GUIDANCE MATERIAL FOR OPERATORS

SOUTH AFRICAN CIVIL AVIATION AUTHORITY

DE-ICING PROGRAM

AIR OPERATOR CERTIFICATION

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1. RECORD OF AMENDMENTS

Amendment Number	Pages Affected	Date Amended	Approved By: Name	Signature
Reissue	All	28 February 2023	S Segwabe	

2. LIST OF EFFECTIVE PAGES

Revision No.: 4

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3. TERMS AND ABBREVIATIONS:

3.1. Terms

TERM	DEFINITION
Pre-take off Check	A pre-take off check is a check of the aircraft's wings or representative aircraft surfaces for frost, ice, or snow during the aircraft's holdover time (HOT).
Pre-take off Contamination Check	The flight-crew and ground personnel conduct a pre-take off contamination check after exceeding the HOT. They conduct this check to make sure that the wings, control surfaces, and other critical surfaces, as defined in the operator's program, are free of frost, ice, and snow. The pre-take off contamination check must be completed within 5 minutes before beginning the take off
Outside-the-Aircraft Check (OTAC)	For those operators without an approved program, if frost, ice, or snow may reasonably be expected to adhere to the aircraft, an OTAC must be performed to ensure that the wings, control surfaces, and other critical surfaces are free of contamination. An OTAC must occur within 5 minutes before beginning the take off .
Holdover Time (HOT)	Holdover time is the estimated time for which de-icing/anti-icing fluid will prevent the formation of frost or ice and the accumulation of snow on the treated surfaces of an aircraft. HOT begins when the final application of de-icing/anti-icing fluid starts and ends when the applied de-icing/anti-icing fluid loses its effectiveness.
De-icing	A procedure by which frost, ice, or snow is removed from the aircraft in order to provide clean surfaces.
Anti-Icing	A precautionary procedure that provides protection against the formation of frost or ice and accumulation of snow on treated surfaces of the aircraft for a limited period of time.
Outside the Aircraft Check	A check to ensure that the wings and control surfaces are free of frost, ice, and snow. It must be completed within 5 minutes prior to beginning take off. It must be accomplished from outside the aircraft.
OpSpec	?????

3.2. Abbreviations:

ABBREVIATION	DESCRIPTION
FAA	
FAR	
FOI's	
ICAO	International Civil Aviation Organization
ISO	
KT	Knots
NDoT	National Department of Transport
SACAA	South African Civil Aviation Authority
SACAR	South African Civil Aviation Regulation
SACM	
SAE	

CHAPTER 1

1. INTRODUCTION

This manual is for the use of Flight Operations Inspectors to ensure that they carry out their duties in accordance with the requirements of the Civil Aviation Authority as well as the recommendations of the ICAO and the practices of stakeholders in the international arena.

This manual, being a "living document, will as a result of new technology in aviation, legislative changes and changes in international best practice, will be revised and the revisions properly recorded in the relevant section of the manual.

Note: Reference has been made throughout this document to FAA Advisory Circular material. This will continue to be used until the SACAA has published its own advisory documentation.

1.1 GENERAL

1.1.1 The current regulations in the Civil Aviation Regulations parts 121 and 135 requires that operator that conducts operations under conditions that may produce frost, snow, or ice accumulation must have one or both of the following:

a) An approved aircraft de-icing program
b) An inspection program that ensures that aircraft are free of any accumulation of frost ice/snow before take-off

CHAPTER 2

2. APPROVAL PROCESS OF DE-ICING PROGRAM

2.1 APPROVAL PROCESS

2.1.1 **The** approval of an operator's de-icing/anti-icing program involves the following steps:

a) Reviewing the Operator's Program Submission: Both the A/W and the FOI initially review the proposed program to ensure that all required elements have been submitted. After the A/W and the FOI are satisfied that all the required elements are suitably addressed, they will both review the program.
b) Evaluating the Operator's Program Submission. Conduct a detailed analysis of the proposed program, training, equipment, and facilities.
c) Validation Testing. Validate the operator's performance during actual operations.

2.2 ISSUANCE OF OPERATIONS SPECIFICATION

At the conclusion of the process, the FOI with primary responsibility for this job task approves the OpSpecs. The OpSpecs authorize the operator to conduct operations under the program in ground icing conditions in which frost, ice, or snow may reasonably be expected to adhere to the operator's aircraft.

2.3 USE OF INFRARED DE-ICING FACILITIES

An operator wishing to use an infrared de-icing facility should ensure that the infrared de-icing system used by that facility meets the criteria presented in this chapter or provides an alternative, acceptable means of assuring the operational safety of the de-icing facility. Once an operator has determined that the infrared de-icing system to be used by a de-icing facility meets the criteria presented in this chapter, the operator should present their findings to the SACM office for review. Once SACAA (SACM) determines, from the findings presented, that the infrared de-icing system does meet all criteria, then the system may become part of the operator's ground de-icing/anti-icing program. Operators should use the following criteria for approving the use of infrared de-icing systems:

a) The operator should create an appropriate description of the system: hardware, energy source, markings, etc. In addition, the operator should ensure that:
   i. The infrared de-icing system performs its intended purpose (i.e., it effectively de-ices an aircraft).
   ii. The operation of infrared de-icing systems does not create a hazard to: Aircraft Ground personnel, as determined by appropriate Occupational Safety and Health Administration (OSHA) standards, crew members and passengers, cargo (sensitive materials, plants, animals, airport facilities (Navigation Aids, Antennas, Communication facilities, building, etc).

The infrared system submitted for approval is in agreement with appropriate industry standards as created by groups such as: the Society of Automotive Engineers (SAE), the International Standards Organization (ISO), FAA guidance (In a form of AC's and any additional published material), and SACAA published documents.

b) The method for approving the operational use of an infrared system should follow established guidelines set by industry groups, such as SAE, ISO, Air Transport Association (ATA), International Civil Aviation Organization (ICAO), and the General Aviation Manufacturers Association (GAMA). These guidelines should address:

   i. The training of flight crew, infrared equipment ground operator personnel, facility maintenance personnel, and de-icing/anti-icing ground personnel
   ii. The temperature of the aircraft surface, including thermal cyclic loading, thermal stresses, and temperature

extremes

iii. Melted ice flowing into aerodynamically quiet areas and refreezing additional de-icing and anti-icing requirements (Environmental Considerations)

2.4 PROPOSED METHODS OF DE-ICING AS COST EFFECTIVCE STRATEGY .

Given the cost of de-icing with conventional fluids and the recent demand for alternative de-icing methods, interest in infrared de-icing systems has increased. The SACAA encourages the development and use of alternative methods of de-icing such as infrared systems; however, it is necessary to ensure that infrared de-icing systems are used with the highest degree of safety. Consequently, the SACAA has developed general safety criteria for operators and inspectors to use in evaluating and approving the use of infrared de-icing systems in an operator's deice/anti-ice program.

2.5 USAGE OF INFRARED DE-ICING FACILITY

An operator wishing to use an infrared de-icing facility should ensure that the infrared de-icing system used by that facility meets the criteria, or provides an alternative, acceptable means of assuring the operational safety of the de-icing facility.

2.6 PROCEDURES

2.6.1 PREREQUISITES AND COORDINATION REQUIREMENTS

a) Prerequisites: Knowledge of the regulatory requirements of CAR parts 121, or 135, as applicable Successful completion of appropriate Airworthiness Indoctrination course(s)
b) Co-ordination: This task requires coordination with FOi, A/W and the operator.

