, as well as on the nose cone on the aircraft. This ice build-up will need to be removed and may require spraying these areas twice (or as needed) with deicing fluid.

C. The APU should not normally be running during primary deicing. Some circumstances may require the engines to be running on the side opposite to the deicing activity during primary deicing or GPU to be connected to power. Refer to "De/Anti-icing Fluids and Deicing Methods" section in this chapter.

F.6 Secondary Deicing

A. At airport facilities that have secondary deicing stations and as operationally necessary, Mesa Airlines, Inc. will permit aircraft engines on the opposite side of the aircraft to be running during deicing procedures provided idle thrust or power is set.

WARNING

Extreme caution must be exercised at all times. Special attention must be exercised when deicing an aircraft with operating engines.

B. The captain may also request the aircraft be sprayed with deicing fluid if the temperature is at or below the freezing point and the aircraft will be subjected to rain between ramp departure and takeoff.

C. Deicing will be performed as explained in the "Holdover Time" criteria explained in the "De/Anti-icing Fluids and Deicing Methods" section of this chapter.

D. All snow, ice and frost should be removed from the critical aircraft surfaces before the aircraft leaves the gate area.

EXCEPTION

If an aircraft is otherwise “clean” and a dry, light, powdery snow has fallen onto its surfaces, deicing may not be required. The determination as to whether this condition exists will be the direct responsibility of the captain only. The captain will ensure a layer of ice is not under the snow. Should the captain decide deicing is not required, the snow will be lightly brushed from the wing and tail surfaces prior to departure.

E. Whenever deicing is necessary, those areas depicted and pictured in this manual must be deiced. The captain will advise the ground crew of any additional areas or surfaces of the aircraft that need deicing (refer to "Holdover Time" in the "De/Anti-icing Fluids and Deicing Methods" section of this chapter).

F. Ice and snow accumulation on aircraft surfaces can become significant in the elapsed time it takes to taxi from the gate to actual takeoff of the aircraft. This is dependent upon length of taxi, amount of aircraft in the takeoff line, weather conditions, etc.

Therefore, immediately prior to taxiing onto the runway for departure, the crew will visually check for ice and snow accumulation on aircraft surfaces. This may necessitate an inspection of upper surfaces of the wings and control surfaces from the cabin. At night, use of ice/inspection lights would facilitate such an inspection. The departure check described above will be in compliance with the "Holdover Time" criteria explained in this chapter. **The captain will not hesitate to return to re-apply deicing fluid if necessary.** This can be accomplished by shutting down an engine on one side of the aircraft, deicing that side of the aircraft, restarting the engine, shutting down the opposite side, deicing that side and then restarting so all engines and systems are functioning properly for a normal departure.

NOTE

Aircraft specific procedures for operations in icing conditions are located in the respective aircraft CFM.

All crewmembers shall familiarize themselves with the deice sections of this manual and the respective CFM prior to October first of each year.

F.7 Summary of Changes for Winter 2023-2024

A. Purpose

This document details changes to the ground deicing program related documents such as the FAA Holdover Times tables, allowance times tables and other documents detailed below.

B. FAA Holdover Time (HOT) Guidelines

The principal changes from the previous year are briefly detailed below.

1. Holdover Time Tables

   a. Fluid specific HOT guidelines have been created for one new fluid: ALAB International PROFLIGHT EG4 (Type IV).

   b. The HOT guidelines for Newave Aerochemical FCY-2 Bio+ (Type II), Clariant Max Flight 04 (Type IV), JSC RCP Nordix Defrost EG 4 (Type IV), and Shaanxi Cleanway Cleansurface IV (Type IV) have been removed.

   c. An increase has been made to the Type II generic holdover times in natural snow as a result of the removed fluid.

   d. Several increases have been made to the Type IV generic holdover times as a result of removed fluids.

   e. Increases have been made to some of the Type II and Type IV Generic HOTs in the Snow mixed with Freezing Fog HOT table as a result of removed fluids.

   f. A note was modified in all Type I, II, III, and IV HOT tables indicating that the visibility table must be used in conditions of very light or light snow mixed with rain or drizzle in order to confirm the snowfall intensity.

   g. A note was added to the Active Frost and Snow mixed with Freezing Fog generic tables indicating that the fluid being used must be listed in the list of fluids (Table 51 - Table 54) in order to use the generic HOTs.

   h. A caution was added for all Type IV fluids indicating that the HOT tables are for use with aircraft conforming to the SAE AS5900 high speed aerodynamic test criterion.

2. Allowance Times Tables

   a. The condition Light Ice Pellets Mixed with Light Drizzle or Moderate Drizzle has been added to all allowance times tables and uses the same allowance time as Light Ice Pellets Mixed with Light Freezing Drizzle or Moderate Freezing Drizzle. An accompanying note was added to indicate that its use is limited to above 0°C.

b. The condition Moderate Ice Pellets (or Small Hail) Mixed with Moderate Drizzle has been added to all Type IV allowance times tables. This condition uses the same allowance times as Moderate Ice Pellets (or Small Hail) Mixed with Moderate Freezing Drizzle. An accompanying note was added to indicate that its use is limited to above 0°C.

c. Degrees Fahrenheit has been added to the temperature row in all allowance times tables.

d. Spaces were added to the mixed conditions METAR codes to more accurately reflect what is reported.

3. Supplemental Guidance.

a. A note has been added to The Snowfall Intensities as a Function of Prevailing Visibility table to indicate that when snowfall is combined with an obscuration the visibility table may overestimate the actual snowfall intensity. However, the MANOBS may underestimate the actual snowfall intensity therefore the use of the visibility table is always recommended

b. The list of fluids has been updated to include highest on-wing viscosity (HOWV) data for all fluids notes relating to viscosity have been updated.

c. The list of fluids (Tables 54, 55, 56 and 57) has been updated to reflect the latest information available on all de/anti-icing fluids.

d. The fluid application tables are unchanged.

C. FAA Holdover Time Guidelines Regression Information

1. Type I Fluid. The Type I regression coefficients are unchanged.

2. Type II Fluid.

a. The regression coefficients table and verification table for Newave Aerochemical FCY-2 Bio+ have been removed.

b. Several changes were made to the Type II generic holdover times for winter 2023-2024. The Type II generic verification table has been updated accordingly.

3. Type III Fluid. The Type III regression coefficients are unchanged.

4. Type IV Fluid.

a. Regression coefficients tables and verification tables have been added for the one new Type IV fluids, added to the holdover time (HOT) guidelines for winter 2023-2024: ALAB International, PROFLIGHT EG4.

b. The regression coefficient tables and verification tables for Clariant Produkte Max Flight 04, JSC RCP Nordix Defrost EG 4, and Shaanxi Cleanway Aviation Chemical Cleansurface IV have been removed.

c. Several changes were made to the Type IV generic holdover times for winter 2023-2024. The Type IV generic verification table has been updated accordingly.

5. Guidance. The guidance section remains unchanged.

D. FAA Degree-Specific Holdover Time Data

1. Fluid specific DSHOTs have been created for one new fluid: ALAB International PROFLIGHT EG4 (Type IV).
2. The DSHOTs for Newave Aerochemical FCY-2 Bio+ (Type II), Clariant Max Flight 04 (Type IV), JSC RCP Nordix Defrost EG 4, and Shaanxi Cleanway Cleansurface IV (Type IV) have been removed.
3. An increase has been made to the Type II generic DSHOTs as a result of the removed fluid.
4. Several increases have been made to the Type IV generic DSHOTs as a result of removed fluids.
5. Increases have been made to some of the Type II and Type IV Generic Snow mixed with Freezing Fog DSHOTs as a result of removed fluids.

E. N 8900.667 and General Information Document. Much of the information contained in the annual publication of the Federal Aviation Administration (FAA)-Approved Deicing Program Notice was removed and placed in the document titled General Information.

F.8 Operations in Ice Pellet and Small Hail Conditions

A. HOTs vs. Allowance Times

1. HOTs are developed using testing protocols described in SAE Aerospace Recommended Practices (ARP) 5485, Endurance Time Tests for Aircraft Deicing/Anti-Icing Fluids SAE Type II, III, and IV; and ARP5945, Endurance Time Tests for Aircraft Deicing/Anti-Icing Fluids SAE Type I. These protocols rely predominantly on the visual inspection of test surfaces to determine fluid failure, which occurs when the fluid is no longer able to absorb actively occurring frozen or freezing precipitation (e.g., snow and freezing drizzle). HOTs are applicable to most forms of precipitation with the exception of ice pellets. Due to their physical characteristics, ice pellets tend to become partially embedded in fluids and can take longer to melt compared to snow or other forms of precipitation. For this reason, the visual indicators conventionally used in developing HOTs cannot be applied to ice pellets.
2. As a means to address ice pellet precipitation, a test protocol was developed that uses a combination of aerodynamic fluid flow off performance of ice pellet-contaminated fluids in combination with visual inspection and evaluation of a wing model test surface. Since 2005, guidance has been derived from this testing protocol and is known as “Allowance Times.” This guidance is also applicable to small hail due to inherent similarities to ice pellets.
3. Operationally, both HOTs and allowance times provide the times for an aircraft to safely depart following proper deicing/anti-icing. The main difference between the two is the applicability of the pre-takeoff contamination check to HOTs, which cannot be used with allowance times. The only scenario for which an allowance time can be extended is if the precipitation stops and does not restart while still within the allowance time and the allowable 90-minute extension time.

B. Hail, Small Hail, Ice Pellets, Snow Grains, and Snow Pellets (METAR Codes GR, PL, SG, GS, and SHGS)

1. Hail, small hail, ice pellets, snow grains, and snow pellets are related winter precipitation types. When anti-icing fluids are used in these conditions, guidance on their performance is provided by:

   a. Snow HOTs;

   b. Ice pellet (and small hail) allowance times; or

   c. Neither (refer to Table F-2).

Table F-2: Holdover or Allowance Times for Hail, Small Hail, Ice Pellets, Snow Grains, and Snow Pellets

Weather Condition	Applicable Holdover Times/Allowance Times
Snow Pellets	Snow Holdover Times
Snow Grains	Snow Holdover Times
Ice Pellets	Ice Pellet (and Small Hail) Allowance Times
Small Hail	Ice Pellet (and Small Hail) Allowance Times
Hail	No Holdover Times or Allowance Times

2. The way some of these precipitation types are reported by METAR varies by country. Different HOTs or allowance times may apply when the same METAR code is reported in different countries. Refer to Table F-3 for the appropriate HOTs or allowance times to be used with METAR codes GS, GR, PL, SHGS, and SG when they are reported in the United States, Canada, or a different country.

Table F-3: METAR Codes and Holdover or Allowance Times Used by Country

UNITED STATES		
METAR Report	**Weather Condition**	**Applicable HOTs/Allowance Times**
SG	Snow Grains	Snow Holdover Times
GS	Snow Pellets	Snow Holdover Times
SHGS	Snow Pellets with Showers	Snow Holdover Times
PL	Ice Pellets	Ice Pellet (and Small Hail) Allowance Times
GR with remarks stating “less than 1/4”	Small Hail	Ice Pellet (and Small Hail) Allowance Times
GR with remarks stating “greater than 1/4”	Hail	No HOTs or Allowance Times
CANADA		
METAR Report	**Weather Condition**	**Applicable HOTs/Allowance Times**
SG	Snow Grains	Snow Holdover Times
GS	N/A (GS never reported in isolation)	N/A
SHGS without remarks	Snow Pellets with Showers	Snow Holdover Times
SHGS without remarks stating diameter of hail	Small Hail	Ice Pellet (and Small Hail) Allowance Times
TSGS without remarks	Snow Pellets with a Thunderstorm	Snow Holdover Times
TSGS without remarks stating diameter of hail	Small Hail with a Thunderstorm	Ice Pellet (and Small Hail) Allowance Times
PL	Ice Pellets	Ice Pellet (and Small Hail) Allowance Times
GR	Hail	No HOTs or Allowance Times
REST OF WORLD		
METAR Report	**Weather Condition**	**Applicable HOTs/Allowance Times**
SG	Snow Grains	Snow Holdover Times
GS or SHGS	Snow Pellets or Small Hail	Ice Pellet (and Small Hail) Allowance Times*
GR	Hail	No HOTs or Allowance Times
PL	Ice Pellets	Ice Pellet (and Small Hail) Allowance Times

* If additional information provided with the METAR makes it clear that the weather condition is snow pellets and not small hail, then snow HOTs can be used.

3. While most countries, including the United States and Canada, do not report an intensity with small hail, some countries do (e.g., Japan). If no intensity code (+ or -) is reported with small hail, the intensity is assumed to be moderate and the moderate ice pellet allowance times apply. If an intensity code (+ or -) is reported with small hail, the intensity can be used to determine the applicable allowance times. (Note that this logic also applies when small hail is reported mixed with another precipitation condition.) Examples are provided, refer to Table F-4.

Table F-4: Examples of Small Hail Allowance Times by Reported Intensity

Weather Condition	Applicable Allowance Times	Examples	
		Weather Reported	Applicable Allowance Times
Small Hail reported without intensity	Moderate Ice Pellets (or Small Hail)	Small Hail, no intensity	Moderate Ice Pellets
		Small Hail mixed with Rain, no intensity	Moderate Ice Pellets mixed with Rain
Small Hail reported with light (-) intensity	Light Ice Pellets (or Small Hail)	Small Hail, light (-) intensity	Light Ice Pellets
		Small Hail, light (-) intensity, mixed with Rain	Light Ice Pellets mixed with Rain
Small Hail reported with heavy (+) intensity	No Allowance Times (No allowance times exist for heavy conditions.)		

4. Mixed Precipitation Conditions
   a. Allowance times are provided for ice pellets mixed with several other precipitation types in the allowance time tables.
   b. A footnote in the HOT tables allows light freezing rain HOTs to be used in conditions of very light or light snow mixed with light rain.
   c. It should be noted that obscurations and descriptors do not count as unique precipitation types. Therefore, when they are reported in conjunction with a single precipitation type, this is not considered a mixed precipitation condition.
      1) Obscurations include mist, dust, fog, sand, smoke, haze, and volcanic ash.

         The FAA HOT Guidelines provide HOTs for the obscuration freezing fog.

      2) Descriptors include showers, blowing, shallow, patches, thunderstorm, partial, low drifting, and freezing.

         Typically HOTs are required for freezing and frozen precipitation, but not for non-freezing precipitation. The “Rain on Cold Soaked Wing” column represents a nonfreezing precipitation condition.
   d. If non-freezing precipitation is reported below 0 °C, the flight crew should determine if freezing precipitation is occurring. If it is, HOTs for the equivalent freezing precipitation type should be used.

C. Operational Guidance

1. Tests have shown that ice pellets generally remain in the frozen state embedded in Types III and IV anti-icing fluid, and are not absorbed and dissolved 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 embedded) would be an indication that the fluid has failed. These embedded ice pellets are generally not readily detectable by the human eye during pre-takeoff contamination inspection procedures. Therefore, a visual pre-takeoff contamination inspection in ice pellet conditions may not be of value and is not required.

2. The research data have also shown that after proper deicing and anti-icing, the accumulation of light ice pellets, moderate ice pellets, and ice pellets mixed with other forms of precipitation in Types III and IV fluid will not prevent the fluid from flowing off the aerodynamic surfaces during takeoff. This flow-off, due to the shearing forces, occurs with rotation speeds consistent with Type III or IV anti-icing fluid recommended applications, and up to the applicable allowance time listed in the allowance time tables. These allowance times are from the start of the anti-icing fluid application. Additionally, if the ice pellet condition stops, and the allowance time has not been exceeded, the operator is permitted to consider the anti-icing fluid effective without any further action up to 90 minutes after the start of the application time of the anti-icing fluid. To use this guidance in the following conditions, the OAT must remain constant or increase during the 90-minute period:

   a. Light ice pellets mixed with freezing drizzle,

   b. Light ice pellets mixed with freezing rain, and

   c. Light ice pellets mixed with rain.

EXAMPLE

- Type IV anti-icing fluid is applied with a start of application time of 10:00,OAT is 0°C, light ice pellets fall until 10:20 and stop and do not restart. The allowance time stops at 10:50; however, provided that no precipitation restarts after the allowance time of 10:50, the aircraft may takeoff without any further action up to 11:30.
- Type IV anti-icing fluid is applied with a start of application time of 10:00,OAT is 0°C, light ice pellets mixed with freezing drizzle fall until 10:10 and stop and restart at 10:15 and stop at 10:20. The allowance time stops at 10:25; however, provided that the OAT remains constant or increases and that no precipitation restarts after the allowance time of 10:25, the aircraft may takeoff without any further action up to 11:30.

- Type IV anti-icing fluid is applied with a start of application time of 10:00,OAT is 0°C, light ice pellets mixed with freezing drizzle fall until 10:10 and stop and restart at 10:30 with the allowance time stopping at 10:25, the aircraft may not takeoff, no matter how short the time or type of precipitation, after 10:25 without being deiced and anti-iced if precipitation is present.

3. Operators with a deicing program updated to include the allowance time information contained herein will be allowed, in the specified ice pellet and small hail conditions listed in "FAA Table 47: Allowance Times for SAE Type III Fluids" and "FAA Table 48: Allowance Times for SAE Type IV Ethylene Glycol (EG) Fluids", and, if necessary, "FAA Table ADJ-47: Adjusted Allowance Times for SAE Type III Fluids" and "FAA Table ADJ-48: Adjusted Allowance Times for SAE Type IV Ethylene Glycol (EG) Fluids", up to the specific allowance time, to commence the takeoff with the following restrictions:

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

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

   c. The Type III allowance times are only applicable for unheated anti-icing fluid applications.

   d. Due to the shearing qualities of Types III and IV fluids with embedded ice pellets, allowance times are limited to aircraft with a rotation speed of 100 kts or greater or 115 kts or greater, as indicated in the allowance time tables.

   e. If the takeoff is not accomplished within the applicable allowance time, 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, subject to the restrictions in this section.

   f. A pre-takeoff contamination inspection is not required. The allowance time cannot be extended by an internal or external inspection 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, and:

      1) 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) 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.

i. If an intensity is reported with small hail, the ice pellet condition with the equivalent intensity can be used, e.g., if light small hail is reported, the light ice pellets allowance times can be used. This also applies in mixed conditions, e.g., if light small hail mixed with snow is reported, use the light ice pellets mixed with snow allowance times.

D. Operations in Hail, Small Hail and Snow Pellets (METAR Codes GS and GR)

1. Background

a. The World Meteorological Organization (WMO) states that the METAR code “GS” is used for two meteorological conditions: snow pellets and small hail. In most countries, weather observers report the METAR code “GS” in snow pellets and in small hail conditions, as recommended by the WMO. However, in the United States and Canada, weather observers only report “GS” in snow pellets; small hail is reported differently.

1) In the United States, small hail is reported as “GR” with “less than 1/4” in the remarks.

2) In Canada, small hail is reported as “SHGS” with remarks.

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

c. In the United States and most other countries, no intensity is reported with small hail. In some countries (e.g., Japan), an intensity is reported with small hail.

d. Hail, METAR code “GR,” is not the same meteorological condition as small hail, as the individual pellets are larger. In the United States, hail is reported as “GR” with the size provided in remarks being 1/4 or greater (reported in 1/4 inch increments). In most other countries, hail is reported as “GR” without remarks. There are no HOTs or allowance times for hail.

2. Operations Guidance

a. The following guidance should be used to ensure the correct HOTs/allowance times are used with METAR code “GS”:

1) If operating in the United States or Canada and METAR code “GS” is reported, the precipitation type is snow pellets and the snow HOTs can be used.

2) If operating in Canada and METAR code “SHGS” is reported without remarks, the precipitation type is snow pellet showers and the snow HOTs can be used.

3) If operating in Canada and METAR code “SHGS” is reported with remarks, the precipitation type is small hail and the ice pellet and small hail allowance times should be used.

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

b. The following guidance should be used to ensure the correct HOTs/allowance times are used with METAR code “GR”:

1) If operating in the United States and METAR code “GR” is reported with “less than 1/4” in the remarks, the precipitation type is small hail and the ice pellet and small hail allowance times should be used.

2) If operating in the United States and METAR code “GR” is reported with 1/4 or more in the remarks, the precipitation type is hail. There are no HOT or allowance times for hail.

3) If operating outside the United States and METAR code “GR” is reported, the precipitation type is hail. There are no HOT or allowance times for hail.

c. If no intensity is reported with small hail, the moderate ice pellet allowance times should be used. If an intensity is reported with small hail, the allowance times for the ice pellet condition with the equivalent intensity can be used (e.g., light small hail = light ice pellets, moderate small hail = moderate ice pellets). This also applies in mixed conditions (e.g., if light small hail mixed with snow is reported, use the light ice pellets mixed with snow allowance times). The following examples illustrate the application of this guidance:

1) If a report of “Small Hail” is received, but no intensity is reported with it, “Moderate Ice Pellets” allowance times must be used. This is shown in the row “Moderate Ice Pellets (or Small Hail).”

2) If a report of “Small Hail” is received and its intensity is reported as “moderate,” the “Moderate Ice Pellets (or Small Hail)” allowance times must be used.

3) If a report of “Small Hail” is received and its intensity is reported as “light,” “Light Ice Pellets” allowance times can be used.

4) If a report of “Small Hail” is received and its intensity is reported as “light” and it is mixed with another condition (e.g., snow, rain, or freezing rain), the equivalent light ice pellets allowance times can be used. For example, if there is light small hail mixed with rain, “Light Ice Pellets Mixed with Rain” allowance times can be used.

F.9 Operations in Heavy Snow, Heavy Ice Pellets, Moderate and Heavy Freezing Rain, and Hail

Operations will be suspended during continuous heavy snow, heavy ice pellets, moderate and heavy freezing rain, and hail since no HOTs exist for these conditions in the current HOT tables.

F.10 Effect of Extreme Cold on Altimeters

MISC AIM 7-2-3

A. Temperature affects the accuracy of altimeters.

B. The "ICAO Cold Temperature Error Table" indicates the error to be expected at the reported temperatures. To use the table find the reported temperature in the left column, then read across the top row to find the height above the airport/reporting station. The intersection of the column and the row is how much lower the aircraft may actually be as a result of the possible cold temperature induced error.

C. Crews should consider adding the error to their minimum descent and/or decision altitudes when operating in cold weather. For instance at -30 and 200 feet above the airport crews should add 40 feet to their approach minimums.

D. Crews should not adjust their assigned altitudes when operating on IFR clearances or at a published altitude on an approach segment. If terrain avoidance requires adjusting altitude, crews are required to notify ATC of the altitude differential they intend to fly.

E. ICAO Cold Temperature Error Table

Table F-5: ICAO Cold Temperature Error Table

Reported Temp °C	200	300	400	500	600	700	800	900	1000	1500	2000	3000	4000	5000
+10	10	10	10	10	20	20	20	20	20	30	40	60	80	90
0	20	20	30	30	40	40	50	50	60	90	120	170	230	280
-10	20	30	40	50	60	70	80	90	100	150	200	290	390	490
-20	30	50	60	70	90	100	120	130	140	210	280	420	570	710
-30	40	60	80	100	120	140	150	170	190	280	380	570	760	950
-40	50	80	100	120	150	170	190	220	240	360	480	720	970	1210
-50	60	90	120	150	180	210	240	270	300	450	590	890	1190	1500

EXAMPLE

Temperature -10°C, and aircraft altitude is 1,000 feet above the airport elevation. The chart shows that the reported current altimeter setting may place the aircraft as much as 100 feet below the altitude indicated by the altimeter.

F.11 Flight/Ground Crew Communications

Communication among all personnel involved in the deicing/anti-icing of an aircraft is critical to ensure that the pilot has the information needed to make the final determination that the aircraft is free of adhering contamination before flight. ALL personnel who perform duties as outlined in the Mesa Airlines, Inc. approved deice program must clearly and concisely communicate essential information to ensure that no frozen contaminants are adhering to any critical surfaces of the aircraft.

F.12 One-Step and Two-Step Deicing Process Communications

F.12.1 One-Step Deicing Process

F.12.1.1 Prior to Deicing

Before commencing the application of de/anti-icing fluid, the personnel who perform the de/anti-icing should confirm with the flight crew that the aircraft is configured for deicing.

EXAMPLE

Ground: “Captain, is your aircraft ready for de/anti-icing?”

Flight Crew: “Mesa (aircraft number) is configured and ready for Type 1 fluid on the wings and tail.”

F.12.1.2 Post-Deicing

After deicing is complete and the aircraft post-deice check is complete, the deicing personnel will communicate the following to the PIC:

A. Fluid type.

B. Fluid manufacturer name.

C. The start time of the final de/anti-ice application.

D. Verification that post-deice check is complete.

E. Any change in conditions that have affected the aircraft anti-icing treatment since the application.

EXAMPLE

Ground: “Mesa (aircraft number), Safewing, Type I deicing is complete, start time of final fluid application was (military time), post-deice check complete.”

Flight Crew: “Mesa (aircraft number) understand post-deice check complete.”

F.12.2 Two-Step Deicing Process

F.12.2.1 Prior to Deicing

Before commencing the application of de/anti-icing fluid, the personnel who perform the de/anti-icing should confirm with the flight crew that the aircraft is configured for deicing.

EXAMPLE

Ground: “Captain, is your aircraft ready for de/anti-icing?”

Flight Crew: “Mesa (aircraft number) is configured and ready for Type I fluid on the wings and tail.”

F.12.2.2 Post-Deicing

After deicing is complete and the aircraft post-deice check is complete, the deicing personnel will communicate the following to the PIC:

A. Fluid type.

B. Fluid manufacturer name.

C. Mixture percentage for Type II, III and IV fluids.

D. The start time of the final de/anti-ice application.

E. Verification that post-deice check is complete.

F. Any change in conditions that have affected the aircraft anti-icing treatment since the application.

EXAMPLE

Ground: “Mesa (aircraft number), anti-icing is complete, Safewing, Type IV fluid was used at a 100% mixture, start time of final fluid application was (military time), post-deice check complete.”

Flight Crew: “Mesa (aircraft number) understand post-deice check complete.”

F.13 Pilot Assessments of Precipitation Intensity

A. Pilots may not act based on their own assessment of precipitation intensity except in the following instances where their actions are more conservative than the actions prescribed by the reported conditions.

B. If, in the PIC's judgment, the intensity is greater than that being reported, the pilots will request that a new observation be taken. If a new observation is not taken or the new observation remains grossly different from that which is obviously occurring, then the applicable HOTs or allowance times for the higher intensity precipitation must be applied (e.g., if precipitation is being reported as light ice pellets and the pilot assessment is that it is moderate ice pellets, then the pilot must apply the allowance time for moderate ice pellets).

C. If, in the PIC's judgment, a different form of precipitation exists than that being reported, the pilots will request that a new observation be taken. If a new observation is not taken or the new observation remains grossly different from that which is obviously occurring, then the applicable HOTs or allowance times for the higher of the two types of precipitation must be applied.

D. The snowfall visibility table, refer to "FAA Table 50: Snowfall Intensities as a Function of Prevailing Visibility" in this chapter, is published in the annual FAA HOT Guidelines document for use in determining snow intensity rates based on prevailing visibility and must be used in place of official reported intensities. Thus, this table should be used for pilot assessment of snowfall intensity rates, unless snow and an obscuration (fog, smoke, haze, or any other obscuration) are reported. Since very light snow is in the Type IV tables, and since the METAR and the associated ATIS do not report very light snow, a METAR-reported visibility of 2.5 miles or higher can be used as an indication that the snowfall intensity is very light.

NOTE

Pilots are not to use Runway Visual Range (RVR) for determining visibility used with the HOT tables during snowfall. In addition, flight crews are to use Surface Visibility instead of Tower Visibility for determining visibility during snowfall.

F.14 Possible Effects of Runway Deicer on Thickened Aircraft Anti-icing Fluids

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

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

F.15 Fluid Freezing In Flight

It is possible for anti-icing fluid to flow back to aerodynamically quiet areas of aircraft wings after takeoff where the residual fluid can partially freeze or appear thickened. Research indicates that this can occur on a regular basis but poses no risk to safety. Anti-icing fluids are designed in such a way that most of the fluid will flow off aircraft wings, particularly from the leading edge. The leading edge is the most aerodynamically critical section of the wing, whereas its trailing edge can accrue some residual fluid and remain acceptable for safe operations.

F.16 Holdover Times (HOT) Tables

In the holdover tables shown on the following pages:

A. A holdover time range is shown for each type of weather condition. The low end of the range represents estimated holdover time in moderate conditions. The high end of the range represents estimated holdover time in light conditions. An initially determined holdover time can be adjusted (increased or decreased) by the pilot if conditions should change. For example, if conditions were to deteriorate, the holdover time would be shortened. If conditions were to improve significantly, holdover time could be extended. Either way, if holdover time is exceeded, the aircraft has to be deiced again. Refer to "Guidelines for the Application of SAE Type I Fluid" in this chapter.

NOTE

The Types I, III, and IV, and most Type II fluid-specific HOT guidelines include three separate snow columns representing very light snow, light snow, and moderate snow conditions. Recent surveys and analysis of worldwide snow conditions have revealed that more than 75 percent of snow occurrences fall into the light and very light snow category. Values in the “Very Light,” “Light,” and “Moderate” snow columns are based on tests conducted by APS Aviation Inc. These tests were conducted on behalf of the FAA and TC.

B. The HOT Guidelines are provided for information and guidance purposes. The HOT Guidelines on their own do not change, create, amend or permit deviations from regulatory requirements.

   1. The HOT Guidelines may use mandatory terms such as “must”, “shall” and “is/are required” so as to convey the intent of meeting regulatory requirements and SAE Standards, where applicable. The term “should” is to be understood, unless an alternative method of achieving safety is implemented that would meet or exceed the intent of the recommendation.

C. Notes in the tables refer to additional information on the specific allowance times.

D. Cautions located at the beginning of each section apply to all allowance times tables contained therein.

F.17 Active Frost Holdover Time (HOT) Guidelines (FAA Table 1)

CAUTION

- *The responsibility for the application of these data remains with the user.*
- *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 pre-takeoff check procedures.*

TABLE 1: ACTIVE FROST HOLDOVER TIMES FOR SAE TYPE I, TYPE II, TYPE III, AND TYPE IV FLUIDS[1]

Outside Air Temperature[2,3,4]	Type I
-1 °C and above (30 °F and above)	0:45 *(0:35)*[6]
below -1 to -3 °C (below 30 to 27 °F)	
below -3 to -10 °C (below 27 to 14 °F)	
below -10 to -14 °C (below 14 to 7 °F)	
below -14 to -21 °C (below 7 to -6 °F)	
below -21 to -25 °C (below -6 to -13 °F)	
below -25 °C to LOUT (below -13 °F to LOUT)	

Outside Air Temperature[3,4]	Concentration Fluid/Water By % Volume	Type II	Type III[5]	Type IV
-1 °C and above (30 °F and above)	100/0	8:00	2:00	12:00
	75/25	5:00	1:00	5:00
	50/50	2:00	0:30	3:00
below -1 to -3 °C (below 30 to 27 °F)	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 °C (below 27 to 14 °F)	100/0	8:00	2:00	10:00
	75/25	4:00	1:00	5:00
below -10 to -14 °C (below 14 to 7 °F)	100/0	6:00	2:00	6:00
	75/25	1:00	1:00	1:00
below -14 to -21 °C (below 7 to -6 °F)	100/0	3:00	2:00	6:00
below -21 to -25 °C (below -6 to -13 °F)	100/0	2:00	2:00	4:00
below -25 °C (below -13 °F)	100/0	No Holdover Time Guidelines Exist		

NOTES

1 To use the HOTs in this table, ensure that the fluid and dilution being used is listed in the List of Qualified Fluids Tested for Anti-Icing Performance and Aerodynamic Acceptance table (Table 51 - Table 54). Any restrictions on the use of the fluid have to be identified and applied.
2 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.
3 Ensure that the lowest operational use temperature (LOUT) is respected.
4 Changes in outside air temperature (OAT) over the course of longer frost events can be significant; the appropriate holdover time to use is the one provided for the coldest OAT that has occurred in the time between the de/anti-icing fluid application and takeoff.
5 To use the Type III fluid frost holdover times, the fluid brand being used must be known. AllClear AeroClear MAX must be applied unheated.
6 Value in parentheses is for aircraft with critical surfaces that are predominantly or entirely constructed of composite materials.

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 8.

F.17.1 HOT Guidelines for SAE Type I Fluids (FAA Tables 2 and 3)

CAUTION

- *The responsibility for the application of these data remains with the user.*
- *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 outside air temperature.*
- *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 pre-takeoff check procedures.*

A. FAA Table 2: Holdover Times for SAE Type I Fluid on Critical Aircraft Surfaces Composed Predominantly of Aluminum

FAA Holdover Time Guidelines **Winter 2023-2024**

TABLE 2: HOLDOVER TIMES FOR SAE TYPE I FLUID ON CRITICAL AIRCRAFT SURFACES COMPOSED PREDOMINANTLY OF ALUMINUM

Outside Air Temperature[1,2]	Freezing Fog, Freezing Mist[3], or Ice Crystals[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6,7]	Light Snow, Snow Grains or Snow Pellets[5,6,7]	Moderate Snow, Snow Grains or Snow Pellets[5,7]	Freezing Drizzle[8]	Light Freezing Rain	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	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	CAUTION: No holdover time guidelines exist
below -3 to -6 °C (below 27 to 21 °F)	0:08 - 0:13	0:14 - 0:17	0:08 - 0:14	0:05 - 0:08	0:05 - 0:09	0:02 - 0:05		
below -6 to -10 °C (below 21 to 14 °F)	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 °C (below 14 °F)	0:05 - 0:09	0:07 - 0:08	0:04 - 0:07	0:02 - 0:04				

NOTES

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) is respected.
3 Freezing mist is best confirmed by observation. It is never reported by METAR however it can occur when mist is present at 0 °C (32 °F) and below.
4 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or mist.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required.
6 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain or drizzle. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required to confirm the precipitation intensity is no greater than "light". No holdover times exist if the reported visibility correlates to a "moderate" or "heavy" precipitation intensity.
7 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
8 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 10.

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B. FAA Table 3: Holdover Times for SAE Type I Fluid on Critical Aircraft Surfaces Composed Predominantly of Composites

FAA Holdover Time Guidelines **Winter 2023-2024**

TABLE 3: HOLDOVER TIMES FOR SAE TYPE I FLUID ON CRITICAL AIRCRAFT SURFACES COMPOSED PREDOMINANTLY OF COMPOSITES

Outside Air Temperature[1,2]	Freezing Fog, Freezing Mist[3], or Ice Crystals[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6,7]	Light Snow, Snow Grains or Snow Pellets[5,6,7]	Moderate Snow, Snow Grains or Snow Pellets[5,7]	Freezing Drizzle[8]	Light Freezing Rain	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	0:09 - 0:16	0:12 - 0:15	0:06 - 0:12	0:03 - 0:06	0:08 - 0:13	0:02 - 0:05	0:01 - 0:05	CAUTION: No holdover time guidelines exist
below -3 to -6 °C (below 27 to 21 °F)	0:06 - 0:08	0:11 - 0:13	0:05 - 0:11	0:02 - 0:05	0:05 - 0:09	0:02 - 0:05		
below -6 to -10 °C (below 21 to 14 °F)	0:04 - 0:08	0:09 - 0:12	0:05 - 0:09	0:02 - 0:05	0:04 - 0:07	0:02 - 0:05		
below -10 °C (below 14 °F)	0:04 - 0:07	0:07 - 0:08	0:04 - 0:07	0:02 - 0:04				

NOTES

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) is respected.
3 Freezing mist is best confirmed by observation. It is never reported by METAR however it can occur when mist is present at 0 °C (32 °F) and below.
4 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or mist.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required.
6 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain or drizzle. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required to confirm the precipitation intensity is no greater than "light". No holdover times exist if the reported visibility correlates to a "moderate" or "heavy" precipitation intensity.
7 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
8 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 10.

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F.17.2 HOT Guidelines for SAE Type II Fluids (FAA Tables 4 – 16)

CAUTION

- *The responsibility for the application of these data remains with the user.*
- *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 outside air temperature.*
- *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 pre-takeoff check procedures.*

A. FAA Table 4: Generic Holdover Times for SAE Type II Fluids

TABLE 4: GENERIC HOLDOVER TIMES FOR SAE TYPE II FLUIDS[1]

Outside Air Temperature[2]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[3], or Ice Crystals[4]	Snow, Snow Grains or Snow Pellets[5,6,7]	Freezing Drizzle[8]	Light Freezing Rain	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	0:55 - 1:50	0:30 - 0:55	0:30 - 1:00	0:20 - 0:35	0:07 - 0:45	
	75/25	0:40 - 1:10	0:15 - 0:30	0:25 - 0:40	0:15 - 0:25	0:04 - 0:25	
	50/50	0:15 - 0:30	0:07 - 0:15	0:09 - 0:15	0:06 - 0:09	CAUTION: No holdover time guidelines exist	
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:30 - 0:45	0:20 - 0:40	0:20 - 0:45	0:15 - 0:20		
	75/25	0:25 - 0:55	0:10 - 0:25	0:15 - 0:30	0:08 - 0:15		
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:30 - 0:45	0:15 - 0:30	0:20 - 0:45[11]	0:15 - 0:20[11]		
	75/25	0:25 - 0:55	0:09 - 0:20	0:15 - 0:30[11]	0:08 - 0:15[11]		
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:15 - 0:20	0:02 - 0:07				
below -18 to -25 °C[12] (below 0 to -13 °F)	100/0	0:15 - 0:20	0:01 - 0:03				
below -25 °C to LOUT[12] (below -13 °F to LOUT)	100/0	0:15 - 0:20	0:00 - 0:01				

NOTES

1 To use the HOTs in this table, ensure that the fluid and dilution being used is listed in the Type II Fluids Tested for Anti-Icing Performance and Aerodynamic Acceptance table (Table 52). Any restrictions on the use of the fluid have to be identified and applied.
2 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type II fluid cannot be used.
3 Freezing mist is best confirmed by observation. It is never reported by METAR however it can occur when mist is present at 0 °C (32 °F) and below.
4 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or mist.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required.
6 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain or drizzle. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required to confirm the precipitation intensity is no greater than “light”. No holdover times exist if the reported visibility correlates to a “moderate” or “heavy” precipitation intensity.
7 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
8 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10 °C (14 °F).
12 If the LOUT is unknown, no holdover time guidelines exist below -25 °C (-13 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 13.

