



GHANA
CIVIL AVIATION AUTHORITY

ADVISORY CIRCULAR

AC 09-012

APPLICATION & PROCESS: GROUND DEICING PROGRAM

SECTION 1 POLICY & GENERAL INFORMATION

1.1 PURPOSE

- A. The purpose of this advisory circular (AC) is to provide guidance to aircraft operators seeking Ghana Civil Aviation Authority (GCAA) approval for operations requiring ground deicing and anti-icing program for safety operation.
- B. This advisory circular also provides the basis by which an operator, with an approved ground deicing and anti-icing program, may deice and anti-ice their aircraft using another operators's ground deicing and anti-icing program that has been approved by the national civil aviation authorities.

1.2 STATUS OF THIS AC

This AC is an original issuance.

1.3 BACKGROUND

- A. There have been a significant number of accidents and near-accidents which have been attributed to the failure to deice the aircraft prior to takeoff.
- B. There are now standardized international safety practices to ensure that aircraft are properly deiced prior to takeoff.
- C. The GCAA is obligated to ensure that Ghana operators that fly into areas and aerodromes where they may encounter icing conditions during takeoff have—
 - 1) An approved ground deicing program with adequate policy and procedures;
 - 2) Trained personnel and service providers; and
 - 3) Adequate arrangements at all aerodromes where ground deicing may be required.

1.4 APPLICABILITY

The requirement for an operator to have GCAA approval before conducting operations involving ground deicing applies to Ghana operators of—

- 1) Large and turbine-engine aircraft in general aviation; and
- 2) Any aircraft operated in commercial air transport.

- Advisory Circulars are intended to provide advice and guidance to illustrate a means, but not necessarily the only means, of complying with the directives, or to explain certain regulatory requirements by providing informative, interpretative and explanatory material.
- Where a directive contains the words “prescribed by the Authority,” the AC may consider to “prescribe” a viable method of compliance, but status of that “prescription” is always “guidance” (never a directive).

1.5 RELATED DIRECTIVES

- GCADs Part 08 includes the requirements for ground deicing program
- GCADs Part 09 includes the requirements for GCAA approval of a ground deicing program

1.6 RELATED PUBLICATIONS

A. International Civil Aviation Organization (ICAO)—

- Document 9640, Aircraft Ground Deicing/ Anti-Icing

Copies may be obtained from Document Sales Unit, ICAO, 999 University Street, Montreal, Quebec, Canada H3C 5H7.

B. International Standards Organization (ISO)—

- ISO 11075, Aerospace-Aircraft Deicing/Anti-Icing Newtonian Fluids ISO Type I.
- ISO 11076, Aerospace-Aircraft Deicing/Anti-Icing Methods with Fluids.
- ISO 11078, Aerospace-Aircraft Deicing/Anti-Icing Non-Newtonian Fluids ISO Type II.

Copies may be obtained from American National Standards Institute, 11 West 42nd Street, New York, New York, 10036, (212) 642-4900.

C. 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"

D. United States Federal Aviation Administration—

- Annually issued Deicing Holdover Tables (refer to Appendix A)
- AC 20-117, Hazards Following Ground Deicing and Ground Operations in Conditions Conducive to Aircraft Icing.
- AC 120-58, Pilot Guide for Large Aircraft Ground Deicing.

This publication can be found on the following Web site: <http://www.faa.gov>. Select "advisory circulars" then search for "deicing/anti-icing"

1.7 ACRONYMS & DEFINITIONS

1.7.1 DEFINITIONS

The following definitions apply to this advisory circular—

- 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—
 - (a) SAE Type I fluid;
 - (b) Concentrates or mixtures of water and SAE Type I fluid;
 - (c) Concentrates or mixtures of water and SAE Type II fluid
 - (d) Concentrates of SAE Type III fluid;
 - (e) Concentrates or mixtures of water and SAE Type IV fluid.
- 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—

- (a) Heated water;
 - (b) SAE Type I fluid;
 - (c) Heated concentrates or mixtures of water and SAE Type I fluid;
 - (d) Heated concentrates or mixtures of water and SAE Type II fluid;
 - (e) Heated concentrates or mixtures of water and SAE Type III fluid; or
 - (f) Heated concentrates or mixtures of water and SAE Type IV fluid.
- 3) **Frozen Contaminants.** As used in this AC, frozen contaminants include light freezing rain, freezing rain, freezing drizzle, frost, ice, ice pellets, snow, snow grains, and slush.
 - 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 application of deicing/anti-icing fluid commences and expires when the deicing/anti-icing fluid loses its effectiveness.
 - 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 GCAA-approved program.
 - 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 operator'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 operator's GCAA-approved program specifies otherwise.
 - 7) **Post Deicing Check.** A check, after deicing application, to ensure all aircraft surfaces are free of frozen contaminants.