2.6.2 REFERENCES, FORMS AND CHECKLISTS (References (current editions:)

a) Advisory Circular (AC) 20-73, Aircraft Ice Protection (see chapter 2, sections 3 and 4) (Published by the FAA)
b) AC 20-117, Hazards Following Ground De-icing and Ground Operations in Conditions Conducive to Aircraft Icing
c) Published by the FAA)
d) AC 23.1419-2, Certification of Part 23 Airplanes for Flight in Icing Conditions (Published by the FAA) AC 65-9, Airframe and Power plant Mechanics General Handbook (see chapter 11) (Published by the FAA) AC 65-15, Airframe and Power plant Mechanics Airframe Handbook (see chapter 7) (Published by the FAA) AC 91-6, Water, Slush, and Snow on the Runway (Published by the FAA)
e) AC 91-13, Cold Weather Operation of Aircraft (Published by the FAA)
f) AC 120-58, Pilot Guide for Large Aircraft Ground De-icing (Published by the FAA)
g) AC 120-60, Ground De-icing and Anti- Icing Program (Published by the FAA) AC 120-89, Ground De-icing Using Infrared Energy (Published by the FAA) AC 135-9, FAR Part 135 Icing Limitations (Published by the FAA)
h) AC 135-16, Ground De-icing and Anti-Icing Training and Checking (Published by the FAA)
i) AC 135-17, Pilot Guide - Small Aircraft Ground De-icing (Published by the FAA)
j) Aerospace Material Specifications (AMS) 1424, De-icing/Anti-Icing Fluid, Aircraft, SAE Type I
k) AMS 1428, Fluid, Aircraft De-icing/Anti-Icing Non-Newtonian, (Pseudo-Plastic}, SAE Types II, Ill, and IV Aerospace Recommended Practices (ARP) 4737, Aircraft De-icing/Anti-icing Methods.
l) ARP 5149, Training Program Guidelines for Icing/Anti-Icing of Aircraft on Ground
m) FAA Order 8400.10, Air Transportation Operations Inspector's Handbook, Volume 4, Chapter 8, Ground De-icing/Anti-Icing Programs
n) ISO 11075, Aerospace-Aircraft De-icing/ Anti-Icing Newtonian Fluids ISO type I ISO 11076, Aerospace-

Aircraft De-icing/ Anti-Icing Methods with Fluids

o) ISO 11077, Aerospace-Self Propelled De-icing/Anti-Icing Vehicles-Functional Requirements
p) ISO 11078, Aerospace-Aircraft De-icing/Anti-Icing Non-Newtonian Fluids, ISO Type II
q) Publications of the Association of European Airlines (AEA) found on
r) Website: http://www.aea.be/AEA Website/Presentation Tier/Pr_Home.asp x

Note: Numerous videos have been produced by manufacturers of de-icing/anti-icing products and by aircraft operators Access to these videos may be available through the regional de-icing/anti-icing coordinator.

2.6.3 Forms. None

2.6.4 Job Aids. None

CHAPTER 3

3. PROCEDURES FOR OPERATORS

3.1 BRIEFING OF THE OPERATOR

a) Assist the operator in acquiring all of the pertinent published information.

b) Ensure that the operator is familiar with the technical difficulties that may be involved and the regulatory requirements that must be met.

c) Outline for the operator those elements that must be contained in the operator's proposed program and the required actions at each stage of the approval process.

d) FOIs and A!Ws should inform the operators for which they have oversight responsibility of the process and criteria for approving infrared de-icing systems. The operators should be informed that it is their responsibility to evaluate any infrared de-icing system that they wish to use for their aircraft ground de-icing/anti-icing program.

3.2 REVIEW THE OPERATOR'S SUBMITTAL.

a) If the submission is incomplete, immediately inform the operator and determine if the operator intends to complete the package.

b) If the submission is complete, inform the operator and distribute the documents to the appropriate inspectors for initial examination.

c) If the package is unacceptable, discuss with the operator those elements that were unacceptable and/or return the package with a letter outlining the deficiencies.

d) Once an operator has determined that an infrared de-icing system meets the criteria, that operator should present its findings of the evaluation to its principal inspector.

3.3 EVALUATION OF OPERATORS DE-ICING AND ANTI ICING PROGRAM

3.3.1 Ensure that the manual provides all categories of employees with instructions and information that helps them to perform their duties with a high degree of safety Ensure that the operator's manual material includes the following:

a) Clear identification of each category of employee with responsibility for de-icing/anti-icing program elements.

b) Duty definition of each category of employee involved.

c) Background information and step-by-step procedures; and

d) Checklists, where appropriate, that will allow each category of employee to perform their responsibilities to the required standard.

3.3.2 To ensure that the program complies with the SACAR, each operator's ground de-icing/anti-icing program must cover a management plan detailing operational responsibilities and procedures as described in FAA document AC 120-60.

e) **Review Management Plan:** The operator should develop, implement, and use a management plan to

ensure proper execution of its approved de-icing/anti-icing program. The management plan should include operations and maintenance responsibilities and identify the management positions that are responsible for ensuring that all necessary elements of the de-icing/anti-icing program are properly executed.

f) **Examine Holdover Timetables and the Procedures for their Use**: Ensure that each operator has developed, and has available, holdover timetables for use by its personnel. In addition, each operator must make its holdover timetables available for use in the cockpit. These timetables are required to be supported by data acceptable to the Administrator's Evaluate the Operator's Training. Ensure that the operator has developed a training program that qualifies each category of employee with responsibilities for de-icing/anti-icing. Flight crew training must be incorporated into the operator's approved training program. The training program must include the following:
   i. General procedures and any specific requirements for each make, model, and variant of aircraft used by the operator.
   ii. Means of testing, qualification, and requalification for each category of employee involved in the program.
   iii. Demonstration of proficiency, by performance, of flight crewmembers, equipment operators, and inspectors.
   iv. Procedures for recurrent training

3.4 PROCEDURES FOR RECURRENT TRAINING

3.4.1 Determine if Operator's Program Meets Training Requirements of the SACAR on Ground De-icing Rule.

3.4.2 For operators required to have an approved training program, the training program must include pilot ground training in those subject areas relating to de-icing and anti-icing operations required by the CAR for initial, transition, and upgrade training and by the SACAR for recurrent training and testing.

3.4.3 These training requirements must include procedures for operating airplanes during ground icing conditions.

3.4.4 The operator must provide that training to its pilots and all other participating personnel. The training must include at least the following elements:

a) Use of HOTs: In part 135 operations, HOTs are only advisory and serve as guidance to the pilot in making take off decisions. If the operator uses the de-icing/anti-icing fluids, it must train its pilots in the use of HOTs.

b) De-icing/Anti-icing Procedures: Airplane de-icing/anti-icing procedures include inspections and check procedures, and responsibilities and requirements for the pre take off contamination check or alternative procedures, as applicable.

c) Communications: The operator must provide training for all company personnel in communicating with all agencies involved in the de-icing/anti-icing process and the decision-making process.

d) Contamination.: Aircraft surface contamination training includes how to identify frost, ice, or snow, and how to locate critical areas. Training should include an explanation of how small amounts of surface contamination adversely affect aircraft performance and flight characteristics.

e) De-icing/Anti-Icing Fluids: If the operator uses de-icing/anti-icing fluids, it must train its pilots, as well as any other participating personnel, in the types and characteristics of de-icing/anti-icing fluids.