B. FAA Table 5: Type II Holdover Times for ABAX ECOWING AD-2

TABLE 5: TYPE II HOLDOVER TIMES FOR ABAX ECOWING AD-2

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Very Light Snow, Snow Grains or Snow Pellets[4,5,6]	Light Snow, Snow Grains or Snow Pellets[4,5,6]	Moderate Snow, Snow Grains or Snow Pellets[4,6]	Freezing Drizzle[7]	Light Freezing Rain	Rain on Cold-Soaked Wing[8]	Other[9]
-3 °C and above (27 °F and above)	100/0	1:20 - 3:00	2:25 - 2:55	1:15 - 2:25	0:40 - 1:15	0:40 - 1:40	0:30 - 0:45	0:09 - 1:25	
	75/25	1:15 - 1:25	1:45 - 2:10	0:55 - 1:45	0:25 - 0:55	0:35 - 1:05	0:20 - 0:30	0:04 - 0:50	
	50/50	0:15 - 0:30	0:35 - 0:40	0:15 - 0:35	0:07 - 0:15	0:09 - 0:15	0:06 - 0:09	CAUTION: No holdover time guidelines exist	
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:45 - 2:30	2:00 - 2:25	1:00 - 2:00	0:30 - 1:00	0:25 - 1:10	0:20 - 0:30		
	75/25	0:35 - 1:55	1:40 - 2:05	0:50 - 1:40	0:25 - 0:50	0:15 - 0:55	0:20 - 0:35		
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:45 - 2:30	1:45 - 2:05	0:55 - 1:45	0:30 - 0:55	0:25 - 1:10[10]	0:20 - 0:30[10]		
	75/25	0:35 - 1:55	1:35 - 2:00	0:50 - 1:35	0:25 - 0:50	0:15 - 0:55[10]	0:20 - 0:35[10]		
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:15 - 0:40	0:20 - 0:30	0:07 - 0:20	0:02 - 0:07				
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:15 - 0:40	0:09 - 0:15	0:03 - 0:09	0:01 - 0:03				
below -25 to -27 °C (below -13 to -17 °F)	100/0	0:15 - 0:40	0:05 - 0:07	0:01 - 0:05	0:00 - 0:01				

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type II fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR however it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or mist.
4 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required.
5 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain or drizzle. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required to confirm the precipitation intensity is no greater than “light”. No holdover times exist if the reported visibility correlates to a “moderate” or “heavy” precipitation intensity.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
9 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
10 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 13.

TABLE 6: TYPE II HOLDOVER TIMES FOR AVIATION XI'AN HIGH-TECH CLEANWING II

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Very Light Snow, Snow Grains or Snow Pellets[4,5,6]	Light Snow, Snow Grains or Snow Pellets[4,5,6]	Moderate Snow, Snow Grains or Snow Pellets[4,6]	Freezing Drizzle[7]	Light Freezing Rain	Rain on Cold-Soaked Wing[8]	Other[9]
-3 °C and above (27 °F and above)	100/0	0:55 - 1:50	1:35 - 1:55	0:55 - 1:35	0:30 - 0:55	0:35 - 1:05	0:25 - 0:35	0:10 - 0:55	
	75/25	0:50 - 1:20	1:20 - 1:40	0:45 - 1:20	0:25 - 0:45	0:35 - 1:00	0:20 - 0:30	0:07 - 0:50	
	50/50	0:35 - 1:00	0:50 - 1:05	0:25 - 0:50	0:15 - 0:25	0:20 - 0:40	0:10 - 0:20		
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:45 - 1:50	1:20 - 1:35	0:40 - 1:20	0:25 - 0:40	0:30 - 0:55	0:20 - 0:25		
	75/25	0:40 - 1:45	1:20 - 1:35	0:45 - 1:20	0:25 - 0:45	0:35 - 0:40	0:20 - 0:25		
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:45 - 1:50	1:05 - 1:20	0:35 - 1:05	0:20 - 0:35	0:30 - 0:55[10]	0:20 - 0:25[10]	CAUTION: No holdover time guidelines exist	
	75/25	0:40 - 1:45	1:20 - 1:35	0:45 - 1:20	0:25 - 0:45	0:35 - 0:40[10]	0:20 - 0:25[10]		
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:20 - 0:50	0:45 - 1:00	0:25 - 0:45	0:15 - 0:25				
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:20 - 0:50	0:30 - 0:35	0:15 - 0:30	0:07 - 0:15				

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type II fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR however it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or mist.
4 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required.
5 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain or drizzle. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required to confirm the precipitation intensity is no greater than "light". No holdover times exist if the reported visibility correlates to a "moderate" or "heavy" precipitation intensity.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
9 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
10 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 13.

TABLE 7: TYPE II HOLDOVER TIMES FOR CLARIANT SAFEWING MP II FLIGHT

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Very Light Snow, Snow Grains or Snow Pellets[4,5,6]	Light Snow, Snow Grains or Snow Pellets[4,5,6]	Moderate Snow, Snow Grains or Snow Pellets[4,6]	Freezing Drizzle[7]	Light Freezing Rain	Rain on Cold-Soaked Wing[8]	Other[9]
-3 °C and above (27 °F and above)	100/0	3:30 - 4:00	2:35 - 3:00	1:35 - 2:35	1:00 - 1:35	1:20 - 2:00	0:45 - 1:25	0:10 - 1:30	
	75/25	1:50 - 2:45	2:35 - 3:00	1:20 - 2:35	0:40 - 1:20	1:10 - 1:30	0:30 - 0:55	0:06 - 0:50	
	50/50	0:55 - 1:45	0:45 - 0:55	0:25 - 0:45	0:10 - 0:25	0:20 - 0:30	0:10 - 0:15	CAUTION: No holdover time guidelines exist	
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:55 - 1:45	2:05 - 2:30	1:15 - 2:05	0:45 - 1:15	0:35 - 1:30	0:25 - 0:45		
	75/25	0:25 - 1:05	1:45 - 2:10	0:55 - 1:45	0:30 - 0:55	0:25 - 1:10	0:20 - 0:35		
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:55 - 1:45	1:50 - 2:10	1:05 - 1:50	0:40 - 1:05	0:35 - 1:30[10]	0:25 - 0:45[10]		
	75/25	0:25 - 1:05	1:20 - 1:40	0:40 - 1:20	0:20 - 0:40	0:25 - 1:10[10]	0:20 - 0:35[10]		
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:30 - 0:50	1:10 - 1:40	0:25 - 1:10	0:08 - 0:25				
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:30 - 0:50	0:30 - 0:40	0:10 - 0:30	0:03 - 0:10				
below -25 to -29 °C (below -13 to -20 °F)	100/0	0:30 - 0:50	0:20 - 0:30	0:07 - 0:20	0:02 - 0:07				

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type II fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR however it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or mist.
4 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required.
5 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain or drizzle. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required to confirm the precipitation intensity is no greater than “light”. No holdover times exist if the reported visibility correlates to a “moderate” or “heavy” precipitation intensity.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
9 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
10 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 13.

TABLE 8: TYPE II HOLDOVER TIMES FOR CLARIANT SAFEWING MP II FLIGHT PLUS

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow, Snow Grains or Snow Pellets[4,5,6]	Freezing Drizzle[7]	Light Freezing Rain	Rain on Cold-Soaked Wing[8]	Other[9]
-3 °C and above (27 °F and above)	100/0	2:40 - 4:00	0:50 - 1:50	1:25 - 2:00	0:45 - 1:00	0:15 - 2:00	
	75/25	2:35 - 4:00	1:00 - 1:45	1:35 - 2:00	0:50 - 1:15	0:15 - 1:15	
	50/50	1:05 - 2:20	0:15 - 0:25	0:30 - 1:05	0:15 - 0:20	CAUTION: No holdover time guidelines exist	
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:40 - 2:20	0:40 - 1:30	0:35 - 1:25	0:35 - 0:55		
	75/25	0:30 - 1:45	1:00 - 1:40	0:25 - 1:10	0:30 - 0:45		
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:40 - 2:20	0:35 - 1:15	0:35 - 1:25[10]	0:35 - 0:55[10]		
	75/25	0:30 - 1:45	0:55 - 1:40	0:25 - 1:10[10]	0:30 - 0:45[10]		
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:20 - 0:40	0:02 - 0:07				
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:20 - 0:40	0:01 - 0:03				
below -25 to -29 °C (below -13 to -20 °F)	100/0	0:20 - 0:40	0:00 - 0:01				

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type II fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR however it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or mist.
4 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required.
5 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain or drizzle. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required to confirm the precipitation intensity is no greater than “light”. No holdover times exist if the reported visibility correlates to a “moderate” or “heavy” precipitation intensity.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
9 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
10 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 13.

TABLE 9: TYPE II HOLDOVER TIMES FOR CRYOTECH POLAR GUARD® II

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Very Light Snow, Snow Grains or Snow Pellets[4,5,6]	Light Snow, Snow Grains or Snow Pellets[4,5,6]	Moderate Snow, Snow Grains or Snow Pellets[4,6]	Freezing Drizzle[7]	Light Freezing Rain	Rain on Cold-Soaked Wing[8]	Other[9]
-3 °C and above (27 °F and above)	100/0	2:50 - 4:00	3:00 - 3:00	1:55 - 3:00	1:05 - 1:55	1:35 - 2:00	1:15 - 1:30	0:15 - 2:00	
	75/25	2:30 - 4:00	3:00 - 3:00	1:25 - 3:00	0:40 - 1:25	1:40 - 2:00	0:40 - 1:10	0:09 - 1:40	
	50/50	0:50 - 1:25	1:10 - 1:35	0:25 - 1:10	0:10 - 0:25	0:20 - 0:45	0:09 - 0:20	CAUTION: No holdover time guidelines exist	
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:55 - 2:30	2:25 - 2:50	1:25 - 2:25	0:50 - 1:25	0:35 - 1:35	0:35 - 0:45		
	75/25	0:40 - 1:30	2:20 - 3:00	1:05 - 2:20	0:30 - 1:05	0:25 - 1:05	0:35 - 0:45		
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:55 - 2:30	2:00 - 2:20	1:10 - 2:00	0:40 - 1:10	0:35 - 1:35[10]	0:35 - 0:45[10]		
	75/25	0:40 - 1:30	2:00 - 2:30	0:55 - 2:00	0:25 - 0:55	0:25 - 1:05[10]	0:35 - 0:45[10]		
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:25 - 0:50	1:35 - 2:15	0:35 - 1:35	0:10 - 0:35				
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:25 - 0:50	0:40 - 0:55	0:15 - 0:40	0:04 - 0:15				
below -25 to -30.5 °C (below -13 to -23 °F)	100/0	0:25 - 0:50	0:25 - 0:30	0:07 - 0:25	0:02 - 0:07				

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type II fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR however it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or mist.
4 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required.
5 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain or drizzle. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required to confirm the precipitation intensity is no greater than “light”. No holdover times exist if the reported visibility correlates to a “moderate” or “heavy” precipitation intensity.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
9 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
10 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 13.

TABLE 10: TYPE II HOLDOVER TIMES FOR JSC RCP NORDIX DEFROST PG 2

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Very Light Snow, Snow Grains or Snow Pellets[4,5,6]	Light Snow, Snow Grains or Snow Pellets[4,5,6]	Moderate Snow, Snow Grains or Snow Pellets[4,6]	Freezing Drizzle[7]	Light Freezing Rain	Rain on Cold-Soaked Wing[8]	Other[9]
-3 °C and above (27 °F and above)	100/0	0:55 - 1:50	1:50 - 2:15	0:55 - 1:50	0:30 - 0:55	0:30 - 1:00	0:20 - 0:35	0:10 - 1:20	
	75/25	1:05 - 2:00	1:45 - 2:15	0:45 - 1:45	0:20 - 0:45	0:25 - 0:50	0:15 - 0:30	0:06 - 0:35	
	50/50	1:00 - 1:50	2:10 - 2:40	1:00 - 2:10	0:30 - 1:00	0:30 - 0:50	0:15 - 0:30	CAUTION: No holdover time guidelines exist	
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:55 - 1:25	1:25 - 1:45	0:45 - 1:25	0:25 - 0:45	0:35 - 0:50	0:20 - 0:30		
	75/25	0:40 - 1:20	1:10 - 1:30	0:30 - 1:10	0:15 - 0:30	0:25 - 0:40	0:15 - 0:20		
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:55 - 1:25	1:15 - 1:30	0:40 - 1:15	0:20 - 0:40	0:35 - 0:50[10]	0:20 - 0:30[10]		
	75/25	0:40 - 1:20	0:55 - 1:05	0:25 - 0:55	0:10 - 0:25	0:25 - 0:40[10]	0:15 - 0:20[10]		
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:35 - 1:05	0:20 - 0:30	0:07 - 0:20	0:02 - 0:07				
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:35 - 1:05	0:09 - 0:15	0:03 - 0:09	0:01 - 0:03				
below -25 to -27 °C (below -13 to -17 °F)	100/0	0:35 - 1:05	0:05 - 0:07	0:01 - 0:05	0:00 - 0:01				

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type II fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR however it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or mist.
4 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required.
5 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain or drizzle. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required to confirm the precipitation intensity is no greater than “light”. No holdover times exist if the reported visibility correlates to a “moderate” or “heavy” precipitation intensity.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
9 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
10 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 13.

TABLE 11: TYPE II HOLDOVER TIMES FOR KILFROST ABC-K PLUS

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow, Snow Grains or Snow Pellets[4,5,6]	Freezing Drizzle[7]	Light Freezing Rain	Rain on Cold-Soaked Wing[8]	Other[9]
-3 °C and above (27 °F and above)	100/0	2:15 - 3:45	1:00 - 1:40	1:50 - 2:00	1:00 - 1:25	0:20 - 2:00	
	75/25	1:40 - 2:30	0:35 - 1:10	1:25 - 2:00	0:50 - 1:10	0:15 - 2:00	
	50/50	0:35 - 1:05	0:07 - 0:15	0:20 - 0:30	0:10 - 0:15	CAUTION: No holdover time guidelines exist	
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:30 - 1:05	0:55 - 1:30	0:25 - 1:00	0:15 - 0:35		
	75/25	0:25 - 1:25	0:35 - 1:05	0:20 - 0:55	0:09 - 0:30		
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:30 - 1:05	0:50 - 1:25	0:25 - 1:00[10]	0:15 - 0:35[10]		
	75/25	0:25 - 1:25	0:35 - 1:05	0:20 - 0:55[10]	0:09 - 0:30[10]		
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:30 - 0:55	0:02 - 0:07				
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:30 - 0:55	0:01 - 0:03				
below -25 to -29 °C (below -13 to -20 °F)	100/0	0:30 - 0:55	0:00 - 0:01				

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type II fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR however it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or mist.
4 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required.
5 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain or drizzle. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required to confirm the precipitation intensity is no greater than “light”. No holdover times exist if the reported visibility correlates to a “moderate” or “heavy” precipitation intensity.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
9 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
10 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 13.

TABLE 12: TYPE II HOLDOVER TIMES FOR KILFROST ICE CLEAR II

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Very Light Snow, Snow Grains or Snow Pellets[4,5,6]	Light Snow, Snow Grains or Snow Pellets[4,5,6]	Moderate Snow, Snow Grains or Snow Pellets[4,6]	Freezing Drizzle[7]	Light Freezing Rain	Rain on Cold-Soaked Wing[8]	Other[9]
-3 °C and above (27 °F and above)	100/0	1:25 - 2:25	2:25 - 2:55	1:20 - 2:25	0:40 - 1:20	1:00 - 1:35	0:40 - 1:05	0:15 - 2:00	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist	
below -3 to -8 °C (below 27 to 18 °F)	100/0	1:05 - 2:35	2:10 - 2:35	1:10 - 2:10	0:40 - 1:10	0:30 - 1:15	0:35 - 0:55		
	75/25	N/A	N/A	N/A	N/A	N/A	N/A		
below -8 to -14 °C (below 18 to 7 °F)	100/0	1:05 - 2:35	2:00 - 2:25	1:05 - 2:00	0:35 - 1:05	0:30 - 1:15[10]	0:35 - 0:55[10]		
	75/25	N/A	N/A	N/A	N/A	N/A	N/A		
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:35 - 0:45	0:55 - 1:05	0:30 - 0:55	0:15 - 0:30				
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:35 - 0:45	0:30 - 0:35	0:15 - 0:30	0:08 - 0:15				
below -25 to -28 °C (below -13 to -18 °F)	100/0	0:35 - 0:45	0:25 - 0:30	0:10 - 0:25	0:06 - 0:10				

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type II fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR however it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or mist.
4 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required.
5 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain or drizzle. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required to confirm the precipitation intensity is no greater than “light”. No holdover times exist if the reported visibility correlates to a “moderate” or “heavy” precipitation intensity.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
9 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
10 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 13.

J. FAA Table 13: Type II Holdover Times for MKS DevO COREICEPHOB Type II

TABLE 13: TYPE II HOLDOVER TIMES FOR MKS DEVO COREICEPHOB TYPE II

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Very Light Snow, Snow Grains or Snow Pellets[4,5,6]	Light Snow, Snow Grains or Snow Pellets[4,5,6]	Moderate Snow, Snow Grains or Snow Pellets[4,6]	Freezing Drizzle[7]	Light Freezing Rain	Rain on Cold-Soaked Wing[8]	Other[9]
-3°C and above (27°F and above)	100/0	1:55 - 2:45	2:35 - 3:00	1:25 - 2:35	0:45 - 1:25	1:15 - 2:00	0:45 - 1:10	0:15 - 1:35	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	1:05 - 1:45	1:45 - 2:05	1:00 - 1:45	0:35 - 1:00	0:50 - 1:15	0:25 - 0:40	CAUTION: No holdover time guidelines exist	
below -3 to -8°C (below 27 to 18°F)	100/0	0:55 - 1:55	1:50 - 2:15	1:00 - 1:50	0:30 - 1:00	0:30 - 1:10	0:25 - 0:35		
	75/25	N/A	N/A	N/A	N/A	N/A	N/A		
below -8 to -14°C (below 18 to 7°F)	100/0	0:55 - 1:55	1:30 - 1:50	0:50 - 1:30	0:25 - 0:50	0:30 - 1:10[10]	0:25 - 0:35[10]		
	75/25	N/A	N/A	N/A	N/A	N/A	N/A		
below -14 to -18°C (below 7 to 0°F)	100/0	0:20 - 0:30	0:35 - 0:40	0:20 - 0:35	0:10 - 0:20				
below -18 to -25°C (below 0 to -13°F)	100/0	0:20 - 0:30	0:15 - 0:15	0:07 - 0:15	0:04 - 0:07				
below -25 to -27°C (below -13 to -17°F)	100/0	0:20 - 0:30	0:10 - 0:10	0:05 - 0:10	0:03 - 0:05				

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type II fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR however it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or mist.
4 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required.
5 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain or drizzle. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required to confirm the precipitation intensity is no greater than “light”. No holdover times exist if the reported visibility correlates to a “moderate” or “heavy” precipitation intensity.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 No holdover time guidelines exist for this condition for 0°C (32°F) and below.
9 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
10 No holdover time guidelines exist for this condition below -10°C (14°F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 13.

TABLE 14: TYPE II HOLDOVER TIMES FOR NEWAVE AEROCHEMICAL FCY-2

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow, Snow Grains or Snow Pellets[4,5,6]	Freezing Drizzle[7]	Light Freezing Rain	Rain on Cold-Soaked Wing[8]	Other[9]
-3 °C and above (27 °F and above)	100/0	1:15 - 2:25	0:30 - 0:55	0:35 - 1:05	0:25 - 0:35	0:08 - 0:45	
	75/25	0:50 - 1:30	0:20 - 0:40	0:25 - 0:45	0:15 - 0:25	0:05 - 0:25	
	50/50	0:25 - 0:35	0:15 - 0:25	0:10 - 0:20	0:07 - 0:10	CAUTION: No holdover time guidelines exist	
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:45 - 1:30	0:20 - 0:40	0:20 - 0:45	0:15 - 0:20		
	75/25	0:30 - 1:05	0:15 - 0:25	0:15 - 0:30	0:08 - 0:15		
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:45 - 1:30	0:15 - 0:30	0:20 - 0:45[10]	0:15 - 0:20[10]		
	75/25	0:30 - 1:05	0:10 - 0:20	0:15 - 0:30[10]	0:08 - 0:15[10]		
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:25 - 0:35	0:02 - 0:07				
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:25 - 0:35	0:01 - 0:03				
below -25 to -28 °C (below -13 to -18 °F)	100/0	0:25 - 0:35	0:00 - 0:01				

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type II fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR however it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or mist.
4 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required.
5 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain or drizzle. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required to confirm the precipitation intensity is no greater than “light”. No holdover times exist if the reported visibility correlates to a “moderate” or “heavy” precipitation intensity.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
9 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
10 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 13.

L. FAA Table 15: Type II Holdover Times for ROMCHIM ADD-PROTECT NG Type II

TABLE 15: TYPE II HOLDOVER TIMES FOR ROMCHIM ADD-PROTECT NG TYPE II

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Very Light Snow, Snow Grains or Snow Pellets[4,5,6]	Light Snow, Snow Grains or Snow Pellets[4,5,6]	Moderate Snow, Snow Grains or Snow Pellets[4,6]	Freezing Drizzle[7]	Light Freezing Rain	Rain on Cold-Soaked Wing[8]	Other[9]
-3 °C and above (27 °F and above)	100/0	1:10 - 2:25	2:35 - 3:00	1:10 - 2:35	0:35 - 1:10	0:50 - 1:20	0:35 - 0:50	0:07 - 1:10	
	75/25	1:00 - 1:50	1:55 - 2:25	0:55 - 1:55	0:25 - 0:55	0:40 - 1:15	0:25 - 0:40	0:07 - 0:55	
	50/50	0:25 - 0:55	0:55 - 1:05	0:30 - 0:55	0:15 - 0:30	0:20 - 0:35	0:10 - 0:20	CAUTION: No holdover time guidelines exist	
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:55 - 1:35	1:50 - 2:20	0:50 - 1:50	0:25 - 0:50	0:35 - 1:10	0:25 - 0:35		
	75/25	0:55 - 1:25	1:25 - 1:45	0:40 - 1:25	0:20 - 0:40	0:25 - 1:05	0:20 - 0:30		
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:55 - 1:35	1:25 - 1:50	0:40 - 1:25	0:20 - 0:40	0:35 - 1:10[10]	0:25 - 0:35[10]		
	75/25	0:55 - 1:25	1:05 - 1:25	0:30 - 1:05	0:15 - 0:30	0:25 - 1:05[10]	0:20 - 0:30[10]		
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:15 - 0:20	0:20 - 0:30	0:07 - 0:20	0:02 - 0:07				
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:15 - 0:20	0:09 - 0:15	0:03 - 0:09	0:01 - 0:03				
below -25 to -28 °C (below -13 to -18 °F)	100/0	0:15 - 0:20	0:05 - 0:07	0:01 - 0:05	0:00 - 0:01				

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type II fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR however it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or mist.
4 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required.
5 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain or drizzle. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required to confirm the precipitation intensity is no greater than “light”. No holdover times exist if the reported visibility correlates to a “moderate” or “heavy” precipitation intensity.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
9 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
10 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 13.

M. FAA Table 16: Type II Holdover Times for ROMCHIM ADD-PROTECT Type II

TABLE 16: TYPE II HOLDOVER TIMES FOR ROMCHIM ADD-PROTECT TYPE II

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Very Light Snow, Snow Grains or Snow Pellets[4,5,6]	Light Snow, Snow Grains or Snow Pellets[4,5,6]	Moderate Snow, Snow Grains or Snow Pellets[4,6]	Freezing Drizzle[7]	Light Freezing Rain	Rain on Cold-Soaked Wing[8]	Other[9]
-3 °C and above (27 °F and above)	100/0	1:40 - 3:30	1:55 - 2:25	1:00 - 1:55	0:30 - 1:00	0:40 - 1:35	0:25 - 0:45	0:09 - 0:50	
	75/25	0:40 - 1:10	1:00 - 1:10	0:30 - 1:00	0:15 - 0:30	0:25 - 0:40	0:15 - 0:25	0:05 - 0:25	
	50/50	0:20 - 0:35	0:30 - 0:35	0:15 - 0:30	0:09 - 0:15	0:10 - 0:30	0:08 - 0:10	CAUTION: No holdover time guidelines exist	
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:30 - 0:45	1:20 - 1:40	0:40 - 1:20	0:20 - 0:40	0:25 - 0:50	0:20 - 0:30		
	75/25	0:30 - 0:55	0:40 - 0:50	0:25 - 0:40	0:10 - 0:25	0:20 - 0:30	0:15 - 0:20		
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:30 - 0:45	1:05 - 1:20	0:35 - 1:05	0:15 - 0:35	0:25 - 0:50[10]	0:20 - 0:30[10]		
	75/25	0:30 - 0:55	0:35 - 0:40	0:20 - 0:35	0:09 - 0:20	0:20 - 0:30[10]	0:15 - 0:20[10]		
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:15 - 0:25	0:20 - 0:30	0:07 - 0:20	0:02 - 0:07				
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:15 - 0:25	0:09 - 0:15	0:03 - 0:09	0:01 - 0:03				
below -25 to -28 °C (below -13 to -18 °F)	100/0	0:15 - 0:25	0:05 - 0:07	0:01 - 0:05	0:00 - 0:01				

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type II fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR however it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or mist.
4 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required.
5 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain or drizzle. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required to confirm the precipitation intensity is no greater than “light”. No holdover times exist if the reported visibility correlates to a “moderate” or “heavy” precipitation intensity.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
9 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
10 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 13.

F.17.3 HOT Guidelines for SAE Type III Fluids (FAA Tables 17 – 19)

CAUTION

- *The responsibility for the application of these data remains with the user.*
- *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 outside air temperature.*
- *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 pre-takeoff check procedures.*

A. FAA Table 17: Type III Holdover Times for AllClear AeroClear MAX Applied Unheated on Low Speed Aircraft

TABLE 17: TYPE III HOLDOVER TIMES FOR ALLCLEAR AEROCLEAR MAX APPLIED UNHEATED ON LOW SPEED AIRCRAFT[1]

Outside Air Temperature[2]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[3], or Ice Crystals[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6,7]	Light Snow, Snow Grains or Snow Pellets[5,6,7]	Moderate Snow, Snow Grains or Snow Pellets[5,7]	Freezing Drizzle[8]	Light Freezing Rain	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	0:45 - 1:55	1:20 - 1:45	0:40 - 1:20	0:18 - 0:40	0:25 - 0:50	0:14 - 0:25	0:05 - 0:40	CAUTION: No holdover time guidelines exist
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist	
below -3 to -10 °C (below 27 to 14 °F)	100/0	0:50 - 1:40	1:20 - 1:45	0:40 - 1:20	0:18 - 0:40	0:25 - 0:45	0:15 - 0:25		
	75/25	N/A	N/A	N/A	N/A	N/A	N/A		
below -10 to -16 °C (below 14 to 3 °F)	100/0	0:40 - 1:45	1:20 - 1:45	0:40 - 1:20	0:18 - 0:40				

NOTES

1 These holdover times are for aircraft conforming to the SAE AS5900 low speed aerodynamic test criterion. Fluid must be applied unheated to use these holdover times. No holdover times exist for this fluid applied heated. If uncertain whether the aircraft conforms to the low, middle, or high speed aerodynamic test criterion, no holdover time guidelines exist below -16°C (3°F).
2 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type III fluid cannot be used.
3 Freezing mist is best confirmed by observation. It is never reported by METAR however it can occur when mist is present at 0 °C (32 °F) and below.
4 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or mist.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required.
6 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain or drizzle. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required to confirm the precipitation intensity is no greater than “light”. No holdover times exist if the reported visibility correlates to a “moderate” or “heavy” precipitation intensity.
7 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
8 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 27.

B. FAA Table 18: Type III Holdover Times for AllClear AeroClear MAX Applied Unheated on Middle Speed Aircraft

TABLE 18: TYPE III HOLDOVER TIMES FOR ALLCLEAR AEROCLEAR MAX APPLIED UNHEATED ON MIDDLE SPEED AIRCRAFT[1]

Outside Air Temperature[2]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[3], or Ice Crystals[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6,7]	Light Snow, Snow Grains or Snow Pellets[5,6,7]	Moderate Snow, Snow Grains or Snow Pellets[5,7]	Freezing Drizzle[8]	Light Freezing Rain	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	0:45 - 1:55	1:20 - 1:45	0:40 - 1:20	0:18 - 0:40	0:25 - 0:50	0:14 - 0:25	0:05 - 0:40	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A		
below -3 to -10 °C (below 27 to 14 °F)	100/0	0:50 - 1:40	1:20 - 1:45	0:40 - 1:20	0:18 - 0:40	0:25 - 0:45	0:15 - 0:25	CAUTION: No holdover time guidelines exist	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A		
below -10 to -20.5 °C (below 14 to -5 °F)	100/0	0:40 - 1:45	1:20 - 1:45	0:40 - 1:20	0:18 - 0:40				

NOTES

1 These holdover times are for aircraft conforming to the SAE AS5900 middle speed aerodynamic test criterion. Fluid must be applied unheated to use these holdover times. No holdover times exist for this fluid applied heated. If uncertain whether the aircraft conforms to the low, middle, or high speed aerodynamic test criterion, no holdover time guidelines exist below -16°C (3°F).
2 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type III fluid cannot be used.
3 Freezing mist is best confirmed by observation. It is never reported by METAR however it can occur when mist is present at 0 °C (32 °F) and below.
4 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or mist.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required.
6 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain or drizzle. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required to confirm the precipitation intensity is no greater than “light”. No holdover times exist if the reported visibility correlates to a “moderate” or “heavy” precipitation intensity.
7 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
8 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 27.

C. FAA Table 19: Type III Holdover Times for AllClear AeroClear MAX Applied Unheated on High Speed Aircraft

TABLE 19: TYPE III HOLDOVER TIMES FOR ALLCLEAR AEROCLEAR MAX APPLIED UNHEATED ON HIGH SPEED AIRCRAFT[1]

Outside Air Temperature[2]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[3], or Ice Crystals[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6,7]	Light Snow, Snow Grains or Snow Pellets[5,6,7]	Moderate Snow, Snow Grains or Snow Pellets[5,7]	Freezing Drizzle[8]	Light Freezing Rain	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	0:45 - 1:55	1:20 - 1:45	0:40 - 1:20	0:18 - 0:40	0:25 - 0:50	0:14 - 0:25	0:05 - 0:40	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A		
below -3 to -10 °C (below 27 to 14 °F)	100/0	0:50 - 1:40	1:20 - 1:45	0:40 - 1:20	0:18 - 0:40	0:25 - 0:45	0:15 - 0:25		
	75/25	N/A	N/A	N/A	N/A	N/A	N/A		
below -10 to -25 °C (below 14 to -13 °F)	100/0	0:40 - 1:45	1:20 - 1:45	0:40 - 1:20	0:18 - 0:40			CAUTION: No holdover time guidelines exist	
below -25 to -35 °C (below -13 to -31 °F)	100/0	0:25 - 1:00	0:45 - 1:00	0:20 - 0:45	0:10 - 0:20				

NOTES

1 These holdover times are for aircraft conforming to the SAE AS5900 high speed aerodynamic test criterion. Fluid must be applied unheated to use these holdover times. No holdover times exist for this fluid applied heated. If uncertain whether the aircraft conforms to the low, middle, or high speed aerodynamic test criterion, no holdover time guidelines exist below -16°C (3°F).
2 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type III fluid cannot be used.
3 Freezing mist is best confirmed by observation. It is never reported by METAR however it can occur when mist is present at 0 °C (32 °F) and below.
4 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or mist.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required.
6 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain or drizzle. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required to confirm the precipitation intensity is no greater than "light". No holdover times exist if the reported visibility correlates to a "moderate" or "heavy" precipitation intensity.
7 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
8 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table 47 provides allowance times for ice pellets and small hail for SAE Type III fluids, applied unheated).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 27.

F.17.4 HOT Guidelines for SAE Type IV Fluids (FAA Tables 20 – 45)

CAUTION

- *The responsibility for the application of these data remains with the user.*
- *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 outside air temperature.*
- *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 pre-takeoff check procedures.*
- *These holdover times are for aircraft conforming to the SAE AS5900 high speed aerodynamic test criterion. If uncertain whether the aircraft conforms to the low, middle, or high speed aerodynamic test criterion, no holdover time guidelines exist.*

A. FAA Table 20: Generic Holdover Times for SAE Type IV Fluids

TABLE 20: GENERIC HOLDOVER TIMES FOR SAE TYPE IV FLUIDS[1]

Outside Air Temperature[2]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[3], or Ice Crystals[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6,7]	Light Snow, Snow Grains or Snow Pellets[5,6,7]	Moderate Snow, Snow Grains or Snow Pellets[5,7]	Freezing Drizzle[8]	Light Freezing Rain	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	1:15 - 2:40	1:55 - 2:20	1:00 - 1:55	0:30 - 1:00	0:40 - 1:10	0:20 - 0:35	0:08 - 1:05	
	75/25	1:25 - 2:40	2:05 - 2:25	1:15 - 2:05	0:40 - 1:15	1:00 - 1:20	0:30 - 0:50	0:09 - 1:20	
	50/50	0:30 - 0:55	1:00 - 1:10	0:25 - 1:00	0:10 - 0:25	0:15 - 0:40	0:09 - 0:20	CAUTION: No holdover time guidelines exist	
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:20 - 1:35	1:45 - 2:05	0:55 - 1:45	0:25 - 0:55	0:25 - 1:10	0:20 - 0:25		
	75/25	0:30 - 1:20	1:50 - 2:10	1:05 - 1:50	0:30 - 1:05	0:20 - 1:05	0:15 - 0:25		
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:20 - 1:35	1:30 - 1:50	0:50 - 1:30	0:25 - 0:50	0:25 - 1:10[11]	0:20 - 0:25[11]		
	75/25	0:30 - 1:20	1:40 - 2:00	0:55 - 1:40	0:25 - 0:55	0:20 - 1:05[11]	0:15 - 0:25[11]		
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:20 - 0:35	0:30 - 0:45	0:09 - 0:30	0:02 - 0:09				
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:20 - 0:35	0:10 - 0:20	0:03 - 0:10	0:01 - 0:03				
below -25 °C to LOUT[12] (below -13 °F to LOUT)	100/0	0:20 - 0:35	0:07 - 0:10	0:02 - 0:07	0:00 - 0:02				

NOTES

1 To use the HOTs in this table, ensure that the fluid and dilution being used is listed in the Type IV Fluids Tested for Anti-Icing Performance and Aerodynamic Acceptance table (Table 54). Any restrictions on the use of the fluid have to be identified and applied.
2 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
3 Freezing mist is best confirmed by observation. It is never reported by METAR however it can occur when mist is present at 0 °C (32 °F) and below.
4 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or mist.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required.
6 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain or drizzle. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required to confirm the precipitation intensity is no greater than “light”. No holdover times exist if the reported visibility correlates to a “moderate” or “heavy” precipitation intensity.
7 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
8 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table 48 provides allowance times for Type IV EG fluids and Table 49 provides allowance times for Type IV PG fluids in ice pellets and small hail. If the glycol type is unknown, the allowance times for SAE Type IV PG fluids should be used).
11 No holdover time guidelines exist for this condition below -10 °C (14 °F).
12 If the LOUT is unknown, no holdover time guidelines exist below -25.5 °C (-14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 31.

B. FAA Table 21: Type IV Holdover Times for ABAX ECOWING AD-49

TABLE 21: TYPE IV HOLDOVER TIMES FOR ABAX ECOWING AD-49

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Very Light Snow, Snow Grains or Snow Pellets[4,5,6]	Light Snow, Snow Grains or Snow Pellets[4,5,6]	Moderate Snow, Snow Grains or Snow Pellets[4,6]	Freezing Drizzle[7]	Light Freezing Rain	Rain on Cold-Soaked Wing[8]	Other[9]
-3 °C and above (27 °F and above)	100/0	3:20 - 4:00	3:00 - 3:00	1:55 - 3:00	1:00 - 1:55	1:25 - 2:00	1:00 - 1:25	0:10 - 1:55	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist	
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:20 - 1:35	2:55 - 3:00	1:30 - 2:55	0:45 - 1:30	0:25 - 1:25	0:20 - 0:25		
	75/25	N/A	N/A	N/A	N/A	N/A	N/A		
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:20 - 1:35	2:25 - 3:00	1:15 - 2:25	0:40 - 1:15	0:25 - 1:25[10]	0:20 - 0:25[10]		
	75/25	N/A	N/A	N/A	N/A	N/A	N/A		
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:25 - 0:40	0:30 - 0:45	0:09 - 0:30	0:02 - 0:09				
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:25 - 0:40	0:10 - 0:20	0:03 - 0:10	0:01 - 0:03				
below -25 to -26 °C (below -13 to -15 °F)	100/0	0:25 - 0:40	0:07 - 0:10	0:02 - 0:07	0:00 - 0:02				

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR however it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or mist.
4 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required.
5 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain or drizzle. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required to confirm the precipitation intensity is no greater than “light”. No holdover times exist if the reported visibility correlates to a “moderate” or “heavy” precipitation intensity.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
9 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table 49 provides allowance times for Type IV PG fluids in ice pellets and small hail).
10 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 31.

TABLE 22: TYPE IV HOLDOVER TIMES FOR ALAB INTERNATIONAL PROFLIGHT EG4

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Very Light Snow, Snow Grains or Snow Pellets[4,5,6]	Light Snow, Snow Grains or Snow Pellets[4,5,6]	Moderate Snow, Snow Grains or Snow Pellets[4,6]	Freezing Drizzle[7]	Light Freezing Rain	Rain on Cold-Soaked Wing[8]	Other[9]
-3 °C and above (27 °F and above)	100/0	2:10 - 4:00	2:30 - 3:00	1:20 - 2:30	0:40 - 1:20	1:05 - 1:55	0:35 - 0:55	0:15 - 2:00	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist	
below -3 to -8 °C (below 27 to 18 °F)	100/0	2:05 - 3:55	3:00 - 3:00	1:40 - 3:00	0:55 - 1:40	1:00 - 2:00	0:50 - 1:05		
	75/25	N/A	N/A	N/A	N/A	N/A	N/A		
below -8 to -14 °C (below 18 to 7 °F)	100/0	2:05 - 3:55	3:00 - 3:00	1:55 - 3:00	1:00 - 1:55	1:00 - 2:00[10]	0:50 - 1:05[10]		
	75/25	N/A	N/A	N/A	N/A	N/A	N/A		
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:30 - 1:30	0:50 - 1:05	0:25 - 0:50	0:10 - 0:25				
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:30 - 1:30	0:40 - 0:55	0:15 - 0:40	0:05 - 0:15				
below -25 to -26 °C (below -13 to -15 °F)	100/0	0:30 - 1:30	0:25 - 0:35	0:08 - 0:25	0:02 - 0:08				

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR however it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or mist.
4 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required.
5 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain or drizzle. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required to confirm the precipitation intensity is no greater than “light”. No holdover times exist if the reported visibility correlates to a “moderate” or “heavy” precipitation intensity.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
9 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table 48 provides allowance times for Type IV EG fluids in ice pellets and small hail).
10 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 31.

