



AEROSPACE STANDARD	AS6286™/1	REV. A
	Issued	2016-11
	Cancelled	2019-11
Superseded by AS6286A		
Processes Including Methods		

RATIONALE

SAE G-12T, Training and Quality Programs Committee recommends AS6286/1 to AS6286/6 be cancelled since the requirements in this AS have been superseded by and re-introduced into Aerospace Standard AS6286 "Training and Qualification Program for Deicing/Anti-icing of Aircraft on the Ground" (which now includes the six corresponding Slash Sheets). All of these documents address training for aircraft ground de/anti-icing. AS6286 was developed as a global standard and the slash sheets caused confusion in some areas. As a result, all the appropriate requirements in AS6286 Slash Sheets 1 to 6 have been carried over to the new AS (i.e., there are no aspects of the slash sheets that are not covered by the superseding AS). As such, AS6286/1 to AS6286/6 should be cancelled and considered for "Archival Use Only". This proposal to cancel SAE AS6286/1 to AS6286/6 is based on the guidance provided in the SAE Aerospace Council document "Organization and Operating Procedures", section 7.4.2, which identifies that one of the grounds for cancelling a document is "when its technical requirements are totally superseded by another document."

CANCELLATION NOTICE

This Technical Report has been declared "CANCELLED" as of November 2019 and has been superseded by AS6286A. By this action, this document will remain listed in the respective index, if applicable. Cancelled Technical Reports are available from SAE.

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FOREWORD

This manual is divided in two parts:

1. Training and qualification standards, including the scope of training
and
2. Overview and background information about deicing/anti-icing procedures and related subjects.

RESPONSIBILITIES

It is the responsibility of the Deicing Operator to ensure that all frozen deposits (with the possible exception of frost which may be allowed), are removed from the specified surfaces during the deicing process.

COMPLIANCE WITH SPECIFIC RULES FOR AIRCRAFT DEICING/ANTI-ICING ON THE GROUND, ISSUED BY REGULATORY AVIATION AUTHORITIES, IS THE RESPONSIBILITY OF THE USER.

TABLE OF CONTENTS

1.	SCOPE.....	4
1.1	Field of Application.....	4
2.	REFERENCES.....	4
2.1	Applicable Documents	4
2.2	Definitions and Abbreviations	4
3.	METHODS/PROCEDURES.....	4
3.1	Inspection of Critical Surfaces	4
3.2	Clear Ice Precautions.....	5
3.3	Flight Crew/Ground Crew Preflight Check Requirement	5
3.4	Deice/Anti-Ice Determination	5
3.5	Initiation of Deicing/Anti-Icing.....	5
3.6	Deice/Anti-Ice Location	6
3.7	Communication Prior to Deicing/Anti-Icing	6
3.8	General Deice/Anti-Ice Precautions.....	6
3.9	Aircraft Engines Running	7
3.10	Propeller Aircraft	7
3.11	Jet Aircraft	8
3.12	Aircraft with Wing-Mounted Engines.....	8
3.13	Aircraft with Center-Mounted Engines	8
3.14	Deicing	8
3.14.1	Requirements.....	8
3.14.2	General.....	8
3.14.3	For Removal of Frost and Light Ice.....	9
3.14.4	For Removal of Snow.....	9
3.14.5	For Removal of Ice.....	9
3.14.6	Alternate Deicing Technologies	9
3.15	Anti-Icing	10
3.15.1	Required Usage	10
3.15.2	Preventative Anti-Icing	10
3.15.3	General.....	10
3.16	Deicing/Anti-Icing	11
3.16.1	One-Step Deicing/Anti-Icing.....	11
3.16.2	Two-Step Deicing/Anti-Icing.....	11
3.16.3	Guidelines for the Application of Deicing/Anti-Icing Fluids	11
3.17	Post Deicing/Anti-Icing Check Requirement.....	11
3.17.1	Flight Control Check.....	12
3.17.2	Communications after Deicing/Anti-Icing	12
3.17.3	Deicing/Anti-Icing Report	12
3.17.4	Post Deicing/Anti-Icing Check and Transmission of the Anti-Icing Code to the Flight Crew.....	13
3.17.5	All Clear Signal.....	13
3.17.6	Station Deicing/Anti-Icing Log.....	13
4.	PRE-TAKEOFF CHECK REQUIREMENTS	14
4.1	Identification of Representative Surfaces	14
4.2	Pre-Takeoff Contamination Check Requirement	14
4.3	Communications After Pre-Takeoff Contamination Check	15
5.	ENVIRONMENTAL CONSIDERATIONS.....	15
5.1	Alternative Procedures.....	16
6.	BACKGROUND INFORMATION	16
6.1	Aerodynamics	16
6.1.1	General.....	16
6.1.2	Forces Involved	16

