

AP 1.1.042A	 רשות התעופה האזרחית Civil Aviation Authority	01 DEC 10
Ground De-Icing and Anti-Icing Program		
		Air Operator Certification

Advisory Pamphlet

Ground Deicing and Anti-icing Program

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AIR OPERATOR CERTIFICATION

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1. Purpose

1.1. This pamphlet reflects current industry practices to standardize the application process and training programs associated with ground deicing/anti-icing. It provides an industry-wide standard means for obtaining approval of a Ground Deicing /Anti-Icing Program in accordance with ANR.OPS.394 and 516. In addition, it provides a means acceptable to the Administrator for a certificate holder to deice/anti-ice aircraft using another certificate holder's personnel and procedures or contract personnel who have been trained by the other certificate holder.

2. Reference Material

2.1. Regulatory Requirements

2.1.1. ANR Ops. 394 , 516

2.2. Reference Material

The following material is useful in developing training program subject material and instructions, and procedures for incorporation in the certificate holder's manuals:

2.2.1. Publications of the United States Government.

2.2.1.1. **FAA AC 20-117**, Hazards Following Ground Deicing and Ground Operations in

2.2.1.2. Conditions Conducive to Aircraft Icing.

2.2.1.3. **FAA AC 120-58**, Pilot Guide for Large Aircraft Ground Deicing.

2.2.1.4. FAA publication, Winter Operations Guidance for Air Carriers and other Adverse

2.2.1.5. Weather Topics.

2.2.1.6. The annual Flight Standards Information Bulletin (FSAT) on ground de-icing.

2.2.2. Publications of the Society of Automotive Engineers (SAE).

Copies of the following documents may be obtained by writing to the Society of Automotive Engineers, 400 Commonwealth Drive, Warrendale, Pennsylvania, 15096-0001.

2.2.2.1. Aerospace Materials Specification (AMS) 1424, Deicing/Anti-Icing, Fluid, Aircraft, SAE Type I.

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2.2.2.2. Aerospace Materials Specification (AMS) 1428, Deicing/Anti-Icing, Fluid, Aircraft, Non-Newtonian, Pseudo-Plastic, SAE Type II, III & IV.

2.2.2.3. Aerospace Recommended Practice (ARP) 4737, Aircraft Deicing/Anti-Icing

2.2.2.4. Methods.

2.2.2.5. Aerospace Recommended Practice (ARP) 5149, Training Program Guidelines for Deicing/Anti-icing of Aircraft on Ground.

2.2.3. Publications of the International Standards Organization (ISO). Copies of the following documents may be obtained from the American National Standards Institute, 11 West 42nd Street, New York, New York, 10036, (212) 642-4900.

2.2.3.1. ISO 11075, Aerospace-Aircraft Deicing/Anti-Icing Newtonian Fluids ISO Type I.

2.2.3.2. ISO 11076, Aerospace-Aircraft Deicing/Anti-Icing Methods with Fluids.

2.2.3.3. ISO 11078, Aerospace-Aircraft Deicing/Anti-Icing Non-Newtonian Fluids ISO Type II.

2.2.4. Publications of the Association of European Airlines(AEA). AEA Recommendations for Deicing/Anti-icing of Aircraft on the Ground. This publication can be found on the following Web site: <http://www.aea.be>. Select “publications” then click on “deicing/anti-icing”.

2.3. DEFINITIONS

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2.3.1. **Anti-icing.**

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

2.3.1.1. SAE Type I fluid.

2.3.1.2. Concentrates or mixtures of water and SAE Type I fluid.

2.3.1.3. Concentrates or mixtures of water and SAE Type II fluid.

2.3.1.4. Concentrates of SAE Type III fluid.

2.3.1.5. Concentrates or mixtures of water and SAE Type IV fluid.

2.3.2. **Deicing.**

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

2.3.2.1. Heated water.

2.3.2.2. SAE Type I fluid.

2.3.2.3. Heated concentrates or mixtures of water and SAE Type I fluid.

2.3.2.4. Heated concentrates or mixtures of water and SAE Type II fluid.

2.3.2.5. Heated concentrates or mixtures of water and SAE Type III fluid.

2.3.2.6. Heated concentrates or mixtures of water and SAE Type IV fluid.

2.3.3. **Frozen Contaminants.**

As used in this pamphlet, frozen contaminants include light freezing rain, freezing rain, freezing drizzle, frost, ice, ice pellets, snow, snow grains, and slush.

2.3.4. **Holdover Time (HOT).**

The estimated time that deicing/anti-icing fluid will prevent the formation of frost or ice and the accumulation of snow on the critical surfaces of an aircraft. HOT begins when the final

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application of deicing/anti-icing fluid commences and expires when the deicing/anti-icing fluid loses its effectiveness.