TABLE 23: TYPE IV HOLDOVER TIMES FOR ALLCLEAR CLEARWING ECO

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Very Light Snow, Snow Grains or Snow Pellets[4,5,6]	Light Snow, Snow Grains or Snow Pellets[4,5,6]	Moderate Snow, Snow Grains or Snow Pellets[4,6]	Freezing Drizzle[7]	Light Freezing Rain	Rain on Cold-Soaked Wing[8]	Other[9]
-3 °C and above (27 °F and above)	100/0	2:00 - 4:00	3:00 - 3:00	1:45 - 3:00	0:50 - 1:45	1:50 - 2:00	1:20 - 1:40	0:20 - 2:00	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist	
below -3 to -8 °C (below 27 to 18 °F)	100/0	1:00 - 2:30	2:40 - 3:00	1:20 - 2:40	0:40 - 1:20	0:55 - 2:00	0:45 - 1:15		
	75/25	N/A	N/A	N/A	N/A	N/A	N/A		
below -8 to -14 °C (below 18 to 7 °F)	100/0	1:00 - 2:30	2:10 - 2:40	1:05 - 2:10	0:30 - 1:05	0:55 - 2:00[10]	0:45 - 1:15[10]		
	75/25	N/A	N/A	N/A	N/A	N/A	N/A		
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:25 - 0:45	1:05 - 1:20	0:35 - 1:05	0:15 - 0:35				
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:25 - 0:45	0:30 - 0:35	0:15 - 0:30	0:07 - 0:15				
below -25 to -26 °C (below -13 to -15 °F)	100/0	0:25 - 0:45	0:25 - 0:35	0:15 - 0:25	0:07 - 0:15				

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR however it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or mist.
4 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required.
5 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain or drizzle. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required to confirm the precipitation intensity is no greater than “light”. No holdover times exist if the reported visibility correlates to a “moderate” or “heavy” precipitation intensity.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
9 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table 49 provides allowance times for Type IV PG fluids in ice pellets and small hail).
10 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 31.

TABLE 24: TYPE IV HOLDOVER TIMES FOR ALLCLEAR CLEARWING EG

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Very Light Snow, Snow Grains or Snow Pellets[4,5,6]	Light Snow, Snow Grains or Snow Pellets[4,5,6]	Moderate Snow, Snow Grains or Snow Pellets[4,6]	Freezing Drizzle[7]	Light Freezing Rain	Rain on Cold-Soaked Wing[8]	Other[9]
-3 °C and above (27 °F and above)	100/0	1:50 - 3:15	2:40 - 3:00	1:20 - 2:40	0:40 - 1:20	1:10 - 1:35	0:30 - 1:00	0:10 - 1:30	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist	
below -3 to -8 °C (below 27 to 18 °F)	100/0	1:35 - 3:45	2:25 - 3:00	1:10 - 2:25	0:35 - 1:10	1:05 - 1:30	0:30 - 1:00		
	75/25	N/A	N/A	N/A	N/A	N/A	N/A		
below -8 to -14 °C (below 18 to 7 °F)	100/0	1:35 - 3:45	2:15 - 2:45	1:05 - 2:15	0:30 - 1:05	1:05 - 1:30[10]	0:30 - 1:00[10]		
	75/25	N/A	N/A	N/A	N/A	N/A	N/A		
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:55 - 2:00	1:35 - 2:05	0:45 - 1:35	0:20 - 0:45				
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:55 - 2:00	0:55 - 1:10	0:25 - 0:55	0:15 - 0:25				
below -25 to -29 °C (below -13 to -20 °F)	100/0	0:55 - 2:00	0:45 - 0:55	0:20 - 0:45	0:10 - 0:20				

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR however it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or mist.
4 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required.
5 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain or drizzle. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required to confirm the precipitation intensity is no greater than “light”. No holdover times exist if the reported visibility correlates to a “moderate” or “heavy” precipitation intensity.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
9 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table 48 provides allowance times for Type IV EG fluids in ice pellets and small hail).
10 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 31.

TABLE 25: TYPE IV HOLDOVER TIMES FOR ASGLOBAL 4FLITE EG

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Very Light Snow, Snow Grains or Snow Pellets[4,5,6]	Light Snow, Snow Grains or Snow Pellets[4,5,6]	Moderate Snow, Snow Grains or Snow Pellets[4,6]	Freezing Drizzle[7]	Light Freezing Rain	Rain on Cold-Soaked Wing[8]	Other[9]
-3 °C and above (27 °F and above)	100/0	1:35 - 3:15	2:05 - 2:35	1:00 - 2:05	0:30 - 1:00	0:40 - 1:10	0:20 - 0:35	0:08 - 1:05	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist	
below -3 to -8 °C (below 27 to 18 °F)	100/0	1:25 - 2:45	1:50 - 2:15	0:55 - 1:50	0:25 - 0:55	0:40 - 1:10	0:20 - 0:35		
	75/25	N/A	N/A	N/A	N/A	N/A	N/A		
below -8 to -14 °C (below 18 to 7 °F)	100/0	1:25 - 2:45	1:35 - 2:00	0:50 - 1:35	0:25 - 0:50	0:40 - 1:10[10]	0:20 - 0:35[10]		
	75/25	N/A	N/A	N/A	N/A	N/A	N/A		
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:50 - 1:25	1:35 - 2:00	0:45 - 1:35	0:20 - 0:45				
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:50 - 1:25	1:20 - 1:40	0:35 - 1:20	0:20 - 0:35				
below -25 to -30 °C (below -13 to -22 °F)	100/0	0:30 - 1:05	0:55 - 1:05	0:25 - 0:55	0:10 - 0:25				

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR however it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or mist.
4 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required.
5 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain or drizzle. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required to confirm the precipitation intensity is no greater than “light”. No holdover times exist if the reported visibility correlates to a “moderate” or “heavy” precipitation intensity.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
9 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table 48 provides allowance times for Type IV EG fluids in ice pellets and small hail).
10 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 31.

TABLE 26: TYPE IV HOLDOVER TIMES FOR ASGLOBAL 4FLITE PG

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Very Light Snow, Snow Grains or Snow Pellets[4,5,6]	Light Snow, Snow Grains or Snow Pellets[4,5,6]	Moderate Snow, Snow Grains or Snow Pellets[4,6]	Freezing Drizzle[7]	Light Freezing Rain	Rain on Cold-Soaked Wing[8]	Other[9]
-3 °C and above (27 °F and above)	100/0	1:50 - 3:15	2:50 - 3:00	1:35 - 2:50	0:50 - 1:35	1:10 - 1:35	0:45 - 1:05	0:15 - 1:20	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist	
below -3 to -8 °C (below 27 to 18 °F)	100/0	1:05 - 1:55	2:05 - 2:30	1:10 - 2:05	0:35 - 1:10	0:55 - 1:10	0:35 - 0:55		
	75/25	N/A	N/A	N/A	N/A	N/A	N/A		
below -8 to -14 °C (below 18 to 7 °F)	100/0	1:05 - 1:55	1:40 - 2:00	0:55 - 1:40	0:30 - 0:55	0:55 - 1:10[10]	0:35 - 0:55[10]		
	75/25	N/A	N/A	N/A	N/A	N/A	N/A		
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:30 - 0:45	1:05 - 1:20	0:35 - 1:05	0:15 - 0:35				
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:30 - 0:45	0:35 - 0:45	0:20 - 0:35	0:09 - 0:20				
below -25 to -26 °C (below -13 to -15 °F)	100/0	0:30 - 0:45	0:35 - 0:45	0:20 - 0:35	0:08 - 0:20				

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR however it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or mist.
4 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required.
5 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain or drizzle. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required to confirm the precipitation intensity is no greater than “light”. No holdover times exist if the reported visibility correlates to a “moderate” or “heavy” precipitation intensity.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
9 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table 49 provides allowance times for Type IV PG fluids in ice pellets and small hail).
10 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 31.

TABLE 27: TYPE IV HOLDOVER TIMES FOR AVIAFLUID AVIAFLIGHT EG

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Very Light Snow, Snow Grains or Snow Pellets[4,5,6]	Light Snow, Snow Grains or Snow Pellets[4,5,6]	Moderate Snow, Snow Grains or Snow Pellets[4,6]	Freezing Drizzle[7]	Light Freezing Rain	Rain on Cold-Soaked Wing[8]	Other[9]
-3 °C and above (27 °F and above)	100/0	1:30 - 3:05	1:55 - 2:20	1:10 - 1:55	0:40 - 1:10	1:05 - 2:00	0:30 - 0:50	0:10 - 2:00	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist	
below -3 to -8 °C (below 27 to 18 °F)	100/0	1:20 - 3:00	1:45 - 2:05	1:00 - 1:45	0:35 - 1:00	0:55 - 1:30	0:35 - 0:50		
	75/25	N/A	N/A	N/A	N/A	N/A	N/A		
below -8 to -14 °C (below 18 to 7 °F)	100/0	1:20 - 3:00	1:35 - 1:55	0:55 - 1:35	0:30 - 0:55	0:55 - 1:30[10]	0:35 - 0:50[10]		
	75/25	N/A	N/A	N/A	N/A	N/A	N/A		
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:35 - 1:45	1:40 - 2:00	0:50 - 1:40	0:25 - 0:50				
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:35 - 1:45	1:20 - 1:35	0:40 - 1:20	0:20 - 0:40				
below -25 to -31 °C (below -13 to -24 °F)	100/0	0:35 - 1:05	0:35 - 0:45	0:20 - 0:35	0:09 - 0:20				

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR however it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or mist.
4 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required.
5 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain or drizzle. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required to confirm the precipitation intensity is no greater than “light”. No holdover times exist if the reported visibility correlates to a “moderate” or “heavy” precipitation intensity.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
9 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table 48 provides allowance times for Type IV EG fluids in ice pellets and small hail).
10 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 31.

TABLE 28: TYPE IV HOLDOVER TIMES FOR AVIAFLUID AVIAFLIGHT PG

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Very Light Snow, Snow Grains or Snow Pellets[4,5,6]	Light Snow, Snow Grains or Snow Pellets[4,5,6]	Moderate Snow, Snow Grains or Snow Pellets[4,6]	Freezing Drizzle[7]	Light Freezing Rain	Rain on Cold-Soaked Wing[8]	Other[9]
-3 °C and above (27 °F and above)	100/0	2:15 - 4:00	3:00 - 3:00	1:40 - 3:00	0:55 - 1:40	2:00 - 2:00	1:10 - 1:55	0:20 - 2:00	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist	
below -3 to -8 °C (below 27 to 18 °F)	100/0	1:05 - 2:10	2:00 - 2:25	1:05 - 2:00	0:35 - 1:05	0:35 - 1:55	0:45 - 1:05		
	75/25	N/A	N/A	N/A	N/A	N/A	N/A		
below -8 to -14 °C (below 18 to 7 °F)	100/0	1:05 - 2:10	1:30 - 1:50	0:50 - 1:30	0:25 - 0:50	0:35 - 1:55[10]	0:45 - 1:05[10]		
	75/25	N/A	N/A	N/A	N/A	N/A	N/A		
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:20 - 0:35	0:50 - 1:00	0:25 - 0:50	0:15 - 0:25				
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:20 - 0:35	0:25 - 0:30	0:15 - 0:25	0:06 - 0:15				
below -25 to -25.5 °C (below -13 to -14 °F)	100/0	0:20 - 0:35	0:25 - 0:30	0:10 - 0:25	0:06 - 0:10				

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR however it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or mist.
4 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required.
5 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain or drizzle. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required to confirm the precipitation intensity is no greater than “light”. No holdover times exist if the reported visibility correlates to a “moderate” or “heavy” precipitation intensity.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
9 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table 49 provides allowance times for Type IV PG fluids in ice pellets and small hail).
10 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 31.

TABLE 29: TYPE IV HOLDOVER TIMES FOR CHEMCO CHEMR EG IV

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Very Light Snow, Snow Grains or Snow Pellets[4,5,6]	Light Snow, Snow Grains or Snow Pellets[4,5,6]	Moderate Snow, Snow Grains or Snow Pellets[4,6]	Freezing Drizzle[7]	Light Freezing Rain	Rain on Cold-Soaked Wing[8]	Other[9]
-3 °C and above (27 °F and above)	100/0	2:05 - 3:35	3:00 - 3:00	1:15 - 3:00	0:35 - 1:15	0:45 - 1:40	0:25 - 0:40	0:09 - 1:45	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist	
below -3 to -8 °C (below 27 to 18 °F)	100/0	1:25 - 3:40	3:00 - 3:00	1:15 - 3:00	0:35 - 1:15	1:00 - 1:35	0:35 - 0:50		
	75/25	N/A	N/A	N/A	N/A	N/A	N/A		
below -8 to -14 °C (below 18 to 7 °F)	100/0	1:25 - 3:40	3:00 - 3:00	1:15 - 3:00	0:35 - 1:15	1:00 - 1:35[10]	0:35 - 0:50[10]		
	75/25	N/A	N/A	N/A	N/A	N/A	N/A		
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:40 - 1:25	1:25 - 1:45	0:40 - 1:25	0:20 - 0:40				
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:40 - 1:25	1:25 - 1:45	0:40 - 1:25	0:20 - 0:40				
below -25 to -27 °C (below -13 to -17 °F)	100/0	0:40 - 1:25	1:25 - 1:45	0:40 - 1:25	0:20 - 0:40				

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR however it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or mist.
4 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required.
5 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain or drizzle. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required to confirm the precipitation intensity is no greater than “light”. No holdover times exist if the reported visibility correlates to a “moderate” or “heavy” precipitation intensity.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
9 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table 48 provides allowance times for Type IV EG fluids in ice pellets and small hail).
10 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 31.

TABLE 30: TYPE IV HOLDOVER TIMES FOR CHEMCO CHEMR NORDIK IV

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Very Light Snow, Snow Grains or Snow Pellets[4,5,6]	Light Snow, Snow Grains or Snow Pellets[4,5,6]	Moderate Snow, Snow Grains or Snow Pellets[4,6]	Freezing Drizzle[7]	Light Freezing Rain	Rain on Cold-Soaked Wing[8]	Other[9]
-3 °C and above (27 °F and above)	100/0	2:15 - 4:00	3:00 - 3:00	1:45 - 3:00	0:55 - 1:45	1:20 - 2:00	0:55 - 1:20	0:25 - 2:00	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist	
below -3 to -8 °C (below 27 to 18 °F)	100/0	1:50 - 4:00	3:00 - 3:00	1:45 - 3:00	0:55 - 1:45	1:15 - 2:00	0:45 - 1:20		
	75/25	N/A	N/A	N/A	N/A	N/A	N/A		
below -8 to -14 °C (below 18 to 7 °F)	100/0	1:50 - 4:00	3:00 - 3:00	1:45 - 3:00	0:55 - 1:45	1:15 - 2:00[10]	0:45 - 1:20[10]		
	75/25	N/A	N/A	N/A	N/A	N/A	N/A		
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:40 - 1:30	3:00 - 3:00	1:35 - 3:00	0:50 - 1:35				
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:40 - 1:30	2:10 - 2:40	1:05 - 2:10	0:35 - 1:05				
below -25 to -29 °C (below -13 to -20 °F)	100/0	0:40 - 1:30	1:50 - 2:15	0:55 - 1:50	0:30 - 0:55				

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR however it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or mist.
4 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required.
5 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain or drizzle. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required to confirm the precipitation intensity is no greater than “light”. No holdover times exist if the reported visibility correlates to a “moderate” or “heavy” precipitation intensity.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
9 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table 48 provides allowance times for Type IV EG fluids in ice pellets and small hail).
10 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 31.

TABLE 31: TYPE IV HOLDOVER TIMES FOR CLARIANT MAX FLIGHT AVIA

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Very Light Snow, Snow Grains or Snow Pellets[4,5,6]	Light Snow, Snow Grains or Snow Pellets[4,5,6]	Moderate Snow, Snow Grains or Snow Pellets[4,6]	Freezing Drizzle[7]	Light Freezing Rain	Rain on Cold-Soaked Wing[8]	Other[9]
-3 °C and above (27 °F and above)	100/0	3:05 - 4:00	3:00 - 3:00	1:45 - 3:00	1:00 - 1:45	1:25 - 2:00	0:55 - 1:10	0:09 - 2:00	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist	
below -3 to -8 °C (below 27 to 18 °F)	100/0	1:45 - 3:55	2:30 - 3:00	1:25 - 2:30	0:50 - 1:25	1:10 - 2:00	0:55 - 1:30		
	75/25	N/A	N/A	N/A	N/A	N/A	N/A		
below -8 to -14 °C (below 18 to 7 °F)	100/0	1:45 - 3:55	2:10 - 2:35	1:15 - 2:10	0:40 - 1:15	1:10 - 2:00[10]	0:55 - 1:30[10]		
	75/25	N/A	N/A	N/A	N/A	N/A	N/A		
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:35 - 1:25	0:50 - 1:05	0:25 - 0:50	0:10 - 0:25				
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:35 - 1:25	0:40 - 0:55	0:15 - 0:40	0:05 - 0:15				
below -25 to -28.5 °C (below -13 to -19 °F)	100/0	0:35 - 1:25	0:25 - 0:35	0:08 - 0:25	0:02 - 0:08				

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR however it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or mist.
4 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required.
5 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain or drizzle. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required to confirm the precipitation intensity is no greater than “light”. No holdover times exist if the reported visibility correlates to a “moderate” or “heavy” precipitation intensity.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
9 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table 48 provides allowance times for Type IV EG fluids in ice pellets and small hail).
10 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 31.

M. FAA Table 32: Type IV Holdover Times for Clariant Max Flight SNEG

TABLE 32: TYPE IV HOLDOVER TIMES FOR CLARIANT MAX FLIGHT SNEG

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Very Light Snow, Snow Grains or Snow Pellets[4,5,6]	Light Snow, Snow Grains or Snow Pellets[4,5,6]	Moderate Snow, Snow Grains or Snow Pellets[4,6]	Freezing Drizzle[7]	Light Freezing Rain	Rain on Cold-Soaked Wing[8]	Other[9]
-3 °C and above (27 °F and above)	100/0	2:25 - 4:00	3:00 - 3:00	1:40 - 3:00	0:55 - 1:40	2:00 - 2:00	0:50 - 1:40	0:20 - 1:30	
	75/25	4:00 - 4:00	2:25 - 2:50	1:30 - 2:25	0:55 - 1:30	1:30 - 2:00	1:05 - 1:20	0:15 - 1:45	
	50/50	1:30 - 3:30	1:45 - 2:20	0:45 - 1:45	0:20 - 0:45	0:35 - 1:10	0:15 - 0:30	CAUTION: No holdover time guidelines exist	
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:45 - 2:20	2:25 - 2:55	1:20 - 2:25	0:45 - 1:20	0:30 - 1:25	0:25 - 0:40		
	75/25	0:30 - 1:25	1:55 - 2:15	1:10 - 1:55	0:45 - 1:10	0:20 - 1:05	0:20 - 0:40		
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:45 - 2:20	2:05 - 2:30	1:10 - 2:05	0:40 - 1:10	0:30 - 1:25[10]	0:25 - 0:40[10]		
	75/25	0:30 - 1:25	1:40 - 2:00	1:00 - 1:40	0:40 - 1:00	0:20 - 1:05[10]	0:20 - 0:40[10]		
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:20 - 0:50	0:30 - 0:45	0:09 - 0:30	0:02 - 0:09				
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:20 - 0:50	0:10 - 0:20	0:03 - 0:10	0:01 - 0:03				
below -25 to -29 °C (below -13 to -20 °F)	100/0	0:20 - 0:50	0:07 - 0:10	0:02 - 0:07	0:00 - 0:02				

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR however it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or mist.
4 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required.
5 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain or drizzle. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required to confirm the precipitation intensity is no greater than “light”. No holdover times exist if the reported visibility correlates to a “moderate” or “heavy” precipitation intensity.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
9 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table 49 provides allowance times for Type IV PG fluids in ice pellets and small hail).
10 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 31.

TABLE 33: TYPE IV HOLDOVER TIMES FOR CLARIANT SAFEWING EG IV NORTH

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Very Light Snow, Snow Grains or Snow Pellets[4,5,6]	Light Snow, Snow Grains or Snow Pellets[4,5,6]	Moderate Snow, Snow Grains or Snow Pellets[4,6]	Freezing Drizzle[7]	Light Freezing Rain	Rain on Cold-Soaked Wing[8]	Other[9]
-3 °C and above (27 °F and above)	100/0	2:20 - 3:55	3:00 - 3:00	1:40 - 3:00	0:50 - 1:40	1:30 - 2:00	0:50 - 0:55	0:08 - 2:00	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist	
below -3 to -8 °C (below 27 to 18 °F)	100/0	1:45 - 4:00	2:50 - 3:00	1:30 - 2:50	0:50 - 1:30	1:05 - 1:50	0:55 - 1:25		
	75/25	N/A	N/A	N/A	N/A	N/A	N/A		
below -8 to -14 °C (below 18 to 7 °F)	100/0	1:45 - 4:00	2:45 - 3:00	1:30 - 2:45	0:50 - 1:30	1:05 - 1:50[10]	0:55 - 1:25[10]		
	75/25	N/A	N/A	N/A	N/A	N/A	N/A		
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:40 - 1:20	0:50 - 1:05	0:25 - 0:50	0:10 - 0:25				
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:40 - 1:20	0:40 - 0:55	0:15 - 0:40	0:05 - 0:15				
below -25 to -30 °C (below -13 to -22 °F)	100/0	0:40 - 1:20	0:25 - 0:35	0:08 - 0:25	0:02 - 0:08				

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR however it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or mist.
4 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required.
5 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain or drizzle. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required to confirm the precipitation intensity is no greater than “light”. No holdover times exist if the reported visibility correlates to a “moderate” or “heavy” precipitation intensity.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
9 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table 48 provides allowance times for Type IV EG fluids in ice pellets and small hail).
10 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 31.

TABLE 34: TYPE IV HOLDOVER TIMES FOR CLARIANT SAFEWING MP IV LAUNCH

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Very Light Snow, Snow Grains or Snow Pellets[4,5,6]	Light Snow, Snow Grains or Snow Pellets[4,5,6]	Moderate Snow, Snow Grains or Snow Pellets[4,6]	Freezing Drizzle[7]	Light Freezing Rain	Rain on Cold-Soaked Wing[8]	Other[9]
-3 °C and above (27 °F and above)	100/0	4:00 - 4:00	2:50 - 3:00	1:45 - 2:50	1:05 - 1:45	1:30 - 2:00	1:00 - 1:40	0:15 - 1:40	
	75/25	3:40 - 4:00	3:00 - 3:00	1:45 - 3:00	1:00 - 1:45	1:40 - 2:00	0:45 - 1:15	0:10 - 1:45	
	50/50	1:25 - 2:45	1:25 - 1:40	0:45 - 1:25	0:25 - 0:45	0:30 - 0:50	0:20 - 0:25	CAUTION: No holdover time guidelines exist	
below -3 to -8 °C (below 27 to 18 °F)	100/0	1:00 - 1:55	2:25 - 2:50	1:30 - 2:25	0:55 - 1:30	0:35 - 1:40	0:25 - 0:45		
	75/25	0:40 - 1:20	2:40 - 3:00	1:30 - 2:40	0:50 - 1:30	0:25 - 1:10	0:25 - 0:45		
below -8 to -14 °C (below 18 to 7 °F)	100/0	1:00 - 1:55	2:10 - 2:30	1:20 - 2:10	0:50 - 1:20	0:35 - 1:40[10]	0:25 - 0:45[10]		
	75/25	0:40 - 1:20	2:25 - 2:55	1:25 - 2:25	0:45 - 1:25	0:25 - 1:10[10]	0:25 - 0:45[10]		
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:30 - 0:50	1:15 - 1:45	0:20 - 1:15	0:06 - 0:20				
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:30 - 0:50	0:30 - 0:45	0:09 - 0:30	0:02 - 0:09				
below -25 to -28.5 °C (below -13 to -19 °F)	100/0	0:30 - 0:50	0:20 - 0:30	0:06 - 0:20	0:01 - 0:06				

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR however it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or mist.
4 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required.
5 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain or drizzle. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required to confirm the precipitation intensity is no greater than “light”. No holdover times exist if the reported visibility correlates to a “moderate” or “heavy” precipitation intensity.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
9 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table 49 provides allowance times for Type IV PG fluids in ice pellets and small hail).
10 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 31.

P. FAA Table 35: Type IV Holdover Times for Clariant Safewing MP IV LAUNCH PLUS

TABLE 35: TYPE IV HOLDOVER TIMES FOR CLARIANT SAFEWING MP IV LAUNCH PLUS

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Very Light Snow, Snow Grains or Snow Pellets[4,5,6]	Light Snow, Snow Grains or Snow Pellets[4,5,6]	Moderate Snow, Snow Grains or Snow Pellets[4,6]	Freezing Drizzle[7]	Light Freezing Rain	Rain on Cold-Soaked Wing[8]	Other[9]
-3 °C and above (27 °F and above)	100/0	3:55 - 4:00	3:00 - 3:00	2:05 - 3:00	0:55 - 2:05	2:00 - 2:00	1:00 - 2:00	0:20 - 2:00	
	75/25	3:55 - 4:00	3:00 - 3:00	1:55 - 3:00	0:50 - 1:55	2:00 - 2:00	1:20 - 1:25	0:20 - 1:50	
	50/50	1:15 - 1:50	1:35 - 2:00	0:45 - 1:35	0:20 - 0:45	0:25 - 1:00	0:15 - 0:20	CAUTION: No holdover time guidelines exist	
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:55 - 2:15	3:00 - 3:00	1:40 - 3:00	0:45 - 1:40	0:25 - 1:35	0:25 - 0:40		
	75/25	0:40 - 2:00	3:00 - 3:00	1:30 - 3:00	0:35 - 1:30	0:20 - 1:05	0:20 - 0:30		
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:55 - 2:15	3:00 - 3:00	1:25 - 3:00	0:40 - 1:25	0:25 - 1:35[10]	0:25 - 0:40[10]		
	75/25	0:40 - 2:00	2:55 - 3:00	1:15 - 2:55	0:30 - 1:15	0:20 - 1:05[10]	0:20 - 0:30[10]		
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:25 - 0:50	1:15 - 1:50	0:25 - 1:15	0:07 - 0:25				
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:25 - 0:50	0:30 - 0:45	0:09 - 0:30	0:03 - 0:09				
below -25 to -29 °C (below -13 to -20 °F)	100/0	0:25 - 0:50	0:20 - 0:30	0:06 - 0:20	0:02 - 0:06				

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR however it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or mist.
4 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required.
5 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain or drizzle. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required to confirm the precipitation intensity is no greater than “light”. No holdover times exist if the reported visibility correlates to a “moderate” or “heavy” precipitation intensity.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
9 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table 49 provides allowance times for Type IV PG fluids in ice pellets and small hail).
10 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 31.

Q. FAA Table 36: Type IV Holdover Times for Cryotech Polar Guard® Advance

TABLE 36: TYPE IV HOLDOVER TIMES FOR CRYOTECH POLAR GUARD® ADVANCE

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Very Light Snow, Snow Grains or Snow Pellets[4,5,6]	Light Snow, Snow Grains or Snow Pellets[4,5,6]	Moderate Snow, Snow Grains or Snow Pellets[4,6]	Freezing Drizzle[7]	Light Freezing Rain	Rain on Cold-Soaked Wing[8]	Other[9]
-3 °C and above (27 °F and above)	100/0	2:50 - 4:00	3:00 - 3:00	1:55 - 3:00	1:05 - 1:55	1:35 - 2:00	1:15 - 1:30	0:15 - 2:00	
	75/25	2:30 - 4:00	3:00 - 3:00	1:25 - 3:00	0:40 - 1:25	1:40 - 2:00	0:40 - 1:10	0:09 - 1:40	
	50/50	0:50 - 1:25	1:10 - 1:35	0:25 - 1:10	0:10 - 0:25	0:20 - 0:45	0:09 - 0:20	CAUTION: No holdover time guidelines exist	
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:55 - 2:30	2:25 - 2:50	1:25 - 2:25	0:50 - 1:25	0:35 - 1:35	0:35 - 0:45		
	75/25	0:40 - 1:30	2:20 - 3:00	1:05 - 2:20	0:30 - 1:05	0:25 - 1:05	0:35 - 0:45		
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:55 - 2:30	2:00 - 2:20	1:10 - 2:00	0:40 - 1:10	0:35 - 1:35[10]	0:35 - 0:45[10]		
	75/25	0:40 - 1:30	2:00 - 2:30	0:55 - 2:00	0:25 - 0:55	0:25 - 1:05[10]	0:35 - 0:45[10]		
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:25 - 0:50	1:35 - 2:15	0:35 - 1:35	0:10 - 0:35				
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:25 - 0:50	0:40 - 0:55	0:15 - 0:40	0:04 - 0:15				
below -25 to -30.5 °C (below -13 to -23 °F)	100/0	0:25 - 0:50	0:25 - 0:30	0:07 - 0:25	0:02 - 0:07				

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR however it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or mist.
4 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required.
5 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain or drizzle. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required to confirm the precipitation intensity is no greater than “light”. No holdover times exist if the reported visibility correlates to a “moderate” or “heavy” precipitation intensity.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
9 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table 49 provides allowance times for Type IV PG fluids in ice pellets and small hail).
10 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 31.

R. FAA Table 37: Type IV Holdover Times for Cryotech Polar Guard® Xtend

TABLE 37: TYPE IV HOLDOVER TIMES FOR CRYOTECH POLAR GUARD® XTEND

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Very Light Snow, Snow Grains or Snow Pellets[4,5,6]	Light Snow, Snow Grains or Snow Pellets[4,5,6]	Moderate Snow, Snow Grains or Snow Pellets[4,6]	Freezing Drizzle[7]	Light Freezing Rain	Rain on Cold-Soaked Wing[8]	Other[9]
-3 °C and above (27 °F and above)	100/0	2:30 - 4:00	3:00 - 3:00	2:00 - 3:00	1:05 - 2:00	2:00 - 2:00	1:00 - 1:50	0:20 - 1:45	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist	
below -3 to -8 °C (below 27 to 18 °F)	100/0	1:00 - 1:50	2:50 - 3:00	1:35 - 2:50	0:50 - 1:35	0:35 - 1:40	0:50 - 0:55		
	75/25	N/A	N/A	N/A	N/A	N/A	N/A		
below -8 to -14 °C (below 18 to 7 °F)	100/0	1:00 - 1:50	2:25 - 2:55	1:20 - 2:25	0:45 - 1:20	0:35 - 1:40[10]	0:50 - 0:55[10]		
	75/25	N/A	N/A	N/A	N/A	N/A	N/A		
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:25 - 0:40	1:20 - 1:40	0:40 - 1:20	0:20 - 0:40				
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:25 - 0:40	0:30 - 0:40	0:15 - 0:30	0:06 - 0:15				
below -25 to -29 °C (below -13 to -20 °F)	100/0	0:25 - 0:40	0:20 - 0:25	0:09 - 0:20	0:04 - 0:09				

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR however it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or mist.
4 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required.
5 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain or drizzle. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required to confirm the precipitation intensity is no greater than “light”. No holdover times exist if the reported visibility correlates to a “moderate” or “heavy” precipitation intensity.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
9 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table 49 provides allowance times for Type IV PG fluids in ice pellets and small hail).
10 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 31.

TABLE 38: TYPE IV HOLDOVER TIMES FOR DOW CHEMICAL UCAR ENDURANCE™ EG106

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Very Light Snow, Snow Grains or Snow Pellets[4,5,6]	Light Snow, Snow Grains or Snow Pellets[4,5,6]	Moderate Snow, Snow Grains or Snow Pellets[4,6]	Freezing Drizzle[7]	Light Freezing Rain	Rain on Cold-Soaked Wing[8]	Other[9]
-3 °C and above (27 °F and above)	100/0	2:05 - 3:10	2:45 - 3:00	1:20 - 2:45	0:40 - 1:20	1:10 - 2:00	0:50 - 1:15	0:20 - 2:00	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist	
below -3 to -8 °C (below 27 to 18 °F)	100/0	1:50 - 3:20	2:25 - 3:00	1:10 - 2:25	0:35 - 1:10	0:55 - 1:50	0:45 - 1:10		
	75/25	N/A	N/A	N/A	N/A	N/A	N/A		
below -8 to -14 °C (below 18 to 7 °F)	100/0	1:50 - 3:20	2:10 - 2:45	1:05 - 2:10	0:30 - 1:05	0:55 - 1:50[10]	0:45 - 1:10[10]		
	75/25	N/A	N/A	N/A	N/A	N/A	N/A		
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:30 - 1:05	1:45 - 2:15	0:50 - 1:45	0:25 - 0:50				
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:30 - 1:05	1:30 - 1:55	0:40 - 1:30	0:20 - 0:40				
below -25 to -29 °C (below -13 to -20 °F)	100/0	0:30 - 1:05	1:20 - 1:45	0:40 - 1:20	0:20 - 0:40				

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR however it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or mist.
4 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required.
5 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain or drizzle. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required to confirm the precipitation intensity is no greater than “light”. No holdover times exist if the reported visibility correlates to a “moderate” or “heavy” precipitation intensity.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
9 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table 48 provides allowance times for Type IV EG fluids in ice pellets and small hail).
10 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 31.

TABLE 39: TYPE IV HOLDOVER TIMES FOR DOW CHEMICAL UCAR™ FLIGHTGUARD™ AD-49

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Very Light Snow, Snow Grains or Snow Pellets[4,5,6]	Light Snow, Snow Grains or Snow Pellets[4,5,6]	Moderate Snow, Snow Grains or Snow Pellets[4,6]	Freezing Drizzle[7]	Light Freezing Rain	Rain on Cold-Soaked Wing[8]	Other[9]
-3 °C and above (27 °F and above)	100/0	3:20 - 4:00	3:00 - 3:00	1:55 - 3:00	1:00 - 1:55	1:25 - 2:00	1:00 - 1:25	0:10 - 1:55	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist	
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:20 - 1:35	2:55 - 3:00	1:30 - 2:55	0:45 - 1:30	0:25 - 1:25	0:20 - 0:25		
	75/25	N/A	N/A	N/A	N/A	N/A	N/A		
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:20 - 1:35	2:25 - 3:00	1:15 - 2:25	0:40 - 1:15	0:25 - 1:25[10]	0:20 - 0:25[10]		
	75/25	N/A	N/A	N/A	N/A	N/A	N/A		
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:25 - 0:40	0:30 - 0:45	0:09 - 0:30	0:02 - 0:09				
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:25 - 0:40	0:10 - 0:20	0:03 - 0:10	0:01 - 0:03				
below -25 to -26 °C (below -13 to -15 °F)	100/0	0:25 - 0:40	0:07 - 0:10	0:02 - 0:07	0:00 - 0:02				

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR however it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or mist.
4 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required.
5 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain or drizzle. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required to confirm the precipitation intensity is no greater than “light”. No holdover times exist if the reported visibility correlates to a “moderate” or “heavy” precipitation intensity.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
9 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table 49 provides allowance times for Type IV PG fluids in ice pellets and small hail).
10 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 31.

TABLE 40: TYPE IV HOLDOVER TIMES FOR INLAND TECHNOLOGIES ECO-SHIELD®

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Very Light Snow, Snow Grains or Snow Pellets[4,5,6]	Light Snow, Snow Grains or Snow Pellets[4,5,6]	Moderate Snow, Snow Grains or Snow Pellets[4,6]	Freezing Drizzle[7]	Light Freezing Rain	Rain on Cold-Soaked Wing[8]	Other[9]
-3 °C and above (27 °F and above)	100/0	1:15 - 2:40	2:25 - 2:50	1:20 - 2:25	0:45 - 1:20	0:40 - 1:30	0:35 - 0:40	0:15 - 1:35	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist	
below -3 to -8 °C (below 27 to 18 °F)	100/0	1:10 - 2:35	2:05 - 2:30	1:10 - 2:05	0:40 - 1:10	0:50 - 1:25	0:30 - 0:40		
	75/25	N/A	N/A	N/A	N/A	N/A	N/A		
below -8 to -14 °C (below 18 to 7 °F)	100/0	1:10 - 2:35	1:55 - 2:15	1:05 - 1:55	0:35 - 1:05	0:50 - 1:25[10]	0:30 - 0:40[10]		
	75/25	N/A	N/A	N/A	N/A	N/A	N/A		
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:30 - 1:00	0:30 - 0:45	0:09 - 0:30	0:02 - 0:09				
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:30 - 1:00	0:10 - 0:20	0:03 - 0:10	0:01 - 0:03				
below -25 to -25.5 °C (below -13 to -14 °F)	100/0	0:30 - 1:00	0:07 - 0:10	0:02 - 0:07	0:00 - 0:02				

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR however it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or mist.
4 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required.
5 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain or drizzle. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required to confirm the precipitation intensity is no greater than “light”. No holdover times exist if the reported visibility correlates to a “moderate” or “heavy” precipitation intensity.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
9 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table 49 provides allowance times for Type IV PG fluids in ice pellets and small hail).
10 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 31.

TABLE 41: TYPE IV HOLDOVER TIMES FOR JSC RCP NORDIX DEFROST ECO 4

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Very Light Snow, Snow Grains or Snow Pellets[4,5,6]	Light Snow, Snow Grains or Snow Pellets[4,5,6]	Moderate Snow, Snow Grains or Snow Pellets[4,6]	Freezing Drizzle[7]	Light Freezing Rain	Rain on Cold-Soaked Wing[8]	Other[9]
-3 °C and above (27 °F and above)	100/0	1:30 - 2:40	2:30 - 3:00	1:15 - 2:30	0:35 - 1:15	1:05 - 1:30	0:40 - 1:05	0:15 - 1:10	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist	
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:55 - 2:35	2:15 - 2:45	1:05 - 2:15	0:35 - 1:05	0:50 - 1:20	0:35 - 0:50		
	75/25	N/A	N/A	N/A	N/A	N/A	N/A		
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:55 - 2:35	2:05 - 2:35	1:00 - 2:05	0:30 - 1:00	0:50 - 1:20[10]	0:35 - 0:50[10]		
	75/25	N/A	N/A	N/A	N/A	N/A	N/A		
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:30 - 0:50	0:30 - 0:45	0:09 - 0:30	0:02 - 0:09				
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:30 - 0:50	0:10 - 0:20	0:03 - 0:10	0:01 - 0:03				
below -25 to -25.5 °C (below -13 to -14 °F)	100/0	0:30 - 0:50	0:07 - 0:10	0:02 - 0:07	0:00 - 0:02				

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR however it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or mist.
4 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required.
5 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain or drizzle. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required to confirm the precipitation intensity is no greater than “light”. No holdover times exist if the reported visibility correlates to a “moderate” or “heavy” precipitation intensity.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
9 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table 49 provides allowance times for Type IV PG fluids in ice pellets and small hail).
10 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 31.