6.1.3	Basic Aerodynamics.....	16
6.1.4	Aerodynamic Areas.....	16
6.1.5	Aircraft Surfaces.....	17
6.1.6	How Contamination Affects Lift and Performance	17
6.1.7	Frost Affecting Lift	17
6.1.8	Frost Affecting Stall.....	17
6.1.9	Other Effects on Performance	18
6.1.10	Fluid Behavior on Aircraft Surfaces	18
6.2	Deicing/Anti-Icing Operations	18
6.2.1	General.....	18
6.2.2	Preliminary Work for the Start of Deicing/Anti-Icing.....	19
6.2.3	Determining the Need for Deicing/Anti-Icing.....	19
6.2.4	One-Step/Two-Step Deicing/Anti-Icing	20
6.3	Critical Surfaces	20
6.4	Clean Aircraft Concept	22
6.4.1	Spray Areas	22
6.4.2	Aircraft Surfaces.....	22
6.4.3	Other Areas	23
6.5	Spray Methods, Fluid Application, and Alternate Methods	23
6.5.1	Removal of Contamination.....	24
6.5.2	General Fluid Application Strategy	24
6.5.3	Alternate Methods.....	25
6.5.4	Manual Deicing	25
6.5.5	Alternative Deicing/Anti-Icing Methods	26
6.6	Off Gate Deicing/Anti-Icing Operation.....	26
6.6.1	Airport Operations	26
6.6.2	Centralized/Remote Deicing/Anti-Icing	27
6.6.3	Aircraft Throughput	27
6.6.4	Air Traffic Control	28
6.6.5	Safety Areas.....	28
6.6.6	Deicing/Anti-Icing Procedures.....	28
6.6.7	Deicing/Anti-Icing Spray and Operational Procedures	29
6.6.8	Pre- and Post-Deicing/Anti-Icing Checks.....	30
6.6.9	Management of the Centralized Deicing/Anti-Icing Operation.....	30
6.7	Checks	31
6.7.1	Post De-/Anti-Icing Check.....	31
6.7.2	Pre-Takeoff Check	31
6.7.3	Clear Ice Checks and Precautions.....	32
6.8	Communication	32
6.8.1	Deicing/Anti-Icing Communication	32
6.8.2	Releasing/Dispatching Aircraft and Final Walk-Around	33
6.8.3	The Anti-Icing Code	33
6.8.4	Flight Crew Information	34
6.8.5	Off-Gate Deicing/Anti-Icing Communication	34
6.8.6	Radio Telephony Phraseology	35
6.8.7	ICAO Phraseology	36
6.9	Environment.....	37
6.9.1	Airport Layout and Environmental Considerations	37
6.9.2	Glycol Identification and Environmental Impact.....	38
6.9.3	Collection and Disposal of Fluids.....	38
6.9.4	Recycling of Glycol.....	39
7.	NOTES.....	39
7.1	Revision Indicator.....	39
FIGURE 1	STATION DEICING/ANTI-ICING FORM	13

1. SCOPE

1.1 Field of Application

This document shall be used in conjunction with:

AS6286	Training and Qualification Program for Deicing/Anti-icing of Aircraft on the Ground
AS6286/2	Equipment
AS6286/3	Fluids
AS6286/4	Weather
AS6286/5	Health, Safety and First Aid
AS6286/6	Aircraft Deicing/Anti-icing Diagrams, No-Spray-Zones

2. REFERENCES

2.1 Applicable Documents

Refer to AS6286 main document Section 2 for all applicable and related publications.

