Aircraft Deicing Program

Mission Statement

Provide profitable, quality aviation services

Provide opportunity for challenging and competitive employment

Be economically, socially and morally responsible

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Revision Instructions/Highlights

Revision: 51 – Aircraft Deicing Program **Revision Date:** August 30, 2024

DOM or Rep. _____ DQA or Rep. _____

VP Ops or Rep. _____ SRM# 472

Review this revision and file in your manual in accordance with the following instructions:

Where **REP** is shown in the Action column, remove the sheet in your manual and replace it with the enclosed page of the same page number; otherwise, Add **(ADD)** or Delete **(DEL)** pages as indicated.

File Revision Instructions/Highlights in the front of your manual and update the Revision Log for this manual.

Action	Page(s)	Highlights
REP	LEP-1 – LEP-2	Updated List of Effective Pages
REP	1-1 – 1-2	Updated Table of Contents for Chapter 1.
REP	1-43 – 1-45	Added Alternative and New Technologies.
REP	1-46	Reissued due to text flow changes.
ADD	1-47 – 1-50	Added due to new text.
REP	2-6	Added new text for the Postflight Inspection.
REP	3-10	Added new paragraph F.
REP	4-8	In Note 2, changed "manufacturers" to "generic HOT."
REP	Chapter 5 - All	Updated HOTs for 2024-2025.
REP	6-9	Added new table for Type I and Type IV fluids.

Ensure manual is current before printing.

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Date: 08/30/24
Revision: 51

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PROGRAM DESCRIPTION

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PROGRAM DESCRIPTION

Scope

14 CFR: 121.629, 135.227

A. Empire's Aircraft Deicing Program **(ADP)** is designed to provide safe and expeditious release of Empire aircraft in icing conditions. The program is designed to assure that, in accordance with 14 CFR 121.629, 135.227, and conforming to the guidance contained in AC 120-60B and AC 120-58 no Empire aircraft is released for flight in icing conditions without determining that the aircraft has been safely deiced/anti-iced and remains safe through takeoff.

B. In accordance with 14 CFR 121.629(a) no person may dispatch or release an aircraft, continue to operate an aircraft en route, or land an aircraft when in the opinion of the pilot in command or aircraft dispatcher, icing conditions are expected or met that might adversely affect the safety of the flight.

C. Supplemental operations in accordance with 14 CFR 121.597(b) no person may release a flight unless the pilot in command and the Dispatcher or Flight Follower believe the flight can be completed safely.

D. Domestic operations in accordance with 121.593, Except when an airplane lands at an intermediate airport specified in the original dispatch release and remains there for not more than one hour, no person may start a flight unless an aircraft dispatcher specifically authorizes that flight.

E. 14 CFR 121.629(b) prohibits takeoff when snow, ice, or frost is adhering to wings, propellers, control surfaces, engine inlets, and other critical surfaces of the aircraft. This rule is the basis for the ***clean aircraft concept.*** It is imperative that takeoff not be attempted unless the pilot-in-command **(PIC)** has determined that all critical surfaces of the aircraft are free of frozen contaminants. The PIC has the ultimate responsibility to determine that the aircraft is clean and in a condition for safe flight. The requirement for a clean aircraft may be met if the PIC obtains verification from trained deice personnel that the aircraft is ready for flight.

F. FAA authorization for operations during ground icing conditions is contained in the Operations Specifications, A023. Compliance with Operations Specifications is mandatory. Operations Specifications A023 directly references this Empire Airlines Aircraft Ground Deicing Program Manual as the FAA approved ground deicing/anti-icing program.

Revisions and Approvals

A. The ADP will be reviewed by the Director of Operations **(DO)** each year to determine that it continues to meet the requirements of 14 CFR 121.629 and incorporates the applicable guidance of the latest Advisory Circulars, current FAA Holdover Time Tables, and aircraft manufacturers' limitations and procedures.

B. ADP revisions are controlled by the List of Effective Pages **(LEP)** in the front of the manual. Revisions will be distributed to manual holders in accordance with the Technical Library procedures; distribution control is also listed in the Technical Library. Program approval is shown by FAA approval stamp and signature on the LEP and by Operations Specifications paragraph A023.

C. A copy of this manual will be located at:

- Empire Technical Publications library;
- Empire aircraft operated under Supplemental Part 121 or 135;
- Empire stations where ADP operations are anticipated;
- Dispatch/Flight Following/Maintenance Control, and
- Vendors contracted to perform ADP operations.

PROGRAM DESCRIPTION

ADP Authority and Control

A. Authority and control over the administration and revision to the ADP rests with the Director of Operations. The Director of Operations has authority to approve changes to the ADP.

B. The Director of Operations has the authority to approve the use of another air carrier's deicing/anti-icing procedures and/or training based on their program's conformity to AC 120-60, current edition. Deice contractors will be trained in accordance with Empire Airlines' FAA approved Aircraft Deicing Program.

C. Interface – There are many incidents of similar and/or identical text in multiple Empire manuals. In order to identify this text, a special symbol (Tapestry Triangle font ⚠)will be assigned to each manual affected. This symbol will alert us that making a change in one manual may affect another manual. These symbols are shown in the PPM Ch. 2-01.

Abbreviations

AC – Advisory Circular
AD – Air Worthiness Directive
ADP – Aircraft Deicing Program
ºC – degrees Celsius
ºF – degrees Fahrenheit
FP - Freezing point
FPD - Freezing Point Depressant
ISO – International Standard Organization
LOUT – Lowest Operational Use Temperature
OAT - Outside air temperature
SAE – Society of Automotive Engineers

Definitions

A. The following definitions are used throughout this manual and apply to ground deicing/anti-icing procedures:

(1) Anti-icing is a procedure that provides protection against formation of frost or ice and accumulation of snow or slush treated 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.

(2) Buffer/Freezing Point – The difference between OAT and the freezing point of the fluid.

(3) Check – An examination of an item against a relevant standard by a trained person.

(4) Clear ice – A smooth compact ice formation, usually transparent.

(5) Cold Soak Wings – The wings of aircraft are said to be "cold-soaked" when they contain very cold fuel as a result of having just landed after a flight at high altitude or from having been re-fueled with very cold fuel.

(6) Cold Weather Preflight – Check of a critical surface of the aircraft to determine if frozen contaminants are adhering.

(7) Critical Surfaces – Surfaces on the aircraft that must be clear of frozen contaminants before takeoff. See the aircraft specific chapter of the ADP for a description of the critical surfaces.

(8) Deicing – is a procedure by which ice, frost, slush, or snow is removed from the aircraft in order to provide clean surfaces. The procedure can be accomplished using fluids, infrared energy, mechanical means, or by heating the aircraft.

(9) Deicing/Anti-icing – can be performed in one or two steps:

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

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

(10) Designated Instructor – is an Empire employee that has been trained on the ADP and has been selected by management to train other Empire employees or contract deice personnel to perform their duties and responsibilities per this ADP. Designated Instructors include:

(a) Flight operations instructors listed in the Flight Training Manual Chapter 1.
(b) Ground operations instructors as determined by the Maintenance Training Manager.

(11) Frozen Contaminants – include all forms of frozen moisture such as freezing rain, freezing drizzle, frost, ice, ice pellets, snow, snow grains, and slush.

(12) Freezing Point (FP) – The temperature at which a liquid (precipitation) turns into a solid (frozen contaminant).

(13) Freezing Point Depressant (FPD) – Refers to deicing/anti-icing fluid and describes the purpose of the fluid, which is to lower or depress the freezing point of precipitation on aircraft surfaces.

(14) Holdover Table – Guideline on the amount of time that an FPD in a specified icing condition will protect the aircraft's critical surfaces from frozen contaminants.

(15) Holdover Time (HOT) – is the estimated time an FPD will prevent the formation of frost or ice, or the accumulation of snow on the critical surfaces of an aircraft. HOT begins when the final application of FPD commences and expires when the FPD loses its effectiveness.

(16) Icing Conditions – conditions that are conducive to ground icing, such that frost, ice or snow may reasonably be expected to adhere to the aircraft, also when frozen contaminants are adhering to aircraft surfaces or freezing precipitation conditions exist.

(17) 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.

(18) MIL Spec Fluids – Military deicing/anti-icing fluids are different from SAE or ISO fluids and no holdover times have been established.

(19) Neat – Undiluted Type II, III, or IV fluid as supplied by the manufacturer. HOT tables for Type II, III, and IV contain a column showing various concentration ratios of neat fluid to water. For instance a 75/25 concentration is 75% fluid and 25% water by volume.

(20) Pre-takeoff Check – is a check of the aircraft's representative surfaces for frozen contaminants. This check is conducted within the aircraft's HOT and may be made by observing the aircraft specific representative surfaces from the flight deck.

(21) Pre-takeoff Contamination Check – is a check, conducted after the aircraft's HOT has been exceeded, to ensure the aircraft's critical surfaces are free of frozen contaminants:

(a) The check must be made by trained deice personnel from outside the aircraft.

(b) The check must confirm that the critical surfaces are free of frozen contamination.

(c) The check must be conducted within 5 minutes of takeoff.

(22) Post Anti-Ice Check – is a check, after anti-icing fluid application, to ensure a uniform application of anti-ice fluid on the critical surfaces.

(23) Post Deicing Check – is a check, after deicing fluid application, to ensure critical aircraft surfaces are free of frozen contaminants.

(24) Representative Surface – Where fluids tend to fail first. Preliminary aircraft testing indicates that the first fluid failure on test aircraft appear to occur on the leading or trailing edges of the wing's surface. Representative aircraft surfaces can be observed from within the aircraft and used to determine whether or not frozen contaminants are accumulating or forming on that surface. By using it as a representative surface, the flight crew can make a judgment regarding whether or not frozen contaminants are adhering to other aircraft surfaces. For use during the pre-takeoff check only. See the aircraft specific chapter of the ADP for a description of the representative surfaces.

(25) Sensitive Areas – are areas that should be avoided during deice/anti-ice fluid application. See the aircraft specific chapter of the ADP for a description of the sensitive areas.

(26) Shear Force – Force applied laterally on an anti-icing fluid. When applied to a thickened fluid, the shear force will reduce the viscosity of the fluid; when the shear force is no longer applied, the anti-icing fluid should recover its viscosity. For instance, shear forces are applied when the fluid is pumped, forced through an orifice, or when subjected to airflow, as during takeoff.

(27) Significant Improvement – which allows the extension of the HOT would be:

(a) A change in precipitation rate from moderate to light (the HOT in each holdover table time box has a long and short time, the longer time is for light and the shorter time for moderate precipitation), or

(b) A change in the type of precipitation, i.e. light freezing rain to light freezing drizzle, or precipitation has ended, or

(c) A temperature change that moves the HOT into a new time box.

(28) Visible Moisture – present in any form, such as fog with visibility less than one mile, rain, snow, sleet, freezing rain, freezing drizzle, ice pellets, snow grains, snow pellets, or hail.

(29) Freezing Precipitation – precipitation that could adhere to aircraft surfaces:

(a) Snow – (SN) Precipitation in the form of small ice crystals or flakes that may accumulate on aircraft surfaces.

(b) Sleet – (SLT) Precipitation in the form of a mixture of rain and snow. For operations in light sleet treat as light freezing rain.

(c) Freezing Rain – (FZRA) Water condensed from atmospheric vapor falling to Earth in supercooled drops, forming ice on objects.

(d) Freezing Drizzle – (FZDZ) Fairly uniform precipitation composed exclusively of fine drops very close together that freeze upon impact with the surface.

(e) Hail – (GR) Precipitation of small balls or pieces of ice with a diameter ranging from 5 to >50mm.

(f) Active frost - is a frost condition that is actively growing crystals and gaining in mass and thickness and is considered a precipitation condition. It typically forms at night under clear skies and calm winds when the OAT is below 32°F (0°C) and the dew point temperature spread is less than 3°C.

(g) Freezing fog – (FZFG) Clouds of supercooled water droplets that form a deposit of ice on objects in cold weather conditions.

(h) Ice Pellets – (PL) Precipitation of transparent (sleet or grains of ice) or translucent (small hail) pellets of ice, which have a diameter of .2 in (5mm) or less. The ice pellets usually bounce when hitting hard surfaces.

(i) Rain or High Humidity – (RA) Water forming ice or frost on the wing surface when the temperature of the aircraft wing surface is below freezing due to cold soaked wing fuel tanks.

(j) Snow Grains – (SG) Precipitation of very small white and opaque grains of ice. Diameter is less than 1mm (.04 in). When the grains hit hard surfaces they do not bounce.

(k) Frost – (FRST) (including hoar frost) – is a crystallized deposit formed from water vapor that condenses on surfaces that are at or below 32°F (0°C).

(l) Snow Pellets – (GS) Precipitation of white and opaque grains of ice. Diameter of .1 to .2 in (2 to 5mm). Grains are brittle, easily crushed; they bounce and break on hard surfaces.

(30) In-flight Ice Accumulation – Ice that accumulates during flight and remains on the aircraft after landing.

(31) Slush – Water saturated with snow, which spatters when stepping firmly on it.

(32) Under Wing Frost – (may not require deicing/anti-icing within certain limits; see the aircraft specific chapter for under wing frost acceptability.) In certain conditions frost may form under the horizontal stabilizer and elevator, this frost formation is on a critical surface and requires deicing.

Contamination Effects

A. The effects that ice accumulations will have on aircraft performance and flight characteristics are dependent upon ice surface roughness, ice shape, and areas covered. These effects will generally be reflected in the form of decreased thrust, decreased lift, increased drag, increased stall speed, trim changes, altered stall characteristics, and handling qualities. Slight weight increases will also occur, however, the effect of weight increase (with the exception of heavy snow and freezing rain deposits during ground operations) is usually insignificant in comparison to aerodynamic degradation. More specifically, the ice formation effects on aircraft performance and flight characteristics are:

(1) Slight surface roughness can have significant effects on stall speed and power required to achieve or to sustain flight.

(2) Increased surface roughness, due to ice formation, on wing leading edges and after bodies will produce additional drag and further reduce lift.

(3) Due to increased stall speed, maneuvers should be gentler and airspeed margin during approach should be increased.

(4) Stall angle-of-attack will decrease and in some aircraft stall will occur prior to activation of stall warning devices.

(5) Stall characteristics will change and the nature of ice information can cause either violent stall or a slower progression of stall. Pitch-up tendencies may be greater and roll-off tendencies can be exaggerated.

(6) Controllability may be reduced requiring more stick deflection for maneuvers or stall recovery.

(7) Power available may be reduced due to ice formation on propellers.

(8) Ice or excessive quantities of FPD fluid have been known to cause control surface flutter.

(9) Trim effectiveness can deteriorate with the accumulation of ice on unprotected surfaces.

(10) Power failures may occur due to clogging of fuel tank vents and fuel caps.

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(11) Severe vibrations may occur due to asymmetric shedding of ice from propellers.

(12) Control surfaces can freeze in place if water deposits, snow, and FPD fluids are not properly cleaned or drained from critical areas.

(13) Wing flaps may be damaged if retracted with ice formations adhering to critical areas.

(14) Landing gear mechanisms may be damaged or frozen in place if not properly cleared of ice formations.

(15) Forward visibility may be lost or significantly reduced if windshield anti-icing systems are not properly utilized.

(16) Radio, radar and other communication and navigation antennas may be damaged or efficiency reduced due to ice formations.

(17) Ventilation and other air inlets can be blocked or flow restricted.

(18) Ice dislodged from fuselage sections, antennas and other components forward of engines and other critical components can produce damage.

(19) Ice formations under certain conditions may not have noticeable effects on aircraft performance and flight characteristics. However, these effects may become exaggerated in the event of engine failure or other emergencies.

(20) Flight, engine and other instruments are subject to error if ice formations exist on external probes, in pressure lines, or on areas forward of or adjacent to external probes. Operational experience indicates that typical sources of error are caused by icing of pitot-static and probes used for airspeed, altitude and engine pressure ratio measurements.

(21) Residual moisture on door and cargo hatch seals may freeze under certain conditions causing leaks or seal damage.

Recognizing Contamination

A. In Flight Ice Accumulation - Aircraft that land with residual in-flight ice accumulations may need to be deiced prior to the next takeoff if the ice accumulations are still adhering to the aircraft surfaces.

B. Clear Ice - Clear ice can be hidden under a layer of snow or slush. During the deice removal of snow or slush make sure that any ice is also removed. To check for clear ice, momentarily direct a concentrated stream of deice fluid at a single point, if any ice is present, it will become visible as it melts and breaks away from the aircraft surface. Repeat this process to ensure that all critical surfaces are free of ice.

C. Cold Soaked Wings - Cold soaked wings can cause clear ice or frost to form in the vicinity of the fuel tanks, on upper wing surfaces as well as lower wing surfaces. This type of ice formation normally occurs at cold wing temperatures caused by cold fuel in the wing tanks during ground time. The fuel temperature is reduced by extended exposure to high altitude flight. If frost or ice is present on the lower surface of either wing in the vicinity of the fuel tanks, the upper surface of the wing must be visually checked. If frost or ice is also present on the upper wing surface, it will be necessary to deice the critical wing surfaces before takeoff.

D. Atmospheric Icing Conditions - When atmospheric icing conditions exist (below +5°C with visible moisture) a cold weather preflight will be conducted from a vantage that allows a visual check of an aircraft critical surface to determine if frozen contaminants are adhering and if deicing is necessary. If a positive determination cannot be made that the critical surface is clear of frozen contaminants, deicing is necessary.

E. Contaminants Not Adhering. The regulations clearly state "no person may take off an aircraft when frost, ice, or snow is adhering to the wings…" 121.629(b) and "…no person may Dispatch/Flight Following, release or take off an aircraft any time conditions are such that frost, ice, or snow may reasonably be expected to adhere to the aircraft…" 121.629(c). Under some conditions the aircraft critical surfaces may be considered free of contaminants when a cold, dry aircraft has not had deicing and/or anti ice fluids applied, and ice/snow pellets are not adhering and are not expected to adhere to the aircraft critical surfaces. Refueling with fuel warmer than the wing skin temperature may create a condition that previously non adhering contaminants may adhere to the wing surfaces.

Fluid Types and Characteristics

Type I Fluid Characteristics

Type I fluids are Newtonian, non-thickened fluids used primarily for deicing, but may also be used for anti-icing with associated HOTs. They are thin in appearance, and, if colored, orange. Newtonian fluids tend to flow regardless of the forces acting on them, as evidenced by these fluids readily flowing off nonmoving aircraft surfaces. Type I fluids are never used undiluted.

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

- Holdover Time for SAE Type I Fluid on Critical Aircraft Surfaces Composed Predominantly of Aluminum (Table 2); and
- Holdover Time for SAE Type I Fluid on Critical Aircraft Surfaces Composed Predominantly of Composites (Table 3).

Note: The ATR 42/72 is considered predominantly composite.

Note: The Cessna C208 and C408 are considered predominantly aluminum.

Note: The Type I fluid HOTs for aluminum surfaces also apply to other metals used in aircraft construction, such as titanium. The Type I fluid HOTs for composite surfaces must be applied to aircraft with all critical surfaces that are predominantly or entirely constructed of composite materials.

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

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

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

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

(2) Effectiveness of Heated Type I Fluids. The heating requirements for Type I fluids are located in the FAA Type I fluid application table (refer to HOT Guidelines, Guidelines for the Application of SAE Type I Fluid).

PROGRAM DESCRIPTION

(a) As previously stated, Type I HOTs are heavily dependent on the heating of aircraft surfaces. Unlike Types II, III, and IV fluids, which contain thickeners to keep these fluids on aircraft surfaces, Type I fluids are not thickened and flow off relatively soon after application; therefore, the heating of aircraft surfaces during the Type I fluid deicing and anti-icing process contributes to the HOT by elevating the surface temperature above the freezing point of the residual fluid.

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

(3) Freezing Point of Type I Fluids. There is a note under the Type I HOT tables (Tables 2 and 3) that reads, "...freezing point of the mixture is at least 10 °C (18 °F) below outside air temperature." The difference between the freezing point of the fluid and the outside air temperature (OAT) is known as the temperature or freezing point buffer. In this case, the buffer is 10 °C (18 °F), which you can interpret as the freezing point of the fluid being 10 °C (18 °F) below the OAT. The 10 °C (18 °F) temperature buffer is used to accommodate inaccuracies and impreciseness in determining the many variables that affect the freezing point of a fluid mixture. Some of these variables include:

- OAT measurements.
- Refractometer freezing point measurements.
- Temperature of applied fluid/water mixture.
- Inaccuracies in freezing point depressant (FPD) fluid/water mixtures volumes.
- Differences between OAT and aircraft surface temperatures.
- Changes in OAT following fluid application.
- Differences in aircraft surface materials.
- Evaporation from repeated heating.
- Contamination from snow or rain entering the storage vessel.
- Wind effects.
- Solar radiation.

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

(4) Type I Fluid Verification. Type I HOTs are based upon a minimum fluid temperature, at the nozzle, of 60ºC (140ºF.) To ensure that Type I fluid temperatures meet the temperature parameters specified in the FAA HOT Guidelines, Empire Airlines (EM) will use the following procedures:

(a) For stations where smaller deice units are used that may not have an attached temperature gauge to measure fluid temperature. EM will place a calibrated infrared thermometer at each aircraft base station. Each season, before the deice unit is used for deicing any EM aircraft, Dispatch will assign an EM employee to take the IR thermometer to the station and use it to check the temperature of Type I fluid in the deice unit. The EM employee follows the instructions on the use of the IR thermometer written in the ADP. If access to the heated fluid in the tank is available, the temperature may be taken from that location or it may be taken

from the nozzle when the fluid is sprayed. The pilot will report the temperature measurement to dispatch. If the fluid temperature in the tank is 70ºC it is acceptable and may be used to apply HOT guidelines. If the temperature is less than 70ºC, then the fluid may be used for deicing but HOT guidelines may not be used.

(b) For stations where larger deice units are used that have a fluid temperature gauge attached, the accuracy of the deice unit temperature gauge will be verified during the deice vendor audit as outlined in 7-3 of this manual. The fluid temperature will be verified using a calibrated infrared thermometer. This check will most likely be accomplished by a qualified QA auditor but is simple enough to be accomplished by any EM employee using the guidance in the ADP. If there is a fleet of deice trucks or more than 1 at a certain location such as ANC, every truck does not need to be tested. A sampling of 1 deice truck may be accomplished, preferably the truck most likely to be used on EM aircraft.

(c) For stations that use an instant heat or last bypass heater deice unit, the temperature in the tank or at the last point of measurement may be 65ºC.

(d) When establishing compliance with the temperature parameter of 60ºC (140ºF) at the nozzle, as stated in the table Guidelines for the Application of SAE Type I Fluid, the FAA does not intend for air carriers or deicing operators to continually measure the fluid temperature at the nozzle. The FAA deems that establishing the temperature drop (at typical anti-icing fluid application flow rates) between the last temperature-monitored point in the plumbing chain and the nozzle is sufficient. Manufacturers of ground vehicle-based deicing equipment have indicated a temperature drop of 10ºC (18ºF) or less. Some manufacturers producing equipment using instant-on heat or last bypass heaters have indicated a temperature drop of 5ºC (9ºF) or less. Ensuring that the drop in fluid temperature from the last measured point in the plumbing chain to the nozzle does not result in a fluid temperature of less than 60ºC (140ºF) at the nozzle is sufficient.

(e) The IR thermometers used to verify Type I fluid temperature will be calibrated in accordance with the manufacturer's instructions.

(f) The record keeping log is kept by dispatch. The monthly and annual temperature checks will be recorded on this log and the information will be made available on the ForeFlight app for pilot use. Dispatch will update this log on Foreflight anytime new information is added. If the information is not readily available on the app, the pilot will check with dispatch before using the deice unit with HOT guidelines. Any station deice unit temperature check that is recorded as below 70ºC will not be used with HOT guidelines. This means that during active ground icing conditions no holdover time guidelines exist for Type I fluid. For stations that may have more than one deice unit, the log entry will specify a unit number that is recorded with the fluid temperature check.

(g) When dispatch assigns a temperature check for a specific station and deice unit, dispatch will notify that station deice vendor of the check so that the deice unit is made ready for the check.

(h) Empire uses the 62 Max infrared thermometer made by Fluke to measure Type I deice fluid temperature. The user instructions are as follows:

(i) The Fluke 62 MAX and 62 MAX + Infrared Thermometers (the Product) can determine the surface temperature by measuring the amount of infrared energy radiated by the target's surface.

(ii) A Warning identifies conditions and procedures that are dangerous to the user. A Caution identifies conditions and procedures that can cause damage to the Product or the equipment under test. Table 1 tells your about symbols used on the Product.

(iii) To prevent eye damage and personal injury;

- Read all safety information before you use the Product.
- Do not use the Product if it operates incorrectly.
- Use the Product only as specified, or the protection supplied by the Product can be compromised.
- Before you use the Product, inspect the case. Do not use the Product if it appears damaged. Look for cracks or missing plastic.
- See emissivity information for actual temperatures. Reflective objects result in lower than actual temperature measurements. These objects pose a burn hazard.
- Do not look directly into the laser with optical tools (for example, binoculars, telescopes, microscopes.) Optical tools can focus the laser and be dangerous to the eye.
- Do not look into the laser. Do not point laser directly at persons or animals or indirectly off reflective surfaces.
- Replace the batteries when the low battery indicator shows to prevent incorrect measurements.
- Do not use the Product around explosive gas, vapor, or in damp or went environments.
- Use the Product only as specified or hazardous laser radiation exposure can occur.

Instructions for the Fluke IR Thermometer

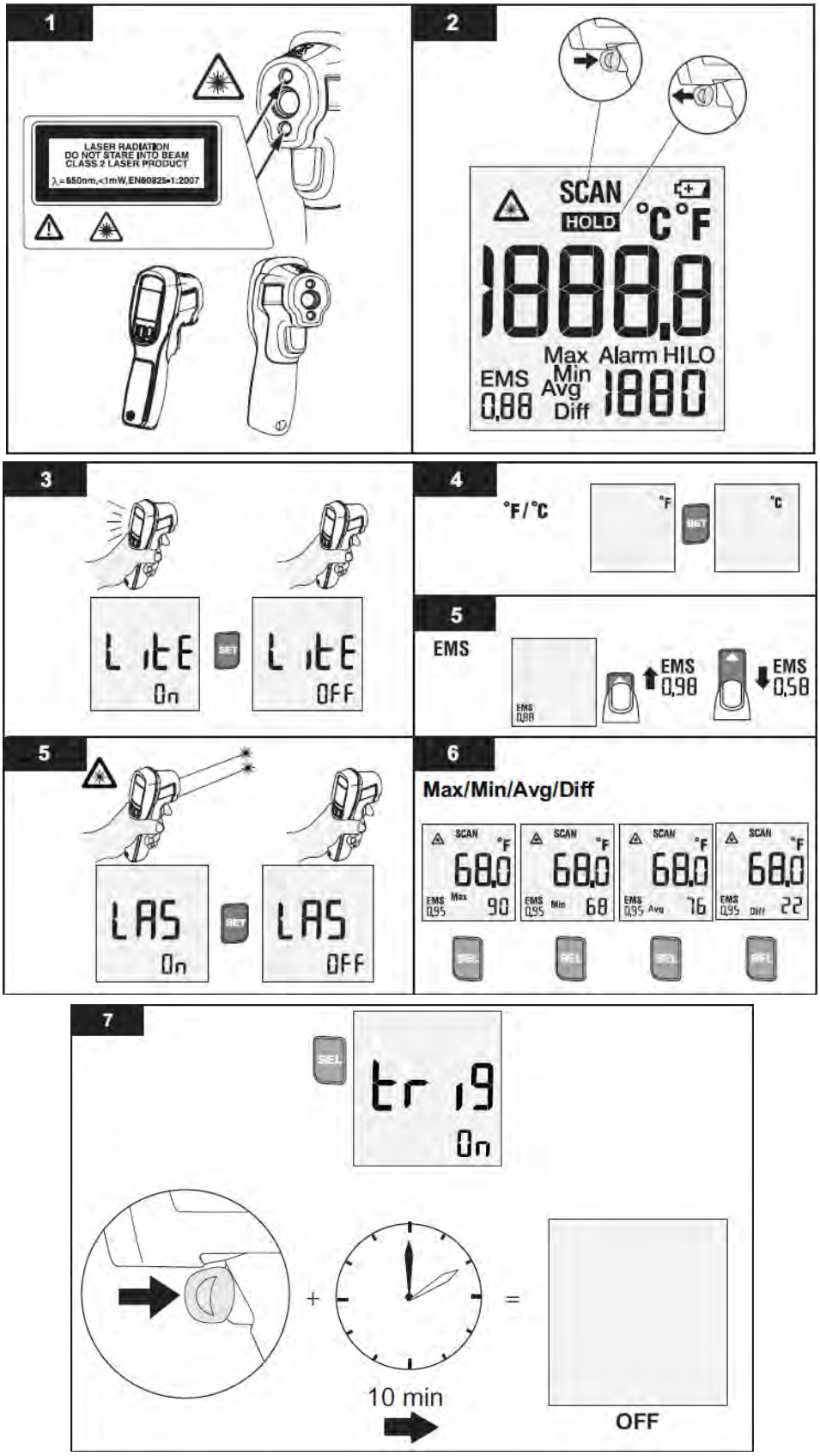
Table 1. Symbols

Symbol	Meaning	Symbol	Meaning
⚠	Risk of danger. Important information. See Manual.		This product complies with the WEEE Directive (2002/96/EC) marking requirements. The affixed label indicates that you must not discard this electrical/electronic product in domestic household waste. Product Category: With reference to the equipment types in the WEEE Directive Annex I, this product is classed as category 9 "Monitoring and Control Instrumentation" product. Do not dispose of this product as unsorted municipal waste. Go to Fluke's website for recycling information.

Table 1. Symbols (cont.)

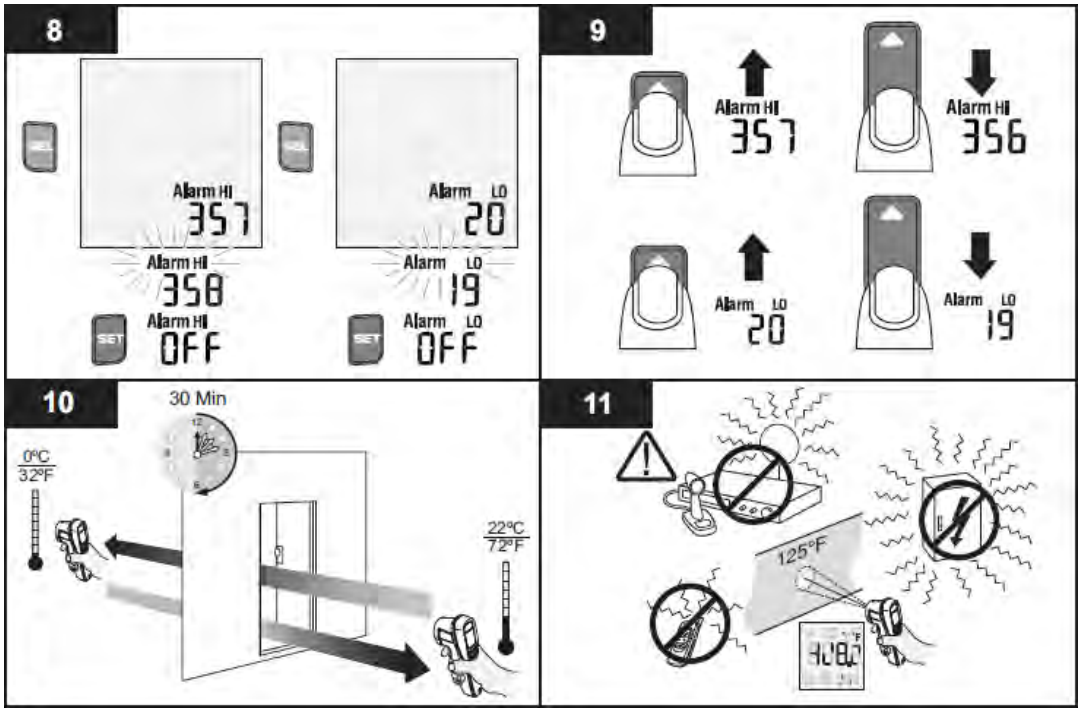
Symbol	Meaning	Symbol	Meaning
	Warning. Laser.	CE	Conforms to European Union directives.
	Battery	C N10140	Conforms to relevant Australian standards.
MC 沪制01120009号	Conforms to China Metrology Certification		

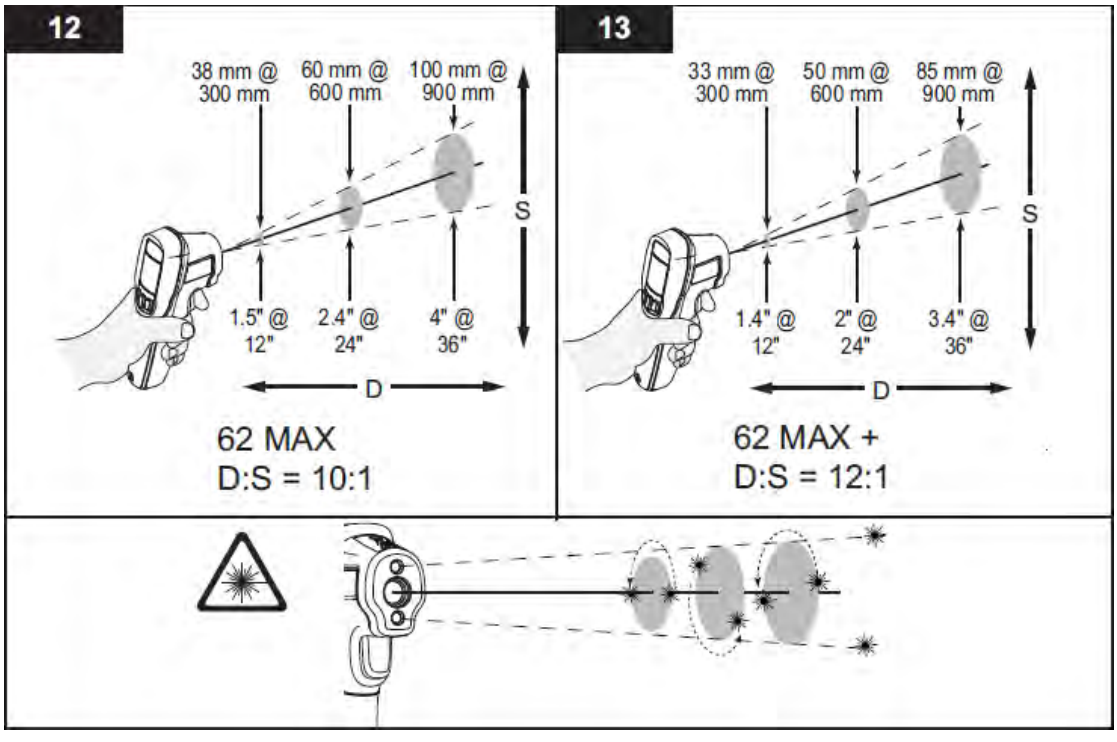
PROGRAM DESCRIPTION



AIRCRAFT DEICING PROGRAM

PROGRAM DESCRIPTION





PROGRAM DESCRIPTION

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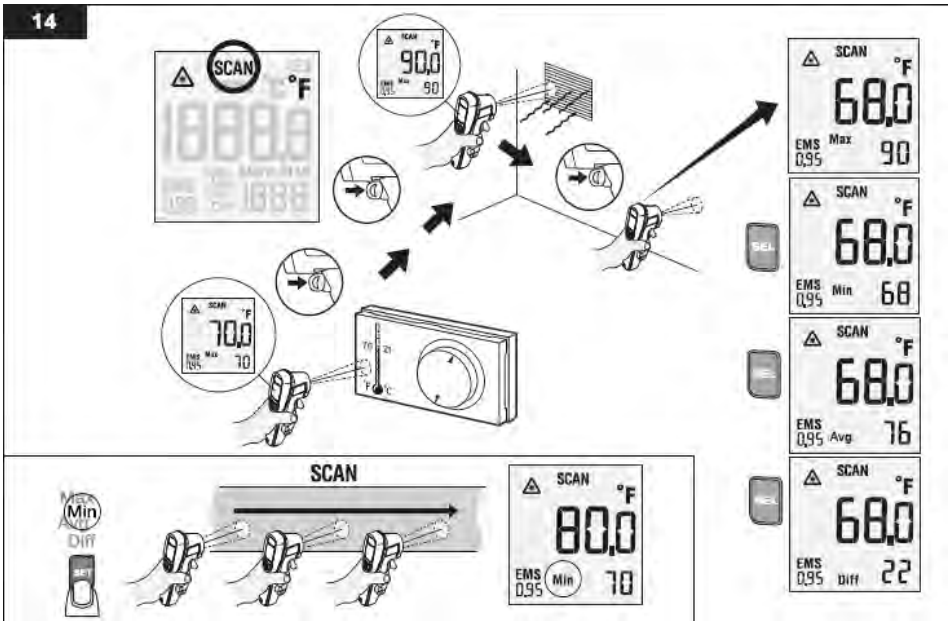

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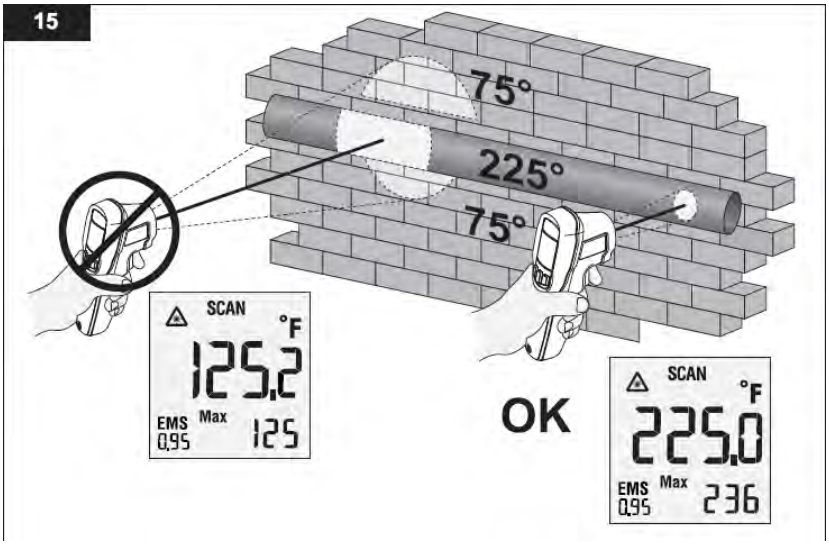

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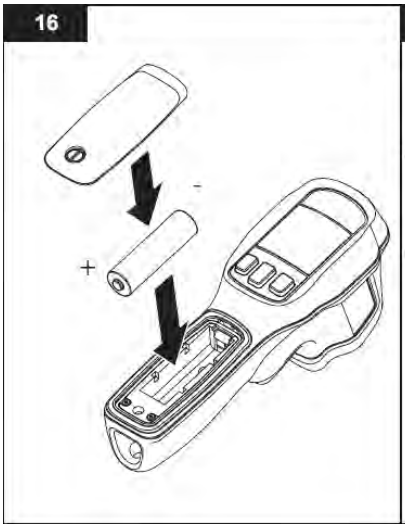
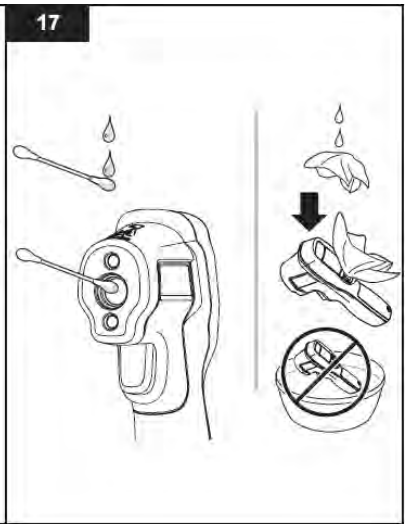


17



AIRCRAFT DEICING PROGRAM

PROGRAM DESCRIPTION

Types II, III, and IV Fluids Characteristics.