Note: It is important that flight-crews do not use de-icing/anti-icing fluids unless they have been trained in the characteristics and effects of these fluids on their operation.

f) Cold Weather Pre-flight Inspection Procedures: Training should include procedures for cold weather pre-flight inspections.

g) Contamination Recognition: This aspect of training should cover techniques for recognizing contamination on the aircraft. These techniques should be used during both the pre-flight inspection and the pre-take off contamination check.

Note: Both part 121 and 135 operators must have documentation in their operations manuals for the procedures they intend to use to comply with their respective de-icing/anti-icing rule.

4 TASK OUTCOMES

4.1 TASK COMPLETION

4.1.1 Completion of this task will result in one of the following:

a) For Program Approval: Issuance of Ops Spec CI
b) For Program Disapproval: Listing of the results restriction in the OpSpecs.

4.2 TASK DOCUMENTING

4.2.1 File all of the supporting paperwork in the operator's office file.

4.3 FUTURE ACTIVITIES (Normal Surveillance)

APPENDIX "A"

1. GROUND DEICING AND ANTI-ICING PROGRAM

1.1 PURPOSE.

1.2 This advisory circular (AC) provides one means, but not the only means, for obtaining approval of a Ground De-icing and Anti-Icing Program, and for ensuring compliance with the Federal Aviation Regulations (FAR)

1.3 RELATED READING MATERIAL.

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

a) AC 20-117, Hazards Following Ground De-icing and Ground Operations in Conditions Conducive to Aircraft Icing
b) AC 120-58, Pilot Guide for Large Aircraft Ground De-icing.
c) FAA publication, Winter Operations Guidance for Air Carriers and Other Adverse Weather Topics
d) Publications of the Society of Automotive Engineers (SAE): Aerospace Materials Specification (AMS) 1424, "De-icing/Anti-Icing Fluid, Aircraft Newtonian - SAE Type I;" AMS 1428, "Fluid, Aircraft De-icing/Anti-Icing, Non-Newtonian, Pseudo-Plastic, SAE Type 11;" and Aerospace Recommended Practice (ARP) 4737, "Aircraft De-icing/Anti-Icing Methods with Fluids, for Large Transport Aircraft."
e) Publications of the Society of Automotive Engineers (SAE): Aerospace Materials Specification (AMS) 1424, "De-icing/Anti-Icing Fluid, Aircraft Newtonian - SAE Type I;" AMS 1428, "Fluid, Aircraft De-icing/Anti-Icing, Non-Newtonian, Pseudo-Plastic, SAE Type 11;" and Aerospace Recommended Practice (ARP) 4737, "Aircraft De-icing/Anti-Icing Methods with Fluids, for Large Transport Aircraft."
f) Publications of the International Standards Organization (ISO): ISO 11075, "Aerospace - Aircraft De-icing/Anti-Icing Newtonian Fluids ISO Type I;" ISO 11076, "Aerospace - Aircraft De-icing/Anti- Icing Methods with Fluids;" ISO 11077, "Aerospace De-icing/Anti-Icing Self Propelled Vehicles - Functional Requirements;" and ISO 11078, "Aerospace - Aircraft De-icing/Anti- Icing Non-Newtonian Fluids ISO Type II."

1.4 BACKGROUND

a) **Accidents Related to Icing**: According to information received in 1992 from the National Transportation Safety Board (NTSB), in the last 23 years there have been 15 accidents involving FAR Part 121 operators related to the failure to deice and/or anti-ice aircraft adequately before take-off. On March 22, 1992, an airplane operated by a U.S. air carrier crashed on take-off from LaGuardia Airport in a snowstorm during night-time operations. The NTSB determined that the probable causes of this accident were failure of the airline industry and the Federal Aviation Administration (FAA) to provide flight crews with procedures, requirements, and criteria compatible with departure delays in conditions conducive to airframe icing and the decision by the flight crew to take off without positive assurance that the airplane's wings were free of ice accumulation after prolonged exposure to precipitation following de-icing.

b) **Reassessment of Icing Procedures:** Prior to the LaGuardia accident, the FAA and the aviation community, in general, had placed priority on emphasizing the need during icing conditions. for the pilot in command (PIC) to ensure a "clean aircraft" before take-off. The FAA believed that pilot education appeared to be key to combating the threat of wing icing. The FAA still believes the PIC ultimately must make the decision on whether or not to take off, based on a thorough understanding of factors involved in aircraft icing; however, the FAA has determined that certificate holders conducting operations under FAR Part 121 must provide their PICs with pertinent information and operator developed procedures and criteria so that the PIC will be able to make a proper decision

c) **Content of this AC: Accordingly, this AC provides guidance about the program elements that should be** incorporated in an certificate holder's approved ground de-icing and anti-icing program. It provides guidance and suggestions about methods, but not the only methods, for complying with all pertinent regulations.

1.5 : PROGRAM ELEMENTS

1.5.1 An AOC certificate holder's ground de-icing and anti-icing program include at least the following elements:

a) Management plan including a detailed description of the operational responsibilities and procedures associated with the implementation and conduct of the certificate holder's ground de-icing/anti-icing program.
b) A certificate holder's holdover timetables and procedures for the use of these tables by the certificate holder's personnel
c) Aircraft de-icing/anti-icing procedures and responsibilities, pre-take off check procedures and responsibilities, and pre-take off contamination check procedures and responsibilities.
d) Initial and recurrent ground training and testing for flight crewmembers and qualification for all other affected personnel (for example, aircraft dispatchers, ground crews, contract personnel

1.6 MANAGEMENT PLAN

1.6.1 Each Air Carrier and Commercial Operator is responsible for Operational Control: In order to properly exercise operational control (when conditions at an airport are such that frost, ice, or snow may reasonably be expected to adhere to its aircraft), the certificate holder should develop, coordinate with other affected parties, implement, and use a management plan to ensure proper execution of its approved de-icing/anti-icing program. The SACAA would accept an operator's management plan that identifies the manager responsible for the overall de-icing/ant i-icing program, identifies each subordinate manager, and describes each manager's functions and responsibilities which are needed to properly manage the certificate holder's de-icing/anti-icing program. A plan encompassing the elements discussed in the following paragraphs is acceptable:

1.6.2 Operations: Determine the management position responsible for ensuring that all the elements of the management plan and the de-icing/anti-icing program have been developed, properly integrated, and coordinated; that the plan and program have been disseminated to all those persons who have duties, responsibilities, and functions to perform in accordance with them; and that adequate management oversight of the program continues to be maintained. The following should be considered:

1.6.3 At each Airport where operations are expected to be conducted in conditions conducive to ground icing, determine who will be responsible for deciding when ground de-icing/anti-icing operational procedures are to be implemented.

1.6.4 Specify the functions, duties, responsibilities, instructions, and procedures to be used by Flight Crewmembers, Aircraft Dispatchers or flight followers, and management personnel for safely dispatching or releasing each type aircraft used in its operations while ground de-icing/anti-icing operational procedures are in effect. A plan should include a detailed description of how the certificate holder determines that conditions at an airport are such that frost, ice, or snow may reasonably be expected to adhere to the aircraft, and when ground de-icing/anti-icing operational procedures must be in effect.

1.6.5 Determine who will be responsible for coordinating the applicable portions of the management plan and the de-icing/anti-icing program with the appropriate air traffic control tower {ATC) personnel and other appropriate airport authorities, including:

a) Determine who will be authorized to enter into agreements with the manager of the ATC at each airport

regarding air traffic control (ATC) procedures during ground icing conditions, and with each airport's manager regarding aircraft secondary de-icing/anti-icing locations and where aircraft may conduct pre-take off contamination checks; and

b) Ensure that a detailed description of the de-icing/anti-icing program is incorporated in the certificate holder's manuals for flight crewmembers, dispatchers or flight followers, ground operations personnel, and management personnel to use in conducting operations underground icing conditions.