2.2 Definitions and Abbreviations

Refer to AS6285 Aircraft Ground Deicing/Anti-icing Processes.

3. METHODS/PROCEDURES

3.1 Inspection of Critical Surfaces

Operators should identify for each type of aircraft used in their operations, the critical surfaces which should be checked on preflight, post deicing/anti-icing, and pre-takeoff contamination checks. Information from the aircraft manufacturer should be used to determine the critical surfaces for each aircraft type. Examples of this information are available in AS6286/6. Contact the aircraft manufacturer for specific information.

The following is a general list of critical surfaces:

- 3.1.1 Wings, tail, and control surfaces shall be free of frost, snow, slush, or ice. Some coating of frost may be permissible on wing tank lower surfaces cold-soaked by fuel. Ice can build up on aircraft surfaces during flight through dense clouds or precipitation. When ground OAT at the destination is low, it is possible for flaps and other moveable surfaces to be retracted and for accumulations of ice to remain undetected between stationary and moveable surfaces. It is, therefore, important that these areas are checked prior to departure and any frozen deposits removed.
- 3.1.2 Pitot heads, static ports, airstream direction detector probes, and angle of attack sensors shall be clear of frost, snow, slush, ice, fluid residues, and protective covers.
- 3.1.3 Engine inlets shall be clear of internal ice and snow, and fan shall be free to rotate. Under freezing fog, or other freezing precipitation conditions, it is necessary for the front and rear side on the fan blades to be checked for ice buildup prior to start-up. Any deposits discovered are to be removed by directing air from a low flow hot air source or other means recommended by the aircraft and engine manufacturer. Exceptions will be noted in the Engine Manufacturers Manual.

- 3.1.4 Air-conditioning inlets/exits shall be clear of frost, snow, slush, or ice. Outflow valves clear and unobstructed.
- 3.1.5 Landing gear and landing gear doors shall be unobstructed and clear of frost, snow, slush, or ice.
- 3.1.6 Fuel tank vents shall be clear of frost, snow, slush, or ice.
- 3.1.7 Fuselage shall be clear of ice and snow. In accordance with the aircraft manufacturers' manuals, adhering frost may be allowed. Do not close any door until all ice or snow has been removed from the surrounding area.

3.2 Clear Ice Precautions

- Clear ice can form on aircraft surfaces below a layer of snow or slush.
- Significant deposits of clear ice can form in the vicinity of the fuel tanks, on wing upper surfaces, as well as under wing.
- Aircraft are most vulnerable in regard to this type of buildup when one or more of the following conditions exist:
 - a. Wing temperatures remain well below 0 °C (32 °F) during the turnaround transit.
 - b. Ambient temperatures between -2 °C (28 °F) and 15 °C (59 °F) are experienced, although clear ice may form at other temperatures if conditions a, c, and d exist.
 - c. Precipitation occurs while the aircraft is on the ground.
 - d. When frost or ice is present on lower surface of either wing.

Clear ice formation is extremely difficult to detect. Therefore, when the above conditions prevail, or when there is otherwise any doubt that clear ice may have formed, a close examination shall be made prior to departure, in order to ensure that all adhering frozen deposits have in fact been removed.

NOTE: Low wing temperatures associated with this type of buildup normally occur when large quantities of cold fuel remain in wing tanks during the turnaround/transit and any subsequent refueling is insufficient to cause a significant increase in fuel temperature.

3.3 Flight Crew/Ground Crew Preflight Check Requirement

Prior to departure, conduct this check for adhering contamination on critical surfaces.

3.4 Deice/Anti-Ice Determination

Deice aircraft if any frost, snow, slush, or ice is adhering to any critical surfaces.

Anti-ice aircraft if there will be active frost or adhering contamination falling or blowing onto any applicable critical surfaces prior to take off.

