FEDEX AIRCRAFT

DE / ANTI-ICING

NOTE: **Nothing in this presentation shall be construed as authority for deviation from Federal Aviation Regulations or approved aircraft or component maintenance and overhaul manuals.**

Please refer to http://amt.aod.fedex.com/mx/acmx/mtt/resources/manuals.html to access this manual online.

TABLE OF CONTENTS

The following publications contain information relevant to winter operations, duties and responsibilities of personnel, and deicing procedures:

1. **Controlled Publications (These should always be consulted for latest policy)**
   - A. ***Winter Operations Manual*: contains current policy and procedural information regarding De/Anti-icing of FedEx aircraft.**

http://flightweb.pilot.fedex.com/mpv/index.jsp?topic=/com.fedex.aod.regpubs.manuals_wom/fm_intro.html

   - B. ***General Maintenance Manual*: contains current training policy, including initial and recurrent training requirements.**

http://flightweb.pilot.fedex.com/mpv/index.jsp?topic=/com.fedex.aod.regpubs.manuals_gmm/fm_intro.html

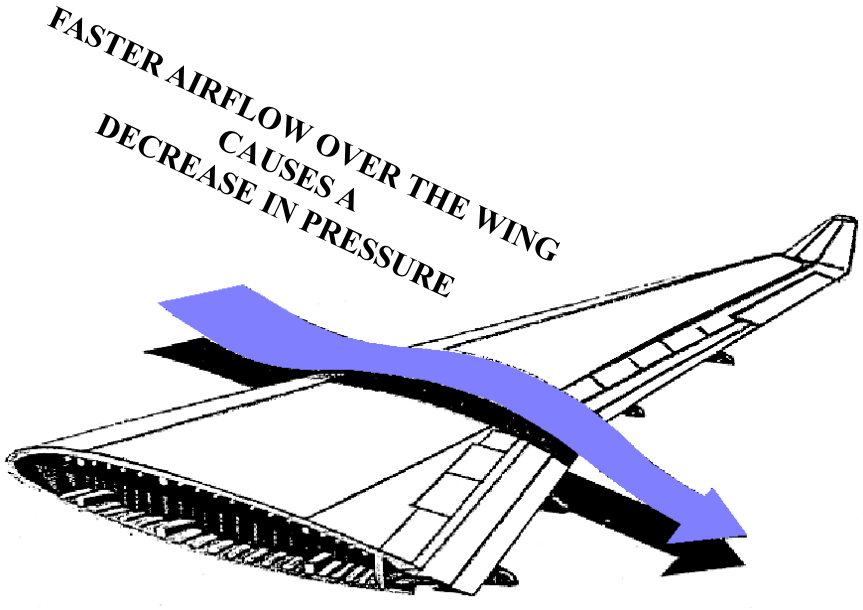
2. **Station Compliance**
   - A. ***Local Field Station Winter Operations Plan*: (developed by station management and District Maintenance manager) The Winter Operations Manual discusses procedures specific to your location and lists qualified personnel.**

3. **Training Purposes Only**
   - A. ***De-ice Study Guide*: includes recurrent course codes and De-ice DE checklist.**
   - B. ***De-ice Equipment Study Guide*: covers information specific to the operation of each type of De-ice equipment.**

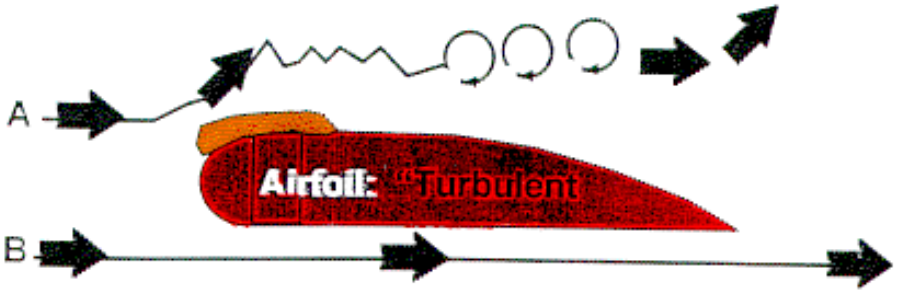
OPPOSING FACTORS

Bernoulli Principle

The Swiss scientist, Daniel Bernoulli (1700-1782), demonstrated that, in most cases, the pressure in a fluid (air, water, gas, etc.) decreases as the fluid moves faster. This explains in part why a wing lifts an airplane.