1.6.6 Maintenance: Determine who is responsible for ensuring that enough trained and qualified personnel, as well as adequate facilities and equipment, are available at each airport where operations are expected to be conducted under conditions conducive to ground icing for the proper de-icing and anti-icing of the certificate holder's aircraft. The following should be considered.

1.6.7 Ensure that all necessary maintenance elements of the management plan and the de- icing/anti-icing program have been developed, properly integrated, and co-ordinated; that the maintenance plan and de-icing/anti-icing program have been disseminated to all those personnel who have duties, responsibilities, and functions to perform; and that adequate management oversight of the program continues to be maintained

1.6.8 Detail the functions, duties, responsibilities, instructions, and procedures to be used by its ground personnel, maintenance personnel, and management personnel for safely dispatching or releasing aircraft used in its operations while ground de-icing/anti-icing operational procedures are in effect.

1.6.9 Ensure that a detailed description of the maintenance portion of the de-icing/anti-ici ng program is incorporated in the certificate holder's manuals for the use and guidance of maintenance, ground, flight crew, and management personnel.

1.7 HOLDOVER TIMETABLES AND PROCEDURES FOR THEIR USE.

The de-icing/anti-icing program shall include holdover timetables and the procedures for the use of these tables by the certificate holder's personnel. An acceptable program includes procedures to be followed in the event that the holdover times, as determined by the PIG from the certificate holder's holdover timetables, are exceeded. Each of these areas is discussed in the following paragraphs.

Note: The procedures for the use of the holdover timetables requires a pre-take off check by the flight crew. To effectively use holdover timetables, they should be available in the cockpit for flight crews to use.

1.7.1 Responsibilities and Procedures: The certificate holder's program should define operational responsibilities and contain procedures for the flight crew, aircraft dispatchers, flight followers, and maintenance and ground personnel applicable to the use of holdover times and resultant actions if the determined holdover time is exceeded. These procedures should include gate procedures, communication between ground crew and flight crew to establish the start of holdover time and to relay other pertinent information regarding the de-icing/anti-icing process, flight crewmember use of the pertinent holdover timetables, coordination with dispatchers or flight followers, and coordination with ATC.

1.7.2 **Development of Holdover Timetables:** Each certificate holder is required to develop holdover timetables for use by its personnel. These timetables are required to be supported by data acceptable to the Administrator. Currently, the only acceptable data is that developed by SAE and ISO. ARP 4737, "Aircraft De-icing/Anti-Icing Methods with Fluids, for Large Transport Aircraft," and ISO 11076, "Aerospace - Aircraft De-icing/Anti-Icing Methods with Fluids," contain the tables that are currently considered acceptable for use by the certificate holders to develop their holdover timetables. Holdover times exceeding those specified in the current editions of the SAE and ISO tables are currently not acceptable; however, the certificate holder may require the use of more conservative times than those specified in the SAE and ISO tables.

1.7.3 **Use of Holdover Timetables:** Holdover time ranges are only an estimate of the time that de-icing/anti- icing fluid

will prevent the formation of frost or ice and the accumulation of snow on the protected surfaces of an aircraft. Holdover time begins when the final application of de-icing/anti-icing fluid commences and expires when the de-icing/anti-icing fluid applied to the aircraft loses its effectiveness. Holdover times vary with weather conditions; the holdover time determined should be appropriate for the existing weather conditions. It should be noted the SAE and ISO holdover timetables specifically state that holdover time protection will be shortened in heavy weather conditions. The effectiveness of de-icing/anti-icing fluids is based on a number of variables (for example, temperature, moisture content of the precipitation, wind, and aircraft skin temperature). The holdover timetables are to be used for departure planning and in conjunction with pre-take off check procedures. Depending on the length of the holdover time, weather, or other conditions, pre-take off check procedures may be accomplished several times during the aircraft's holdover time. A pre-take off check should be accomplished just prior to taking the active runway for departure. Air carrier manuals should contain detailed procedures for using holdover timetables and the conduct of pre-take off checks in their operations.

1.7.4 The certificate holder's program shall contain procedures for flight crewmembers to increase or decrease the determined holdover time in changing conditions. This requires the flight crew to maintain a continued awareness of environmental or situational conditions that could affect the determined holdover time. Weather conditions that could result in a change to the determined holdover time include, but are not limited to, a significant rise or drop in ambient temperature, an increase or decrease in precipitation rate or intensity, water content, or density, a change in type of precipitation; for example, rain to freezing rain, light to heavy snow, or the end of precipitation. Procedures should consider the certificate holder's capability to disseminate information, in real-time, concerning changing weather conditions. Additional guidance regarding holdover timetables is contained in AC 20-117, Hazards Following Ground De-icing and Ground Operations in Conditions Conducive to Aircraft Icing; AC 120-58, Pilot Guide for Large Aircraft Ground De-icing; SAE ARP 4737, "Aircraft De-icing/Anti-Icing Methods with Fluids, for Large Transport Aircraft"; and ISO 11076, "Aerospace - Aircraft De-icing/Anti-Icing Methods with Fluids

1.7.5 **Take-off After the Holdover Time is Exceeded:** Take-off after the determined holdover time is exceeded is permitted only if one of the three conditions described in e. (1)(2)(3) exists. The certificate holder's program should detail actions that must be accomplished if the holdover time is exceeded.

1.7.6 A pre-take off contamination check is completed to make sure that wings, control surfaces, and other critical surfaces, as defined in the certificate holder's program, are free of frost, ice, and snow. The operator's program must include detailed aircraft type specific procedures and responsibilities for flight crew and ground personnel to use while accomplishing this check. This check must be completed within 5 minutes prior to beginning take off and must be accomplished from outside the aircraft unless the certificate holder's program specifies otherwise. Factors determining whether the check can be accomplished from inside the aircraft include the ability of the flight crew to see aircraft surfaces, lighting conditions, weather conditions, as well as other factors which determine the flight crew's ability to assess the condition of the aircraft. The certificate holder's program should emphasize that if any doubt exists as to the condition of the aircraft after completing this check from inside the aircraft, the take-off must not be attempted. If doubt exists, the PIC should request a pre-take off contamination check be accomplished from outside the aircraft, or the aircraft should be received, and a new holdover time determined; or

1.7.7 It is otherwise determined by an alternate procedure, that wings, control surfaces, and other critical surfaces, as defined in the certificate holder's program, are free of frost, ice, and snow. Alternative procedures consist of procedures, techniques, or equipment (such as wing icing sensors) that might be used to establish that the above-mentioned surfaces are not contaminated.

1.7.8 The wings, control surfaces, and other critical surfaces have been re-deiced and a new holdover time has been determined. Coordination procedures with ATC and ground personnel should be detailed for the accomplishment of this re-deicin

2. AIRCARFT DE-ICING AND ANTI DE-ICING PROCEDURE AND RESPONSIBILITITIES

2 AIRCRAFT DE-ICING AND ANTI DE-ICING PROCEDURES AND RESPONSIBILITIES, PRE-TAKE-OFF, CHECK PROCEDURES, AND RESPONSIBILITIES AND PRE-TAKE-OFF CONTANIMATION CHECK PROCEDURES AND RESPONSIBILITIES.

2.1 OPERATIONAL MANUAL

a) Certificate holders' manuals should contain detailed procedures for the de-icing and anti-icing process specific to each aircraft type. Certificate holders should have aircraft type specific instructions and checking guidelines and procedures for the use of their flight crewmembers and other personnel to determine whether or not aircraft surfaces are free of contaminants.