1.7.2 ACRONYMS & ABBREVIATIONS

The following acronyms apply to this advisory circular—

- 1) **AC** – Advisory Circular
- 2) **AOC** – Air Operator Certificate
- 3) **ATC** – Air Traffic Control
- 4) **GCADs** – Ghana Civil Aviation Directives
- 5) **HOT** – Holdover Time
- 6) **ISO** – International Safety Standards
- 7) **MEL** – Minimum Equipment List
- 8) **SAE** – Society of Automotive Engineers

SECTION 2 OPERATIONAL APPROVAL PROCESS

2.1 GENERAL INTERNATIONAL REQUIREMENTS

2.1.1 COMPLETE CERTIFICATION REQUIREMENTS

Prior to operating a civil aircraft of Ghana registry in airspace in weather conditions that will require ground deicing for takeoff must first—

- 1) Satisfactorily complete the process for granting of the authorization;

- 2) Obtain an approval document for the specific aircraft or fleet from GCAA.

2.1.2 CERTIFICATION EVALUATION REQUIRED

In making this certification evaluation, GCAA shall take into account the—

- 1) Areas of operations;
- 2) Suitability of the aircraft for such operations;
- 3) Qualifications of the personnel involved;
- 4) Adequacy of the operator's policy and procedures.

2.1.3 CRITERIA FOR GRANTING THE APPROVAL DOCUMENT

GCAA shall be satisfied that the—

- 1) Operator has developed adequate process with supporting policy and procedures for dissemination to the personnel that will be involved in ground deicing;
- 2) Operator has instituted ground deicing procedures in the operations manual for takeoff and landing operations in weather conditions that required ground deicing; and
- 3) Operator has ensured that all company and service provider personnel are qualified for the proposed ground deicing program.

2.2 GENERAL GHANA REQUIREMENTS

2.2.1 CERTIFICATION PROCESS

- A. While all certification proceeds through the same 5-phase process, whether is a single document or a completely new airline, the lines between the phases blur in a simple certification.
- B. Granting of ground deicing program approval is a simple process. The applicant will provide the required formal application as prescribed by GCAA.
- C. The certification team will then accomplish the document conformance.
- D. Document conformance is considered complete when all submitted documents have been—
 - 1) Evaluated;
 - 2) Found to be acceptable for use in aviation; and
 - 3) Issued a formal instrument of approval or acceptance.

2.2.2 INSPECTION & DEMONSTRATION

- A. The specific station will to be used will be inspected for communications equipment capability and reliability.
- B. If there is any doubt that the operator's personnel and equipment may not be capable of implementing the ground deicing program, the applicant will be issued an LOA to demonstrate an actual operation under the close supervision of GCAA inspector personnel.

2.2.3 FINAL CERTIFICATION ACTIONS

- A. This is the period of time that GCAA completes the necessary documentation to formalize the approval of the applicant for ground deicing in specific aircraft type(s) and, if necessary, in specific areas and aerodromes.
- B. That approval will be in the form of—

- 1) For general aviation operators of large and turbine-engined aircraft; an LOA valid for a period of 24 months; and
- 2) For AOC holders, a revision to the—
 - (a) Master (formal) opsspecs; and
 - (b) Aircraft Display opsspecs (for each type of aircraft).

SECTION 3 CONTENTS OF FORMAL APPLICATION PACKAGE

3.1 GENERAL REQUIREMENTS

The following documents will be provided by the operator—

- 1) Letter of request for approval of an ground deicing program;
- 2) Proposed Deicing Program Manual;
- 3) Proposed amendment to the Flight Operations Manual, if applicable;
- 4) Proposed amendment to the Flight Training Program Manual integrating the deicing training elements;
- 5) Proposed amendment to the Station Operations Manual, if applicable, to incorporate the ground deicing program;
- 6) Proposed qualification training of station personnel and/or service providers;
- 7) Proposed amendment the Quality Assurance Program to incorporate the auditing of the ground deicing process;
- 8) Proposed forms and checklists to be used by operator and service provider personnel.