W. FAA Table 42: Type IV Holdover Times for JSC RCP Nordix Defrost NORTH 4

TABLE 42: TYPE IV HOLDOVER TIMES FOR JSC RCP NORDIX DEFROST NORTH 4

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Very Light Snow, Snow Grains or Snow Pellets[4,5,6]	Light Snow, Snow Grains or Snow Pellets[4,5,6]	Moderate Snow, Snow Grains or Snow Pellets[4,6]	Freezing Drizzle[7]	Light Freezing Rain	Rain on Cold-Soaked Wing[8]	Other[9]
-3 °C and above (27 °F and above)	100/0	2:10 - 4:00	2:55 - 3:00	1:25 - 2:55	0:40 - 1:25	1:05 - 2:00	0:30 - 0:50	0:09 - 1:55	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist	
below -3 to -8 °C (below 27 to 18 °F)	100/0	2:40 - 4:00	2:55 - 3:00	1:25 - 2:55	0:40 - 1:25	1:05 - 2:00	0:40 - 1:00		
	75/25	N/A	N/A	N/A	N/A	N/A	N/A		
below -8 to -14 °C (below 18 to 7 °F)	100/0	2:40 - 4:00	2:55 - 3:00	1:25 - 2:55	0:40 - 1:25	1:05 - 2:00[10]	0:40 - 1:00[10]		
	75/25	N/A	N/A	N/A	N/A	N/A	N/A		
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:45 - 1:55	0:50 - 1:05	0:25 - 0:50	0:10 - 0:25				
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:45 - 1:55	0:40 - 0:55	0:15 - 0:40	0:05 - 0:15				
below -25 to -26 °C (below -13 to -15 °F)	100/0	0:45 - 1:55	0:25 - 0:35	0:08 - 0:25	0:02 - 0:08				

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR however it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or mist.
4 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required.
5 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain or drizzle. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required to confirm the precipitation intensity is no greater than “light”. No holdover times exist if the reported visibility correlates to a “moderate” or “heavy” precipitation intensity.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
9 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table 48 provides allowance times for Type IV EG fluids in ice pellets and small hail).
10 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 31.

X. FAA Table 43: Type IV Holdover Times for Kilfrost ABC-S Plus

TABLE 43: TYPE IV HOLDOVER TIMES FOR KILFROST ABC-S PLUS

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Very Light Snow, Snow Grains or Snow Pellets[4,5,6]	Light Snow, Snow Grains or Snow Pellets[4,5,6]	Moderate Snow, Snow Grains or Snow Pellets[4,6]	Freezing Drizzle[7]	Light Freezing Rain	Rain on Cold-Soaked Wing[8]	Other[9]
-3 °C and above (27 °F 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 -8 °C (below 27 to 18 °F)	100/0	0:55 - 3:30	3:00 - 3:00	1:50 - 3:00	1:05 - 1:50	0:25 - 1:35	0:20 - 0:30		
	75/25	0:45 - 1:50	1:50 - 2:10	1:05 - 1:50	0:40 - 1:05	0:20 - 1:10	0:15 - 0:25		
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:55 - 3:30	2:55 - 3:00	1:45 - 2:55	1:00 - 1:45	0:25 - 1:35[10]	0:20 - 0:30[10]		
	75/25	0:45 - 1:50	1:45 - 2:00	1:00 - 1:45	0:35 - 1:00	0:20 - 1:10[10]	0:15 - 0:25[10]		
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:40 - 1:00	0:30 - 0:45	0:09 - 0:30	0:02 - 0:09				
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:40 - 1:00	0:10 - 0:20	0:03 - 0:10	0:01 - 0:03				
below -25 to -28 °C (below -13 to -18 °F)	100/0	0:40 - 1:00	0:07 - 0:10	0:02 - 0:07	0:00 - 0:02				

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR however it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or mist.
4 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required.
5 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain or drizzle. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required to confirm the precipitation intensity is no greater than “light”. No holdover times exist if the reported visibility correlates to a “moderate” or “heavy” precipitation intensity.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
9 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table 49 provides allowance times for Type IV PG fluids in ice pellets and small hail).
10 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 31.

TABLE 44: TYPE IV HOLDOVER TIMES FOR NEWAVE AEROCHEMICAL FCY 9311

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Very Light Snow, Snow Grains or Snow Pellets[4,5,6]	Light Snow, Snow Grains or Snow Pellets[4,5,6]	Moderate Snow, Snow Grains or Snow Pellets[4,6]	Freezing Drizzle[7]	Light Freezing Rain	Rain on Cold-Soaked Wing[8]	Other[9]
-3 °C and above (27 °F and above)	100/0	1:55 - 4:00	2:20 - 2:55	1:10 - 2:20	0:35 - 1:10	1:10 - 2:00	0:40 - 1:05	0:15 - 1:25	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist	
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:35 - 2:05	1:50 - 2:20	0:55 - 1:50	0:30 - 0:55	0:35 - 1:20	0:20 - 0:35		
	75/25	N/A	N/A	N/A	N/A	N/A	N/A		
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:35 - 2:05	1:35 - 2:00	0:50 - 1:35	0:25 - 0:50	0:35 - 1:20[10]	0:20 - 0:35[10]		
	75/25	N/A	N/A	N/A	N/A	N/A	N/A		
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:30 - 0:55	1:00 - 1:15	0:30 - 1:00	0:15 - 0:30				
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:30 - 0:55	0:35 - 0:40	0:15 - 0:35	0:07 - 0:15				
below -25 to -29.5 °C (below -13 to -21 °F)	100/0	0:30 - 0:55	0:30 - 0:40	0:15 - 0:30	0:06 - 0:15				

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR however it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or mist.
4 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required.
5 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain or drizzle. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required to confirm the precipitation intensity is no greater than “light”. No holdover times exist if the reported visibility correlates to a “moderate” or “heavy” precipitation intensity.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
9 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table 49 provides allowance times for Type IV PG fluids in ice pellets and small hail).
10 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 31.

TABLE 45: TYPE IV HOLDOVER TIMES FOR NEWAVE AEROCHEMICAL FCY-EGIV

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Very Light Snow, Snow Grains or Snow Pellets[4,5,6]	Light Snow, Snow Grains or Snow Pellets[4,5,6]	Moderate Snow, Snow Grains or Snow Pellets[4,6]	Freezing Drizzle[7]	Light Freezing Rain	Rain on Cold-Soaked Wing[8]	Other[9]
-3 °C and above (27 °F and above)	100/0	2:35 - 4:00	2:35 - 3:00	1:10 - 2:35	0:35 - 1:10	1:20 - 2:00	0:40 - 1:05	0:15 - 2:00	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist	
below -3 to -8 °C (below 27 to 18 °F)	100/0	1:25 - 3:25	2:10 - 2:45	1:00 - 2:10	0:25 - 1:00	0:50 - 2:00	0:45 - 1:05		
	75/25	N/A	N/A	N/A	N/A	N/A	N/A		
below -8 to -14 °C (below 18 to 7 °F)	100/0	1:25 - 3:25	1:55 - 2:25	0:50 - 1:55	0:25 - 0:50	0:50 - 2:00[10]	0:45 - 1:05[10]		
	75/25	N/A	N/A	N/A	N/A	N/A	N/A		
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:35 - 1:55	1:35 - 2:05	0:40 - 1:35	0:15 - 0:40				
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:35 - 1:55	1:10 - 1:35	0:30 - 1:10	0:15 - 0:30				
below -25 to -29 °C (below -13 to -20 °F)	100/0	0:35 - 1:55	1:00 - 1:20	0:25 - 1:00	0:10 - 0:25				

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR however it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or mist.
4 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required.
5 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain or drizzle. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required to confirm the precipitation intensity is no greater than “light”. No holdover times exist if the reported visibility correlates to a “moderate” or “heavy” precipitation intensity.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
9 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table 48 provides allowance times for Type IV EG fluids in ice pellets and small hail).
10 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 31.

F.17.5 HOT Guidelines for Mixed Snow and Freezing Fog (FAA Table 46)

CAUTION

- *The responsibility for the application of these data remains with the user.*
- *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 outside air temperature.*
- *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 pre-takeoff check procedures.*

A. FAA Table 46: Holdover Times for Snow Mixed with Freezing Fog for SAE Type I, Type II, Type III, and Type IV Fluids

TABLE 46: HOLDOVER TIMES FOR SNOW MIXED WITH FREEZING FOG FOR SAE TYPE I, TYPE II, TYPE III, AND TYPE IV FLUIDS[1,2]

Outside Air Temperature	Type I[3] Aluminum	Type I[3] Composite	Type III[4]
below 0 °C to -3 °C (below 32 °F to 27 °F)	0:03 - 0:06	0:02 - 0:03	0:09 - 0:20
below -3 to -6 °C (below 27 to 21 °F)	0:03 - 0:04	0:01 - 0:03	0:09 - 0:20
below -6 to -10 °C (below 21 to 14 °F)	0:02 - 0:03	0:01 - 0:03	0:09 - 0:20
below -10 to -25 °C[6] (below 14 to -13 °F[6])	0:01 - 0:02	0:01 - 0:02	0:09 - 0:20[5]
below -25 °C to LOUT[6] (below -13 °F to LOUT[6])	0:01 - 0:02	0:01 - 0:02	0:05 - 0:10[5]

Outside Air Temperature	Concentration Fluid/Water By % Volume	Type II	Type IV
below 0 °C to -3 °C (below 32 °F to 27 °F)	100/0	0:15 - 0:28	0:15 - 0:30
	75/25	0:08 - 0:15	0:20 - 0:38
	50/50	0:04 - 0:08	0:05 - 0:13
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:10 - 0:20	0:13 - 0:28
	75/25	0:05 - 0:13	0:15 - 0:33
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:08 - 0:15	0:13 - 0:25
	75/25	0:05 - 0:10	0:13 - 0:28
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:01 - 0:04	0:01 - 0:05
below -18 to -25 °C[6] (below 0 to -13 °F[6])	100/0	0:01 - 0:02	0:01 - 0:02
below -25 °C to LOUT[6] (below -13 °F to LOUT[6])	100/0	0:00 - 0:01	0:00 - 0:01

NOTES

1 To use the HOTs in this table, ensure that the fluid and dilution being used is listed in the List of Qualified Fluids Tested for Anti-Icing Performance and Aerodynamic Acceptance table (Table 51-Table 54). Any restrictions on the use of the fluid have to be identified and applied.
2 These holdover times are for use in -SN FZFG and SN FZFG. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required to confirm the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
3 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.
4 To use the Type III fluid holdover times, the fluid brand being used must be known. AllClear AeroClear MAX must be applied unheated.
5 No holdover time guidelines exist below -16°C (3°F) for low speed aircraft and below -20.5 °C (-5 °F) middle speed aircraft. If uncertain whether the aircraft conforms to the low, middle, or high speed aerodynamic test criterion, no holdover time guidelines exist below -16°C (3°F).
6 Ensure that the lowest operational use temperature (LOUT) is respected. If the LOUT is unknown, no holdover time guidelines exist below -25 °C (-13 °F) for Type II fluids and below -25.5 °C (-14 °F) for Type IV fluids.

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 58.

F.17.6 Allowance Times Tables (FAA Tables 47 – 49)

CAUTION

- *The responsibility for the application of these data remains with the user.*
- *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 pre-takeoff check procedures.*
- *Allowance time cannot be extended by an inspection of the aircraft critical surfaces.*

A. FAA Table 47: Allowance Times for SAE Type III Fluids

FAA Holdover Time Guidelines **Winter 2023-2024**

TABLE 47: ALLOWANCE TIMES FOR SAE TYPE III FLUIDS[1,2]

Precipitation Types or Combinations	Applicable METAR Codes	Outside Air Temperature		
		-5 °C and above (23 °F and above)	Below -5 to -10 °C (Below 23 to 14 °F)	Below -10 °C[3] (Below 14 °F)
Light Ice Pellets	**-PL**	10 minutes	10 minutes	**Caution: No allowance times currently exist**
Light Ice Pellets Mixed with Light Snow	**-PL SN, -SN PL**	10 minutes	10 minutes	
Light Ice Pellets Mixed with Light Freezing Drizzle or Moderate Freezing Drizzle	**-PL FZDZ, -FZDZ PL, FZDZ PL**	7 minutes	5 minutes	
Light Ice Pellets Mixed with Light Drizzle or Moderate Drizzle	**-PL DZ, -DZ PL, DZ PL**	7 minutes[4]		
Light Ice Pellets Mixed with Light Freezing Rain	**-PL FZRA, -FZRA PL**	7 minutes	5 minutes	
Light Ice Pellets Mixed with Light Rain	**-PL RA, -RA PL**	7 minutes[5]		
Moderate Ice Pellets (or Small Hail[6])	**PL, GS**	5 minutes	5 minutes	

NOTES

1 These allowance times are for use with undiluted (100/0) fluids applied unheated on aircraft with rotation speeds of 100 knots or greater.
2 Takeoff is allowed up to 90 minutes after start of fluid application if the precipitation stops at or before the allowance time expires and does not restart. The OAT must not decrease during the 90 minutes to use this guidance in conditions of light ice pellets mixed with either: light freezing drizzle, moderate freezing drizzle, light freezing rain, or light rain.
3 Ensure that the lowest operational use temperature (LOUT) is respected.
4 No allowance times exist in this condition for temperatures of 0 °C and below; consider use of light ice pellets mixed with light freezing drizzle or moderate freezing drizzle.
5 No allowance times exist in this condition for temperatures of 0 °C and below; consider use of light ice pellets mixed with light freezing rain.
6 In the US, small hail is reported by METAR as GR and the remarks section is used to indicate “GR LESS THAN ¼”. Outside of the US the METAR code GS is used to indicate small hail when it is less than 5 mm and GR to indicate hail when it is 5mm or greater. If METAR does not report an intensity for small hail, use the “moderate ice pellets or small hail” allowance times. If METAR reports an intensity with small hail, the ice pellet condition with the equivalent intensity can be used, e.g. if light small hail is reported, the “light ice pellets” allowance times can be used. This also applies in mixed conditions, e.g. if light small hail mixed with light snow is reported, use the “light ice pellets mixed with light snow” allowance times.

CAUTIONS

- The cautions that apply to the allowance times in the table above can be found on page 60.

B. FAA Table 48: Allowance Times for SAE Type IV Ethylene Glycol (EG) Fluids

FAA Holdover Time Guidelines **Winter 2023-2024**

TABLE 48: ALLOWANCE TIMES FOR SAE TYPE IV ETHYLENE GLYCOL (EG) FLUIDS[1,2]

Precipitation Types or Combinations	Applicable METAR Codes	Outside Air Temperature			
		-5 °C and above[3] (23 °F and above)	Below -5 to -10 °C[3] (Below 23 to 14 °F)	Below -10 to -16 °C[3] (Below 14 to 3 °F)	Below -16 to -22 °C[3,4] (Below 3 to -8 °F)
Light Ice Pellets	**-PL**	70 minutes	50 minutes	50 minutes	30 minutes
Light Ice Pellets Mixed with Light Snow	**-PL SN, -SN PL**	50 minutes	30 minutes	25 minutes	**Caution: No allowance times currently exist**
Light Ice Pellets Mixed with Light Freezing Drizzle or Moderate Freezing Drizzle	**-PL FZDZ, -FZDZ PL, FZDZ PL**	40 minutes	30 minutes	**Caution: No allowance times currently exist**	
Light Ice Pellets Mixed with Light Drizzle or Moderate Drizzle	**-PL DZ, -DZ PL, DZ PL**	40 minutes[5]	**Caution: No allowance times currently exist**		
Light Ice Pellets Mixed with Light Freezing Rain	**-PL FZRA, -FZRA PL**	40 minutes	30 minutes	**Caution: No allowance times currently exist**	
Light Ice Pellets Mixed with Light Rain	**-PL RA, -RA PL**	40 minutes[6]	**Caution: No allowance times currently exist**		
Moderate Ice Pellets (or Small Hail[7])	**PL, GS**	35 minutes	25 minutes	15 minutes	10 minutes
Moderate Ice Pellets (or Small Hail[7]) Mixed with Moderate Freezing Drizzle	**PL FZDZ, GS FZDZ,**	20 minutes	10 minutes	**Caution: No allowance times currently exist**	
Moderate Ice Pellets (or Small Hail[7]) Mixed with Moderate Drizzle	**PL DZ, GS DZ**	20 minutes[8]	**Caution: No allowance times currently exist**		
Moderate Ice Pellets (or Small Hail[7]) Mixed with Moderate Rain	**PL RA, GS RA, RA PL, RA GS**	15 minutes[9]	**Caution: No allowance times currently exist**		

NOTES

1 These allowance times are for use with undiluted (100/0) EG based fluids. The following fluids are EG based; ALAB International PROFLIGHT EG4, AllClear ClearWing EG, ASGlobal 4Flite EG, AVIAFLUID AVIAFlight EG, CHEMCO ChemR EG IV, CHEMCO ChemR Nordik IV, Clariant Max Flight AVIA, Clariant Safewing EG IV NORTH, Dow EG106, JSC RCP Nordix Defrost NORTH 4, and Newave Aerochemical FCY-EGIV. If the glycol type is unknown, the allowance times for SAE Type IV PG fluids should be used.

2 Takeoff is allowed up to 90 minutes after start of fluid application if the precipitation stops at or before the allowance time expires and does not restart. The OAT must not decrease during the 90 minutes to use this guidance in conditions of light ice pellets mixed with either: light freezing drizzle, moderate freezing drizzle, light freezing rain, or light rain.

3 No allowance times exist for EG based fluids when used on aircraft with rotation speeds less than 100 knots.

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

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

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

7 In the US, small hail is reported by METAR as GR and the remarks section is used to indicate “GR LESS THAN ¼”. Outside of the US the METAR code GS is used to indicate small hail when it is less than 5 mm and GR to indicate hail when it is 5mm or greater. If METAR does not report an intensity for small hail, use the “moderate ice pellets or small hail” allowance times. If METAR reports an intensity with small hail, the ice pellet condition with the equivalent intensity can be used, e.g. if light small hail is reported, the “light ice pellets” allowance times can be used. This also applies in mixed conditions, e.g. if light small hail mixed with light snow is reported, use the “light ice pellets mixed with light snow” allowance times.

8 No allowance times exist in this condition for temperatures of 0 °C and below; consider use of moderate ice pellets (or small hail) mixed with moderate freezing drizzle.

9 No allowance times exist in this condition for temperatures of 0 °C and below.

CAUTIONS

- The cautions that apply to the allowance times in the table above can be found on page 60.

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C. FAA Table 49: Allowance Times for SAE Type IV Propylene Glycol (PG) Fluids

FAA Holdover Time Guidelines **Winter 2023-2024**

TABLE 49: ALLOWANCE TIMES FOR SAE TYPE IV PROPYLENE GLYCOL (PG) FLUIDS[1,2]

Precipitation Types or Combinations	Applicable METAR Codes	Outside Air Temperature			
		-5 °C and above[3] (23 °F and above)	Below -5 to -10 °C[3] (Below 23 to 14 °F)	Below -10 to -16 °C[4] (Below 14 to 3 °F)	Below -16 to -22 °C[4,5] (Below 3 to -8 °F)
Light Ice Pellets	**-PL**	50 minutes	30 minutes	30 minutes	20 minutes
Light Ice Pellets Mixed with Light Snow	**-PL SN, -SN PL**	40 minutes	15 minutes	15 minutes	
Light Ice Pellets Mixed with Light Freezing Drizzle or Moderate Freezing Drizzle	**-PL FZDZ, -FZDZ PL, FZDZ PL**	25 minutes	10 minutes		
Light Ice Pellets Mixed with Light Drizzle or Moderate Drizzle	**-PL DZ, -DZ PL, DZ PL**	25 minutes[6]		**Caution: No allowance times currently exist**	
Light Ice Pellets Mixed with Light Freezing Rain	**-PL FZRA, -FZRA PL**	25 minutes	10 minutes		
Light Ice Pellets Mixed with Light Rain	**-PL RA, -RA PL**	25 minutes[7]			
Moderate Ice Pellets (or Small Hail[8])	**PL, GS**	15 minutes	10 minutes	10 minutes	
Moderate Ice Pellets (or Small Hail[8]) Mixed with Moderate Freezing Drizzle	**PL FZDZ, GS FZDZ**	10 minutes	7 minutes		
Moderate Ice Pellets (or Small Hail[8]) Mixed with Moderate Drizzle	**PL DZ, GS DZ**	10 minutes[9]		**Caution: No allowance times currently exist**	
Moderate Ice Pellets (or Small Hail[8]) Mixed with Moderate Rain	**PL RA, GS RA, RA PL, RA GS**	10 minutes[10]			

NOTES

1 These allowance times are for use with undiluted (100/0) PG based fluids applied on aircraft with rotation speeds of 100 knots or greater. All Type IV fluids are PG based with the exception of ALAB International PROFLIGHT EG4, AllClear ClearWing EG, ASGlobal 4Flite EG, AVIAFLUID AVIAFlight EG, CHEMCO ChemR EG IV, CHEMCO ChemR Nordik IV, Clariant Max Flight AVIA, Clariant Safewing EG IV NORTH, Dow EG106, JSC RCP Nordix Defrost NORTH 4, and Newave Aerochemical FCY-EGIV, which are EG based. If the glycol type is unknown, the allowance times for SAE Type IV PG fluids should be used.

2 Takeoff is allowed up to 90 minutes after start of fluid application if the precipitation stops at or before the allowance time expires and does not restart. The OAT must not decrease during the 90 minutes to use this guidance in conditions of light ice pellets mixed with either: light freezing drizzle, moderate freezing drizzle, light freezing rain, or light rain.

3 No allowance times exist for PG based fluids when used on aircraft with rotation speeds less than 100 knots.

4 No allowance times exist for PG based fluids when used on aircraft with rotation speeds less than 115 knots.

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

6 No allowance times exist in this condition for temperatures of 0 °C and below; consider use of light ice pellets mixed with light freezing drizzle or moderate freezing drizzle.

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

8 In the US, small hail is reported by METAR as GR and the remarks section is used to indicate “GR LESS THAN ¼”. Outside of the US the METAR code GS is used to indicate small hail when it is less than 5 mm and GR to indicate hail when it is 5mm or greater. If METAR does not report an intensity for small hail, use the “moderate ice pellets or small hail” allowance times. If METAR reports an intensity with small hail, the ice pellet condition with the equivalent intensity can be used, e.g. if light small hail is reported, the “light ice pellets” allowance times can be used. This also applies in mixed conditions, e.g. if light small hail mixed with light snow is reported, use the “light ice pellets mixed with light snow” allowance times.

9 No allowance times exist in this condition for temperatures of 0 °C and below; consider use of moderate ice pellets (or small hail) mixed with moderate freezing drizzle.

10 No allowance times exist in this condition for temperatures of 0 °C and below.

CAUTIONS

- The cautions that apply to the allowance times in the table above can be found on page 60.

F.17.7 Supplemental Guidance (FAA Tables 50 – 58)

A. FAA Table 50: Snowfall Intensities as a Function of Prevailing Visibility

FAA Holdover Time Guidelines **Winter 2023-2024**

TABLE 50: SNOWFALL INTENSITIES AS A FUNCTION OF PREVAILING VISIBILITY

Visibility		Day		Night	
Statute Miles	Meters	-1°C and below 30 °F and below	Above -1°C Above 30 °F	-1°C and Below 30 °F and below	Above -1°C Above 30 °F
≤1/4 (≤3/8)	**≤400** (≤600)	Heavy	Heavy	Heavy	Heavy
1/2 (>3/8 to ≤5/8)	**800** (>600 to ≤1000)	Moderate	Heavy	Heavy	Heavy
3/4 (>5/8 to ≤7/8)	**1200** (>1000 to ≤1400)	Moderate	Moderate	Moderate	Heavy
1 (>7/8 to ≤1 1/8)	**1600** (>1400 to ≤1800)	Light	Light	Moderate	Moderate
1 ¼ (>1 1/8 to ≤1 3/8)	**2000** (>1800 to ≤2200)	Light	Light	Moderate	Moderate
1 ½ (>1 3/8 to ≤1 5/8)	**2400** (>2200 to ≤2600)	Light	Light	Moderate	Moderate
1 ¾ (>1 5/8 to ≤1 7/8)	**2800** (>2600 to ≤3000)	Very Light	Light	Light	Light
2 (>1 7/8 to ≤2 ¼)	**3200** (>3000 to ≤3600)	Very Light	Very Light	Light	Light
2 ½ (>2 ¼ to ≤2 ¾)	**4000** (>3600 to ≤4400)	Very Light	Very Light	Very Light	Very Light
3 (>2 ¾ to ≤3 ¼)	**4800** (>4400 to ≤5200)	Very Light	Very Light	Very Light	Very Light
≥3 ½ (>3 ¼)	**≥5600** (>5200)	Very Light	Very Light	Very Light	Very Light

NOTES

- The METAR/SPECI reported visibility or flight crew observed visibility will be used with this visibility table to establish snowfall intensity for Type I, II, III and IV holdover time guidelines, during snow, snow grain, or snow pellet precipitation conditions. This visibility table will also be used when snow, snow grains, or snow pellets are accompanied by blowing or drifting snow, or when snow is mixed with ice crystals or freezing fog in the METAR/SPECI.
- The use of Runway Visual Range (RVR) is not permitted for determining visibility used with the holdover tables.
- 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.
- If the visibility is being reduced by snow along with form(s) of obscuration such as fog, haze, smoke, etc., use of the table above may overestimate the actual snowfall intensity. However, use of the snowfall intensity being reported by the weather observer or automated surface observing system (ASOS), from the FMH-1 Table, may underestimate the actual snowfall intensity as it does not directly correlate to the snowfall intensities used when determining holdover times. Use of the visibility table in all snow conditions with or without obscurations is recommended.

Example for how to read and use the table: `CYVO 160200Z 15011G17KT 1SM -SN DRSN OVC009 M06/M08 A2948`

In the above METAR the snowfall intensity is reported as light. However, based upon the "Snowfall Intensities as a Function of Prevailing Visibility" table, with a visibility of 1 statute mile, at night and a temperature of -6°C, the snowfall intensity is classified as moderate. The snowfall intensity of moderate - not the METAR reported intensity of light - will be used to determine which holdover time guideline value is appropriate for the fluid in use.

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B. FAA Table 51: Type I Fluids Tested for Anti-Icing Performance and Aerodynamic Acceptance

NOTE

Refer to "Cautions and Notes for FAA Tables 51, 52, 53, 54" in this section.

FAA Holdover Time Guidelines **Winter 2023-2024**

TABLE 51:
TYPE I FLUIDS TESTED FOR ANTI-ICING PERFORMANCE AND AERODYNAMIC ACCEPTANCE
(see cautions and notes on pages 76 and 77)

Fluid Name	Type of Glycol[1]	Expiry[2] (y-m-d)	Lowest Operational Use Temperature[3]					
			Dilution[4,5] (fluid/water)	low speed aerodynamic test[6]		middle speed aerodynamic test[6]		high speed aerodynamic test[6]	
				°C	°F	°C	°F	°C	°F
ABAX Industries									
DE-950	PG	26-06-01	71/29	-26	-15	Not tested[11]		-31	-24
ADDCON EUROPE GmbH[10]									
IceFree I.80	*PG*	*21-03-14[9]*	*70/30*	*-26*	*-15*	*Not tested[11]*		*-32*	*-26*
Aero Mag 2000 SYR LLC									
DeiceX PG ADF Concentrate[12]	PG	27-06-15	65/35	Currently in testing[13]		Not tested[11]		-31.5	-25
ALAB Industries[10]									
WDF 1	*EG*	*22-03-02[9]*	*70/30*	*-40*	*-40*	*Not tested[11]*		*-45*	*-49*
ALAB International									
PROFLIGHT EG1	EG	25-06-01	70/30	-43.5	-46	Not tested[11]		-44	-47
AllClear Systems LLC[10]									
Lift-Off E-188	EG	26-06-01	70/30	-40	-40	Not tested[11]		-41.5	-43
Lift-Off P-88	PG	26-06-01	70/30	-24.5	-12	Not tested[11]		-29.5	-21
Arcton Ltd.[10]									
Arctica DG ready-to-use	*DEG*	*22-03-26[9]*	*as supplied*	*-26*	*-15*	*Not tested[11]*		*-26*	*-15*
ASGlobal									
Sky-Go EG	EG	26-09-23	70/30	-31[14]	-24[14]	Not tested[11]		-40	-40
Sky-Go PG	PG	26-07-27	70/30	-21.5[14]	-7[14]	Not tested[11]		-30.5	-23
Sky-Go PG 80	PG	23-09-02	70/30	-25	-13	Not tested[11]		-31.5	-25
AVIAFLUID International Ltd									
AVIAFLO EG	*EG*	*21-06-19[9]*	*70/30*	*-40.5*	*-41*	*Not tested[11]*		*-44*	*-47*
AVIAFLO PG	*PG*	*22-02-10[9]*	*70/30*	*Not tested[11]*		*Not tested[11]*		*-30*	*-22*
Aviation Xi'an High-Tech Physical Chemical Co. Ltd.									
Cleanwing I	*PG*	*23-05-14[13]*	*75/25*	*Not tested[11]*		*Not tested[11]*		*-39.5*	*-39*
Cleanwing E	*EG*	*22-07-09[9]*	*75/25*	*-37*	*-35*	*Not tested[11]*		*-37*	*-35*
Cleanwing S-92	*EG*	*22-06-03[9]*	*75/25*	*-35*	*-31*	*Not tested[11]*		*-40*	*-40*
KHF-1	*PG*	*23-05-24[13]*	*75/25*	*Not tested[11]*		*Not tested[11]*		*-38.5*	*-37*

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TABLE 51 (CONT'D):
TYPE I FLUIDS TESTED FOR ANTI-ICING PERFORMANCE AND AERODYNAMIC ACCEPTANCE

(see cautions and notes on pages 76 and 77)

Fluid Name	Type of Glycol[1]	Expiry[2] (y-m-d)	Lowest Operational Use Temperature[3]					
			Dilution[4,5] (fluid/water)	low speed aerodynamic test[6]		middle speed aerodynamic test[6]		high speed aerodynamic test[6]
				°C	°F	°C	°F	°C	°F
Beijing Wangye Aviation Chemical Product Co Ltd.[10]									
KLA-1	*EG*	*19-09-08[9]*	*60/40*	*Not tested[11]*		*Not tested[11]*		*-30.5*	*-23*
KLA-1A	*EG*	*22-05-22[9]*	*60/40*	*Not tested[11]*		*Not tested[11]*		*-32*	*-26*
Beijing Yadilite Aviation Advanced Materials Corporation									
YD-101 Type I	*PG*	*21-03-07[9]*	*60/40*	*Not tested[11]*		*Not tested[11]*		*-30*	*-22*
YD-101A Type I	EG	25-02-26	70/30	Not tested[11]		Not tested[11]		-38	-36
CHEMCO Inc.									
CHEMR EG I	EG	24-04-17	70/30	-37	-35	Not tested[11]		-43	-45
CHEMR REG I	EG	26-06-01	75/25	-36.5	-34	Not tested[11]		-43.5	-46
Clariant Produkte (Deutschland) GmbH									
Octaflo EF Concentrate	*PG*	*22-03-28[9]*	*65/35*	*-25*	*-13*	*Not tested[11]*		*-33*	*-27*
Octaflo LYOD	EG	24-07-28	70/30	-40	-40	Not tested[11]		-45.5	-50
Safewing EG I 1996 (88)	EG	23-11-19	70/30	-39.5	-39	Not tested[11]		-41.5	-43
Safewing MP I 1938 ECO	PG	24-07-02	65/35	-25.5	-14	*Not tested[11]*		-32	-26
Safewing MP I 1938 ECO (80)	PG	24-06-23	71/29	-25	-13	Not tested[11]		-32.5	-27
Safewing MP I 1938 ECO (80) Premix 55% i.g. ready-to-use	PG	25-04-01	as supplied	Not tested[11]		Not tested[11]		-19	-2
Safewing MP I ECO PLUS (80)	*PG*	*23-04-12[13]*	*71/29*	*-25*	*-13*	*Not tested[11]*		*-33*	*-27*
Safewing MP I LFD 80	PG	25-04-15	71/29	-26	-15	Not tested[11]		-33	-27
Safewing MP I LFD 80 Pre-Mix 55%	PG	23-08-26	as supplied	Not tested[11]		Not tested[11]		-17	1
Safewing MP I LFD 88	*PG*	*23-06-12[13]*	*65/35*	*-26*	*-15*	*Not tested[11]*		*-33*	*-27*
Cryotech Deicing Technology									
Polar Plus®	*PG*	*20-01-13[9]*	*63/37*	*-27*	*-17*	Not tested[11]		*-32*	*-26*
Polar Plus® LT	PG	24-01-21	63/37	-27	-17	Not tested[11]		-33	-27
Polar Plus® LT (80)	PG	24-06-15	70/30	-27	-17	Not tested[11]		-33	-27
Dow Chemical Company									
UCAR™ ADF Concentrate	EG	27-06-01	75/25	-36	-33	Not tested[11]		-45	-49
UCAR™ ADF XL54[15]	*EG*	*23-03-26[13]*	*as supplied*	*-33*	*-27*	*Not tested[11]*		*-33*	*-27*

TABLE 51 (CONT'D): TYPE I FLUIDS TESTED FOR ANTI-ICING PERFORMANCE AND AERODYNAMIC ACCEPTANCE

(see cautions and notes on pages 76 and 77)

Fluid Name	Type of Glycol[1]	Expiry[2] (y-m-d)	Lowest Operational Use Temperature[3]						
			Dilution[4,5] (fluid/water)	low speed aerodynamic test[6]		middle speed aerodynamic test[6]		high speed aerodynamic test[6]	
				°C	°F	°C	°F	°C	°F
Dow Chemical Company									
UCAR™ PG ADF Concentrate	*PG*	*23-05-29[13]*	*65/35*	*-25*	*-13*	*Not tested[11]*		*-32*	*-26*
UCAR™ PG ADF Dilute 55/45[16]	*PG*	*23-04-16[13]*	*as supplied*	*-24*	*-11*	*Not tested[11]*		*-25*	*-13*
Gansu xiexin huineng Science and technology development Co., Ltd.[10]									
XHN-1	*PG DEG*	*19-10-04[9]*	*75/25*	*Not tested[11]*		*Not tested[11]*		*-36*	*-33*
Heilongjiang Hangjie Aero-chemical Technology Co. Ltd.[10]									
HJF-1	*EG*	*21-06-14[9]*	*65/35*	*Not tested[11]*		*Not tested[11]*		*-42*	*-44*
HOC Industries									
SafeTemp® ES Plus	PG	24-06-30	65/35	-25.5	-14	Not tested[11]		-29	-20
Inland Technologies Inc.									
DuraGly-E Type I ADF Concentrate	*EG*	*23-02-08[13]*	*60/40*	*-33*	*-27*	*Not tested[11]*		*-33*	*-27*
Inland ADF Concentrate (Multiple Location)	EG	Y-M-D[17]	75/25	-36	-33	Not tested[11]		-42.5	-45
SafeTemp® ES Plus (Multiple Location)	PG	Y-M-D[18]	65/35	-25.5	-14	Not tested[11]		-31	-24
JSC RCP Nordix									
DEFROST EG 88.1	EG	25-04-13	70/30	-40.5	-41	Not tested[11]		-44.5	-48
DEFROST PG 1	PG	23-11-21	70/30	-24.5	-12	Not tested[11]		-31.5	-25
Kilfrost Limited									
Kilfrost DF Plus	*PG*	*23-06-18[13]*	*69/31*	*-25.5*	*-14*	*Not tested[11]*		*-32*	*-26*
Kilfrost DF Plus (80)	PG	24-07-14	69/31	-26	-15	Not tested[11]		-31.5	-25
Kilfrost DF Plus (88)	*PG*	*23-06-05[9]*	*63/37*	*-25.5*	*-14*	*Not tested[11]*		*-32*	*-26*
Kilfrost Ice Clear I	*PG*	*23-04-20[13]*	*70/30*	*-26*	*-15*	*Not tested[11]*		*-33*	*-27*
LNT Solutions									
LNT E188	EG	25-08-13	70/30	-30.5	-23	Not tested[11]		-41	-42
LNT P180	PG	26-11-10	69/31	-26	-15	Not tested[11]		-32	-26
MKS DEVO KIMYA SANAYI TIC AS.									
COREICEPHOB TYPE I	PG	26-06-01	71/29	Not tested[11]		Not tested[11]		-32.5	-27

TABLE 51 (CONT'D):
TYPE I FLUIDS TESTED FOR ANTI-ICING PERFORMANCE AND AERODYNAMIC ACCEPTANCE

(see cautions and notes on pages 76 and 77)

Fluid Name	Type of Glycol[1]	Expiry[2] (y-m-d)	Lowest Operational Use Temperature[3]						
			Dilution[4,5] (fluid/water)	low speed aerodynamic test[6]		middle speed aerodynamic test[6]		high speed aerodynamic test[6]	
				°C	°F	°C	°F	°C	°F
Newave Aerochemical Co. Ltd.									
FCY-1A	*EG*	*23-06-04[13]*	*75/25*	*-40*	*-40*	*Not tested[11]*		*-40*	*-40*
FCY-1Bio+	EG	24-07-28	75/25	Not tested[11]		Not tested[11]		-40.5	-41
ROMCHIM PROTECT SRL									
ADD-PROTECT NG Type I	EG	26-06-01	60/40	-22	-8	Not tested[11]		-22	-8
ADD-PROTECT Type I	PG	27-06-01	70/30	-25.5	-14	Not tested[11]		-31	-24
Shaanxi Cleanway Aviation Chemical Co., Ltd									
Cleansurface I	EG	25-06-07	75/25	Not tested[11]		Not tested[11]		-40.5	-41
Cleansurface I-BIO	*EG*	*22-05-02[9]*	*75/25*	*Not tested[11]*		*Not tested[11]*		*-37*	*-35*
Topan LLC									
TOPAN TYPE I	EG	24-07-13	75/25	-35.5	-32	Not tested[11]		-42	-44
Xinjiang Zhongtian Liyang Aviation Newmaterial Technology Co., Ltd. (Formerly Xinjiang Zhongtian Liyang Chemical Technology Co., Ltd)									
Clearice-I	EG	23-10-24	60/40	Not tested[11]		Not tested[11]		-30	-22
Clearice-IB	EG	24-08-04	75/25	Not tested[11]		Not tested[11]		-43.5	-46

C. FAA Table 52: Type II Fluids Tested for Anti-Icing Performance and Aerodynamic Acceptance

NOTE

Refer to "Cautions and Notes for FAA Tables 51, 52, 53, 54" in this section.