3.5 Initiation of Deicing/Anti-Icing

In the pre-departure sequence, ground deicing/anti-icing may be initiated whenever the flight crew or ground personnel determine that deicing/anti-icing is required for safe dispatch.

Typically, this would be:

- On overnight aircraft, prior to the flight crew's arrival.
- Following a check by the flight crew and a request for deicing.

- After a normal preflight inspection by ground personnel or the flight crew.
- After the flight crew is on board the aircraft.

3.6 Deice/Anti-Ice Location

Determine if deicing/anti-icing will be performed at the gate/terminal, off-gate, or at a remote pad. When deicing/anti-icing is performed away from the gate make sure that the following items are accomplished prior to departing the gate:

- All APU and engine inlet/exhaust areas are free of contamination prior to start;
- All doors and door seals are free of contamination prior to closing;
- Windows are clean and visibility is adequate from the flight deck, if aircraft will be taxied;
- Tires do not appear to be frozen to the ramp;
- Passengers are informed if applicable; and
- Critical sensing devices are free of contamination.

3.7 Communication Prior to Deicing/Anti-Icing

When the flight crew is onboard the aircraft the ground crew and flight crew will communicate:

- Whether the aircraft needs to be deiced, anti-iced, or both, including fluids to be used,
- Engine running considerations
- That the aircraft is configured and crews are ready for procedure to begin.

In a remote deicing/anti-icing operation, a positive communication link shall be maintained to the aircraft flight crew throughout the deicing/anti-icing process.

Communication to the flight crew may be verbal or by means of Electronic Message Boards or Data Link/ACARS. In the event of conflict, verbal communication shall take precedence.

Visual communications (i.e., Electronic Message Boards or Data Link/ACARS) with flight crew shall occur in the English language.

Verbal communications with flight crew should occur in the English language. In states where other native languages are approved for aeronautical verbal communication, these approved native languages may be used to communicate verbally between ground crew and flight crew upon mutual agreement between both parties. However, services in the English language shall be made available upon request.

Personnel who will be communicating with flight crew in the English language shall be proficient in the English language, familiar with common aviation and de/anti-icing terminology and phraseology, at a minimum level equivalent to an Operational Level 4 on the ICAO Language Proficiency Rating Scale. Additional regulatory authority certification of competency may be required and/or accepted in place of the above-mentioned requirement.

3.8 General Deice/Anti-Ice Precautions

- The application of deicing/anti-icing fluid shall be in accordance with the requirements of the airframe/engine manufacturers, and local procedures.
- With regard to HOT provided by the applied fluid, the objective is that it be equal to or greater than the estimated time from start of anti-icing to start of takeoff based on existing weather conditions.

- Aircraft shall be treated symmetrically, that is, left hand and right hand side shall receive the same and complete treatment.

CAUTION: Aerodynamic problems could result if this requirement is not met. Engines are normally shut down but may remain running at idle during deicing/anti-icing operations. Air conditioning and/or APU bleed air must be selected OFF, or as recommended by the airframe and engine manufacturer.

- Do not spray deicing/anti-icing fluids directly onto brakes, wheels, exhausts, or thrust reversers.
- Deicing/anti-icing fluid shall not be directed into the orifices of pitot heads, static vents, or directly onto airstream direction detectors probes/angle of attack sensors.
- All reasonable precautions shall be taken to minimize fluid entry into engines, other intakes/outlets, and control surface cavities. Refer to Airframe/Engine Manufacturer specifications.
- Do not direct fluid onto flight deck or cabin windows as this can cause cracking of acrylic or penetration of the window seals.

All doors and windows should be closed to prevent:

- Floor areas being contaminated with slippery fluids
- Upholstery becoming soiled
- Any forward area from which fluid may blow back onto windscreens during taxi or subsequent takeoff shall be free of fluid prior to departure. If SAE Type II, III, or IV fluids are used, all traces of the fluid on flight deck windows shall be removed prior to departure, particular attention being paid to windows fitted with wipers.