3.2 FOR AIRCRAFT TYPE-SPECIFIC

The following documents must be submitted for each aircraft type—

- 1) Proposed type-specific amendment to the Aircraft Operating Manual (Standard Operating Procedures), if applicable;
- 2) Proposed Minimum Equipment List (MEL) revisions for ground deicing, if applicable;

SECTION 4 ELEMENTS OF AN ACCEPTABLE DEICING PROGRAM

An operators ground deicing and anti-icing program to include the following elements—

4.1 MANAGEMENT PLAN

- A. 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 operator should develop, coordinate with other affected parties, implement, and use a management plan for proper execution of its approved deicing/anti-icing program.
- B. A plan encompassing the following elements is acceptable—
 - 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.

- 2) **Implementation.** At each airport, determine who is responsible for implementation of the ground deicing/anti-icing procedures, including adequate qualified personnel and equipment.
- 3) **Incorporation In Manuals.** A detailed description of the deicing/anti-icing program should be incorporated in the operator's manuals for flight crew members, 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) **Coordination.** At each airport, a winter operations plan should be developed to include coordination with ATC and the appropriate airport authorities.
- 5) **Application Procedures.** In an appropriate manual, operators 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 operator's program, do not require additional training and qualification to deice and anti-ice similar aircraft operated by another operator with a deicing and anti-icing program also approved in accordance with the published deicing safety standards and training.
 - ◆ However, specific training is needed for an operator's deicing personnel to deice aircraft with different configurations (e.g., turboprop with t-tail).
- 6) **HOT Tables and Procedures for Their Use.** An approved deicing/anti-icing program include HOT tables and the procedures for the use of these tables by the operator's personnel.

4.2 PROCEDURES

The following elements should be included in the approved program—

- 1) **Responsibilities and Procedures.** The operator's program should define operational responsibilities and contain procedures for the flight crew, 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.
 - (a) Procedures should be developed to address deicing operations at specific deicing locations (e.g., gate, remote, or centralized facilities).
 - (b) Procedures should be developed for ground crew and flight crew to communicate
 - (i). During aircraft positioning (if required);
 - (ii). Other pertinent information regarding the deicing/anti-icing process;
 - (iii). Start of the HOT;
 - (iv). The aircraft departure process;
 - (v). Equipment clear/job done – safe to start taxiing.
- 2) In addition, procedures should be developed for the flight crew's use of the pertinent HOT tables, coordination with dispatchers or flight followers and coordination with ATC.

4.3 HOLDOVER TABLES

- A. Unless the operator is approved for operations without a ground deicing program, they are required to implement HOT tables for use by its personnel.
 - These HOT tables are published annually 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.

- B. HOTs that exceed those specified the manufacturer's specific HOT of approved fluids are not acceptable. However, the operator may require the use of more conservative times than those specified in the tables authorized for use by the GCAA.

- ◆ Tables 1 and 2 of Appendix B are samples of HOT tables.

4.4 USE OF HOT TABLES

- A. 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.
- B. 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).
- C. 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).
- D. The HOT tables are to be used for departure planning and in conjunction with pretakeoff check procedures.

SECTION 5 FROZEN CONTAMINANTS ON THE AIRCRAFT

As required by GCAD Part 10, the aircraft must be free of all frozen contaminants adhering to the wings, control surfaces, propellers, engine inlets, or other critical surfaces before takeoff.

5.1 IDENTIFICATION OF CRITICAL AIRCRAFT SURFACES

- A. 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.
 - 1) Generally, the following should be considered to be critical aircraft surfaces, if the aircraft manufacturer's information is not available—
 - (a) 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;
 - (b) Wings, empennage, and control surfaces;
 - (c) Fuselage upper surfaces on aircraft with center mounted engine(s).
 - 2) Operators 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 crew member-conducted preflight inspections, pretakeoff checks, and pretakeoff contamination checks.
 - 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.

5.2 IDENTIFICATION OF REPRESENTATIVE AIRCRAFT SURFACES

- A. For each type of aircraft operated, operators should list, in an appropriate manual, the representative surfaces that may be checked while conducting pretakeoff checks.

The guidance in this Section is for use in conducting pretakeoff checks only.