Types II, III, and IV fluids are thickened, non-Newtonian fluids. A non-Newtonian fluid is one whereby the viscosity (thickness) decreases when a shearing force is applied, such as the airflow over aircraft surfaces on takeoff. When applied to aircraft surfaces, these fluids form an anti-icing thickness layer which absorbs freezing or frozen contamination with the exception of ice pellets and small hail. Although thickened, Type III fluid is much thinner than Type II or IV fluids, a characteristic making it suitable for lower rotation speed aircraft, as well as those with sufficient rotation speeds to use Type II or IV fluids.

Note: Fluid colors have been standardized. Type II is yellow and Type IV is green. Type III has not been standardized.

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

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

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

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

(5) Longer HOTs for 75/25 Dilutions. For some fluids in some conditions, HOT increases when fluid concentration is reduced. This counter-intuitive phenomenon, which occurs rarely, happens when certain quantities of water added to fluids results in an increase in fluid viscosity and an enhancement in HOT performance (up to a certain point). Without knowing about this phenomenon, an operator may think that the data presented in the related HOT table is in error.

(6) HOTs for Non Standard Dilutions of Types II, III, and IV Fluids. When Type II, III, or IV fluid are diluted to other than the standard published 100/0, 75/25, or 50/50 dilutions, the more conservative HOT and LOUT associated with either the dilution above or below the selected dilution are applicable. For example:

- The HOT and LOUT of a 80/20 dilution would be the more conservative HOT and LOUT of either the 100/0 or 75/25 dilutions.
- The HOT and LOUT of a 60/40 dilution would be the more conservative HOT and LOUT of either the 75/25 or 50/50 dilutions.

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

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

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

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

✍**Note:** Fluids that have not undergone the full range of testing required to obtain fluid-specific HOTs in very cold snow (below -14 °C/7 °F) are given generic values. These values are different for Type IV EG- and Type IV PG-based fluids.

✍**Note:** The lowest on-wing viscosity (LOWV) of the fluid being used must always be respected, even when the generic Type II or IV HOTs are used.

✍**Note:** When flaps and/or slats are extended to the takeoff configuration prior to anti-icing fluid application and remain in that configuration while taxiing to takeoff, the adjusted HOT tables must be used. Adjusted HOT tables are not included, standard holdover and allowance times can be used since flaps are deployed as close to departure as safely allowed.

✍**Note:** The ATR 42/72 flap extension for takeoff is delayed until application of the Takeoff Checklist.

I ✍**Note:** The Cessna C208 uses 0° flap for takeoff with Type II, III or IV fluid.

✍**Note:** The ATR 42/72 is approved to use Types I, II and IV.

✍**Note:** The Cessna C208 is approved to use Types I, II, III, and IV.

✍**Note:** The Cessna C408 is approved to use Type I, II, III, and IV..

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

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

- Type I fluids are applied to maintain at least a 10 °C (18 °F) buffer between the OAT and the freezing point of the fluid/water mix.

PROGRAM DESCRIPTION

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

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

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

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

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

Type II/IV Cautions

(1) Incidents of restricted flight control surfaces while in flight have been attributed to fluid dry-out. Such events may occur with repeated use of Types II and IV fluids without prior application of water or Type I. This can result in fluid collecting in aerodynamically quiet areas or crevices that do not flow off during the takeoff. These accumulations can dry to a gel like or powdery substance. Such residues can re-hydrate and expand under certain atmospheric conditions, such as high humidity or rain. Subsequently, the residue freezes, typically during flight at higher altitudes. Re-hydrated fluid gels have been found in and around gaps between stabilizers, elevators, tabs, and hinge areas. Some reports have indicated that reducing altitude until the frozen residue melts has restored flight control movement.

(2) Aircraft quiet areas and crevices shall be checked for abnormal fluid thickening deposits, especially if Type II or IV fluids are used exclusively. If you suspect residue as a result of fluid dry-out, spray with water and wait 10 minutes. Residue will re-hydrate in a few minutes and be easier to identify.

(3) Flight crews should exercise caution as fluid blown off departing aircraft may accumulate on the runway or taxiway surface reducing the coefficient of friction.

(4) Type II or IV fluids applied to prevent contamination from adhering to aircraft surfaces during a layover must be removed prior to takeoff and the aircraft re-deiced or anti-iced as necessary.

General

Empire Airlines personnel with aircraft deicing responsibilities should read and understand all notes and cautions in the FAA HOT Guidelines document, such as the reference to the 10 °C (18 °F) buffer for Type I fluids to preclude improper usage of fluids.

PROGRAM DESCRIPTION

Precipitation Intensity, Types, and Other Related Information

Precipitation Intensity

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

✎**Note:** The FAA does not approve takeoff in conditions of moderate or heavy freezing rain , heavy ice pellets, or hail. The FAA has developed allowance times and associated limitations for takeoff in light or moderate ice pellets, light ice pellets mixed with other forms of precipitation, and small hail, as listed in the Ice Pellet and Small Hail Allowance Times tables (refer to FAA HOT Guidelines, Table 47, Allowance Times for SAE Type III Fluids, Table 48, Allowance Times for SAE Type IV Ethylene Glycol (EG) Fluids, and Table 49, Allowance Times for SAE Type IV Propylene Glycol (PG) Fluids). Additionally, takeoff in heavy snow maybe accomplished if the requirements for operating in this condition are met. (Empire does not approve takeoff in heavy snow conditions.)

✎**Note:** In addition to following the operations in heavy snow guidance in the FAA HOT Guidelines, the FAA Engine and Propeller Standard Branch (AIR-6A0) has issued the following statement: "Turbine engine power run-up procedures are defined in the Aircraft Flight Manual (AFM)." AIR-6A0 recommends that operators consider performing more frequent engine power run-ups when operating in heavy snow conditions.

✎**Note:** Empire Airlines does not approve takeoff in freezing drizzle or freezing rain of any intensity.

(1) Example. In Table 2 of the FAA HOT Guidelines, under the "Outside Air Temperature" column, below -3 °C to -6 °C for freezing drizzle, the HOT is 0:05 to 0:09, which is interpreted as an HOT from 0 hours, 5 minutes to 0 hours, 9 minutes. Depending on the freezing drizzle intensity, the approximate time of protection could be:

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

(2) Snow Conditions.

(a) The 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. 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) HOT values for liquid equivalent snowfall rates between 0.4 and 1 mm/h (0.02 and 0.04 inches per hour (in/h), and 4 and 10 grams per decimeter squared per hour (g/dm2/h)) are selected for the "Light" snow column and HOT values for liquid equivalent snowfall rates between 0.3 and 0.4 mm/h (0.01 and 0.02 in/h, and 3 and 4 g/dm2/h) are selected for the "Very Light" snow column. Overall, these selections were based upon a number of factors, including:

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

(c) Varying Weather Conditions After Completion of Anti-Icing Procedure. During periods when the weather conditions are varying after completion of the anti-icing procedure, crews should reassess the previously selected HOT. When doing so crews need to consider the following:

- Improving weather conditions—if the snowfall intensity decreases or fluctuates between the original intensity and a lower intensity, and does not stop, the original HOT should be retained.
- Worsening weather conditions—if the snowfall intensity increases beyond the intensity used to establish the original HOT, a new, lower HOT should be established and used.

(3) Frost Conditions. Only one HOT value is provided in each cell of the FAA frost HOT table (refer to FAA HOT Guidelines, Table 1, Active Frost Holdover Times for SAE Type I, Type II, Type III, and Type IV Fluids). Frost intensities or accumulations are low in comparison to other precipitation conditions and decrease at colder temperatures. This usually results in HOTs for frost being considerably longer in comparison to HOTs for other precipitation conditions. The longer HOTs should accommodate most aircraft ground operational requirements.

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.

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

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

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

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

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

(5) 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 (18°F) or more; therefore, the pilot should shorten the HOT based on decreases in OAT that may have occurred following the deicing/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 deicing/anti-icing fluid application and takeoff.

Freezing Fog, Ice Crystals, and Freezing Mist

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

(2) Freezing mist is never reported by METAR; however, it can occur when mist is present a 0°C (32°F) and below. Freezing mist is best confirmed by observation. Mist must be reported alone in order to use the HOTs in the “Freezing Fog, Freezing Mist, or Ice Crystals” column ion the HOT tables. If mist is reported mixed with another precipitation condition, these HOTs do not apply and mist could be treated as an obscuration.

Operations in Heavy Snow

Note: Empire Airlines does not approve takeoff in heavy snow conditions.

Operations in Ice Pellet and Small Hail Conditions

(1) HOTs vs. Allowance Times.

(a) 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.

(b) 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.

(c) 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 pretakeoff contamination inspection (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.

(2) Operations Guidance.

(a) Tests have shown that ice pellets generally remain in the frozen state imbedded 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 imbedded) would be an indication that the fluid has failed. These imbedded ice pellets are generally not readily detectable by the human eye during pretakeoff contamination inspection procedures. Therefore, a visual pretakeoff contamination inspection in ice pellet conditions may not be of value and is not required.

(b) 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:

- Light ice pellets mixed with freezing drizzle,
- Light ice pellets mixed with freezing rain, and
- Light ice pellets mixed with rain.

Note: Empire Airlines does not approve takeoff in freezing drizzle or freezing rain of any intensity.

Examples:

1. 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.
2. 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.

3. 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.

c. 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 Tables 40 and 41, up to the specific allowance time, to commence the takeoff with the following restrictions:

1. 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.
2. The allowance time is valid only if the aircraft is anti-iced with undiluted Type III or IV fluid.
3. The Type III allowance times are only applicable for unheated anti-icing fluid applications.
4. Due to the shearing qualities of Types III and IV fluids with imbedded 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.
5. 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 IV anti-icing fluid, subject to the restrictions in Operations Guidance (2)b.
6. A pretakeoff contamination inspection is not required. The allowance time cannot be extended by an internal or external inspection of the aircraft critical surfaces.
7. 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.
8. If the temperature decreases below the temperature on which the allowance time was based, and
   - The new lower temperature has an associated allowance time for the precipitation condition and the present time is within the new allowance time, then that new time must be used as the allowance time limit.
   - 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.
9. 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.

PROGRAM DESCRIPTION

Hail, Small Hail, Ice Pellets, Snow Grains, and Snow Pellets (METAR Codes GR, PL, SG, GS, and SHGS)

A. 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 (see Table 1).

Table 1. 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 (less than ¼")	Ice Pellet (and Small Hail) Allowance Times
Hail (¼" or greater)	No Holdover Times or Allowance Times

B. 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. Table 2 shows 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 2. 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 ¼"	Small Hail	Ice Pellet (and Small Hail) Allowance Times
GR with remarks stating "¼ or greater"	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 with 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 with 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 the 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.

C. 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 in Table 3.

Table 3. 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)		

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

1. General. HOTs and/or allowance times have not been established for heavy ice pellets, moderate and heavy freezing rain, and hail. Therefore, this notice does not provide HOTs or other forms of relief for dispatch in these conditions.
2. Regulations. The regulations clearly state, “No person may take off an aircraft when frost, ice, or snow is adhering to the wings…” (refer to § 121.629(b)) and “…no person may dispatch, release, or take off an aircraft any time conditions are such that frost, ice, or snow may reasonably be expected to adhere to the aircraft…” (refer to 121.629(c)). Under some conditions, the aircraft critical surfaces may be considered free of contaminants when a cold, dry aircraft has not had deicing and/or anti-icing fluids applied, and ice pellets/snow pellets are not adhering and are not expected to adhere to the aircraft critical surfaces. Refueling with fuel warmer than the wing skin temperature may create a condition whereby previously non-adhering contaminants may adhere to the wing surfaces.

Program Description

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 Test Procedures for SAE Type II/III/IV Aircraft Deicing/Anti-Icing Fluids; and ARP5945, Endurance Time Test Procedures for SAE Type I Aircraft Deicing/Anti-Icing Fluids. 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 pretakeoff contamination check to HOTs, which should not 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. Operations 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 pretakeoff contamination check procedures. Therefore, a visual pretakeoff contamination check in ice pellet conditions may not be of value and should not be approved. Section 135.227(b)(2) permits the use of an alternate procedure approved by the Administrator. In this case, the part 135 operator who foresees occasional authority to depart in active ice pellet precipitation may request approval to use the appropriate allowance times table.

(2) The research data has 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 times tables. These allowance times are from the start of the anti-icing fluid application. In constant precipitation, the allowance time ends when the fluid’s allowance time expires. Additionally, if the ice pellet precipitation stops, and the allowance time has not been exceeded, the operator may 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 should remain constant or increase during the 90-minute period:

- Light ice pellets mixed with freezing drizzle,
- Light ice pellets mixed with freezing rain, and
- Light ice pellets mixed with rain.

Examples:

1. Type IV PG 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.
2. Type IV PG 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.
3. Type IV PG 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 may be allowed, in the specified ice pellet and small hail conditions listed in the Type III, Type IV EG, and Type IV PG allowance times tables up to the specific allowance time, to commence the takeoff with the following restrictions:

1. The aircraft critical surfaces should be free of contaminants before applying anti-icing fluid. If not, the aircraft should be properly deiced and checked to be free of contaminants before the application of anti-icing fluid.
2. The allowance time is valid only if the aircraft is anti-iced with undiluted Type III or IV fluid.
3. The Type III allowance times are only applicable for unheated anti-icing fluid applications.
4. 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 times tables.
5. If the takeoff is not accomplished within the applicable allowance time, the aircraft should be completely deiced again, 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 IV anti-icing fluid, subject to the restrictions in subparagraph 8e(2)(b).
6. A pretakeoff contamination check is not authorized when using allowance times. The allowance time cannot be extended by an internal or external check of the aircraft critical surfaces.
7. 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.
8. If the temperature decreases below the temperature on which the allowance time was based, and:
   - The new lower temperature has an associated allowance time for the precipitation condition and the present time is within the new allowance time, then that new time should be used as the allowance time limit.

- The allowance time has expired (within the 90-minute post-anti-icing window if the precipitation has stopped within the allowance time), the aircraft should not takeoff and the aircraft should be completely deiced again and, if applicable, anti-iced again before takeoff.
9. 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).

9. 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).

Mixed Precipitation Conditions

A. Neither HOTs nor allowance times are provided for conditions in which multiple unique precipitation types are reported simultaneously. There are several exceptions to this statement:

(1) Allowance times are provided for ice pellets mixed with several other precipitation types in the allowance time tables.

(2) 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.

B. 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.

✎**Note:** For the purposes of HOT guidance, freezing fog is considered a precipitation type as well as an obscuration.

(2) Descriptors include showers, blowing, shallow, patches, thunderstorm, partial, low drifting, and freezing.

✎**Note:** The descriptor “freezing” is important in the context of deicing as it determines whether HOTs are required for a given precipitation type. Typically, HOTs are required for freezing precipitation but not for non-freezing precipitation.

C. If non-freezing precipitation is reported below 0 °C, the flightcrew should determine if freezing precipitation is occurring. If it is, HOTs for the equivalent freezing precipitation type should be used.

D. When a combination of precipitation types is reported which is not listed in either the HOT tables or allowance time tables, or described as an exception above, takeoff is only allowed with the following restrictions:

(1) If neither of the precipitation types reported is ice pellets or small hail.

(2) The aircraft critical surfaces must be free of contaminants, or the aircraft must be properly deiced before the application of the anti-icing fluid.

(3) The flightcrew must accomplish a visual check (pre-takeoff check) of the aircraft critical surfaces within 5 minutes of takeoff.

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

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

Guidelines for Pilot Assessments of Precipitation Intensity Procedures

Note: Empire Airlines does not perform pilot assessments of precipitation intensity.

Starting and Stopping the HOT Clock

Once the HOT time clock has been started, it must not be stopped for intermittent precipitation. Intermittent precipitation conditions during ground icing operations are a common occurrence at some airports. As precipitation falls on an aircraft that has been anti-iced, the fluid is diluted. The more diluted the fluid becomes, the more readily it flows off the aircraft, and the higher the freezing point becomes. Even if the precipitation stops, the diluted fluid will continue to flow off the aircraft due to gravity. There is no practical way to determine how much residual anti-icing fluid is on the wing under these circumstances. HOT values under these conditions have not been assessed. Therefore, after the anti-icing HOT clock has been started, it must not be stopped. HOT credit cannot be given due to the fact that the precipitation has temporarily stopped falling.

Health Effects

A. All personnel should be aware of the potential health effects of deicing and anti-icing fluids. Exposure to their vapors may cause temporary irritation of the eyes, and in poorly ventilated areas may cause nose and throat irritations, headaches, nausea, vomiting, and dizziness. All glycols cause some irritation upon contact with the eyes or skin. Although the irritation is described as negligible, chemical manufacturers recommend avoiding skin contact and wearing protective clothing when performing deicing operations. Glycol is moderately toxic for humans and ingestion of the fluid should be avoided.

Caution: Irritation to the eyes may result from direct contact with deicing fluids. Hands should be washed before touching the face in the vicinity of the eyes. Product Safety Data Sheets (SDS) should be consulted prior to use.

Handling and Storage

A. To maintain the HOT and flow off properties of anti-icing fluids a number of important precautions should be observed. Reductions in critical viscosity properties and thus HOT may occur.

B. Incorrect Storage (all types) – Fluid should be stored in tanks dedicated to the specific fluid. Tanks should be constructed of stainless steel, lined steel, mild steel, or reinforced plastic. The chemical manufacturer provides storage instructions with their fluids. The fluids are generally non-corrosive but their vapors may be corrosive. Therefore, a high fluid level in the tank is recommended.

C. Mechanical Shearing (types II & IV) – The effect of mechanical or equipment shearing of the fluid reduces its viscosity and therefore, the estimated holdover time. Special attention must be used to minimize the shearing that can occur during unloading, transferring, and applying the fluid. Centrifugal and high-speed piston pumps can reduce the viscosity up to 50% in a single transfer.

D. For Type II fluids only positive displacement pumps such as screw or diaphragm pumps should be used. Continuous recirculation should be minimized.

E. Mixing of Fluids – When provided in concentrates, Type I fluids require mixing. The use of undiluted propylene glycol-based deicing fluids is prohibited. Type II, III, or IV fluids may be diluted in accordance with desired holdover times.

PROGRAM DESCRIPTION

Fluid Quality Control

A. Fluid testing – To ensure the quality of the deice/anti-ice fluid being applied, Empire Airlines will conduct fluid tests. Fluid tests will be conducted using the refractometer and the instructions in Chapter 6 of this ADP.

B. Testing will be conducted under the following:

(1) Prior to using fluid that has been stored in a deice unit during non-icing season.

(2) Prior to using fluid that has been just loaded into the deice unit.

(3) Routinely conducted during the ground-icing season, October 1 through March 31.

(4) At flight crew's discretion testing may also be performed the rest of the year as conditions warrant.

C. Fluid will be tested once per month for online operations, and prior to use during offline operations. The vendor may test their own fluid and provide that information to the flight crew.

✎ **Note:** Online operations are those operations that are conducted from stations that have Empire trained deice personnel. Offline operations are those operations that are conducted from stations that do not have Empire trained deice personnel.

D. Dispatch/Flight Following will determine the fluid type, manufacturer, and mixture ratio by inquiring of the vendor at each station where deicing is anticipated.

E. Dispatch/Flight Following will notify the PIC of the station and date to conduct testing. Along with the information about fluid type, manufacturer, and mixture ratio.

F. The PIC will conduct a refractometer test of the fluid (see Chapter 6 of this ADP for use of the refractometer).

G. The refractometer reading and freezing point information will be transmitted to Dispatch/Flight Following.

H. Dispatch/Flight Following will record the fluid testing information in a spreadsheet and maintain the record during that particular icing season. The record will show the following information:

- Station;
- Vendor name (point of contact and phone number);
- Fluid type(s) I, II, III, and/or IV;
- Manufacturer and brand name of each fluid type;
- Mixture ratio of each fluid type;
- Date of fluid test;
- BRIX and freezing point readings from fluid test;
- Name of person conducting the fluid test, and
- Initials of Dispatcher/Flight Follower recording test results.
- For vendors that conduct their own fluid testing an entry will be made to indicate "vendor tested."

✎ **Note:** This fluid testing procedure is not required on vendors that conduct fluid testing that at least meets the requirements of this procedure and maintain a record of those tests. Vendors that meet this requirement are listed in the deice fluid test record that is maintained by Dispatch/Flight Following as "vendor tested".

I. The minimum acceptable BRIX/FP will be for a 50/50 mixture from the BRIX/FP tables in the ADP. A fluid test with less than this minimum will require Dispatch/Flight Following to contact the vendor and attempt to resolve the less than minimum fluid test. If successful, a note will be added to the fluid test record describing the resolution. If unsuccessful, the DO will be notified and the vendor will be

suspended from use for any deice/anti-ice service during icing conditions until the fluid test meets the minimum standard. The vendor or fluid may be used for removing frozen contaminants when actual icing conditions do not exist. The DO, in cooperation with the DQA, will determine if any additional auditing or corrective action is required.

J. Any time Type II, III, and IV fluid appears to be contaminated or fails the refractometer test, a viscosity check shall be performed. A fluid sample will be collected and sent to the manufacturer for testing.

K. Fluid Temperatures – Deicing fluids are generally applied heated. Heated fluid will cool approximately 10% before it reaches the aircraft surfaces after it travels through a hose and wand. A probe-type thermometer may be used to test fluid temperatures at the nozzle. Deicing fluid temperatures in any case should not exceed 200°F (93°C) at the service unit tank and 185°F (85°C) at the nozzle. To use the HOT for Type I, the fluid must be heated to 140°F (60°C) at the nozzle. If the tank temperature is 158°F (70°C) or more, it may be assumed that the nozzle temperature is 140°F (60°C) or greater.

L. Fluid Mixture – The fluid mixture ratio is best determined by the outside air temperature that exists during the deice/anti-ice procedure. Guidelines for fluid mixture are shown in the following table. Type I fluids are mixed at a minimum of a 50/50 ratio. Other mixture ratios are determined by inquiring of the vendor.

Management Plan

A. Operations

(1) The Director of Operations (DO) is responsible for ensuring that all elements of the ADP have been developed and implemented; that the program has been disseminated to all those persons or vendors who have duties and responsibilities to perform in accordance with the ADP. These duties may be delegated to other managers, such as the Chief Pilot, Manager of Dispatch/Flight Following, Manager of Flight Training, or Flight Standards Captain but the responsibility may not be delegated.

(2) The DO will develop a current list of deicing equipment and capabilities for online operations. Dispatch/Flight Following will maintain this list.

B. Maintenance

(1) The Director of Maintenance **(DOM)** is responsible for ensuring that enough qualified personnel, as well as adequate facilities and equipment, are available at each regularly scheduled airports.

(2) The DOM will ensure that all necessary maintenance elements of the management plan and deicing/anti-icing program have been developed and implemented.

(3) The DOM will ensure that all maintenance elements of the plan and program have been disseminated to maintenance personnel who have duties, responsibilities, and functions to perform in accordance with this ADP.

(4) The DOM will work closely with the DO to ensure that the appropriate maintenance portions of the plan and deicing/anti-icing program are contained in the ADP. The DOM will notify the DO of changes that would improve this program.

(5) The DOM will maintain a list of current Empire technicians and ground personnel trained and qualified under this program.

Program Description

Duties and Responsibilities

A. Director of Maintenance (DOM)

(1) During periods of icing and subsequent deicing/anti-icing, the DOM will monitor the implementation and performance of maintenance elements of this program, ensuring that company standards are met. This duty may be delegated to other managers but the responsibility may not be delegated.

(2) The DOM is responsible for assuring that annual ADP "Train-the-Trainer" classes are provided to all appropriate personnel other than flight crew and Dispatch/Flight Following, and to respond to training concerns regarding the ADP for ground personnel.

B. Quality Assurance

(1) The DQA will monitor the quality of this program. This duty may be delegated to other managers but the responsibility may not be delegated.

(2) The qualification of personnel will be checked by the following Empire personnel or designees:

(a) Director of Operations – for flight operations personnel, and

(b) Maintenance Training Manager – for ground personnel.

(3) Maintenance Training Manager will ensure that qualification is determined as needed for all ground deicing personnel. Training may be provided by Quality Assurance, Operations or Maintenance designated instructors. Flight Operations retains the responsibility for initial and recurrent training of flight crew personnel.

(4) In the event Empire experiences deicing/anti-icing difficulties or receives reports of substandard practices from a crewmember, the DQA will send an auditor to perform an on site audit of a vendor's compliance with this ADP.

C. Chief Pilot

(1) The Chief Pilot is responsible for ensuring that the flight crews adhere to the procedures identified in the ADP and to ensure that flight crews are trained and qualified to perform their duties according to the ADP. These duties may be delegated to other managers, such as the Manager of Flight Training or Flight Standards Captain but the responsibility may not be delegated.

D. Pilot in Command (PIC)

(1) The PIC will monitor weather conditions that are conducive to icing conditions such that frost, ice, or snow may reasonably be expected to adhere to the aircraft surfaces. The PIC is responsible to have a cold weather preflight conducted when the OAT is +5°C or below with visible moisture.

(2) The PIC will directly notify the deice provider of the need for deicing and ask the deice provider if the equipment is ready to function; such as having adequate heated fluid.

(3) Inform Dispatch/Flight Following of any problems or delays with deicing.

(4) Prior to deicing/anti-icing coordinate with ATC as to possible delays that could affect the takeoff within the HOT. When ground delays or gate hold procedures are in effect, the flight crew will coordinate the deicing/anti-icing and departure time with ATC.

(5) After the preflight, point out to deicing personnel any areas on the airplane that may need more than ordinary deicing.

(6) During deicing/anti-icing operations, perform the deicing/anti-icing checklist, located in the aircraft specific chapter of the ADP and on the flight deck. The deicing/anti-icing checklist is not carried onboard the ATRs operated solely within the state of Hawaii.

(7) Ensure that all required aircraft deicing/anti-icing equipment is operational. The ice detection light(s) must be operating for flight into icing conditions at night.

(8) Keep track of the times that deicing/anti-icing was started and finished.

(9) Determine the appropriate HOT from the tables in the ADP. Use the current airport weather conditions, OAT, and fluid information to determine the appropriate table. If the specific fluid information is not available, use the generic HOT.

(10) Be prepared to start engines and taxi immediately after the deicing inspection is completed.

(11) Perform the pre-takeoff check just before takeoff to ensure that the representative surfaces are free of contamination, if not return to the ramp for additional deicing/anti-icing.

(12) Bring the airplane back to the ramp if the holdover time expires or conditions worsen to the extent that the holdover time should be shortened.

(13) Whenever an Empire aircraft needs deicing at a location where Empire has not conducted deicing training, the PIC will instruct the deicing personnel on procedures for deicing and checking the airplane to ensure that company deicing standards are met.

(14) Advise the Chief Pilot of any changes that will improve the deicing program.

E. Manager of Dispatch/Flight Following

(1) The Manager of Dispatch/Flight Following is responsible to respond to operational, procedural or training concerns regarding the ADP for Dispatch/Flight Following and to ensure that all Dispatch/Flight Following personnel are trained and qualified in this ADP. These duties may be delegated to other managers, such as the Chief Pilot, Manager of Flight Training or Flight Standards Captain but the responsibility may not be delegated.

(2) Near the beginning of each icing season contact our deice vendors to determine their deice/anti-ice product capability. Record the following information for each vendor, include secondary vendor, if available:

- Airport identifier
- Vendor business name
- Contact information
- Application equipment type
- Fluid types available
- Brand name of fluids
- Mixture ratio
- ADP and training video availability
- Personnel training
  (a) All deice personnel have viewed video this year?
  (b) Recorded meeting attendance?
- Applicable comments

(3) Advise the DO of any changes that will improve the deicing program.

F. Dispatch/Flight Following

(1) Dispatch/Flight Following is responsible for the following:

(a) When problems or delays are reported, call the deice provider and try to resolve the situation. If unable to resolve notify the Manager of Dispatch/Flight Following, DOM, or DO.

(b) Arrange deice capability when operations are conducted at off line airports and weather forecasts or reports indicate that deicing may be necessary.

(c) Have available current list of qualified deice vendors and facilities.

(d) Maintain the fluid quality control record.

(e) Advise the Manager of Dispatch/Flight Following of any changes that would improve the ADP.

G. Maintenance Control (MC)

(1) MC is responsible for the following:

(a) Assist Dispatch/Flight Following as necessary to help resolve problems or delays with deicing.

(b) Advise the DOM of any changes that would improve the ADP.

H. Empire or Contract Technician

(1) At locations where Empire is responsible for deicing/anti-icing, check that the application equipment:

(a) Has adequate amount of fluid(s) for anticipated need,

(b) Will heat the deice fluid to 140°F/60°C,

(c) Will function properly.

(2) Initiate deicing procedures when notified by the PIC.

(3) At locations where Empire deices the aircraft:

(a) Operate the deicing equipment,

(b) Perform checks in accordance with the ADP when required,

- Cold weather preflight
- Post deicing check,
- Post anti-icing check
- Pre-takeoff contamination check

(c) Communicate with the PIC:

- When deicing begins,
- When the HOT begins,
- When the deicing/anti-icing is complete, the aircraft is free of frozen contaminants, and all personnel and equipment are clear.

(4) Advise the DOM of any changes that would improve the ADP.

I. Trained Deice Personnel

(1) At locations where trained deice personnel are responsible for deicing/anti-icing, check that the application equipment:

(a) Has adequate amount of fluid(s) for anticipated need,

(b) Will heat the deice fluid to 140°F/60°C,

(c) Will function properly.

(2) Initiate deicing procedures when notified by the PIC

(3) Operate the deicing equipment

(4) Perform checks in accordance with the ADP when required,

(a) Cold weather preflight

(b) Post deicing check,

(c) Post anti-icing check

(d) Pre-takeoff contamination check

(5) Communicate with the PIC:

(a) When deicing begins,

(b) When the HOT begins,

(c) When the deicing/anti-icing is complete, the aircraft is free of frozen contaminants, and all personnel and equipment are clear.

(6) Advise the DOM of any changes that would improve the ADP.

Outside the Aircraft Checks

A. Cold Weather Preflight – The cold weather preflight is required when atmospheric icing conditions exist (OAT is +5°C or less with visible moisture) or when the PIC determines that conditions exist so that frost, snow, or ice may reasonably be expected to adhere to the critical surfaces. Reference Chapter 3 for ATR and Chapter 4 for C208 to identify critical surfaces. A critical surface of the aircraft is to be checked by either the flight crew, technician, or deice personnel from a vantage point that allows a visual check to be accomplished. The critical surfaces of each aircraft are identified in the aircraft specific chapter.

B. Post Deicing Check – After deicing is complete, the technician/ground personnel will perform a post deicing check to ensure that the aircraft has been properly deiced so that all critical surfaces are free of frozen contaminants. Once the technician/ground personnel is satisfied that the aircraft has been properly deiced, the technician/ground personnel will communicate to the PIC that the deicing is complete and the aircraft is free of frozen contaminants. When the aircraft begins to taxi, the technician/ground personnel will monitor the VHF radio (if available) for any follow up communication that may be necessary.

C. Post Anti-icing Quality Assurance (QA) Check. The technician or trained deice personnel must ensure that sufficient anti-icing fluid is applied to cover remaining deicing fluid. Anytime orange color from Type I fluid can be seen mixed with the green color from Type IV fluid, the Type IV fluid was not adequately applied to the aircraft surfaces. It is critically important to completely cover the aircraft critical surfaces with a coating of Type IV fluid (the thickness of the anti icing fluid should be approximately the thickness of a U.S. dime). The anti icing protective coating must completely cover and run over the front of the wings' leading edges as well as have a uniform coating over all the critical surfaces.

D. Pre-takeoff Contamination Check – The PIC may call for a pre-takeoff contamination check if the HOT has expired. This inspection of the critical surfaces is made by the technician/ground personnel to insure that the aircraft is still free of frozen contaminants. In most cases, a pre-takeoff contamination check will be impractical due to the time required to taxi back to the ramp or the inability to drive the deice equipment to the aircraft. However, at some locations it may be possible for the deice equipment to relocate so as to be near the takeoff runway should a pre-takeoff contamination check become necessary.

(1) The check is required when a holdover time has been exceeded.

(2) The check must be made by trained deice personnel from outside the aircraft.

(3) The check must confirm that the critical surfaces are free of contamination.

(4) The takeoff must be commenced within five minutes of the check.

(5) If the HOT is expired, the airplane must be deiced/anti-iced again unless:

(a) The PIC determines that the airplane is free of frozen contaminants because precipitation has ended or the temperature has increased. If weather conditions significantly improve, the PIC may extend the holdover time so that no pre-takeoff contamination check or additional deicing is required.

(b) The deicing personnel check the critical surfaces from a vantage point that allows a visual check to be accomplished and confirm that the critical surfaces are free of frozen contaminants. If icing conditions still exist the takeoff must be made within 5 minutes of the pre-takeoff contamination check.

Inside the Aircraft Check

A. Pre-takeoff Check – This check is made by the flight crew from the flight deck just before takeoff to ensure that the representative surfaces of the aircraft remain free of frozen contaminants. The check is conducted within the aircraft's HOT. The representative surfaces for the aircraft type are located in the aircraft specific chapter of this ADP.

Communication Procedures

A. At regular deicing locations, the deice personnel will communicate with the PIC by radio, verbally, written and/or by hand signals.

B. At off-line stations where Empire ADP training has not been done, the PIC will instruct the deicing personnel to communicate the standard notification to them by radio, hand signals, by writing it down on paper and passing it to them through a door or cockpit window, or any other effective means.

C. Standard notification (sometimes known as de/anti-icing code) that ground personnel make known to the PIC is:

(1) Fluid type; i.e., Type I, II, III, or IV;

(2) Concentration of fluid within the fluid/water mixture, expressed as a percentage of volume;

✎**Note:** Not required for Type I fluid.

(3) Time at the beginning of the final deicing/anti-icing step, and

(4) Brand name for Type II, III, or IV fluids not required. Use the generic HOT tables for Type II, III, or IV fluid, as appropriate.

Example: A deicing/anti-icing procedure whose last step is the use of a mixture of Kilfrost ABC-S at 75% Type IV fluid and 25% water, commencing at 0635 local time, is communicated as follows: "Type IV, 75%, 0635, Kilfrost ABC-S."

D. Hand signals – the following hand signals will be used for ground crew and flight crew communications in relation to deicing/anti-icing procedures:

(1) Ground personnel to flight crew:

(a) Shades eyes – Means protect yourself; deicing/anti-icing has begun. Keep windows and doors closed.

(b) Thumbs up – Means deicing/anti-icing is completed and the post deicing/anti-icing check determines the aircraft is free of frozen contaminants and that all personnel and equipment are clear for reconfiguring or moving the aircraft.

(c) Thumbs down – Means deicing/anti-icing is either not complete, or the aircraft is not free of frozen contaminants.

(d) Index finger pointed to opposite wrist – Means HOT starts now. HOT begins when the final application of deice/anti-ice fluid commences.