Ice, snow and frost on the leading edge and upper lift surfaces can disrupt proper airflow causing significant lift degradation



Class Exercise

What went wrong?

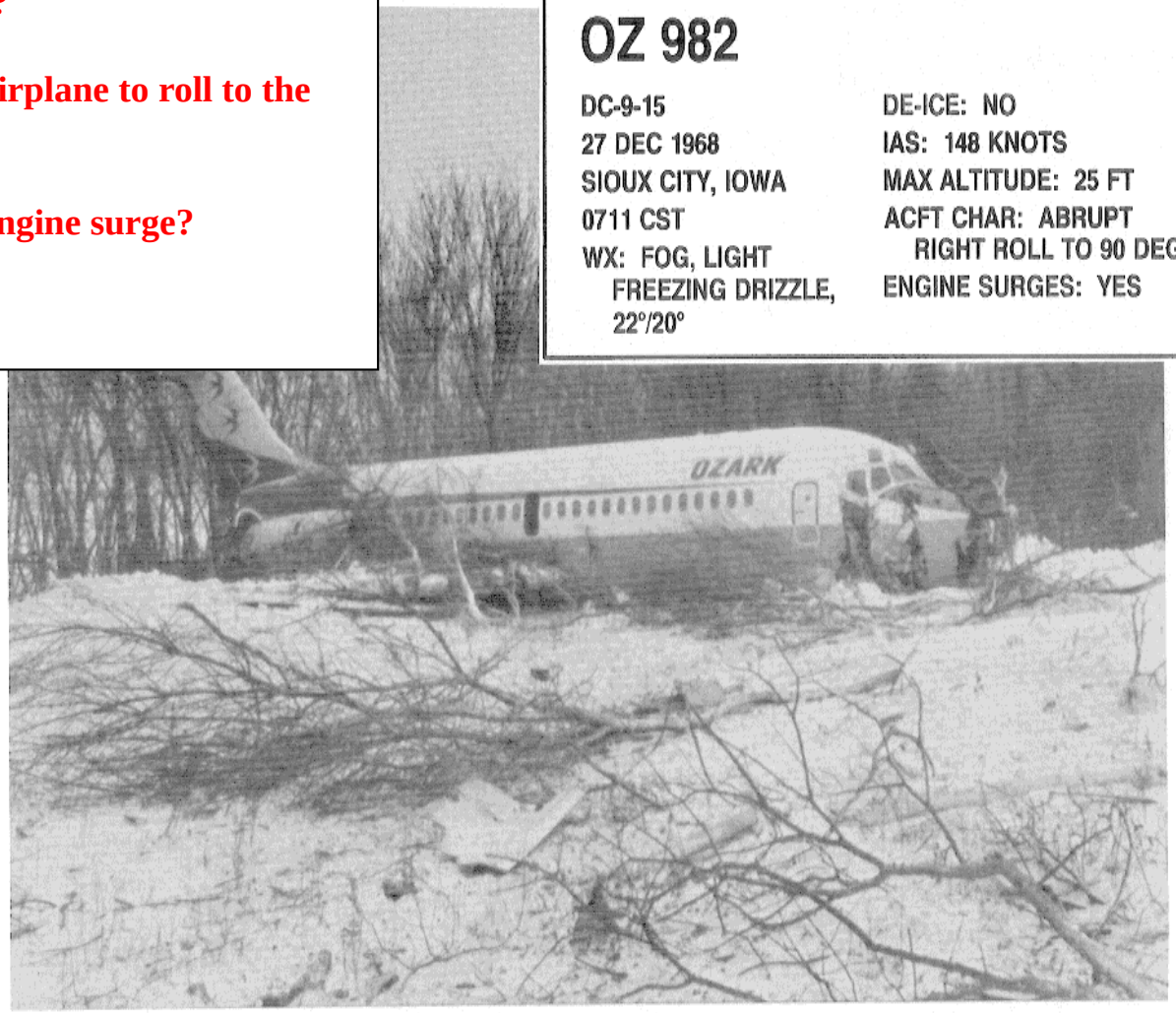
What caused the airplane to roll to the right?