- B. Some aircraft manufacturers have identified certain aircraft surfaces that the flight crew 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.
- C. When identifying a representative aircraft surface, the following guidelines should be considered:
 - 1) The surface can be seen clearly to determine whether or not frozen contaminants are forming or accumulating on the surface;
 - 2) The surface should be unheated;
- D. During the deicing/anti-icing procedure, the representative surface should be one of the first surfaces treated with deicing/anti-icing fluid.

5.3 RECOGNITION TECHNIQUES

- A. Operator's Initial, Transition, Recurrent, Upgrade, Continuing Qualification training curricula should include aircraft type-specific techniques for use by the flight crew and other personnel for recognizing contamination on aircraft surfaces.
- B. The flight crew and other personnel should use these type-specific techniques while conducting—
 - 1) Preflight aircraft icing checks;
 - 2) Pretakeoff checks; and
 - 3) Pretakeoff contamination checks.

Frozen contaminants can take the form of ice, frost, snow, or slush.

- The formation of clear ice may be difficult to detect visually.
- Specific techniques for identification of clear ice should be included in all training programs.

SECTION 6 TYPES OF ICING CHECKS

This Section outlines the pretakeoff and pretakeoff contamination checks that are required to be accomplished under an 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.

6.1 PRETAKEOFF CHECK (WITHIN THE HOT)

- A. This check is required anytime procedures for the use of HOT are required.
 - The flight crew must accomplish the check within the HOT.
 - The flight crew 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 AC.
- B. Because of the limitations and cautions associated with the use of HOTs, the flight crew 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.

The GCAA recommends that only the flight crew accomplish the pretakeoff check.

The pretakeoff check is integral to the use of HOTs.

- 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.
- C. The flight crew 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 flight crew must factor in the application sequence (i.e., where on the aircraft the deicing process began).

6.2 PRETAKEOFF CONTAMINATION CHECK (WHEN HOT HAS BEEN EXCEEDED)

- A. Completing a pretakeoff contamination check is one of the conditions that allows a takeoff after a HOT has been exceeded.
- B. When a HOT has been exceeded, operators must have appropriate pretakeoff contamination check procedures for the flight crew's and/or other qualified ground personnel's use to ensure that the aircraft's critical surfaces remain free of frozen contaminants.
- This check must be accomplished from outside the aircraft unless the operator'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.
- C. The following should be considered while developing procedures for this check—
- 1) Unless otherwise authorized in the operator's approved program, operators 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.
 - 2) The pretakeoff contamination check for these aircraft should include a method, approved by the GCAA; to determine that all aircraft surfaces are free of contaminants.
- D. Operators of aircraft other than those addressed in paragraph C1 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 operator's program.
- The program must detail procedures and requirements for this check.
- E. When developing a program for conducting the pretakeoff contamination check from inside the aircraft, operators should consider if crew members are able to see enough of the wings, control surfaces, and other surfaces to determine whether or not they are free of contaminants.
- F. 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.



Flight crews and/or other qualified ground personnel must complete the pretakeoff contamination check within 5 minutes before beginning takeoff.

6.3 POST DEICING/ANTI-ICING CHECK

- A. This multi-part check is an integral part of the deicing/anti-icing process. The check ensures that—

- 1) All critical surfaces are free of adhering frozen contaminants after deicing;
- 2) All critical surfaces are free of frozen contaminants before the application of any anti-icing fluid;
- 3) All critical surfaces are free of frozen contaminants before pushback or taxi.

- Operators 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.

6.4 COMMUNICATIONS

6.4.1 GENERAL

- A. Communication between ground personnel and the flight crew prior to commencing deicing/ anti-icing operations is critical.
- B. Upon completion of deicing/anti-icing operations, ground personnel should communicate with the flight crew to determine the start of the HOT.
 - The particular HOT the flight crew uses is also critical.

6.4.2 STANDARDIZED FLOW SEQUENCE

- A. Since many deicers service multiple carriers, the GCAA recommends that all approved programs include the following flow sequence and information to provide standardized phraseology.
- B. Before commencing deicing/anti-icing operations, ground personnel and the flight crew should review the following (as applicable)—
 - 1) Deicing/anti-icing prior to crew arrival;
 - 2) Gate or remote deicing/anti-icing procedures;
 - 3) Aircraft-specific procedures;
 - 4) Communications between ground personnel and the flight crew.
- C. Just before commencing the application of deicing/anti-icing fluid, ground personnel should confirm with the flight crew that the aircraft is properly configured for deicing, as follows—
 - “CAPTAIN, IS YOUR AIRCRAFT READY FOR DEICING/ANTI-ICING?”