(2) Flight crew to ground personnel:

(a) Crewmember nods to the affirmative – Means that they understand deicing/anti-icing operations are now in progress.

(b) Thumbs up – Means that the crew understands the deicing/anti-icing is completed, the aircraft is free of frozen contaminants, and all personnel and equipment are clear.

(c) Thumbs down – Means that the crew understands deicing/anti-icing is either not complete, or the aircraft is not free of frozen contaminants. In any case, the aircraft is not ready for takeoff.

(d) Index finger pointed to opposite wrist – Means that the crew concurs with ground personnel. The HOT starts now.

Use of Holdover Time Tables

A. Holdover Time **(HOT)** is the estimated time the application of deicing or anti-icing fluid will prevent the adherence of frost, ice, or snow on the treated surfaces of an aircraft. Holdover time begins with the commencement of the final application of fluid and expires when the fluid applied to the critical surfaces loses its effectiveness.

(1) In a one-step procedure the HOT begins when the deicing first begins.

(2) In a two-step procedure the HOT begins at the commencement of the final application.

B. The PIC will use the holdover table to determine the holdover time based on the type of fluid, concentration, outside air temperature, and weather condition. Several variables that can effect holdover time are incorporated in the tables under CAUTIONS; the PIC must consider these variables and how they may effect the HOT.

C. The HOT should not be considered as a minimum or maximum, as the actual time of protection may be extended or reduced, depending upon the particular conditions existing at the time.

D. The lower limit of the published time span is used to indicate the estimated time of protection during moderate precipitation and the upper limit indicates the estimated time of protection during light precipitation.

☝**Caution:** Heavy precipitation rates, high moisture content, high wind velocity, or jet blast may reduce HOT below the lowest time stated in the range. HOT may also be reduced when aircraft skin temperature is lower than OAT. Therefore, the indicated HOT should only be used with a pre-takeoff check.

E. Prior to takeoff within the HOT, the flight crew will perform a pre-takeoff check from the flight deck by checking the aircraft representative surfaces to be free of frozen contaminants. The airplane will not takeoff after the holdover time has expired **except** that takeoff after the expiration of a holdover time will be permitted if:

(1) A pre-takeoff contamination check of the critical surfaces determines that the aircraft is free of frozen contaminants, or

(2) Weather conditions have improved significantly. The PIC determines that the airplane is still free of contaminants because precipitation has ended or the temperature has risen, or

(3) The airplane is deiced again and a new holdover time is determined.

F. Before deicing begins, the PIC will determine the amount of holdover time available based on the temperature, weather conditions, type fluid and mixture ratio. The PIC will note when the holdover time begins and track the lapsed time as the airplane begins to taxi.

G. The PIC may increase or decrease the holdover time if changing weather conditions warrant. If the weather deteriorates after deicing is completed, the PIC may shorten the holdover time or require a pre-takeoff contamination check if it is determined that the critical surfaces of the airplane have been contaminated. If the weather improves significantly, such as precipitation ending or temperature rising, the PIC may increase the holdover time using the holdover table as a guide.

H. At airports where gate hold procedures may be employed, the flight crew will coordinate the deicing and departure time with ATC.

I. Fluid Failure Recognition – Fluids are considered failed and no longer effective when they become diluted with falling precipitation raising the freezing point. When this occurs the fluid begins to appear opaque rather than transparent and glossy. The inability to discern structural details (rivets, screws, seams) through the fluid is an indication of fluid failure. Failed fluids are considered to have exceeded their HOT, requiring a pre-takeoff contamination check.

LOUT

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

(a) The freezing point buffer is 7 °C (13 °F) below OAT for SAE Types II, III, and IV fluids and 10 °C (18 °F) below OAT for SAE Type I fluids.

(b) There are three aerodynamic fluid flow-off test protocols: the high speed test for aircraft with rotation speeds generally greater than 100 knots (kts), the middle-speed test for aircraft with rotation speeds generally between 80 kts and 100 kts, and the low speed test is for aircraft with rotation speeds generally between 60 kts and 100 kts. Types II and IV fluids typically do not pass the low speed test. Therefore, in order for these fluids to be used on a low rotation speed aircraft, the aircraft manufacturer should conduct testing to determine if these fluids can be safely applied on these aircraft and published operational procedures that should be implements to ensure safe operation when these fluids have been applied.

(2) Following are three examples to illustrate how LOUTs are determined:

- Example A: A specific Type IV fluid is aerodynamically acceptable down to -33 °C (-27 °F) and has a freezing point of -36 °C (-33 °F). Once the 7 °C (13 °F) freezing point buffer is factored in, the limiting factor is the freezing point, resulting in a LOUT of -29 °C (-20 °F).
- Example B: A specific Type I fluid is aerodynamically acceptable down to -30 °C (-22 °F) and has a freezing point of -35 °C (-31 °F). Once the 10 °C (18 °F) freezing point buffer is factored in, the limiting factor is the freezing point, resulting in a LOUT of -25 °C (-13 °F).
- Example C: A specific Type I fluid is aerodynamically acceptable down to -30 °C (-22 °F) and has a freezing point of -42 °C (-44 °F). Since the 10 °C (18 °F) freezing point buffer requirement is met at -32 °C (-26 °F), the limiting factor is the aerodynamic performance, resulting in a LOUT of -30 °C (-22 °F).

(3) LOUT information is provided for each Types I, II, III, and IV fluids in the FAA HOT Guidelines document. This information is derived by the FAA based on data provided by the fluid manufacturers. Contact the fluid manufacturer if further clarification with respect to the information in Tables 8-1, 8-2, 8-3, and 8-4 is required.

(a) LOUTs for Type I fluids include the manufacturer-specified fluid/water concentration used to establish the LOUT for each fluid. This concentration should not be exceeded.

(b) There can be multiple LOUTs provided for Types II, III, and IV fluids to account for the undiluted fluid (100/0) and the 75/25 and 50/50 dilutions.

Flight Crew Awareness of Conditions Affecting the Aircraft Anti-icing Treatment Following Deicing and Anti-icing Operations

A. The operator's deicing plan must provide a process that informs the captain of the time of the deicing/anti-icing treatment and conditions that could have affected the aircraft anti-icing treatment since that time. If the flight crew is not present at the time of the deicing/anti-icing application, the crew will review this information before calculating the holdover time. Empire Airlines requires the flight crew to be present during deicing operations and receive communication per the Communications Procedures in this chapter of the ADP.

Type I HOT Guidelines

A. Fluid Temperature – Type I HOT guidelines are not approved for the application of unheated Type I fluid mixtures. To use Type I HOT guidelines the fluid must be heated to a minimum temperature of 140°F (60°C) at the nozzle.

B. When establishing compliance with the temperature requirement of 140°F (60°C) at the nozzle, the FAA does not intend for air carriers or deicing operators to continually measure the fluid temperature at the nozzle. The FAA deems that establishing the temperature drop (at nominal flow rates) between the last temperature monitored point in the plumbing chain and the nozzle is sufficient. Manufacturers of ground vehicular deicing equipment have indicated a temperature drop of 50°F (10°C) or less. Some manufacturers producing equipment that uses instant-on heat or last bypass heaters have indicated a temperature drop of 41°F (5°C) or less. Ensuring that the drop in fluid temperature from the last measured point in the plumbing chain to the nozzle does not preclude a fluid temperature of 140°F (60°C) at the nozzle is sufficient.

C. Fluid Quantity – To use Type I HOT guidelines the fluid must be applied to deiced surfaces of at least 2 gals/100ft^2 (1 Liter/m^2). The intent of this HOT guideline is that the quantity of fluid that must be applied is over and above that required for deicing.

D. This minimum quantity will vary depending on the aircraft, fluid application equipment, crew technique and experience, outside air temperature **(OAT)**, and fluid spray pattern. Larger aircraft with greater skin thickness and more massive internal structure may require quantities greater than 2 gals/100ft^2 (1 Liter/m^2). The FAA does not intend for air carriers to measure this fluid quantity during the anti-icing step. For anti-icing, a moderate amount of Type I applied to drive-off all fluids that have absorbed snow, ice, and slush during the deicing process has proven safe.

ATR42	ATR72	C208	C408
Total Surface Area = 721 ft^2	Total Surface Area = 808 ft^2	Total Surface Area = 360 ft^2	Total Surface Area = 600ft^2
2gals/100ft^2=15USgallons	2gals/100ft^2=17USgallons	2gals/100ft^2=8USgallons	2gals/100ft^2=12USgallons

E. Temperature Buffer – For Type I fluid, note the statement in the HOT commentary that reads, "... FP of the mixture is at least 18°F (10°C) below OAT." The difference between the FP (freezing point) of the fluid and the OAT is known as the temperature buffer. In this case, the buffer is 18°F (10°C), which you can interpret as the FP of the fluid being 18°F (10°C) below the OAT. The 18°F (10°C) temperature buffer is used to accommodate inaccuracies and impreciseness in determining the many variables that affect the FP of a fluid mixture.

Example: If the OAT is 27°F (-3°C), the FP of the Type I fluid mix should be 9°F (-13°C) or lower and applied at a minimum temperature of 140°F (60°C) at the nozzle before the HOT guidelines information can be used.

Program Description

Snowfall Intensity Table

A. Table 50 in the HOT chapter contains a snowfall intensity table that uses prevailing visibility to provide guidance for Type I holdover times during snowfall. The categories are; very light, light, moderate, and heavy snow. When expecting to takeoff during snowfall, the PIC will reference the snowfall intensity chart to the prevailing visibility, determine intensity, and apply the appropriate holdover time.

Example: At night, OAT is 24.8°F (-4°C), reported visibility is two miles. The intensity chart indicates this is light snow.

B. The snowfall intensity chart may also be used to estimate snow intensity for use with Type II, III, or IV fluids.

C. There are no Type I, II, III, or IV fluid holdover time guidelines for heavy snowfall.

Deicing and Defrosting Procedures

A. Deicing and defrosting may be accomplished by the application of a deicing fluid, by hot air using a ground heating unit, or when the ambient temperature is above freezing by hot water spraying. After hot air or hot water spraying, the aircraft must be anti-iced to prevent refreezing, if icing conditions are still in effect. Although more efficient, it is not necessary for deice fluid to be heated for the removal of frozen contaminants provided it is not used for Hold Over Times during ground icing conditions.

B. Type I fluids supplied as concentrates for dilution with water prior to use shall not be used undiluted. This is due to adverse aerodynamic effects of propylene glycol based fluids and the freeze point characteristics of ethylene glycol based fluids. The value of Type I fluid as an anti-icing agent to prevent frozen precipitation from adhering to the airplane is very limited.

C. Hot Air – Frozen snow, ice and slush can be removed by application of hot air. Air temperature should be considered, and the distance between the end of the supply duct and the aircraft increased to avoid excessively high heat. Temperatures in excess of 185°F (85°C) should be avoided. Care should be taken to prevent heat damage to painted surfaces, rubber, glass, composite, and fiberglass parts. Lubricated areas should be avoided as grease might melt if too much heat is applied.

Caution: Do not use hot air to remove ice and snow from the windows and windshields. Cracking and crazing of the windows and windshields can occur. Do not use sharp tools to remove ice from any surface.

D. It is more effective and safer to use large quantities of warm air rather than small quantities of hot air since there is less chance of overheating. Warm air should be applied until all parts are dry. Water formed by melting snow or ice will run down and freeze again on cold parts and easily create a greater problem than the original situation. Warm air is especially useful in deicing of areas that include delicate parts such as landing gear, switches, pitot tubes and stall warning vanes. Hot air is the best method for deicing engine intakes, but manual removal of snow or ice is also possible if no inlet cover is fitted, or not installed quickly enough, ice or snow may enter the inlets. Warm air blown into the intakes for a few minutes will thaw any deposits. Freedom of movement should be checked by rotating the propeller through several revolutions.

E. Deicing Fluid Temperature – For maximum effect, heated (140°F min. up to 185°F max.) Type I fluid should be applied close to the surface to minimize heat loss. The fluid FP should be as low as possible but not less than 18°F (10°C) lower than the OAT.

F. The heated fluid effectively melts any frost, as well as deposits of slush, snow and ice. Heat must break the bond of heavier accumulations between frozen deposits and the structure; the hydraulic force of the fluid spray is then used to flush off the residue. The deicing fluid will prevent refreezing for a period of time depending on airplane skin temperature, OAT, the fluid used and the weather.

Program Description

G. To remove frost and light ice, heated deicing fluid and a solid cone (fan) spray setting is recommended. This ensures the largest droplet pattern available, thus retaining the maximum heat in the fluid. A minimal amount of fluid will be required to melt the deposit if the fluid is applied close to the airplane's skin. When performing the first step deicing procedure, apply the heated fluid with the nozzle as close as possible to the surface without damaging aircraft surfaces. This will minimize the occurrence of frozen contamination on wing surfaces at altitude. Increasing the distance from the nozzle to the surface results in progressively greater loss of fluid heat and deicing capability. This condition is aggravated as the fluid application pattern is adjusted toward a spray mode.

H. Heavy accumulations of loose snow and slush should be removed by hand using long handled brooms or other suitable means that will not damage aircraft surface areas. Finish the removal of snow and slush by application of heated deicing fluid. Remove light deposits of wet or dry snow as you would frost. Wet snow is more difficult to remove than dry snow and unless deposits are relatively light, selection of a high fluid flow will be more effective. Under certain conditions it will be possible to use the heat, combined with the hydraulic force of the fluid spray to melt and subsequently flush off frozen deposits. However, where snow has bonded to the airplane skin it should be removed in the same way as ice.

I. When removing ice, heated fluid will be needed to break the ice bond. The high thermal conductivity of the metal skin is utilized and a jet of hot fluid directed at close range onto one spot until the skin surface finish is just exposed. The metal surface will transmit heat laterally in all directions raising the temperature above the freezing point and breaking the adhesion of the frozen mass with the aircraft surface. By repeating this procedure a number of times, the adhesion of a large area of frozen snow or glazed ice can be broken. The deposits can then be flushed off with either a low or high flow, depending on the amount of the deposit.

J. "Polishing frost" is not an approved deice procedure, the safest course of action is to completely remove all frost contaminants from wing and flight control surfaces.

K. When spraying the airplane with deicing fluids, observe the following techniques and precautions:

(1) Be careful when you apply the deicing and anti-icing fluid to lubricated parts. Damage to the lubricant can occur. Deicing/anti-icing fluid has a detrimental effect on lubricated components.

(2) Do not spray perpendicular to aircraft surfaces as they may be damaged.

(3) Avoid direct spraying of pitot heads, static vents, probes, and angle-of-attack vanes.

(4) Do not spray into fuel tank vent openings.

(5) Avoid direct spraying of the brake units, landing gear, wheels, tires, or shock absorbers.

(6) Do not spray directly onto flight deck windows, use a broom or squeegee to remove snow. If frozen contaminants are adhering to the windows, apply fluid above the windows and allow the fluid to flow down over the windows loosening the frozen contaminants. It may be necessary to clear the windows of contaminants or excess fluid before engine start so that hand signal communication with ground personnel/marshaller and visual clearing of prop area is adequate.

(7) Try not to spray into the wind.

(8) Use spray to clear the engine nacelles, and hot air or manual removal to clear the engine intakes.

(9) When spraying the tail, start at the highest part from the tip of the vertical stabilizer down towards the fuselage.

(10) When spraying the horizontal stabilizer, start at the tips and work towards the rear of the stabilizer surface.

(11) When spraying the wings, start at the leading edge and work towards the trailing edge to remove snow and ice from wings, flaps, ailerons and tabs.

PROGRAM DESCRIPTION

Anti-Icing Procedures

A. Whenever snow or other freezing precipitation is falling, anti-icing Type II, III, or IV fluid (when available) should be applied to the airplane to prevent contamination from adhering to the surfaces. If contaminants are already on the aircraft, they should be removed from the aircraft first with heated deicing fluid, then Type II, III, or IV fluid is applied. This is called two-step deicing/anti-icing.

B. Anti-ice or deice fluid may be applied to the airplane during turnarounds or overnights when frost or freezing precipitation is expected. The anti-ice or deice fluid will minimize the adherence of frozen contaminants, which should assist the deicing process when preparing the airplane for the next flight. However, the application of the Aircraft Deicing Program is not changed or reduced by using this pre-spray technique.

☝**Caution:** Anti-ice fluids should only be applied to surfaces clear of frozen contaminants.

C. The spray process should be continuous and carried out as near to the departure time as possible to maximize the holdover time. The anti-icing fluid should be distributed uniformly. In order to control the uniformity, all horizontal surfaces should be visually checked during application of the fluid. The amount required will be visually indicated by the fluid running off in considerable quantities on sloped surfaces and running off flat surfaces also.

D. When precipitation is falling with the potential of freezing, the anti-icing step should begin within three minutes of the deicing. If an airplane that has been anti-iced needs another treatment, the first coat of Type II or IV must be removed with hot deicing fluid before another coat of Type II or IV is applied.

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, flightcrews should be conscious of the effects of having the runway deicing fluid blown up onto the aircraft by preceding aircraft jet blast.

Anti-Icing in a Hangar.

A. There are operational conditions when air operators may choose to anti-ice their aircraft while the aircraft is in a heated hangar. This is one way to reduce the consumption of deicing fluid and to minimize the environmental impact of deicing.

B. The period of time after fluid application and the air temperature in the hangar both have an effect on the ability of the fluid to protect the aircraft when it is pulled out of the hangar and into freezing/frozen precipitation. The HOT for a fluid is based largely on the fluid's thickness on the surface. The fluid thickness varies with time and temperature. Unless otherwise approved in an air operator's program, the HOT clock must be started at the time of the first application of anti-icing fluid onto a clean wing. It may not be started when the aircraft is first exposed to freezing/frozen precipitation.

C. When anti-icing T-tail aircraft in a hangar, care must be taken to ensure that the horizontal stabilizer/elevator of the aircraft is not in close proximity to the ceiling heating system. Excessive heating of these critical surfaces during and after anti-icing can reduce applied anti-icing fluid thickness below what is required to achieve the HOT.

D. If it is impossible to position the aircraft in such a way that the tail section is not below a heating element, consider disabling the heating element before, during and after anti-icing. Alternately, consider opening the hangar doors to cool all surfaces if this can be done without exposing the aircraft to additional contamination.

Alternative and New Technologies

A. Forced Air Systems (FAS).

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

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

Note: When deice vendors use forced air augmented with Type I fluid, it does not provide for a holdover time. The Deice vendor must then apply either Type I or an anti-ice fluid to provide a holdover time.

(2) Possible Concerns with FAS.

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

Note: Empire Airlines Deice vendors do not use forced air applied anti-ice fluid.

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

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

sample recovered from the wing, and for Types II and IV fluids, rounded up to the nearest 500 millipascal seconds.

Note: CHs should use the manufacturer's viscosity test method from the Fluids Tested for Anti-Icing Performance and Aerodynamic Acceptance tables, in the FAA HOT Guidelines document while conducting these or similar tests.

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

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

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

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

(3) Additional Precautions for FAS.

(a) Ear protection should be worn when noise levels exceed 85 decibels (dB).

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

(c) Exercise caution to avoid the following:

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

Note: Information regarding a specific system can be obtained from the manufacturer's technical literature. SAE Aerospace Information Report (AIR) 6284, Forced Air or Forced Air/Fluid Equipment for Removal of Frozen Contaminants, provides some information on FAS usage, limitations, and precautions. This document is available at https://www.sae.org/standards/content/ air6284.

B. Liquid Water Equivalent Systems (LWES). LWES have been in development for a number of years. They include HOTDS. At this time, SureHOT and SureHOT+, provided by SureWx Inc., are the only LWES available by Operations Specification (OpSpec) A323, Liquid Water Equivalent System (LWES). All of these systems convert snowfall data, freezing drizzle data, and light freezing rain data into LWE data, which is then used to develop a HOT. The precipitation rate determined by these devices is matched with HOT data developed when fluids are tested in natural snow conditions, and artificial conditions for other precipitation types, to determine a HOT for a particular fluid type in the case of Type I fluids, and for a specific fluid name brand and type for Types II, III, and IV fluids. FAA Order 8900.1, Volume 3, Chapter 27, Section 5, Liquid Water Equivalent Systems, describes the approval process for using these devices to determine HOTs as part of an FAA-approved program.

✍**Note:** Empire Airlines does not use LWES technology in this Aircraft Deicing Program.

C. Electronic Hand-Held Devices to Determine Electronic HOTs (eHOT). Electronic devices that determine eHOTs may be used as part of an air operator's § 121.629 winter operations plan submitted to the FAA for approval. If, for any reason, the device or application fails, or if the user has any concern regarding the accuracy of the data being displayed, printed tables sourced from the FAA HOT Guidelines should be used as a fallback information source. Questions regarding the use of these devices should be submitted via email to timothy.mcclain@faa.gov or via phone at 703-999-6648.

✍**Note:** Empire Airlines does not use eHOT technology in this Aircraft Deicing Program.

Training Program

14 CFR: 121.629(c)(2)(i-vii)

A. Initial and recurrent ground training and testing for flight crews and dispatchers are contained in the Flight Training Manual.

B. Empire personnel and contract deice trainers will be initially trained through instruction and testing by Empire's designated instructors or via Empire's instructional deice video. If an airplane is regularly scheduled into a station where deicing is contracted, Empire will ensure the contract personnel are trained on the ADP.

C. Empire Airlines may accept the training and the deicing/anti-icing program of another Part 121 air carrier. Empire must verify that the other Part 121 air carrier's program was developed in accordance with the requirements of Advisory Circular 120-60 (current edition). To determine that another air carrier's deicing/anti-icing program conforms, the Director of Operations will review their program manual and ensure that the current edition of AC 120-60 is referenced and that the program has been FAA approved.

D. Ground crew personnel, after their initial training, will be kept current through the maintenance training bulletin program, on changes and updates to the deicing/anti-icing program. These training bulletins may or may not include written tests, depending upon the scope of the changes.

E. Initial training for technicians and ground personnel shall be conducted to assure that all obtain a thorough knowledge of aircraft ground deicing/anti-icing policies and procedures, including new procedures and lessons learned.

F. Initial training for technicians and ground personnel shall be conducted concerning the specific duties, responsibilities, and functions detailed in the ADP.

G. Records of personnel training shall be maintained on file for proof of training by Maintenance Training COE for ground crew training, and Flight Operations COE for flight crew and Dispatch/ Flight Follower training.

PROGRAM DESCRIPTION

H. All Empire personnel and contract deice trainers trained in deicing/anti-icing procedures in accordance with this program will be required to pass, with a score of 70% or better, a written test administered by Empire.

I. The source of material for the written test will be based on latest revision of the ADP.

Training Objective

A. To ensure that ground crews and contract personnel are qualified concerning the specific requirements of the approved program and each person's responsibilities and duties under the approved program.

Training Aids/Devices

- Aircraft Deicing Program manual;
- Empire's Deicing video;
- ATR's "Cold Weather Operations" brochure

Training Hours

A. Recommended minimum is 2 hours

Qualification

A. The instructor will determine the qualification of each person by asking questions and soliciting feedback on the specific requirements of this ADP and on each person's duties and responsibilities.

Training Curriculum

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:

Loss of Lift
Increased drag and weight
Decreased control
Aircraft specific areas:
- Engine foreign object damage potential
- Ram air intakes
- Instrument pick up points
- Airworthiness Directives/specific inspections
- Critical Area Identification (critical surfaces)

B. Aircraft Icing Conditions. Describe conditions that cause implementation of deicing/anti-icing procedures:

In Flight Ice Accumulation
Frost, including hoar frost
Freezing precipitation (snow, freezing rain, freezing drizzle, or hail which could adhere to aircraft surfaces)
Freezing fog
Rain or high humidity on cold soaked wings
Rain or high humidity on cold soaked wing fuel tanks
Under wing frost (may not require deicing/anti-icing within certain limits)
Fluid failure recognition
Location specific deicing/anti-icing procedures
Communication procedures between the flight crew, ground personnel, ATC, and company station personnel
Means for obtaining the most current weather information

Characteristics and capabilities of fluid used:
- General fluid description
- Composition and appearance
- Differences between Type I, III, and Type II/IV deicing/anti-icing fluids
- Purpose for each type
- Deicing fluids
- Anti-icing fluids
- De/anti-icing capabilities
- Approved deicing/anti-icing fluids for use (SAE, ISO, etc.)
- Fluid specific information provided by fluid or aircraft manufacturer
- Fluid temperature requirements (hot vs. cold)
- Properties associated with infrared deicing/anti-icing

C. Fluid Storage and Handling

Fluid storage
Fluid handling
Fluid sampling
Fluid testing

D. Deicing/Anti-Icing Facilities and Equipment Operation Procedures An understanding of the capabilities of the deicing equipment and the qualification for operation. The equipment portion of the training program should include the following:

Description of various equipment types
- Deicing vehicles
- Infrared vehicles
- Hard stands (gantry)

Operation of equipment
Emergency procedures
Health, safety, and first aid
Environmental considerations
Fluid selection

E. Contractor Deicing/Anti-Icing Train the trainer per the ADP.

Empire may verify equipment training of contract deicers and, if adequate, accept that training in lieu of duplicate training. Verification may be obtained through training records or other written confirmation supplied by the contractor.

F. Methods/Procedures

Inspection of critical surfaces
Clear ice precautions
Flight crew/ground crew preflight check requirement
Deicing/anti-icing determination
Deicing/anti-icing location
Communication before deicing/anti-icing
General deicing/anti-ice precautions
Aircraft specific requirements
Cold weather preflight inspection

Deicing:
- Requirements
- Effective removal of frost, snow, and ice

Program Description

Anti-Icing:

- Requirements
- Preventative anti-icing
- Application

Deicing/Anti-Icing

- One step
- Two step
- Guidelines for the application of deicing/anti-icing fluids
- Post deicing/anti-icing check requirements
- Flight control check
- Communication after deicing/anti-icing

Use of HOTs

- Definition of HOT
- When HOT begins and ends
- Limitations and cautions associated with the use of HOTs
- Source of HOT data
- Relationship of HOT to particular fluid concentrations and for different types of fluids
- Precipitation category (e.g. fog, drizzle, rain, or snow)
- Precipitation intensity
- How to determine a specific HOT from the HOT range that accounts for moderate or light weather conditions
- Adjusting HOT for changing weather conditions

Cold Weather Preflight accomplished from elevated vantage point

Pre-takeoff Check Requirement (identification of representative surfaces)

Pre-takeoff Contamination Check Communications
Aircraft Surface Contamination Recognition

Contamination Recognition Techniques

- During cold weather preflight inspection
- During post deicing/anti-icing check
- During pre-takeoff check
- During pre-takeoff contamination check

Contract Deicing

A. Empire may contract with other companies to perform deicing. For aircraft operated for FedEx, FedEx Corporation will normally supply deicing equipment and personnel.

B. Empire will supply this ADP, ADP-based training manuals or deice videos as the training material and standards for contract deicers.

C. Contract deicers will follow the procedures of this ADP and comply with Empire standards during deicing and contamination checks.

D. Empire-designated instructors will train the designated trainer at the contract locations. The Maintenance Training department will maintain training records.

E. The flight crew or station mechanic will monitor the contract deicing to ensure that Empire deicing and check standards are met.

F. Responsibilities of contract deicers:

(1) Provide deicing upon Empire's request.

Program Description

(2) Advise the flight crew or station mechanic whenever additional deicing instruction is needed.

(3) Use qualified personnel who will use approved procedures to deice Empire aircraft in accordance with this plan.

(4) During deicing, follow the instructions of the Empire mechanic or crew if additional deicing is needed.

(5) Deice the airplane as thoroughly as needed and as quickly as possible.

(6) Advise Empire Director of Operations at COE of changes that would improve this ADP.

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C408 Aircraft Deicing Program

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C408 Aircraft Deicing Program

Cold Weather Operations

These procedures are additional to the Normal Procedures and are recommended for operations where prolonged exposure to ambient air temperatures less than 0°C is anticipated or has occurred. Refer to Volume 1, Section II, Operating Limitations , for any system affected by cold temperatures. Operation of the airplane has been demonstrated after prolonged exposure to an ambient air temperature of -42°C. Engine oil temperature, as displayed on the EIS display, is a good indicator of cold- soak temperature for the engine.

Exterior Inspection

If prolonged exposure to temperatures less than 0°C has occurred:

1. Make sure brake reservoir and calipers are not leaking. The brake system is more prone to leaks and the brake reservoir can indicate lower.
2. Make sure propellers are free to move and rotate them a couple of times to assist in moving the engine oil.
3. Remove snow or ice from the tail first to avoid airplane falling on its tail.
4. The airplane and inlets must be cleared of snow and ice and if the wing, empennage, or control surfaces are frosted, they must be de-iced. Refer to Normal Procedures, Ground De-icing/Anti-icing Operations.
5. Some fuselage panels can exhibit minor distortion with reduced temperatures. This is temporary and will return to normal when the airplane warms up.

Taxi

1. Brake pedals should be pumped several times in order to ensure normal braking can be achieved.
2. Exercise the propeller lever several times from full forward to feather and exercise power lever into ground fine and reverse to flush any congealed oil thru the system.

Exterior Inspection

Refer to Normal Procedures, Cold Weather Operations and Contaminated Field Operations, prior to exterior inspection if prolonged exposure to ambient air temperatures below 0°C has occurred or contaminated field conditions exist. Give particular attention to engine inlets, propeller blades and wing trailing edge (forward of flaps) for ice/slush from previous landing.

Refer to Volume 1, Section II, Takeoff and Landing Operational Limits and Ice and Rain Protection, prior to exterior inspection, if the ambient air temperature is at or below +5°C (SAT) or if upper wing surface cannot be verified to be free of contamination.

✎**Note:** Above the windshield, top of the engine pylon, propeller spinner or nose are representative of the wing upper surface.

During inspection, make a general check for security, condition and cleanliness of the airplane and components. Check for damage, fuel, oil leakage, security of access panels and doors, and removal of keys from locks.

C408 Aircraft Deicing Program

Left Forward Fuselage and Nose

1. Cockpit Door, Steps, and Seal ..... **Condition**
2. AOA Probe ..... **Condition/Rotates Freely/Base Warm**
3. External Power Door ..... **Condition**
4. Fresh Air Inlets (if installed) ..... **Clear**
5. Left Nose Compartment Door ..... **Secure**
6. Nose Vent ..... **Clear**
7. Taxi Light ..... **Condition**
8. Wheel/Tire/Strut ..... **Condition**
   a. Nose strut must have chrome showing.
9. Radome ..... **Condition/Secure**

Right Forward Fuselage and Nose

1. Ice Detector ..... **Condition**
2. Nose Vent ..... **Clear**
3. Oxygen Blowout Disc ..... **Green**
4. Fresh Air Inlets (if installed) ..... **Clear**
5. Right Nose Compartment Door ..... **Secure**
6. Brake Fluid Reservoir/Door ..... **Check/Secure**
   (Verify fluid visible in both sight gauges.)
7. AOA Probe ..... **Condition/Rotates Freely/Base Warm**
8. Cockpit Door and Seal ..... **Condition**
9. Antennas ..... **Condition**
10. Fuselage Drains ..... **Clear**
11. Wing Inspection Light ..... **Condition**

Ground De-icing/Anti-icing Operations

Prior to takeoff, flight crews are responsible for making sure the airplane is free of ice contaminants as required by

- Volume 1, Section II, Takeoff and Landing Operational Limits
- Volume 1, Section II, Ice and Rain Protection

Critical areas of the airplane such as empennage, wings, wheel brakes, windshield, engine inlets and exhausts, propellers, and control surfaces should be checked to make sure they are free of ice, slush, and snow or the de-ice/anti-ice fluids are still protecting the airplane.

- Refer to the Airplane Maintenance Manual for wheel brake de-icing.
- Refer to Normal Procedures, Cold Weather Operations, for other relevant operating I, or IV fluids.

De-icing/Anti-icing Procedures with Type I, II, III, or IV Fluids

Type I, II, III, or IV fluids may be used on the airframe to ensure compliance with FAA regulations (clean wing concept) requiring critical component airframe de-icing and anti-icing.

It is recommended flight crews re-familiarize themselves seasonally with the following publications for expanded de-ice and anti-ice procedures:

- Model 408 Airplane Maintenance Manual
- FAA Advisory Circular AC 120-58 (large airplanes)
- FAA Advisory Circular AC 135-17 (small airplanes)
- Refer to FAA Website for approved de-icing program updates and holdover time guidelines for the applicable fluid type and brand.

NOTE

- Airplane operators are solely responsible for making sure that holdover timetables contain current data.
- The required tactile check prior to takeoff where additional contamination may reasonably be expected may be accomplished any time between final application of the fluid and takeoff when appropriate anti-icing has been conducted.
- Type I, II, III, or IV fluids are not compatible and may not be mixed.
- Most manufacturers prohibit mixing of brands of fluid within a type.
- This method is not to be used on the wheel brakes.

Refer to Figures 3-NRM-20 and 3-NRM-21 for essential areas to be de-iced/anti-iced with Type I, II, III, or IV fluids and areas where direct spray should be avoided.

One Step De-icing/Anti-icing – Heated Type I, II. III, or IV fluid is used as de-icing fluid to remove ice, slush, and snow from the airplane prior to departure, and to provide anti-icing protection.

Two Step De-icing/Anti-icing – Heated Type I, II, III, or IV fluid is used as de-icing fluid to remove ice, slush, and snow from the airplane, then Type I, II, III, or IV fluid is applied to anti-ice the airplane prior to departure.

Holdover Times

1. Holdover time guidelines are only estimates and vary depending upon brand, mixture ratio, temperature, precipitation type, wind, and airplane skin temperature.

2. Holdover time starts when the last application begins.

Spraying Technique

1. Line personnel should be supervised by the flight crew to ensure proper application of de-ice or anti-ice fluids. Refer to Figures 3-NRM-20 and 3-NRM-21 for essential areas to be de-iced and anti-iced and areas where direct spray should be avoided.

2. Recommend pointing the airplane into the wind to reduce fluid on the windshield. Spray from the front of the airplane where practical. Spraying from the rear can force fluid into aerodynamic quiet areas where it will not drain from the airplane.

3. The first area to be de-iced/anti-iced should be easily visible from the cockpit and should be used to provide a conservative estimate for unseen areas of the airplane before initiating takeoff roll.

4. The fluid should be sprayed as close as possible to the airplane surfaces, but not closer than 10 feet if a high-pressure nozzle is used.

5. Spraying with engines off is preferred for consistent fluid application. Spraying can be conducted with the engines running but will use approximately twice as much fluid. Use the following procedure as required:

Before Spraying

a. INERTIAL SEP Switches..... **MAIN or STBY**

b. COCKPIT/CABIN VENT Handles (if installed)..... **Push Closed**

c. Engines (both) ..... **DLE and Propeller Feathered or Return to Normal Procedures, Shutdown**

After Spraying

a. If engines not running, return to Normal Procedures, Cockpit Preparation.

b. If engines running:

(1) COCKPIT/CABIN VENT Handles (if installed)..... **As Desired**

Takeoff

Takeoff performance is degraded when Type II, III, or IV fluid has been applied. The fluid that remains on the airplane during takeoff causes an increased pitch force at rotation, a slower than normal rotation rate and delayed liftoff, thereby increasing takeoff distance.

Determine the takeoff field length and speeds from Volume 1, Section IV,

Performance. Multiply this takeoff field length by the following Takeoff Distance

Factor to determine the new takeoff field length with Type II, III, or IV fluid applied.

Takeoff Distance Factor
Flaps 1 X 1.15

Postflight Inspection – Type I, II, III, or IV Fluids

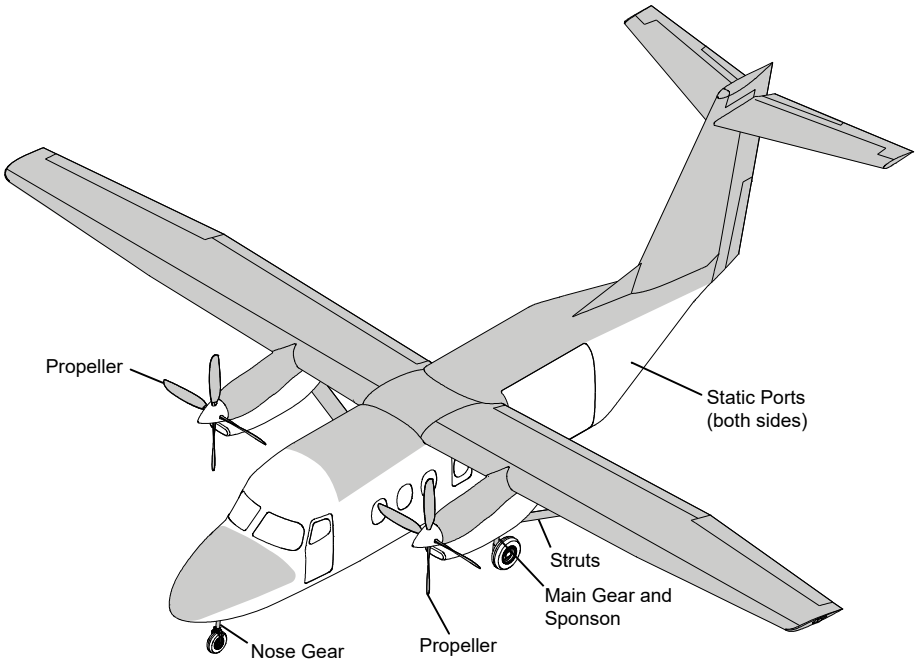
The C408 Airplane Maintenance Manual requires that visual inspections for fluid residue are completed after a day of flying when Type I, II, III, or IV fluids are used. In order for MX to track this inspection frequency the PIC will notify dispatch during the close out call when de/anti-ice fluids are used. MX will track the number of events and schedule the residue wash as required. When fluid residue is detected during the visual inspection, MX will wash the residue from the aircraft.