2.3.5. **Pretakeoff Check.**

A check of the aircraft's wings or representative aircraft surfaces for frozen contaminants. This check is conducted within the aircraft's HOT and **may** be made by observing representative surfaces from the flight deck, cabin, or outside the aircraft, depending on the type of aircraft and operator's CAAI-approved program.

2.3.6. **Pretakeoff Contamination Check.**

A check (conducted after the aircraft's HOT has been exceeded) to ensure the aircraft's wings, control surfaces, and other critical surfaces, as defined

in the certificate holder's program, are free of all frozen contaminants. This check must be completed within 5 minutes before beginning takeoff and from outside the aircraft, unless the certificate holder's CAAI-approved program specifies otherwise .

2.3.7. **Post Deicing Check.**

A check, after deicing application, to ensure all aircraft surfaces are free of frozen contaminants.

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3. Guidance and Procedures

This pamphlet provides guidelines for acceptable program elements for incorporation in the certificate holder's approved ground deicing and anti-icing program. Also, a certificate holder, with a ground deicing and anti-icing program approved in accordance with this pamphlet, may deice and anti-ice aircraft using another certificate holder's ground deicing and anti-icing program that is approved in accordance with this pamphlet.

4. Program Elements

ANR.OPS.394(13) requires a certificate holder's ground deicing and anti-icing program to include the following elements:

4.1. Management Plan

In order to properly exercise operational control (when conditions are such that frost, ice, snow, or slush may reasonably be expected to adhere to an aircraft), the certificate holder should develop, coordinate with other affected parties, implement, and use a management plan for proper execution of its approved deicing/anti-icing program. A plan encompassing the following elements is acceptable:

- 4.1.1. **Responsibility.** At each airport where operations are expected to be conducted in conditions conducive to ground icing, determine who is responsible for deciding when ground deicing/anti-icing procedures are in effect.
- 4.1.2. **Implementation.** At each airport, determine who is responsible for implementation of the ground deicing/anti-icing procedures, including adequate qualified personnel and equipment.
- 4.1.3. **Incorporation In Manuals.** A detailed description of the deicing/anti-icing program should be incorporated in the certificate holder's manuals for flight crewmembers, dispatchers or flight followers, ground operations personnel, and management personnel to use when conducting operations under ground icing conditions. This description should include the functions, duties, responsibilities, instructions, and procedures to be used.
- 4.1.4. **Coordination.** At each airport, a winter operations plan should be developed to include coordination with ATC and the appropriate airport authorities.

4.2. Application Procedures.

In an appropriate manual, certificate holders shall specify the deicing and anti-icing fluid procedures for each type of aircraft operated. Ground personnel trained and qualified to apply deicing and anti-icing fluid, in accordance with a certificate holder's program, do not require additional training and qualification to deice and anti-ice similar aircraft operated by

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another certificate holder with a deicing and anti-icing program also approved in accordance with the current edition of **AP.1.4.042**. However, specific training is needed for an operator's deicing personnel to deice aircraft with different configurations (e.g., turboprop with t-tail).

4.3. **HOT Tables and Procedures for Their Use.**

The deicing/anti-icing program should include HOT tables and procedures, for the use by the certificate holder's personnel. The following elements should be included in the approved program:

4.3.1. **Responsibilities and Procedures.** The certificate holder's program should define operational responsibilities and contain procedures for the flightcrew, aircraft dispatchers, flight followers, and maintenance and ground personnel that apply to the use of HOTs and resultant actions if the determined HOT is exceeded.

4.3.1.1. Procedures should be developed to address deicing operations at specific deicing locations (e.g., gate, remote, or centralized facilities).

4.3.1.2. Procedures should be developed for ground crew and flightcrew to communicate:

4.3.1.2.1 During aircraft positioning (if required).

4.3.1.2.2 Other pertinent information regarding the deicing/anti-icing process.

4.3.1.2.3 Start of the HOT.

4.3.1.2.4 The aircraft departure process.

4.3.1.2.5 Equipment clear/job done – safe to start taxiing.

4.3.1.3. In addition, procedures should be developed for the flightcrew's use of the pertinent HOT tables, coordination with dispatchers or flight followers and coordination with ATC.

4.3.2. **HOT Tables.** Each certificate holder is required to implement HOT tables for use by its personnel. The FAA developed HOT tables for Type I deice/anti-ice fluid and generic Type II and IV anti-ice fluid in accordance with SAE ARP 4737, Aircraft Deicing/Anti-Icing Methods, and ISO 11076, Aerospace Aircraft Deicing/Anti-Icing Methods with Fluids. HOTs that exceed those specified in the current editions of the manufacturer's specific HOT of approved fluids are not acceptable. However, the certificate holder may require the use of more conservative times than those

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specified in the tables. Tables 1 and 2 of Appendix 1 are samples of HOT tables.