Note: Take-offs with underwing frost in the area of the fuel tanks within limits established by the aircraft manufacturer, accepted by FAA aircraft certification offices, and stated in aircraft maintenance and flight manuals can be authorized by the FAA.

b) Identification of Critical Aircraft Surfaces: The critical aircraft surfaces which should be clear of contaminants before take-off should be described in the aircraft manufacturer's maintenance manual or other manufacturer developed documents, such as service or operations bulletins.

Note: Take-offs with underwing frost in the area of the fuel tanks within limits established by the aircraft manufacturer, accepted by FAA aircraft certification offices, and stated in aircraft maintenance and flight manuals can be authorized by the FAA

i. Pilot 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.
ii. Wings, empennage, and control surfaces.
iii. Fuselage upper surfaces on aircraft with center mounted engine(s).

c) Certificate holders should list in the flight manual or the operations manual, for each type of aircraft used in their operations, the critical surfaces which should be checked on flight crewmember conducted pre-flight inspections, pre-take-off checks, and pre-take-off contamination checks.

d) Critical surfaces should be defined for the use of ground personnel for conducting the check following the de-icing/anti-icing process and for any pre-take-off contamination checks that may be accomplished by ground personnel.

i. Identification of Representative Aircraft Surfaces (for use in conducting pre-take-off checks only). Certificate holders should list in the flight manual or the operations manual, for each type of aircraft used in their operations, the representative surfaces which may be checked while conducting pre-take-off checks.

a) Some aircraft manufacturers have identified certain aircraft surfaces which the flight crew can readily observe to determine whether or not ice, frost, or snow is accumulating or forming on that surface and, by using it as a representative surface, can make a reasoned judgment regarding whether or not ice, frost, or snow is adhering to other aircraft surfaces. Certificate holder operational experience can also be used to define representative surfaces. In the absence of this information, the following guidelines should be considered in identifying a representative aircraft surface:

(i) The surface can be seen clearly to determine whether or not ice, frost, or snow is forming or accumulating on the surface.
(ii) The surface should be unheated.
(iii) Surfaces such as windshield wipers should also be considered.
(iv) The surface should be one of the first surfaces treated with de-icing/anti-icing fluid during the de-icing/anti-icing procedure; however, designation of representative surfaces is not limited to treated surfaces.

2.2 TECHNIQUES FOR RECOGNISING CONTAMINATION ON AIRCARFT CRITICAL OR REPRESENTATIVE SURFACES

a) In annual and recurrent training, certificate holders must include aircraft type specific techniques for flight crewmembers and other personnel for recognizing contamination on critical and representative aircraft surfaces.
b) These types specific techniques should be used while conducting pre-flight aircraft icing checks, pre-take-off checks, and pre-take-off contamination checks.
c) Some indications for loss of effectiveness of de-icing/anti-icing fluid or contamination on aircraft surfaces include surface freezing or snow accumulation, random snow accumulation, and dulling of surface reflectivity (loss of gloss) caused by the gradual deterioration of the fluid to slush.
d) De-icing/anti-icing fluid manufacturers should also be consulted for information on the fluid characteristics and indications that the fluid is losing its effectiveness.

2.3 TYPES OF DE-ICING CHECKS

Three different icing checks or procedures which, when applicable, are required to be accomplished under an operators approved de-icing/anti-icing program:

a) **Aircraft:** The aircraft de-icing/anti-icing procedure includes a check of the wings, control surfaces, propellers, engine inlets, and other critical surfaces. This check is an integral part of the de-icing/anti- icing procedure. Certificate holders should have procedures, which ensure that, following aircraft de-icing and anti-icing fluid application, this check is conducted by qualified ground personnel. This check determines if the wings, control surfaces, propellers, engine inlets, and other critical surfaces are free of frost, ice, or snow before pushback or taxi. It should be noted that, for airplanes not equipped with wing clear ice detectors, a tactile check of airplane surfaces is the only known method to date to verify whether or not the surfaces are uncontaminated. Communication procedures should be established to relay pertinent de-icing/anti-icing information and the results of this check to the PIG.

b) **Pre-take-off Check:** This check is aircraft type specific and procedures for the use of holdover times are required. It must be accomplished within the holdover time and is normally accomplished by the flight crew from inside the cockpit. The aircraft's wings or representative aircraft surfaces are checked for contamination. The surfaces to be checked are determined by manufacturer's data, carriers operational experience, or guidance contained in this AC. The pre-take-off check is integral to the use of holdover times. Because of the limitations and cautions associated with the use of holdover times, the flight crew must assess the current weather, other situational conditions, and the aircraft's condition, and not rely on the use of holdover times as the sole determinant that the aircraft is free of contaminants. Several pre-take-off checks may be required during the holdover time period based on factors including the length of the holdover time range, weather, or other conditions. A continued awareness of the aircraft condition should be maintained. A pre-take-off check should be accomplished just prior to taking the active runway for departure.

c) **Pre-take-off Contamination Check:** A pre-take-off contamination check is one of the conditions that allow a take-off after a holdover time has been exceeded . Certificate holders must have appropriate pre-take-off contamination check

procedures for flight crewmembers and other qualified ground personnel's use to ensure that the aircraft wings, control surfaces, and other critical surfaces remain free of frost, ice, and snow when a holdover time has been exceeded. The pre-take-off contamination check must be completed within 5 minutes prior to beginning take-off and must be accomplished from outside the aircraft unless the certificate holder's program specifies otherwise. Reliance on representative surfaces are not satisfactory for determining the aircraft is free of contamination while conducting this check. If any doubt exists concerning the aircraft's condition after completing this check, the aircraft cannot take off unless it is redeiced and a new holdover time determined. The following should be considered while developing procedures for this check:

(i) Certificate holders who operate hard wing airplanes with aft, fuselage mounted, turbine powered engines should conduct pre-take-off contamination checks from outside the airplane, unless otherwise authorized in the certificate holder's approved program. The pre-take-off contamination check for these airplanes should include a tactile check of selected portions of the wing leading edges and the upper wing surfaces. Alternatives to a tactile check procedure may be approved. As of the date of this AC, only one airplane manufacturer has developed an approved alternative to tactile pre-take-off contamination checks. This procedure is contained in the manufacturer's maintenance manual and details the requirements for conducting this check.

(ii) Operators of other aircraft must 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 the conduct of this check. Certificate holders should consider the following in the development of guidelines for conducting pre- take-off contamination checks from inside the aircraft:

a) Can enough of the wings, control surfaces, and other critical surfaces be seen to accurately determine whether or not they are free of contaminants? This determination should consider the aircraft type, the method of conducting the check - that is, from the cockpit or cabin, and other factors including aircraft lighting and other ambient conditions.

b) Does the certificate holder have procedures to recognize, and have flight crewmembers been properly trained on these procedures to recognize, changes in weather conditions so they will be able to determine if the wings, control surfaces, and other critical aircraft surfaces could reasonably be expected to remain free of contamination?