FAA Holdover Time Guidelines — Winter 2023-2024

TABLE 52:
TYPE II FLUIDS TESTED FOR ANTI-ICING PERFORMANCE AND AERODYNAMIC ACCEPTANCE
(see cautions and notes on pages 76 and 77)

Fluid Name	Type of Glycol[1]	Expiry[2] (y-m-d)	Dilution (fluid/water)	Lowest Operational Use Temperature[3]				AS 9968 Viscosity[7] (mPa.s)			
				middle speed aerodynamic test[6]		high speed aerodynamic test[6]		Lowest On-Wing Viscosity[8]		Highest On-Wing Viscosity[8]	
				°C	°F	°C	°F	Manufacturer Method	Alternate Method	Manufacturer Method	Alternate Method
ABAX Industries											
ECOWING AD-2	PG	25-06-01	100/0	Not tested[11]		-27	-17	5 750 (a)	Not Available[19]	17 200 (a)	14 000 (g)
			75/25	Not tested[11]		-15	5	12 000 (c)	Not Available[19]	30 200 (c)	32 000 (g)
			50/50[9]	*Not tested*[11]		-3	27	*7 500 (a)*	*Not Available*[19]	*26 900 (c)*	*36 800 (g)*
Aviation Xi'an High-Tech Physical Chemical Co. Ltd.											
Cleanwing II	*PG*	*23-06-01*[13]	*100/0*	*Not tested*[11]		*-25*	*-13*	*4 650 (d)*	*4 500 (a)*	*13 500 (a)*	*11 100 (h)*
			75/25	*Not tested*[11]		*-15*	*5*	*9 450 (d)*	*10 000 (a)*	*14 600 (h)*	*Not Available*[19]
			50/50	*Not tested*[11]		*-4.5*	*24*	*10 150 (d)*	*10 200 (a)*	*12 900 (h)*	*Not Available*[19]
Clariant Produkte (Deutschland) GmbH											
Safewing MP II FLIGHT	PG	24-05-19	*100/0*	Not tested[11]		-29	-20	3 340 (a)	Not Available[19]	20 500 (r)	20 500 (c)
			75/25	Not tested[11]		-14	7	12 900 (c)	Not Available[19]	47 800 (r)	47 800 (c)
			50/50	Not tested[11]		-3.5	26	11 500 (a)	Not Available[19]	63 000 (r)	63 000 (c)
Safewing MP II FLIGHT PLUS	*PG*	*20-02-26*[9]	*100/0*	*Not tested*[11]		*-29*	*-20*	*3 650 (p)*	*3 100 (a)*	*14 100 (h)*	*18 800 (c)*
			75/25	*Not tested*[11]		*-14.5*	*6*	*12 400 (p)*	*10 450 (a)*	*31 200 (h)*	*Not Available*[19]
			50/50	*Not tested*[11]		*-4*	*25*	*7 800 (p)*	*7 050 (a)*	*11 600 (h)*	*Not Available*[19]
Cryotech Deicing Technology											
Polar Guard® II	PG	25-06-01	100/0	Not tested[11]		-30.5	-23	4 400 (e)	4 050 (a)	17 000 (e)	16 200 (a)
			75/25	Not tested[11]		-14	7	11 600 (e)	9 750 (a)	38 000 (c)	Not Available[19]
			50/50	Not tested[11]		-3.5	26	80 (a)	Not Available[19]	48 000 (c)	Not Available[19]
JSC RCP Nordix											
Defrost PG 2	*PG*	*20-06-27*[9]	*100/0*	*Not tested*[11]		*-27*	*-17*	*4 450 (a)*	*Not Available*[19]	*6 400 (a)*	*Not Available*[19]
			75/25	*Not tested*[11]		*-16*	*3*	*8 000 (a)*	*Not Available*[19]	*7 700 (h)*	*Not Available*[19]
			50/50	*Not tested*[11]		*-4*	*25*	*17 900 (g)*	*25 400 (c)*	*24 600 (h)*	*Not Available*[19]
Kilfrost Limited											
ABC-K Plus	PG	25-06-01	100/0	Not tested[11]		-29	-20	2 850 (d)	2 640 (a)	13 400 (a)	Not Available[19]
			75/25	Not tested[11]		-14.5	6	12 650 (d)	12 650 (c)	29 000 (c)	20 700 (h)
			50/50	Not tested[11]		-3.5	26	4 200 (d)	5 260 (a)	15 000 (a)	10 900 (h)

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TABLE 52 (CONT'D):
TYPE II FLUIDS TESTED FOR ANTI-ICING PERFORMANCE AND AERODYNAMIC ACCEPTANCE

(see cautions and notes on pages 76 and 77)

Fluid Name	Type of Glycol[1]	Expiry[2] (y-m-d)	Dilution (fluid/water)	Lowest Operational Use Temperature[3]				AS 9968 Viscosity[7] (mPa.s)			
				middle speed aerodynamic test[6]		high speed aerodynamic test[6]		Lowest On-Wing Viscosity[8]		Highest On-Wing Viscosity[8]	
				Manufacturer Method	Alternate Method	Manufacturer Method	Alternate Method				
				°C	°F	°C	°F				
Kilfrost Limited											
Ice Clear II	PG	24-06-06	100/0	Not tested[11]		-28	-18	4 100 (a)	18 000 (l)	26 000 (c)	20 700 (h)
			75/25	Dilution Not Applicable				Dilution Not Applicable			
			50/50	Dilution Not Applicable				Dilution Not Applicable			
MKS DEVO KIMYA SANAYI TIC AS.											
COREICEPHOB Type II	PG	24-05-26	100/0	Not tested[11]		-27	-17	45 600 (h)	Not Available[19]	50 200 (h)	Not Available[19]
			75/25	Dilution Not Applicable				Dilution Not Applicable			
			50/50	Not tested[11]		-3.5	26	26 000 (h)	Not Available[19]	30 700 (h)	Not Available[19]
Newave Aerochemical Co. Ltd.											
FCY-2	*PG*	*23-07-08[13]*	*100/0*	*Not tested[11]*		*-28*	*-18*	*7 000 (d)*	*8 920 (a)*	*24 800 (c)*	*Not Available[19]*
			75/25	*Not tested[11]*		*-14.5*	*6*	*18 550 (d)*	*18 550 (c)*	*31 300 (h)*	*Not Available[19]*
			50/50	*Not tested[11]*		*-4.5*	*24*	*6 750 (d)*	*7 030 (a)*	*15 200 (h)*	*Not Available[19]*
ROMCHIM PROTECT SRL											
ADD-PROTECT NG Type II	PG	25-06-01	100/0	Not tested[11]		-28	-18	5 200 (a)	Not Available[19]	12 400 (a)	Not Available[19]
			75/25	Not tested[11]		-14.5	6	8 250 (a)	Not Available[19]	43 800 (h)	Not Available[19]
			50/50	Not tested[11]		-3	27	5 850 (a)	Not Available[19]	38 900 (h)	Not Available[19]
ADD-PROTECT Type II	PG	25-06-01	100/0	Not tested[11]		-28	-18	4 000 (a)	Not Available[19]	18 250 (a)	12 900 (h)
			75/25	Not tested[11]		-14	7	7 700 (a)	Not Available[19]	23 300 (c)	23 200 (h)
			50/50	Not tested[11]		-3	27	14 500 (a)	Not Available[19]	31 400 (c)	22 600 (h)

D. FAA Table 53: Type III Fluids Tested for Anti-Icing Performance and Aerodynamic Acceptance

NOTE

Refer to "Cautions and Notes for FAA Tables 51, 52, 53, 54" in this section.

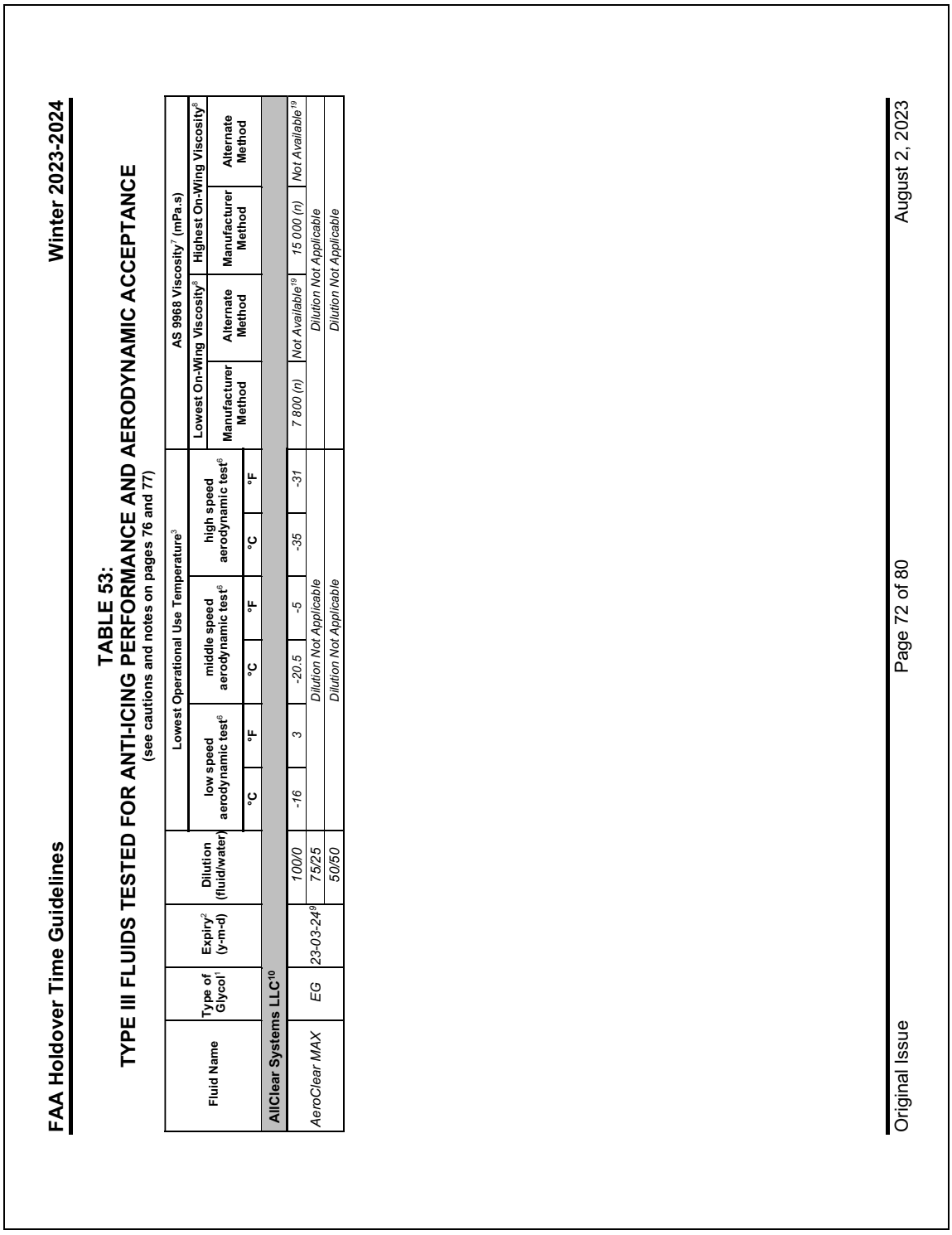

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TABLE 53:
TYPE III FLUIDS TESTED FOR ANTI-ICING PERFORMANCE AND AERODYNAMIC ACCEPTANCE
(see cautions and notes on pages 76 and 77)

Fluid Name	Type of Glycol[1]	Expiry[2] (y-m-d)	Dilution (fluid/water)	Lowest Operational Use Temperature[3]						AS 9968 Viscosity[7] (mPa.s)			
				low speed aerodynamic test[6]		middle speed aerodynamic test[6]		high speed aerodynamic test[6]		Lowest On-Wing Viscosity[8]		Highest On-Wing Viscosity[8]	
				°C	°F	°C	°F	°C	°F	Manufacturer Method	Alternate Method	Manufacturer Method	Alternate Method
AllClear Systems LLC[10]													
AeroClear MAX	*EG*	*23-03-24*[9]	*100/0*	*-16*	*3*	*-20.5*	*-5*	*-35*	*-31*	*7 800 (n)*	*Not Available*[19]	*15 000 (n)*	*Not Available*[19]
			75/25	*Dilution Not Applicable*							*Dilution Not Applicable*		
			50/50	*Dilution Not Applicable*							*Dilution Not Applicable*		

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E. FAA Table 54: Type IV Fluids Tested for Anti-Icing Performance and Aerodynamic Acceptance

NOTE

Refer to "Cautions and Notes for FAA Tables 51, 52, 53, 54" in this section.

FAA Holdover Time Guidelines — Winter 2023-2024

TABLE 54:
TYPE IV FLUIDS TESTED FOR ANTI-ICING PERFORMANCE AND AERODYNAMIC ACCEPTANCE
(see cautions and notes on pages 76 and 77)

Fluid Name	Type of Glycol[1]	Expiry[2] (y-m-d)	Dilution (fluid/water)	Lowest Operational Use Temperature[3]				AS 9968 Viscosity[7] (mPa.s)			
				middle speed aerodynamic test[6]		high speed aerodynamic test[6]		Lowest On-Wing Viscosity[8]		Highest On-Wing Viscosity[8]	
				°C	°F	°C	°F	Manufacturer Method	Alternate Method	Manufacturer Method	Alternate Method
ABAX Industries											
ECOWING AD-49	PG	24-03-01	100/0	Not tested[11]		-26	-15	12 150 (g)	11 000 (a)	22 400 (g)	25 900 (c)
			75/25	Dilution Not Applicable				Dilution Not Applicable			
			50/50	Dilution Not Applicable				Dilution Not Applicable			
ALAB International											
PROFLIGHT EG4	EG	25-06-01	100/0	Not tested[11]		-26	-15	1 840 (a)	Not Available[19]	6 180 (a)	Not Available[19]
			75/25	Dilution Not Applicable				Dilution Not Applicable			
			50/50	Dilution Not Applicable				Dilution Not Applicable			
AllClear Systems LLC[10]											
ClearWing ECO	*PG*	*23-03-29[9]*	*100/0*	*Not tested[11]*		*-26*	*-15*	*37 600 (k)*	*42 000 (c)*	*30 600 (h)*	*51 900 (c)*
			75/25	*Dilution Not Applicable*				*Dilution Not Applicable*			
			50/50	*Dilution Not Applicable*				*Dilution Not Applicable*			
ClearWing EG	*EG*	*23-03-17[9]*	*100/0*	*Not tested[11]*		*-29*	*-20*	*35 500 (m)*	*13 350 (a)*	*51 800 (j)*	*Not Available[19]*
			75/25	*Dilution Not Applicable*				*Dilution Not Applicable*			
			50/50	*Dilution Not Applicable*				*Dilution Not Applicable*			
ASGlobal											
4Flite EG	EG	24-07-15	100/0	Not tested[11]		-30	-22	6 600 (a)	Not Available[19]	17 300 (a)	Not Available[19]
			75/25	Dilution Not Applicable				Dilution Not Applicable			
			50/50	Dilution Not Applicable				Dilution Not Applicable			
4Flite PG	*PG*	*23-06-29[13]*	*100/0*	*Not tested[11]*		*-26*	*-15*	*26 100 (c)*	*Not Available[19]*	*36 500 (c)*	*Not Available[19]*
			75/25	*Dilution Not Applicable*				*Dilution Not Applicable*			
			50/50	*Dilution Not Applicable*				*Dilution Not Applicable*			
AVIAFLUID International Ltd											
AVIAFlight EG	*EG*	*22-04-28[9]*	*100/0*	*Not tested[11]*		*-31*	*-24*	*5 600 (a)*	*Not Available[19]*	*12 800 (a)*	*11 200 (h)*
			75/25	*Dilution Not Applicable*				*Dilution Not Applicable*			
			50/50	*Dilution Not Applicable*				*Dilution Not Applicable*			
AVIAFlight PG	*PG*	*23-07-01[9]*	*100/0*	*Not tested[11]*		*-25.5*	*-14*	*28 600 (c)*	*Not Available[19]*	*35 900 (c)*	*22 200 (h)*
			75/25	*Dilution Not Applicable*				*Dilution Not Applicable*			
			50/50	*Dilution Not Applicable*				*Dilution Not Applicable*			

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TABLE 54 (CONT'D):
TYPE IV FLUIDS TESTED FOR ANTI-ICING PERFORMANCE AND AERODYNAMIC ACCEPTANCE

(see cautions and notes on pages 76 and 77)

Fluid Name	Type of Glycol[1]	Expiry[2] (y-m-d)	Dilution (fluid/water)	Lowest Operational Use Temperature[3]				AS 9968 Viscosity[7] (mPa.s)			
				middle speed aerodynamic test[6]		high speed aerodynamic test[6]		Lowest On-Wing Viscosity[8]		Highest On-Wing Viscosity[8]	
				°C	°F	°C	°F	Manufacturer Method	Alternate Method	Manufacturer Method	Alternate Method
CHEMCO Inc.											
ChemR EG IV	*EG*	*23-04-07[9]*	*100/0*	*Not tested[11]*		*-27*	*-17*	*46 400 (l)*	*19 450 (c)*	*67 000 (l)*	*Not Available[19]*
			75/25	*Dilution Not Applicable*				*Dilution Not Applicable*			
			50/50	*Dilution Not Applicable*				*Dilution Not Applicable*			
ChemR Nordik IV	EG	25-06-01	100/0	Not tested[11]		-29	-20	60 800 (m)	43 100 (c)	87 100 (m)	Not Available[19]
			75/25	Dilution Not Applicable				Dilution Not Applicable			
			50/50	Dilution Not Applicable				Dilution Not Applicable			
Clariant Produkte (Deutschland) GmbH											
Max Flight AVIA	*EG*	*22-12-18[9]*	*100/0*	*Not tested[11]*		*-28.5*	*-19*	*1 000 (o)*	*Not Available[19]*	*7 650 (a)*	*Not Available[19]*
			75/25	*Dilution Not Applicable*				*Dilution Not Applicable*			
			50/50	*Dilution Not Applicable*				*Dilution Not Applicable*			
Max Flight SNEG	*PG*	*22-06-09[9]*	*100/0*	*Not tested[11]*		*-29*	*-20*	*8 700 (q)*	*8 050 (a)*	*17 600 (h)*	*21 700 (c)*
			75/25	*Not tested[11]*		*-14*	*7*	*20 200 (r)*	*21 800 (c)*	*35 600 (h)*	*Not Available[19]*
			50/50	*Not tested[11]*		*-3*	*27*	*13 600(r)*	*15 000 (c)*	*23 900 (h)*	*Not Available[19]*
Safewing EG IV NORTH	*EG*	*22-11-18[9]*	*100/0*	*Not tested[11]*		*-30*	*-22*	*830 (o)*	*Not Available[19]*	*6 750 (a)*	*Not Available[19]*
			75/25	*Dilution Not Applicable*				*Dilution Not Applicable*			
			50/50	*Dilution Not Applicable*				*Dilution Not Applicable*			
Safewing MP IV LAUNCH	PG	24-05-26	100/0	Not tested[11]		-28.5	-19	7 550 (a)	Not Available[19]	20 500 (r)	20 500 (c)
			75/25	Not tested[11]		-14	7	18 000 (a)	Not Available[19]	47 800 (r)	47 800 (c)
			50/50	Not tested[11]		-3.5	26	17 800 (a)	Not Available[19]	63 000 (r)	63 000 (c)
Safewing MP IV LAUNCH PLUS	*PG*	*23-03-12[13]*	*100/0*	*Not tested[11]*		*-29*	*-20*	*8 700 (q)*	*8 450 (a)*	*21 000 (r)*	*21 000 (c)*
			75/25	*Not tested[11]*		*-14*	*7*	*18 800 (r)*	*17 200 (c)*	*51 600 (r)*	*51 600 (c)*
			50/50	*Not tested[11]*		*-3.5*	*26*	*9 700 (q)*	*12 150 (a)*	*65 700 (r)*	*65 700 (c)*
Cryotech Deicing Technology											
Polar Guard® Advance	*PG*	*23-05-28[13]*	*100/0*	*Not tested[11]*		*-30.5*	*-23*	*4 400 (e)*	*4 050 (a)*	*17 000 (e)*	*16 200 (a)*
			75/25	*Not tested[11]*		*-14*	*7*	*11 600 (e)*	*9 750 (a)*	*38 000 (c)*	*Not Available[19]*
			50/50	*Not tested[11]*		*-3.5*	*26*	*80 (a)*	*Not Available[19]*	*48 000 (c)*	*Not Available[19]*
Polar Guard® Xtend	PG	25-06-01	100/0	Not tested[11]		-29	-20	6 000 (e)	6 350 (a)	23 500 (e)	23 200 (c)
			75/25	Dilution Not Applicable				Dilution Not Applicable			
			50/50	Dilution Not Applicable				Dilution Not Applicable			

TABLE 54 (CONT'D):
TYPE IV FLUIDS TESTED FOR ANTI-ICING PERFORMANCE AND AERODYNAMIC ACCEPTANCE

(see cautions and notes on pages 76 and 77)

Fluid Name	Type of Glycol[1]	Expiry[2] (y-m-d)	Dilution (fluid/water)	Lowest Operational Use Temperature[3]				AS9968 Viscosity[7] (mPa.s)			
				middle speed aerodynamic test[5]		high speed aerodynamic test[5]		Lowest On-Wing Viscosity[8]		Highest On-Wing Viscosity[8]	
				°C	°F	°C	°F	Manufacturer Method	Alternate Method	Manufacturer Method	Alternate Method
Dow Chemical Company											
UCAR ENDURANCE™ EG106 ADF/AAF	EG	25-06-01	100/0	Not tested[11]		-29	-20	24 850 (i)	2 230 (a)	47 800 (i)	5 900 (a)
			75/25	Dilution Not Applicable				Dilution Not Applicable			
			50/50	Dilution Not Applicable				Dilution Not Applicable			
UCAR™ FLIGHTGUARD™ AD-49	*PG*	*23-05-27[13]*	*100/0*	*Not tested[11]*		*-26*	*-15*	*12 150 (g)*	*11 000 (a)*	*22 400 (g)*	*25 900 (c)*
			75/25	*Dilution Not Applicable*				*Dilution Not Applicable*			
			50/50	*Dilution Not Applicable*				*Dilution Not Applicable*			
Inland Technologies Inc.											
ECO-SHIELD®	PG	24-10-28	100/0	Not tested[11]		-25.5	-14	11 050 (a)	Not Available[19]	25 800 (h)	34 500 (c)
			75/25	Dilution Not Applicable				Dilution Not Applicable			
			50/50	Dilution Not Applicable				Dilution Not Applicable			
JSC RCP Nordix											
Defrost ECO 4	*PG*	23-08-12	100/0	Not tested[11]		-25.5	-14	9 800 (g)	12 350 (a)	14 800 (h)	13 700 (c)
			75/25	Dilution Not Applicable				Dilution Not Applicable			
			50/50	Dilution Not Applicable				Dilution Not Applicable			
Defrost NORTH 4	*EG*	*23-06-01[9]*	*100/0*	*Not tested[11]*		*-26*	*-15*	*2 500 (a)*	*Not Available[19]*	*5 350 (a)*	*Not Available[19]*
			75/25	*Dilution Not Applicable*				*Dilution Not Applicable*			
			50/50	*Dilution Not Applicable*				*Dilution Not Applicable*			
Kilfrost Limited											
ABC-S Plus	*PG*	*23-06-09[13]*	*100/0*	*Not tested[11]*		*-28*	*-18*	*17 900 (d)*	*17 900 (c)*	*43 800 (c)*	*32 000 (h)*
			75/25	*Not tested[11]*		*-14.5*	*6*	*18 300 (d)*	*18 300 (c)*	*58 000 (c)*	*40 200 (h)*
			50/50	*Not tested[11]*		*-3.5*	*26*	*7 500 (d)*	*7 500 (a)*	*27 000 (c)*	*21 200 (h)*
Newave Aerochemical Co. Ltd.											
FCY 9311	PG	24-12-09	100/0	Not tested[11]		-29.5	-21	14 100 (c)	Not Available[18]	27 600 (c)	25 700 (h)
			75/25	Dilution Not Applicable				Dilution Not Applicable			
			50/50	Dilution Not Applicable				Dilution Not Applicable			
FCY-EGIV	EG	24-07-05	100/0	Not tested[11]		-29	-20	24 800 (f)	6 300 (a)	43 700 (j)	78 000 (c)
			75/25	Dilution Not Applicable				Dilution Not Applicable			
			50/50	Dilution Not Applicable				Dilution Not Applicable			

F. Cautions and Notes for FAA Tables 51, 52, 53, 54

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CAUTIONS AND NOTES FOR TABLES 51, 52, 53, 54

CAUTIONS

- These tables list fluids that have been tested with respect to endurance time performance (Holdover Times), anti-icing performance (Water Spray Endurance Testing/High Humidity Endurance Testing) and aerodynamic acceptance (Type I: SAE ARP6207 §3.4.1, AMS1424 §3.5.2 and §3.5.3; Type II/ III/ IV: SAE ARP5718 §FOREWARD, AMS1428 §3.2.4 and §3.2.5) only. These tests were conducted by APS Aviation Inc. (www.apsaviation.ca) and Anti-icing Materials International Laboratory (AMIL) (www.uqac.ca/amil). The end user is responsible for contacting the fluid manufacturer to confirm all other SAE AMS1424/1428 technical requirement tests, such as fluid stability, toxicity, materials compatibility, etc. have been conducted. These technical requirement tests are typically conducted by Scientific Material International (SMI) (www.smiinc.com) and AMIL, or any acceptable source.
- LOUT data provided in these tables is based strictly on the manufacturer's data; the end user is responsible for verifying the validity of this data.
- Type I fluids supplied in concentrated form must not be used in that form and must be diluted.

NOTES

1 PG = conventional glycol (propylene glycol); EG = conventional glycol (ethylene glycol); DEG = conventional glycol (diethylene glycol); NCG = non-conventional glycol (organic non-ionic diols and triols, e.g. 1,3-propanediol, glycerine) and mixtures of non-conventional glycol and conventional glycol; NG = non-glycol (e.g. organic salts) and mixtures of non-glycol and glycol.

2 Expiry date is the earlier expiry date of the Aerodynamic Test(s) or Water Spray Endurance Test. Fluids that are tested after the issuance of this list will appear in a later update.

3 The values in this table were determined using test results from pre-production fluid samples when available. In some cases, the fluid manufacturer requested the publication of a more conservative value than the pre-production test value. The lowest operational use temperature (LOUT) for a given fluid is the higher (warmer) of:

a) The lowest temperature at which the fluid meets the aerodynamic acceptance test for a given aircraft type; or
b) The actual freezing point of the fluid plus its freezing point buffer (Type I = 10 °C/18 °F; Type II/III/IV = 7 °C/13 °F).

Note: LOUTs are rounded to the nearest half degree Celsius and the values in degrees Fahrenheit are calculated to the nearest whole degree.

4 The LOUT for Type I fluids that are intended to be diluted is derived from a dilution that provides the lowest operational use temperature. For other Type I dilutions, determine the freezing point of the fluid and add a 10 °C freezing point buffer, as a dilution will usually yield a higher and more restrictive operational use temperature. Consult the fluid manufacturer or fluid documentation for further clarification and guidance on establishing the appropriate operational use temperature of a diluted fluid.

5 Type I concentrate fluids have also been tested at 50/50 (glycol/water) dilution.

6 If uncertain whether the aircraft to be treated conforms to the low speed, the middle speed, or the high speed aerodynamic test, consult the aircraft manufacturer. The aerodynamic test is defined in SAE AS5900 (latest version).

7 The Alternate viscosity method should only be used for field verification and auditing purposes; when in doubt as to which method is appropriate, use the manufacturer method. Viscosity measurement methods are indicated as letters (in parentheses) beside each viscosity value. Details of each measurement method are shown in the table on the following page. The exact measurement method (spindle, container, fluid volume, temperature, speed, duration) must be used to compare the viscosity of a sample to a viscosity given in this table.

8 The lowest on-wing viscosity (LOWV), and highest on-wing viscosity (HOWV) values in this table are those of the fluids provided by the manufacturers for holdover time testing, and initial qualification aerodynamic testing. For the holdover times and lowest operation use temperature to be valid, the viscosity of the fluid on the wing shall not be lower than the LOWV value in this table and higher than the HOWV value in this table. The user should periodically ensure that the viscosity of a fluid sample taken from the wing surface complies with these limits.

9 Aerodynamic Performance and Anti-Icing Performance test data has expired; fluids listed in italics will be removed from this listing four years after expiry.

10 Manufacturer has not provided fluid information as required in SAE ARP5718B; fluid may be removed from this listing in subsequent revisions.

11 Manufacturer has indicated fluid was not tested.

12 For DeiceX PG ADF Concentrate, refer to primary site qualification of UCAR™ PG ADF Concentrate.

13 Currently in the test/re-test process. Contact the fluid manufacturer for latest information (see Appendix C for latest available contact information).

14 Fluid was not retested for low speed aerodynamics. This data will be removed four years after the expiry of the last low speed test.

15 For UCAR™ ADF XL54, refer to primary site qualification of UCAR™ ADF Concentrate.

16 For UCAR™ PG ADF Dilute 55/45, refer to primary site qualification of UCAR™ PG ADF Concentrate.

17 Dow UCAR™ ADF Concentrate, sold under the product name Inland ADF Concentrate, qualified from 2015-09-04.

18 Refer to preproduction qualification of SafeTemp® ES Plus submitted by HOC Industries, qualified from 2017-11-20.

19 Manufacturer has not provided an alternate method for measuring viscosity. Please use the Manufacturer Method.

G. FAA Table 55: Viscosity measurement methods for Type II, III, and IV Fluids Tested for Anti-Icing Performance and Aerodynamic Acceptance

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TABLE 55:
VISCOSITY MEASUREMENT METHODS FOR TYPE II, III, AND IV FLUIDS TESTED FOR ANTI-ICING PERFORMANCE AND AERODYNAMIC ACCEPTANCE

Method	Brookfield Spindle*	Container	Fluid Volume	Temp.**	Speed	Duration
a	LV1 (with guard leg)	600 mL low form (Griffin) beaker	575 mL***	20 °C	0.3 rpm	10.0 minutes
b	LV1 (with guard leg)	600 mL low form (Griffin) beaker	575 mL***	20 °C	0.3 rpm	33.3 minutes
c	LV2-disc (with guard leg)	600 mL low form (Griffin) beaker	425 mL***	20 °C	0.3 rpm	10.0 minutes
d	LV2-disc (with guard leg)	150 mL tall form (Berzelius) beaker	135 mL***	20 °C	0.3 rpm	10.0 minutes
e	SC4-34/13R	small sample adapter	10 mL	20 °C	0.3 rpm	10.0 minutes
f	SC4-34/13R	small sample adapter	10 mL	0 °C	0.3 rpm	30.0 minutes
g	SC4-31/13R	small sample adapter	10 mL	20 °C	0.3 rpm	10.0 minutes
h	SC4-31/13R	small sample adapter	10 mL	20 °C	0.3 rpm	30.0 minutes
i	SC4-31/13R	small sample adapter	10 mL	0 °C	0.3 rpm	10.0 minutes
j	SC4-31/13R	small sample adapter	10 mL	0 °C	0.3 rpm	30.0 minutes
k	SC4-31/13R	small sample adapter	9 mL	20 °C	0.3 rpm	15.0 minutes
l	SC4-31/13R	small sample adapter	9 mL	0 °C	0.3 rpm	10.0 minutes
m	SC4-31/13R	small sample adapter	9 mL	0 °C	0.3 rpm	30.0 minutes
n	SC4-31/13R	small sample adapter	9 mL	0 °C	0.3 rpm	65.0 minutes
o	LV0	ultra low adapter	16 mL	20 °C	0.3 rpm	10.0 minutes
p	LV1	big sample adapter	50 mL	20 °C	0.3 rpm	10.0 minutes
q	LV1	big sample adapter	55 mL	20 °C	0.3 rpm	10.0 minutes
r	LV2-disc	big sample adapter	60 mL	20 °C	0.3 rpm	10.0 minutes

* Spindle must be attached to a Brookfield viscometer model equipped with an LV spring.

** Sample temperature will affect readings; ensure sufficient time is allowed for sample to reach thermal equilibrium before starting test. Use of a cooling bath strongly recommended.

*** If necessary, adjust fluid volume to ensure fluid is level with notch on the spindle shaft.

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H. FAA Table 56: Guidelines for the Application of SAE Type I Fluid

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TABLE 56: GUIDELINES FOR THE APPLICATION OF SAE TYPE I FLUID

Outside Air Temperature (OAT)[1]	One-Step Procedure De/Anti-icing[2]	Two-Step Procedure	
		First Step: Deicing	Second Step: Anti-icing[3]
0 °C (32 °F) and above	Fluid/water mixture heated to at least 60°C (140°F) at the nozzle with a freezing point of at least 10°C (18°F) below OAT	Heated water or a heated fluid/water mixture	Fluid/water mixture heated to at least 60°C (140°F) at the nozzle with a freezing point of at least 10°C (18°F) below OAT
Below 0 °C (32 °F) to LOUT		Heated fluid/water mixture with a freezing point at OAT or below	

NOTES

1 Fluids must not be used at temperatures below their lowest operational use temperature (LOUT).
2 When anti-icing using the one-step procedure, a minimum quantity of 1 litre/m^2 (~2 gal./100 sq. ft.) of Type I fluid mixture heated to at least 60°C (140°F) is required after all frozen contamination is removed. This is achieved using a continuous process. This application is necessary to heat the surfaces, as heat contributes significantly to the Type I fluid holdover times.
3 To be applied before first-step fluid freezes, typically within 3 minutes. This time may be higher than 3 minutes in some conditions, but potentially lower in heavy precipitation, colder temperatures, or for critical surfaces constructed of composite materials. If necessary, the second step shall be applied area by area (sectionally).

CAUTIONS

- This table is applicable for the use of Type I holdover time guidelines in all conditions, including active frost. If holdover times are not required, a temperature of 60 °C (140 °F) at the nozzle is desirable.
- If holdover times are required, the temperature of water or fluid/water mixtures shall be at least 60 °C (140 °F) at the nozzle. Upper temperature limit shall not exceed fluid and aircraft manufacturers' recommendations.
- To use Type I Holdover Times Guidelines in all conditions including active frost, an additional minimum of 1 liter/m^2 (~2 gal./100 sq. ft.) of heated Type I fluid mixture must be applied to the surfaces after all frozen contamination is removed. This application is necessary to heat the surfaces, as heat contributes significantly to the Type I fluid holdover times. The required protection can be provided using a 1-step method by applying more fluid than is strictly needed to just remove all of the frozen contamination (the same additional amount stated above is required).
- The lowest operational use temperature (LOUT) for a given Type I fluid is the higher (warmer) of:
  a) The lowest temperature at which the fluid meets the aerodynamic acceptance test for a given aircraft type; or
  b) The actual freezing point of the fluid plus a freezing point buffer of 10 °C (18 °F).
- Wing skin temperatures may be colder or warmer than the OAT. Causes can include: radiation cooling, cold-soaked wing, or hangar storage. Consult the appropriate guidance (HOT Tables and FAA Ground Deicing General Information Document, Winter 2023-2024") for the contaminant in question.
- When conducting aircraft deicing using a Type I fluid and not using the 10 °C/18 °F buffer, procedures must be developed and approved to ensure refreezing does not occur prior to takeoff.

I. FAA Table 57: Guidelines for the Application of SAE Type II and IV Fluid

FAA Holdover Time Guidelines **Winter 2023-2024**

TABLE 57: GUIDELINES FOR THE APPLICATION OF SAE TYPE II AND IV FLUID

(FLUID CONCENTRATIONS IN % VOLUME)

Outside Air Temperature (OAT)[1]	One-Step Procedure De/Anti-icing	Two-Step Procedure	
		First Step: Deicing	Second Step: Anti-icing[2]
0 °C (32 °F) and above	100/0, 75/25 or 50/50 Heated[3] Type II or IV fluid/water mixture	Heated water or a heated Type I, II, III, or IV fluid/water mixture	100/0, 75/25 or 50/50 Heated or unheated Type II or IV fluid/water mixture
Below 0 °C (32 °F) to -3 °C (27 °F)	100/0, 75/25 or 50/50 Heated[3] Type II or IV fluid/water mixture	Heated Type I, II, III, or IV fluid/water mixture with a freezing point at OAT or below	100/0, 75/25 or 50/50 Heated or unheated Type II or IV fluid/water mixture
Below -3 °C (27 °F) to -14 °C (7 °F)	100/0 or 75/25 Heated[3] Type II or IV fluid/water mixture	Heated Type I, II, III, or IV fluid/water mixture with a freezing point at OAT or below	100/0 or 75/25 Heated or unheated Type II or IV fluid/water mixture
Below -14 °C (7 °F) to LOUT	100/0 Heated[3] Type II or IV fluid	Heated Type I, II, III, or IV fluid/water mixture with a freezing point at OAT or below	100/0 Heated or unheated Type II or IV fluid

NOTES

1 Fluids used for the anti-icing procedure must not be used at temperatures below their lowest operational use temperature (LOUT). First step fluids must not be used below their freezing points. Consideration should be given to the use of Type I/III fluid when Type II/IV fluid cannot be used due to LOUT limitations (see Tables 55 and 57). The LOUT for a given Type II/IV fluid is the higher (warmer) of:

a) The lowest temperature at which the fluid meets the aerodynamic acceptance test for a given aircraft type; or
b) The actual freezing point of the fluid plus its freezing point buffer of 7 °C (13 °F).

Although some LOUTs are lower than the temperatures stated in the HOT table, holdover times do not apply when anti-icing below the lowest temperature stated in the band.

2 To be applied before first step fluid freezes, typically within 3 minutes. Time may be longer than 3 minutes in some conditions, but potentially shorter in heavy precipitation, colder temperatures, or for critical surfaces constructed of composite materials. If necessary, the second step shall be applied area by area (sectionally).

3 Clean aircraft may be anti-iced with unheated fluid.

CAUTIONS

- For heated fluids, a fluid temperature not less than 60 °C (140 °F) at the nozzle is desirable.
- Upper temperature limit shall not exceed fluid and aircraft manufacturers' recommendations.
- Wing skin temperatures may be colder or warmer than the OAT. Causes can include: radiation cooling, cold-soaked wing, or hangar storage. Consult the appropriate guidance (HOT Tables and FAA Ground Deicing General Information Document, Winter 2023-2024") for the contaminant in question.
- Whenever frost or ice occurs on the lower surface of the wing in the area of the fuel tank, indicating a cold-soaked wing, the 50/50 dilutions of Type II or IV shall not be used for the anti-icing step because fluid freezing may occur.
- An insufficient amount of anti-icing fluid may cause a substantial loss of holdover time. This is particularly true when using a Type I fluid mixture for the first step in a two-step procedure.
- When conducting aircraft deicing using a Type I fluid and not using the 10 °C/18 °F buffer, procedures must be developed and approved to ensure refreezing does not occur prior to takeoff.