4.3.3. **Use of HOT Tables.** HOT ranges are an estimate of the time that deicing/anti-icing fluid will prevent the formation of frost or ice and the accumulation of snow on the unprotected surfaces of an aircraft. HOT begins when the final application of deicing/anti-icing fluid commences and expires when the deicing/anti-icing fluid applied to the aircraft loses its effectiveness (e.g., when ice begins to form on or in the fluid). HOTs vary with weather conditions. The effectiveness of deicing/anti-icing fluids is based on a number of variables e.g., temperature, moisture content of the precipitation, wind, and the aircraft skin temperature). The HOT tables are to be used for departure planning and in conjunction with pretakeoff check procedures.

4.4. Frozen Contaminants on the Aircraft.

In accordance with ANR .OPS .516 the aircraft **must** be free of all frozen contaminants adhering to the wings, control surfaces, propellers, engine inlets, or other critical surfaces before takeoff.

***NOTE:** The DGCA may authorize "Takeoff" with frost under the wing in the area of the fuel tanks, if it can be shown that there is minimal degradation of aircraft performance due to these accumulations. However, under-wing frost that degrades airplane performance beyond a minimal amount is acceptable if the appropriate performance information is provided in the AFM.*

4.4.1. **Identification of Critical Aircraft Surfaces.** The critical aircraft surfaces, which must be clear of contaminants before takeoff should be described in the aircraft manufacturer's maintenance manual or other manufacturer-developed documents, such as service or operations bulletins.

4.4.1.1. Generally, the following should be considered to be critical aircraft surfaces, if the aircraft manufacturer's information is not available:

4.4.1.1.1 Pitot heads, static ports, ram-air intakes for engine control and flight instruments, other kinds of instrument sensor pickup points, fuel vents, propellers, and engine inlets.

4.4.1.1.2 Wings, empennage, and control surfaces.

4.4.1.1.3 Fuselage upper surfaces on aircraft with center mounted engine(s).

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

4.4.1.3. Critical surfaces should be defined for the use of ground personnel for conducting the check following the deicing/anti-icing process and for any pretakeoff contamination checks that may be accomplished by ground personnel.

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4.4.2. **Identification of Representative Aircraft Surfaces (for use in conducting pretakeoff checks only).** For each type of aircraft operated, certificate holders should list, in an appropriate manual, the representative surfaces that may be checked while conducting pretakeoff checks. Some aircraft manufacturers have identified certain aircraft surfaces that the flightcrew can readily observe to determine whether or not frozen contaminants are accumulating or forming on that surface and, by using it as a representative surface, can make a reasoned judgment regarding whether or not frozen contaminants are adhering to other aircraft surfaces. When identifying a representative aircraft surface, the following guidelines should be considered:

4.4.2.1. The surface can be seen clearly to determine whether or not frozen contaminants are forming or accumulating on the surface.

4.4.2.2. The surface should be unheated.

4.4.2.3. During the deicing/anti-icing procedure, the representative surface should be one of the first surfaces treated with deicing/anti-icing fluid. However, the designation of representative surfaces is not limited to treated surfaces.

4.4.3. **Recognition Techniques.** Certificate holder's Initial, Transition, Recurrent, Upgrade, or Advanced Qualification Program (AQP) and Continuing Qualification training curricula should include aircraft type-specific techniques for use by the flightcrew and other personnel for recognizing contamination on aircraft surfaces. The flightcrew and other personnel should use these type-specific techniques while conducting preflight aircraft icing checks, pretakeoff checks, and pretakeoff contamination checks. Frozen contaminants can take the form of ice, frost, snow, or slush.

***NOTE:** The formation of clear ice may be difficult to detect visually. Therefore, specific techniques for identification of clear ice should be included in all training programs.*

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4.5. Types of Icing Checks

The pretakeoff and pretakeoff contamination checks that, when applicable, are required to be accomplished under the operator's approved deicing/anti-icing program. The aircraft deicing/anti-icing procedure also includes a post deicing/anti icing check of all aircraft surfaces.

4.5.1. **Pretakeoff Check (within the HOT).** This check is required anytime when procedures for the use of HOT are required. The **CAAI** recommends that only the flightcrew accomplish the pretakeoff check. The flightcrew must accomplish the check within the HOT. The flightcrew should check the aircraft's wings or representative aircraft surfaces for frozen contamination. The surfaces to be checked are determined by manufacturer's data or guidance contained in this pamphlet. The pretakeoff check is integral to the use of HOTS. Because of the limitations and cautions associated with the use of HOTS, the flightcrew must assess the current weather and other situational conditions that affect the aircraft's condition and not rely on the use of HOTS as the sole determinant that the aircraft is free of contaminants. Several pretakeoff checks may be required during the HOT period based on factors that include the length of the HOT range, weather, or other conditions. The flightcrew should maintain a continued awareness of the condition of the aircraft and accomplish a pretakeoff check just before taking the active runway for departure. When conducting the pretakeoff check, the flightcrew must factor in the application sequence (i.e., where on the aircraft the deicing process began).