6.4.3 POST-DEICING BRIEFING

Upon completion of deicing/anti-icing, provide the flight crew with the following elements—

- 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;
 - Transmission of the first 3 of these elements to the flight crew confirms that a post deicing/anti-icing check was completed and the aircraft is clean.
- 2) Fluid/water mix ratio by volume of Types II, III, and IV. Reporting the concentration of Type I fluid is not required.
- 3) Specify, in local time (hours and minutes) the beginning of the final fluid application (e.g. 1330).
- 4) Post application check accomplished. Specify date (day, written month, year).
 - Element 4 is required for record-keeper, optional for crew notification.

6.4.4 EXAMPLE OF POST-DEICING BRIEFING

Examples of the ground/flight crew communication sequence for the one and two-step processes follow—

- 1) One Step Process with Type I or other approved deicing fluid—

■“CAPTAIN, I AM YOUR DESIGNATED DEICER. YOUR AIRCRAFT HAS BEEN DEICED WITH TYPE I FLUID. YOUR FLUID APPLICATION BEGAN AT 1430.”

- 2) 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 1645.

SECTION 7 INITIAL/RECURRENT GROUND TRAINING & QUALIFICATION

7.1 TRAINING PROGRAMS: GENERAL

Each operator’s approved program must consist of the following—



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

7.1.1 TRAINING PROGRAMS

- A. Operators must conduct initial and annual recurrent training for flight crews, 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.
- B. Flight crew, 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.

7.1.2 RECORDS OF QUALIFICATION

The program should have a tracking system that records all required personnel have been satisfactorily trained. operators shall maintain records of personnel training and qualification (refer to Appendix C) for proof of qualification.

7.1.3 ADDITIONAL SAFETY REQUIREMENTS

- A. Flight crew and ground personnel must be able to adequately read, speak, and understand English (or another acceptable common language) in order to follow written and oral procedures applicable to the deicing/anti-icing program.
- B. When the anti-icing fluids are used, the flight crews should be made aware of any unusual flying qualities, such as the need for additional takeoff rotation stick-force.
- C. Flight crew, 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.

7.2 TRAINING ELEMENTS

- A. Operators should train and qualify flight crew, dispatcher, and ground personnel on at least the following subjects in this Section
- B. Those subject limited to specific technical specialities are identified immediately after the training element as—
 - F=Flight crew

- D=Dispatcher
- G=Ground Personnel (G):

7.2.1 EFFECTS OF FROZEN CONTAMINANTS ON AIRCRAFT SURFACES

- A. Provide an understanding of the critical effect the presence of minute amounts of frost, ice, or snow has on flight surfaces.
- B. This discussion should include, but is not limited to—
 - 1) Loss of lift;
 - 2) Increased drag and weight;
 - 3) Decreased control;
 - 4) Tendency for rapid pitch-up and roll-off during rotation (F/D only);
 - 5) Stall occurs at lower-than-normal angle of attack (F/D only);
 - 6) Buffet or stall occurs before activation of stall warning (F/D only);
 - 7) Aircraft specific areas:
 - (a) Engine foreign object damage potential;
 - (b) Ram air intakes;
 - (c) Instrument pickup points;
 - (d) Leading edge device (LED) aircraft (aircraft that have slats or leading edge flaps) and non-LED aircraft;
 - (e) Airworthiness Directives/Specific inspections; and
 - (f) Winglets.

7.2.2 AIRCRAFT GROUND ICING CONDITIONS

- A. Describe conditions that cause implementation of deicing/anti-icing procedures (F/D/G).
 - 1) In-flight Ice Accumulation'
 - ◆ Operators should have procedures for flight crews on arriving flights to report occurrences of in-flight icing to the personnel responsible for executing the operator'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).
 - 2) Frost, including hoarfrost;
 - 3) Freezing precipitation (snow, freezing rain, freezing drizzle, or hail, which could adhere to aircraft surfaces);
 - 4) Freezing fog;
 - 5) Rain or high humidity on cold soaked wing;
 - 6) Rain or high humidity on cold soaked wing fuel tanks;
 - 7) Under-wing frost (may not require deicing/anti-icing within certain limits);
 - 8) Fluid failure identification;
 - 9) Location specific deicing/anti-icing procedures (F/D and/or G, as appropriate)

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



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

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

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

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

7.2.3 FLUID STORAGE AND HANDLING (G)

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

7.2.4 DEICING/ANTI-ICING FACILITIES & EQUIPMENT OPERATION PROCEDURES (G).

- A. An understanding of the capabilities of the deicing equipment and the qualifications for operation.
- B. The equipment portion of the training program should include the following—
- 1) Description of Various Equipment Type—
 - (a) Deicing vehicles
 - (b) Infrared facilities
 - (c) Hard stands
 - 2) Operation of the equipment
 - 3) Emergency procedures.
- C. Health, Safety, and First Aid (F/D/G).
- D. Environmental Considerations (G).
- E. Fluid Selection (F/D/G).