NOTE: Deicing/anti-icing fluid can be removed by rinsing with approved cleaner and a soft cloth or flushing with Type I fluid.

- Landing gear and wheel bays shall be kept free from buildup of slush, ice, or accumulations of blown snow.
- When removing ice, snow, or slush from aircraft surfaces care shall be taken to prevent it entering and accumulating in auxiliary intakes or control surface hinge areas.

3.9 Aircraft Engines Running

Engines are normally shut down but may remain running at idle during deicing/anti-icing operations. During deicing/anti-icing with aircraft engines running specific procedures and equipment must be employed e.g., to enable effective “front to rear” deicing of aircraft surfaces in accordance with safe operating practices. If these procedures and equipment are not employed, refer to engines off procedures.

Also refer to ARP5660.

3.10 Propeller Aircraft

- Use caution when removing contamination near the engine intake. Never spray deicing/anti-icing fluids directly into the engine intake.
- Procedures shall be in place to ensure the equipment/the operator stays out of the danger area of the propeller.
- Never expose parts of the deicing/anti-icing vehicle to the arc of the spinner.
- For under wing deicing, the engine on the treated side must be OFF.

3.11 Jet Aircraft

- Always stay out of the jet blast area with the deicing/anti-icing equipment.
- Always stay out of the engine ingestion area with the deicing/anti-icing equipment. Danger areas can vary depending on the type of the aircraft.
- Never spray deicing/anti-icing fluid into the engine intake.

3.12 Aircraft with Wing-Mounted Engines

- The deicing/anti-icing vehicle should always stay out of the jet blast during the deicing/anti-icing treatment.
- The deicing/anti-icing vehicle should stay in front of the wing to avoid being exposed to the engine jet blast.
- For deicing treatment of the landing gear, the deicing/anti-icing personnel should always remain within the vehicle or outside of the engine inlet danger area until the engine on the side of the aircraft to be treated is turned OFF.

3.13 Aircraft with Center-Mounted Engines

- No additional restrictions for deicing/anti-icing the wings apply.
- The deicing/anti-icing vehicle should always stay next to the center-mounted engine during deicing/anti-icing treatment of the empennage.

3.14 Deicing

3.14.1 Requirements

Adhering contamination shall be removed from aircraft surfaces prior to anti-icing or prior to take off.

Ice, slush, snow, or frost may be removed from aircraft surfaces by fluids or mechanical methods, alternate technologies or combinations thereof. Refer to airframe manufacturer's documentation for guidance. Any deicing process or method used shall ensure compliance with AS6285.

This section establishes the procedures for removal of the frozen precipitation with fluids.

3.14.2 General

For maximum deicing effect, heated fluids should be applied close to the surface of the aircraft skin to minimize heat loss. Fluid temperatures and pressures at skin level should not exceed aircraft manufacturer's recommendations.

NOTE: The heat in the fluid effectively melts any frost, as well as light deposits of slush, snow, and ice. Heavier accumulations require the heat to break the bond between the frozen deposits and the structure; the hydraulic force of the fluid spray is then used to flush off the residue. The deicing fluid will prevent re-freezing for a period of time depending on aircraft skin temperature, temperature of the fluid, OAT, fluid used, mixture strength, and the weather.

Ice, snow, or frost dilutes the fluid. Apply enough hot deicing fluid to ensure that refreezing does not occur and all contaminated fluid is driven off.

For effective removal of snow and ice the following techniques should be adopted. Aircraft may require unique procedures to accommodate design differences.

- Wings/Tail Plane: The direction of the spray shall be from the leading edge to the trailing edge. However, it is possible that aircraft configuration and local conditions may dictate a different procedure.
- Vertical Surfaces: Start at top and work down.

- Fuselage: Spray along top centerline and then outboard. Ensure that it is clear of ice and snow in accordance with the aircraft manufacturer's manuals. Hoarfrost may be allowed in accordance with the aircraft manufacturer's manuals.
- Landing Gear and Wheel Bays: Keep application of deicing fluid in this area to a minimum. Do not spray deicing fluid directly on wheels, on brakes or into wheel bays.