4.5.2. **Pretakeoff Contamination Check (when HOT has been exceeded).** Completing a pretakeoff contamination check is one of the conditions that allows a takeoff after a HOT has been exceeded. When a HOT has been exceeded, certificate holders must have appropriate pretakeoff contamination check procedures for the flightcrew's and/or other qualified ground personnel's use to ensure that the aircraft's critical surfaces remain free of frozen contaminants. Flightcrews and/or other qualified ground personnel must complete the pretakeoff contamination check within 5 minutes before beginning takeoff. This check must be accomplished from outside the aircraft unless the certificate holder's program specifies otherwise. If any doubt exists concerning the aircraft's condition after completing this check, the aircraft cannot takeoff unless it is deiced again and a new HOT is determined. The following should be considered while developing procedures for this check:

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4.5.2.1. Unless otherwise authorized in the certificate holder's approved program, certificate holders who operate hard-wing (wings without moveable leading edge lift devices) aircraft with aft, fuselage-mounted, turbine-powered engines should conduct pretakeoff contamination checks from outside the airplane. The pretakeoff contamination check for these aircraft should include a method, approved by the Administrator; to determine that all aircraft surfaces are free of contaminants.

4.5.2.2. Operators of aircraft other than those addressed in paragraph (a) above, should conduct this check from outside the aircraft unless they can show that the check can be adequately accomplished from inside the aircraft, as specified in the certificate holder's program. The program must detail procedures and requirements for this check. When developing a program for conducting the pretakeoff contamination check from inside the aircraft, certificate holders should consider if crewmembers are able to see enough of the wings, control surfaces, and other surfaces to determine whether or not they are free of contaminants. When making this determination, consider the aircraft type, the method of conducting the check (from the cockpit or cabin), and other factors, such as aircraft lighting and ambient conditions.

4.5.3. **Post Deicing/Anti-Icing Check.** This multi-part check is an integral part of the deicing/anti-icing process. The check ensures that:

4.5.3.1. All critical surfaces are free of adhering frozen contaminants after deicing.

4.5.3.2. All critical surfaces are free of frozen contaminants before the application of any anti-icing fluid.

4.5.3.3. All critical surfaces are free of frozen contaminants before pushback or taxi.

NOTE: Certificate holders should have procedures that require that qualified ground personnel conduct this check. Communication procedures should be established to relay pertinent deicing/anti icing information and the results of this check to the PIC.

4.6. **Communications.**

Communication between ground personnel and the flightcrew prior to commencing deicing/anti-icing operations is critical. Upon completion of deicing/anti-icing operations, ground personnel should communicate with the flightcrew to determine the start of the HOT. The particular HOT the flightcrew uses is also critical. Since many deicers service multiple carriers, the **CAAI** recommends that all approved programs include the

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following flow sequence and information to provide standardized phraseology:

4.6.1. Before commencing deicing/anti-icing operations, ground personnel and the flightcrew should review the following (as applicable):

- 4.6.1.1. Deicing/anti-icing prior to crew arrival.
- 4.6.1.2. Gate or remote deicing/anti-icing procedures.
- 4.6.1.3. Aircraft-specific procedures.
- 4.6.1.4. Communications between ground personnel and the flightcrew.

4.6.2. Just before commencing the application of deicing/anti-icing fluid, ground personnel should confirm with the flightcrew that the aircraft is properly configured for deicing, as follows:

Example: “Captain, is your aircraft ready for deicing/anti-icing?”

4.6.3. Upon completion of deicing/anti-icing, provide the flightcrew with the following elements:

- 4.6.3.1. Fluid type (e.g., Type I, Type II, Type III or Type IV) Fluid product name optional for each type of fluid if fluid meets product on-wing viscosity requirements.
- 4.6.3.2. Fluid/water mix ratio by volume of Types II, III, and IV. Reporting the concentration of Type I fluid is not required..
- 4.6.3.3. Specify, in local time (hours and minutes) the beginning of the final fluid application (e.g. 13.30).
- 4.6.3.4. Post application check accomplished. Specify date (day, written month, year).

NOTE: Element D is required for recordkeeping, optional for crew notification.

NOTE: Transmission of elements A-C to the flightcrew confirms that a post deicing/anti-icing check was completed and the aircraft is clean.

Examples of the ground/flightcrew communication sequence for the one and two-step processes follow:

One Step Process with Type I or other approved deicing fluid:

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“Captain, I am your designated deicer. Your aircraft has been deiced with Type I fluid. Your fluid application began at 14.30.”