J. FAA Table 58: Guidelines for the Application of Unheated SAE Type III Fluid

FAA Holdover Time Guidelines **Winter 2023-2024**

TABLE 58: GUIDELINES FOR THE APPLICATION OF UNHEATED SAE TYPE III FLUID

(FLUID CONCENTRATIONS IN % VOLUME)

Outside Air Temperature (OAT)[1]	Anti-icing Only[4]	Two-Step Procedure	
		First Step: Deicing	Second Step: Anti-icing[2]
0 °C (32 °F) and above	100/0, 75/25 or 50/50 Unheated Type III fluid/water mixture	Heated[3] water or a heated[3] Type I, II, III, or IV fluid/water mixture	100/0, 75/25 or 50/50 Unheated Type III fluid/water mixture
Below 0 °C (32 °F) to -3 °C (27 °F)	100/0, 75/25 or 50/50 Unheated Type III fluid/water mixture	Heated[3] Type I, II, III, or IV fluid/water mixture with a freezing point at OAT or below	100/0, 75/25 or 50/50 Unheated Type III fluid/water mixture
Below -3 °C (27 °F) to -10 °C (14 °F)	100/0 or 75/25 Unheated Type III fluid/water mixture	Heated[3] Type I, II, III, or IV fluid/water mixture with a freezing point at OAT or below	100/0 or 75/25 Unheated Type III fluid/water mixture
Below -10 °C (14 °F) to LOUT	100/0 Unheated Type III fluid	Heated[3] Type I, II, III, or IV fluid/water mixture with a freezing point at OAT or below	100/0 Unheated Type III fluid

NOTES

1 Fluids used for the anti-icing procedure must not be used at temperatures below their lowest operational use temperature (LOUT). First step fluids must not be used below their freezing points. Consider the use of Type I when Type III fluid cannot be used (see Table 56). The LOUT for a given Type III fluid is the higher (warmer) of:

a) The lowest temperature at which the fluid meets the aerodynamic acceptance test for a given aircraft type; or
b) The actual freezing point of the fluid plus its freezing point buffer of 7 °C (13 °F).

Although the LOUTs may be lower than the temperatures stated in the HOT table, holdover times do not apply when anti-icing below the lowest temperature stated in the band.

2 To be applied before first step fluid freezes, typically within 3 minutes. This time may be longer than 3 minutes in some conditions, but potentially shorter in heavy precipitation, colder temperatures, or for critical surfaces constructed of composite materials. If necessary, the second step shall be applied area by area (sectionally).

3 For heated fluids, a fluid temperature not less than 60 °C (140 °F) at the nozzle is desirable.

4 Anti-icing only with unheated Type III fluid is only possible on a clean aircraft. If deicing is required, a two-step procedure must be used.

CAUTIONS

- Upper temperature limit shall not exceed fluid and aircraft manufacturers' recommendations.
- Wing skin temperatures may be colder or warmer than the OAT. Causes can include: radiation cooling, cold-soaked wing, or hangar storage. Consult the appropriate guidance (HOT Tables and FAA Ground Deicing General Information Document, Winter 2023-2024") for the contaminant in question.
- Whenever frost or ice occurs on the lower surface of the wing in the area of the fuel tank, indicating a cold-soaked wing, the 50/50 dilutions of Type III shall not be used for the anti-icing step because fluid freezing may occur.
- An insufficient amount of anti-icing fluid may cause a substantial loss of holdover time. This is particularly true when using a Type I fluid mixture for the first step in a two-step procedure.
- When conducting aircraft deicing using a Type I fluid and not using the 10 °C/18 °F buffer, procedures must be developed and approved to ensure refreezing does not occur prior to takeoff.

F.18 Adjusted Holdover Time (HOT) Tables

These tables are for use when flaps/slats are deployed prior to de/anti-icing. Holdover and allowance times have been adjusted to 76 percent of standard times. Standard holdover and allowance times can be used if flaps and slats are deployed as close to departure as safety allows.

NOTE

Industry data indicates the possibility of increased takeoff misconfigurations when the selection of takeoff flaps is delayed later in the taxi regime. If an air carrier chooses to select the flaps/slats to the takeoff configuration prior to beginning the anti-icing process, operators should have robust procedures in place to ensure that the aircraft is properly configured prior to takeoff. Air Carriers should follow the airframe manufacturer's recommended procedures regarding anti-icing operations and the configuration of flaps/slats while taxiing.

F.18.1 Adjusted Active Frost HOT Guidelines (FAA Table ADJ-1)

CAUTION

- *The responsibility for the application of these data remains with the user.*
- *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 pre-takeoff check procedures.*

TABLE ADJ-1: ADJUSTED ACTIVE FROST HOLDOVER TIMES FOR SAE TYPE I, TYPE II, TYPE III, AND TYPE IV FLUIDS[1]

Outside Air Temperature[2,3,4]	Type I
-1 °C and above (30 °F and above)	0:34 *(0:27)*[6]
below -1 to -3 °C (below 30 to 27 °F)	
below -3 to -10 °C (below 27 to 14 °F)	
below -10 to -14 °C (below 14 to 7 °F)	
below -14 to -21 °C (below 7 to -6 °F)	
below -21 to -25 °C (below -6 to -13 °F)	
below -25 °C to LOUT (below -13 °F to LOUT)	

Outside Air Temperature[3,4]	Concentration Fluid/Water By % Volume	Type II	Type III[5]	Type IV
-1 °C and above (30 °F and above)	100/0	6:05	1:31	9:07
	75/25	3:48	0:46	3:48
	50/50	1:31	0:23	2:17
below -1 to -3 °C (below 30 to 27 °F)	100/0	6:05	1:31	9:07
	75/25	3:48	0:46	3:48
	50/50	1:08	0:23	2:17
below -3 to -10 °C (below 27 to 14 °F)	100/0	6:05	1:31	7:36
	75/25	3:02	0:46	3:48
below -10 to -14 °C (below 14 to 7 °F)	100/0	4:34	1:31	4:34
	75/25	0:46	0:46	0:46
below -14 to -21 °C (below 7 to -6 °F)	100/0	2:17	1:31	4:34
below -21 to -25 °C (below -6 to -13 °F)	100/0	1:31	1:31	3:02
below -25 °C (below -13 °F)	100/0	No Holdover Time Guidelines Exist		

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 To use the HOTs in this table, ensure that the fluid and dilution being used is listed in the List of Qualified Fluids Tested for Anti-Icing Performance and Aerodynamic Acceptance table (Table 51 - Table 54). Any restrictions on the use of the fluid have to be identified and applied.
2 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.
3 Ensure that the lowest operational use temperature (LOUT) is respected.
4 Changes in outside air temperature (OAT) over the course of longer frost events can be significant; the appropriate holdover time to use is the one provided for the coldest OAT that has occurred in the time between the de/anti-icing fluid application and takeoff.
5 To use the Type III fluid frost holdover times, the fluid brand being used must be known. AllClear AeroClear MAX must be applied unheated.
6 Value in parentheses is for aircraft with critical surfaces that are predominantly or entirely constructed of composite materials.

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-4.

F.18.2 Adjusted HOT Guidelines for SAE Type I Fluids (FAA Tables ADJ-2 and ADJ-3)

CAUTION

- *The responsibility for the application of these data remains with the user.*
- *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 outside air temperature.*
- *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 pre-takeoff check procedures.*

A. FAA Table ADJ-2: Adjusted Holdover Times for SAE Type I Fluid on Critical Aircraft Surfaces Composed Predominantly of Aluminum

Appendix A: FAA Adjusted Holdover Time Guidelines **Winter 2023-2024**

TABLE ADJ-2: ADJUSTED HOLDOVER TIMES FOR SAE TYPE I FLUID ON CRITICAL AIRCRAFT SURFACES COMPOSED PREDOMINANTLY OF ALUMINUM

Outside Air Temperature[1,2]	Freezing Fog, Freezing Mist[3], or Ice Crystals[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6,7]	Light Snow, Snow Grains or Snow Pellets[5,6,7]	Moderate Snow, Snow Grains or Snow Pellets[5,7]	Freezing Drizzle[8]	Light Freezing Rain	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	0:08 - 0:13	0:14 - 0:17	0:08 - 0:14	0:05 - 0:08	0:07 - 0:10	0:02 - 0:04	0:02 - 0:04	CAUTION: No holdover time guidelines exist
below -3 to -6 °C (below 27 to 21 °F)	0:06 - 0:10	0:11 - 0:13	0:06 - 0:11	0:04 - 0:06	0:04 - 0:07	0:02 - 0:04		
below -6 to -10 °C (below 21 to 14 °F)	0:05 - 0:08	0:08 - 0:10	0:05 - 0:08	0:03 - 0:05	0:03 - 0:05	0:02 - 0:04		
below -10 °C (below 14 °F)	0:04 - 0:07	0:05 - 0:06	0:03 - 0:05	0:02 - 0:03				

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

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) is respected.
3 Freezing mist is best confirmed by observation. It is never reported by METAR however it can occur when mist is present at 0 °C (32 °F) and below.
4 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or mist.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required.
6 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain or drizzle. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required to confirm the precipitation intensity is no greater than "light". No holdover times exist if the reported visibility correlates to a "moderate" or "heavy" precipitation intensity.
7 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
8 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-6.

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TABLE ADJ-3: ADJUSTED HOLDOVER TIMES FOR SAE TYPE I FLUID ON CRITICAL AIRCRAFT SURFACES COMPOSED PREDOMINANTLY OF COMPOSITES

Outside Air Temperature[1,2]	Freezing Fog, Freezing Mist[3], or Ice Crystals[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6,7]	Light Snow, Snow Grains or Snow Pellets[5,6,7]	Moderate Snow, Snow Grains or Snow Pellets[5,7]	Freezing Drizzle[8]	Light Freezing Rain	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	0:07 - 0:12	0:09 - 0:11	0:05 - 0:09	0:02 - 0:05	0:06 - 0:10	0:02 - 0:04	0:01 - 0:04	
below -3 to -6 °C (below 27 to 21 °F)	0:05 - 0:06	0:08 - 0:10	0:04 - 0:08	0:02 - 0:04	0:04 - 0:07	0:02 - 0:04	CAUTION: No holdover time guidelines exist	
below -6 to -10 °C (below 21 to 14 °F)	0:03 - 0:06	0:07 - 0:09	0:04 - 0:07	0:02 - 0:04	0:03 - 0:05	0:02 - 0:04		
below -10 °C (below 14 °F)	0:03 - 0:05	0:05 - 0:06	0:03 - 0:05	0:02 - 0:03				

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

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) is respected.
3 Freezing mist is best confirmed by observation. It is never reported by METAR however it can occur when mist is present at 0 °C (32 °F) and below.
4 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or mist.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required.
6 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain or drizzle. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required to confirm the precipitation intensity is no greater than “light”. No holdover times exist if the reported visibility correlates to a “moderate” or “heavy” precipitation intensity.
7 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
8 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-6.

F.18.3 Adjusted HOT Guidelines for SAE Type II Fluids (FAA Tables ADJ-4 – ADJ-16)

CAUTION

- *The responsibility for the application of these data remains with the user.*
- *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 outside air temperature.*
- *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 pre-takeoff check procedures.*

A. FAA Table ADJ-4: Adjusted Generic Holdover Times for SAE Type II Fluids

TABLE ADJ-4: ADJUSTED GENERIC HOLDOVER TIMES FOR SAE TYPE II FLUIDS[1]

Outside Air Temperature[2]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[3], or Ice Crystals[4]	Snow, Snow Grains or Snow Pellets[5,6,7]	Freezing Drizzle[8]	Light Freezing Rain	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	0:42 - 1:24	0:23 - 0:42	0:23 - 0:46	0:15 - 0:27	0:05 - 0:34	
	75/25	0:30 - 0:53	0:11 - 0:23	0:19 - 0:30	0:11 - 0:19	0:03 - 0:19	
	50/50	0:11 - 0:23	0:05 - 0:11	0:07 - 0:11	0:05 - 0:07	CAUTION: No holdover time guidelines exist	
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:23 - 0:34	0:15 - 0:30	0:15 - 0:34	0:11 - 0:15		
	75/25	0:19 - 0:42	0:08 - 0:19	0:11 - 0:23	0:06 - 0:11		
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:23 - 0:34	0:11 - 0:23	0:15 - 0:34[11]	0:11 - 0:15[11]		
	75/25	0:19 - 0:42	0:07 - 0:15	0:11 - 0:23[11]	0:06 - 0:11[11]		
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:11 - 0:15	0:02 - 0:05				
below -18 to -25 °C[12] (below 0 to -13 °F)	100/0	0:11 - 0:15	0:01 - 0:02				
below -25 °C to LOUT[12] (below -13 °F to LOUT)	100/0	0:11 - 0:15	0:00 - 0:01				

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 To use the HOTs in this table, ensure that the fluid and dilution being used is listed in the Type II Fluids Tested for Anti-Icing Performance and Aerodynamic Acceptance table (Table 52). Any restrictions on the use of the fluid have to be identified and applied.
2 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type II fluid cannot be used.
3 Freezing mist is best confirmed by observation. It is never reported by METAR however it can occur when mist is present at 0 °C (32 °F) and below.
4 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or mist.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required.
6 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain or drizzle. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required to confirm the precipitation intensity is no greater than “light”. No holdover times exist if the reported visibility correlates to a “moderate” or “heavy” precipitation intensity.
7 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
8 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
11 No holdover time guidelines exist for this condition below -10 °C (14 °F).
12 If the LOUT is unknown, no holdover time guidelines exist below -25 °C (-13 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-9.

TABLE ADJ-5: ADJUSTED TYPE II HOLDOVER TIMES FOR ABAX ECOWING AD-2

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Very Light Snow, Snow Grains or Snow Pellets[4,5,6]	Light Snow, Snow Grains or Snow Pellets[4,5,6]	Moderate Snow, Snow Grains or Snow Pellets[4,6]	Freezing Drizzle[7]	Light Freezing Rain	Rain on Cold-Soaked Wing[8]	Other[9]
-3 °C and above (27 °F and above)	100/0	1:01 - 2:17	1:50 - 2:13	0:57 - 1:50	0:30 - 0:57	0:30 - 1:16	0:23 - 0:34	0:07 - 1:05	
	75/25	0:57 - 1:05	1:20 - 1:39	0:42 - 1:20	0:19 - 0:42	0:27 - 0:49	0:15 - 0:23	0:03 - 0:38	
	50/50	0:11 - 0:23	0:27 - 0:30	0:11 - 0:27	0:05 - 0:11	0:07 - 0:11	0:05 - 0:07	CAUTION: No holdover time guidelines exist	
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:34 - 1:54	1:31 - 1:50	0:46 - 1:31	0:23 - 0:46	0:19 - 0:53	0:15 - 0:23		
	75/25	0:27 - 1:27	1:16 - 1:35	0:38 - 1:16	0:19 - 0:38	0:11 - 0:42	0:15 - 0:27		
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:34 - 1:54	1:20 - 1:35	0:42 - 1:20	0:23 - 0:42	0:19 - 0:53[10]	0:15 - 0:23[10]		
	75/25	0:27 - 1:27	1:12 - 1:31	0:38 - 1:12	0:19 - 0:38	0:11 - 0:42[10]	0:15 - 0:27[10]		
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:11 - 0:30	0:15 - 0:23	0:05 - 0:15	0:02 - 0:05				
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:11 - 0:30	0:07 - 0:11	0:02 - 0:07	0:01 - 0:02				
below -25 to -27 °C (below -13 to -17 °F)	100/0	0:11 - 0:30	0:04 - 0:05	0:01 - 0:04	0:00 - 0:01				

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type II fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR however it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or mist.
4 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required.
5 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain or drizzle. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required to confirm the precipitation intensity is no greater than “light”. No holdover times exist if the reported visibility correlates to a “moderate” or “heavy” precipitation intensity.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
9 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
10 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-9.

TABLE ADJ-6: ADJUSTED TYPE II HOLDOVER TIMES FOR AVIATION XI'AN HIGH-TECH CLEANWING II

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Very Light Snow, Snow Grains or Snow Pellets[4,5,6]	Light Snow, Snow Grains or Snow Pellets[4,5,6]	Moderate Snow, Snow Grains or Snow Pellets[4,6]	Freezing Drizzle[7]	Light Freezing Rain	Rain on Cold-Soaked Wing[8]	Other[9]
-3 °C and above (27 °F and above)	100/0	0:42 - 1:24	1:12 - 1:27	0:42 - 1:12	0:23 - 0:42	0:27 - 0:49	0:19 - 0:27	0:08 - 0:42	
	75/25	0:38 - 1:01	1:01 - 1:16	0:34 - 1:01	0:19 - 0:34	0:27 - 0:46	0:15 - 0:23	0:05 - 0:38	
	50/50	0:27 - 0:46	0:38 - 0:49	0:19 - 0:38	0:11 - 0:19	0:15 - 0:30	0:08 - 0:15		
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:34 - 1:24	1:01 - 1:12	0:30 - 1:01	0:19 - 0:30	0:23 - 0:42	0:15 - 0:19		
	75/25	0:30 - 1:20	1:01 - 1:12	0:34 - 1:01	0:19 - 0:34	0:27 - 0:30	0:15 - 0:19		
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:34 - 1:24	0:49 - 1:01	0:27 - 0:49	0:15 - 0:27	0:23 - 0:42[10]	0:15 - 0:19[10]	CAUTION: No holdover time guidelines exist	
	75/25	0:30 - 1:20	1:01 - 1:12	0:34 - 1:01	0:19 - 0:34	0:27 - 0:30[10]	0:15 - 0:19[10]		
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:15 - 0:38	0:34 - 0:46	0:19 - 0:34	0:11 - 0:19				
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:15 - 0:38	0:23 - 0:27	0:11 - 0:23	0:05 - 0:11				

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type II fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR however it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or mist.
4 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required.
5 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain or drizzle. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required to confirm the precipitation intensity is no greater than "light". No holdover times exist if the reported visibility correlates to a "moderate" or "heavy" precipitation intensity.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
9 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
10 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-9.

TABLE ADJ-7: ADJUSTED TYPE II HOLDOVER TIMES FOR CLARIANT SAFEWING MP II FLIGHT

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Very Light Snow, Snow Grains or Snow Pellets[4,5,6]	Light Snow, Snow Grains or Snow Pellets[4,5,6]	Moderate Snow, Snow Grains or Snow Pellets[4,6]	Freezing Drizzle[7]	Light Freezing Rain	Rain on Cold-Soaked Wing[8]	Other[9]
-3 °C and above (27 °F and above)	100/0	2:40 - 3:02	1:58 - 2:21	1:12 - 1:58	0:46 - 1:12	1:01 - 1:31	0:34 - 1:05	0:08 - 1:08	
	75/25	1:24 - 2:05	1:58 - 2:24	1:01 - 1:58	0:30 - 1:01	0:53 - 1:08	0:23 - 0:42	0:05 - 0:38	
	50/50	0:42 - 1:20	0:34 - 0:42	0:19 - 0:34	0:08 - 0:19	0:15 - 0:23	0:08 - 0:11	CAUTION: No holdover time guidelines exist	
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:42 - 1:20	1:35 - 1:54	0:57 - 1:35	0:34 - 0:57	0:27 - 1:08	0:19 - 0:34		
	75/25	0:19 - 0:49	1:20 - 1:39	0:42 - 1:20	0:23 - 0:42	0:19 - 0:53	0:15 - 0:27		
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:42 - 1:20	1:24 - 1:39	0:49 - 1:24	0:30 - 0:49	0:27 - 1:08[10]	0:19 - 0:34[10]		
	75/25	0:19 - 0:49	1:01 - 1:16	0:30 - 1:01	0:15 - 0:30	0:19 - 0:53[10]	0:15 - 0:27[10]		
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:23 - 0:38	0:53 - 1:16	0:19 - 0:53	0:06 - 0:19				
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:23 - 0:38	0:23 - 0:30	0:08 - 0:23	0:02 - 0:08				
below -25 to -29 °C (below -13 to -20 °F)	100/0	0:23 - 0:38	0:15 - 0:23	0:05 - 0:15	0:02 - 0:05				

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type II fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR however it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or mist.
4 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required.
5 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain or drizzle. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required to confirm the precipitation intensity is no greater than “light”. No holdover times exist if the reported visibility correlates to a “moderate” or “heavy” precipitation intensity.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
9 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
10 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-9.

TABLE ADJ-8: ADJUSTED TYPE II HOLDOVER TIMES FOR CLARIANT SAFEWING MP II FLIGHT PLUS

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow, Snow Grains or Snow Pellets[4,5,6]	Freezing Drizzle[7]	Light Freezing Rain	Rain on Cold-Soaked Wing[8]	Other[9]
-3 °C and above (27 °F and above)	100/0	2:02 - 3:02	0:38 - 1:24	1:05 - 1:31	0:34 - 0:46	0:11 - 1:31	
	75/25	1:58 - 3:02	0:46 - 1:20	1:12 - 1:31	0:38 - 0:57	0:11 - 0:57	
	50/50	0:49 - 1:46	0:11 - 0:19	0:23 - 0:49	0:11 - 0:15	CAUTION: No holdover time guidelines exist	
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:30 - 1:46	0:30 - 1:08	0:27 - 1:05	0:27 - 0:42		
	75/25	0:23 - 1:20	0:46 - 1:16	0:19 - 0:53	0:23 - 0:34		
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:30 - 1:46	0:27 - 0:57	0:27 - 1:05[10]	0:27 - 0:42[10]		
	75/25	0:23 - 1:20	0:42 - 1:16	0:19 - 0:53[10]	0:23 - 0:34[10]		
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:15 - 0:30	0:02 - 0:05				
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:15 - 0:30	0:01 - 0:02				
below -25 to -29 °C (below -13 to -20 °F)	100/0	0:15 - 0:30	0:00 - 0:01				

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type II fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR however it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or mist.
4 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required.
5 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain or drizzle. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required to confirm the precipitation intensity is no greater than “light”. No holdover times exist if the reported visibility correlates to a “moderate” or “heavy” precipitation intensity.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
9 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
10 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-9.

TABLE ADJ-9: ADJUSTED TYPE II HOLDOVER TIMES FOR CRYOTECH POLAR GUARD® II

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Very Light Snow, Snow Grains or Snow Pellets[4,5,6]	Light Snow, Snow Grains or Snow Pellets[4,5,6]	Moderate Snow, Snow Grains or Snow Pellets[4,6]	Freezing Drizzle[7]	Light Freezing Rain	Rain on Cold-Soaked Wing[8]	Other[9]
-3 °C and above (27 °F and above)	100/0	2:09 - 3:02	2:28 - 2:59	1:27 - 2:28	0:49 - 1:27	1:12 - 1:31	0:57 - 1:08	0:11 - 1:31	
	75/25	1:54 - 3:02	2:17 - 2:55	1:05 - 2:17	0:30 - 1:05	1:16 - 1:31	0:30 - 0:53	0:07 - 1:16	
	50/50	0:38 - 1:05	0:53 - 1:12	0:19 - 0:53	0:08 - 0:19	0:15 - 0:34	0:07 - 0:15	CAUTION: No holdover time guidelines exist	
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:42 - 1:54	1:50 - 2:09	1:05 - 1:50	0:38 - 1:05	0:27 - 1:12	0:27 - 0:34		
	75/25	0:30 - 1:08	1:46 - 2:17	0:49 - 1:46	0:23 - 0:49	0:19 - 0:49	0:27 - 0:34		
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:42 - 1:54	1:31 - 1:46	0:53 - 1:31	0:30 - 0:53	0:27 - 1:12[10]	0:27 - 0:34[10]		
	75/25	0:30 - 1:08	1:31 - 1:54	0:42 - 1:31	0:19 - 0:42	0:19 - 0:49[10]	0:27 - 0:34[10]		
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:19 - 0:38	1:12 - 1:43	0:27 - 1:12	0:08 - 0:27				
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:19 - 0:38	0:30 - 0:42	0:11 - 0:30	0:03 - 0:11				
below -25 to -30.5 °C (below -13 to -23 °F)	100/0	0:19 - 0:38	0:19 - 0:23	0:05 - 0:19	0:02 - 0:05				

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type II fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR however it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or mist.
4 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required.
5 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain or drizzle. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required to confirm the precipitation intensity is no greater than “light”. No holdover times exist if the reported visibility correlates to a “moderate” or “heavy” precipitation intensity.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
9 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
10 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-9.

TABLE ADJ-10: ADJUSTED TYPE II HOLDOVER TIMES FOR JSC RCP NORDIX DEFROST PG 2

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Very Light Snow, Snow Grains or Snow Pellets[4,5,6]	Light Snow, Snow Grains or Snow Pellets[4,5,6]	Moderate Snow, Snow Grains or Snow Pellets[4,6]	Freezing Drizzle[7]	Light Freezing Rain	Rain on Cold-Soaked Wing[8]	Other[9]
-3 °C and above (27 °F and above)	100/0	0:42 - 1:24	1:24 - 1:43	0:42 - 1:24	0:23 - 0:42	0:23 - 0:46	0:15 - 0:27	0:08 - 1:01	
	75/25	0:49 - 1:31	1:20 - 1:43	0:34 - 1:20	0:15 - 0:34	0:19 - 0:38	0:11 - 0:23	0:05 - 0:27	
	50/50	0:46 - 1:24	1:39 - 2:02	0:46 - 1:39	0:23 - 0:46	0:23 - 0:38	0:11 - 0:23		
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:42 - 1:05	1:05 - 1:20	0:34 - 1:05	0:19 - 0:34	0:27 - 0:38	0:15 - 0:23		
	75/25	0:30 - 1:01	0:53 - 1:08	0:23 - 0:53	0:11 - 0:23	0:19 - 0:30	0:11 - 0:15		
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:42 - 1:05	0:57 - 1:08	0:30 - 0:57	0:15 - 0:30	0:27 - 0:38[10]	0:15 - 0:23[10]		
	75/25	0:30 - 1:01	0:42 - 0:49	0:19 - 0:42	0:08 - 0:19	0:19 - 0:30[10]	0:11 - 0:15[10]		
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:27 - 0:49	0:15 - 0:23	0:05 - 0:15	0:02 - 0:05				
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:27 - 0:49	0:07 - 0:11	0:02 - 0:07	0:01 - 0:02				
below -25 to -27 °C (below -13 to -17 °F)	100/0	0:27 - 0:49	0:04 - 0:05	0:01 - 0:04	0:00 - 0:01				

CAUTION: No holdover time guidelines exist

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type II fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR however it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or mist.
4 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required.
5 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain or drizzle. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required to confirm the precipitation intensity is no greater than “light”. No holdover times exist if the reported visibility correlates to a “moderate” or “heavy” precipitation intensity.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
9 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
10 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-9.

TABLE ADJ-11: ADJUSTED TYPE II HOLDOVER TIMES FOR KILFROST ABC-K PLUS

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow, Snow Grains or Snow Pellets[4,5,6]	Freezing Drizzle[7]	Light Freezing Rain	Rain on Cold-Soaked Wing[8]	Other[9]
-3 °C and above (27 °F and above)	100/0	1:43 - 2:51	0:46 - 1:16	1:24 - 1:31	0:46 - 1:05	0:15 - 1:31	
	75/25	1:16 - 1:54	0:27 - 0:53	1:05 - 1:31	0:38 - 0:53	0:11 - 1:31	
	50/50	0:27 - 0:49	0:05 - 0:11	0:15 - 0:23	0:08 - 0:11	CAUTION: No holdover time guidelines exist	
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:23 - 0:49	0:42 - 1:08	0:19 - 0:46	0:11 - 0:27		
	75/25	0:19 - 1:05	0:27 - 0:49	0:15 - 0:42	0:07 - 0:23		
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:23 - 0:49	0:38 - 1:05	0:19 - 0:46[10]	0:11 - 0:27[10]		
	75/25	0:19 - 1:05	0:27 - 0:49	0:15 - 0:42[10]	0:07 - 0:23[10]		
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:23 - 0:42	0:02 - 0:05				
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:23 - 0:42	0:01 - 0:02				
below -25 to -29 °C (below -13 to -20 °F)	100/0	0:23 - 0:42	0:00 - 0:01				

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type II fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR however it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or mist.
4 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required.
5 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain or drizzle. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required to confirm the precipitation intensity is no greater than “light”. No holdover times exist if the reported visibility correlates to a “moderate” or “heavy” precipitation intensity.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
9 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
10 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-9.

TABLE ADJ-12: ADJUSTED TYPE II HOLDOVER TIMES FOR KILFROST ICE CLEAR II

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Very Light Snow, Snow Grains or Snow Pellets[4,5,6]	Light Snow, Snow Grains or Snow Pellets[4,5,6]	Moderate Snow, Snow Grains or Snow Pellets[4,6]	Freezing Drizzle[7]	Light Freezing Rain	Rain on Cold-Soaked Wing[8]	Other[9]
-3 °C and above (27 °F and above)	100/0	1:05 - 1:50	1:50 - 2:13	1:01 - 1:50	0:30 - 1:01	0:46 - 1:12	0:30 - 0:49	0:11 - 1:31	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A		
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:49 - 1:58	1:39 - 1:58	0:53 - 1:39	0:30 - 0:53	0:23 - 0:57	0:27 - 0:42		
	75/25	N/A	N/A	N/A	N/A	N/A	N/A		
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:49 - 1:58	1:31 - 1:50	0:49 - 1:31	0:27 - 0:49	0:23 - 0:57[10]	0:27 - 0:42[10]		
	75/25	N/A	N/A	N/A	N/A	N/A	N/A		
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:27 - 0:34	0:42 - 0:49	0:23 - 0:42	0:11 - 0:23				
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:27 - 0:34	0:23 - 0:27	0:11 - 0:23	0:06 - 0:11				
below -25 to -28 °C (below -13 to -18 °F)	100/0	0:27 - 0:34	0:19 - 0:23	0:08 - 0:19	0:05 - 0:08				

CAUTION: No holdover time guidelines exist

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type II fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR however it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or mist.
4 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required.
5 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain or drizzle. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required to confirm the precipitation intensity is no greater than “light”. No holdover times exist if the reported visibility correlates to a “moderate” or “heavy” precipitation intensity.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
9 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
10 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-9.

TABLE ADJ-13: ADJUSTED TYPE II HOLDOVER TIMES FOR MKS DEVO COREICEPHOB TYPE II

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Very Light Snow, Snow Grains or Snow Pellets[4,5,6]	Light Snow, Snow Grains or Snow Pellets[4,5,6]	Moderate Snow, Snow Grains or Snow Pellets[4,6]	Freezing Drizzle[7]	Light Freezing Rain	Rain on Cold-Soaked Wing[8]	Other[9]
-3 °C and above (27 °F and above)	100/0	1:27 - 2:05	1:58 - 2:24	1:05 - 1:58	0:34 - 1:05	0:57 - 1:31	0:34 - 0:53	0:11 - 1:12	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	0:49 - 1:20	1:20 - 1:35	0:46 - 1:20	0:27 - 0:46	0:38 - 0:57	0:19 - 0:30		
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:42 - 1:27	1:24 - 1:43	0:46 - 1:24	0:23 - 0:46	0:23 - 0:53	0:19 - 0:27		
	75/25	N/A	N/A	N/A	N/A	N/A	N/A		
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:42 - 1:27	1:08 - 1:24	0:38 - 1:08	0:19 - 0:38	0:23 - 0:53[10]	0:19 - 0:27[10]		
	75/25	N/A	N/A	N/A	N/A	N/A	N/A		
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:15 - 0:23	0:27 - 0:30	0:15 - 0:27	0:08 - 0:15				
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:15 - 0:23	0:11 - 0:11	0:05 - 0:11	0:03 - 0:05				
below -25 to -27 °C (below -13 to -17 °F)	100/0	0:15 - 0:23	0:08 - 0:08	0:04 - 0:08	0:02 - 0:04				

CAUTION: No holdover time guidelines exist

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type II fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR however it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or mist.
4 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required.
5 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain or drizzle. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required to confirm the precipitation intensity is no greater than “light”. No holdover times exist if the reported visibility correlates to a “moderate” or “heavy” precipitation intensity.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
9 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
10 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-9.

TABLE ADJ-14: ADJUSTED TYPE II HOLDOVER TIMES FOR NEWAVE AEROCHEMICAL FCY-2

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow, Snow Grains or Snow Pellets[4,5,6]	Freezing Drizzle[7]	Light Freezing Rain	Rain on Cold-Soaked Wing[8]	Other[9]
-3 °C and above (27 °F and above)	100/0	0:57 - 1:50	0:23 - 0:42	0:27 - 0:49	0:19 - 0:27	0:06 - 0:34	
	75/25	0:38 - 1:08	0:15 - 0:30	0:19 - 0:34	0:11 - 0:19	0:04 - 0:19	
	50/50	0:19 - 0:27	0:11 - 0:19	0:08 - 0:15	0:05 - 0:08	CAUTION: No holdover time guidelines exist	
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:34 - 1:08	0:15 - 0:30	0:15 - 0:34	0:11 - 0:15		
	75/25	0:23 - 0:49	0:11 - 0:19	0:11 - 0:23	0:06 - 0:11		
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:34 - 1:08	0:11 - 0:23	0:15 - 0:34[10]	0:11 - 0:15[10]		
	75/25	0:23 - 0:49	0:08 - 0:15	0:11 - 0:23[10]	0:06 - 0:11[10]		
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:19 - 0:27	0:02 - 0:05				
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:19 - 0:27	0:01 - 0:02				
below -25 to -28 °C (below -13 to -18 °F)	100/0	0:19 - 0:27	0:00 - 0:01				

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type II fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR however it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or mist.
4 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required.
5 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain or drizzle. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required to confirm the precipitation intensity is no greater than “light”. No holdover times exist if the reported visibility correlates to a “moderate” or “heavy” precipitation intensity.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
9 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
10 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-9.

TABLE ADJ-15: ADJUSTED TYPE II HOLDOVER TIMES FOR ROMCHIM ADD-PROTECT NG TYPE II

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Very Light Snow, Snow Grains or Snow Pellets[4,5,6]	Light Snow, Snow Grains or Snow Pellets[4,5,6]	Moderate Snow, Snow Grains or Snow Pellets[4,6]	Freezing Drizzle[7]	Light Freezing Rain	Rain on Cold-Soaked Wing[8]	Other[9]
-3 °C and above (27 °F and above)	100/0	0:53 - 1:50	1:58 - 2:28	0:53 - 1:58	0:27 - 0:53	0:38 - 1:01	0:27 - 0:38	0:05 - 0:53	
	75/25	0:46 - 1:24	1:27 - 1:50	0:42 - 1:27	0:19 - 0:42	0:30 - 0:57	0:19 - 0:30	0:05 - 0:42	
	50/50	0:19 - 0:42	0:42 - 0:49	0:23 - 0:42	0:11 - 0:23	0:15 - 0:27	0:08 - 0:15		
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:42 - 1:12	1:24 - 1:46	0:38 - 1:24	0:19 - 0:38	0:27 - 0:53	0:19 - 0:27		
	75/25	0:42 - 1:05	1:05 - 1:20	0:30 - 1:05	0:15 - 0:30	0:19 - 0:49	0:15 - 0:23		
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:42 - 1:12	1:05 - 1:24	0:30 - 1:05	0:15 - 0:30	0:27 - 0:53[10]	0:19 - 0:27[10]		
	75/25	0:42 - 1:05	0:49 - 1:05	0:23 - 0:49	0:11 - 0:23	0:19 - 0:49[10]	0:15 - 0:23[10]		
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:11 - 0:15	0:15 - 0:23	0:05 - 0:15	0:02 - 0:05	CAUTION: No holdover time guidelines exist			
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:11 - 0:15	0:07 - 0:11	0:02 - 0:07	0:01 - 0:02				
below -25 to -28 °C (below -13 to -18 °F)	100/0	0:11 - 0:15	0:04 - 0:05	0:01 - 0:04	0:00 - 0:01				

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type II fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR however it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or mist.
4 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required.
5 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain or drizzle. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required to confirm the precipitation intensity is no greater than “light”. No holdover times exist if the reported visibility correlates to a “moderate” or “heavy” precipitation intensity.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
9 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
10 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-9.

TABLE ADJ-16: ADJUSTED TYPE II HOLDOVER TIMES FOR ROMCHIM ADD-PROTECT TYPE II

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Very Light Snow, Snow Grains or Snow Pellets[4,5,6]	Light Snow, Snow Grains or Snow Pellets[4,5,6]	Moderate Snow, Snow Grains or Snow Pellets[4,6]	Freezing Drizzle[7]	Light Freezing Rain	Rain on Cold-Soaked Wing[8]	Other[9]
-3 °C and above (27 °F and above)	100/0	1:16 - 2:40	1:27 - 1:50	0:46 - 1:27	0:23 - 0:46	0:30 - 1:12	0:19 - 0:34	0:07 - 0:38	
	75/25	0:30 - 0:53	0:46 - 0:53	0:23 - 0:46	0:11 - 0:23	0:19 - 0:30	0:11 - 0:19	0:04 - 0:19	
	50/50	0:15 - 0:27	0:23 - 0:27	0:11 - 0:23	0:07 - 0:11	0:08 - 0:23	0:06 - 0:08	CAUTION: No holdover time guidelines exist	
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:23 - 0:34	1:01 - 1:16	0:30 - 1:01	0:15 - 0:30	0:19 - 0:38	0:15 - 0:23		
	75/25	0:23 - 0:42	0:30 - 0:38	0:19 - 0:30	0:08 - 0:19	0:15 - 0:23	0:11 - 0:15		
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:23 - 0:34	0:49 - 1:01	0:27 - 0:49	0:11 - 0:27	0:19 - 0:38[10]	0:15 - 0:23[10]		
	75/25	0:23 - 0:42	0:27 - 0:30	0:15 - 0:27	0:07 - 0:15	0:15 - 0:23[10]	0:11 - 0:15[10]		
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:11 - 0:19	0:15 - 0:23	0:05 - 0:15	0:02 - 0:05				
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:11 - 0:19	0:07 - 0:11	0:02 - 0:07	0:01 - 0:02				
below -25 to -28 °C (below -13 to -18 °F)	100/0	0:11 - 0:19	0:04 - 0:05	0:01 - 0:04	0:00 - 0:01				

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type II fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR however it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or mist.
4 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required.
5 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain or drizzle. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required to confirm the precipitation intensity is no greater than “light”. No holdover times exist if the reported visibility correlates to a “moderate” or “heavy” precipitation intensity.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
9 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
10 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-9.