3. INITIAL AND CURRENT GROUND TRAINING AND TESTING FOR FLIGHT CREW AND GROUND STAFF

3.1 INITIAL AND CURRENT TRAINING AND TESTING FOR FLIGHT CREW, GROUND TRAINING AND QUALIFICATION FOR DISPATCHERS.

Flight Crewmember Training and Testing. The operator's training program must include a detailed description of initial and annual recurrent ground training and testing for flight crewmembers concerning the specific requirements of the program and the duties, responsibilities, and functions detailed in the program. Flight crewmembers and dispatchers must be trained and tested or qualified on at least the following subjects (after each subject listed, recommendations concerning the content of the training are provided):

a) The Use of Holdover Times. Holdover times are a range of times derived from an analysis of airline experience and laboratory testing of the freeze points of particular types of fluids (currently Type I and Type II) under various temperatures, fluid concentrations, and humidity conditions. A discussion of holdover times should include the following:
   (i) Definition of holdover time.
b) Limitation and cautious associated with the use of hold-over times
c) Source of holdover time data.
d) How to determine a specific holdover time from the holdover time range that accounts for "heavy, • "medium,• or "light" weather conditions
e) Adjusting holdover time for changing weather conditions.
   (ii) Precipitation category (for example, fog, drizzle, rain, or snow) .
f) Precipitation intensity.
g) Duration of precipitation.
h) Relationship of precipitation change to holdover time.
   (iii) Relationship of holdover time to fluid concentrations and for different types of fluids
   (iv) When holdover time begins and ends.
   (v) Communication procedures.
i) Communication between ground personnel and the flight crew to determine the start of holdover time, and the holdover timetable to be used. Communications from the ground crew to the cockpit crew should consist of the following information:
   (i) Fluid type; for example, Type I or Type II.
   (ii) Fluid/water mix ratio.
   (iii) Start time of final fluid application which is when holdover time begins.
   (iv) Accomplishment and results of post de-icing/anti-icing check.
j) ATC co-ordination
k) Dispatch or flight following coordination.
l) Means for obtaining most current weather information.
   i. Use of holdover times by the flight crew.
   ii. Procedures when holdover time is not exceeded.
m) When, where, and how to accomplish the pre-take-off check.
   iii. Procedures when holdover time is exceeded.
n) Pre-take-off contamination check; or
o) Alternate means to determine whether or not surfaces are free of frost, ice, or snow; or
p) Redeice and determine a new holdover time.

3.2 AIRCARFT DE-ICING AND ANTI -ICING PROCEDURES

. Aircraft De-icing/Anti-Icing Procedures Including Checks to Detect Contaminated Surfaces, and Responsibilities:

i. De-icing is a procedure by which frost, ice, or snow is removed from the aircraft in order to provide clean surfaces. The procedure can be accomplished by the use of fluids, mechanical means, or by heating the aircraft.
ii. Anti-icing is a procedure by which the application of certain types of anti-icing fluids provides protection against the formation of frost or ice and accumulation of snow on treated surfaces of the aircraft for a limited period of time (holdover time).
iii. De-icing/Anti-icing is a combination of the two procedures above. It can be performed in one or two steps.

a) One step de-icing/anti-icing is carried out with an anti-icing fluid. The fluid used to deice the aircraft remains on aircraft surfaces to provide limited anti-icing capability.
b) Two step de-icing/anti- icing consists of two distinct steps. The first step, de-icing, is followed by the second step, anti-icing, as a separate fluid application. When it has been determined that the surfaces are clean, anti-icing fluid is applied to protect the relevant surfaces, thus providing maximum possible anti-icing protection (holdover time).

iv. Safety requirements during fluid application.
v. De-icing/anti-icing fluid application procedures.
vi. If applicable, remote de-icing procedures.

a) Aircraft type specific considerations
b) Location-specific procedures.

vii. Contractor De-icing/Anti-icing. In order to comply with the rule, certificate holders who engage in supplemental operations and employ contractor de-icing/anti-icing services and who are unable to arrange for the training and qualification of these personnel in advance should have a person assigned to the flights who is fully trained under the certificate holders' approved program to supervise the de-icing/anti-icing procedure.
viii. De-icing/Anti-icing Checking Procedures and Responsibilities. The training program should have aircraft type specific surface contamination check procedures and guidelines to include the following:

3.3 DE-ICING AND ANTI-ICING TRAINING PROGRAM

3.3.1 Types of Checks Required. Each certificate holder should detail the types of checks required and the methods for accomplishing these checks. This includes procedural steps for conducting the check as well as the location, personnel requirements, de-icing equipment, and lighting required to accomplish the check:

a) Flight crew pre-flight inspection/cold weather pre-flight inspection procedures. This is the normal walk around pre-flight inspection conducted by the flight crew. This inspection should note any aircraft surface contamination and direct any required de-icing/anti-icing operations.

b) Aircraft de-icing/anti-icing procedures include a check performed by qualified ground personnel after the de-icing/anti-icing fluid application has been completed. This check is an integral part of the aircraft de-icing/anti-icing procedure.

c) A pre-take-off check is performed by the flight crew prior to take-off and within the holdover time. This is a check normally conducted from inside the cockpit. Identification of representative surfaces and continual assessment of environmental and other situational conditions should be included in the operator's program.

d) Pre-take-off contamination check. This check is accomplished after the holdover time has been exceeded and must be completed within 5 minutes prior to beginning take-off. Each carrier must define aircraft type specific pre-take-off contamination check procedures. The check must be conducted from outside the aircraft unless

otherwise approved in the carrier's program. Rather than accomplishing this check, the PIG may elect to be redeiced and a new holdover time established.

e) Identification of critical surfaces or representative surfaces to be checked/inspected during each type of check.:
   i. Techniques for recognizing contamination on the aircraft.
   ii. Communications procedures to include communications between the flight crew, ground personnel, ATC, and company station personnel. Communications with ATC should include coordinating de-icing/anti-icing of the aircraft with any proposed ATC push back time and coordinating any other special requirements needed for accomplishing required aircraft checks.

3.3.2 Aircraft Surface Contamination and Critical Area Identification, and How Contamination Adversely Affects Aircraft Performance and Flight Characteristics.

a) Aircraft Ground Icing Conditions: Certificate holders should have a description of the following conditions included in their program that would implement ground de-icing/anti-icing operational procedures:
   i. In-flight Ice Accumulation.: Certificate holders should have procedures for flight crews of arriving flights to report occurrences of in-flight icing to the personnel responsible for executing the certificate holder's de-icing/anti-icing program. In-flight ice accumulation could result in a ground de-icing situation when flights are scheduled for short turnaround times; that is, for 30 minutes or less, and when ambient temperatures on the ground are at or below freezing.
   ii. Freezing Precipitation: Snow, sleet, freezing rain, drizzle, or hail which could adhere to aircraft surfaces.
   iii. Frost, including hoarfrost, which is a crystallized deposit, formed from water vapor on surfaces which are at or below 0 °C (32 °F).
   iv. Freezing Fog. Clouds of super cooled water droplets that form a deposit of ice on objects in cold weather conditions.
   v. Snow. Precipitation in the form of small ice crystals or flakes which may accumulate on, or adhere to, aircraft surfaces.
   vi. Freezing Rain: Water condensed from atmospheric vapor falling to earth in supercooled drops, forming ice on objects.
   vii. Rain or High Humidity on Cold Soaked Wing: Water forming ice or frost on the wing surface when the temperature of the aircraft wing surface is at or below 0 °C (32 °F). This ice or frost may freeze over the entire wing surface and on the wing leading edge.
   viii. Rain or High Humidity on Cold Soaked Wing Fuel Tanks: Water forming ice or frost may form on the wing surface when the temperature of the aircraft wing surface in the vicinity of the wing fuel tanks is at or below 0 °C (32 °F) due to cold soaked fuel. Certain aircraft are susceptible to the formation of frost or ice on wing upper surfaces when cold soaked fuel is in the main wing fuel tanks, and the aircraft are exposed to conditions of high humidity, rain, drizzle, or fog at ambient temperatures well above freezing. Under some atmospheric and temperature conditions clear ice may form. The certificate holder's program should include procedures for removing this type of contamination. In certain circumstances, this type of contamination may not require the certificate holder to implement its ground de-icing/anti-icing program.