What caused the engine surge?

OZ 982

DC-9-15
27 DEC 1968
SIOUX CITY, IOWA
0711 CST
WX: FOG, LIGHT FREEZING DRIZZLE, 22°/20°

DE-ICE: NO
IAS: 148 KNOTS
MAX ALTITUDE: 25 FT
ACFT CHAR: ABRUPT RIGHT ROLL TO 90 DEG
ENGINE SURGES: YES



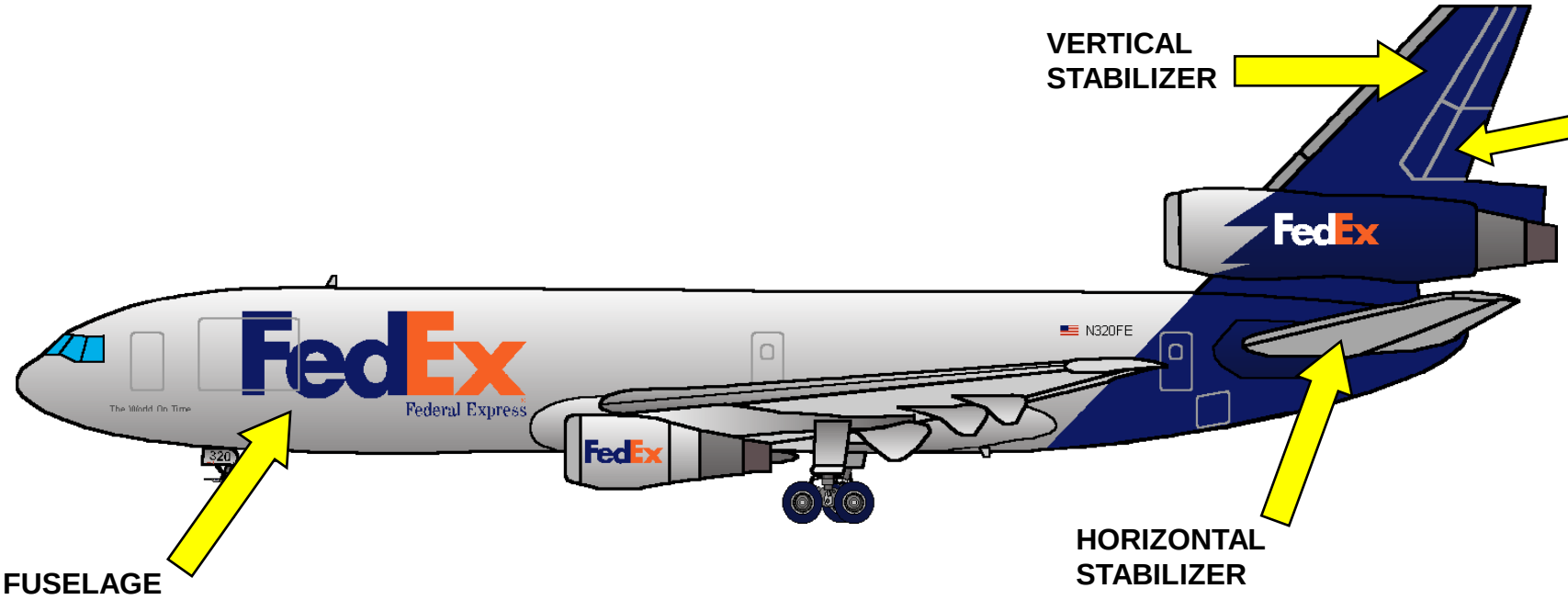
27 DEC 68 OZARK SIOUX CITY DC-9-10

OZ 982

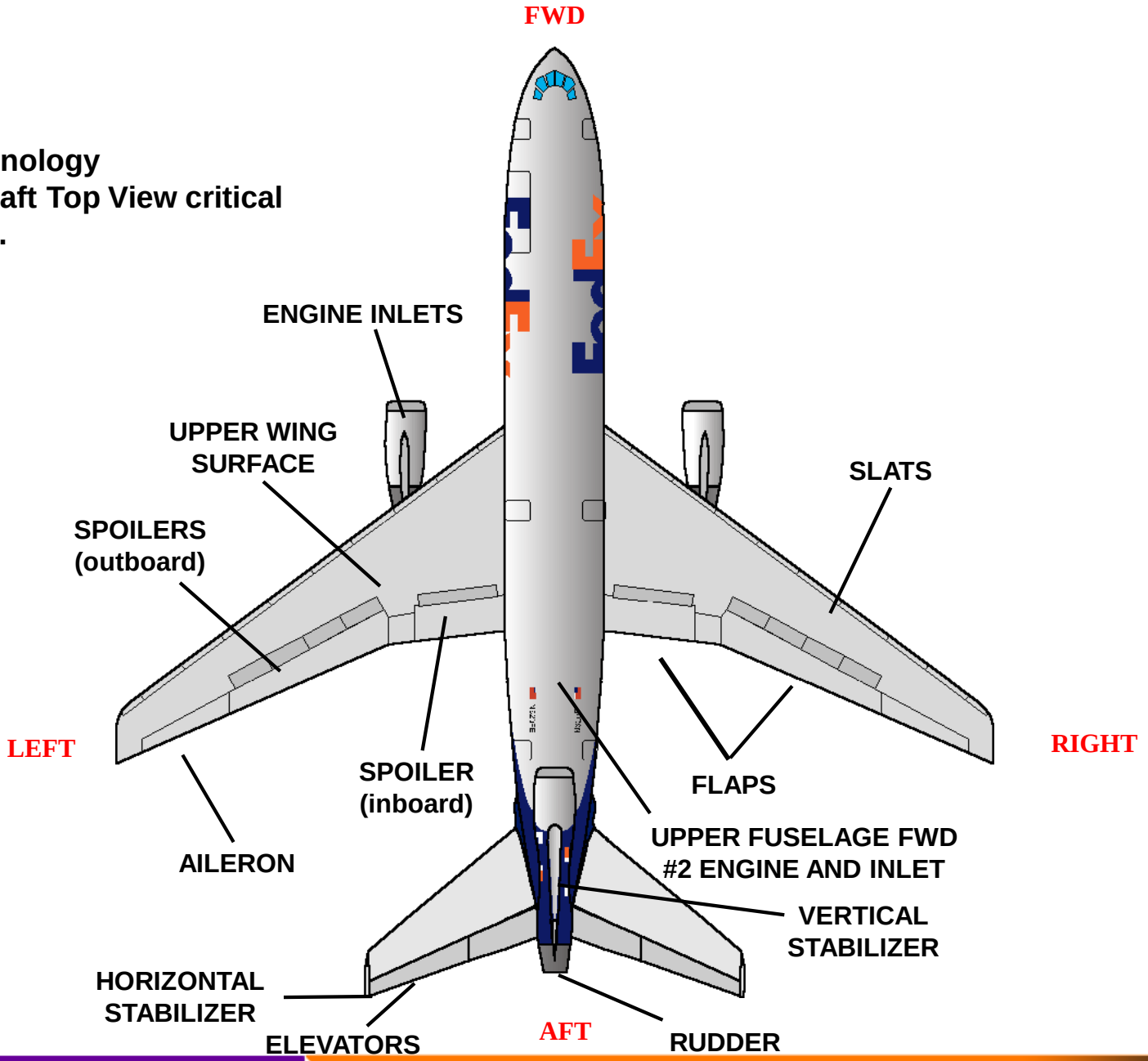
THIS IS NEVER ACCEPTABLE

You are the front line defense to ensuring all the ice and snow is removed from the aircraft!

Aircraft Terminology
Douglas Aircraft - Left Side View



Aircraft Terminology
Douglas Aircraft Top View critical surface areas.



1. During the operation of a de/anti-icing vehicle, de/anti-ice crews must adhere to the basic safety related procedures noted in this section. The safety procedures in this section are documented as a mandatory minimum and are not meant to supersede more stringent local requirements.

2. PPE Personal Protection Equipment

   A. All deicers must use a company approved fall protection device.

      a) Open basket deicers must wear a harness with a 4-5 ft shock absorbing lanyard attached to approved anchor points.

      b) Enclosed cab deicers must wear the seatbelt provided.

   B. Any deicer riding in an open basket must wear company approved eye protection, rain gear, and gloves.

1. Basic Vehicle Safety

   A. Do not exceed posted ramp speed limits.

   B. At no time during a deice operation is the vehicle or basket to pass under or be positioned under any part of the aircraft.