Two Step Process with Types II, III, or IV: Captain, I am your designated deicer. Your aircraft has been deiced with Type I fluid and anti-iced with Type IV. An anti-ice fluid mixture of 75 was used. Your anti-ice fluid application began at 16.45.

4.7. Initial/Recurrent Ground Training and Qualification.

Only exclusively trained and qualified personnel may carry out deicing/anti-icing procedures.

4.7.1. Each certificate holder’s approved program must consist of the following:

4.7.1.1. Certificate holders must conduct initial and annual recurrent training for flightcrews, dispatchers, and ground personnel and should ensure that all such crews obtain and retain a thorough knowledge of aircraft ground deicing/anti-icing policies and procedures, including required procedures and lessons learned.

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4.7.1.2. Flightcrew, dispatcher, and ground personnel training programs must include a detailed description of initial and annual recurrent ground training and qualification concerning the specific requirements of the program and the duties, responsibilities, and functions detailed in the program.

4.7.1.3. Flightcrew, dispatcher, and ground personnel training programs should have a Quality Assurance Program to monitor and maintain a high level of competence. An ongoing review plan is advisable to evaluate the effectiveness of the deicing/anti-icing training received.

4.7.1.4. The program should have a tracking system that records all required personnel have been satisfactorily trained. Certificate holders shall maintain records of personnel training and qualification (see Appendix 2) for proof of qualification.

4.7.1.5. Personnel must be able to adequately read, speak, and understand English in order to follow written and oral procedures applicable to the deicing/anti-icing program.

4.7.1.6. When the anti-icing fluids are used, the flightcrews should be made aware of any unusual flying qualities, such as the need for additional takeoff rotation stick-force.

4.7.2. Certificate holders should train and qualify flightcrew, dispatcher, and ground personnel on at least the following subjects, identified as Flightcrew **(F)**, Dispatcher **(D)**, or Ground Personnel **(G)**:

4.7.2.1. **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:

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- 4.7.2.1.1 Loss of lift.
- 4.7.2.1.2 Increased drag and weight.
- 4.7.2.1.3 Decreased control.
- 4.7.2.1.4 Tendency for rapid pitch-up and roll-off during rotation (**F/D** only).
- 4.7.2.1.5 Stall occurs at lower-than-normal angle of attack (**F/D** only).
- 4.7.2.1.6 Buffet or stall occurs before activation of stall warning (**F/D** only).
- 4.7.2.1.7 Aircraft specific areas:
 - Engine foreign object damage potential.
 - Ram air intakes.
 - Instrument pickup points.
 - Leading edge device (LED) aircraft (aircraft that have slats or leading edge flaps) and non-LED aircraft.
 - Airworthiness Directives/Specific inspections
 - Winglets.

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4.7.2.2. Aircraft Ground Icing Conditions. Describe conditions that cause implementation of deicing/anti-icing procedures **(F/D/G)**.

4.7.2.2.1 **In-flight Ice Accumulation.** Certificate holders should have procedures for flightcrews on arriving flights to report occurrences of in-flight icing to the personnel responsible for executing the certificate holder's deicing/anti-icing program. In-flight ice accumulation could result in a ground-deicing situation when flights are scheduled for short turnaround times (i.e., for 30 minutes or less and when ambient temperatures on the ground are at or below freezing).

4.7.2.2.2 Frost, including hoarfrost.

4.7.2.2.3 Freezing precipitation (snow, freezing rain, freezing drizzle, or hail, which could adhere to aircraft surfaces).

4.7.2.2.4 Freezing fog.

4.7.2.2.5 Rain or high humidity on cold soaked wing.

4.7.2.2.6 Rain or high humidity on cold soaked wing fuel tanks.

4.7.2.2.7 Under-wing frost (may not require deicing/anti-icing within certain limits).

4.7.2.2.8 Fluid failure identification.

4.7.2.3. Location specific deicing/anti-icing procedures **(F/D and/or G)**, as appropriate).

4.7.2.4. Communications procedures between the flightcrew, ground personnel, ATC, and company station personnel **(F/D/G)**.

NOTE: Use caution when exercising 3-way communication. They may be confusing, misleading, or misdirected. Communication procedures must include ground crew confirmation to the flightcrew after the deicing and

anti-icing process is completed that all personnel and equipment are clear

before reconfiguring or moving the aircraft.