3.3.3 **Underwing Frost:** Take-off with frost under the wing in the area of the fuel tanks (caused by cold soaked fuel) within limits established by the aircraft manufacturer, accepted by FAA aircraft certification offices and stated in aircraft maintenance and flight manuals, may be permitted. This type of contamination may not require the certificate holder to implement its ground de-icing/anti-icing program.

3.3.4 **Critical Aircraft Surfaces:** Certificate holders should identify for each type of aircraft used in their operations, the critical surfaces which should be checked on pre-flight and pre-take-off contamination checks. Information from the aircraft manufacturer (or from this AC if the subject information is not available from the aircraft manufacturer) should be used to determine the critical surfaces for each aircraft type.

3.3.5 **Representative Aircraft Surfaces:** Certificate holders should identify, for each type of aircraft used in their operations, the representative aircraft surfaces which should be checked during pre-take-off checks. Information from the aircraft manufacturer, or information developed from carrier operating experience, should be used to determine representative surfaces. In the absence of such information, information from this AC can be used to determine representative aircraft surfaces.

3.3.6 **Effects of Frost, Ice, Snow, and Slush on Aircraft Performance, Stability, and Control:** The certificate holder should obtain information on aircraft performance when undetected frost, ice, snow, or slush could be adhering to aircraft surfaces from the manufacturer of each type of aircraft it uses in its operations and should ensure that its flight crewmembers and aircraft dispatchers understand these effects. Accident data and National Aeronautics and Space Administration studies have confirmed that some aircraft manufacturers' data indicates that the effects of wing contamination may be significantly more pronounced for hard leading edge (hard wing) airplanes than for slatted leading edge (slatted wing) airplanes. This data indicates for airplanes without leading edge, high lift devices that the presence of even minute amounts of ice or other contaminates (equivalent to medium grit sandpaper) results in significant loss of wing lift, which causes the airplane to stall at lower-than-normal angles of attack during take-off. The discussion of these effects should include, but is not limited to, the following subjects:

a) Increased drag and weight.
b) Tendency for rapid pitch up and wing roll off during rotation.
c) Lost of Lift
d) Stall occurs at lower-than-normal angle of attack.
e) Buffet or stall occurs before activation of stall warning.
f) Decreased effectiveness of flight controls.

3.4 TYPES, CHARACTERISTICS AND EFFECTIVENESS OF DE-ICING FLUIDS

3.4.1 There are several kinds of de-icing and anti-icing fluids currently available, and each has different characteristics and capabilities.

3.4.2 Certificate holders should ensure that their flight crewmembers, aircraft dispatchers, and ground personnel generally understand the purpose and capabilities of the fluids used in the certificate holders, de-icing/anti-icing program; and that their flight crewmembers are generally knowledgeable of the characteristics of each type of fluid

3.4.3 Certificate holders should refer to the following SAE publications for additional information on specific de-icing and anti-icing methods and procedures and on fluid characteristics and capabilities: AMS 1424, "De-icing/Anti-Icing Fluid, Aircraft, Newtonian - SAE Type I;" AMS 1428, "Fluid, Aircraft De-icing/Anti-Icing, Non-Newtonian, Pseudo- Plastic, SAE Type 111'; and ARP 4737, "Aircraft De-icing/Anti- Icing Methods with Fluids, for Large Transport Aircraft;" and the following ISO documents: ISO 11075, "Aerospace - Aircraft De-icing/Anti- Icing Newtonian Fluids ISO Type I;" ISO 11076, "Aerospace - Aircraft Deicing/Anti-icing methods with fluids"; ISO 11077, "Aerospace De-icing/Anti-Icing Self Propelled Vehicles - Functional Requirements;" and ISO 11078, "Aerospace - Aircraft De-icing/Anti-Icing Non-Newtonian Fluids ISO Type 11:

3.4.4 The following subjects should be discussed De-Icing Fluid:

a) Heated Water
b) Newtonian fluid (SAE/ISO Type I)
c) Mixtures of water and SAE/ISO Type I fluid.
d) Mixtures of water and SAE/ISO Type II fluid.

Note: De-icing fluid should be applied heated to assure maximum efficiency.

3.4.5 Anti-icing fluids:

a) Newtonian fluid (SAE/ISO Type I)
b) Mixtures of water and SAE/ISO Type I fluid.

c) Non-Newtonian fluid (SAE/ISO Type II)
d) Mixtures of water and SAE/ISO Type II fluid

Note: SAE/ISO Type II anti-icing fluid is normally applied cold on clean aircraft surfaces but may be applied heated. Cold SAE/ISO Type II fluid normally provides longer anti-icing protection.

e) Fluid Characteristics

i. **Type I De-icing Fluids**.(Unthickened, very limited holdover time, applied to form thin liquid film on wing)

ii. **Type II Anti-icing Fluids**. (Thickened, longer holdover times in comparisons to those Type I fluid, application results in a thick film(a gel like consistency) on wing, Air flow over the wing (shear) causes the fluid to progressively flow off the wing during take-off)

3.4.6 DE-ICING AND ANTI-ICING FLUID SPECIFICATION

a) SAE and ISO Type I De-icing and Anti-icing Fluids. The following specifications apply: SAE AMS 1424, De-icing and Anti-Icing Fluid, Aircraft, Newtonian - SAE Type I.

i. Monoethylene Glycol (EG
ii. Propylene Glycol (PG)

b) ISO 11075, Aerospace - Aircraft De-icing/Anti-Icing Newtonian Fluids ISO Type I: These fluids have been approved by nearly all aircraft manufacturers for use on their aircraft when properly applied. The ISO and SAE holdover timetables for Type I fluids are applicable to these fluids.

c) SAE and ISO Type II De-icing and Anti-icing Fluids.: The following specifications apply: SAE AMS 1428, Fluid, Aircraft De-icing/Anti-Icing, Non-Newtonian, Pseudo-Plastic, SAE Type II; and ISO 11078, Aerospace - Aircraft De-icing/Anti-Icing, Non-Newtonian Fluids ISO Type II. These fluids have been approved by most of the manufacturers of large transport category airplanes. In order to be classified as meeting SAE-AMS 1428 and ISO 11078 specification s, these fluids must meet certain chemical performance requirements, and the aerodynamic and high humidity and freezing water spray endurance tests that are required of Type II fluids. These fluids should be applied in accordance with appropriate SAE/ISO methods documents. The SAE and ISO holdover timetables for Type II fluids are applicable to these fluids.

d) Association of European Airlines (AEA) De-icing and Anti-icing Fluids.: AEA Type I de-icing fluid and AEA Type II de-icing/anti-icing fluids have been approved by nearly all manufacturers of large transport category airplanes for use on their aircraft when properly applied in accordance with aircraft manufacturers' recommendations. The holdover timetables applicable to SAE and ISO approved fluids may be applied for use with AEA Type I and AEA Type II Freezing Point Depressant (FPD) fluids.

e) United States Military De-icing Fluids: Military Type I and Type II designations have an entirely different meaning than SAE, ISO, or AEA designations. A military Type II fluid does not indicate that the fluid has a longer holdover time than a military Type I fluid. Holdover times have not been established for military de-icing fluids. Since holdover timetables do not apply, use of these fluids should only be used in conjunction with a pre-take-off contamination check.

f) Other De-icing and Anti-icing Fluids: Use of any de-icing/anti-icing fluid should be in accordance with the aircraft manufacturer's recommendations. Holdover timetables are not approved for use for any de-icing or anti-icing fluid that does not meet SAE, ISO or AEA approved specifications. Use of any fluid that does not meet these specifications

should only be used as a last resort and when used should be in conjunction with a pre-take-off contamination check.