NOTE: It may be possible to mechanically remove accumulations such as blown snow, however, where deposits have bonded to surfaces they can be removed by the application of hot air, with the bristle end of a broom, or by spraying with hot deicing fluids.

- Engines: Deposits of snow must be removed from engine intakes prior to departure. Any frozen deposits that may have bonded to either the lower surface of the intake or the fan blades may be removed by hot air or other means recommended by the engine manufacturer. If use of deicing fluid is permitted, do not spray directly into engine core.

3.14.3 For Removal of Frost and Light Ice

A nozzle setting with a fan spray is recommended.

NOTE: Providing the hot fluid is applied close to the aircraft's skin, a minimal amount of fluid will be required to melt the deposit. (Refer to minimum distances required by aircraft manufacturers and fluid manufacturers).

3.14.4 For Removal of Snow

A nozzle setting sufficient to flush off deposits and minimize foam production is recommended.

NOTE: Foam could be confused as snow.

NOTE: The method adopted will depend on the equipment available and the depth and the type of snow; i.e., dry and light or wet and heavy. In general, the heavier the deposits, the heavier the fluid flow that will be required to effectively and efficiently remove it from the aircraft surfaces. For light deposits of both wet and dry snow, adopt a similar procedure as for frost removal. Wet snow is more difficult to remove than dry snow and unless deposits are relatively light, selection of a high fluid flow will be found to be more effective.

NOTE: Under certain conditions it will be possible to use the heat, combined with the hydraulic pressure of the fluid spray to melt and subsequently flush off frozen deposits. However, where snow has bonded to the aircraft skin, the procedures detailed in 3.14.3 should be utilized. Heavy accumulation of snow will always be difficult to remove from aircraft surfaces and vast quantities of fluid will invariably be consumed in the attempt. Under these conditions serious consideration should be given to manually removing the snow before attempting a normal deicing procedure.

3.14.5 For Removal of Ice

Heated fluid shall be used to break the ice bond.

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

CAUTION: Consult aircraft manufacturers' limitations for maximum fluid application pressure and temperature.

3.14.6 Alternate Deicing Technologies

Alternate technology may be used to accomplish the deicing process. Refer to ARP4737 for information regarding any specific procedural recommendation associated with their use.

NOTE: Pre-step process to be done prior to deicing/anti-icing.

A pre-step process to the deicing process, in order to remove large amounts of frozen contamination (e.g., snow, slush, or ice), may be considered to reduce the quantity of glycol-based deicing fluids that is needed.

This pre-step process may be performed with various means (e.g., brooms, forced air, heat, heated water, heated fluids with negative buffer freezing point). If the pre-step procedure is used, make sure that the subsequent deicing process removes all frozen contamination including the contamination that may have formed on surfaces and/or in cavities due to the pre-step process.

3.15 Anti-Icing

Ice, slush, snow, or frost will, for a period of time, be prevented from adhering to or accumulating on aircraft surfaces by the application of anti-icing fluids. This section provides recommended procedures for the use of anti-icing fluids.

3.15.1 Required Usage

Anti-icing fluid shall be applied to aircraft critical surfaces when freezing rain, snow, or other freezing precipitation may adhere to the aircraft prior to takeoff (per AS6285).

3.15.2 Preventative Anti-Icing

Anti-icing fluid may be applied to clean aircraft surfaces prior to the start of freezing precipitation. This will minimize the formation of adhering contamination prior to departure and often makes subsequent deicing/anti-icing easier or unnecessary.

3.15.3 General

For effective anti-icing an even film of fluid is required over the prescribed aircraft surfaces which are clean or which have been deiced. For longer anti-icing protection, undiluted SAE Type II, III, or IV fluid should be used. The high fluid pressures and flow rates normally associated with deicing are not required for this operation.

NOTE: SAE Type I fluids have limited effectiveness when used for anti-icing purposes. Little benefit is gained from the minimal HOT generated. The process should be continuous and as short as possible. Anti-icing should be carried out as near to the departure time as possible in order to utilize available HOT.