- F. Service Provider Deicing/Anti-icing (F/D/G). Train-the-trainer (per the approved program).
- G. Methods/Procedures (F/D/G).
 - 1) Inspection of critical surfaces
 - 2) Clear ice precautions
 - 3) Flight crew/ground crew preflight check requirement
 - 4) Deicing/anti-ice determination
 - 5) Deicing/anti-ice location
 - 6) Communication before deicing/anti-icing
 - 7) General deicing/anti-ice precautions
 - 8) Aircraft specific requirements
 - 9) Deicing—
 - (a) Requirements
 - (b) Effective removal of frost, snow, and ice (G).
 - 10) Anti-icing—
 - (a) Requirements
 - (b) Preventative anti-icing (G)
 - (c) Application (G).
 - 11) Deicing/anti-icing—
 - (a) One step
 - (b) Two step.
 - 12) Guidelines for the application of deicing/anti-icing fluids
 - 13) Post deicing/anti-icing checks requirement.
 - 14) Flight control check
 - 15) Communications after deicing/anti-icing
 - 16) Use of the deicing/anti-icing log (refer to Appendix D).

7.2.5 USE OF HOTs (F/D/G)

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

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

- 9) Adjusting HOT for changing weather conditions (F/D).
- A. Pretakeoff Check Requirement (F/D)
- B. Identification of representative surfaces
- C. Pretakeoff Contamination Check Requirement (F/D/G). Communications.
- D. Aircraft Surface Contamination Recognition (F/D/G).

SECTION 8 OPERATIONS IN LIEU OF AN APPROVED PROGRAM

- A. An operator 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.
- B. The operator's operations specifications must contain the authorization for conducting this check in lieu of an approved program.
- C. This check is accomplished when conditions are such that frost, ice, or snow may reasonably be expected to adhere to the aircraft.
- D. The check must be completed within 5 minutes before beginning takeoff and from outside the aircraft.
- E. Operator's manuals and training programs should detail procedures for accomplishing this check.

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APPENDIX A

Resource: Current FAA Holdover Time Tables

The United States Federal Aviation Administration annually publishes the most up-to-date tabulated data for holdover tables. They are accessible by going to <http://www.faa.gov>. Search for “holdover tables” The front cover of the holdover tables will appear as shown below:

This document also contains—

- Holdover times for specific types of deicing and anti-icing fluids
- FAA guidelines for the application of SAE TYPE II, TYPE III, and TYPE IV fluid mixtures minimum concentrations as a function of outside air temperature
- Lowest on-wing viscosity values for anti-icing fluids
- List of qualified deicing and anti-icing fluids
- Ice pellet allowance times



End of Appendix A

APPENDIX B

Example of Holdover Table

FAA TYPE I HOLDOVER TIME GUIDELINE

TABLE 1. FAA GUIDELINES FOR HOLDOVER TIMES SAE TYPE I FLUID MIXTURES AS A FUNCTION OF WEATHER CONDITIONS AND OUTSIDE AIR TEMPERATURE

CAUTION: THIS TABLE IS FOR DEPARTURE PLANNING ONLY AND SHOULD BE USED IN CONJUNCTION WITH PRETAKEOFF CHECK PROCEDURES.