3.4.7 DE-ICING AND ANTI-ICING FLUID HANDLING AND PERFORMANCE IMPLICATIONS

a) type of fluid used and how completely the fluid flows off the wing during take-off determines the effects on the following:
   i. Increased rotation speeds/increased field length.
   ii. Increased control (elevator) pressures on take-off.
   iii. Increased stall speeds/reduced stall margins.
   iv. Lift loss during climb out/increased pitch attitude.
   v. Increased drag during acceleration/increased field length.
   vi. Increased drag during climb

b) Other Affected Ground Personnel Training. At least the following subjects for ground personnel (that is, maintenance mechanic, ramp agent, service personnel, and contractors) should be discussed.

c) Effects of Frost, Ice, Snow, and Slush on Aircraft Surfaces. This discussion is intended to provide ground personnel with an understanding of the critical effect the presence of even minute amounts of frost, ice, or snow on flight surfaces and should include, but is not limited to, the following:
   i. Loss of Lift.
   ii. Increased drag and weight.
   iii. Decreased control.
   iv. Aircraft specific areas

d) Engine Foreign Object damage potential

e) Instrument pickup points.

f) Leading edge device (LED) aircraft (aircraft that have slats or leading-edge flaps) and non-LED

g) Fluid characteristics and capabilities: De-icing and anti-icing fluids with differing properties exist and may continue to be developed. To the extent that they are being utilized by an air carrier, they should be addressed in training programs:
   i. Genera fluid description.
   ii. Composition and appearance.
   iii. Health precautions/environmental considerations.
   iv. Differences between Type I and Type II de-icing and anti-icing fluids.
   v. Purpose for each type.
   vi. Capabilities.
   vii. Shearing characteristics in storage and handling.
   viii. Fluid application methods.
   ix. Holdover Times. A discussion of holdover times should include the following: Source of holding time data
   x. Precipitation category.

h) Duration of precipitation

i) Relationship of precipitation change to holdover time.
   i. Relationship of holdover time to particular fluid concentrations for Type Iand Type II fluids.
   ii. Identification of when holdover time begins and ends.

iii. Communication procedures between ground personnel and flight crew to relay the start time of the final de-icing/ and anti-icing fluid application, the type of fluid used, the fluids/water mix ratio, and confirmation that the post application check was accomplished and that the aircraft is free of all contamination.

j) Equipment. An understanding of the capabilities of the de-icing equipment and the qualifications for operation are necessary. The equipment portion of the training program should include the following:
   i. Description of various equipment types.
   ii. Operation of the equipment.

3.4.8 PRE-FLIGHT CHECK-DE ICING AND ANTI-ICING

In the predeparture sequence, ground de-icing may be initiated at one or more of the following times:

a) On overnight aircraft prior to the flight crew's arrival.
b) Following a check by the flight crew and a request for de-icing.
c) After a normal pre-flight inspection by ground personnel or the flight crew, and after the crew is on- board the aircraft:
   i. In each case, the pre-flight and the decision on whether or not to deice/anti-ice should be based on appropriate consideration of the circumstances and should include the following:
d) Weather conducive to frost or ice formation or snow accumulation.
e) Aircraft critical areas (general and aircraft specific).

3.4.9 GROUND STAFF DE-ICING AND ANTI-ICING PROCEDURES:

a) Ground personnel should be knowledgeable of de-icing and anti-- icing application procedures:

Note: For aircraft type specific procedures, refer to the aircraft operating manual:

   i. One step de-ice and two step deice/anti-ice process.
   ii. Communications from the ground crew to the flight crew should provide the following information:
b) Fluid type.
c) Fluid/water mix ratio.
d) Start time of final deice/anti-ice application.
e) Post application check accomplished.
   i. Safety requirements and emergency procedures
   ii. De-icing/anti-icing prior to air crew arrival.
   iii. Gate de-icing procedures.
   iv. Remote de-icing procedures.
a) Aircraft specific considerations
b) Location specific procedures.
c) Safety precautions.
   i. Post application check procedures.

3.5 PRE-TAKE OFF CONTAMINATION CHECK

3.5.1 This check is accomplished when the holdover time has been exceeded and must be completed within 5 minutes of beginning take-off. Each carrier must define the content of the pre-take-off contamination check. The check should be conducted from outside the aircraft by qualified ground personnel unless the certificate holder's program authorizes it to be conducted from inside the aircraft by the flight crew. Training for ground personnel should include the following:

   i. When the check is required.
   ii. The necessary resources, personnel, and equipment to accomplish the check properly.

iii. Where the check could be accomplished.
iv. What surfaces must be checked.
v. Procedures for relaying the condition of the aircraft to the PIC.

3.5.2 Contractor De-icing: Many certificate holders use parties other than themselves to perform de-icing. The party with whom they reach an agreement to provide de-icing services could be another carrier, a fixed base operator or some other service provider. Training for de-icing services should include the following:
i. An approved contract training program. This program should meet the carrier's own training standards.
ii. Train-the-trainer program (the carrier trains the contract de-icing personnel or designated trainer.
iii. Alternative procedures at airports where contract service agreements are not present. For example, a trained and qualified flight crew member or other appropriately qualified certificate holder employee provides supervision and quality control during the de-icing/anti-icing process and ensures contractor procedures meet the certificate holder's approved program standards.
iv. Guidance that the flight crew will hold the contractor to their own approved program standards.

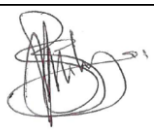
3.5.3 Ground Personnel Qualification. Certificate holders' ground de-icing programs should have a qualification program and a quality assurance program to monitor and maintain a high level of competence.
i. The program should be tailored to the individual airline with each air carrier maintaining its own quality assurance responsibility.
ii. The program should have a tracking system that ensures that all required training has been satisfactorily completed and recorded for all ground personnel participating in the de-icing process. Also, a list naming qualified de-icing personnel should be made available to all local managers responsible for de-icing.
iii. An ongoing review plan is advisable to evaluate the effectiveness of the training received by the de-icing personnel. Recurrent training should be key to this process.

3.6 "OUTSIDE THE AIRCRAFT CHECK" IN LIEU OF AN APPROVED GROUND DEICING/ANTI-ICING PROGRAM.

A certificate holder may continue to operate without an approved ground de-icing and anti-icing program if it has approved procedures and properly trained personnel for conducting an "outside the aircraft check". Authorization for conducting this check, in lieu of an approved program, should be contained in the certificate holder's operations specifications (OpSpecs).

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 of beginning take-off and must be accomplished from outside the aircraft. Certificate holders' manuals and training programs should detail procedures for accomplishing this check.

4. DOCUMENT AUTHORISATION

DEVELOPED BY:		
	**Siphamandla Mhlanga**	**01 March 2023**
SIGNATURE OF M: FOD	**NAME IN BLOCK LETTERS**	**DATE**
REVIEWED & VALIDATED BY:		
	**Eric Mataba**	**01 March 2023**
SIGNATURE OF SM: FOD	**NAME IN BLOCK LETTERS**	**DATE**
APPROVED BY:		
	**Simon Segwabe**	**01 March 2023**
SIGNATURE OF E: ASO	**NAME IN BLOCK LETTERS**	**DATE**