An example close out notification could be like this, “Deiced/Anti-iced in YKM”.

Airplane De-icing

SHADED AREAS INDICATE ESSENTIAL AREAS TO BE DE-ICED

Direct Spray Avoidance Areas:
StaticPorts,AOAVanes,NoseVentilationLouvers,PitotProbes,EngineInletsand Exhausts,EngineCowlVentilationScoops,IceDetector,RamAirScoops,Brakes, Windshields,CabinWindows,ECSInletScoops,AirConditioningInlet,TailVentilation Louver



NOTE: Remove snow ice, and slush from AOA Vanes, Pitot Probes and all Inlet, Louvers, and Scoops by hand only.

Figure 3-NRM-20

C408 Aircraft Deicing Program

Airplane Anti-icing

SHADED AREAS INDICATE ESSENTIAL AREAS TO BE ANTI-ICE

Direct Spray Avoidance Areas:
StaticPorts,AOAVanes,NoseVentilationLouvers,PitotProbes,EngineInletsand Exhausts,EngineCowlVentilationScoops,IceDetector,RamAirScoops,Brakes, Windshields,CabinWindows,ECSInletScoops,AirConditioningInlet,TailVentilation Louver

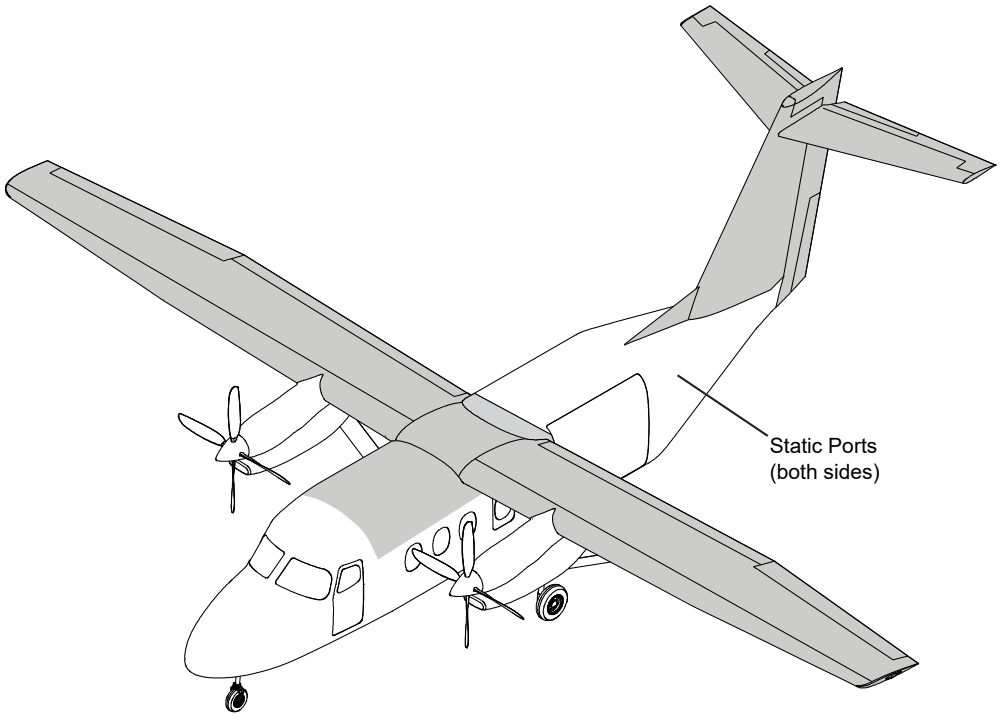


Figure 3-NRM-21

Ice and Rain Protection

1. On the ground, icing conditions are defined as visible moisture (such as fog with visibility of one mile or less, rain, drizzle, sleet, snow or ice crystals) with an ambient air temperature of +5°C or below.
2. In flight, icing conditions are defined as visible moisture (such as clouds, rain, drizzle, sleet, snow or ice crystals) with a SAT Indication of +5°C or below.
3. The airplane must be operated, and its ice protection systems must be used, in accordance with this FAA Approved Airplane Flight Manual.
4. Prior to takeoff, the white **ICE PROT ALL ON** CAS message must be displayed when in icing conditions or if icing conditions may be encountered at or below 400 feet AGL.
5. In flight, select INERTIAL SEP (both) - MAIN or STBY and AUTO IGNITION (both) - ARM when in rain.
6. In flight, select INERTIAL SEP (both) - MAIN or STBY, AUTO IGNITION (both) - ARM, W/S HEAT - HIGH, and PROP HEAT - ON when in icing conditions. Select WING/STAB - ON when amber **ICING** CAS message is displayed and/or ice accumulation is observed.
7. Minimum SAT for WING/STAB switch operation is -40°C.
8. Minimum airspeed in icing conditions. Refer to Limitations, Speed Limits
9. Flaps FULL prohibited in icing conditions.
10. Prolonged flight in icing conditions with flaps extended is prohibited.

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ATR42/72 Procedures

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ATR42/72 Procedures

Introduction

A. This Chapter describes deice and anti-ice procedures specific to the ATR42/72 airframe.

B. Critical surface areas of the ATR42/72 are described in the Maintenance Manual and are included in this Chapter. After deicing, critical areas must be free of frozen contaminants before the airplane can be declared "clean" and approved for takeoff.

Cold Weather Preflight

A. Flight Crew

(1) The cold weather preflight is required when atmospheric icing conditions exist (OAT is +5°C or below with visible moisture) or when the PIC determines that conditions exist so that frost, snow, or ice may reasonably be expected to adhere to the critical surfaces. A critical surface of the aircraft is to be checked by either the flight crew, technician, or deice personnel from a vantage point that allows a visual check to be accomplished.

(2) To conduct the cold weather preflight a ladder, belt loader, deice equipment, or other suitable platform must be used to attain a vantage point for checking a critical surface. The critical surface checked will be the top of the horizontal stabilizer.

(3) If frost, ice, or snow is found to be adhering to the critical surface, or if a positive determination cannot be made, then deicing is necessary.

(4) The critical surface check may be disregarded when a crewmember continuously attends the aircraft and the flight is only on the ground for a short time, such as a quick turn, allowing the crew to be confident that no frozen contaminants have accumulated.

B. Technician

(1) Any time the temperature is 32°F (0°C) or below the technician, where available, should arrive at the airplane early enough to begin preheating. Preheating the avionics and flight instruments has proven to increase reliability during cold weather operations. ATR42/72 engine/exhaust plugs should be in place to prevent snow and ice from entering the engine. The PW124/127 engines on the ATR72 will be preheated anytime the engines have been cold soaked at temperatures of -15°C (0°F) or lower. Refer to Empire Maintenance Bulletin 08-01 for additional information.

Underwing Frost

A. The only acceptable exception to the clean aircraft rule for the ATR is that a maximum of 2mm (approximately the thickness of a nickel) layer of frost or ice is permitted under the wing in accordance with FAR 121.629(b). The layer must be smooth and level. A visual check of the leading edge, upper surface of the wing, control surfaces, and propellers is performed to make certain that those surfaces are totally free of frozen contaminants.

Thin Hoar Frost

A. Thin hoar frost is acceptable on the upper surface of the aircraft fuselage if all vents and ports are clear. This hoar frost is usually a uniform white deposit of fine crystalline texture and is thin enough for observers to visually distinguish aircraft paint surface features underneath it, such as paint lines, markings, and lettering. Frost is not acceptable on the items listed in paragraph A of the Cold Weather Preflight section.

Aircraft Preparation

Deicing/Anti-Icing Checklist

✍**Note:** This checklist will be used when the aircraft is not required to reposition for deicing.

Prior to the start of Deicing /Anti Icing

Brakes ..... SET C
Cold Weather Preflight ..... Complete F
Engines ..... Shutdown C
Propeller Blades ..... Positioned CR
Doors, Hatches, Emergency Exits ..... Closed C
Overboard Valve ..... Full Closed F
Fluid Type, Mixture and Brand ..... Determine for Type II/IV C
Type II/IV Takeoff ..... Crew Brief Method 2 C
(ATR PH 2.02 Adverse Weather)
HOT ..... Determine C
Control Column ..... Full Forward C
Gust Lock ..... Engaged C
HOT ..... Start Time when applicable C
Airport Analysis ..... Icing Conditions Reviewed C

Deicing/Anti-Icing Complete

Post Deicing/Anti-Icing Check ..... Complete C
Flight Controls ..... CKD CR
Control Column ..... Neutral C
Pre-takeoff Check when applicable ..... Complete C
Pre-takeoff / Contamination Check ..... AS REQ'D C

Deicing/Anti-Icing Checklist in HOTEL Mode

✍**Note:** This checklist is intended to be used when the aircraft will be repositioned to the deice pad and Hotel Mode used during the deicing process.

Parked at the Deicing Pad

Taxi Light ..... OFF C
Brakes ..... SET C
CLs ..... FEATHER C
CL #1 ..... FUEL SO C
Prop Brake ..... ON C
Beacon ..... OFF C
Overboard Valve ..... FULL CLOSED F

Prior to Start of Deicing / Anti-Icing

Cold Weather Preflight ..... Complete F
Fluid Type, Mixture and Brand ..... Determine for Type II/IV C
Type II/IV Takeoff ..... Crew Brief Method 2 C
(ATR PH 2.02 Adverse Weather)
HOT ..... Determine C
Control Column ..... Full Forward C
Gust Lock ..... Engaged C
Engine 2 Bleed ..... OFF F
HOT ..... Start Time when applicable C
Airport Analysis ..... Icing Conditions Reviewed C

ATR42/72 Procedures

Deicing/Anti-Icing Complete

Belts/Harnesses ..... ON CR
Post Deicing/Anti-Icing Check ..... Complete C
Engine 2 Bleed ..... ON F
Voltage ..... CKD C
Doors ..... Closed C
Beacon ..... ON C
Prop Brake ..... OFF C
Flight Controls ..... CKD CR
Control Column ..... Neutral/Forward C
Start Selector ..... Start #1 Engine
Pre-takeoff check when applicable ..... Complete C
Pre-takeoff / Contamination Check ..... AS REQ'D C

Complete After Start Checklist

ATR72-600F Deicing/Anti-Icing Checklist

Note: This checklist will be used when the aircraft is not required to reposition for deicing.

Prior to the start of Deicing /Anti Icing

Brakes ..... SET C
Cold Weather Preflight ..... Complete F
Engines ..... Shutdown C
Propeller Blades ..... Positioned CR
Doors, Hatches, Emergency Exits ..... Closed C
Overboard Valve ..... Full Closed F
Fluid Type, Mixture and Brand ..... Determine for Type II/IV C
Type II/IV Takeoff ..... Crew Brief Method 2 C
(ATR PH 2.02 Adverse Weather)
HOT ..... Determine C
Control Column ..... Full Forward C
Gust Lock ..... Engaged C
HOT ..... Start Time when applicable C
Airport Analysis ..... Icing Conditions Reviewed C

Deicing/Anti-Icing Complete

Post Deicing/Anti-Icing Check ..... Complete C
Flight Controls ..... CKD CR
Control Column ..... Neutral C
Pre-takeoff Check when applicable ..... Complete C
Pre-takeoff / Contamination Check ..... AS REQ'D C

ATR72-600F Deicing/Anti-Icing Checklist in HOTEL Mode

Note: This checklist is intended to be used when the aircraft will be repositioned to the deice pad and Hotel Mode used during the deicing process.

Parked at the Deicing Pad

Taxi Light ..... OFF C
Brakes ..... SET C
CLs ..... FEATHER C
CL #1 ..... FUEL SO C
Prop Brake ..... ON C
Beacon ..... OFF C
Overboard Valve ..... FULL CLOSED F

Prior to Start of Deicing / Anti-Icing

Cold Weather Preflight ..... Complete F
Fluid Type, Mixture and Brand ..... Determine for Type II/IV C
Type II/IV Takeoff ..... Crew Brief Method 2 C
(ATR PH 2.02 Adverse Weather)
HOT ..... Determine C
Control Column ..... Full Forward C
Gust Lock ..... Engaged C
Engine 2 Bleed ..... OFF F
HOT ..... Start Time when applicable C
Airport Analysis ..... Icing Conditions Reviewed C

Deicing/Anti-Icing Complete

Belts/Harnesses	ON	CR
Post Deicing/Anti-Icing Check	Complete	C
Engine 2 Bleed	ON	F
Voltage	CKD	C
Overboard Valve	Auto	F
Doors	Closed	C
Beacon	ON	C
Prop Brake	OFF	C
Flight Controls	CKD	CR
Control Column	Neutral/Forward	C
Start Selector	Start #1 Engine	
Pre-takeoff check when applicable	Complete	C
Pre-takeoff / Contamination Check	AS REQ'D	C

Complete Before Propeller Rotation Checklist

Note: To maximize Type IV holdover times, Flaps 15 should be selected when takeoff clearance is assured.

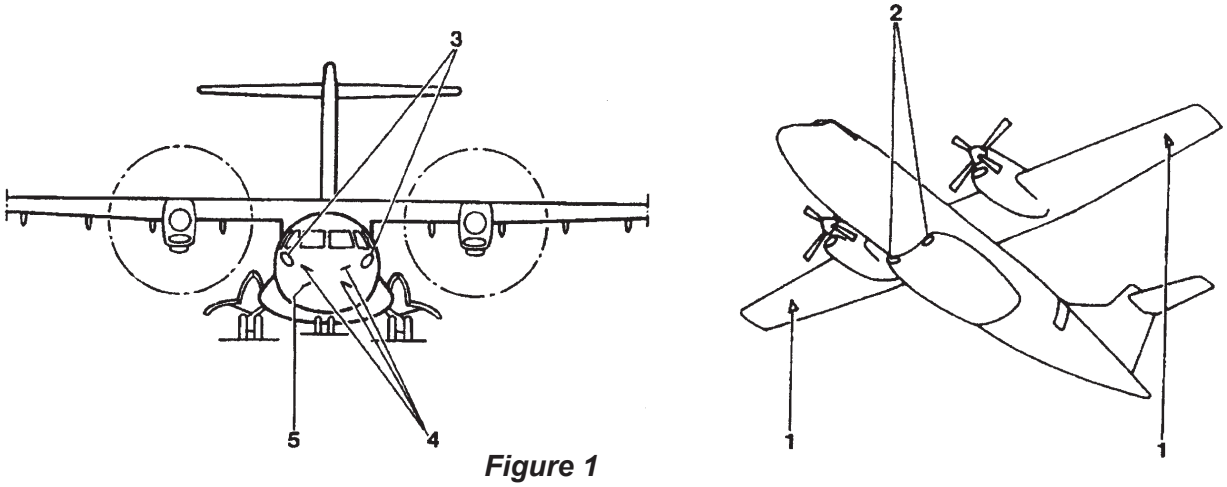


Figure 1
Location of Blanks and Protective Devices

NACA ports (1)
Air conditioning inlets by the main landing gear fairing (2)
Static ports (3)
Pitot probes (4)
Temperature sensor (5)

Note: When blanking devices and protective equipment are not installed, do not spray FPD fluid directly at or into the components listed.

HOTEL mode is when the #2 engine is running with the propeller brake engaged, this mode provides electrical power and air conditioning, and a qualified crewmember or technician must be on the flight deck.

Caution: Air intake and wing snow removal, and propeller deicing must be performed prior to "HOTEL" mode activation.

Observe the following while deicing/anti-icing during HOTEL mode:

Deicing/Anti-icing gantry is not used. (Gantry is a fixed mechanical deicing unit.)

Manual procedures are applied (with a deicing nozzle from a movable platform) to avoid any inadvertent entry of fluid into engines, NACA ports, air conditioning inlets, static ports, pitot probes, or temperature sensors.

Deicing Procedures – Snow Removal

A. If practical, before fluid deicing, manually remove as much snow as possible from wings and other critical surfaces. Use long-handled push brooms from the bucket of the deicer equipment or other suitable platform.

B. To avoid pushing snow into hinge points or gaps between critical surfaces, start at the critical area and push snow away. Manually remove snow from engine air intakes and brakes.

Caution: Be aware for antennae, probes, vortex generators, and static wicks. Do not apply any mechanical means force as damage is likely to occur. Do not walk on wing "NO STEP" areas.

ATR42/72 Procedures

Deice/Anti-ice Procedures

A. Set platform/bucket to suitable height so that the operator is above the surface to be treated. The spray should be applied at low angles, preferably less than 45°.

B. To ensure the best possible tail plane deicing/anti-icing the control column must be firmly maintained on the forward stop together with the aileron gust lock engaged.

Warning: Deicing or anti-icing of horizontal stabilizer must be performed with the elevators at full down position (trailing edge down).

C. Aircraft shall be deiced/anti-iced symmetrically, that is, left-hand and right-hand side shall receive the same and complete treatment, regardless of the condition of the aircraft prior to the deicing/anti-icing procedure. Aerodynamic problems could result if this requirement is not met.

D. Pay particular attention to these areas:

(1) Avoid, as far as possible, spraying directly on the windshields and windows.

(2) After deicing of a critical surface, it is important to observe the gaps between the fixed and movable surfaces and to deice the gaps until free of all frozen contaminants.

(3) Special attention shall be paid to the gaps between:

- Wings/ailerons/tabs;
- Horizontal stabilizer/elevators/tabs, and
- Rudder/vertical stabilizer/tab, to ensure that all frozen contamination is removed from the gaps between fixed and movable control surfaces.

E. Area by Area Procedure

(1) During ground icing conditions that require the use of the two-step procedure (deicing then anti-icing), the second step is to be applied before the first step fluid freezes, typically within 3 minutes. In order to accomplish the second step in a timely manner it may be necessary to spray area by area.

Note: The area by area method is not the only way to accomplish the two-step procedure. For example; the first step procedure may be applied to the whole aircraft before the second step procedure is applied.

(2) Area by area spraying is accomplished by applying the first step to an area then applying the second step to that same area before moving to the next aircraft surface. For example, if the left wing is deiced by the first step procedure it would then be anti-iced by the second step procedure before moving on to the tail or right wing.

(3) There are two critical precautions when using the area by area procedure:

(a) The HOT begins when the anti-ice fluid is first applied. Deice personnel will use the beginning of the first application of the anti-ice fluid as the time to communicate to the flight crew of when the HOT begins.

(b) When de/anti-icing area by area the deice crew must ensure that any area already treated with anti-ice fluid is not diluted with deice fluid overspray. If an inadvertent overspray occurs, respray the affected area with anti-ice fluid.

Sensitive Areas

A. Avoid direct spraying of FPD fluid on shock absorbers.

B. Avoid deicing or anti-icing fluid entering brake unit.

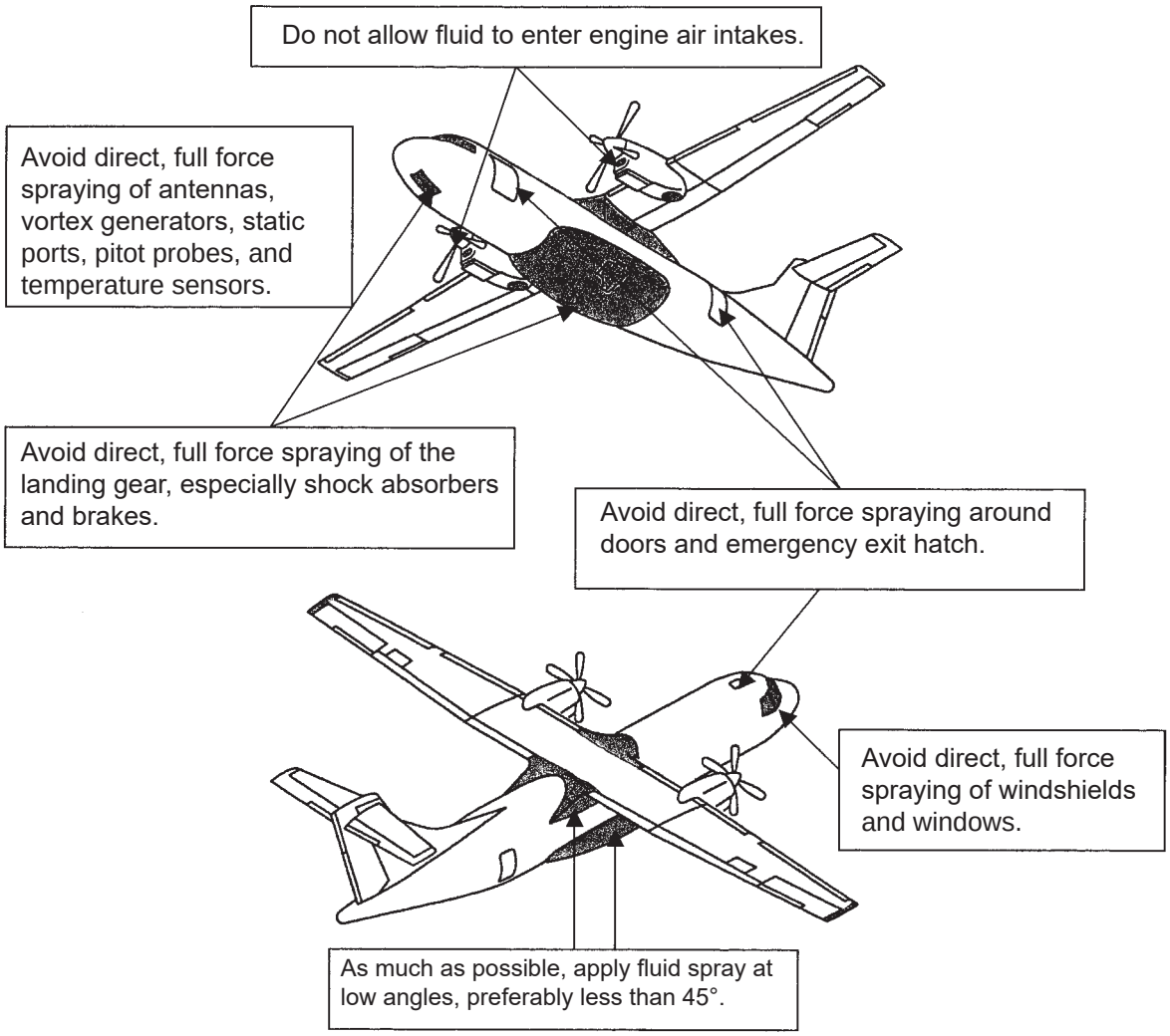
C. Pay particular attention to proximity (squat) switches. Do not spray directly.

D. Check that the tires are not frozen to the ramp.

E. In order to avoid any deicing fluid ingress in the engine air intakes, no propeller blade should be in front of the air intake or the air intake cover should be installed.

Note: Do not allow deicing fluid to enter an engine air intake.

F. Avoid direct spraying into the top cowling inlets and the area behind the propeller cone where the propeller brush blocks are located.



Post Deicing/Anti-icing Check

A. This check is performed by the technician/deicing personnel and will visually cover all critical surfaces (see the Critical Areas graphic) of the aircraft and be performed from points offering sufficient visibility of the critical surfaces (from the deicer or other elevated piece of equipment) Any frozen contaminants discovered will be removed by additional deicing/anti-icing and the check repeated. The thumbs up communication will not be transmitted until the Post Deicing/Anti-Icing Check is complete and the critical surfaces are free of frozen contaminants.

B. When performing the Post Deicing/Anti-Icing Check it is important to ensure adequate illumination is available and that surfaces are viewed from a position that permits adequate visibility of critical surface areas.

C. After completion of frozen contamination removal, the flight crew will check the flight controls (ailerons, rudder, elevators, trim tabs, and flaps) for full and free movement.

D. Check that the following are free of frost, ice, or snow. Deice again as necessary.

- Engine inlets, cowling, drains, and propellers;
- Pack inlets;
- Landing gear assemblies, landing gear doors, and bays;
- Drains, pitot probes, static vents, and angle of attack sensor;
- Fuel tank vents;
- All external surfaces (fuselage, wings, tail plane, vertical and horizontal stabilizers, control surfaces);
- Gaps between flight control surfaces and fixed surfaces with particular attention to the elevator/horizontal stabilizer gap, and
- Flight deck windows are clear of frozen contaminants and excess deice fluid so that there is adequate visibility to provide positive communication with ground personnel/marshaller and to clear the prop and engine area prior to engine start. A limited amount of ice or snow on the flight deck windows is acceptable for engine start and taxi providing that the marshaller(s) and props are visible and adequate visibility is available for taxi. The ice or snow must be melted away by windshield heat and defrost prior to takeoff.

E. Remove any covers or protections previously installed.

F. Remove access platforms.

G. Remove wheel chocks. (Ensure nose wheel chock remains in place until the PIC signals for removal.)

H. Make certain that working area is clear of tools, GSE, and miscellaneous items of equipment.

☝**Caution:** Anti-icing procedure can only be performed on an aircraft previously cleared of all icing, ice or snow. If an additional treatment is required after previous anti-icing, it is prohibited to perform new anti-icing without having washed or deiced the aircraft.

I. Performance penalties for takeoff in atmospheric icing conditions are applied as follows:

(1) Reference the Icing Conditions page of the Airport Analysis Manual for operations during atmospheric icing conditions. Apply applicable performance penalties for:

(a) Contaminated runway conditions,

(b) Type II/IV fluid takeoff (the penalty for the use of Type II/IV is based on Method 1, which more than accounts for a Method 2 penalty, see AFM Chapter 7 page 25 for details).

Representative Surfaces

A. Representative surface for pre-takeoff check by the flight crew will be the nose area ahead and to the side of the flight deck windows and the surface leading edge of the wing that may be seen from the flight deck, and the spoilers when activated to the UP position.

Pre-Takeoff Check

A. This check is accomplished just before takeoff to determine if the representative surfaces remain free of frozen contaminants. Takeoff may be initiated if representative surfaces are free of frozen contaminants and still within HOT.

B. If either the HOT time is exceeded or the representative surfaces have frozen contaminants, the PIC will:

(1) Call for a Pre-Takeoff Contamination Check, or

(2) Request another deicing/anti-icing treatment.

Pre-Takeoff Contamination Check

A. This check shall be performed when the condition of the critical surfaces cannot be effectively determined by a pre-takeoff check or when the HOT has been exceeded.

(1) The check must be accomplished by trained deice personnel from outside the aircraft.

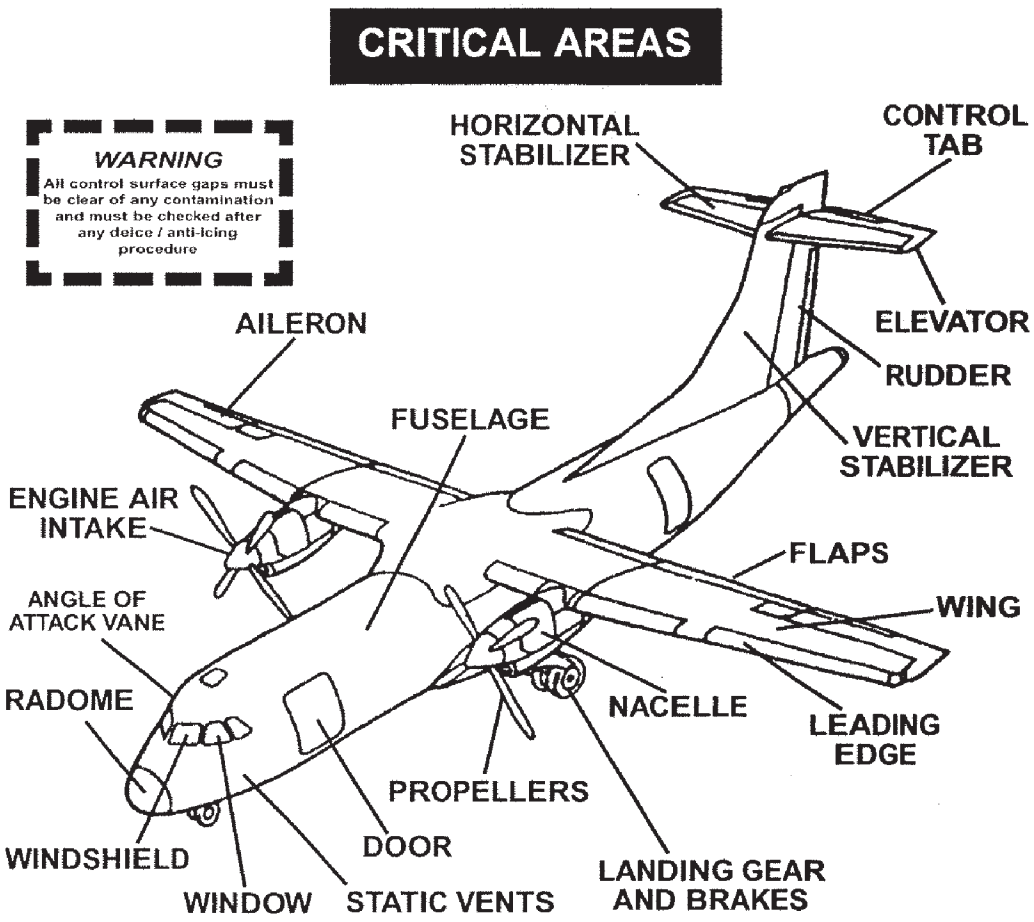
(2) The check must confirm that the critical surfaces are free of frozen contaminants.

(3) The check must be completed within five minutes of takeoff.

B. If performing a pre-takeoff contamination check is not possible, the takeoff must be delayed until another deicing/anti-icing treatment is applied.

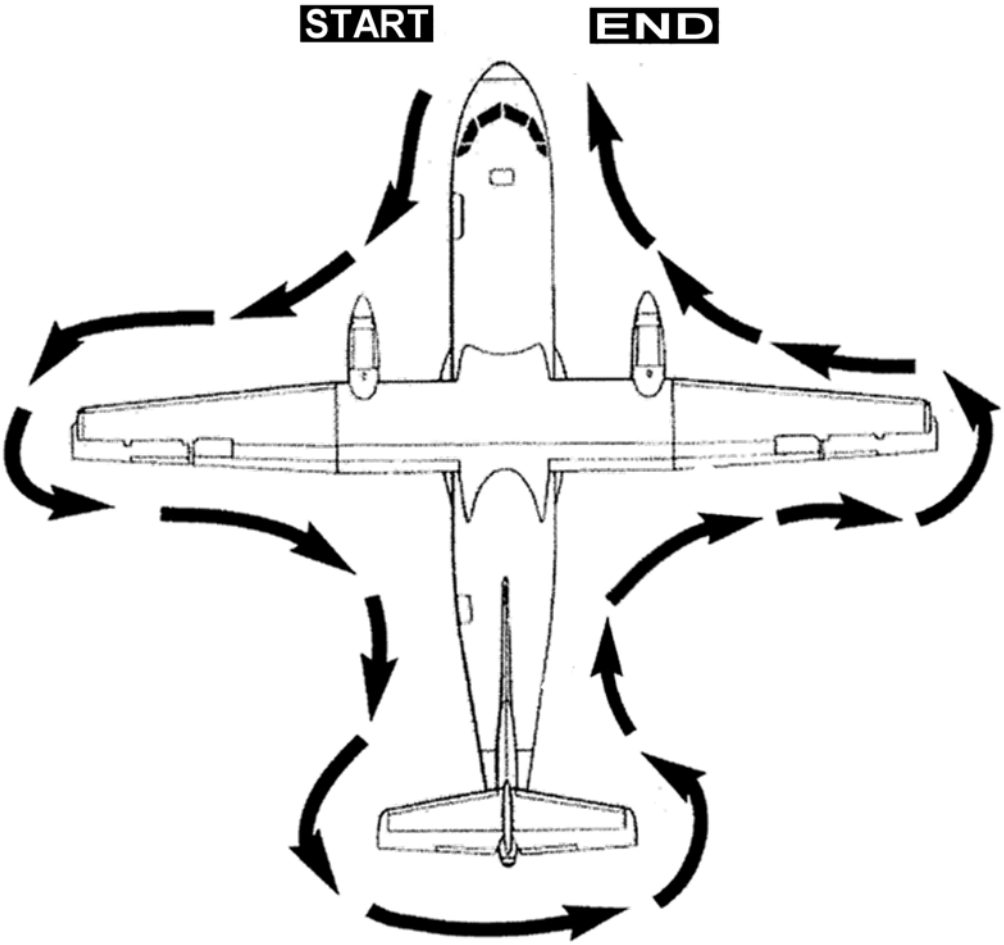
Identification of Critical Surfaces

A. The following areas of the ATR42/72 are defined as critical surfaces for deicing/anti-icing and are to be checked by deicing personnel during the Post Deicing/Anti-Icing Check. These areas must be free of frozen contaminants before the airplane may be released for flight. There may be residual frozen contaminants on the windshield for start up and taxi assuming that windshield heat will melt any contaminants prior to takeoff and visibility is not impaired for engine start and taxi.

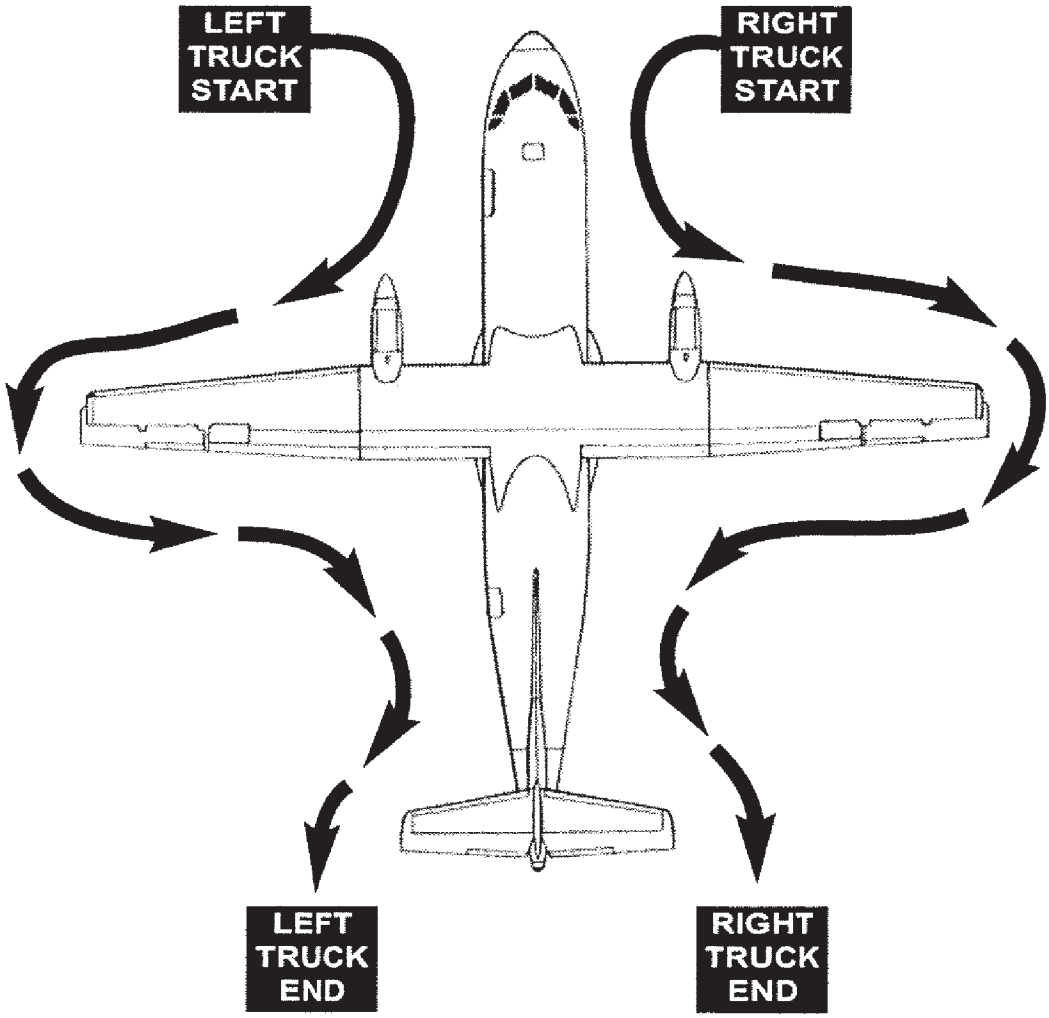


Spray Pattern – General

A. The direction of the deice vehicle around the aircraft is known as the spray pattern. It is not required that the spray pattern be of any particular order. The important points are that the holdover time starts at the commencement of the final application of the anti-icing fluid and that the aircraft's critical surfaces are free of frozen contaminants. The depicted patterns are only suggested ways to accomplish deicing and/or anti-icing.



Spray Pattern – Two Truck Operation



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C208 Procedures

Contents

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C208 Procedures

Introduction

A. This program describes procedures specific to Cessna 208 Caravan operations. Information is extracted from the manufacturer's maintenance manual and SAE technical documentation on deicing procedures. This complies with the deicing requirements of FAR 121 and presents Empire's policy towards deicing of the Caravan fleet for pilots and ground crews.

B. Caravan pilots and deicing personnel will be trained to the material contained in this program. A copy of this manual is required on board the aircraft for deicing to take place.

Caravan General Procedures

A. This program presents procedures for Cessna 208 aircraft required by regulation as Empire's Aircraft Deicing Program. Critical surface areas of the Caravan are included in this program. These critical areas are to be thoroughly deiced, anti-iced and/or inspected prior to takeoff.