Outside Air Temperature		Approximate Holdover Times Under Various Weather Conditions (hours: minutes)							
Degrees Celsius	Degrees Fahrenheit	Freezing Fog	Snow/Snow Grains			Freezing Drizzle [†]	Light Freezing Rain [†]	Rain on Cold Soaked Wing ^{**}	Other [‡]
			Very Light ^{**}	Light ^{**}	Moderate ^{**}				
-3 and above	27 and above	0:11-0:17	0:18-0:22	0:11-0:18	0:06-0:11	0:09-0:13	0:02-0:05	0:02-0:05	CAUTION: No holdover time guidelines exist
below -3 to -6	below 27 to 21	0:08-0:13	0:14-0:17	0:08-0:14	0:05-0:08	0:05-0:09	0:02-0:05		
below -6 to -10	below 21 to 14	0:06-0:10	0:11-0:13	0:06-0:11	0:04-0:06	0:04-0:07	0:02-0:05		
below -10	below 14	0:05-0:09	0:07-0:08	0:04-0:07	0:02-0:04				

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

- * Use light freezing rain holdover times if positive identification of freezing drizzle is not possible
- ** This column is for use at temperatures above 0 degrees Celsius (32 degrees Fahrenheit) only
- ‡ Heavy snow, snow pellets, ice pellets, moderate and heavy freezing rain, hail
- † Use light freezing rain holdover times in conditions of light snow mixed with light rain.

**** 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 freezing point 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 MAY REDUCE HOLDOVER TIME BELOW THE LOWEST TIME STATED IN THE RANGE. HOLDOVER TIME MAY BE REDUCED WHEN AIRCRAFT SKIN TEMPERATURE IS LOWER THAN OAT.
- SAE TYPE I FLUID USED DURING GROUND DEICING/ANTI-ICING IS NOT INTENDED FOR AND DOES NOT PROVIDE PROTECTION DURING FLIGHT.

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TABLE 1A. FAA GUIDELINES FOR THE APPLICATION OF SAE TYPE I FLUID MIXTURE MINIMUM CONCENTRATIONS AS A FUNCTION OF OUTSIDE AIR TEMPERATURE

Outside Air Temperature (OAT)	One-step Procedure Deicing/Anti-icing ¹	Two-step Procedure	
		First step: Deicing	Second step: Anti-icing ^{1,2}
-3 °C (27 °F) and above	Mix of fluid and water heated to 60 °C (140 °F) minimum at the nozzle, with a freezing point of at least 10 °C (18 °F) below OAT	Heated water or a mix of fluid and water heated to 60 °C (140 °F) minimum at the nozzle	Mix of fluid and water heated to 60 °C (140 °F) minimum at the nozzle, with a freezing point of at least 10 °C (18 °F) below OAT
Below -3 °C (27 °F)		Freezing point of heated fluid mixture shall not be more than 3 °C (5 °F) above OAT	

1) Fluids must only be used at temperatures above their lowest operational use temperature (LOUT).
2) To be applied before first-step fluid freezes, typically within 3 minutes.

Notes:

- Upper temperature limit shall not exceed fluid and aircraft manufacturers' recommendations.
- To use Type I holdover time guidelines in snow conditions, at least 1 liter per square meter (2 gal. Per 100 square feet) fluid must be applied to the deiced surfaces.
- This table is applicable for the use of Type I Holdover Time Guidelines. If holdover times are not required, a temperature of 60 °C (140 °F) at the nozzle is desirable.
- The lowest operational use temperature (LOUT) for a given Type 1 fluid is the higher 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).

Caution: Wing skin temperatures may differ and, in some cases, be lower than OAT. A stronger mix (more glycol) may be needed under these conditions.

TABLE 1B. SNOWFALL INTENSITIES AS A FUNCTION OF PREVAILING VISIBILITY

Time of Day	Temp.		Visibility (Statute Mile)							Snowfall Intensity
	Degrees Celsius	Degrees Fahrenheit	≥ 2 1/2	2	1 1/2	1	3/4	1/2	≤ 1/4	
Day	colder/equal -1	colder/equal 30	Very Light	Very Light	Light	Light	Moderate	Moderate	Heavy	
	warmer than -1	warmer than 30	Very Light	Light	Light	Moderate	Moderate	Heavy	Heavy	
Night	colder/equal -1	colder/equal 30	Very Light	Light	Moderate	Moderate	Heavy	Heavy	Heavy	
	warmer than -1	warmer than 30	Very Light	Light	Moderate	Heavy	Heavy	Heavy	Heavy	

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

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

BEAVY = Caution-No Holdover Time Guidelines Exist

End of Appendix B

APPENDIX C

Example of Deicing Qualification Records

The following example of a deicing qualification records is provided—

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 _____
--	--

End of Appendix C

APPENDIX D

Example of a Deicing Log

The following form is provided as an example of Deicing Log—

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"/> TYREN	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.							

**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**

End of Advisory Circular