3.15.3.1 Anti-Icing Fluid Application Strategy

The anti-icing fluid should be distributed uniformly. In order to control the uniformity, all horizontal aircraft surfaces shall be visually checked during application of the fluid. The amount required will be visually indicated by the fluid just beginning to drip off the leading and trailing edges. Surfaces to be protected include:

- Wing upper surface and leading edges
- Horizontal stabilizer upper surfaces and leading edges and elevator upper surfaces
- Vertical stabilizer and rudder
- Fuselage upper surfaces (especially on aircraft with center-mounted engines), depending on amount and type of precipitation.

CAUTION: It is possible that Anti-icing fluids may not flow evenly over wing leading edges, horizontal and vertical stabilizers. These surfaces should be checked to ensure that they are properly coated with fluid. Under no circumstances shall an aircraft that has been anti-iced receive a further coating of anti-icing fluid directly on top of the contaminated film. Should it be necessary for an aircraft to be re-protected prior to the next flight, a complete deicing/anti-icing treatment shall be performed. Ensure that any fluid remaining from a previous treatment is flushed off before a further application of anti-icing fluid.

CAUTION: The repeated application of Type II, III, or IV fluid may cause residues to collect in aerodynamically quiet areas, cavities, and gaps. The application of hot water or heated Type I fluid in the first step of the deicing/anti-icing process may minimize the formation of residues. Residues may rehydrate and freeze under certain temperature, high humidity, and/or rain conditions and may block or impede critical flight control systems. These residues may require removal.

NOTE: When checking for residues, their visibility may be facilitated by misting with water. Deicing/anti-icing near the beginning of the departure runway provides the minimum interval between deicing/anti-icing and take off.

3.16 Deicing/Anti-Icing

If both deicing and anti-icing are required, the procedure may be performed in one or two steps. The selection of a one-step or two-step process depends upon weather conditions, available equipment, available fluids, and the HOT to be achieved.

NOTE: When longer HOTs are desired, use of undiluted SAE Type II, III, or IV fluid should be considered.

3.16.1 One-Step Deicing/Anti-Icing

This treatment is performed with an anti-icing fluid. The correct fluid concentration is chosen with regard to desired HOT, dictated by OAT and weather conditions. Refer to application guidelines in AS6286/6 of this document and holdover guidelines in AS6286/3 for guidance regarding fluid limitations.

CAUTION: Wing skin temperature may differ and in some cases may be lower than OAT. A stronger mix can be used under the latter conditions.

3.16.2 Two-Step Deicing/Anti-Icing

The first-step deicing is followed by a second-step, anti-icing as a separate process. The first-step is performed with deicing fluid. The correct deicing fluid mixture is chosen with regard to OAT. The second-step is performed with anti-icing fluid. This fluid and its concentration are chosen with regard to desired HOT, which is dictated by OAT and weather conditions. The second-step shall be performed before first-step fluid freezes (typically within 3 minutes) if necessary area-by-area. Use a second-step spraying technique which replaces the first-step fluid and provide a sufficient amount of second-step fluid to completely cover the surfaces with an adequate fluid thickness. Where re-freezing occurs following the initial treatment, both first- and second-step must be repeated. Refer to application guidelines in AS6286/3, Section 5 for guidance regarding fluid limitations.

CAUTION: Wing skin temperature may differ, and in some cases may be lower than OAT. A mix with higher glycol concentration can be used under these conditions.

CAUTION: In order to maximize HOT, the second-step fluid must be applied to make sure there is minimum dilution and reaction with the first-step fluid.

Deicing/anti-icing near the beginning of the departure runway provides the minimum interval between deicing/anti-icing and takeoff.

NOTE: Non-glycol based fluids are not covered in this section

3.16.3 Guidelines for the Application of Deicing/Anti-Icing Fluids

Refer to AS6286/6 for application guidelines.

3.17 Post Deicing/Anti-Icing Check Requirement

Conduct this check to ensure all critical surfaces are free of adhering contamination following deicing/anti-icing.