B. Taking off with polished frost on the wings or control surfaces is not an approved deicing procedure.

Cold Weather Preflight

A. If the OAT is below 10°C (50°F) a tactile check of the wing leading edge and upper surface is required in addition to a visual inspection. During ground icing conditions the takeoff must be accomplished within 5 minutes of completing the tactile inspection unless the aircraft is deiced and/or anti-iced, as necessary, per the ADP.

B. Ground icing conditions are defined as:

(1) OAT is 2°C (36°F) or below and visible moisture is present (rain, drizzle, sleet, snow, fog, or water is present on the wing), or

(2) OAT is 5°C (41°F) or below and conditions are conducive to active frost formation (clear night with a dew point temperature/OAT difference of 3°C (5°F) or less).

C. Takeoff is prohibited if frost, ice, or snow may reasonably be expected to adhere to the airplane between the tactile check and takeoff (e.g. snow near freezing temperature with no deicing/anti-icing fluid application).

Deicing Precautions

A. Before Type I deicing procedures begin, deice personnel should familiarize themselves with the areas to be sprayed and areas to avoid direct spray of fluid. Refer to Figure 2 for areas to be deiced, Figure 3 for areas to apply anti-ice fluid and Figure 1 for critical areas to pay special attention to.

☝**Caution:** Type I deicing fluids should never be used full strength (undiluted). Undiluted glycol fluid is quite viscous below 14°F (-10°C) and can actually produce lift restrictions of about 20%. Additionally, undiluted glycol has a higher freezing point than glycol/water mixture.

B. Deicing procedures should be performed with the engine shutdown.

C. Before Type II/IV anti-icing procedures begin, deice personnel should familiarize themselves with areas to be sprayed and areas to avoid spraying. Type II/IV anti-icing is applied primarily to protect wings, control surfaces and fuselage. Refer to Figure 3 for areas which receive anti-ice application and Figure 1 for areas of special attention.

☝**Caution:** Never spray fluid or water on or into engine inlets and exhaust, brakes, pitot-static tubes, windshields, cabin windows, stall warning vane, GPU connections, cabin intakes, NACA Scoop (if installed), or against trailing edges of wings or control surfaces.

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(1) Ensure all windows and doors are closed, as well as the alternate air inlet (see Figure 1, Detail 1).

(2) Keep fluid clear of the following items by avoiding direct spraying on or into:

(a) Engine air inlets.
(b) Fuel tank vents (see Figure 1, Detail 2).
(c) Instrument heads and ports.
(d) Flap tracks (see Figure 1, Detail 3).
(e) VOR antennae (see Figure 1, Detail 4).
(f) Pitot tubes, static ports, GPU connections, engine inlets and cabin intakes.
(g) NACA scoop (if installed) (See Figure 1, Detail 6)

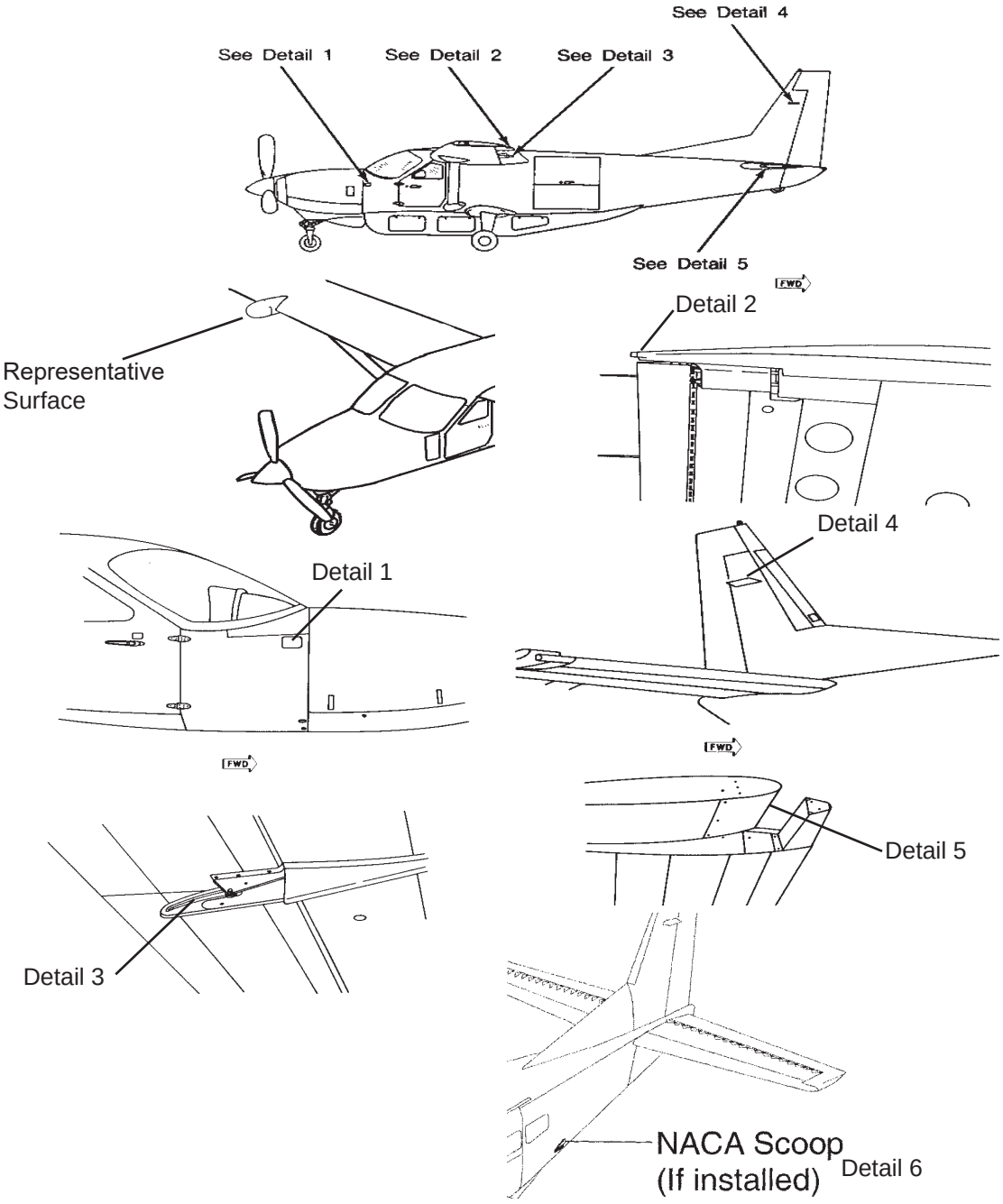

Figure 1. *Areas of special attention*

(3) Spray aircraft symmetrically: Wings and tail of planes on both sides should be covered equally.

(4) Maintain a 10 foot separation between deicing fluid truck and aircraft.

(5) Aircraft that have been hangared and then moved outside into icing conditions may temporarily melt freezing precipitation that comes in contact with the aircraft surfaces. However, as the aircraft's surfaces cool, the resulting water can freeze and adhere to the aircraft. To prevent this possibility of refreezing, the aircraft should be deiced when exposed to any precipitation in icing conditions. If the aircraft's surface temperature drops to below freezing, it may not be necessary to deice as precipitation will not melt and refreeze, a tactile inspection will be necessary to determine this case.

Type I Deicing Preparations

A. Before deicing procedures begin, maintenance personnel need to know the lowest anticipated outside air temperature **(OAT)**. The glycol/water mixture must be at least 18°F (10°C) below this OAT. The difference between anticipated OAT and the freezing point of the solution is known as the "buffer".

(1) Each manufacturer has specific instructions for mixing glycol/water solutions to achieve freezing points levels. A 50/50 mixture of Octagon ADF Plus provides SAE Type I protection to 0°F and makes a good "standard" mix. In extreme cold conditions (below 0°F) a 60/40 mixture may be necessary for best protection. Refer to the manufacturer's mixture chart on deicing fluid container.

(2) Type I deicing fluid may not be intermixed between brands.

Type II/IV Anti-Icing Preparations

A. Type II/IV anti-icing fluids should be applied undiluted and at ambient temperature unless otherwise specified by the manufacturer.

B. Ensure that dedicated Type II/IV equipment is set to apply low-to-moderate pressure fluid. Because Type II/IV anti-icing fluid is applied immediately after Type I deicing procedure, Type II/IV equipment should be fully serviced before Type I deicing begins.

Caution: Type II/IV anti-icing fluid may never be mixed with Type I deicing fluid. Type II/IV anti-icing fluid requires dedicated equipment and may not be dispersed with equipment used for Type I deicing fluid. Type II/IV fluids may not be mixed between brands.

Note: Type II/IV anti-icing fluid has thickening agents added which are designed to remain on the wings of an airplane during ground operations or short-term storage thereby providing some anti-icing protection. This fluid is also designed to flow off readily during takeoff at speeds of approximately 85 knots. Type II/IV anti-icing procedures provide longer holdover times than Type I deicing procedures.

C. Type II, III, or IV Anti-ice Fluid Takeoff

When Type II, III, or IV fluid is applied to the airplane, a rotation speed of 83 KIAS with 0° flaps is required. Use of 0° flaps allows the airplane to accelerate to a higher rotation speed without any liftoff tendencies, which is required for the Type II, III, or IV fluid to be effective. Takeoff performance data shown in Section 5 of the pilot's operating handbook is based on this speed and configuration.

Type III Deicing/Anti-Icing Procedures

A. HOT guideline data was obtained for the Type III fluid when applied heated and unheated, and no significant HOT performance differences were observed. Therefore, anti-icing applications of Type III fluid may be heated or unheated. However, to use the HOT in a one step application, the fluid must be applied heated.

B. Type III fluid is designed primarily for aircraft with low 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. Type III fluid is designed to be used in Type I fluid application equipment, either diluted or undiluted for deicing and anti-icing.

Deicing Procedures

A. Deicing Guidelines

Warning: Type I deicing fluids should never be applied in undiluted form to pitot heads, control surface cavities, cockpit windows and windshield, fuselage nose, static ports, air inlets or engine.

(1) Spray the critical surfaces (see Figure 2) with enough fluid to wet these entire areas down, then let the ice or frost melt.

Note: Use as much deicing fluid as needed for each deicing operation, but do not use in a wasteful manner. Deicing fluid is very expensive.

(2) Visually check the leading edges and flaps. Pay close attention to hinged areas.

(3) When snow or freezing rain is falling, deicing should be accomplished as close to departure time as possible. If the aircraft is deiced too early, it may be necessary to repeat the entire procedure before departure.

(4) When freezing precipitation is falling at departure time, it may be necessary to perform a two step procedure. After initial deicing is accomplished a second fluid application may need to be applied in order to maximize protection.

(5) When applying glycol mixture, special attention should be given to ensure that control surfaces, control hinges, balance panels, cove areas between control surfaces and the main structure cutouts, all horizontal surfaces, wing-to-fuselage fillets, vertical-to-horizontal stabilizer fillets and all leading edges are covered with the glycol mixture.

(6) Do not chip or beat ice. Do not attempt to break ice by moving aircraft control surfaces. Damage to the aircraft will probably result.

(7) Avoid direct spray of deicing solution into any hole or opening, with emphasis on avoiding engine intake or exhaust area, brakes, windshields, cabin windows, pitot-static tubes, fuel vents, angle-of-attack/airflow sensors, and NACA vents (if installed).

Caution: If possible, during windy conditions position yourself so that you are high enough to spray down onto the aircraft surfaces or so that you are spraying in the same direction as the wind.

B. Precautions During Application

(1) Remove snow, ice and slush from pitot tubes and NACA scoop (if installed) by hand only. Use extreme caution to prevent deicing solution from entering the pitot-static ports. If deicing/anti-icing fluids are sprayed into the pitot-static ports, the lines may require draining.

(2) Use caution to prevent deicing/anti-icing solution from entering any ducts, inlets or exhaust.

(3) If the landing gear needs deicing, be careful not to spray glycol mixture on the brakes. Brake effectiveness may be decreased.

(4) Before beginning any deicing operations, make sure that all ground equipment is well out of the path of the deicing unit (especially rectifier cords) and that all electrical power to the aircraft is off.

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C. Deicing with Engine Running

(1) Empire has a policy of not deicing Caravans with the engine running. This protects not only personnel but the aircraft as well.

D. Ice Removal

(1) Observe the following precautions during ice removal:

(a) Do not use tools to scrape or chip ice from surfaces or attempt to loosen ice by beating; damage is certain to result.

(b) Avoid temperatures in excess of 185°F when heating aircraft surfaces. Apply externally ducted heat carefully to window areas. High temperatures on cold windows will crack or craze windows.

(c) **Do not use isopropyl alcohol on windows** or above window line on fuselage; alcohol causes crazing and cracking of acrylic windows.

(d) In all applications of heat for deicing purposes, exercise care to avoid overheat damage to painted surfaces, rubber hoses, acrylic or fiberglass parts, landing gear fairings, cargo pod, brake lines, fabrics and lubricated surfaces. Remove heat source immediately after surfaces are dry or mechanisms are functioning normally.

(e) If snow, slush or ice is suspected in critical areas forward of control surfaces, the aircraft shall not be cleared for flight until noted areas and all control components are completely clear and dry.

(2) Apply heat for snow/ice removal in accordance with the following:

Caution: Hand actuation of all primary flight control surfaces through full range of motion should be accomplished prior to any attempt to operate cockpit controls. After removal of snow/ice, perform a complete operational check of flight controls including trim tabs and flaps.

(a) When icing conditions occur at ground level, aircraft must be checked thoroughly for iced surfaces, frozen controls and mechanisms, plugged orifices, frozen landing gear components, and ice or snow clogged air inlet and outlet ports.

(b) Engine cowl inlet and exhaust areas must be checked for ice before attempting to start engines.

(c) Ice may be removed from fuselage areas by application of heat ducted to affected area by large capacity heater unit.

Note: A heat source providing a large area of warm dry air is more effective than a small volume of hot air, and can be used with less danger of overheating.

(d) Ice and frost formations can be removed from wing and empennage surfaces by spraying an application of heated deicing solution.

(e) Ice formations on wings, empennage, landing gear or wheel well areas can be removed by heat from large capacity heater units.

Caution: After deicing wing and empennage, check balance bays. Remove any slush and/or ice accumulations. Ensure that bay drain holes are not closed.

(f) Ice formation in control areas may be removed by using warm air until ice is melted and area is dry. Ensure that drain holes in panels below control areas are open.

(g) To help prevent ice formation in cargo door side or lower jamb areas, apply periodic applications of Fluorocarbon Teflon MS-122 spray or Frekote No. 33 spray.

(h) After ice removal is complete, a complete operational check of all flight controls (including trim tabs) is **mandatory.**

E. Servicing – Snow Removal

(1) Observe the following precautions during snow removal operations:

(a) Work from support stands placed near aircraft when sweeping snow from wing or stabilizer.

(b) Wear rubber or fabric footwear to aid in preventing personnel from slipping and/or sliding on work surfaces. Do not stand or walk on aircraft surfaces.

(c) Use only approved solutions for snow removal and cleaning acrylic windows.

(d) Remove all snow accumulations on fuselage nose forward of windshield; snow may blow back and stick to heated windshield restricting pilot's visibility during takeoff.

Caution: Do not use snow removal tools or implements to remove snow from pitot tube, antennas, probes. Remove by hand or a light, soft brush. Do not attempt to loosen snow by beating. Damage is certain to result.

(e) Avoid using deicing solution for snow removal. Dilution of deicing solutions could result in a weak mixture refreezing and creating an icing condition more difficult to remove.

(f) Use care to prevent flushing of slush into control surface gaps and hinge points.

(2) For best results, follow these snow removal procedures:

Note: Before heating aircraft interior, ensure that as much snow as possible is removed from upper fuselage area.

Caution: When cleaning snow from wings and horizontal stabilizer fixed surfaces, sweep snow over leading edge and tip. Avoid sweeping snow over control surfaces on trailing edges.

(a) With soft bristle brushes and brooms, remove as much residual or light snow as possible.

(b) Ensure drain holes are open and drain freely.

(c) After completion of snow removal, perform a complete operational check of primary and secondary flight controls.

(d) Ensure all cockpit and cargo door jamb areas are clean and dry.

Anti-Icing Procedures

Caution: During windy conditions position yourself high enough to spray down onto the aircraft surfaces or so that you are spraying in the same direction as the wind.

Note 1: Type II/IV anti-icing should be applied within three minutes after deicing is completed due to the limited holdover times of Type I deicing fluid. If Type II/IV anti-icing fluid has been applied and the airplane has not been completely deiced, the aircraft must be deiced again before applying the anti-ice treatment.

Note 2: Record the time anti-icing procedures begin. The length of time an anti-icing fluid remains effective is known as "holdover time" and is dependent on a number of variables. Refer to the appropriate generic HOT information for approximate holdover time of Type II/IV anti-icing fluid in undiluted form.

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✎ **Note 3:** Anti-icing fluid is applied to the airplane surface at low pressure to form a thin film on surfaces. Ideally, Type II/IV anti-icing fluids should just cover the airplane surfaces without runoff. Type II/IV anti-icing fluids are applied only from the wing section aft.

A. Make certain aircraft is completely deiced before starting anti-icing procedures.

B. Avoid direct spray of deicing/anti-icing solution into any hole or opening, with emphasis on avoiding engine intake or exhaust area, pitot-static tubes, fuel vents and angle-of-attack/airflow sensors, and NACA scoop (if installed).

C. Spray the critical areas (see Figure 3) with enough fluid to wet these entire areas down.

D. Use as much deicing/anti-icing fluid as needed for each operation, but do not use in a wasteful manner.

Area by Area Procedure

A. During ground icing conditions that require the use of the two-step procedure (deicing then anti-icing), the second step is to be applied before the first step fluid freezes, typically within 3 minutes. In order to accomplish the second step in a timely manner it may be necessary to spray area by area.

✎ **Note:** The area by area method is not the only way to accomplish the two-step procedure. For example; the first step procedure may be applied to the whole aircraft before the second step procedure is applied.

B. Area by area spraying is accomplished by applying the first step to an area then applying the second step to that same area before moving to the next aircraft surface. For example, if the left wing is deiced by the first step procedure it would then be anti-iced by the second step procedure before moving on to the tail or right wing.

C. There are two critical precautions when using the area by area procedure:

(1) The HOT begins when the anti-ice fluid is first applied. Deice personnel will use the beginning of the first application of the anti-ice fluid as the time to communicate to the flight crew of when the HOT begins.

(2) When de/anti-icing area by area the deice crew must ensure that any area already treated with anti-ice fluid is not diluted with deice fluid overspray. If an inadvertent overspray occurs, re-spray the affected area with anti-ice fluid.

Critical Areas and Deicing Check Procedures

A. Figure 2 identifies critical surface areas of the Caravan. These areas are to be checked from the outside by the pilot and/or deicing personnel when initially inspecting the airplane. After deicing/anti-icing, these critical surfaces must be free of contaminants before the airplane can be declared “clean” and approved for takeoff.

B. Flight deck windows are clear of frozen contaminants and excess deice fluid so that there is adequate visibility to provide positive communication with ground personnel/marshaller and to clear the prop and engine area prior to engine start. A limited amount of ice or snow on the flight deck windows is acceptable for engine start and taxi providing that the marshaller(s) and prop are visible and adequate visibility is available for taxi. The ice or snow must be melted away by windshield heat and defrost prior to takeoff.

C. It is important to recognize that there are three different checks that must be made on an airplane prior to takeoff in ground icing conditions. These are as follows:

(1) Post deicing/anti-icing check – The trained deicing person will perform this check in accordance with the diagram of the critical inspection areas for the aircraft (see Figure 2). The deicing person

will ensure these places are free of contamination and point out to the deicing crew any areas that need additional deicing. After the deicing person is satisfied that the airplane is clean, he or she will inform the crew and prepare for engine start.

(2) Pre-Takeoff Check – This check is accomplished just before takeoff to determine if the representative surfaces remain free of frozen contaminants. Takeoff may be initiated if representative surfaces are free of frozen contaminants and still within HOT. The C208 Representative Surface is the upper surface of the Radome, and will only be used for a Pre-Takeoff Check. If either the HOT time is exceeded or the representative surfaces have frozen contaminants, the PIC will:

(a) Call for a Pre-Takeoff Contamination Check, or

(b) Request another deicing/anti-icing treatment.

(3) Pre-Takeoff Contamination Check – This check shall be performed when the condition of the critical surfaces cannot be effectively determined by a pre-takeoff check or when the HOT has been exceeded.

(a) The check must be accomplished by trained deice personnel from outside the aircraft.

(b) The check must confirm that the critical surfaces are free of frozen contaminants.

(c) The check must be completed within five minutes of takeoff.

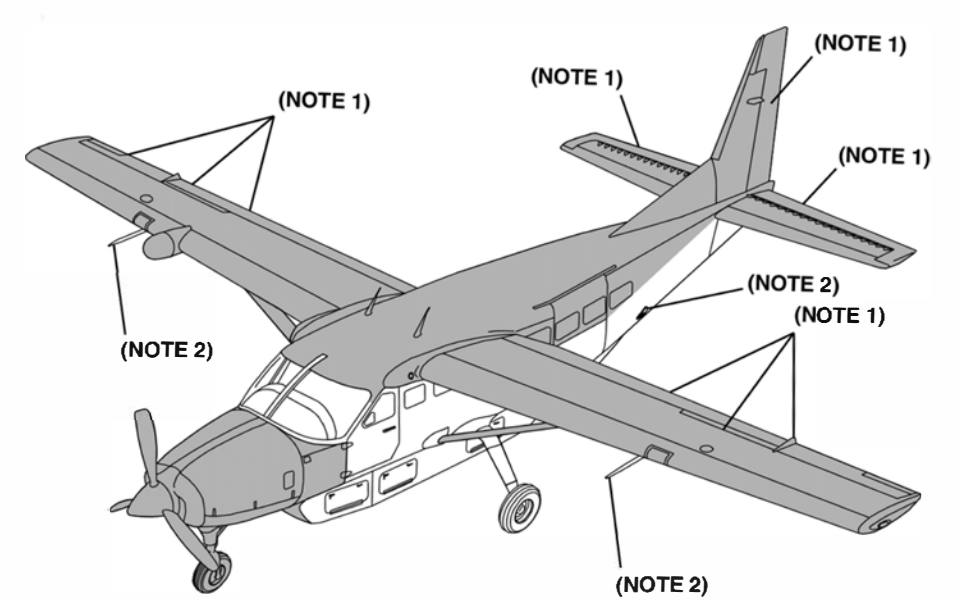

Figure 2. *C208 critical deice and inspection areas*

- **Note 1:** Shaded areas indicate critical areas to be deiced. Pay special attention to the gaps between all flight controls. all snow, ice and slush must be removed from these gaps.
- **Note 2:** Remove snow, ice and slush from pitot tubes and NACA Scoop (if installed) by hand only.
- **Note 3:** All flight control surfaces are critical deice areas.

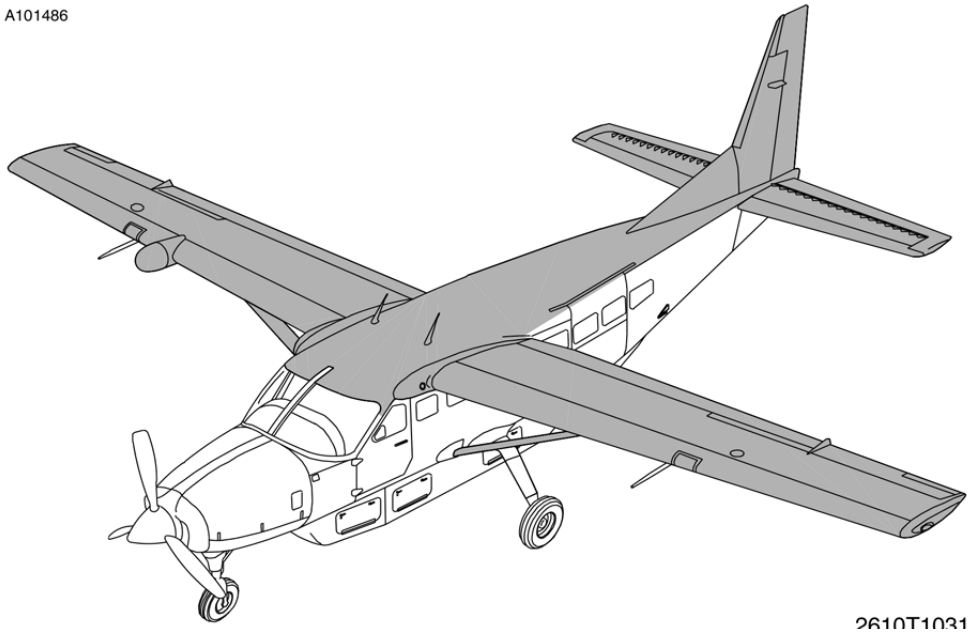

Figure 3. *C208 anti-ice areas*

- **Note 1:** Shaded areas indicate where anti-ice is to be applied.
- **Note 2:** Anti-ice fluid should be applied at low pressures to form a thin film on surface.
- **Note 3:** Avoid direct spray on pitot-static tubes, windshields, cabin windows, stall warning vane, and NACA Scoop (if installed).

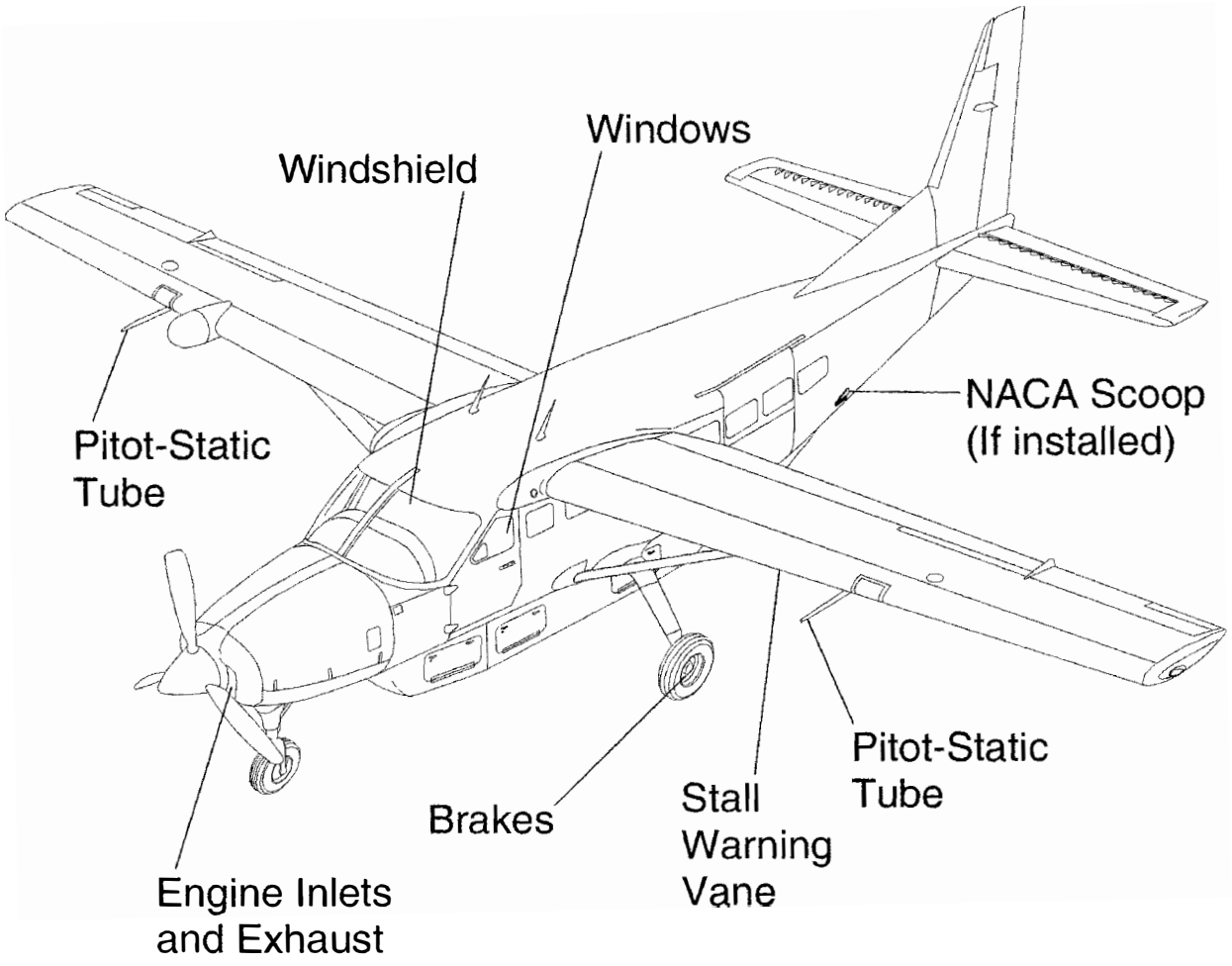

Figure 4 *C208 Sensitive Areas*

Note 1: Avoid direct spray on engine inlets and exhaust, brakes, pitot-static tubes, windshields, cabin windows, stall warning vane, and NACA Scoop (if installed).

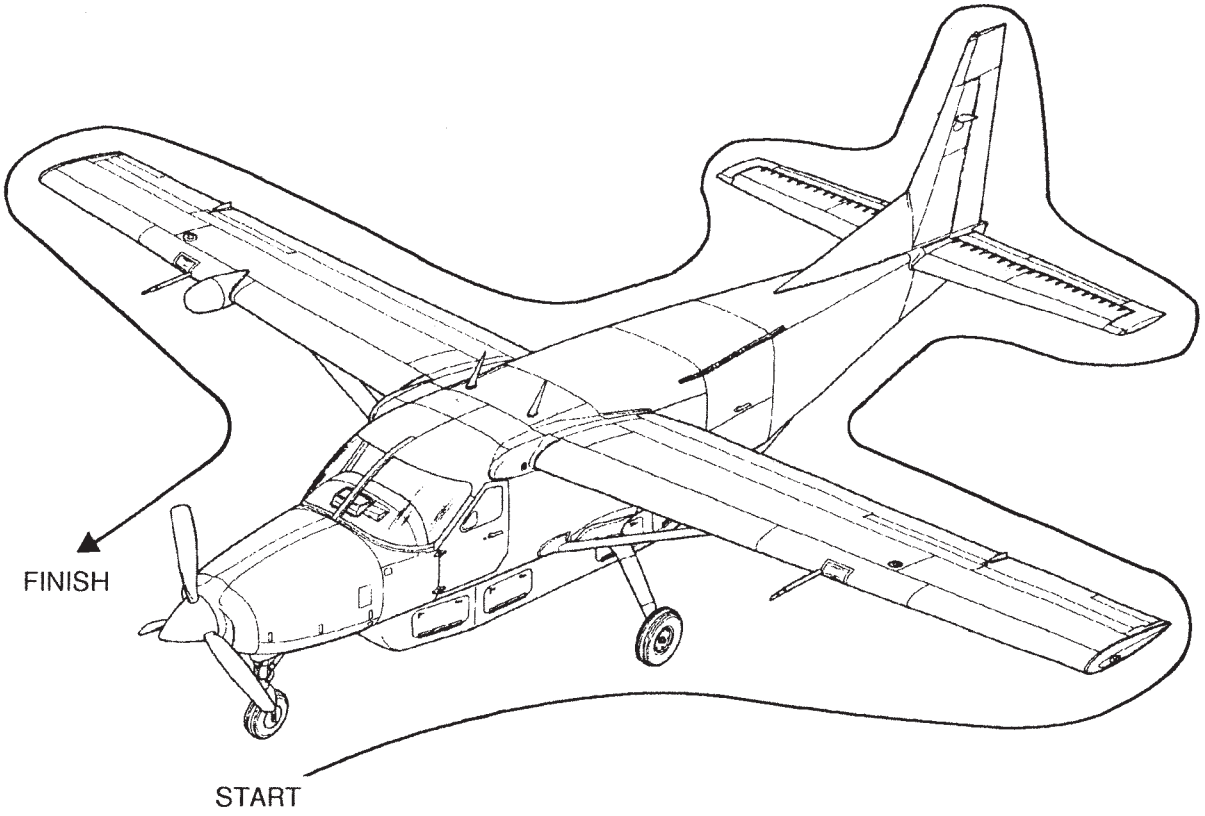

Figure 5 *C208 Deicing Application*

Spray Pattern – General

A. The direction of the deice vehicle around the aircraft is known as the spray pattern. It is not required that the spray pattern be of any particular order. The important points are that the holdover time starts at the commencement of the final application of the anti-icing fluid and that the aircraft's critical surfaces are free of frozen contaminants. The depicted pattern is only a suggested way to accomplish deicing and/or anti-icing.

✍**Note:** By starting deice application at left nose, the pilot can get a conservative estimate of ice reformation from inside the cockpit. Since this was the first area deiced, it will be the first area to experience new ice reformation. When less than adequate room is available to maneuver as depicted, use whatever pattern is necessary to ensure that the aircraft is clear of all frozen contaminates.

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HOLDOVER TABLES

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Complementary Documents

This document is designed to be used in conjunction with the FAA N 8900 series notice "Revised FAA-Approved Deicing Program Updates, Winter 2024-2025." The two documents complement each other and should be used together for a thorough understanding of the subject matter.

Beginning in the winter of 2021-22, the FAA has published an annual database of degree-specific holdover times (DSHOTs) for snow and snow-related precipitation conditions (including snow, snow grains, and snow pellets). The DSHOT database contains an expanded set of snow precipitation HOTs for all undiluted Type II, III and IV anti-icing fluids listed in the FAA HOT Guidelines. This database can be found at the following website:

https://www.faa.gov/other_visit/aviation_industry/airline_operators/airline_safety/deicing/.

Guidance and conditions on the use of DSHOT data can be found in the FAA General Information Ground Deicing Program document, Issue 2.

Note: Empire does not use the degree-specific holdover times (DSHOTs).

Applicability

A new version of this document is published for each winter operating season, typically in early August preceding the winter operating season. Updates to the winter's document may be published at any time after the Original Issue document is published. When a new document is published, either mid-season or each new season, the previous document becomes obsolete. It is the responsibility of the end user to periodically check for document updates on the following website:

https://www.faa.gov/other_visit/aviation_industry/airline_operators/airline_safety/deicing/.

Main Document Structure and Content

This document is divided into several sections.

- Change Control Records: Provides details of any changes made to the document in mid-season document updates.
- Table of Contents: Provides a list of sections, tables, and appendices in the document.
- How to Use This Document: Provides top-level guidance on how to use the document.
- Highlights and Changes for Winter 2024-2025: Describes key changes made to the document for the current winter operating season.
- Holdover Time Guidelines: Series of tables that provide estimated holdover times (in hh:mm). Fluids are divided by fluid type (Type I, II, III, and IV), aircraft construction materials (Type I only), fluid brand (Type II, III, IV), aircraft rotation speed (Type III only), and fluid application temperature (Type III only). Columns in the tables divide the information by precipitation type; rows in the tables divide the information by temperature and fluid dilution. Notes in the tables refer to additional information on the specific HOTs. Cautions that apply to all tables in a section are located on the flysheets before each section.
- Allowance Times Tables: Tables that provide allowance times (in minutes) for Type III and Type IV fluids. Rows in the tables divide the information by precipitation type; columns in the tables divide the information by temperature. Notes in the tables refer to additional information on the specific allowance times. Cautions that apply to all allowance times tables are located on the flysheet before the section.

Note: Empire does not use Allowance times, refer to the HOTs.

- Supplementary Guidance: Series of tables that provide supplementary information for using the holdover time guidelines and allowance times tables. Includes a table for estimating snowfall intensity from prevailing visibility, tables of fluid information (one table per fluid type), and tables of fluid application guidance (by fluid type).

Highlights and Changes for Winter 2024-2025

Changed From Previous Year

The changes from the previous year are minor edits.

HOLDOVER TABLES

Active Frost Holdover Time (HOT) Guidelines Winter 2024-2025

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.

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.

CAUTIONS

- 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 pretakeoff check procedures

Table 1: Active Frost Holdover Time Guidelines for SAE Type I, Type II, Type III, and Type IV Fluids[1]

Outside Air Temperature[2,3,4]	Type I Aluminum	Type I Composite
-1 °C and above (30 °F and above)	0:45	0:35
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 49 - Table 52). 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.

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 5-5.

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Holdover Tables

HOT Guidelines for SAE Type I Fluids Winter 2024-2025

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.

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.

CAUTIONS

- 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 pretakeoff check procedures

Table 2: Holdover Times for SAE Type I Fluid on Critical Aircraft Surfaces Composed Predominantly of Aluminum (C208 and C408)

Outside Air Temperature[1,2]	Freezing Fog, Freezing Mist[3], or Ice Crystals[4]	Snow mixed with Freezing Fog[5]	Very Light Snow, Snow Grains or Snow Pellets[6,7,8]	Light Snow, Snow Grains or Snow Pellets[6,7,8]	Moderate Snow, Snow Grains or Snow Pellets[6,8]	Freezing Drizzle[9]	Light Freezing Rain	Rain on Cold-Soaked Wing[10]	Other[11]
-3 °C and above (27 °F and above)	0:11 - 0:17	0:05 - 0:08	0:18 - 0:22	0:11 - 0:18	0:06 - 0:11	Operation Prohibited		0:02 - 0:05	CAUTION: No holdover time guidelines exist
below -3 to -6 °C (below 27 to 21 °F)	0:08 - 0:13	0:04 - 0:06	0:14 - 0:17	0:08 - 0:14	0:05 - 0:08				
below -6 to -10 °C (below 21 to 14 °F)	0:06 - 0:10	0:03 - 0:05	0:11 - 0:13	0:06 - 0:11	0:04 - 0:06				
below -10 °C (below 14 °F)	0:05 - 0:09	0:02 - 0:03	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 These holdover times are for use in -SNFZFG and SNFZFG. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 48) 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.
6 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 48) is required.
7 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 48) 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.
8 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
9 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
10 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
11 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 5-6.