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

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

4.7.2.6.1 General fluid descriptions.

4.7.2.6.2 Composition and appearance.

4.7.2.6.3 Differences between Type I and Type II/IV deicing/anti-icing fluids.

4.7.2.6.4 Purpose for each type.

4.7.2.6.5 Deicing fluids.

4.7.2.6.6 Anti-icing fluids.

4.7.2.6.7 De/anti-icing fluids capabilities.

4.7.2.6.8 Approved deicing/anti-icing fluids for use (SAE, ISO, etc.).

4.7.2.6.9 Fluid-specific information provided by fluid or aircraft manufacturer (**F/D** and/or **G** as appropriate).

4.7.2.6.10 Fluid temperature requirements (Hot vs. Cold).

4.7.2.6.11 Properties associated with infrared deicing/anti-icing.

4.7.2.7. Fluid Storage and Handling (G).

4.7.2.7.1 Fluid storage.

4.7.2.7.2 Fluid handling.

4.7.2.7.3 Fluid sampling.

4.7.2.7.4 Fluid testing.

4.7.2.8. Deicing/Anti-icing Facilities and Equipment Operation Procedures (G). An understanding of the capabilities of the deicing equipment and the qualifications for operation. The equipment portion of the training program should include the following:

4.7.2.8.1 Description of Various Equipment Types:

- Deicing vehicles.
 - Infrared facilities.
- Hard stands

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4.7.2.8.2 Operation of the equipment.

4.7.2.8.3 Emergency procedures.

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

4.7.2.10. Environmental Considerations **(G)**.

4.7.2.11. Fluid Selection **(F/D/G)**.

4.7.2.12. Contractor Deicing/Anti-icing (F/D/G). Train-the-trainer (per the approved program).

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

4.7.2.13.1 Inspection of critical surfaces.

4.7.2.13.2 Clear ice precautions.

4.7.2.13.3 Flightcrew/groundcrew preflight check requirement.

4.7.2.13.4 Deicing/anti-ice determination.

4.7.2.13.5 Deicing/anti-ice location.

4.7.2.13.6 Communication before deicing/anti-icing.

4.7.2.13.7 General deicing/anti-ice precautions.

4.7.2.13.8 Aircraft specific requirements.

4.7.2.13.9 **Deicing:**

- Requirements.
- Effective removal of frost, snow, and ice **(G)**.

4.7.2.13.10 Anti-icing:

- Requirements.
- Preventative anti-icing **(G)**.
- Application **(G)**.

4.7.2.13.11 Deicing/anti-icing:

- **One step.**
- **Two step.**

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4.7.2.13.12 Guidelines for the application of deicing/anti-icing fluids.

4.7.2.13.13 Post deicing/anti-icing checks requirement.

4.7.2.13.14 Flight control check.

4.7.2.13.15 Communications after deicing/anti-icing.

4.7.2.13.16 Use of the deicing/anti-icing log (Appendix 3).

4.7.2.14. Use of HOTs (F/D/G).

4.7.2.14.1 Definition of HOT.

4.7.2.14.2 When HOT begins and ends.

4.7.2.14.3 Limitations and cautions associated with the use of HOTs.

4.7.2.14.4 Source of HOT data.

4.7.2.14.5 Relationship of HOT to particular fluid concentrations and for different types of fluids.

4.7.2.14.6 Precipitation category (e.g., fog, drizzle, rain, or snow).

4.7.2.14.7 Precipitation intensity.

4.7.2.14.8 How to determine a specific HOT from the HOT range that accounts for moderate or light weather conditions **(F/D)**.

4.7.2.14.9 Adjusting HOT for changing weather conditions **(F/D)**.

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

4.7.2.15. **Pretakeoff Check Requirement (F/D)**. Identification of representative surfaces.

4.7.2.16. **Pretakeoff Contamination Check Requirement (F/D/G)**. Communications.

4.7.2.17. **Aircraft Surface Contamination Recognition (F/D/G)**.

AP 1.1.042A		01 DEC 10
Ground De-Icing and Anti-Icing Program		
		Air Operator Certification

5. OPERATIONS IN LIEU OF AN APPROVED DEICING/ANTI-ICING PROGRAM.

- 5.1. Per ANR.OPS.394 a certificate holder may continue to operate without an approved ground deicing/anti-icing program if it has approved procedures and properly trained personnel for conducting a pretakeoff contamination check. The certificate holder's operations specifications must contain the authorization for conducting this check in lieu of an approved program. As stated in ANR.OPS 516 this check is accomplished when conditions are such that frost, ice, or snow may reasonably be expected to adhere to the aircraft. The check must be completed within 5 minutes before beginning takeoff and from outside the aircraft. Certificate holder's manuals and training programs should detail procedures for accomplishing this check.



**APPENDIX 1. SAMPLE HOLDOVER TIME TABLES
TYPE I HOLDOVER TIME GUIDELINE**

TABLE 1. GUIDELINE FOR HOLDOVER TIMES ANTICIPATED FOR SAE TYPE I FLUID MIXTURE AS A FUNCTION OF WEATHER CONDITIONS AND OAT.

CAUTION: THIS TABLE IS FOR USE IN DEPARTURE PLANING ONLY AND SHOULD BE USED IN CONJUNCTION WITH PRE-TAKEOFF CHECK PROCEDURES.