F.18.4 Adjusted HOT Guidelines for SAE Type III Fluids (FAA Tables ADJ-17 – ADJ-19)

CAUTION

- *The responsibility for the application of these data remains with the user.*
- *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 outside air temperature.*
- *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 pre-takeoff check procedures.*

A. FAA Table ADJ-17: Adjusted Type III Holdover Times for AllClear AeroClear MAX Applied Unheated on Low Speed Aircraft

TABLE ADJ-17: ADJUSTED TYPE III HOLDOVER TIMES FOR ALLCLEAR AEROCLEAR MAX APPLIED UNHEATED ON LOW SPEED AIRCRAFT[1]

Outside Air Temperature[2]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[3], or Ice Crystals[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6,7]	Light Snow, Snow Grains or Snow Pellets[5,6,7]	Moderate Snow, Snow Grains or Snow Pellets[5,7]	Freezing Drizzle[8]	Light Freezing Rain	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	0:34 - 1:27	1:01 - 1:20	0:30 - 1:01	0:14 - 0:30	0:19 - 0:38	0:11 - 0:19	0:04 - 0:30	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A		
below -3 to -10 °C (below 27 to 14 °F)	100/0	0:38 - 1:16	1:01 - 1:20	0:30 - 1:01	0:14 - 0:30	0:19 - 0:34	0:11 - 0:19	CAUTION: No holdover time guidelines exist	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A		
below -10 to -16 °C (below 14 to 3 °F)	100/0	0:30 - 1:20	1:01 - 1:20	0:30 - 1:01	0:14 - 0:30				

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 These holdover times are for aircraft conforming to the SAE AS5900 low speed aerodynamic test criterion. Fluid must be applied unheated to use these holdover times. No holdover times exist for this fluid applied heated. If uncertain whether the aircraft conforms to the low, middle, or high speed aerodynamic test criterion, no holdover time guidelines exist below -16°C (3°F).
2 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type III fluid cannot be used.
3 Freezing mist is best confirmed by observation. It is never reported by METAR however it can occur when mist is present at 0 °C (32 °F) and below.
4 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or mist.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required.
6 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain or drizzle. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required to confirm the precipitation intensity is no greater than “light”. No holdover times exist if the reported visibility correlates to a “moderate” or “heavy” precipitation intensity.
7 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
8 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-23.

TABLE ADJ-18: ADJUSTED TYPE III HOLDOVER TIMES FOR ALLCLEAR AEROCLEAR MAX APPLIED UNHEATED ON MIDDLE SPEED AIRCRAFT[1]

Outside Air Temperature[2]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[3], or Ice Crystals[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6,7]	Light Snow, Snow Grains or Snow Pellets[5,6,7]	Moderate Snow, Snow Grains or Snow Pellets[5,7]	Freezing Drizzle[8]	Light Freezing Rain	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	0:34 - 1:27	1:01 - 1:20	0:30 - 1:01	0:14 - 0:30	0:19 - 0:38	0:11 - 0:19	0:04 - 0:30	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist	
below -3 to -10 °C (below 27 to 14 °F)	100/0	0:38 - 1:16	1:01 - 1:20	0:30 - 1:01	0:14 - 0:30	0:19 - 0:34	0:11 - 0:19		
	75/25	N/A	N/A	N/A	N/A	N/A	N/A		
below -10 to -20.5 °C (below 14 to -5 °F)	100/0	0:30 - 1:20	1:01 - 1:20	0:30 - 1:01	0:14 - 0:30				

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 These holdover times are for aircraft conforming to the SAE AS5900 middle speed aerodynamic test criterion. Fluid must be applied unheated to use these holdover times. No holdover times exist for this fluid applied heated. If uncertain whether the aircraft conforms to the low, middle, or high speed aerodynamic test criterion, no holdover time guidelines exist below -16°C (3°F).
2 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type III fluid cannot be used.
3 Freezing mist is best confirmed by observation. It is never reported by METAR however it can occur when mist is present at 0 °C (32 °F) and below.
4 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or mist.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required.
6 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain or drizzle. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required to confirm the precipitation intensity is no greater than “light”. No holdover times exist if the reported visibility correlates to a “moderate” or “heavy” precipitation intensity.
7 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
8 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-23.

C. FAA Table ADJ-19: Adjusted Type III Holdover Times for AllClear AeroClear MAX Applied Unheated on High Speed Aircraft

TABLE ADJ-19: ADJUSTED TYPE III HOLDOVER TIMES FOR ALLCLEAR AEROCLEAR MAX APPLIED UNHEATED ON HIGH SPEED AIRCRAFT[1]

Outside Air Temperature[2]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[3], or Ice Crystals[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6,7]	Light Snow, Snow Grains or Snow Pellets[5,6,7]	Moderate Snow, Snow Grains or Snow Pellets[5,7]	Freezing Drizzle[8]	Light Freezing Rain	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	0:34 - 1:27	1:01 - 1:20	0:30 - 1:01	0:14 - 0:30	0:19 - 0:38	0:11 - 0:19	0:04 - 0:30	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A		
below -3 to -10 °C (below 27 to 14 °F)	100/0	0:38 - 1:16	1:01 - 1:20	0:30 - 1:01	0:14 - 0:30	0:19 - 0:34	0:11 - 0:19		
	75/25	N/A	N/A	N/A	N/A	N/A	N/A		
below -10 to -25 °C (below 14 to -13 °F)	100/0	0:30 - 1:20	1:01 - 1:20	0:30 - 1:01	0:14 - 0:30				
below -25 to -35 °C (below -13 to -31 °F)	100/0	0:19 - 0:46	0:34 - 0:46	0:15 - 0:34	0:08 - 0:15				

CAUTION: No holdover time guidelines exist

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 These holdover times are for aircraft conforming to the SAE AS5900 high speed aerodynamic test criterion. Fluid must be applied unheated to use these holdover times. No holdover times exist for this fluid applied heated. If uncertain whether the aircraft conforms to the low, middle, or high speed aerodynamic test criterion, no holdover time guidelines exist below -16°C (3°F).
2 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type III fluid cannot be used.
3 Freezing mist is best confirmed by observation. It is never reported by METAR however it can occur when mist is present at 0 °C (32 °F) and below.
4 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or mist.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required.
6 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain or drizzle. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required to confirm the precipitation intensity is no greater than “light”. No holdover times exist if the reported visibility correlates to a “moderate” or “heavy” precipitation intensity.
7 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
8 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table Adj-47 provides allowance times for ice pellets and small hail for SAE Type III fluids, applied unheated).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-23.

F.18.5 Adjusted HOT Guidelines for SAE Type IV Fluids (FAA Tables ADJ-20 – ADJ-45)

CAUTION

- *The responsibility for the application of these data remains with the user.*
- *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 outside air temperature.*
- *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 pre-takeoff check procedures.*
- *These holdover times are for aircraft conforming to the SAE AS5900 high speed aerodynamic test criterion. If uncertain whether the aircraft conforms to the low, middle, or high speed aerodynamic test criterion, no holdover time guidelines exist.*

TABLE ADJ-20: ADJUSTED GENERIC HOLDOVER TIMES FOR SAE TYPE IV FLUIDS[1]

Outside Air Temperature[2]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[3], or Ice Crystals[4]	Very Light Snow, Snow Grains or Snow Pellets[5,6,7]	Light Snow, Snow Grains or Snow Pellets[5,6,7]	Moderate Snow, Snow Grains or Snow Pellets[5,7]	Freezing Drizzle[8]	Light Freezing Rain	Rain on Cold-Soaked Wing[9]	Other[10]
-3 °C and above (27 °F and above)	100/0	0:57 - 2:02	1:27 - 1:46	0:46 - 1:27	0:23 - 0:46	0:30 - 0:53	0:15 - 0:27	0:06 - 0:49	
	75/25	1:05 - 2:02	1:35 - 1:50	0:57 - 1:35	0:30 - 0:57	0:46 - 1:01	0:23 - 0:38	0:07 - 1:01	
	50/50	0:23 - 0:42	0:46 - 0:53	0:19 - 0:46	0:08 - 0:19	0:11 - 0:30	0:07 - 0:15		
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:15 - 1:12	1:20 - 1:35	0:42 - 1:20	0:19 - 0:42	0:19 - 0:53	0:15 - 0:19		
	75/25	0:23 - 1:01	1:24 - 1:39	0:49 - 1:24	0:23 - 0:49	0:15 - 0:49	0:11 - 0:19		
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:15 - 1:12	1:08 - 1:24	0:38 - 1:08	0:19 - 0:38	0:19 - 0:53[11]	0:15 - 0:19[11]		
	75/25	0:23 - 1:01	1:16 - 1:31	0:42 - 1:16	0:19 - 0:42	0:15 - 0:49[11]	0:11 - 0:19[11]		
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:15 - 0:27	0:23 - 0:34	0:07 - 0:23	0:02 - 0:07				
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:15 - 0:27	0:08 - 0:15	0:02 - 0:08	0:01 - 0:02				
below -25° C to LOUT[12] (below -13° F to LOUT)	100/0	0:15 - 0:27	0:05 - 0:08	0:02 - 0:05	0:00 - 0:02				

CAUTION: No holdover time guidelines exist

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 To use the HOTs in this table, ensure that the fluid and dilution being used is listed in the Type IV Fluids Tested for Anti-Icing Performance and Aerodynamic Acceptance table (Table 54). Any restrictions on the use of the fluid have to be identified and applied.
2 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
3 Freezing mist is best confirmed by observation. It is never reported by METAR however it can occur when mist is present at 0 °C (32 °F) and below.
4 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or mist.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required.
6 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain or drizzle. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required to confirm the precipitation intensity is no greater than “light”. No holdover times exist if the reported visibility correlates to a “moderate” or “heavy” precipitation intensity.
7 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
8 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
9 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
10 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table Adj-48 provides allowance times for Type IV EG fluids and Table Adj-49 provides allowance times for Type IV PG fluids in ice pellets and small hail. If the glycol type is unknown, the allowance times for SAE Type IV PG fluids should be used).
11 No holdover time guidelines exist for this condition below -10 °C (14 °F).
12 If the LOUT is unknown, no holdover time guidelines exist below -25.5 °C (-14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-27.

TABLE ADJ-21: ADJUSTED TYPE IV HOLDOVER TIMES FOR ABAX ECOWING AD-49

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Very Light Snow, Snow Grains or Snow Pellets[4,5,6]	Light Snow, Snow Grains or Snow Pellets[4,5,6]	Moderate Snow, Snow Grains or Snow Pellets[4,6]	Freezing Drizzle[7]	Light Freezing Rain	Rain on Cold-Soaked Wing[8]	Other[9]
-3 °C and above (27 °F and above)	100/0	2:32 - 3:02	2:47 - 3:00	1:27 - 2:47	0:46 - 1:27	1:05 - 1:31	0:46 - 1:05	0:08 - 1:27	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A		
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:15 - 1:12	2:13 - 2:40	1:08 - 2:13	0:34 - 1:08	0:19 - 1:05	0:15 - 0:19		
	75/25	N/A	N/A	N/A	N/A	N/A	N/A		
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:15 - 1:12	1:50 - 2:17	0:57 - 1:50	0:30 - 0:57	0:19 - 1:05[10]	0:15 - 0:19[10]		
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist	
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:19 - 0:30	0:23 - 0:34	0:07 - 0:23	0:02 - 0:07				
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:19 - 0:30	0:08 - 0:15	0:02 - 0:08	0:01 - 0:02				
below -25 to -26 °C (below -13 to -15 °F)	100/0	0:19 - 0:30	0:05 - 0:08	0:02 - 0:05	0:00 - 0:02				

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR however it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or mist.
4 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required.
5 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain or drizzle. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required to confirm the precipitation intensity is no greater than “light”. No holdover times exist if the reported visibility correlates to a “moderate” or “heavy” precipitation intensity.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
9 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table Adj-49 provides allowance times for Type IV PG fluids in ice pellets and small hail).
10 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-27.

C. FAA Table ADJ-22: Adjusted Type IV Holdover Times for ALAB International PROFLIGHT EG4

TABLE ADJ-22: ADJUSTED TYPE IV HOLDOVER TIMES FOR ALAB INTERNATIONAL PROFLIGHT EG4

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Very Light Snow, Snow Grains or Snow Pellets[4,5,6]	Light Snow, Snow Grains or Snow Pellets[4,5,6]	Moderate Snow, Snow Grains or Snow Pellets[4,6]	Freezing Drizzle[7]	Light Freezing Rain	Rain on Cold-Soaked Wing[8]	Other[9]
-3 °C and above (27 °F and above)	100/0	1:39 - 3:02	1:54 - 2:17	1:01 - 1:54	0:30 - 1:01	0:49 - 1:27	0:27 - 0:42	0:11 - 1:31	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A		
below -3 to -8 °C (below 27 to 18 °F)	100/0	1:35 - 2:59	2:24 - 2:59	1:16 - 2:24	0:42 - 1:16	0:46 - 1:31	0:38 - 0:49		
	75/25	N/A	N/A	N/A	N/A	N/A	N/A		
below -8 to -14 °C (below 18 to 7 °F)	100/0	1:35 - 2:59	2:43 - 3:00	1:27 - 2:43	0:46 - 1:27	0:46 - 1:31[10]	0:38 - 0:49[10]		
	75/25	N/A	N/A	N/A	N/A	N/A	N/A		
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:23 - 1:08	0:38 - 0:49	0:19 - 0:38	0:08 - 0:19				
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:23 - 1:08	0:30 - 0:42	0:11 - 0:30	0:04 - 0:11				
below -25 to -26 °C (below -13 to -15 °F)	100/0	0:23 - 1:08	0:19 - 0:27	0:06 - 0:19	0:02 - 0:06				

CAUTION: No holdover time guidelines exist

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR however it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or mist.
4 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required.
5 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain or drizzle. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required to confirm the precipitation intensity is no greater than “light”. No holdover times exist if the reported visibility correlates to a “moderate” or “heavy” precipitation intensity.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
9 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table Adj-48 provides allowance times for Type IV EG fluids in ice pellets and small hail).
10 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-27.

D. FAA Table ADJ-23: Adjusted Type IV Holdover Times for AllClear ClearWing ECO

TABLE ADJ-23: ADJUSTED TYPE IV HOLDOVER TIMES FOR ALLCLEAR CLEARWING ECO

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Very Light Snow, Snow Grains or Snow Pellets[4,5,6]	Light Snow, Snow Grains or Snow Pellets[4,5,6]	Moderate Snow, Snow Grains or Snow Pellets[4,6]	Freezing Drizzle[7]	Light Freezing Rain	Rain on Cold-Soaked Wing[8]	Other[9]
-3 °C and above (27 °F and above)	100/0	1:31 - 3:02	2:43 - 3:00	1:20 - 2:43	0:38 - 1:20	1:24 - 1:31	1:01 - 1:16	0:15 - 1:31	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A		
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:46 - 1:54	2:02 - 2:32	1:01 - 2:02	0:30 - 1:01	0:42 - 1:31	0:34 - 0:57		
	75/25	N/A	N/A	N/A	N/A	N/A	N/A		
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:46 - 1:54	1:39 - 2:02	0:49 - 1:39	0:23 - 0:49	0:42 - 1:31[10]	0:34 - 0:57[10]		
	75/25	N/A	N/A	N/A	N/A	N/A	N/A		
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:19 - 0:34	0:49 - 1:01	0:27 - 0:49	0:11 - 0:27				
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:19 - 0:34	0:23 - 0:27	0:11 - 0:23	0:05 - 0:11				
below -25 to -26 °C (below -13 to -15 °F)	100/0	0:19 - 0:34	0:19 - 0:27	0:11 - 0:19	0:05 - 0:11				

CAUTION: No holdover time guidelines exist

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR however it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or mist.
4 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required.
5 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain or drizzle. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required to confirm the precipitation intensity is no greater than “light”. No holdover times exist if the reported visibility correlates to a “moderate” or “heavy” precipitation intensity.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
9 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table Adj-49 provides allowance times for Type IV PG fluids in ice pellets and small hail).
10 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-27.

TABLE ADJ-24: ADJUSTED TYPE IV HOLDOVER TIMES FOR ALLCLEAR CLEARWING EG

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Very Light Snow, Snow Grains or Snow Pellets[4,5,6]	Light Snow, Snow Grains or Snow Pellets[4,5,6]	Moderate Snow, Snow Grains or Snow Pellets[4,6]	Freezing Drizzle[7]	Light Freezing Rain	Rain on Cold-Soaked Wing[8]	Other[9]
-3 °C and above (27 °F and above)	100/0	1:24 - 2:28	2:02 - 2:32	1:01 - 2:02	0:30 - 1:01	0:53 - 1:12	0:23 - 0:46	0:08 - 1:08	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A		
below -3 to -8 °C (below 27 to 18 °F)	100/0	1:12 - 2:51	1:50 - 2:17	0:53 - 1:50	0:27 - 0:53	0:49 - 1:08	0:23 - 0:46		
	75/25	N/A	N/A	N/A	N/A	N/A	N/A		
below -8 to -14 °C (below 18 to 7 °F)	100/0	1:12 - 2:51	1:43 - 2:05	0:49 - 1:43	0:23 - 0:49	0:49 - 1:08[10]	0:23 - 0:46[10]		
	75/25	N/A	N/A	N/A	N/A	N/A	N/A		
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:42 - 1:31	1:12 - 1:35	0:34 - 1:12	0:15 - 0:34				
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:42 - 1:31	0:42 - 0:53	0:19 - 0:42	0:11 - 0:19				
below -25 to -29 °C (below -13 to -20 °F)	100/0	0:42 - 1:31	0:34 - 0:42	0:15 - 0:34	0:08 - 0:15				

CAUTION: No holdover time guidelines exist

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR however it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or mist.
4 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required.
5 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain or drizzle. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required to confirm the precipitation intensity is no greater than “light”. No holdover times exist if the reported visibility correlates to a “moderate” or “heavy” precipitation intensity.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
9 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table Adj-48 provides allowance times for Type IV EG fluids in ice pellets and small hail).
10 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-27.

TABLE ADJ-25: ADJUSTED TYPE IV HOLDOVER TIMES FOR ASGLOBAL 4FLITE EG

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Very Light Snow, Snow Grains or Snow Pellets[4,5,6]	Light Snow, Snow Grains or Snow Pellets[4,5,6]	Moderate Snow, Snow Grains or Snow Pellets[4,6]	Freezing Drizzle[7]	Light Freezing Rain	Rain on Cold-Soaked Wing[8]	Other[9]
-3 °C and above (27 °F and above)	100/0	1:12 - 2:28	1:35 - 1:58	0:46 - 1:35	0:23 - 0:46	0:30 - 0:53	0:15 - 0:27	0:06 - 0:49	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A		
below -3 to -8 °C (below 27 to 18 °F)	100/0	1:05 - 2:05	1:24 - 1:43	0:42 - 1:24	0:19 - 0:42	0:30 - 0:53	0:15 - 0:27		
	75/25	N/A	N/A	N/A	N/A	N/A	N/A		
below -8 to -14 °C (below 18 to 7 °F)	100/0	1:05 - 2:05	1:12 - 1:31	0:38 - 1:12	0:19 - 0:38	0:30 - 0:53[10]	0:15 - 0:27[10]		
	75/25	N/A	N/A	N/A	N/A	N/A	N/A		
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:38 - 1:05	1:12 - 1:31	0:34 - 1:12	0:15 - 0:34				
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:38 - 1:05	1:01 - 1:16	0:27 - 1:01	0:15 - 0:27				
below -25 to -30 °C (below -13 to -22 °F)	100/0	0:23 - 0:49	0:42 - 0:49	0:19 - 0:42	0:08 - 0:19				

CAUTION: No holdover time guidelines exist

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR however it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or mist.
4 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required.
5 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain or drizzle. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required to confirm the precipitation intensity is no greater than “light”. No holdover times exist if the reported visibility correlates to a “moderate” or “heavy” precipitation intensity.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
9 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table Adj-48 provides allowance times for Type IV EG fluids in ice pellets and small hail).
10 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-27.

TABLE ADJ-26: ADJUSTED TYPE IV HOLDOVER TIMES FOR ASGLOBAL 4FLITE PG

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Very Light Snow, Snow Grains or Snow Pellets[4,5,6]	Light Snow, Snow Grains or Snow Pellets[4,5,6]	Moderate Snow, Snow Grains or Snow Pellets[4,6]	Freezing Drizzle[7]	Light Freezing Rain	Rain on Cold-Soaked Wing[8]	Other[9]
-3 °C and above (27 °F and above)	100/0	1:24 - 2:28	2:09 - 2:36	1:12 - 2:09	0:38 - 1:12	0:53 - 1:12	0:34 - 0:49	0:11 - 1:01	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A		
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:49 - 1:27	1:35 - 1:54	0:53 - 1:35	0:27 - 0:53	0:42 - 0:53	0:27 - 0:42		
	75/25	N/A	N/A	N/A	N/A	N/A	N/A		
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:49 - 1:27	1:16 - 1:31	0:42 - 1:16	0:23 - 0:42	0:42 - 0:53[10]	0:27 - 0:42[10]		
	75/25	N/A	N/A	N/A	N/A	N/A	N/A		
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:23 - 0:34	0:49 - 1:01	0:27 - 0:49	0:11 - 0:27				
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:23 - 0:34	0:27 - 0:34	0:15 - 0:27	0:07 - 0:15				
below -25 to -26 °C (below -13 to -15 °F)	100/0	0:23 - 0:34	0:27 - 0:34	0:15 - 0:27	0:06 - 0:15				

CAUTION: No holdover time guidelines exist

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR however it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or mist.
4 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required.
5 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain or drizzle. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required to confirm the precipitation intensity is no greater than “light”. No holdover times exist if the reported visibility correlates to a “moderate” or “heavy” precipitation intensity.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
9 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table Adj-49 provides allowance times for Type IV PG fluids in ice pellets and small hail).
10 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-27.

TABLE ADJ-27: ADJUSTED TYPE IV HOLDOVER TIMES FOR AVIAFLUID AVIAFLIGHT EG

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Very Light Snow, Snow Grains or Snow Pellets[4,5,6]	Light Snow, Snow Grains or Snow Pellets[4,5,6]	Moderate Snow, Snow Grains or Snow Pellets[4,6]	Freezing Drizzle[7]	Light Freezing Rain	Rain on Cold-Soaked Wing[8]	Other[9]
-3 °C and above (27 °F and above)	100/0	1:08 - 2:21	1:27 - 1:46	0:53 - 1:27	0:30 - 0:53	0:49 - 1:31	0:23 - 0:38	0:08 - 1:31	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A		
below -3 to -8 °C (below 27 to 18 °F)	100/0	1:01 - 2:17	1:20 - 1:35	0:46 - 1:20	0:27 - 0:46	0:42 - 1:08	0:27 - 0:38		
	75/25	N/A	N/A	N/A	N/A	N/A	N/A		
below -8 to -14 °C (below 18 to 7 °F)	100/0	1:01 - 2:17	1:12 - 1:27	0:42 - 1:12	0:23 - 0:42	0:42 - 1:08[10]	0:27 - 0:38[10]		
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist	
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:27 - 1:20	1:16 - 1:31	0:38 - 1:16	0:19 - 0:38				
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:27 - 1:20	1:01 - 1:12	0:30 - 1:01	0:15 - 0:30				
below -25 to -31 °C (below -13 to -24 °F)	100/0	0:27 - 0:49	0:27 - 0:34	0:15 - 0:27	0:07 - 0:15				

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR however it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or mist.
4 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required.
5 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain or drizzle. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required to confirm the precipitation intensity is no greater than “light”. No holdover times exist if the reported visibility correlates to a “moderate” or “heavy” precipitation intensity.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
9 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table Adj-48 provides allowance times for Type IV EG fluids in ice pellets and small hail).
10 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-27.

TABLE ADJ-28: ADJUSTED TYPE IV HOLDOVER TIMES FOR AVIAFLUID AVIAFLIGHT PG

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Very Light Snow, Snow Grains or Snow Pellets[4,5,6]	Light Snow, Snow Grains or Snow Pellets[4,5,6]	Moderate Snow, Snow Grains or Snow Pellets[4,6]	Freezing Drizzle[7]	Light Freezing Rain	Rain on Cold-Soaked Wing[8]	Other[9]
-3 °C and above (27 °F and above)	100/0	1:43 - 3:02	2:17 - 2:47	1:16 - 2:17	0:42 - 1:16	1:31 - 1:31	0:53 - 1:27	0:15 - 1:31	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A		
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:49 - 1:39	1:31 - 1:50	0:49 - 1:31	0:27 - 0:49	0:27 - 1:27	0:34 - 0:49		
	75/25	N/A	N/A	N/A	N/A	N/A	N/A		
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:49 - 1:39	1:08 - 1:24	0:38 - 1:08	0:19 - 0:38	0:27 - 1:27[10]	0:34 - 0:49[10]		
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist	
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:15 - 0:27	0:38 - 0:46	0:19 - 0:38	0:11 - 0:19				
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:15 - 0:27	0:19 - 0:23	0:11 - 0:19	0:05 - 0:11				
below -25 to -25.5 °C (below -13 to -14 °F)	100/0	0:15 - 0:27	0:19 - 0:23	0:08 - 0:19	0:05 - 0:08				

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR however it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or mist.
4 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required.
5 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain or drizzle. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required to confirm the precipitation intensity is no greater than “light”. No holdover times exist if the reported visibility correlates to a “moderate” or “heavy” precipitation intensity.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
9 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table Adj-49 provides allowance times for Type IV PG fluids in ice pellets and small hail).
10 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-27.

TABLE ADJ-29: ADJUSTED TYPE IV HOLDOVER TIMES FOR CHEMCO CHEMR EG IV

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Very Light Snow, Snow Grains or Snow Pellets[4,5,6]	Light Snow, Snow Grains or Snow Pellets[4,5,6]	Moderate Snow, Snow Grains or Snow Pellets[4,6]	Freezing Drizzle[7]	Light Freezing Rain	Rain on Cold-Soaked Wing[8]	Other[9]
-3 °C and above (27 °F and above)	100/0	1:35 - 2:43	2:17 - 2:55	0:57 - 2:17	0:27 - 0:57	0:34 - 1:16	0:19 - 0:30	0:07 - 1:20	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A		
below -3 to -8 °C (below 27 to 18 °F)	100/0	1:05 - 2:47	2:17 - 2:55	0:57 - 2:17	0:27 - 0:57	0:46 - 1:12	0:27 - 0:38		
	75/25	N/A	N/A	N/A	N/A	N/A	N/A		
below -8 to -14 °C (below 18 to 7 °F)	100/0	1:05 - 2:47	2:17 - 2:55	0:57 - 2:17	0:27 - 0:57	0:46 - 1:12[10]	0:27 - 0:38[10]		
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist	
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:30 - 1:05	1:05 - 1:20	0:30 - 1:05	0:15 - 0:30				
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:30 - 1:05	1:05 - 1:20	0:30 - 1:05	0:15 - 0:30				
below -25 to -27 °C (below -13 to -17 °F)	100/0	0:30 - 1:05	1:05 - 1:20	0:30 - 1:05	0:15 - 0:30				

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR however it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or mist.
4 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required.
5 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain or drizzle. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required to confirm the precipitation intensity is no greater than “light”. No holdover times exist if the reported visibility correlates to a “moderate” or “heavy” precipitation intensity.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
9 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table Adj-48 provides allowance times for Type IV EG fluids in ice pellets and small hail).
10 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-27.

TABLE ADJ-30: ADJUSTED TYPE IV HOLDOVER TIMES FOR CHEMCO CHEMR NORDIK IV

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Very Light Snow, Snow Grains or Snow Pellets[4,5,6]	Light Snow, Snow Grains or Snow Pellets[4,5,6]	Moderate Snow, Snow Grains or Snow Pellets[4,6]	Freezing Drizzle[7]	Light Freezing Rain	Rain on Cold-Soaked Wing[8]	Other[9]
-3 °C and above (27 °F and above)	100/0	1:43 - 3:02	2:28 - 3:00	1:20 - 2:28	0:42 - 1:20	1:01 - 1:31	0:42 - 1:01	0:19 - 1:31	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A		
below -3 to -8 °C (below 27 to 18 °F)	100/0	1:24 - 3:02	2:28 - 3:00	1:20 - 2:28	0:42 - 1:20	0:57 - 1:31	0:34 - 1:01		
	75/25	N/A	N/A	N/A	N/A	N/A	N/A		
below -8 to -14 °C (below 18 to 7 °F)	100/0	1:24 - 3:02	2:28 - 3:00	1:20 - 2:28	0:42 - 1:20	0:57 - 1:31[10]	0:34 - 1:01[10]		
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist	
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:30 - 1:08	2:21 - 2:51	1:12 - 2:21	0:38 - 1:12				
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:30 - 1:08	1:39 - 2:02	0:49 - 1:39	0:27 - 0:49				
below -25 to -29 °C (below -13 to -20 °F)	100/0	0:30 - 1:08	1:24 - 1:43	0:42 - 1:24	0:23 - 0:42				

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR however it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or mist.
4 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required.
5 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain or drizzle. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required to confirm the precipitation intensity is no greater than “light”. No holdover times exist if the reported visibility correlates to a “moderate” or “heavy” precipitation intensity.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
9 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table Adj-48 provides allowance times for Type IV EG fluids in ice pellets and small hail).
10 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-27.

L. FAA Table ADJ-31: Adjusted Type IV Holdover Times for Clariant Max Flight AVIA

TABLE ADJ-31: ADJUSTED TYPE IV HOLDOVER TIMES FOR CLARIANT MAX FLIGHT AVIA

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Very Light Snow, Snow Grains or Snow Pellets[4,5,6]	Light Snow, Snow Grains or Snow Pellets[4,5,6]	Moderate Snow, Snow Grains or Snow Pellets[4,6]	Freezing Drizzle[7]	Light Freezing Rain	Rain on Cold-Soaked Wing[8]	Other[9]
-3 °C and above (27 °F and above)	100/0	2:21 - 3:02	2:17 - 2:43	1:20 - 2:17	0:46 - 1:20	1:05 - 1:31	0:42 - 0:53	0:07 - 1:31	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A		
below -3 to -8 °C (below 27 to 18 °F)	100/0	1:20 - 2:59	1:54 - 2:17	1:05 - 1:54	0:38 - 1:05	0:53 - 1:31	0:42 - 1:08		
	75/25	N/A	N/A	N/A	N/A	N/A	N/A		
below -8 to -14 °C (below 18 to 7 °F)	100/0	1:20 - 2:59	1:39 - 1:58	0:57 - 1:39	0:30 - 0:57	0:53 - 1:31[10]	0:42 - 1:08[10]		
	75/25	N/A	N/A	N/A	N/A	N/A	N/A		
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:27 - 1:05	0:38 - 0:49	0:19 - 0:38	0:08 - 0:19				
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:27 - 1:05	0:30 - 0:42	0:11 - 0:30	0:04 - 0:11				
below -25 to -28.5 °C (below -13 to -19 °F)	100/0	0:27 - 1:05	0:19 - 0:27	0:06 - 0:19	0:02 - 0:06				

CAUTION: No holdover time guidelines exist

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR however it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or mist.
4 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required.
5 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain or drizzle. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required to confirm the precipitation intensity is no greater than “light”. No holdover times exist if the reported visibility correlates to a “moderate” or “heavy” precipitation intensity.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
9 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table Adj-48 provides allowance times for Type IV EG fluids in ice pellets and small hail)..
10 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-27.

M. FAA Table ADJ-32: Adjusted Type IV Holdover Times for Clariant Max Flight SNEG

TABLE ADJ-32: ADJUSTED TYPE IV HOLDOVER TIMES FOR CLARIANT MAX FLIGHT SNEG

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Very Light Snow, Snow Grains or Snow Pellets[4,5,6]	Light Snow, Snow Grains or Snow Pellets[4,5,6]	Moderate Snow, Snow Grains or Snow Pellets[4,6]	Freezing Drizzle[7]	Light Freezing Rain	Rain on Cold-Soaked Wing[8]	Other[9]
-3 °C and above (27 °F and above)	100/0	1:50 - 3:02	2:17 - 2:47	1:16 - 2:17	0:42 - 1:16	1:31 - 1:31	0:38 - 1:16	0:15 - 1:08	
	75/25	3:02 - 3:02	1:50 - 2:09	1:08 - 1:50	0:42 - 1:08	1:08 - 1:31	0:49 - 1:01	0:11 - 1:20	
	50/50	1:08 - 2:40	1:20 - 1:46	0:34 - 1:20	0:15 - 0:34	0:27 - 0:53	0:11 - 0:23		
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:34 - 1:46	1:50 - 2:13	1:01 - 1:50	0:34 - 1:01	0:23 - 1:05	0:19 - 0:30		
	75/25	0:23 - 1:05	1:27 - 1:43	0:53 - 1:27	0:34 - 0:53	0:15 - 0:49	0:15 - 0:30		
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:34 - 1:46	1:35 - 1:54	0:53 - 1:35	0:30 - 0:53	0:23 - 1:05[10]	0:19 - 0:30[10]		
	75/25	0:23 - 1:05	1:16 - 1:31	0:46 - 1:16	0:30 - 0:46	0:15 - 0:49[10]	0:15 - 0:30[10]		
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:15 - 0:38	0:23 - 0:34	0:07 - 0:23	0:02 - 0:07				
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:15 - 0:38	0:08 - 0:15	0:02 - 0:08	0:01 - 0:02				
below -25 to -29 °C (below -13 to -20 °F)	100/0	0:15 - 0:38	0:05 - 0:08	0:02 - 0:05	0:00 - 0:02				

CAUTION: No holdover time guidelines exist

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR however it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or mist.
4 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required.
5 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain or drizzle. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required to confirm the precipitation intensity is no greater than “light”. No holdover times exist if the reported visibility correlates to a “moderate” or “heavy” precipitation intensity.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
9 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table Adj-49 provides allowance times for Type IV PG fluids in ice pellets and small hail).
10 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-27.

TABLE ADJ-33: ADJUSTED TYPE IV HOLDOVER TIMES FOR CLARIANT SAFEWING EG IV NORTH

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Very Light Snow, Snow Grains or Snow Pellets[4,5,6]	Light Snow, Snow Grains or Snow Pellets[4,5,6]	Moderate Snow, Snow Grains or Snow Pellets[4,6]	Freezing Drizzle[7]	Light Freezing Rain	Rain on Cold-Soaked Wing[8]	Other[9]
-3 °C and above (27 °F and above)	100/0	1:46 - 2:59	2:17 - 2:47	1:16 - 2:17	0:38 - 1:16	1:08 - 1:31	0:38 - 0:42	0:06 - 1:31	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist	
below -3 to -8 °C (below 27 to 18 °F)	100/0	1:20 - 3:02	2:09 - 2:40	1:08 - 2:09	0:38 - 1:08	0:49 - 1:24	0:42 - 1:05		
	75/25	N/A	N/A	N/A	N/A	N/A	N/A		
below -8 to -14 °C (below 18 to 7 °F)	100/0	1:20 - 3:02	2:05 - 2:32	1:08 - 2:05	0:38 - 1:08	0:49 - 1:24[10]	0:42 - 1:05[10]		
	75/25	N/A	N/A	N/A	N/A	N/A	N/A		
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:30 - 1:01	0:38 - 0:49	0:19 - 0:38	0:08 - 0:19				
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:30 - 1:01	0:30 - 0:42	0:11 - 0:30	0:04 - 0:11				
below -25 to -30 °C (below -13 to -22 °F)	100/0	0:30 - 1:01	0:19 - 0:27	0:06 - 0:19	0:02 - 0:06				

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR however it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or mist.
4 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required.
5 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain or drizzle. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required to confirm the precipitation intensity is no greater than “light”. No holdover times exist if the reported visibility correlates to a “moderate” or “heavy” precipitation intensity.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
9 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table Adj-48 provides allowance times for Type IV EG fluids in ice pellets and small hail).
10 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-27.

O. FAA Table ADJ-34: Adjusted Type IV Holdover Times for Clariant Safewing MP IV LAUNCH

TABLE ADJ-34: ADJUSTED TYPE IV HOLDOVER TIMES FOR CLARIANT SAFEWING MP IV LAUNCH

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Very Light Snow, Snow Grains or Snow Pellets[4,5,6]	Light Snow, Snow Grains or Snow Pellets[4,5,6]	Moderate Snow, Snow Grains or Snow Pellets[4,6]	Freezing Drizzle[7]	Light Freezing Rain	Rain on Cold-Soaked Wing[8]	Other[9]
-3 °C and above (27 °F and above)	100/0	3:02 - 3:02	2:09 - 2:32	1:20 - 2:09	0:49 - 1:20	1:08 - 1:31	0:46 - 1:16	0:11 - 1:16	
	75/25	2:47 - 3:02	2:21 - 2:47	1:20 - 2:21	0:46 - 1:20	1:16 - 1:31	0:34 - 0:57	0:08 - 1:20	
	50/50	1:05 - 2:05	1:05 - 1:16	0:34 - 1:05	0:19 - 0:34	0:23 - 0:38	0:15 - 0:19		
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:46 - 1:27	1:50 - 2:09	1:08 - 1:50	0:42 - 1:08	0:27 - 1:16	0:19 - 0:34		
	75/25	0:30 - 1:01	2:02 - 2:28	1:08 - 2:02	0:38 - 1:08	0:19 - 0:53	0:19 - 0:34		
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:46 - 1:27	1:39 - 1:54	1:01 - 1:39	0:38 - 1:01	0:27 - 1:16[10]	0:19 - 0:34[10]		
	75/25	0:30 - 1:01	1:50 - 2:13	1:05 - 1:50	0:34 - 1:05	0:19 - 0:53[10]	0:19 - 0:34[10]		
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:23 - 0:38	0:57 - 1:20	0:15 - 0:57	0:05 - 0:15	CAUTION: No holdover time guidelines exist			
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:23 - 0:38	0:23 - 0:34	0:07 - 0:23	0:02 - 0:07				
below -25 to -28.5 °C (below -13 to -19 °F)	100/0	0:23 - 0:38	0:15 - 0:23	0:05 - 0:15	0:01 - 0:05				

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR however it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or mist.
4 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required.
5 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain or drizzle. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required to confirm the precipitation intensity is no greater than “light”. No holdover times exist if the reported visibility correlates to a “moderate” or “heavy” precipitation intensity.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
9 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table Adj-49 provides allowance times for Type IV PG fluids in ice pellets and small hail).
10 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-27.