   C. The vehicle is to skirt the outside periphery of the horizontal tail surfaces and wings as well as the fuselage.

   D. Exercise caution when operating basket controls. Move them slowly for smooth basket motion.

   E. Maintain a minimum of 8-foot clearance between the deicing vehicle and the aircraft.

   F. Maintain a minimum of 3-foot clearance between the basket and/or spray nozzle and the aircraft.

   G. Do not exceed 4 mph (normal walking speed) with deicer in basket.

   H. Do not exceed 25 mph when fluid tanks are filled.

   I. While directing the deice vehicle to move, if the basket operator cannot see clearly, stop all deice operations until conditions that impair vision have been cleared.

   J. While driving the deice vehicle, if the vehicle driver cannot see clearly, stop the vehicle until conditions that impair vision have been cleared.

   K. When deicing from a Tempest Deice Truck, ensure the main boom is even with or higher than the jib boom. This will help prevent aircraft strikes.

K. The driver must test the brakes before approaching the aircraft.

L. When driving from aircraft to aircraft the boom must be in the cradle

M. De/anti-icing vehicles are designed to operate safely in wind speeds of up to 46 MPH

N. De/anti-icing vehicle booms must be placarded for maximum weight. The person working in the boom must not exceed the maximum weight allowed for the boom they are operating.

NOTE: TEMPEST / AIRFIRST DEICER ENCLOSED CABS HAVE A WEIGHT LIMIT OF 300 LBS. YOU MUST BE ABLE TO FASTEN THE SEAT BELT IN THE ENCLOSED CAB.

NOTE: OPEN BASKET TRUCKS HAVE A WEIGHT LIMIT OF 450 LBS.

WARNING: If you exceed the manufactures safe operating weight limit, for safety purposes, you should refrain from operating the boom on a deicer truck.

Open Bucket Deicing Vehicle

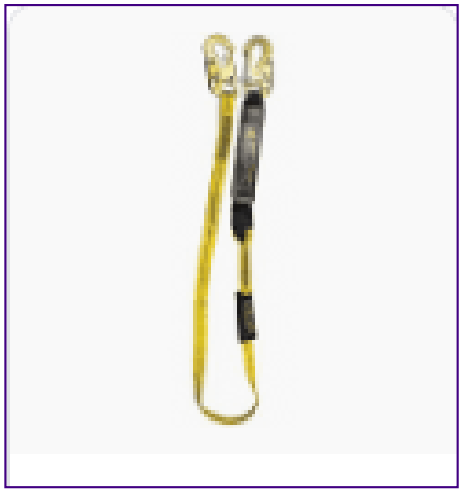
Employees working in an open bucket deicing vehicle must wear a full body safety harness and lanyard.

Harness—must have a back D-ring

Lanyard—must be a 4 ft. or 5 ft. shock absorbing lanyard

The lanyard must be attached to the D-ring on the back of the harness and to a designated anchor point on the vehicle.

Prior to the initial movement of the vehicle, the driver of the deicing vehicle must verbally verify with the bucket operator that the operator is wearing a harness and the harness is attached to the vehicle anchor point.



Any deicer riding in an open basket must wear company approved eye protection, rain gear, and gloves.

POLICY

Refer to G.M.M. 2-1-700

1. **FedEx TechOps Training initially trains and certifies AOD personnel for de/anti-icing operations on trunk aircraft.**

2. **Proficiency training is the responsibility of local Ramp Operations and/or Aircraft Maintenance management.**

FLC recurrent course codes

Course Name	Course Code	Course Name	Course Code
Aircraft DE/ANTI-ICE	M91334P	Designated Examiner	M91308P
FMC 2000II Ops	M91330P	LMD 2000 Ops	M91353P
Global 2110 Ops	M91360P	Tempest I Ops	M91399P
Tempest II Ops	M91433P	FMC Airfirst Ops	M91363P
Tempest II XR Plus Ops	M91525P	Tempest II Single Drive Ops	M91562P
Tempest II Open Basket Ops	M91588P	Tempest II Open Basket XR Ops	M91711P
Tempest i Open Basket Ops	M91749P	Tempest i Enclosed Basket Ops	M91750P
Vestergaard Elephant/Beta Ops	M91725P	Vetergaard My Lite Ops	M91726P
Global 2200 Air Plus XR Ops	M91542P	GS1400 Deicer Ops	M91475P

TRAINING REQUIREMENTS

1. Aircraft maintenance personnel and ramp operations personnel are qualified and certified to de-ice/anti-ice FedEx aircraft upon the completion of the appropriate de-ice/anti-icing training courses. Qualification on the deicing/anti-icing equipment is done on each individual piece of equipment and does not carry over to any other piece of de/anti-ice equipment.