Approximate Holdover Times Under Various Weather Conditions (hours:minutes)								OAT	
Other [‡]	Rain on Cold Soaked Wing	Light Freezing Rain	**Freezing Drizzle	Moderate Snow ^{°°}	Light Snow ^{°°}	Freezing Fog	Frost*	°F	°C
CAUTION: No holdover time guidelines exist	0:02 - 0:05	0:02 - 0:05	0:09 - 0:13	0:06 - 0:11	0:11 - 0:16	0:11 - 0:17	0:45	above 27	above -3
	CAUTION: Clear ice may require touch for confirmation	0:02 - 0:05	0:07 - 0:10	0:05 - 0:08	0:08 - 0:13	0:08 - 0:14	0:45	27 to 21	-3 to -6
		0:02 - 0:05	0:05 - 0:08	0:04 - 0:06	0:06 - 0:10	0:06 - 0:10	0:45	20 to 14	-7 to -10
				0:02 - 0:04	0:04 - 0:06	0:05 - 0:09	0:45	below 14	below -10

= Outside Air Temperature
= Freezing Point

OAT = Degrees Celsius °C
FP = Degrees Fahrenheit °F

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

- * During conditions that apply to aircraft protection for ACTIVE FROST
- ** Use light freezing rain holdover times if positive identification of freezing drizzle is not possible
- ‡ Heavy snow, snow pellets, ice pellets, moderate and heavy freezing rain, hail

°° TO USE THESE TIMES, THE FLUID MUST BE HEATED TO A MINIMUM TEMPERATURE OF 60°C (140°F) AT THE NOZZLE AND AT LEAST 1 LITER/M² (≈ 2 GALS/100FT²) MUST BE APPLIED TO DEICED SURFACES

SAE Type I fluid/water mixture is selected so that the FP of the mixture is at least 10 °C (18 °F) below OAT.

CAUTIONS:

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



**APPENDIX 1. SAMPLE HOLDOVER TIME TABLES (CON'T)
TYPE II HOLDOVER TIME GUIDELINE**

TABLE 2 - Guideline for Holdover Times Anticipated for SAE Type II Fluid Mixtures as a Function of Weather Conditions and OAT.

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

Approximate Holdover Times under Various Weather Conditions (hours: minutes)							SAE Type II Fluid Concentration Neat-Fluid/Water (Vol. %/Vol. %)	OAT		
Other [‡]	Rain on Cold Soaked Wing	Light Freezing Rain	Freezing Drizzle***	Snow [⊙]	Freezing Fog	Frost*		°F	°C	
CAUTION: No holdover time guidelines exist	0:05-0:40	0:15-0:30	0:30-0:55	0:20-0:55	0:35-1:30	12:00	100/0	above 32	above 0	
	0:05-0:25	0:10-0:25	0:20-0:45	0:15-0:40	0:25-1:00	6:00	75/25			
	CAUTION: Clear ice may require touch for confirmation	0:05-0:10	0:05-0:15	0:05-0:15	0:05-0:15	0:15-0:30	4:00	50/50	32 to 27	0 to -3
		0:15-0:30	0:30-0:55	0:20-0:45	0:35-1:30	8:00	100/0			
		0:10-0:25	0:20-0:45	0:15-0:30	0:25-1:00	5:00	75/25			
		0:05-0:10	0:05-0:15	0:05-0:15	0:15-0:30	3:00	50/50			
	**0:10-0:25	**0:15-0:45	0:15-0:35	0:20-1:05	8:00	100/0	below	below		
**0:10-0:20	**0:15-0:30	0:15-0:25	0:20-0:55	5:00	75/25	27 to 7	-3 to -14			
			0:15-0:30	0:15-0:20	8:00	100/0	below 7 to -13	below -14 to -25		
SAE Type II fluid may be used below -25 °C (-13 °F) provided the freezing point of the fluid is at least 7 °C (13 °F) below the OAT and the aerodynamic acceptance criteria are met. Consider use of SAE Type I when SAE Type II fluid cannot be used.							100/0	below -13	below -25	

°C = Degrees Celsius OAT = Outside Air Temperature
°F = Degrees Fahrenheit VOL = Volume

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

- * During conditions that apply to aircraft protection for ACTIVE FROST
- ** No holdover time guidelines exist for this condition below -10 °C (14 °F)
- *** Use light freezing rain holdover times if positive identification of freezing drizzle is not possible
- ‡ Snow pellets, ice pellets, heavy snow, moderate and heavy freezing rain, hail
- ⊙ Snow includes snow grains

CAUTIONS:

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

NOTE: Type III fluids are no longer used in the. Therefore, Table 3 is currently not offered.



**APPENDIX 1. SAMPLE HOLDOVER TIME TABLES (CON'T)
TYPE IV HOLDOVER TIME GUIDELINE**

TABLE 4 - Guideline for Holdover Times Anticipated for SAE Type IV Fluid Mixtures as a Function of Weather Conditions and OAT.