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Holdover Tables

Table 3: Holdover Times for SAE Type I Fluid on Critical Aircraft Surfaces Composed Predominantly of Composites (ATR)

Outside Air Temperature[1,2]	Freezing Fog, Freezing Mist[3], or Ice Crystals[4]	Snow mixed with Freezing Fog[5]	Very Light Snow, Snow Grains or Snow Pellets[6,7,8]	Light Snow, Snow Grains or Snow Pellets[6,7,8]	Moderate Snow, Snow Grains or Snow Pellets[6,8]	Freezing Drizzle[9]	Light Freezing Rain	Rain on Cold-Soaked Wing[10]	Other[11]
-3 °C and above (27 °F and above)	0:09 - 0:16	0:02 - 0:04	0:12 - 0:15	0:06 - 0:12	0:03 - 0:06	Operation Prohibited		0:01 - 0:05	CAUTION: No holdover time guidelines exist
below -3 to -6 °C (below 27 to 21 °F)	0:06 - 0:08	0:02 - 0:04	0:11 - 0:13	0:05 - 0:11	0:02 - 0:05				
below -6 to -10 °C (below 21 to 14 °F)	0:04 - 0:08	0:02 - 0:04	0:09 - 0:12	0:05 - 0:09	0:02 - 0:05				
below -10 °C (below 14 °F)	0:04 - 0:07	0:02 - 0:03	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 These holdover times are for use in -SNFZFG and SNFZFG. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 48) 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.
6 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 48) is required.
7 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 48) 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.
8 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
9 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
10 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
11 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 5-6.

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Holdover Tables

HOT Guidelines for SAE Type II Fluids Winter 2024-2025

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.

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.

CAUTIONS

- 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 pretakeoff check procedures

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 mixed with Freezing Fog[5]	Snow, Snow Grains or Snow Pellets[6,7,8]	Freezing Drizzle[9]	Light Freezing Rain	Rain on Cold-Soaked Wing[10]	Other[11]
-3 °C and above (27 °F and above)	100/0	0:55 - 1:50	0:20 - 0:40	0:30 - 0:55	Operation Prohibited		0:07 - 0:45	CAUTION: No holdover time guidelines exist
	75/25	0:40 - 1:10	0:15 - 0:25	0:15 - 0:30			0:04 - 0:25	
	50/50	0:15 - 0:30	0:05 - 0:10	0:07 - 0:15				
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:30 - 0:45	0:15 - 0:30	0:20 - 0:40				
	75/25	0:25 - 0:55	0:09 - 0:15	0:10 - 0:25				
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:30 - 0:45	0:10 - 0:25	0:15 - 0:30				
	75/25	0:25 - 0:55	0:07 - 0:15	0:09 - 0:20				
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:15 - 0:20	0:01 - 0:05	0:02 - 0:07				
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:15 - 0:20	0:00 - 0:02	0:01 - 0:03				
below -25 °C to LOUT[13] (below -13 °F to LOUT)	100/0	0:15 - 0:20	0:00 - 0:00	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 50). 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 These holdover times are for use in -SNFZFG and SNFZFG. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 48) 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.
6 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 48) is required.
7 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 48) 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.
8 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
9 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
10 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
11 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail.
12 No holdover time guidelines exist for this condition below -10 °C (14 °F).
13 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 5-8.

August 6, 2024

Holdover Tables

Table 5: Type II Holdever Times for ABAX ECOWING AD-2

Note: The specific fluid HOTs are only used for quality control purposes. Use the generic HOTs to determine actual holdover times.

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[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	1:20 - 3:00	0:30 - 0:55	2:25 - 2:55	1:15 - 2:25	0:40 - 1:15	Operation Prohibited		0:09 - 1:25	CAUTION: No holdover time guidelines exist
	75/25	1:15 - 1:25	0:20 - 0:40	1:45 - 2:10	0:55 - 1:45	0:25 - 0:55			0:04 - 0:50	
	50/50	0:15 - 0:30	0:05 - 0:10	0:35 - 0:40	0:15 - 0:35	0:07 - 0:15				
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:45 - 2:30	0:25 - 0:45	2:00 - 2:25	1:00 - 2:00	0:30 - 1:00				
	75/25	0:35 - 1:55	0:20 - 0:35	1:40 - 2:05	0:50 - 1:40	0:25 - 0:50				
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:45 - 2:30	0:20 - 0:40	1:45 - 2:05	0:55 - 1:45	0:30 - 0:55				
	75/25	0:35 - 1:55	0:20 - 0:35	1:35 - 2:00	0:50 - 1:35	0:25 - 0:50				
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:15 - 0:40	0:01 - 0:05	0:20 - 0:30	0:07 - 0:20	0:02 - 0:07				
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:15 - 0:40	0:00 - 0:02	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	0:00 - 0:00	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 These holdover times are for use in -SNFZFG and SNFZFG. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 48) 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.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 48) 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 48) 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).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 5-8.

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Holdover Tables

Table 6: Type II Holdover Times for AVIATION XI'AN HIGH-TECH CLEANWING II

Note: The specific fluid HOTs are only used for quality control purposes. Use the generic HOTs to determine actual holdover times.

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[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	0:55 - 1:50	0:20 - 0:40	1:35 - 1:55	0:55 - 1:35	0:30 - 0:55	Operation Prohibited		0:10 - 0:55	CAUTION: No holdover time guidelines exist
	75/25	0:50 - 1:20	0:20 - 0:35	1:20 - 1:40	0:45 - 1:20	0:25 - 0:45			0:07 - 0:50	
	50/50	0:35 - 1:00	0:10 - 0:20	0:50 - 1:05	0:25 - 0:50	0:15 - 0:25				
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:45 - 1:50	0:15 - 0:30	1:20 - 1:35	0:40 - 1:20	0:25 - 0:40				
	75/25	0:40 - 1:45	0:20 - 0:35	1:20 - 1:35	0:45 - 1:20	0:25 - 0:45				
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:45 - 1:50	0:15 - 0:25	1:05 - 1:20	0:35 - 1:05	0:20 - 0:35				
	75/25	0:40 - 1:45	0:20 - 0:35	1:20 - 1:35	0:45 - 1:20	0:25 - 0:45				
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:20 - 0:50	0:09 - 0:20	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	0:05 - 0:10	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 These holdover times are for use in -SNFZFG and SNFZFG. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 48) 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.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 48) 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 48) 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).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 5-8.

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Holdover Tables

Table 7: Type II Holdover Times for CLARIANT SAFEWING MP II FLIGHT

Note: The specific fluid HOTs are only used for quality control purposes. Use the generic HOTs to determine actual holdover times.

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[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	3:30 - 4:00	0:45 - 1:10	2:35 - 3:00	1:35 - 2:35	1:00 - 1:35	Operation Prohibited		0:10 - 1:30	CAUTION: No holdover time guidelines exist
	75/25	1:50 - 2:45	0:30 - 1:00	2:35 - 3:00	1:20 - 2:35	0:40 - 1:20			0:06 - 0:50	
	50/50	0:55 - 1:45	0:09 - 0:20	0:45 - 0:55	0:25 - 0:45	0:10 - 0:25				
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:55 - 1:45	0:35 - 1:00	2:05 - 2:30	1:15 - 2:05	0:45 - 1:15				
	75/25	0:25 - 1:05	0:20 - 0:40	1:45 - 2:10	0:55 - 1:45	0:30 - 0:55				
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:55 - 1:45	0:30 - 0:50	1:50 - 2:10	1:05 - 1:50	0:40 - 1:05				
	75/25	0:25 - 1:05	0:15 - 0:30	1:20 - 1:40	0:40 - 1:20	0:20 - 0:40				
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:30 - 0:50	0:06 - 0:20	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	0:02 - 0:07	0:30 - 0:40	0:10 - 0:30	0:03 - 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 These holdover times are for use in -SNFZFG and SNFZFG. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 48) 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.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 48) 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 48) 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).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 5-8.

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Holdover Tables

Table 8: Type II Holdover Times for CRYOTECH POLAR GUARD® II

Note: The specific fluid HOTs are only used for quality control purposes. Use the generic HOTs to determine actual holdover times.

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[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	2:50 - 4:00	0:50 - 1:25	3:00 - 3:00	1:55 - 3:00	1:05 - 1:55	Operation Prohibited		0:15 - 2:00	CAUTION: No holdover time guidelines exist
	75/25	2:30 - 4:00	0:30 - 1:05	3:00 - 3:00	1:25 - 3:00	0:40 - 1:25			0:09 - 1:40	
	50/50	0:50 - 1:25	0:07 - 0:20	1:10 - 1:35	0:25 - 1:10	0:10 - 0:25				
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:55 - 2:30	0:35 - 1:05	2:25 - 2:50	1:25 - 2:25	0:50 - 1:25				
	75/25	0:40 - 1:30	0:25 - 0:50	2:20 - 3:00	1:05 - 2:20	0:30 - 1:05				
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:55 - 2:30	0:30 - 0:50	2:00 - 2:20	1:10 - 2:00	0:40 - 1:10				
	75/25	0:40 - 1:30	0:20 - 0:45	2:00 - 2:30	0:55 - 2:00	0:25 - 0:55				
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:25 - 0:50	0:08 - 0:25	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	0:03 - 0:10	0:40 - 0:55	0:15 - 0:40	0:04 - 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 These holdover times are for use in -SNFZFG and SNFZFG. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 48) 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.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 48) 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 48) 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).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 5-8.

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Holdover Tables

Table 9: Type II Holdover Times for KILFROST ABC-K PLUSI

Note: The specific fluid HOTs are only used for quality control purposes. Use the generic HOTs to determine actual holdover times.

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[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	2:15 - 3:45	0:45 - 1:15	1:00 - 1:40	Operation Prohibited		0:20 - 2:00	
	75/25	1:40 - 2:30	0:25 - 0:50	0:35 - 1:10			0:15 - 2:00	
	50/50	0:35 - 1:05	0:05 - 0:10	0:07 - 0:15			CAUTION: No holdover time guidelines exist	
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:30 - 1:05	0:40 - 1:10	0:55 - 1:30				
	75/25	0:25 - 1:25	0:25 - 0:50	0:35 - 1:05				
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:30 - 1:05	0:40 - 1:05	0:50 - 1:25				
	75/25	0:25 - 1:25	0:25 - 0:50	0:35 - 1:05				
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:30 - 0:55	0:01 - 0:05	0:02 - 0:07				
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:30 - 0:55	0:00 - 0:02	0:01 - 0:03				

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 These holdover times are for use in -SNFZFG and SNFZFG. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 48) 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.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 48) 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 48) 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).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 5-8.

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Holdover Tables

Table 10: Type II Holdover Times for KILFROST ICE CLEAR II

Note: The specific fluid HOTs are only used for quality control purposes. Use the generic HOTs to determine actual holdover times.

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[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	1:25 - 2:25	0:30 - 1:00	2:25 - 2:55	1:20 - 2:25	0:40 - 1:20	Operation Prohibited		0:15 - 2:00	CAUTION: No holdover time guidelines exist
	75/25	N/A	N/A	N/A	N/A	N/A			N/A	
	50/50	N/A	N/A	N/A	N/A	N/A				
below -3 to -8 °C (below 27 to 18 °F)	100/0	1:05 - 2:35	0:30 - 0:50	2:10 - 2:35	1:10 - 2:10	0:40 - 1:10				
	75/25	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	0:25 - 0:50	2:00 - 2:25	1:05 - 2:00	0:35 - 1:05				
	75/25	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	0:10 - 0:20	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	0:06 - 0:10	0:30 - 0:35	0:15 - 0:30	0:08 - 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 These holdover times are for use in -SNFZFG and SNFZFG. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 48) 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.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 48) 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 48) 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).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 5-8.

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Holdover Tables

Table 11: Type II Holdover Times for MKS DEVO CHEMICALS COREICEPHOB TYPE II

Note: The specific fluid HOTs are only used for quality control purposes. Use the generic HOTs to determine actual holdover times.

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[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	1:55 - 2:45	0:30 - 1:00	2:35 - 3:00	1:25 - 2:35	0:40 - 1:25	Operation Prohibited		0:15 - 1:35	CAUTION: No holdover time guidelines exist
	75/25	N/A	N/A	N/A	N/A	N/A			N/A	
	50/50	1:05 - 1:45	0:15 - 0:35	1:35 - 1:55	0:45 - 1:35	0:25 - 0:45				
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:45 - 1:25	0:25 - 0:45	1:50 - 2:15	1:00 - 1:50	0:30 - 1:00				
	75/25	N/A	N/A	N/A	N/A	N/A				
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:45 - 1:25	0:20 - 0:35	1:30 - 1:50	0:50 - 1:30	0:25 - 0:50				
	75/25	N/A	N/A	N/A	N/A	N/A				
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:15 - 0:25	0:01 - 0:05	0:20 - 0:30	0:07 - 0:20	0:02 - 0:07				
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:15 - 0:25	0:00 - 0:02	0:09 - 0:15	0:03 - 0:09	0:01 - 0:03				

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 These holdover times are for use in -SNFZFG and SNFZFG. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 48) 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.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 48) 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 48) 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).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 5-8.

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Holdover Tables

Table 12: Type II Holdover Times for NEWAVE AEROCHEMICAL FCY-2

Note: The specific fluid HOTs are only used for quality control purposes. Use the generic HOTs to determine actual holdover times.

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[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	1:15 - 2:25	0:25 - 0:40	0:30 - 0:55	Operation Prohibited		0:08 - 0:45	CAUTION: No holdover time guidelines exist
	75/25	0:50 - 1:30	0:15 - 0:30	0:20 - 0:40			0:05 - 0:25	
	50/50	0:25 - 0:35	0:09 - 0:20	0:15 - 0:25				
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:45 - 1:30	0:15 - 0:30	0:20 - 0:40				
	75/25	0:30 - 1:05	0:10 - 0:20	0:15 - 0:25				
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:45 - 1:30	0:10 - 0:25	0:15 - 0:30				
	75/25	0:30 - 1:05	0:08 - 0:15	0:10 - 0:20				
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:25 - 0:35	0:01 - 0:05	0:02 - 0:07				
below -18 to -25 °C[12] (below 0 to -13 °F)	100/0	0:25 - 0:35	0:00 - 0:02	0:01 - 0:03				

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 These holdover times are for use in -SNFZFG and SNFZFG. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 48) 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.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 48) 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 48) 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).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 5-8.

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Holdover Tables

Table 13: Type II Holdover Times for ROMCHIM ADD-PROTECT NG TYPE II

Note: The specific fluid HOTs are only used for quality control purposes. Use the generic HOTs to determine actual holdover times.

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[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	1:10 - 2:25	0:25 - 0:55	2:35 - 3:00	1:10 - 2:35	0:35 - 1:10	Operation Prohibited		0:07 - 1:10	CAUTION: No holdover time guidelines exist
	75/25	1:00 - 1:50	0:20 - 0:40	1:55 - 2:25	0:55 - 1:55	0:25 - 0:55			0:07 - 0:55	
	50/50	0:25 - 0:55	0:10 - 0:20	0:55 - 1:05	0:30 - 0:55	0:15 - 0:30				
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:55 - 1:35	0:20 - 0:40	1:50 - 2:20	0:50 - 1:50	0:25 - 0:50				
	75/25	0:55 - 1:25	0:15 - 0:30	1:25 - 1:45	0:40 - 1:25	0:20 - 0:40				
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:55 - 1:35	0:15 - 0:30	1:25 - 1:50	0:40 - 1:25	0:20 - 0:40				
	75/25	0:55 - 1:25	0:10 - 0:25	1:05 - 1:25	0:30 - 1:05	0:15 - 0:30				
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:15 - 0:20	0:01 - 0:05	0:20 - 0:30	0:07 - 0:20	0:02 - 0:07				
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:15 - 0:20	0:00 - 0:02	0:09 - 0:15	0:03 - 0:09	0:01 - 0:03				

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 These holdover times are for use in -SNFZFG and SNFZFG. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 48) 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.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 48) 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 48) 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).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 5-8.

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Holdover Tables

Table 14: Type II Holdover Times for ROMCHIM ADD-PROTECT TYPE II

Note: The specific fluid HOTs are only used for quality control purposes. Use the generic HOTs to determine actual holdover times.

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[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	1:40 - 3:30	0:20 - 0:45	1:55 - 2:25	1:00 - 1:55	0:30 - 1:00	Operation Prohibited		0:09 - 0:50	CAUTION: No holdover time guidelines exist
	75/25	0:40 - 1:10	0:15 - 0:25	1:00 - 1:10	0:30 - 1:00	0:15 - 0:30			0:05 - 0:25	
	50/50	0:20 - 0:35	0:07 - 0:15	0:30 - 0:35	0:15 - 0:30	0:09 - 0:15				
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:30 - 0:45	0:15 - 0:30	1:20 - 1:40	0:40 - 1:20	0:20 - 0:40				
	75/25	0:30 - 0:55	0:09 - 0:15	0:40 - 0:50	0:25 - 0:40	0:10 - 0:25				
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:30 - 0:45	0:15 - 0:25	1:05 - 1:20	0:35 - 1:05	0:15 - 0:35				
	75/25	0:30 - 0:55	0:07 - 0:15	0:35 - 0:40	0:20 - 0:35	0:09 - 0:20				
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:15 - 0:25	0:01 - 0:05	0:20 - 0:30	0:07 - 0:20	0:02 - 0:07				
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:15 - 0:25	0:00 - 0:02	0:09 - 0:15	0:03 - 0:09	0:01 - 0:03				

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 These holdover times are for use in -SNFZFG and SNFZFG. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 48) 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.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 48) 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 48) 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).

CAUTIONS

- The cautions that apply to the holdover times in the table above can be found on page 5-8.

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HOLDOVER TABLES

HOT Guidelines for SAE Type III Fluids Winter 2024-2025

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.

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.

CAUTIONS

- 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 jet blast, or blowing snow 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 pretakeoff check procedures.

Table 15: 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]	Snow mixed with Freezing Fog[5]	Very Light Snow, Snow Grains or Snow Pellets[6,7,8]	Light Snow, Snow Grains or Snow Pellets[6,7,8]	Moderate Snow, Snow Grains or Snow Pellets[6,8]	Freezing Drizzle[9]	Light Freezing Rain	Rain on Cold-Soaked Wing[10]	Other[11]
-3 °C and above (27 °F and above)	100/0	0:45 - 1:55	0:13 - 0:30	1:20 - 1:45	0:40 - 1:20	0:18 - 0:40	Operation Prohibited		0:05 - 0:40	CAUTION: No holdover time guidelines exist
	75/25	N/A	N/A	N/A	N/A	N/A			N/A	
	50/50	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	0:13 - 0:30	1:20 - 1:45	0:40 - 1:20	0:18 - 0:40				
	75/25	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	0:13 - 0:30	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 These holdover times are for use in -SNFZFG and SNFZFG. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 48) 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.
6 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 48) is required.
7 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 48) 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.
8 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
9 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
10 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
11 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 5-19.

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Holdover Tables

Table 16: Type III Holdover Times for ALLCLEAR AEROCLEAR MAX APPLIED UNHEATED ON MIDDLE SPEED AIRCRAFT[1]

Note: The specific fluid HOTs are only used for quality control purposes. Use the generic HOTs to determine actual holdover times.

Outside Air Temperature[2]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[3], or Ice Crystals[4]	Snow mixed with Freezing Fog[5]	Very Light Snow, Snow Grains or Snow Pellets[6,7,8]	Light Snow, Snow Grains or Snow Pellets[6,7,8]	Moderate Snow, Snow Grains or Snow Pellets[6,8]	Freezing Drizzle[9]	Light Freezing Rain	Rain on Cold-Soaked Wing[10]	Other[11]
-3 °C and above (27 °F and above)	100/0	0:45 - 1:55	0:13 - 0:30	1:20 - 1:45	0:40 - 1:20	0:18 - 0:40	Operation Prohibited		0:05 - 0:40	CAUTION: No holdover time guidelines exist
	75/25	N/A	N/A	N/A	N/A	N/A			N/A	
	50/50	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	0:13 - 0:30	1:20 - 1:45	0:40 - 1:20	0:18 - 0:40				
	75/25	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	0:13 - 0:30	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 These holdover times are for use in -SNFZFG and SNFZFG. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 48) 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.
6 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 48) is required.
7 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 48) 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.
8 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
9 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
10 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
11 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 5-19.

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Holdover Tables

Table 17: Type III Holdover Times for ALLCLEAR AEROCLEAR MAX APPLIED UNHEATED ON HIGH SPEED AIRCRAFT[1]

Note: The specific fluid HOTs are only used for quality control purposes. Use the generic HOTs to determine actual holdover times.

Outside Air Temperature[2]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[3], or Ice Crystals[4]	Snow mixed with Freezing Fog[5]	Very Light Snow, Snow Grains or Snow Pellets[6,7,8]	Light Snow, Snow Grains or Snow Pellets[6,7,8]	Moderate Snow, Snow Grains or Snow Pellets[6,8]	Freezing Drizzle[9]	Light Freezing Rain	Rain on Cold-Soaked Wing[10]	Other[11]
-3 °C and above (27 °F and above)	100/0	0:45 - 1:55	0:13 - 0:30	1:20 - 1:45	0:40 - 1:20	0:18 - 0:40	Operation Prohibited		0:05 - 0:40	CAUTION: No holdover time guidelines exist
	75/25	N/A	N/A	N/A	N/A	N/A			N/A	
	50/50	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	0:13 - 0:30	1:20 - 1:45	0:40 - 1:20	0:18 - 0:40				
	75/25	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	0:13 - 0:30	1:20 - 1:45	0:40 - 1:20	0:18 - 0:40				
below -25 to -35 °C (below -13 to -31 °F)	100/0	0:25 - 1:00	0:07 - 0:16	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 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 These holdover times are for use in -SNFZFG and SNFZFG. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 48) 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.
6 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 48) is required.
7 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 48) 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.
8 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.
9 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.
10 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.
11 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 5-19.

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Holdover Tables

HOT Guidelines for SAE Type IV Fluids Winter 2024-2025

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.

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.

CAUTIONS

- 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 jet blast, or blowing snow 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 pretakeoff check procedures.
- 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.

Table 18: Generic Holdover Times for SAE Type IV Fluids

Outside Air Temperature[2]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[3], or Ice Crystals[4]	Snow mixed with Freezing Fog[5]	Very Light Snow, Snow Grains or Snow Pellets[6,7,8]	Light Snow, Snow Grains or Snow Pellets[6,7,8]	Moderate Snow, Snow Grains or Snow Pellets[6,8]	Freezing Drizzle[9]	Light Freezing Rain	Rain on Cold-Soaked Wing[10]	Other[11]
-3 °C and above (27 °F and above)	100/0	1:15 - 2:15	0:25 - 0:45	1:55 - 2:20	1:00 - 1:55	0:30 - 1:00	Operation Prohibited		0:08 - 1:05	CAUTION: No holdover time guidelines exist
	75/25	1:25 - 2:40	0:30 - 0:55	2:05 - 2:25	1:15 - 2:05	0:40 - 1:15			0:09 - 1:20	
	50/50	0:30 - 0:55	0:07 - 0:20	1:00 - 1:10	0:25 - 1:00	0:10 - 0:25				
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:15 - 0:35	0:20 - 0:40	1:45 - 2:05	0:55 - 1:45	0:25 - 0:55				
	75/25	0:40 - 1:20	0:25 - 0:50	1:50 - 2:10	1:05 - 1:50	0:30 - 1:05				
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:15 - 0:35	0:15 - 0:35	1:30 - 1:50	0:45 - 1:30	0:20 - 0:45				
	75/25	0:40 - 1:20	0:20 - 0:45	1:45 - 2:00	0:55 - 1:45	0:25 - 0:55				
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:15 - 0:30	0:01 - 0:06	0:30 - 0:45	0:09 - 0:30	0:02 - 0:09				
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:15 - 0:30	0:00 - 0:02	0:10 - 0:20	0:03 - 0:10	0:01 - 0:03				
below -25 °C to LOUT[13] (below -13 °F to LOUT)	100/0	0:15 - 0:30	0:00 - 0:01	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 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 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 These holdover times are for use in -SNFZFG and SNFZFG. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 48) 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.

6 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 48) is required.

7 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 48) 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.

8 Use snow holdover times in conditions of very light, light, or moderate snow mixed with ice crystals.

9 Includes light, moderate and heavy freezing drizzle. Use light freezing rain holdover times if positive identification of freezing drizzle is not possible.

10 No holdover time guidelines exist for this condition for 0 °C (32 °F) and below.

11 Heavy snow, ice pellets, moderate and heavy freezing rain, small hail and hail (Table 46 provides allowance times for Type IV EG fluids and Table 47 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).

12 No holdover time guidelines exist for this condition below -10 °C (14 °F).

13 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 5-22

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Holdover Tables

Table 19: Type IV Holdover Times for ABAX ECOWING AD-49

Note: The specific fluid HOTs are only used for quality control purposes. Use the generic HOTs to determine actual holdover times.

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[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	3:20 - 4:00	0:45 - 1:25	3:00 - 3:00	1:55 - 3:00	1:00 - 1:55	Operation Prohibited		0:10 - 1:55	CAUTION: No holdover time guidelines exist
	75/25	N/A	N/A	N/A	N/A	N/A			N/A	
	50/50	N/A	N/A	N/A	N/A	N/A				
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:20 - 1:35	0:35 - 1:05	2:55 - 3:00	1:30 - 2:55	0:45 - 1:30				
	75/25	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	0:30 - 0:55	2:25 - 3:00	1:15 - 2:25	0:40 - 1:15				
	75/25	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	0:01 - 0:06	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	0:00 - 0:02	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	0:00 - 0:01	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 These holdover times are for use in -SNFZFG and SNFZFG. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 48) 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.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 48) 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 48) 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 Type IV PG fluids in ice pellets and small hail).
11 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 5-22.

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Holdover Tables

Table 20: Type IV Holdover Times for ALAB INTERNATIONAL PROFLIGHT EG4

Note: The specific fluid HOTs are only used for quality control purposes. Use the generic HOTs to determine actual holdover times.

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[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	3:05 - 4:00	0:45 - 1:25	3:00 - 3:00	1:50 - 3:00	1:00 - 1:50	Operation Prohibited		0:10 - 2:00	CAUTION: No holdover time guidelines exist
	75/25	N/A	N/A	N/A	N/A	N/A			N/A	
	50/50	N/A	N/A	N/A	N/A	N/A				
below -3 to -8 °C (below 27 to 18 °F)	100/0	2:30 - 3:55	0:45 - 1:25	3:00 - 3:00	1:50 - 3:00	1:00 - 1:50				
	75/25	N/A	N/A	N/A	N/A	N/A				
below -8 to -14 °C (below 18 to 7 °F)	100/0	2:30 - 3:55	0:45 - 1:25	3:00 - 3:00	1:50 - 3:00	1:00 - 1:50				
	75/25	N/A	N/A	N/A	N/A	N/A				
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:35 - 1:35	0:07 - 0:20	0:50 - 1:05	0:25 - 0:50	0:10 - 0:25				
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:35 - 1:35	0:03 - 0:10	0:40 - 0:55	0:15 - 0:40	0:05 - 0:15				
below -25 to -26°C (below -13 to -15°F)	100/0	0:35 - 1:35	0:01 - 0:06	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 These holdover times are for use in -SNFZFG and SNFZFG. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 48) 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.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 48) 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 48) 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 Type IV PG fluids in ice pellets and small hail).
11 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 5-22.

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Holdover Tables

Table 21: Type IV Holdover Times for ALAB INTERNATIONAL PROFLIGHT PG4

Note: The specific fluid HOTs are only used for quality control purposes. Use the generic HOTs to determine actual holdover times.

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[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	1:25 - 2:15	0:30 - 1:00	2:40 - 3:00	1:20 - 2:40	0:40 - 1:20	Operation Prohibited		0:15 - 1:20	CAUTION: No holdover time guidelines exist
	75/25	N/A	N/A	N/A	N/A	N/A			N/A	
	50/50	N/A	N/A	N/A	N/A	N/A				
below -3 to -8 °C (below 27 to 18 °F)	100/0	1:05 - 2:20	0:25 - 0:50	2:20 - 2:55	1:10 - 2:20	0:35 - 1:10				
	75/25	N/A	N/A	N/A	N/A	N/A				
below -8 to -14 °C (below 18 to 7 °F)	100/0	1:05 - 2:20	0:20 - 0:45	2:05 - 2:35	1:00 - 2:05	0:30 - 1:00				
	75/25	N/A	N/A	N/A	N/A	N/A				
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:35 - 0:50	0:01 - 0:06	0:30 - 0:45	0:09 - 0:30	0:02 - 0:09				
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:35 - 0:50	0:00 - 0:02	0:10 - 0:20	0:03 - 0:10	0:01 - 0:03				
below -25 to -29°C (below -13 to -20°F)	100/0	0:35 - 0:50	0:00 - 0:01	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 These holdover times are for use in -SNFZFG and SNFZFG. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 48) 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.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 48) 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 48) 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 Type IV PG fluids in ice pellets and small hail).
11 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 5-22.

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Holdover Tables

Table 22: Type IV Holdover Times for ALLCLEAR CLEARWING EG

Note: The specific fluid HOTs are only used for quality control purposes. Use the generic HOTs to determine actual holdover times.

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[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	1:50 - 3:15	0:30 - 1:00	2:40 - 3:00	1:20 - 2:40	0:40 - 1:20	Operation Prohibited		0:10 - 1:30	CAUTION: No holdover time guidelines exist
	75/25	N/A	N/A	N/A	N/A	N/A			N/A	
	50/50	N/A	N/A	N/A	N/A	N/A				
below -3 to -8 °C (below 27 to 18 °F)	100/0	1:35 - 3:45	0:25 - 0:55	2:25 - 3:00	1:10 - 2:25	0:35 - 1:10				
	75/25	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	0:25 - 0:50	2:15 - 2:45	1:05 - 2:15	0:30 - 1:05				
	75/25	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	0:15 - 0:35	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	0:09 - 0:20	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	0:07 - 0:15	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 These holdover times are for use in -SNFZFG and SNFZFG. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 48) 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.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 48) 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 48) 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 Type IV PG fluids in ice pellets and small hail).
11 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 5-22.

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Holdover Tables

Table 23: Type IV Holdover Times for ASGLOBAL 4FLITE EG

Note: The specific fluid HOTs are only used for quality control purposes. Use the generic HOTs to determine actual holdover times.

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[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	1:35 - 3:15	0:25 - 0:45	2:05 - 2:35	1:00 - 2:05	0:30 - 1:00	Operation Prohibited		0:08 - 1:05	CAUTION: No holdover time guidelines exist
	75/25	N/A	N/A	N/A	N/A	N/A			N/A	
	50/50	N/A	N/A	N/A	N/A	N/A				
below -3 to -8 °C (below 27 to 18 °F)	100/0	1:25 - 2:45	0:20 - 0:40	1:50 - 2:15	0:55 - 1:50	0:25 - 0:55				
	75/25	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	0:20 - 0:35	1:35 - 2:00	0:50 - 1:35	0:25 - 0:50				
	75/25	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	0:15 - 0:35	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	0:15 - 0:30	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	0:09 - 0:20	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 These holdover times are for use in -SNFZFG and SNFZFG. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 48) 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.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 48) 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 48) 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 Type IV PG fluids in ice pellets and small hail).
11 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 5-22.

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Holdover Tables

Table 24: Type IV Holdover Times for ASGLOBAL 4FLITE PG

Note: The specific fluid HOTs are only used for quality control purposes. Use the generic HOTs to determine actual holdover times.

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[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	1:50 - 3:15	0:40 - 1:10	2:50 - 3:00	1:35 - 2:50	0:50 - 1:35	Operation Prohibited		0:15 - 1:20	CAUTION: No holdover time guidelines exist
	75/25	N/A	N/A	N/A	N/A	N/A			N/A	
	50/50	N/A	N/A	N/A	N/A	N/A				
below -3 to -8 °C (below 27 to 18 °F)	100/0	1:05 - 1:55	0:30 - 0:50	2:05 - 2:30	1:10 - 2:05	0:35 - 1:10				
	75/25	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	0:20 - 0:40	1:40 - 2:00	0:55 - 1:40	0:30 - 0:55				
	75/25	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	0:15 - 0:25	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	0:07 - 0:15	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	0:06 - 0:15	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 These holdover times are for use in -SNFZFG and SNFZFG. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 48) 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.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 48) 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 48) 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 Type IV PG fluids in ice pellets and small hail).
11 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 5-22.

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Holdover Tables

Table 25: Type IV Holdover Times for AVIAFLUID AVIAFLIGHT EG

Note: The specific fluid HOTs are only used for quality control purposes. Use the generic HOTs to determine actual holdover times.

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[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	1:30 - 3:05	0:30 - 0:50	1:55 - 2:20	1:10 - 1:55	0:40 - 1:10	Operation Prohibited		0:10 - 2:00	CAUTION: No holdover time guidelines exist
	75/25	N/A	N/A	N/A	N/A	N/A			N/A	
	50/50	N/A	N/A	N/A	N/A	N/A				
below -3 to -8 °C (below 27 to 18 °F)	100/0	1:20 - 3:00	0:25 - 0:45	1:45 - 2:05	1:00 - 1:45	0:35 - 1:00				
	75/25	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	0:25 - 0:40	1:35 - 1:55	0:55 - 1:35	0:30 - 0:55				
	75/25	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	0:20 - 0:40	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	0:15 - 0:30	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	0:07 - 0:15	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 These holdover times are for use in -SNFZFG and SNFZFG. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 48) 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.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 48) 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 48) 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 Type IV PG fluids in ice pellets and small hail).
11 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 5-22.

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Holdover Tables

Table 26: Type IV Holdover Times for AVIAFLUID AVIAFLIGHT PG

Note: The specific fluid HOTs are only used for quality control purposes. Use the generic HOTs to determine actual holdover times.

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[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	2:15 - 4:00	0:40 - 1:15	3:00 - 3:00	1:40 - 3:00	0:55 - 1:40	Operation Prohibited		0:20 - 2:00	CAUTION: No holdover time guidelines exist
	75/25	N/A	N/A	N/A	N/A	N/A			N/A	
	50/50	N/A	N/A	N/A	N/A	N/A				
below -3 to -8 °C (below 27 to 18 °F)	100/0	1:05 - 2:10	0:25 - 0:50	2:00 - 2:25	1:05 - 2:00	0:35 - 1:05				
	75/25	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	0:20 - 0:35	1:30 - 1:50	0:50 - 1:30	0:25 - 0:50				
	75/25	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	0:10 - 0:20	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	0:05 - 0:09	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	0:05 - 0:09	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 These holdover times are for use in -SNFZFG and SNFZFG. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 48) 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.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 48) 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 48) 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 Type IV PG fluids in ice pellets and small hail).
11 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 5-22.

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Holdover Tables

Table 27: Type IV Holdover Times for CHEMCO CHEMR EG IV

Note: The specific fluid HOTs are only used for quality control purposes. Use the generic HOTs to determine actual holdover times.

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[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	2:05 - 3:35	0:25 - 1:00	3:00 - 3:00	1:15 - 3:00	0:35 - 1:15	Operation Prohibited		0:09 - 1:45	CAUTION: No holdover time guidelines exist
	75/25	N/A	N/A	N/A	N/A	N/A			N/A	
	50/50	N/A	N/A	N/A	N/A	N/A				
below -3 to -8 °C (below 27 to 18 °F)	100/0	1:25 - 3:40	0:25 - 1:00	3:00 - 3:00	1:15 - 3:00	0:35 - 1:15				
	75/25	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	0:25 - 1:00	3:00 - 3:00	1:15 - 3:00	0:35 - 1:15				
	75/25	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	0:15 - 0:30	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	0:15 - 0:30	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	0:15 - 0:30	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 These holdover times are for use in -SNFZFG and SNFZFG. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 48) 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.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 48) 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 48) 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 Type IV PG fluids in ice pellets and small hail).
11 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 5-22.

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Holdover Tables

Table 28: Type IV Holdover Times for CHEMCO CHEMR NORDIK IV

Note: The specific fluid HOTs are only used for quality control purposes. Use the generic HOTs to determine actual holdover times.

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[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	2:15 - 4:00	0:40 - 1:20	3:00 - 3:00	1:45 - 3:00	0:55 - 1:45	Operation Prohibited		0:25 - 2:00	CAUTION: No holdover time guidelines exist
	75/25	N/A	N/A	N/A	N/A	N/A			N/A	
	50/50	N/A	N/A	N/A	N/A	N/A				
below -3 to -8 °C (below 27 to 18 °F)	100/0	1:50 - 4:00	0:40 - 1:20	3:00 - 3:00	1:45 - 3:00	0:55 - 1:45				
	75/25	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	0:40 - 1:20	3:00 - 3:00	1:45 - 3:00	0:55 - 1:45				
	75/25	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	0:35 - 1:10	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	0:25 - 0:50	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	0:20 - 0:40	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 These holdover times are for use in -SNFZFG and SNFZFG. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 48) 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.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 48) 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 48) 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 Type IV PG fluids in ice pellets and small hail).
11 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 5-22.