P. FAA Table ADJ-35: Adjusted Type IV Holdover Times for Clariant Safewing MP IV LAUNCH PLUS

Appendix A: FAA Adjusted Holdover Time Guidelines **Winter 2023-2024**

TABLE ADJ-35: ADJUSTED TYPE IV HOLDOVER TIMES FOR CLARIANT SAFEWING MP IV LAUNCH PLUS

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Very Light Snow, Snow Grains or Snow Pellets[4,5,6]	Light Snow, Snow Grains or Snow Pellets[4,5,6]	Moderate Snow, Snow Grains or Snow Pellets[4,6]	Freezing Drizzle[7]	Light Freezing Rain	Rain on Cold-Soaked Wing[8]	Other[9]
-3 °C and above (27 °F and above)	100/0	2:59 - 3:02	3:00 - 3:00	1:35 - 3:00	0:42 - 1:35	1:31 - 1:31	0:46 - 1:31	0:15 - 1:31	CAUTION: No holdover time guidelines exist
	75/25	2:59 - 3:02	3:00 - 3:00	1:27 - 3:00	0:38 - 1:27	1:31 - 1:31	1:01 - 1:05	0:15 - 1:24	
	50/50	0:57 - 1:24	1:12 - 1:31	0:34 - 1:12	0:15 - 0:34	0:19 - 0:46	0:11 - 0:15		
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:42 - 1:43	2:51 - 3:00	1:16 - 2:51	0:34 - 1:16	0:19 - 1:12	0:19 - 0:30		
	75/25	0:30 - 1:31	2:40 - 3:00	1:08 - 2:40	0:27 - 1:08	0:15 - 0:49	0:15 - 0:23		
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:42 - 1:43	2:28 - 3:00	1:05 - 2:28	0:30 - 1:05	0:19 - 1:12[10]	0:19 - 0:30[10]		
	75/25	0:30 - 1:31	2:13 - 2:55	0:57 - 2:13	0:23 - 0:57	0:15 - 0:49[10]	0:15 - 0:23[10]		
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:19 - 0:38	0:57 - 1:24	0:19 - 0:57	0:05 - 0:19				
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:19 - 0:38	0:23 - 0:34	0:07 - 0:23	0:02 - 0:07				
below -25 to -29 °C (below -13 to -20 °F)	100/0	0:19 - 0:38	0:15 - 0:23	0:05 - 0:15	0:02 - 0:05				

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR however it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or mist.
4 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required.
5 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain or drizzle. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required to confirm the precipitation intensity is no greater than "light". No holdover times exist if the reported visibility correlates to a "moderate" or "heavy" precipitation intensity.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
9 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table Adj-49 provides allowance times for Type IV PG fluids in ice pellets and small hail).
10 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-27.

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Q. FAA Table ADJ-36: Adjusted Type IV Holdover Times for Cryotech Polar Guard® Advance

Appendix A: FAA Adjusted Holdover Time Guidelines **Winter 2023-2024**

TABLE ADJ-36: ADJUSTED TYPE IV HOLDOVER TIMES FOR CRYOTECH POLAR GUARD® ADVANCE

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Very Light Snow, Snow Grains or Snow Pellets[4,5,6]	Light Snow, Snow Grains or Snow Pellets[4,5,6]	Moderate Snow, Snow Grains or Snow Pellets[4,6]	Freezing Drizzle[7]	Light Freezing Rain	Rain on Cold-Soaked Wing[8]	Other[9]
-3 °C and above (27 °F and above)	100/0	2:09 - 3:02	2:28 - 2:59	1:27 - 2:28	0:49 - 1:27	1:12 - 1:31	0:57 - 1:08	0:11 - 1:31	CAUTION: No holdover time guidelines exist
	75/25	1:54 - 3:02	2:17 - 2:55	1:05 - 2:17	0:30 - 1:05	1:16 - 1:31	0:30 - 0:53	0:07 - 1:16	
	50/50	0:38 - 1:05	0:53 - 1:12	0:19 - 0:53	0:08 - 0:19	0:15 - 0:34	0:07 - 0:15		
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:42 - 1:54	1:50 - 2:09	1:05 - 1:50	0:38 - 1:05	0:27 - 1:12	0:27 - 0:34		
	75/25	0:30 - 1:08	1:46 - 2:17	0:49 - 1:46	0:23 - 0:49	0:19 - 0:49	0:27 - 0:34		
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:42 - 1:54	1:31 - 1:46	0:53 - 1:31	0:30 - 0:53	0:27 - 1:12[10]	0:27 - 0:34[10]		
	75/25	0:30 - 1:08	1:31 - 1:54	0:42 - 1:31	0:19 - 0:42	0:19 - 0:49[10]	0:27 - 0:34[10]		
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:19 - 0:38	1:12 - 1:43	0:27 - 1:12	0:08 - 0:27				
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:19 - 0:38	0:30 - 0:42	0:11 - 0:30	0:03 - 0:11				
below -25 to -30.5 °C (below -13 to -23 °F)	100/0	0:19 - 0:38	0:19 - 0:23	0:05 - 0:19	0:02 - 0:05				

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR however it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or mist.
4 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required.
5 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain or drizzle. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required to confirm the precipitation intensity is no greater than "light". No holdover times exist if the reported visibility correlates to a "moderate" or "heavy" precipitation intensity.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
9 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table Adj-49 provides allowance times for Type IV PG fluids in ice pellets and small hail).
10 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-27.

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R. FAA Table ADJ-37: Adjusted Type IV Holdover Times for Cryotech Polar Guard® Xtend

TABLE ADJ-37: ADJUSTED TYPE IV HOLDOVER TIMES FOR CRYOTECH POLAR GUARD® XTEND

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Very Light Snow, Snow Grains or Snow Pellets[4,5,6]	Light Snow, Snow Grains or Snow Pellets[4,5,6]	Moderate Snow, Snow Grains or Snow Pellets[4,6]	Freezing Drizzle[7]	Light Freezing Rain	Rain on Cold-Soaked Wing[8]	Other[9]
-3 °C and above (27 °F and above)	100/0	1:54 - 3:02	2:43 - 3:00	1:31 - 2:43	0:49 - 1:31	1:31 - 1:31	0:46 - 1:24	0:15 - 1:20	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist	
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:46 - 1:24	2:09 - 2:36	1:12 - 2:09	0:38 - 1:12	0:27 - 1:16	0:38 - 0:42		
	75/25	N/A	N/A	N/A	N/A	N/A	N/A		
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:46 - 1:24	1:50 - 2:13	1:01 - 1:50	0:34 - 1:01	0:27 - 1:16[10]	0:38 - 0:42[10]		
	75/25	N/A	N/A	N/A	N/A	N/A	N/A		
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:19 - 0:30	1:01 - 1:16	0:30 - 1:01	0:15 - 0:30				
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:19 - 0:30	0:23 - 0:30	0:11 - 0:23	0:05 - 0:11				
below -25 to -29 °C (below -13 to -20 °F)	100/0	0:19 - 0:30	0:15 - 0:19	0:07 - 0:15	0:03 - 0:07				

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR however it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or mist.
4 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required.
5 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain or drizzle. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required to confirm the precipitation intensity is no greater than “light”. No holdover times exist if the reported visibility correlates to a “moderate” or “heavy” precipitation intensity.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
9 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table Adj-49 provides allowance times for Type IV PG fluids in ice pellets and small hail).
10 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-27.

S. FAA Table ADJ-38: Adjusted Type IV Holdover Times for Dow Chemical UCAR™ Endurance EG106

TABLE ADJ-38: ADJUSTED TYPE IV HOLDOVER TIMES FOR DOW CHEMICAL UCAR ENDURANCE™ EG106

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Very Light Snow, Snow Grains or Snow Pellets[4,5,6]	Light Snow, Snow Grains or Snow Pellets[4,5,6]	Moderate Snow, Snow Grains or Snow Pellets[4,6]	Freezing Drizzle[7]	Light Freezing Rain	Rain on Cold-Soaked Wing[8]	Other[9]
-3 °C and above (27 °F and above)	100/0	1:35 - 2:24	2:05 - 2:40	1:01 - 2:05	0:30 - 1:01	0:53 - 1:31	0:38 - 0:57	0:15 - 1:31	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist	
below -3 to -8 °C (below 27 to 18 °F)	100/0	1:24 - 2:32	1:50 - 2:17	0:53 - 1:50	0:27 - 0:53	0:42 - 1:24	0:34 - 0:53		
	75/25	N/A	N/A	N/A	N/A	N/A	N/A		
below -8 to -14 °C (below 18 to 7 °F)	100/0	1:24 - 2:32	1:39 - 2:05	0:49 - 1:39	0:23 - 0:49	0:42 - 1:24[10]	0:34 - 0:53[10]		
	75/25	N/A	N/A	N/A	N/A	N/A	N/A		
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:23 - 0:49	1:20 - 1:43	0:38 - 1:20	0:19 - 0:38				
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:23 - 0:49	1:08 - 1:27	0:30 - 1:08	0:15 - 0:30				
below -25 to -29 °C (below -13 to -20 °F)	100/0	0:23 - 0:49	1:01 - 1:20	0:30 - 1:01	0:15 - 0:30				

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR however it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or mist.
4 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required.
5 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain or drizzle. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required to confirm the precipitation intensity is no greater than "light". No holdover times exist if the reported visibility correlates to a "moderate" or "heavy" precipitation intensity.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
9 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table Adj-48 provides allowance times for Type IV EG fluids in ice pellets and small hail).
10 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-27.

T. FAA Table ADJ-39: Adjusted Type IV Holdover Times for Dow Chemical UCAR™ FlightGuard AD-49

Appendix A: FAA Adjusted Holdover Time Guidelines **Winter 2023-2024**

TABLE ADJ-39: ADJUSTED TYPE IV HOLDOVER TIMES FOR DOW CHEMICAL UCAR™ FLIGHTGUARD™ AD-49

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Very Light Snow, Snow Grains or Snow Pellets[4,5,6]	Light Snow, Snow Grains or Snow Pellets[4,5,6]	Moderate Snow, Snow Grains or Snow Pellets[4,6]	Freezing Drizzle[7]	Light Freezing Rain	Rain on Cold-Soaked Wing[8]	Other[9]
-3 °C and above (27 °F and above)	100/0	2:32 - 3:02	2:47 - 3:00	1:27 - 2:47	0:46 - 1:27	1:05 - 1:31	0:46 - 1:05	0:08 - 1:27	CAUTION: No holdover time guidelines exist
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A		
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:15 - 1:12	2:13 - 2:40	1:08 - 2:13	0:34 - 1:08	0:19 - 1:05	0:15 - 0:19		
	75/25	N/A	N/A	N/A	N/A	N/A	N/A		
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:15 - 1:12	1:50 - 2:17	0:57 - 1:50	0:30 - 0:57	0:19 - 1:05[10]	0:15 - 0:19[10]		
	75/25	N/A	N/A	N/A	N/A	N/A	N/A		
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:19 - 0:30	0:23 - 0:34	0:07 - 0:23	0:02 - 0:07				
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:19 - 0:30	0:08 - 0:15	0:02 - 0:08	0:01 - 0:02				
below -25 to -26 °C (below -13 to -15 °F)	100/0	0:19 - 0:30	0:05 - 0:08	0:02 - 0:05	0:00 - 0:02				

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR however it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or mist.
4 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required.
5 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain or drizzle. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required to confirm the precipitation intensity is no greater than "light". No holdover times exist if the reported visibility correlates to a "moderate" or "heavy" precipitation intensity.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
9 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table Adj-49 provides allowance times for Type IV PG fluids in ice pellets and small hail).
10 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-27.

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U. FAA Table ADJ-40: Adjusted Type IV Holdover Times for Inland Technologies ECO-SHIELD®

TABLE ADJ-40: ADJUSTED TYPE IV HOLDOVER TIMES FOR INLAND TECHNOLOGIES ECO-SHIELD®

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Very Light Snow, Snow Grains or Snow Pellets[4,5,6]	Light Snow, Snow Grains or Snow Pellets[4,5,6]	Moderate Snow, Snow Grains or Snow Pellets[4,6]	Freezing Drizzle[7]	Light Freezing Rain	Rain on Cold-Soaked Wing[8]	Other[9]
-3 °C and above (27 °F and above)	100/0	0:57 - 2:02	1:50 - 2:09	1:01 - 1:50	0:34 - 1:01	0:30 - 1:08	0:27 - 0:30	0:11 - 1:12	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A		
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:53 - 1:58	1:35 - 1:54	0:53 - 1:35	0:30 - 0:53	0:38 - 1:05	0:23 - 0:30		
	75/25	N/A	N/A	N/A	N/A	N/A	N/A		
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:53 - 1:58	1:27 - 1:43	0:49 - 1:27	0:27 - 0:49	0:38 - 1:05[10]	0:23 - 0:30[10]		
	75/25	N/A	N/A	N/A	N/A	N/A	N/A		
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:23 - 0:46	0:23 - 0:34	0:07 - 0:23	0:02 - 0:07				
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:23 - 0:46	0:08 - 0:15	0:02 - 0:08	0:01 - 0:02				
below -25 to -25.5 °C (below -13 to -14 °F)	100/0	0:23 - 0:46	0:05 - 0:08	0:02 - 0:05	0:00 - 0:02				

CAUTION: No holdover time guidelines exist

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR however it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or mist.
4 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required.
5 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain or drizzle. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required to confirm the precipitation intensity is no greater than “light”. No holdover times exist if the reported visibility correlates to a “moderate” or “heavy” precipitation intensity.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
9 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table Adj-49 provides allowance times for Type IV PG fluids in ice pellets and small hail).
10 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-27.

TABLE ADJ-41: ADJUSTED TYPE IV HOLDOVER TIMES FOR JSC RCP NORDIX DEFROST ECO 4

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Very Light Snow, Snow Grains or Snow Pellets[4,5,6]	Light Snow, Snow Grains or Snow Pellets[4,5,6]	Moderate Snow, Snow Grains or Snow Pellets[4,6]	Freezing Drizzle[7]	Light Freezing Rain	Rain on Cold-Soaked Wing[8]	Other[9]
-3 °C and above (27 °F and above)	100/0	1:08 - 2:02	1:54 - 2:24	0:57 - 1:54	0:27 - 0:57	0:49 - 1:08	0:30 - 0:49	0:11 - 0:53	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A		
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:42 - 1:58	1:43 - 2:05	0:49 - 1:43	0:27 - 0:49	0:38 - 1:01	0:27 - 0:38		
	75/25	N/A	N/A	N/A	N/A	N/A	N/A		
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:42 - 1:58	1:35 - 1:58	0:46 - 1:35	0:23 - 0:46	0:38 - 1:01[10]	0:27 - 0:38[10]		
	75/25	N/A	N/A	N/A	N/A	N/A	N/A		
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:23 - 0:38	0:23 - 0:34	0:07 - 0:23	0:02 - 0:07				
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:23 - 0:38	0:08 - 0:15	0:02 - 0:08	0:01 - 0:02				
below -25 to -25.5 °C (below -13 to -14 °F)	100/0	0:23 - 0:38	0:05 - 0:08	0:02 - 0:05	0:00 - 0:02				

CAUTION: No holdover time guidelines exist

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR however it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or mist.
4 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required.
5 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain or drizzle. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required to confirm the precipitation intensity is no greater than “light”. No holdover times exist if the reported visibility correlates to a “moderate” or “heavy” precipitation intensity.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
9 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table Adj-49 provides allowance times for Type IV PG fluids in ice pellets and small hail).
10 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-27.

W. FAA Table ADJ-42: Adjusted Type IV Holdover Times for JSC RCP Nordix Defrost NORTH 4

Appendix A: FAA Adjusted Holdover Time Guidelines **Winter 2023-2024**

TABLE ADJ-42: ADJUSTED TYPE IV HOLDOVER TIMES FOR JSC RCP NORDIX DEFROST NORTH 4

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Very Light Snow, Snow Grains or Snow Pellets[4,5,6]	Light Snow, Snow Grains or Snow Pellets[4,5,6]	Moderate Snow, Snow Grains or Snow Pellets[4,6]	Freezing Drizzle[7]	Light Freezing Rain	Rain on Cold-Soaked Wing[8]	Other[9]
-3 °C and above (27 °F and above)	100/0	1:39 - 3:02	2:13 - 2:51	1:05 - 2:13	0:30 - 1:05	0:49 - 1:31	0:23 - 0:38	0:07 - 1:27	CAUTION: No holdover time guidelines exist
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A		
below -3 to -8 °C (below 27 to 18 °F)	100/0	2:02 - 3:02	2:13 - 2:51	1:05 - 2:13	0:30 - 1:05	0:49 - 1:31	0:30 - 0:46		
	75/25	N/A	N/A	N/A	N/A	N/A	N/A		
below -8 to -14 °C (below 18 to 7 °F)	100/0	2:02 - 3:02	2:13 - 2:51	1:05 - 2:13	0:30 - 1:05	0:49 - 1:31[10]	0:30 - 0:46[10]		
	75/25	N/A	N/A	N/A	N/A	N/A	N/A		
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:34 - 1:27	0:38 - 0:49	0:19 - 0:38	0:08 - 0:19				
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:34 - 1:27	0:30 - 0:42	0:11 - 0:30	0:04 - 0:11				
below -25 to -26 °C (below -13 to -15 °F)	100/0	0:34 - 1:27	0:19 - 0:27	0:06 - 0:19	0:02 - 0:06				

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR however it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or mist.
4 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required.
5 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain or drizzle. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required to confirm the precipitation intensity is no greater than "light". No holdover times exist if the reported visibility correlates to a "moderate" or "heavy" precipitation intensity.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
9 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table Adj-48 provides allowance times for Type IV EG fluids in ice pellets and small hail).
10 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-27.

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TABLE ADJ-43: ADJUSTED TYPE IV HOLDOVER TIMES FOR KILFROST ABC-S PLUS

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Very Light Snow, Snow Grains or Snow Pellets[4,5,6]	Light Snow, Snow Grains or Snow Pellets[4,5,6]	Moderate Snow, Snow Grains or Snow Pellets[4,6]	Freezing Drizzle[7]	Light Freezing Rain	Rain on Cold-Soaked Wing[8]	Other[9]
-3 °C and above (27 °F and above)	100/0	1:39 - 3:02	2:43 - 3:00	1:35 - 2:43	0:57 - 1:35	1:24 - 1:31	0:49 - 1:31	0:19 - 1:31	
	75/25	1:05 - 2:02	1:35 - 1:50	0:57 - 1:35	0:34 - 0:57	0:46 - 1:01	0:23 - 0:38	0:08 - 1:01	
	50/50	0:23 - 0:42	0:46 - 0:53	0:23 - 0:46	0:11 - 0:23	0:11 - 0:30	0:11 - 0:15		
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:42 - 2:40	2:24 - 2:51	1:24 - 2:24	0:49 - 1:24	0:19 - 1:12	0:15 - 0:23		
	75/25	0:34 - 1:24	1:24 - 1:39	0:49 - 1:24	0:30 - 0:49	0:15 - 0:53	0:11 - 0:19		
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:42 - 2:40	2:13 - 2:40	1:20 - 2:13	0:46 - 1:20	0:19 - 1:12[10]	0:15 - 0:23[10]		
	75/25	0:34 - 1:24	1:20 - 1:31	0:46 - 1:20	0:27 - 0:46	0:15 - 0:53[10]	0:11 - 0:19[10]		
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:30 - 0:46	0:23 - 0:34	0:07 - 0:23	0:02 - 0:07	CAUTION: No holdover time guidelines exist			
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:30 - 0:46	0:08 - 0:15	0:02 - 0:08	0:01 - 0:02				
below -25 to -28 °C (below -13 to -18 °F)	100/0	0:30 - 0:46	0:05 - 0:08	0:02 - 0:05	0:00 - 0:02				

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR however it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or mist.
4 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required.
5 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain or drizzle. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required to confirm the precipitation intensity is no greater than “light”. No holdover times exist if the reported visibility correlates to a “moderate” or “heavy” precipitation intensity.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
9 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table Adj-49 provides allowance times for Type IV PG fluids in ice pellets and small hail).
10 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-27.

TABLE ADJ-44: ADJUSTED TYPE IV HOLDOVER TIMES FOR NEWAVE AEROCHEMICAL FCY 9311

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Very Light Snow, Snow Grains or Snow Pellets[4,5,6]	Light Snow, Snow Grains or Snow Pellets[4,5,6]	Moderate Snow, Snow Grains or Snow Pellets[4,6]	Freezing Drizzle[7]	Light Freezing Rain	Rain on Cold-Soaked Wing[8]	Other[9]
-3 °C and above (27 °F and above)	100/0	1:27 - 3:02	1:46 - 2:13	0:53 - 1:46	0:27 - 0:53	0:53 - 1:31	0:30 - 0:49	0:11 - 1:05	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A		
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:27 - 1:35	1:24 - 1:46	0:42 - 1:24	0:23 - 0:42	0:27 - 1:01	0:15 - 0:27		
	75/25	N/A	N/A	N/A	N/A	N/A	N/A		
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:27 - 1:35	1:12 - 1:31	0:38 - 1:12	0:19 - 0:38	0:27 - 1:01[10]	0:15 - 0:27[10]		
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist	
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:23 - 0:42	0:46 - 0:57	0:23 - 0:46	0:11 - 0:23				
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:23 - 0:42	0:27 - 0:30	0:11 - 0:27	0:05 - 0:11				
below -25 to -29.5 °C (below -13 to -21 °F)	100/0	0:23 - 0:42	0:23 - 0:30	0:11 - 0:23	0:05 - 0:11				

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR however it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or mist.
4 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required.
5 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain or drizzle. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required to confirm the precipitation intensity is no greater than “light”. No holdover times exist if the reported visibility correlates to a “moderate” or “heavy” precipitation intensity.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
9 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table Adj-49 provides allowance times for Type IV PG fluids in ice pellets and small hail).
10 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-27.

TABLE ADJ-45: ADJUSTED TYPE IV HOLDOVER TIMES FOR NEWAVE AEROCHEMICAL FCY-EGIV

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Very Light Snow, Snow Grains or Snow Pellets[4,5,6]	Light Snow, Snow Grains or Snow Pellets[4,5,6]	Moderate Snow, Snow Grains or Snow Pellets[4,6]	Freezing Drizzle[7]	Light Freezing Rain	Rain on Cold-Soaked Wing[8]	Other[9]
-3 °C and above (27 °F and above)	100/0	1:58 - 3:02	1:58 - 2:32	0:53 - 1:58	0:27 - 0:53	1:01 - 1:31	0:30 - 0:49	0:11 - 1:31	
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
	50/50	N/A	N/A	N/A	N/A	N/A	N/A		
below -3 to -8 °C (below 27 to 18 °F)	100/0	1:05 - 2:36	1:39 - 2:05	0:46 - 1:39	0:19 - 0:46	0:38 - 1:31	0:34 - 0:49		
	75/25	N/A	N/A	N/A	N/A	N/A	N/A		
below -8 to -14 °C (below 18 to 7 °F)	100/0	1:05 - 2:36	1:27 - 1:50	0:38 - 1:27	0:19 - 0:38	0:38 - 1:31[10]	0:34 - 0:49[10]		
	75/25	N/A	N/A	N/A	N/A	N/A	N/A	CAUTION: No holdover time guidelines exist	
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:27 - 1:27	1:12 - 1:35	0:30 - 1:12	0:11 - 0:30				
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:27 - 1:27	0:53 - 1:12	0:23 - 0:53	0:11 - 0:23				
below -25 to -29 °C (below -13 to -20 °F)	100/0	0:27 - 1:27	0:46 - 1:01	0:19 - 0:46	0:08 - 0:19				

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 Ensure that the lowest operational use temperature (LOUT) is respected. Consider use of Type I fluid when Type IV fluid cannot be used.
2 Freezing mist is best confirmed by observation. It is never reported by METAR however it can occur when mist is present at 0 °C (32 °F) and below.
3 Use freezing fog holdover times in conditions of ice crystals mixed with freezing fog or mist.
4 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required.
5 Use light freezing rain holdover times in conditions of very light or light snow mixed with light rain or drizzle. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required to confirm the precipitation intensity is no greater than “light”. No holdover times exist if the reported visibility correlates to a “moderate” or “heavy” precipitation intensity.
6 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
7 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
8 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
9 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table Adj-48 provides allowance times for Type IV EG fluids in ice pellets and small hail).
10 No holdover time guidelines exist for this condition below -10 °C (14 °F).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-27.

F.18.6 Adjusted HOT Guidelines for Mixed Snow and Freezing Fog (FAA Table ADJ-46)

CAUTION

- *The responsibility for the application of these data remains with the user.*
- *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 outside air temperature.*
- *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 pre-takeoff check procedures.*

A. FAA Table ADJ-46: Adjusted Holdover Times for Snow Mixed with Freezing Fog for SAE Type I, Type II, Type III, and Type IV Fluids

TABLE ADJ-46: ADJUSTED HOLDOVER TIMES FOR SNOW MIXED WITH FREEZING FOG FOR SAE TYPE I, TYPE II, TYPE III, AND TYPE IV FLUIDS[1,2]

Outside Air Temperature	Type I[3] Aluminum	Type I[3] Composite	Type III[4]
below 0 °C to -3 °C (below 32 °F to 27 °F)	0:02 - 0:05	0:02 - 0:02	0:07 - 0:15
below -3 to -6 °C (below 27 to 21 °F)	0:02 - 0:03	0:01 - 0:02	0:07 - 0:15
below -6 to -10 °C (below 21 to 14 °F)	0:02 - 0:02	0:01 - 0:02	0:07 - 0:15
below -10 to -25 °C[6] (below 14 to -13 °F[6])	0:01 - 0:02	0:01 - 0:02	0:07 - 0:15[5]
below -25 °C to LOUT[6] (below -13 °F to LOUT[6])	0:01 - 0:02	0:01 - 0:02	0:04 - 0:08[5]

Outside Air Temperature	Concentration Fluid/Water By % Volume	Type II	Type IV
below 0 °C to -3 °C (below 32 °F to 27 °F)	100/0	0:11 - 0:21	0:11 - 0:23
	75/25	0:06 - 0:11	0:15 - 0:29
	50/50	0:03 - 0:06	0:04 - 0:10
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:08 - 0:15	0:10 - 0:21
	75/25	0:04 - 0:10	0:11 - 0:25
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:06 - 0:11	0:10 - 0:19
	75/25	0:04 - 0:08	0:10 - 0:21
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:01 - 0:03	0:01 - 0:04
below -18 to -25 °C[6] (below 0 to -13 °F[6])	100/0	0:01 - 0:02	0:01 - 0:02
below -25 °C to LOUT[6] (below -13 °F to LOUT[6])	100/0	0:00 - 0:01	0:00 - 0:01

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. HOLDOVER TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 To use the HOTs in this table, ensure that the fluid and dilution being used is listed in the List of Qualified Fluids Tested for Anti-Icing Performance and Aerodynamic Acceptance table (Table 51 -Table 54). Any restrictions on the use of the fluid have to be identified and applied.
2 These holdover times are for use in -SN FZFG and SN FZFG. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 50) is required to confirm the precipitation intensity is no greater than “moderate”. No holdover times exist if the reported visibility correlates to a “heavy” precipitation intensity.
3 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.
4 To use the Type III fluid holdover times, the fluid brand being used must be known. AllClear AeroClear MAX must be applied unheated.
5 No holdover time guidelines exist below -16°C (3°F) for low speed aircraft and below -20.5 °C (-5 °F) middle speed aircraft. If uncertain whether the aircraft conforms to the low, middle, or high speed aerodynamic test criterion, no holdover time guidelines exist below -16°C (3°F).
6 Ensure that the lowest operational use temperature (LOUT) is respected. If the LOUT is unknown, no holdover time guidelines exist below -25 °C (-13 °F) for Type II fluids and below -25.5 °C (-14 °F) for Type IV fluids.

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page A-54.

F.18.7 Adjusted Allowance Times Tables (FAA Tables ADJ-47 – ADJ-49)

CAUTION

- *The responsibility for the application of these data remains with the user.*
- *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 pre-takeoff check procedures.*
- *Allowance time cannot be extended by an inspection of the aircraft critical surfaces.*

A. FAA Table ADJ-47: Adjusted Allowance Times for SAE Type III Fluids

Appendix A: FAA Adjusted Holdover Time Guidelines **Winter 2023-2024**

TABLE ADJ-47: ADJUSTED ALLOWANCE TIMES FOR SAE TYPE III FLUIDS[1,2]

Precipitation Types or Combinations	Applicable METAR Codes	Outside Air Temperature		
		-5 °C and above (23 °F and above)	Below -5 to -10 °C (Below 23 to 14 °F)	Below -10 °C[3] (Below 14 °F)
Light Ice Pellets	**-PL**	8 minutes	8 minutes	**Caution: No allowance times currently exist**
Light Ice Pellets Mixed with Light Snow	**-PL SN, -SN PL**	8 minutes	8 minutes	
Light Ice Pellets Mixed with Light Freezing Drizzle or Moderate Freezing Drizzle	**-PL FZDZ, -FZDZ PL, FZDZ PL**	5 minutes	4 minutes	
Light Ice Pellets Mixed with Light Drizzle or Moderate Drizzle	**-PL DZ, -DZ PL, DZ PL**	5 minutes[4]		
Light Ice Pellets Mixed with Light Freezing Rain	**-PL FZRA, -FZRA PL**	5 minutes	4 minutes	
Light Ice Pellets Mixed with Light Rain	**-PL RA, -RA PL**	5 minutes[5]		
Moderate Ice Pellets (or Small Hail[6])	**PL, GS**	4 minutes	4 minutes	

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. ALLOWANCE TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 These allowance times are for use with undiluted (100/0) fluids applied unheated on aircraft with rotation speeds of 100 knots or greater.
2 Takeoff is allowed up to 90 minutes after start of fluid application if the precipitation stops at or before the allowance time expires and does not restart. The OAT must not decrease during the 90 minutes to use this guidance in conditions of light ice pellets mixed with either: light freezing drizzle, moderate freezing drizzle, light freezing rain, or light rain.
3 Ensure that the lowest operational use temperature (LOUT) is respected.
4 No allowance times exist in this condition for temperatures of 0 °C and below; consider use of light ice pellets mixed with light freezing drizzle or moderate freezing drizzle.
5 No allowance times exist in this condition for temperatures of 0 °C and below; consider use of light ice pellets mixed with light freezing rain.
6 In the US, small hail is reported by METAR as GR and the remarks section is used to indicate “GR LESS THAN ¼”. Outside of the US the METAR code GS is used to indicate small hail when it is less than 5 mm and GR to indicate hail when it is 5mm or greater. If METAR does not report an intensity for small hail, use the “moderate ice pellets or small hail” allowance times. If METAR reports an intensity with small hail, the ice pellet condition with the equivalent intensity can be used, e.g. if light small hail is reported, the “light ice pellets” allowance times can be used. This also applies in mixed conditions, e.g. if light small hail mixed with light snow is reported, use the “light ice pellets mixed with light snow” allowance times.

CAUTIONS

- The cautions that apply to the allowance times in the table above can be found on page A-56.

B. FAA Table ADJ-48: Adjusted Allowance Times for SAE Type IV Ethylene Glycol (EG) Fluids

Appendix A: FAA Adjusted Holdover Time Guidelines **Winter 2023-2024**

TABLE ADJ-48: ADJUSTED ALLOWANCE TIMES FOR SAE TYPE IV ETHYLENE GLYCOL (EG) FLUIDS[1,2]

Precipitation Types or Combinations	Applicable METAR Codes	Outside Air Temperature			
		-5 °C and above[3] (23 °F and above)	Below -5 to -10 °C[3] (Below 23 to 14 °F)	Below -10 to -16 °C[3] (Below 14 to 3 °F)	Below -16 to -22 °C[3,4] (Below 3 to -8 °F)
Light Ice Pellets	**-PL**	53 minutes	38 minutes	38 minutes	23 minutes
Light Ice Pellets Mixed with Light Snow	**-PL SN, -SN PL**	38 minutes	23 minutes	19 minutes	
Light Ice Pellets Mixed with Light Freezing Drizzle or Moderate Freezing Drizzle	**-PL FZDZ, -FZDZ PL, FZDZ PL**	30 minutes	23 minutes		
Light Ice Pellets Mixed with Light Drizzle or Moderate Drizzle	**-PL DZ, -DZ PL, DZ PL**	30 minutes[5]		**Caution: No allowance times currently exist**	
Light Ice Pellets Mixed with Light Freezing Rain	**-PL FZRA, -FZRA PL**	30 minutes	23 minutes		
Light Ice Pellets Mixed with Light Rain	**-PL RA, -RA PL**	30 minutes[6]			
**Moderate Ice Pellets (or Small Hail[7]) **	**PL, GS**	27 minutes	19 minutes	11 minutes	8 minutes
Moderate Ice Pellets (or Small Hail[7]) Mixed with Moderate Freezing Drizzle	**PL FZDZ, GS FZDZ,**	15 minutes	8 minutes		
Moderate Ice Pellets (or Small Hail[7]) Mixed with Moderate Drizzle	**PL DZ, GS DZ**	15 minutes[8]		**Caution: No allowance times currently exist**	
Moderate Ice Pellets (or Small Hail[7]) Mixed with Moderate Rain	**PL RA, GS RA, RA PL, RA GS**	11 minutes[9]			

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. ALLOWANCE TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 These allowance times are for use with undiluted (100/0) ethylene glycol (EG) based fluids applied on aircraft with rotation speeds of 100 knots or greater. The following fluids are EG based; ALAB International PROFLIGHT EG4, AllClear ClearWing EG, ASGlobal 4Flite EG, AVIAFLUID AVIAFlight EG, CHEMCO ChemR EG IV, CHEMCO ChemR Nordik IV, Clariant Max Flight AVIA, Clariant Safewing EG IV NORTH, Dow EG106, JSC RCP Nordix Defrost NORTH 4, and Newave Aerochemical FCY-EGIV. If the glycol type is unknown, the allowance times for SAE Type IV PG fluids should be used.

2 Takeoff is allowed up to 90 minutes after start of fluid application if the precipitation stops at or before the allowance time expires and does not restart. The OAT must not decrease during the 90 minutes to use this guidance in conditions of light ice pellets mixed with either: light freezing drizzle, moderate freezing drizzle, light freezing rain, or light rain

3 No allowance times exist for ethylene glycol (EG) fluids when used on aircraft with rotation speeds less than 100 knots.

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

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

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

7 In the US, small hail is reported by METAR as GR and the remarks section is used to indicate “GR LESS THAN ¼”. Outside of the US the METAR code GS is used to indicate small hail when it is less than 5 mm and GR to indicate hail when it is 5mm or greater. If METAR does not report an intensity for small hail, use the “moderate ice pellets or small hail” allowance times. If METAR reports an intensity with small hail, the ice pellet condition with the equivalent intensity can be used, e.g. if light small hail is reported, the “light ice pellets” allowance times can be used. This also applies in mixed conditions, e.g. if light small hail mixed with light snow is reported, use the “light ice pellets mixed with light snow” allowance times.

8 No allowance times exist in this condition for temperatures of 0 °C and below; consider use of moderate ice pellets (or small hail) mixed with moderate freezing drizzle.

9 No allowance times exist in this condition for temperatures of 0 °C and below.

CAUTIONS

- The cautions that apply to the allowance times in the table above can be found on page A-56.

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C. FAA Table ADJ-49: Adjusted Allowance Times for SAE Type IV Propylene Glycol (PG) Fluids

Appendix A: FAA Adjusted Holdover Time Guidelines **Winter 2023-2024**

TABLE ADJ-49: ADJUSTED ALLOWANCE TIMES FOR SAE TYPE IV PROPYLENE GLYCOL (PG) FLUIDS[1,2]

Precipitation Types or Combinations	Applicable METAR Codes	Outside Air Temperature			
		-5 °C and above[3] (23 °F and above)	Below -5 to -10 °C[3] (Below 23 to 14 °F)	Below -10 to -16 °C[4] (Below 14 to 3 °F)	Below -16 to -22 °C[4,5] (Below 3 to -8 °F)
Light Ice Pellets	-PL	38 minutes	23 minutes	23 minutes	15 minutes
Light Ice Pellets Mixed with Light Snow	-PL SN, -SN PL	30 minutes	11 minutes	11 minutes	
Light Ice Pellets Mixed with Light Freezing Drizzle or Moderate Freezing Drizzle	-PL FZDZ, -FZDZ PL, FZDZ PL	19 minutes	8 minutes		
Light Ice Pellets Mixed with Light Drizzle or Moderate Drizzle	-PL DZ, -DZ PL, DZ PL	19 minutes[6]		Caution: No allowance times currently exist	
Light Ice Pellets Mixed with Light Freezing Rain	-PL FZRA, -FZRA PL	19 minutes	8 minutes		
Light Ice Pellets Mixed with Light Rain	-PL RA, -RA PL	19 minutes[7]			
Moderate Ice Pellets (or Small Hail[8])	PL, GS	11 minutes	8 minutes	8 minutes	
Moderate Ice Pellets (or Small Hail[8]) Mixed with Moderate Freezing Drizzle	PL FZDZ, GS FZDZ	8 minutes	5 minutes		
Moderate Ice Pellets (or Small Hail[8]) Mixed with Moderate Drizzle	PL DZ, GS DZ	8 minutes[9]		Caution: No allowance times currently exist	
Moderate Ice Pellets (or Small Hail[8]) Mixed with Moderate Rain	PL RA, GS RA, RA PL, RA GS	8 minutes[10]			

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING. ALLOWANCE TIMES HAVE BEEN ADJUSTED TO 76 PERCENT.

NOTES

1 These allowance times are for use with undiluted (100/0) propylene glycol (PG) based fluids. All Type IV fluids are PG based with the exception of ALAB International PROFLIGHT EG4, AllClear ClearWing EG, ASGlobal 4Flite EG, AVIAFLUID AVIAFlight EG, CHEMCO ChemR EG IV, CHEMCO ChemR Nordik IV, Clariant Max Flight AVIA, Clariant Safewing EG IV NORTH, Dow EG106, JSC RCP Nordix Defrost NORTH 4, and Newave Aerochemical FCY-EGIV, which are ethylene glycol (EG) based. If the glycol type is unknown, the allowance times for SAE Type IV PG fluids should be used.

2 Takeoff is allowed up to 90 minutes after start of fluid application if the precipitation stops at or before the allowance time expires and does not restart. The OAT must not decrease during the 90 minutes to use this guidance in conditions of light ice pellets mixed with either: light freezing drizzle, moderate freezing drizzle, light freezing rain, or light rain.

3 No allowance times exist for PG based fluids when used on aircraft with rotation speeds less than 100 knots.

4 No allowance times exist for PG based fluids when used on aircraft with rotation speeds less than 115 knots.

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

6 No allowance times exist in this condition for temperatures of 0 °C and below; consider use of light ice pellets mixed with light freezing drizzle or moderate freezing drizzle.

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

8 In the US, small hail is reported by METAR as GR and the remarks section is used to indicate “GR LESS THAN ¼”. Outside of the US the METAR code GS is used to indicate small hail when it is less than 5 mm and GR to indicate hail when it is 5mm or greater. If METAR does not report an intensity for small hail, use the “moderate ice pellets or small hail” allowance times. If METAR reports an intensity with small hail, the ice pellet condition with the equivalent intensity can be used, e.g. if light small hail is reported, the “light ice pellets” allowance times can be used. This also applies in mixed conditions, e.g. if light small hail mixed with light snow is reported, use the “light ice pellets mixed with light snow” allowance times.

9 No allowance times exist in this condition for temperatures of 0 °C and below; consider use of moderate ice pellets (or small hail) mixed with moderate freezing drizzle.

10 No allowance times exist in this condition for temperatures of 0 °C and below.

CAUTIONS

- The cautions that apply to the allowance times in the table above can be found on page A-56.

END

Index of References