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

Approximate Holdover Times under Various Weather Conditions (hours: minutes)							SAE Type IV Fluid	OAT	
Other [‡]	Rain on Cold Soaked Wing	Light Freezing Rain	Freezing Drizzle ^{***}	Snow [⊙]	Freezing Fog	Frost [*]	Concentration Neat-Fluid/Water (Vol. %/Vol. %)	°F	°C
CAUTION: No holdover time guidelines exist	0:10-0:50	0:25-0:40	0:40-1:10	0:35-1:05	1:05-2:15	18:00	100/0	above 32	above 0
	0:05-0:35	0:15-0:30	0:35-0:50	0:30-1:05	1:05-1:45	6:00	75/25		
	CAUTION: Clear ice may require touch for confirmation	0:05-0:10	0:10-0:20	0:05-0:20	0:15-0:35	4:00	50/50		
		0:25-0:40	0:40-1:10	0:30-0:55	1:05-2:15	12:00	100/0	32 to 27	0 to -3
		0:15-0:30	0:35-0:50	0:25-0:50	1:05-1:45	5:00	75/25		
		0:05-0:10	0:10-0:20	0:05-0:15	0:15-0:35	3:00	50/50		
		**0:10-0:25	**0:20-0:45	0:20-0:40	0:20-1:20	12:00	100/0	below	below
		**0:10-0:20	**0:15-0:30	0:15-0:25	0:25-0:50	5:00	75/25	27 to 7	-3 to -14
			0:15-0:30	0:15-0:40	12:00	100/0	below	below	
							7 to -13	-14 to -25	
SAE Type IV fluid may be used below -25 °C (-13 °F) provided the freezing point of the fluid is at least 7 °C(13 °F) below the OAT and the aerodynamic acceptance criteria are met. Consider use of SAE Type I when SAE Type IV fluid cannot be used.							100/0	below -13	below -25

°C = Degrees Celsius OAT = Outside Air Temperature
°F = Degrees Fahrenheit VOL = Volume

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

- * During conditions that apply to aircraft protection for ACTIVE FROST
- ** No holdover time guidelines exist for this condition below -10 °C (14 °F)
- *** Use light freezing rain holdover times if positive identification of freezing drizzle is not possible
- ‡ Snow pellets, ice pellets, heavy snow, moderate and heavy freezing rain, hail
- ⊙ Snow includes snow grains

CAUTIONS:

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

APPENDIX 2. AIRCRAFT DEICING/ANTI-ICING TRAINING ROSTER

AIRCRAFT DEICING/ANTI-ICING TRAINING ROSTER

DATE _____ LOCATION _____ COURSE NUMBER _____

EMPLOYEE NAME (PRINT)	EMPLOYEE CLASSIFICATION	EMPLOYEE NUMBER OR SIGNATURE	COMPANY	STATION	COURSE RESULT	TRAINING HOURS	SIGNATURE OF INDIVIDUAL COMPLETING COURSE
1.							
2.							
3.							
4.							
5.							
6.							
7.							
8.							
9.							
10.							
11.							
12.							

SAMPLE

INSTRUCTOR (1) NAME _____ SIGNATURE _____ EMPLOYEE NUMBER _____	INSTRUCTOR (2) NAME _____ SIGNATURE _____ EMPLOYEE NUMBER _____
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APPENDIX 3. STATION DEICING/ANTI-ICING FORM

STATION DEICING/ANTI-ICING FORM

DEICING PROVIDER/VENDOR _____ STATION _____

FLIGHT DATE	AIRCRAFT REGISTRATION NUMBER	WEATHER CONDITION AT TIME OF DEICING	OUTSIDE TEMPERATURE IN °C	TYPE I FLUID FREEZE POINT IN °C	NOTE THE _____% GLYCOL MIXTURE <input type="checkbox"/> TYPE II <input type="checkbox"/> TYPE IV	SPECIFY LOCAL START TIME OF FINAL FLUID APPLICATION	SIGNATURE OR EMPLOYEE NUMBER OF THE PERSON CONFIRMING THAT THE AIRCRAFT IS FREE OF CONTAMINANTS AND ALL REQUIRED INSPECTIONS, INCLUDING AIRCRAFT SPECIFIC, HAVE BEEN COMPLETED
1.							
2.							
3.							
4.							
5.							
6.							
7.							
8.							
9.							
10.							
11.							
12.							

SAMPLE

**ESTABLISH VERBAL COMMUNICATION WITH FLIGHT CREW PRIOR TO DEICING.
THE INFORMATION IN COLUMNS WITH BOLD OUTLINE MUST BE COMMUNICATED TO FLIGHT CREW AFTER DEICING AND/OR ANTI-ICING HAS BEEN COMPLETED**