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Holdover Tables

Table 29: Type IV Holdover Times for CHONGQING JOBA CHEMICAL CO., LTD FW-IV

Note: The specific fluid HOTs are only used for quality control purposes. Use the generic HOTs to determine actual holdover times.

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[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	3:15 - 4:00	0:35 - 1:15	3:00 - 3:00	1:40 - 3:00	0:50 - 1:40	Operation Prohibited		0:15 - 2:00	CAUTION: No holdover time guidelines exist
	75/25	N/A	N/A	N/A	N/A	N/A			N/A	
	50/50	N/A	N/A	N/A	N/A	N/A				
below -3 to -8 °C (below 27 to 18 °F)	100/0	2:30 - 4:00	0:30 - 1:00	2:45 - 3:00	1:25 - 2:45	0:40 - 1:25				
	75/25	N/A	N/A	N/A	N/A	N/A				
below -8 to -14 °C (below 18 to 7 °F)	100/0	2:30 - 4:00	0:30 - 0:55	2:25 - 3:00	1:15 - 2:25	0:35 - 1:15				
	75/25	N/A	N/A	N/A	N/A	N/A				
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:35 - 1:40	0:20 - 0:40	2:00 - 2:35	0:55 - 2:00	0:25 - 0:55				
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:35 - 1:40	0:15 - 0:30	1:20 - 1:45	0:35 - 1:20	0:15 - 0:35				
below -25 to -29°C (below -13 to -20°F)	100/0	0:35 - 1:40	0:10 - 0:25	1:10 - 1:30	0:30 - 1:10	0:15 - 0:30				

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 These holdover times are for use in -SNFZFG and SNFZFG. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 48) 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.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 48) 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 48) 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 Type IV PG fluids in ice pellets and small hail).
11 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 5-22.

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Holdover Tables

Table 30: Type IV Holdover Times for CLARIANT SAFEWING MP IV LAUNCH

Note: The specific fluid HOTs are only used for quality control purposes. Use the generic HOTs to determine actual holdover times.

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[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	4:00 - 4:00	0:50 - 1:20	2:50 - 3:00	1:45 - 2:50	1:05 - 1:45	Operation Prohibited		0:15 - 1:40	CAUTION: No holdover time guidelines exist
	75/25	3:40 - 4:00	0:45 - 1:20	3:00 - 3:00	1:45 - 3:00	1:00 - 1:45			0:10 - 1:45	
	50/50	1:25 - 2:45	0:20 - 0:35	1:25 - 1:40	0:45 - 1:25	0:25 - 0:45				
below -3 to -8 °C (below 27 to 18 °F)	100/0	1:00 - 1:55	0:40 - 1:05	2:25 - 2:50	1:30 - 2:25	0:55 - 1:30				
	75/25	0:40 - 1:20	0:40 - 1:10	2:40 - 3:00	1:30 - 2:40	0:50 - 1:30				
below -8 to -14 °C (below 18 to 7 °F)	100/0	1:00 - 1:55	0:35 - 1:00	2:10 - 2:30	1:20 - 2:10	0:50 - 1:20				
	75/25	0:40 - 1:20	0:35 - 1:00	2:25 - 2:55	1:25 - 2:25	0:45 - 1:25				
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:30 - 0:50	0:05 - 0:15	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	0:02 - 0:06	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	0:01 - 0:04	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 These holdover times are for use in -SNFZFG and SNFZFG. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 48) 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.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 48) 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 48) 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 Type IV PG fluids in ice pellets and small hail).
11 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 5-22.

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Holdover Tables

Table 31: Type IV Holdover Times for CLARIANT SAFEWING MP IV LAUNCH PLUS

Note: The specific fluid HOTs are only used for quality control purposes. Use the generic HOTs to determine actual holdover times.

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[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	3:55 - 4:00	0:40 - 1:35	3:00 - 3:00	2:05 - 3:00	0:55 - 2:05	Operation Prohibited		0:20 - 2:00	CAUTION: No holdover time guidelines exist
	75/25	3:55 - 4:00	0:35 - 1:25	3:00 - 3:00	1:55 - 3:00	0:50 - 1:55			0:20 - 1:50	
	50/50	1:15 - 1:50	0:15 - 0:35	1:35 - 2:00	0:45 - 1:35	0:20 - 0:45				
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:55 - 2:15	0:35 - 1:15	3:00 - 3:00	1:40 - 3:00	0:45 - 1:40				
	75/25	0:40 - 2:00	0:30 - 1:05	3:00 - 3:00	1:30 - 3:00	0:35 - 1:30				
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:55 - 2:15	0:30 - 1:05	3:00 - 3:00	1:25 - 3:00	0:40 - 1:25				
	75/25	0:40 - 2:00	0:25 - 0:55	2:55 - 3:00	1:15 - 2:55	0:30 - 1:15				
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:25 - 0:50	0:05 - 0:20	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	0:02 - 0:07	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	0:01 - 0:04	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 These holdover times are for use in -SNFZFG and SNFZFG. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 48) 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.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 48) 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 48) 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 Type IV PG fluids in ice pellets and small hail).
11 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 5-22.

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Holdover Tables

Table 32: Type IV Holdover Times for CRYOTECH POLAR GUARD® ADVANCE

Note: The specific fluid HOTs are only used for quality control purposes. Use the generic HOTs to determine actual holdover times.

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[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	2:50 - 4:00	0:50 - 1:25	3:00 - 3:00	1:55 - 3:00	1:05 - 1:55	Operation Prohibited		0:15 - 2:00	
	75/25	2:30 - 4:00	0:30 - 1:05	3:00 - 3:00	1:25 - 3:00	0:40 - 1:25			0:09 - 1:40	
	50/50	0:50 - 1:25	0:07 - 0:20	1:10 - 1:35	0:25 - 1:10	0:10 - 0:25			CAUTION: No holdover time guidelines exist	
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:55 - 2:30	0:35 - 1:05	2:25 - 2:50	1:25 - 2:25	0:50 - 1:25				
	75/25	0:40 - 1:30	0:25 - 0:50	2:20 - 3:00	1:05 - 2:20	0:30 - 1:05				
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:55 - 2:30	0:30 - 0:50	2:00 - 2:20	1:10 - 2:00	0:40 - 1:10				
	75/25	0:40 - 1:30	0:20 - 0:45	2:00 - 2:30	0:55 - 2:00	0:25 - 0:55				
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:25 - 0:50	0:08 - 0:25	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	0:03 - 0:10	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	0:02 - 0:05	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 These holdover times are for use in -SNFZFG and SNFZFG. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 48) 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.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 48) 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 48) 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 Type IV PG fluids in ice pellets and small hail).
11 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 5-22.

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Holdover Tables

Table 33: Type IV Holdover Times for CRYOTECH POLAR GUARD® XTEND

Note: The specific fluid HOTs are only used for quality control purposes. Use the generic HOTs to determine actual holdover times.

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[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	2:30 - 4:00	0:50 - 1:30	3:00 - 3:00	2:00 - 3:00	1:05 - 2:00	Operation Prohibited		0:20 - 1:45	CAUTION: No holdover time guidelines exist
	75/25	N/A	N/A	N/A	N/A	N/A			N/A	
	50/50	N/A	N/A	N/A	N/A	N/A				
below -3 to -8 °C (below 27 to 18 °F)	100/0	1:00 - 1:50	0:40 - 1:10	2:50 - 3:00	1:35 - 2:50	0:50 - 1:35				
	75/25	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	0:35 - 1:00	2:25 - 2:55	1:20 - 2:25	0:45 - 1:20				
	75/25	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	0:15 - 0:30	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	0:05 - 0:10	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	0:03 - 0:06	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 These holdover times are for use in -SNFZFG and SNFZFG. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 48) 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.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 48) 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 48) 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 Type IV PG fluids in ice pellets and small hail).
11 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 5-22.

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Holdover Tables

Table 34: Type IV Holdover Times for DOW INC. UCAR ENDURANCE™ EG106

Note: The specific fluid HOTs are only used for quality control purposes. Use the generic HOTs to determine actual holdover times.

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[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	2:05 - 3:10	0:30 - 1:00	2:45 - 3:00	1:20 - 2:45	0:40 - 1:20	Operation Prohibited		0:20 - 2:00	CAUTION: No holdover time guidelines exist
	75/25	N/A	N/A	N/A	N/A	N/A			N/A	
	50/50	N/A	N/A	N/A	N/A	N/A				
below -3 to -8 °C (below 27 to 18 °F)	100/0	1:50 - 3:20	0:25 - 0:50	2:25 - 3:00	1:10 - 2:25	0:35 - 1:10				
	75/25	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	0:25 - 0:45	2:10 - 2:45	1:05 - 2:10	0:30 - 1:05				
	75/25	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	0:15 - 0:35	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	0:15 - 0:30	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	0:15 - 0:30	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 These holdover times are for use in -SNFZFG and SNFZFG. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 48) 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.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 48) 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 48) 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 Type IV PG fluids in ice pellets and small hail).
11 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 5-22.

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Holdover Tables

Table 35: Type IV Holdover Times for DOW INC. UCAR™ FLIGHTGUARD™ AD-49

Note: The specific fluid HOTs are only used for quality control purposes. Use the generic HOTs to determine actual holdover times.

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[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	3:20 - 4:00	0:45 - 1:25	3:00 - 3:00	1:55 - 3:00	1:00 - 1:55	Operation Prohibited		0:10 - 1:55	CAUTION: No holdover time guidelines exist
	75/25	N/A	N/A	N/A	N/A	N/A			N/A	
	50/50	N/A	N/A	N/A	N/A	N/A				
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:20 - 1:35	0:35 - 1:05	2:55 - 3:00	1:30 - 2:55	0:45 - 1:30				
	75/25	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	0:30 - 0:55	2:25 - 3:00	1:15 - 2:25	0:40 - 1:15				
	75/25	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	0:01 - 0:06	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	0:00 - 0:02	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	0:00 - 0:01	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 These holdover times are for use in -SNFZFG and SNFZFG. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 48) 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.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 48) 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 48) 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 Type IV PG fluids in ice pellets and small hail).
11 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 5-22.

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Holdover Tables

Table 36: Type IV Holdover Times for INLAND TECHNOLOGIES ECO-SHIELD®

Note: The specific fluid HOTs are only used for quality control purposes. Use the generic HOTs to determine actual holdover times.

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[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	0:35 - 1:00	2:25 - 2:50	1:20 - 2:25	0:45 - 1:20	Operation Prohibited		0:15 - 1:35	CAUTION: No holdover time guidelines exist
	75/25	N/A	N/A	N/A	N/A	N/A			N/A	
	50/50	N/A	N/A	N/A	N/A	N/A				
below -3 to -8 °C (below 27 to 18 °F)	100/0	1:10 - 2:35	0:30 - 0:55	2:05 - 2:30	1:10 - 2:05	0:40 - 1:10				
	75/25	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	0:25 - 0:50	1:55 - 2:15	1:05 - 1:55	0:35 - 1:05				
	75/25	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	0:01 - 0:06	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	0:00 - 0:02	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	0:00 - 0:01	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 These holdover times are for use in -SNFZFG and SNFZFG. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 48) 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.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 48) 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 48) 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 Type IV PG fluids in ice pellets and small hail).
11 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 5-22.

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Holdover Tables

Table 37: Type IV Holdover Times for JSC RCP NORDIX DEFROST ECO 4

Note: The specific fluid HOTs are only used for quality control purposes. Use the generic HOTs to determine actual holdover times.

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[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	1:30 - 2:40	0:30 - 0:55	2:30 - 3:00	1:15 - 2:30	0:35 - 1:15	Operation Prohibited		0:15 - 1:10	CAUTION: No holdover time guidelines exist
	75/25	N/A	N/A	N/A	N/A	N/A			N/A	
	50/50	N/A	N/A	N/A	N/A	N/A				
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:55 - 2:35	0:25 - 0:50	2:15 - 2:45	1:05 - 2:15	0:35 - 1:05				
	75/25	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	0:25 - 0:45	2:05 - 2:35	1:00 - 2:05	0:30 - 1:00				
	75/25	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	0:01 - 0:06	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	0:00 - 0:02	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	0:00 - 0:01	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 These holdover times are for use in -SNFZFG and SNFZFG. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 48) 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.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 48) 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 48) 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 Type IV PG fluids in ice pellets and small hail).
11 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 5-22.

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Holdover Tables

Table 38: Type IV Holdover Times for JSC RCP NORDIX DEFROST NORTH 4

Note: The specific fluid HOTs are only used for quality control purposes. Use the generic HOTs to determine actual holdover times.

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[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	2:10 - 4:00	0:30 - 1:00	2:55 - 3:00	1:25 - 2:55	0:40 - 1:25	Operation Prohibited		0:09 - 1:55	CAUTION: No holdover time guidelines exist
	75/25	N/A	N/A	N/A	N/A	N/A			N/A	
	50/50	N/A	N/A	N/A	N/A	N/A				
below -3 to -8 °C (below 27 to 18 °F)	100/0	2:40 - 4:00	0:30 - 1:00	2:55 - 3:00	1:25 - 2:55	0:40 - 1:25				
	75/25	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	0:30 - 1:00	2:55 - 3:00	1:25 - 2:55	0:40 - 1:25				
	75/25	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	0:07 - 0:20	0:50 - 1:05	0:25 - 0:50	0:10 - 0:25				
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:45 - 1:55	0:03 - 0:10	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	0:01 - 0:06	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 These holdover times are for use in -SNFZFG and SNFZFG. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 48) 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.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 48) 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 48) 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 Type IV PG fluids in ice pellets and small hail).
11 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 5-22.

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Holdover Tables

Table 39: Type IV Holdover Times for KILFROST ABC-S PLUS

Note: The specific fluid HOTs are only used for quality control purposes. Use the generic HOTs to determine actual holdover times.

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[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	2:10 - 4:00	0:55 - 1:35	3:00 - 3:00	2:05 - 3:00	1:15 - 2:05	Operation Prohibited		0:25 - 2:00	CAUTION: No holdover time guidelines exist
	75/25	1:25 - 2:40	0:30 - 0:55	2:05 - 2:25	1:15 - 2:05	0:45 - 1:15			0:10 - 1:20	
	50/50	0:30 - 0:55	0:15 - 0:25	1:00 - 1:10	0:30 - 1:00	0:15 - 0:30				
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:55 - 3:30	0:50 - 1:25	3:00 - 3:00	1:50 - 3:00	1:05 - 1:50				
	75/25	0:45 - 1:50	0:30 - 0:50	1:50 - 2:10	1:05 - 1:50	0:40 - 1:05				
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:55 - 3:30	0:45 - 1:15	2:55 - 3:00	1:45 - 2:55	1:00 - 1:45				
	75/25	0:45 - 1:50	0:25 - 0:45	1:45 - 2:00	1:00 - 1:45	0:35 - 1:00				
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:40 - 1:00	0:01 - 0:06	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	0:00 - 0:02	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	0:00 - 0:01	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 These holdover times are for use in -SNFZFG and SNFZFG. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 48) 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.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 48) 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 48) 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 Type IV PG fluids in ice pellets and small hail).
11 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 5-22.

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Holdover Tables

Table 40: Type IV Holdover Times for MKS DEVO CHEMICALS COREICEPHOB TYPE IV PG

Note: The specific fluid HOTs are only used for quality control purposes. Use the generic HOTs to determine actual holdover times.

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[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	2:20 - 3:50	0:35 - 1:15	3:00 - 3:00	1:40 - 3:00	0:45 - 1:40	Operation Prohibited		0:10 - 1:40	CAUTION: No holdover time guidelines exist
	75/25	N/A	N/A	N/A	N/A	N/A			N/A	
	50/50	N/A	N/A	N/A	N/A	N/A				
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:15 - 0:35	0:25 - 0:55	2:35 - 3:00	1:10 - 2:35	0:35 - 1:10				
	75/25	N/A	N/A	N/A	N/A	N/A				
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:15 - 0:35	0:20 - 0:45	2:05 - 2:40	0:55 - 2:05	0:25 - 0:55				
	75/25	N/A	N/A	N/A	N/A	N/A				
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:15 - 0:30	0:01 - 0:06	0:30 - 0:45	0:09 - 0:30	0:02 - 0:09				
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:15 - 0:30	0:00 - 0:02	0:10 - 0:20	0:03 - 0:10	0:01 - 0:03				
below -25 to -29 °C (below -13 to -20 °F)	100/0	0:15 - 0:30	0:00 - 0:01	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 These holdover times are for use in -SNFZFG and SNFZFG. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 48) 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.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 48) 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 48) 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 Type IV PG fluids in ice pellets and small hail).
11 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 5-22.

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Holdover Tables

Table 41: Type IV Holdover Times for NEWAVE AEROCHEMICAL FCY 9311

Note: The specific fluid HOTs are only used for quality control purposes. Use the generic HOTs to determine actual holdover times.

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[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	1:55 - 4:00	0:25 - 0:55	2:20 - 2:55	1:10 - 2:20	0:35 - 1:10	Operation Prohibited		0:15 - 1:25	CAUTION: No holdover time guidelines exist
	75/25	N/A	N/A	N/A	N/A	N/A			N/A	
	50/50	N/A	N/A	N/A	N/A	N/A				
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:35 - 2:05	0:20 - 0:40	1:50 - 2:20	0:55 - 1:50	0:30 - 0:55				
	75/25	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	0:20 - 0:35	1:35 - 2:00	0:50 - 1:35	0:25 - 0:50				
	75/25	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	0:10 - 0:20	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	0:05 - 0:10	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	0:05 - 0:10	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 These holdover times are for use in -SNFZFG and SNFZFG. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 48) 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.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 48) 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 48) 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 Type IV PG fluids in ice pellets and small hail).
11 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 5-22.

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Holdover Tables

Table 42: Type IV Holdover Times for NEWAVE AEROCHEMICAL FCY-EGIV

Note: The specific fluid HOTs are only used for quality control purposes. Use the generic HOTs to determine actual holdover times.

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[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	2:35 - 4:00	0:25 - 0:55	2:35 - 3:00	1:10 - 2:35	0:35 - 1:10	Operation Prohibited		0:15 - 2:00	CAUTION: No holdover time guidelines exist
	75/25	N/A	N/A	N/A	N/A	N/A			N/A	
	50/50	N/A	N/A	N/A	N/A	N/A				
below -3 to -8 °C (below 27 to 18 °F)	100/0	1:25 - 3:25	0:20 - 0:45	2:10 - 2:45	1:00 - 2:10	0:25 - 1:00				
	75/25	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	0:20 - 0:40	1:55 - 2:25	0:50 - 1:55	0:25 - 0:50				
	75/25	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	0:15 - 0:30	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	0:09 - 0:20	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	0:08 - 0:20	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 These holdover times are for use in -SNFZFG and SNFZFG. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 48) 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.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 48) 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 48) 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 Type IV PG fluids in ice pellets and small hail).
11 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 5-22.

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Holdover Tables

Table 43: Type IV Holdover Times for SHAANXI CLEANWAY CLEANSURFACE IV

Note: The specific fluid HOTs are only used for quality control purposes. Use the generic HOTs to determine actual holdover times.

Outside Air Temperature[1]	Fluid Concentration Fluid/Water By % Volume	Freezing Fog, Freezing Mist[2], or Ice Crystals[3]	Snow mixed with Freezing Fog[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	2:30 - 4:00	0:30 - 1:15	3:00 - 3:00	1:40 - 3:00	0:40 - 1:40	Operation Prohibited		0:15 - 1:50	CAUTION: No holdover time guidelines exist
	75/25	N/A	N/A	N/A	N/A	N/A			N/A	
	50/50	N/A	N/A	N/A	N/A	N/A				
below -3 to -8 °C (below 27 to 18 °F)	100/0	0:55 - 2:05	0:20 - 0:45	2:25 - 3:00	1:00 - 2:25	0:25 - 1:00				
	75/25	N/A	N/A	N/A	N/A	N/A				
below -8 to -14 °C (below 18 to 7 °F)	100/0	0:55 - 2:05	0:15 - 0:35	1:45 - 2:15	0:45 - 1:45	0:20 - 0:45				
	75/25	N/A	N/A	N/A	N/A	N/A				
below -14 to -18 °C (below 7 to 0 °F)	100/0	0:25 - 0:35	0:10 - 0:20	1:05 - 1:20	0:30 - 1:05	0:15 - 0:30				
below -18 to -25 °C (below 0 to -13 °F)	100/0	0:25 - 0:35	0:05 - 0:10	0:35 - 0:45	0:15 - 0:35	0:07 - 0:15				
below -25 to -30 °C (below -13 to -22 °F)	100/0	0:20 - 0:30	0:04 - 0:09	0:30 - 0:35	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 These holdover times are for use in -SNFZFG and SNFZFG. The Snowfall Intensities as a Function of Prevailing Visibility table (Table 48) 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.
5 To determine snowfall intensity, the Snowfall Intensities as a Function of Prevailing Visibility table (Table 48) 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 48) 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 Type IV PG fluids in ice pellets and small hail).
11 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 5-22.

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Holdover Tables

Allowance Times Tables for Winter 2024-2025

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.

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.

CAUTIONS

- 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 pretakeoff check procedures.
- Allowance time cannot be extended by an inspection of the aircraft critical surfaces.

Table 44: List of Fluids Validated for Use With Allowance Times[1]

Manufacturer	Fluid Name	Applicable Allowance Times (ATs)
Type III Fluids		
AllClear Systems LLC	AeroClear MAX	ATs for Type III Fluids
Type IV EG Fluids		
ALAB International	PROFLIGHT EG4	ATs for Type IV EG Fluids[3]
AllClear Systems LLC	ClearWing EG	ATs for Type IV EG Fluids
ASGlobal	4Flite EG	Fluid has not been validated[2]
AVIAFLUID International Ltd	AVIAFlight EG	ATs for Type IV EG Fluids
CHEMCO Inc.	ChemR EG IV	ATs for Type IV EG Fluids
CHEMCO Inc.	ChemR Nordik IV	ATs for Type IV EG Fluids
CHONGQING JOBA CHEMICAL CO,.LTD	FW-IV	ATs for Type IV EG Fluids[3]
Dow Inc	UCAR ENDURANCE™ EG106 ADF/AAF	ATs for Type IV EG Fluids
JSC RCP Nordix	Defrost NORTH 4	ATs for Type IV EG Fluids
Newave Aerochemical Co. Ltd.	FCY-EGIV	ATs for Type IV EG Fluids
Type IV PG Fluids		
ABAX Industries	ECOWING AD-49	ATs for Type IV PG Fluids
ALAB International	PROFLIGHT PG4	ATs for Type IV PG Fluids[3]
ASGlobal	4Flite PG	ATs for Type IV PG Fluids
AVIAFLUID International Ltd	AVIAFlight PG	ATs for Type IV PG Fluids
Clariant Produkte (Deutschland) GmbH	Safewing MP IV LAUNCH	ATs for Type IV PG Fluids
Clariant Produkte (Deutschland) GmbH	Safewing MP IV LAUNCH PLUS	ATs for Type IV PG Fluids
Cryotech Deicing Technology	Polar Guard® Advance	ATs for Type IV PG Fluids
Cryotech Deicing Technology	Polar Guard® Xtend	ATs for Type IV PG Fluids
Dow Chemical Company	UCAR™ FLIGHTGUARD™ AD-49	ATs for Type IV PG Fluids
Inland Technologies Inc.	ECO-SHIELD®	ATs for Type IV PG Fluids
JSC RCP Nordix	Defrost ECO 4	ATs for Type IV PG Fluids
Kilfrost Limited	ABC-S Plus	ATs for Type IV PG Fluids
MKS DevO Chemicals	COREICEPHOB TYPE-IV PG	ATs for Type IV PG Fluids[3]
Newave Aerochemical Co. Ltd.	FCY 9311	ATs for Type IV PG Fluids
Shaanxi Cleanway Aviation Chemical Co., Ltd.	Cleansurface IV	ATs for Type IV PG Fluids[3]

NOTES

1. Allowance times are for use with undiluted (100/0) Type III, Type IV EG, and Type IV PG fluids only. No allowance times exist for Type II fluids.
2. No allowance times exist for this fluid at the time of publication as the allowance times have not yet been validated.
3. Fluid is new to market and in the process of commercialization. The applicable allowance times can be used for a limited grave period of two testing opportunities that is made available to the manufacturer. The fluid must be validated within this time frame to continue the use of the allowance times.

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Holdover Tables

Table 45: Allowance Times for SAE Type III Fluids[1,2]

Precipitation Types or Combinations and Applicable METAR Codes[4]	Outside Air Temperature			
	Above 0 °C (32 °F and above)	**0 to -5 °C** (32 to 23 °F)	**Below -5 to -10 °C** (Below 23 to 14 °F)	**Below -10 °C[3]** (Below 14 °F)
Light Ice Pellets -PL -GS	10 minutes	10 minutes	10 minutes	**Caution: No allowance times currently exist**
Light Ice Pellets Mixed with Light Snow -PLSN, -SNPL, -GSSN, -SNGS	10 minutes	10 minutes	10 minutes	
Light Ice Pellets Mixed with Light or Moderate Freezing Drizzle -PLFZDZ, -FZDZPL, FZDZPL, -GSFZDZ, -FZDZGS, FZDZGS		7 minutes	5 minutes	
Light Ice Pellets Mixed with Light or Moderate Drizzle -PLDZ, -DZPL, DZPL, -GSDZ, -DZGS, DZGS	7 minutes			
Light Ice Pellets Mixed with Light Freezing Rain -PLFZRA, -FZRAPL, -GSFZRA, -FZRAGS		7 minutes	5 minutes	
Light Ice Pellets Mixed with Light Rain -PLRA, -RAPL, -GSRA, -RAGS	7 minutes			
Moderate Ice Pellets (or Small Hail) PL, GS	5 minutes	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. To use the allowance times in this table, ensure the fluid being used is listed in the List of Fluids Validated for the Use of Allowance Times Table (Table 44).

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. Take is not permitted if the OAT decreases during the 90 minutes 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 In the US, small hail is reported as GR with the remark “GR LESS THAN ¼”. Outside of the US small hail is reported as GS. If the METAR does not report an intensity for small hail, use the “moderate ice pellets or small hail” allowance times. If the METAR reports an intensity with small hail, the condition with the equivalent intensity can be used. This also applies in mixed conditions.

CAUTIONS

• The cautions that apply to the allowance times in the table above can be found on page 5-49..

Holdover Tables

Table 46: Allowance Times for SAE TYPE IV ETHYLENE GLYCOL (EG) FLUIDS[1,2]

Precipitation Types or Combinations and Applicable METAR Codes[5]	Outside Air Temperature				
	Above 0 °C[3] (32 °F and above)	0 to -5 °C[3] (32 to 23 °F)	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, -GS	70 minutes	70 minutes	70 minutes	50 minutes	30 minutes
Light Ice Pellets Mixed with Light Snow -PLSN, -SNPL, -GSSN, -SNGS	50 minutes	50 minutes	30 minutes	25 minutes	
Light Ice Pellets Mixed with Light or Moderate Freezing Drizzle -PLFZDZ, -FZDZPL, FZDZPL, -GSFZDZ, -FZDZGS, FZDZGS		40 minutes	30 minutes	**Caution: No allowance times currently exist**	
Light Ice Pellets Mixed with Light or Moderate Drizzle -PLDZ, -DZPL, DZPL, -GSDZ, -DZGS, DZGS	40 minutes				
Light Ice Pellets Mixed with Light Freezing Rain -PLFZRA, -FZRAPL, -GSFZRA, -FZRAGS		40 minutes	30 minutes		
Light Ice Pellets Mixed with Light Rain -PLRA, -RAPL, -GSRA, -RAGS	40 minutes				
Light Ice Pellets Mixed with Light Rain and Light Snow -PLRASN, -PLSNRA, -RAPLSN, -RASNPL, -SNPLRA, -SNRAPL, -GSRASN, -GSSNRA, -RAGSSN, -RASNGS, -SNGSRA, -SNRAGS	20 minutes				
Light Ice Pellets Mixed with Light Freezing Rain and Light Snow -PLFZRASN, -PLSNFZRA, -FZRAPLSN, -FZRASNPL, -SNPLFZRA, -SNFZRAPL, -GSFZRASN, -GSSNFZRA, -FZRAGSSN, -FZRASNGS, -SNGSFZRA, -SNFZRAGS		20 minutes			
Moderate Ice Pellets (or Small Hail) PL, GS	35 minutes	35 minutes	35 minutes	15 minutes	10 minutes
Moderate Ice Pellets (or Small Hail) Mixed with Moderate Snow PLSN, SNPL, GSSN, SNGS	25 minutes	15 minutes	10 minutes		
Moderate Ice Pellets (or Small Hail) Mixed with Moderate Freezing Drizzle PLFZDZ, GSFZDZ		20 minutes	10 minutes		
Moderate Ice Pellets (or Small Hail) Mixed with Moderate Drizzle PLDZ, GSDZ	20 minutes	**Caution: No allowance times currently exist**			
Moderate Ice Pellets (or Small Hail) Mixed with Moderate Rain PLRA, GSRA, RAPL, RAGS	15 minutes				

NOTES

1 These allowance times are for use with undiluted (100/0) EG based fluids. If the glycol type is unknown, the allowance times for SAE Type IV PG fluids should be used. To use the allowance times in this table, ensure the fluid being used is listed in the List of Fluids Validated for the Use of Allowance Times Table (Table 44).

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. Takeoff is not permitted if the OAT decreases during the 90 minutes in conditions of light ice pellets mixed with either: light or moderate freezing drizzle, light or moderate drizzle, light freezing rain, light rain, light rain and light snow, or light freezing rain and light snow.

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 In the US, small hail is reported as GR with the remark “GR LESS THAN ¼”. Outside of the US small hail is reported as GS. If the METAR does not report an intensity for small hail, use the “moderate ice pellets or small hail” allowance times. If the METAR reports an intensity with small hail, the ice pellet condition with the equivalent intensity can be used. This also applies in mixed conditions.

CAUTIONS

• The cautions that apply to the allowance times in the table above can be found on page 5-49.

Holdover Tables

Table 47: Allowance Times for SAE TYPE IV PROPYLENE GLYCOL (PG) FLUIDS[1,2]

Precipitation Types or Combinations and Applicable METAR Codes[6]	Outside Air Temperature				
	Above 0 °C[3] (32 °F and above)	0 to -5 °C[3] (32 to 23 °F)	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, -GS	50 minutes	50 minutes	30 minutes	30 minutes	20 minutes
Light Ice Pellets Mixed with Light Snow -PLSN, -SNPL, -GSSN, -SNGS	40 minutes	40 minutes	15 minutes	15 minutes	
Light Ice Pellets Mixed with Light or Moderate Freezing Drizzle -PLFZDZ, -FZDZPL, FZDZPL, -GSFZDZ -FZDZGS, FZDZGS		25 minutes	10 minutes		
Light Ice Pellets Mixed with Light or Moderate Drizzle -PLDZ, -DZPL, DZPL, -GSDZ, -DZGS, DZGS	25 minutes				
Light Ice Pellets Mixed with Light Freezing Rain -PLFZRA, -FZRAPL, -GSFZRA, -FZRAGS		25 minutes	10 minutes	**Caution: No allowance times currently exist**	
Light Ice Pellets Mixed with Light Rain -PLRA, -RAPL, -GSRA, -RAGS	25 minutes				
Light Ice Pellets Mixed with Light Rain and Light Snow -PLRASN, -PLSNRA, -RAPLSN, -RASNPL, -SNPLRA, -SNRAPL, -GSRASN, -GSSNRA, -RAGSSN, -RASNGS, -SNGSRA, -SNRAGS	20 minutes				
Light Ice Pellets Mixed with Light Freezing Rain and Light Snow -PLFZRASN, -PLSNFZRA, -FZRAPLSN, -FZRASNPL, -SNPLFZRA, -SNFZRAPL, -GSFZRASN, -GSSNFZRA, -FZRAGSSN, -FZRASNGS, -SNGSFZRA, -SNFZRAGS		20 minutes			
Moderate Ice Pellets (or Small Hail) PL, GS	15 minutes	15 minutes	10 minutes	10 minutes	
Moderate Ice Pellets (or Small Hail) Mixed with Moderate Snow PLSN, SNPL, GSSN, SNGS	15 minutes	5 minutes	5 minutes		
Moderate Ice Pellets (or Small Hail) Mixed with Moderate Freezing Drizzle PLFZDZ, GSFZDZ		10 minutes	7 minutes		
Moderate Ice Pellets (or Small Hail) Mixed with Moderate Drizzle PLDZ, GSDZ	10 minutes	**Caution: No allowance times currently exist**			
Moderate Ice Pellets (or Small Hail) Mixed with Moderate Rain PLRA, GSRA, RAPL, RAGS	10 minutes				

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. If the glycol type is unknown, the allowance times for SAE Type IV PG fluids should be used. To use the allowance times in this table, ensure the fluid being used is listed in the List of Fluids Validated for the Use of Allowance Times Table (Table 44).

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. Takeoff is not permitted if the OAT decreases during the 90 minutes in conditions of light ice pellets mixed with either: light or moderate freezing drizzle, light or moderate drizzle, light freezing rain, light rain, light rain and light snow, or light freezing rain and light snow..

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 In the US, small hail is reported as GR with the remark “GR LESS THAN ¼”. Outside of the US , small hail is reported as GS. If the METAR does not report an intensity for small hail, use the “moderate ice pellets or small hail” allowance times. If the METAR reports an intensity with small hail, the ice pellet condition with the equivalent intensity can be used. This also applies in mixed conditions.

CAUTIONS

• The cautions that apply to the allowance times in the table above can be found on page 5-49.

Holdover Tables

Supplemental Guidance for Winter 2024-2025

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.

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.

Table 48: 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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Holdover Tables

Table 49: Type I Fluids Tested for Anti-Icing Performance and Aerodynamic Acceptance

(see cautions and notes on pages 5-59)

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*
Aéro Mag 2000									
DeiceX PG ADF Concentrate (Multiple Location)	PG	Y-M-D[12]	65/35	-25	-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									
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]		-44	-47
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	27-08-07	70/30	*-25[14]*	*-13[14]*	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	27-06-08	75/25	Not tested[11]		Not tested[11]		-39.5	-39
Cleanwing E	*EG*	*22-07-09[13]*	*75/25*	*-37*	*-35*	*Not tested[11]*		*-37*	*-35*
Cleanwing S-92	*EG*	*22-06-03[13]*	*75/25*	*-35*	*-31*	*Not tested[11]*		*-40*	*-40*
KHF-1	PG	27-06-08	75/25	Not tested[11]		Not tested[11]		-38.5	-37

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-1A	*EG*	*22-05-22[9]*	*60/40*	*Not tested[11]*		*Not tested[11]*		*-32*	*-26*
Beijing Yadilite Aviation Advanced Materials Corporation[10]									
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	28-06-01	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
Chongqing Joba Chemical Co., Ltd									
FW-I	EG	25-11-07	75/25	-43	-45	Not tested[11]		-46	-51
Clariant Produkte (Deutschland) GmbH									
Octaflo EF Concentrate	*PG*	*22-03-28[9]*	*65/35*	*-25*	*-13*	*Not tested[11]*		*-33*	*-27*
Safewing MP I 1938 ECO (80)	*PG*	*24-06-23[9]*	*71/29*	*-25*	*-13*	*Not tested[11]*		*-32.5*	*-27*
Safewing MP I ECO PLUS (80)	PG	27-06-01	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	27-06-01	as supplied	Not tested[11]		Not tested[11]		-17	1
Safewing MP I LFD 88	PG	27-06-01	65/35	-26	-15	Not tested[11]		-33	-27
Safewing MP I LFD PLUS 88	PG	26-06-01	65/35	-25	-13	Not tested[11]		-34	-29
Cryotech Deicing Technology									
Polar Plus® LT	PG	28-06-01	63/37	-27	-17	Not tested[11]		-33	-27
Polar Plus® LT (80)	PG	28-06-01	70/30	-27	-17	Not tested[11]		-33	-27
Dow Inc.									
UCAR™ ADF Concentrate	EG	27-06-01	75/25	-36	-33	Not tested[11]		-45	-49
UCAR™ ADF XL54[15]	EG	27-06-01	as supplied	-33	-27	Not tested[11]		-33	-27
UCAR™ PG ADF Concentrate	PG	27-06-01	65/35	-25	-13	Not tested[11]		-32	-26
UCAR™ PG ADF Dilute 55/45[16]	PG	27-06-01	as supplied	-24	-11	Not tested[11]		-25	-13

HOLDOVER TABLES

Table 49 (cont'd): Type I Fluids Tested for Anti-Icing Performance and Aerodynamic Acceptance

(see cautions and notes on pages 5-59)

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
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[13]*	*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[9]*	*70/30*	*-24.5*	*-12*	*Not tested[11]*		*-31.5*	*-25*
Kilfrost Limited									
Kilfrost DF Plus	PG	27-06-01	69/31	-25.5	-14	Not tested[11]		-32	-26
Kilfrost DF Plus (80)	*PG*	*24-07-14[9]*	*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	27-06-01	70/30	-26	-15	Not tested[11]		-33	-27
LNT Solutions[10]									
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 Chemicals									
COREICEPHOB TYPE I	PG	26-06-01	71/29	Not tested[11]		Not tested[11]		-32.5	-27
Newave Aerochemical Co. Ltd.									
FCY-1A	EG	27-06-01	75/25	*-40[14]*	*-40[14]*	Not tested[11]		-40	-40
FCY-1Bio+	EG	25-06-22	75/25	-40.5	-41	Not tested[11]		-40.5	-41
FCY-1Bio+ (R)	EG	25-12-01	75/25	Not tested[11]		Not tested[11]		-46	-51

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
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 LLP[10]									
TOPAN TYPE I	*EG*	*24-07-13[9]*	*75/25*	*-35.5*	*-32*	*Not tested[11]*		*-42*	*-44*
Xinjiang Zhongtian Liyang Aviation Newmaterial Technology Co., Ltd.[10]									
Clearice-I	*EG*	*23-10-24[9]*	*60/40*	*Not tested[11]*		*Not tested[11]*		*-30*	*-22*
Clearice-IB	*EG*	*24-08-04[9]*	*75/25*	*Not tested[11]*		*Not tested[11]*		*-43.5*	*-46*

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Table 50: Type II Fluids Tested for Anti-Icing Performance and Aerodynamic Acceptance

(see cautions and notes on pages 5-59)

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 (h)
			75/25	Not tested[11]		-15	5	12 000 (c)	Not Available[19]	30 200 (c)	32 000 (h)
			50/50[9]	*Not tested*[11]		*-3*	*27*	*7 500 (a)*	*Not Available*[19]	*26 900 (c)*	*36 800 (h)*
Aviation Xi'an High-Tech Physical Chemical Co. Ltd.											
Cleanwing II	PG	25-07-06	100/0	Not tested[11]		-25	-13	4 650 (e)	4 500 (a)	13 500 (a)	11 100 (i)
			75/25	Not tested[11]		-15	5	9 450 (e)	10 000 (a)	14 600 (i)	Not Available[19]
			50/50	Not tested[11]		-4.5	24	10 150 (e)	10 200 (a)	12 900 (i)	Not Available[19]
Clariant Produkte (Deutschland) GmbH											
Safewing MP II FLIGHT	PG	26-06-01	*100/0*	Not tested[11]		-29	-20	3 340 (a)	Not Available[19]	20 500 (q)	20 500 (c)
			75/25	Not tested[11]		-14	7	12 900 (c)	Not Available[19]	47 800 (q)	47 800 (c)
			50/50	Not tested[11]		-3.5	26	11 500 (a)	Not Available[19]	63 000 (q)	63 000 (c)
Cryotech Deicing Technology											
Polar Guard® II	PG	25-06-01	100/0	Not tested[11]		-30.5	-23	4 400 (f)	4 050 (a)	17 000 (f)	16 200 (a)
			75/25	Not tested[11]		-14	7	11 600 (f)	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]
Kilfrost Limited											
ABC-K Plus	PG	25-06-01	100/0	Not tested[11]		-29	-20	2 850 (e)	2 640 (a)	13 400 (a)	Not Available[19]
			75/25	Not tested[11]		-14.5	6	12 650 (e)	12 650 (c)	29 000 (c)	Not Available[19]
			50/50	Not tested[11]		-3.5	26	4 200 (e)	5 260 (a)	15 000 (a)	Not Available[19]
Ice Clear II	PG	26-06-01	100/0	Not tested[11]		-28	-18	4 100 (a)	18 000 (m)	26 000 (c)	Not Available[19]
			75/25	Dilution Not Applicable				Dilution Not Applicable			
			50/50	Dilution Not Applicable				Dilution Not Applicable			
MKS DevO Chemicals											
COREICEPHOB Type II	PG	26-06-01	100/0	Not tested[11]		-27	-17	34 400 (i)	Not Available[19]	50 200 (i)	Not Available[19]
			75/25	Dilution Not Applicable				Dilution Not Applicable			
			50/50	Not tested[11]		-3.5	26	20 700 (i)	Not Available[19]	30 700 (i)	Not Available[19]

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
Newave Aerochemical Co. Ltd.											
FCY-2	PG	25-07-13	100/0	Not tested[11]		-28	-18	7 000 (e)	8 920 (a)	24 800 (c)	Not Available[19]
			75/25	Not tested[11]		-14.5	6	18 550 (e)	18 550 (c)	31 300 (i)	Not Available[19]
			50/50	Not tested[11]		-4.5	24	6 750 (e)	7 030 (a)	15 200 (i)	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 (i)	Not Available[19]
			50/50	Not tested[11]		-3	27	5 850 (a)	Not Available[19]	38 900 (i)	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 (i)
			75/25	Not tested[11]		-14	7	7 700 (a)	Not Available[19]	23 300 (c)	23 200 (i)
			50/50	Not tested[11]		-3	27	14 500 (a)	Not Available[19]	31 400 (c)	22 600 (i)

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Ensure manual is current before printing.

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Table 51: Type III Fluids Tested for Anti-Icing Performance and Aerodynamic Acceptance

(see cautions and notes on pages 5-59)

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]	
										Manufacturer Method	Alternate Method	Manufacturer Method	Alternate Method
				°C	°F	°C	°F	°C	°F				
AllClear Systems LLC													
AeroClear MAX	*EG*	*24-03-08[13]*	*100/0*	*-16*	*3*	*-20.5*	*-5*	*-35*	*-31*	*7 800 (o)*	*Not Available[19]*	*15 000 (o)*	*Not Available[19]*
			75/25	*Dilution Not Applicable*						*Dilution Not Applicable*			
			50/50	*Dilution Not Applicable*						*Dilution Not Applicable*			

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Table 52: Type IV Fluids Tested for Anti-Icing Performance and Aerodynamic Acceptance

(see cautions and notes on pages 5-59)

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	26-06-01	100/0	Not tested[11]		-26	-15	12 150 (h)	11 000 (a)	22 400 (h)	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			
PROFLIGHT PG4	PG	26-06-01	100/0	Not tested[11]		-29	-20	10 600 (a)	Not Available[19]	17 800 (h)	Not Available[19]
			75/25	Dilution Not Applicable				Dilution Not Applicable			
			50/50	Dilution Not Applicable				Dilution Not Applicable			
AllClear Systems LLC											
ClearWing EG	EG	25-06-01	100/0	Not tested[11]		-29	-20	35 500 (n)	13 350 (a)	51 800 (k)	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[13]*	*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	25-08-04	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 (i)*
			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 (i)*
			75/25	*Dilution Not Applicable*				*Dilution Not Applicable*			
			50/50	*Dilution Not Applicable*				*Dilution Not Applicable*			

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 (m)*	*19 450 (c)*	*67 000 (m)*	*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 (n)	43 100 (c)	87 100 (n)	Not Available[19]
			75/25	Dilution Not Applicable				Dilution Not Applicable			
			50/50	Dilution Not Applicable				Dilution Not Applicable			
Chongqing Joba Chemical Co.,Ltd											
FW-IV	EG	25-11-01	100/0	Not tested[11]		-29	-20	32 600 (j)	Not Available[19]	66 200 (j)	Not Available[19]
			75/25	Dilution Not Applicable				Dilution Not Applicable			
			50/50	Dilution Not Applicable				Dilution Not Applicable			
Clariant Produkte (Deutschland) GmbH											
Safewing MP IV LAUNCH	PG	26-06-01	100/0	Not tested[11]		-28.5	-19	7 550 (a)	Not Available[19]	20 500 (q)	20 500 (c)
			75/25	Not tested[11]		-14	7	18 000 (a)	Not Available[19]	47 800 (q)	47 800 (c)
			50/50	Not tested[11]		-3.5	26	17 800 (a)	Not Available[19]	63 000 (q)	63 000 (c)
Safewing MP IV LAUNCH PLUS	PG	25-06-01	100/0	Not tested[11]		-29	-20	8 700 (p)	8 450 (a)	21 000 (q)	21 000 (c)
			75/25	Not tested[11]		-14	7	18 800 (q)	17 200 (c)	51 600 (q)	51 600 (c)
			50/50	Not tested[11]		-3.5	26	9 700 (p)	12 150 (a)	65 700 (q)	65 700 (c)
Cryotech Deicing Technology											
Polar Guard® Advance	PG	25-06-01	100/0	Not tested[11]		-30.5	-23	4 400 (f)	4 050 (a)	17 000 (f)	16 200 (a)
			75/25	Not tested[11]		-14	7	11 600 (f)	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 (f)	6 350 (a)	23 500 (f)	23 200 (c)
			75/25	Dilution Not Applicable				Dilution Not Applicable			
			50/50	Dilution Not Applicable				Dilution Not Applicable			

Ensure manual is current before printing.

HOLDOVER TABLES

Table 52 (cont'd): Type IV Fluids Tested for Anti-Icing Performance and Aerodynamic Acceptance

(see cautions and notes on pages 5-59)

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[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
Dow Inc.											
UCAR ENDURANCE™ EG106 ADF/AAF	EG	25-06-01	100/0	Not tested[11]		-29	-20	24 850 (j)	2 230 (a)	47 800 (j)	5 900 (a)
			75/25	Dilution Not Applicable				Dilution Not Applicable			
			50/50	Dilution Not Applicable				Dilution Not Applicable			
UCAR™ FLIGHTGUARD™ AD-49	PG	25-06-08	100/0	Not tested[11]		-26	-15	12 150 (h)	11 000 (a)	22 400 (h)	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 (i)	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[9]*	*100/0*	*Not tested[11]*		*-25.5*	*-14*	*9 800 (h)*	*12 350 (a)*	*14 800 (i)*	*17 340 (a)*
			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	25-06-15	100/0	Not tested[11]		-28	-18	17 900 (e)	17 900 (c)	43 800 (c)	Not Available[19]
			75/25	Not tested[11]		-14.5	6	18 300 (e)	18 300 (c)	58 000 (c)	Not Available[19]
			50/50	Not tested[11]		-3.5	26	7 500 (e)	7 500 (a)	27 000 (c)	Not Available[19]
MKS DevO Chemicals											
COREICEPHOB TYPE-IV PG	PG	26-06-01	100/0	Not tested[11]		-29	-20	50 200 (i)	Not Available[19]	60 900 (i)	Not Available[19]
			75/25	Dilution Not Applicable				Dilution Not Applicable			
			50/50	Dilution Not Applicable				Dilution Not Applicable			

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[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
Newave Aerochemical Co. Ltd.											
FCY 9311	PG	26-06-01	100/0	Not tested[11]		-29.5	-21	14 100 (c)	Not Available[19]	27 600 (c)	25 700 (i)
			75/25	Dilution Not Applicable				Dilution Not Applicable			
			50/50	Dilution Not Applicable				Dilution Not Applicable			
FCY-EGIV	EG	26-06-01	100/0	Not tested[11]		-29	-20	24 800 (g)	6 300 (a)	43 700 (k)	78 000 (c)
			75/25	Dilution Not Applicable				Dilution Not Applicable			
			50/50	Dilution Not Applicable				Dilution Not Applicable			
Shaanxi Cleanway Aviation Chemical Co., Ltd											
Cleansurface IV	PG	25-11-28	100/0	Not tested[11]		-30	-22	16 750 (a)	Not Available[19]	29 700 (d)	Not Available[19]
			75/25	Dilution Not Applicable				Dilution Not Applicable			
			50/50	Dilution Not Applicable				Dilution Not Applicable			

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Holdover Tables

Cautions and Notes for Tables 49, 50, 51, 52

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 Dow UCAR™ PG ADF Concentrate, sold under the product name DeiceX PG ADF Concentrate, qualified from 2023-06-15.

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.

Holdover Tables

Table 53: 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)	600 mL low form (Griffin) beaker	575 mL***	20 °C	0.3 rpm	10.0 minutes
e	LV2-disc (with guard leg)	150 mL tall form (Berzelius) beaker	135 mL***	20 °C	0.3 rpm	10.0 minutes
f	SC4-34/13R	small sample adapter	10 mL	20 °C	0.3 rpm	10.0 minutes
g	SC4-34/13R	small sample adapter	10 mL	0 °C	0.3 rpm	30.0 minutes
h	SC4-31/13R	small sample adapter	10 mL	20 °C	0.3 rpm	10.0 minutes
i	SC4-31/13R	small sample adapter	10 mL	20 °C	0.3 rpm	30.0 minutes
j	SC4-31/13R	small sample adapter	10 mL	0 °C	0.3 rpm	10.0 minutes
k	SC4-31/13R	small sample adapter	10 mL	0 °C	0.3 rpm	30.0 minutes
l	SC4-31/13R	small sample adapter	9 mL	20 °C	0.3 rpm	15.0 minutes
m	SC4-31/13R	small sample adapter	9 mL	0 °C	0.3 rpm	10.0 minutes
n	SC4-31/13R	small sample adapter	9 mL	0 °C	0.3 rpm	30.0 minutes
o	SC4-31/13R	small sample adapter	9 mL	0 °C	0.3 rpm	65.0 minutes
p	LV1	big sample adapter	55 mL	20 °C	0.3 rpm	10.0 minutes
q	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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Holdover Tables

Table 54: 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/m2 (~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/m2 (~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 2024-2025) 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.

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Holdover Tables

Table 55: 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 2024-2025) 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.

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Holdover Tables

Table 56: 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 54). 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 2024-2025) 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.

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Refractometer Instructions/BRIX-FP Tables

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Refractometer Instructions/BRIX-FP Tables

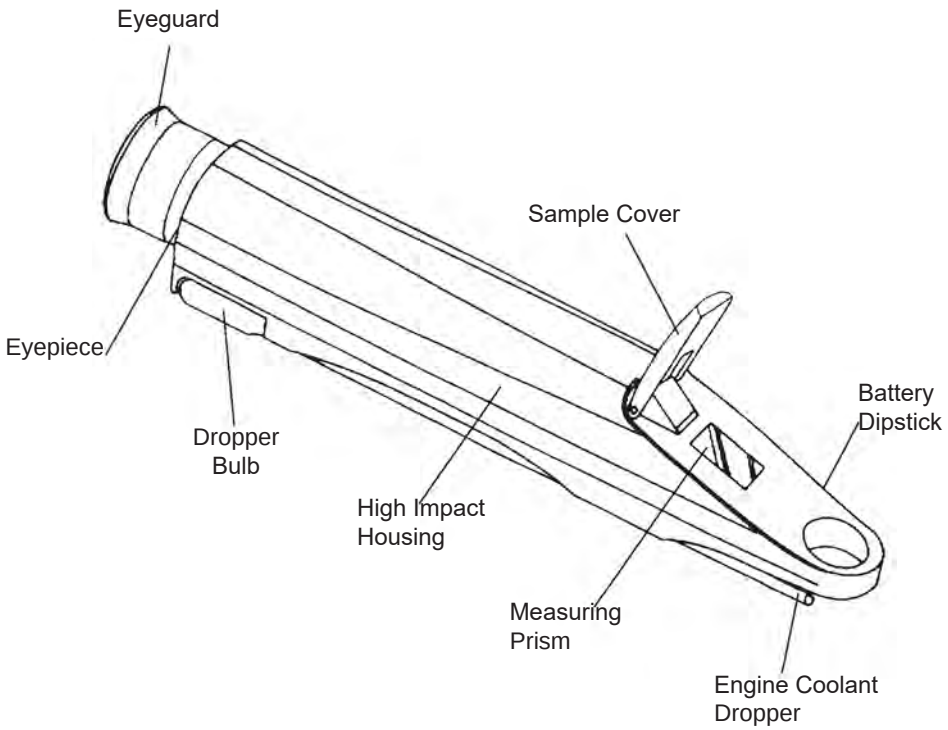
General

A. Empire will use Reichert DuoChek® or MISCO refractometers to test deicing fluid. These instruments will provide an accurate freeze point reading, which is automatically temperature-compensated, for mixtures with a concentration of 60% or less deicing fluid.

B. The refractometer should be checked seasonally, any time it falls or is dropped or at any time the user suspects the readings provided are in error. The check should be performed at room temperature by simply cleaning the unit and placing one or two drops of distilled water under the measuring window. Observe the reading through the eyepiece. The reading should be zero on the BRIX scale (freezing point of distilled water). If the required reading is not obtained, do not use the refractometer to test deicing fluid.

C. If the freezing point/BRIX chart is not in this manual then request the chart from the deice vendor, or use the generic Hold Over Table (**HOT**) for the type of fluid used.

Reichert DuoChek® Model DC70 (°F) and DC60 (°C)



A. Introduction

(1) The Duo-Chek® Tester (refractometer) from Reichert offers a fast and easy-to-use method for testing freeze point. It provides automatic temperature compensation for immediate, accurate direct readings of ethylene glycol or propylene glycol coolants or deicing fluids.

(2) The Duo-Chek is available in two models: Model DC70 (Cat. No. 137584L0) measures freeze point protection in degrees Fahrenheit and Model DC60 (Cat. No. 137564L0) measures in degrees Celsius.

✍ **Note:** Accuracy of the refractometer readings can be affected by the specific fluid formulation of the individual manufacturer.

Refractometer Instructions/BRIX-FP Tables

(3) Using a Duo-Chek to test freeze point, following the American Society for Testing & Materials (ASTM) Standard Practice D3321, provides results that are precise to ±1.0°F (±0.55°C) reading a 50 vol % aqueous solution of ethylene glycol. By comparison, a hydrometer is only precise to ±8.0°F (±4.44°C).

B. Cleaning the Instrument

(1) The Duo-Chek should be thoroughly cleaned after each use. Any residue left on the measuring prism could result in an in accurate reading or damage to the instrument.

(2) To clean, swing back the plastic sample cover located at the slanted end of the instrument to expose the measuring prism. Wipe clean both the prism and the bottom of the sample cover. Dry them with a tissue or a clean soft cloth. Close the sample cover.

C. Sampling

☝**Caution:** Read this section and follow all instructions before using the Duo-Chek.

You should also use extreme caution when testing any acid or caustic solution. They may cause personal injury if they come into contact with your skin or eyes.

(1) To Sample Anti-Freeze Solution. The clear plastic dropper, located on the side of the Duo-Chek, should be used to draw the test sample. Be sure the dropper is free of any previous sample before starting the testing procedure.

Dip the end of the plastic dropper into the fluid without removing it from the tester. Be sure to insert the tube slightly below the fluid level (Figure 1).

Press and release the bulb to draw a sample of fluid. Bend the plastic tube around the Duo-Chek so that the tip can be inserted in the sample cover opening. Eject a few drops of the fluid onto the measuring prism by pressing the bulb (Figure 2). Now take the reading (Paragraph D).

Figure 1.

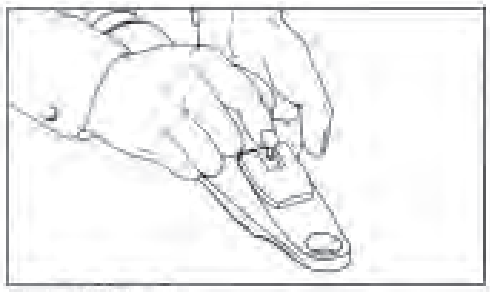


Figure 2.

D. Taking the Reading

(1) The Duo-Chek is equipped with an eyeguard that can be used in two positions. When wearing eyeglasses, the eyeguard should be folded back; when no eyewear is worn the eyeguard should be extended. Proper positioning of the eyeguard will help eliminate stray light and improve image quality.

✍Note: The temperature scale is revered from a standard thermometer scale. Readings below 0° are on the upper half of the scale (Figure 3). The scale is not visible until a sample is placed on the prism. If the concentration of the solution tested is greater than the limits of the scale, the shadow will not be visible.

(2) To take a reading, point the Duo-Chek toward an light source and look into the eyepiece (Figure 4).

Refractometer Instructions/BRIX-FP Tables

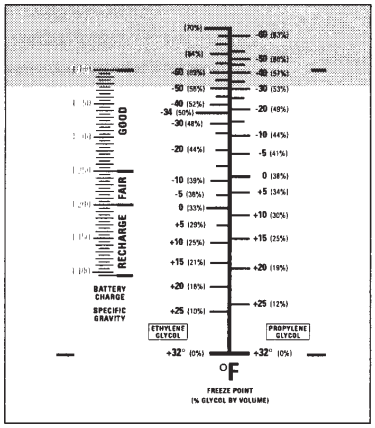


Figure 3.

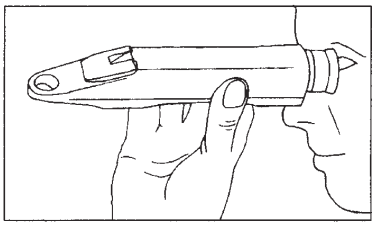


Figure 4.

(3) The freeze point reading is taken where the dark and light portions of the scale meet. Take the fluid reading on the right-hand scale.

(4) To quickly obtain the best contrast between the light and dark portions of the scale, tilt the instrument toward a light source. If the edge between the light and dark shadow is not sharp, the measuring prism was not sufficiently clean and dry or there was not enough fluid on the measuring prism.

(5) Clean the instrument according to the instruction is Paragraph B, and perform a new test.

E. Calibrating the Instrument

(1) The Duo-Chek is factory calibrated and sealed. The instrument will rarely, if ever, need adjustment.

(2) To check adjustment, make sure that the temperature of the instrument is between 70° and 85°F (21° and 29°C) and take a reading with distilled water. If the reading departs from a 32°F (0°F) reading on the antifreeze protection scale, a correction can be made by adjusting the screw on the bottom of the instrument.

(3) Remove the sealant covering the screw. Turn the screw in the direction necessary to adjust the reading to the 32°F (0°C) line.

(4) Never remove the screw from the instrument. Reseal the screw using silicone sealant.

Refractometer Instructions/BRIX-FP Tables

MISCO 7084VP (°F) Glycol Tester Instructions

A. Introduction

(1) The MISCO Glycol Tester (refractometer) is a fast and easy-to-use method for testing the freeze point of glycol-based solutions. It provides automatic-temperature-compensation for immediate, accurate direct readings of ethylene glycol or propylene glycol fluids.

(2) Using a refractometer to test freeze point, following the American Society for Testing and Materials (ASTM) Standard Practice D3321, provides results that are precise to ± 1.0°F (± 0.55°C) reading a 50% vol. aqueous solution of ethylene glycol.

B. Cleaning the Instrument

(1) The instrument should be thoroughly cleaned after each use. Any residue left on the measuring surface could result in an inaccurate reading or damage to the instrument.

(2) To clean, swing back the ViewPoint Illuminator, located at the slanted end of the instrument, to expose the measuring surface. Wipe clean both the surface and the bottom of the ViewPoint Illuminator. Dry them with a tissue or a clean soft cloth. Close the ViewPoint Illuminator.

C. To Sample Glycol Solution

(1) The clear plastic dropper, located on the side of the instrument, should be used to draw the test sample. Be sure the dropper is free of any previous sample before starting the testing procedures.

(2) Dip the end of the plastic dropper into the fluid without removing it from the tester. Be sure to insert the tube slightly below the fluid level (Figure 1).

(3) Press and release the bulb to draw a sample. Bend the plastic tube around the instrument so that the tip can be inserted in the ViewPoint Illuminator opening. Eject a few drops of the fluid onto the measuring surface by pressing the bulb (Figure 2). Now take the reading.

D. Taking the Reading

(1) The instrument is equipped with an eyeguard that can be used in two positions. When wearing eyeglasses, the eyeguard should be folded back; when no eyewear is worn the eyeguard should be extended. Proper positioning of the eyeguard will help eliminate stray light and improve image quality.

> **Note:** The temperature scale is reversed from a standard thermometer scale. Readings below 0° are on the upper half of the scale (Figure 4). The scale is not visible until a sample is placed on the surface. If the concentration of the solution tested is greater than the limits of the scale, the shadow will not be visible.

(2) To take a reading, point the instrument toward any light source, or press the top of the ViewPoint Illuminator, and look into the eyepeice (Figure 3).

(3) The fluid freeze point is taken where the dark and light portions of the scale meet. Take the reading on the right-hand scale (Figure 4).

(4) To obtain the best contrast between the light and dark portions of the scale, it may be necessary to use the ViewPoint Illuminator or tilt the instrument toward an external light source. If the edge between the light and dark shadow is not sharp, the measuring surface was not sufficiently clean and dry or there was not enough fluid on the measuring surface.

(5) Clean the instrument according to the instructions in paragraph B, and perform a new test.

Refractometer Instructions/BRIX-FP Tables

E. Calibrating the Instrument

(1) The instrument is factory calibrated and sealed. The instrument will rarely, if ever, need adjustment.

(2) To check adjustment, make sure that the temperature of the instrument is between 70° and 85°F (21° and 29°C) and take a reading with distilled water. If the reading departs from a 32°F (0°C) reading on the anti-freeze protection scale, reclean the instrument and check again. If the reading is still incorrect, report the discrepancy to Maintenance Control for recalibration.

Note: Use EMP workcard U3000-1 Refractometer Calibration for recalibration. ⚠6

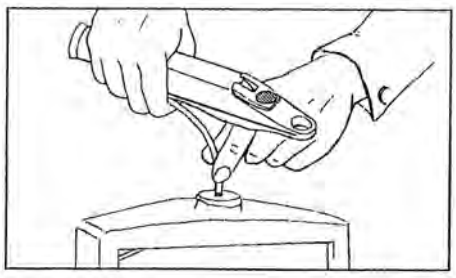


Figure 1

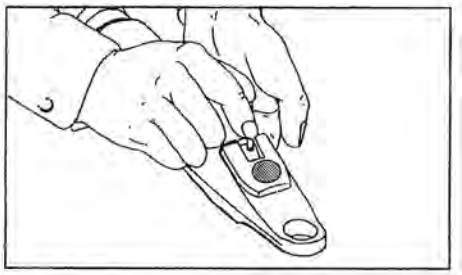


Figure 2

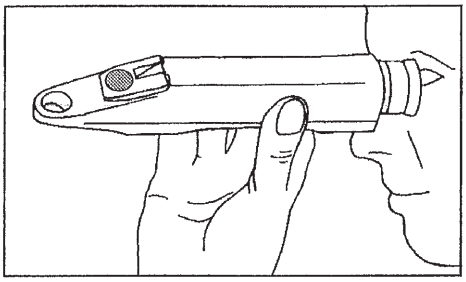


Figure 3

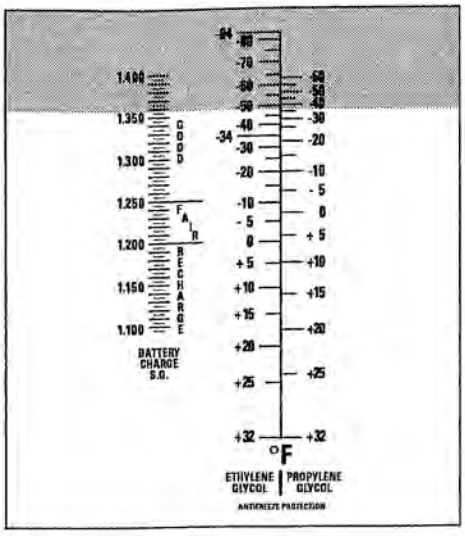


Figure 4

Refractometer Instructions/BRIX-FP Tables

MISCO 10431 Refractometer Instructions

A. Before and after each use, swing back the plastic cover (see Figure 1), exposing the measuring window and the bottom of the plastic cover. Wipe both clean and dry with soft tissue or soft, clean cloth. With the cover up, place a drop or two of the sample on the prism using the dipstick provided. Make sure the dipstick is clean and free of fluid or residue from a prior test.

Figure 1

Caution: Do not use glass or metal applicators to apply samples to prism, as these may scratch the prism. Unfinished wood is also unsuitable as it may absorb some of the water in the sample and give an incorrect reading.

B. Point the instrument toward any light source and look into the eyepiece (see Figure 2).

Figure 2

Note: Refractometers with ViewPoint illuminators may be used in darkness when the pushbutton light source is activated (see Figure 3).

The solution reading is at the point where the dividing line between light and dark (edge of the shadow) crosses the scale (see Figure 4). *The scale is not visible until liquid is placed on it. Also, if the concentration of the sample is greater than the limits of the scale you will not see a shadow line.*

Figure 3

C. A little experience will enable you to quickly obtain the best contrast between the light and dark portions of the field of view. Tilt the instrument towards the light source until best results are obtained. If the "edge of the shadow" is not sharp, the measuring surfaces were not sufficiently cleaned and dried, or there is not enough fluid on the measuring window. Clean as explained above and do a new test.

D. Refer to the BRIX conversion chart for fluid freezing point.

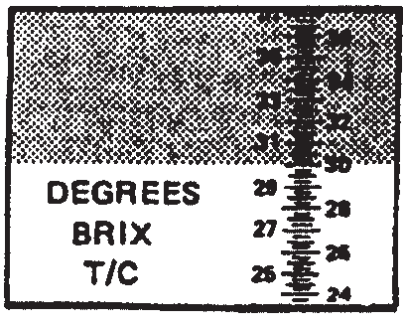


Figure 4

Caution: Make sure that the eyepiece is totally free of solution before viewing. Rinse the measuring surface and top plate with water and wipe dry after testing is completed.

Refractometer Instructions/BRIX-FP Tables

Deicing and Anti-Icing Fluid BRIX Readings and Freezing Points

TYPE I FLUIDS			
Fluid Brand	Mixture Ratio (fluid/water)	BRIX Reading	Freezing Point
Cryotech Polar Plus LT	50/50	31.6	-17F (-27C)
	60/40	36.4	-39F (-40C)
Clariant Safewing MP I LFD 88	65/35	38.8	-54F (-48C)
	55/45	34.0	-27F (-33C)
DOW UCAR XL54	54/46	34.0	-45F (-43C)
DOW UCAR Concentrate	65/35	36.0	-18F (-28C)
DOW UCAR PG	55/45	34.5	-33F (-36C)
TYPE IV FLUIDS			
Cryotech Polar Guard Advanced	100%	34.6 – 36.6	-35F (-37C)
Cryotech Polar Guard Xtend	100%	34.6 – 36.6	-36F (-38C)
Clariant Safewing MP IV LAUNCH	100%	34.3 – 36.0	-33F (-36C)
DOW Flight Guard AD-49	100%	35.7	-33F (-36C)
DOW UCAR Endurance EG106	100%	31.5	-33F (-36C)

REFRACTOMETER INSTRUCTIONS/BRIX-FP TABLES

Type I UCAR PG ADF Freezing Point, Percent by Volume of UCAR PG ADF Concentrate in Water and Refraction

Freezing Point °C	Freezing Point °F	Percent by Volume of UCAR PG ADF Concentrate in Water	Refraction at 20°C °Brix
0	32.0	0	0.0
-1	30.2	5	3.5
-3	26.6	10	7.0
-4	24.8	15	10.3
-6	21.2	20	13.6
-8	17.6	25	16.8
-9	15.8	27	18.1
-10	14.0	28	18.7
-11	12.2	30	19.9
-12	10.4	32	21.2
-13	8.6	33	21.8
-14	6.8	35	23.0
-15	5.0	36	23.6
-16	3.2	37	24.2
-17	1.4	39	25.3
-18	-0.4	40	25.9
-19	-2.2	41	26.5
-20	-4.0	42	27.0
-21	-5.8	43	27.6
-22	-7.6	44	28.2
-23	-9.4	45	28.7

Freezing Point °C	Freezing Point °F	Percent by Volume of UCAR PG ADF Concentrate in Water	Refraction at 20°C °Brix
-24	-11.2	46	29.3
-25	-13.0	47	29.8
-26	-14.8	48	30.4
-28	-18.4	49	30.9
-29	-20.2	50	31.5
-30	-22.0	51	32.0
-31	-23.8	52	32.5
-33	-27.4	53	33.0
-34	-29.2	54	33.6
-36	-32.8	55	34.1
-37	-34.6	56	34.6
-39	-38.2	57	35.1
-40	-40.0	58	35.6
-42	-43.6	59	36.1
-44	-47.2	60	36.6
-45	-49.0	61	37.1
-47	-52.6	62	37.6
-49	-56.2	63	38.0
-51	-59.8	64	38.5
-53	-63.4	65	39.0
does not freeze		100	52.0

Aircraft Deicing and Anti-Icing Vendors

Contents

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Aircraft Deicing and Anti-Icing Vendors

Introduction

A. Each year as winter approaches, Empire Airlines surveys its vendors that provide deicing and anti-icing services to determine their capabilities and make arrangements with them for these services. We also encourage these vendors to conduct meetings with their personnel to review effective and safe operational practices before the weather requires these services.

B Each vendor should be in receipt of an Empire training video in DVD format. This film covers basic deicing and anti-icing techniques for the aircraft in the Company's fleet. If you do not have a copy of this video, please contact Empire's Quality Assurance department and request one.

Training

A. Each deice/anti-ice vendor is expected to train its employees. This training should include quality control procedures for handling and testing various fluid types. It should also cover safe operational procedures that are to be employed when deicing or anti-icing an aircraft. It is our expectation that this training will be done at time of hire and on an annual recurrent basis.

B. Each vendor is expected to maintain training records on each of its operational personnel to establish employee participation and make them available for review by Empire Airlines staff upon request.

Audit Requirements

A. On-site Audits - On-site deice vendor audits will be performed in a frequency range of 2 – 5 years. This frequency range was determined by the DQA using Empire's safety risk management process and will be reevaluated by the DQA annually based on historical data. Using location, vendor history, previous audit findings, and deicing frequency, a risk-based analysis will be used to determine the frequency of on-site audits within this range. This risk-based analysis will be performed by QA annually. Using this analysis, the individual on-site deice vendor audit frequencies will proposed and approved by Empire's CASS Committee.

B. No ATR deicing vendor will go more than 5 years without an on-site audit (effective 2021).

C. Onsite audits will be performed using the A116-DV form.

D. Onsite audits will be performed by designated QA or Maintenance Station Personnel.

E. In the event Empire experiences deicing difficulties or receives reports of substandard deicing practices from a crewmember or as an FAA finding, the DQA will dispatch an auditor to perform an on-site audit of the vendor's operation and compliance with Company procedures.

F. Vendors are to be reminded that our flight crewmembers and maintenance personnel are qualified to instruct them on proper deicing procedures and are encouraged to use them as a resource.

Corrective Action

A. The results of on-site audits will be reported by the DQA office to you in writing. Findings (or discrepancies) are items that do not meet our quality standard. Each finding will result in a Corrective Action Response form (A104R) being sent to you. You are requested to determine the root cause and take corrective action that will prevent a recurrence of each finding.

B. We ask that you correct each finding promptly and return the completed response form to the DQA office within the requested time period. If you will require additional time to correct the finding, please contact the auditor who sent the report. If the finding is unclear to you, please contact the auditor who performed the audit.

Aircraft Deicing and Anti-Icing Vendors

C. Corrective Action Response forms will be reviewed by the auditor and the DQA to determine what if any Deice capabilities may continue to be used. These determinations will be forwarded to Dispatch. Any findings during an audit will also be reviewed in Empire's CASS meetings as described in 121 PPM 5-4.

D. For more details on Empire's audit processes and procedures please see 121 PPM 5-5.

APPENDIX A

Form #	Description	Revision Date
A116-DV	Deicing/Anti-icing Audit Checklist	09/15/23

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Vendor Name:	Date:
Address:	
Telephone:	Fax:
Responsible Manager:	Title:
Auditor's Name:	

This form provides the guidelines to perform an audit of Empire's deice/anti-icing vendors.

Enter ✓ in the appropriate Yes, No, N/A (not applicable) or NP (not performed) check box. All No entries must be substantiated in the audit report.

Yes	No	N/A	NP	
General				
☐	☐	☐	☐	(1) Is Empire Manual website accessible and current?
☐	☐	☐	☐	(2) Is the Empire training video available?
☐	☐	☐	☐	(3) Does the vendor maintain records of employee training?
☐	☐	☐	☐	(4) Is the "Train the Trainer" employee current and available?
☐	☐	☐	☐	(5) Does the vendor have current and available training rosters for deice personnel?
☐	☐	☐	☐	(6) Do the training records show that vendor's personnel have received initial and annual recurrent training?
☐	☐	☐	☐	(7) Does the vendor have a scheduled pre-winter meeting with station personnel for procedure planning and responsibility during winter operations?
Deicing/Anti-icing Performance				
☐	☐	☐	☐	(8) Does the vendor accomplish deicing procedures in accordance with Empire's procedures?
Deicing Equipment Inspections				
☐	☐	☐	☐	(9) Are all safety procedures properly followed when positioning and operating the de-ice equipment?
☐	☐	☐	☐	(10) Does the vendor have proper communication equipment between the cab and basket for the deicing vehicle?
☐	☐	☐	☐	(11) Does the vendor have procedures for accomplishing daily checks of the deicing vehicle for maintenance deficiencies?
☐	☐	☐	☐	(12) Is the deice equipment free of defects that could affect a safe operation?

Yes	No	N/A	NP	
☐	☐	☐	☐	(13) Is the deicing equipment capable of reaching sufficient height to directly observe all the aircraft surfaces?
☐	☐	☐	☐	(14) Is Type 1 fluid being sprayed at the correct temperature at the nozzle? (minimum 140º F/60ºC)
☐	☐	☐	☐	(15) Does the vendor's equipment have a temperature gauge?
☐	☐	☐	☐	(16) Is the gauge calibrated to ensure accuracy?
Quality Control				
☐	☐	☐	☐	(17) Verify Dispatch is requesting monthly fluid quality surveillance as required.
☐	☐	☐	☐	(18) Does the vendor have access to a refractometer for fluid testing and are monthly tests performed and recorded as required.
				(19) Record fluid types available
Storage Facilities				
☐	☐	☐	☐	(20) Dedicated storage tanks for specific fluid types?
☐	☐	☐	☐	(21) Storage tank material appropriate? (stainless, lines, plastic)
☐	☐	☐	☐	(22) Proper type of transfer pump for Type II and IV?

Manufacturer	Brand Name	Fluid Type

The vendor agrees to correct any noted findings and to meet the training requirements set forth in Empire's Aircraft Deicing Program.

Vendor Name _____ Date _____