2. Initial training consist of formal class room lecture and practical training on the ground to cockpit communication procedures, de-ice operations, fluid use/testing, and on ramp spraying.

3. Annual recurrent training is required of all personnel to maintain deicing/anti-icing qualification. This training consists of a review of deicing/anti-icing procedures via video tape and training manuals and the completion of computer test in addition to on ramp equipment operation and an oral and practical exam on ground-to-cockpit communications. A member of management, FedEx TechOps Training instructor or a Designated Examiner (DE) may conduct the video and manuals review and administer the test.

4. A FedEx TechOps Training instructor or a DE must conduct the oral and practical exams on ground to cockpit communications procedures, de/anti-ice operation responsibilities, and the on ramp equipment operations.

5. This portion of the recurrent training must take place prior to taking the computer test.

6. Sequencing of recurrent training is particularly important. The process begins by reporting to a Designated Examiner (DE) or a FedEx TechOps Training instructor and ends with passing a test in FLC for Procedures and each piece of de-ice equipment certified on.

NOTE: The de-ice recurrent tests in FLC are open enrollment, the employee should not take these test until all prior steps of the re-certification process have been completed.

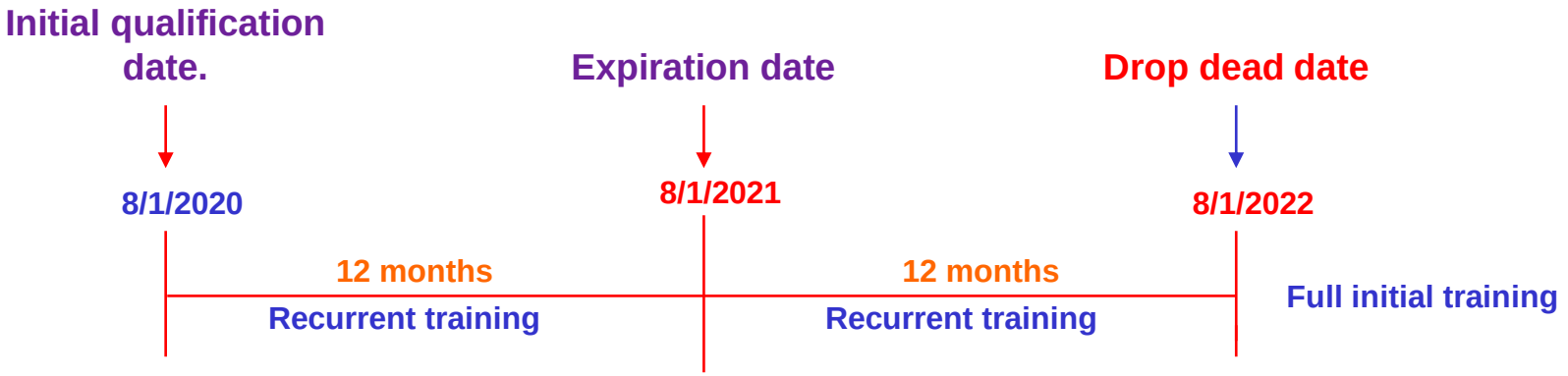
7. When the appropriate tests have been successfully completed with minimum score of 90% sign the printout and give it to the DE for filing in your training record.

CERTIFICATION/REQUALIFICATION REQUIREMENTS

1. **Certification is valid for 12 months since last qualified.**
2. **Re-qualification training is required for personnel who were initially qualified but who have not received annual re-qualification training.**
3. **Satisfactory completion of re-qualification training enables personnel to conduct De/Anti-icing of FedEx trunk aircraft.**

<u>Re-qualification training time limits are:</u>

1. **Up to 12 months since expiration date - employee must complete the full recurrent training program. If deicers exceed their expiration date, they are not qualified to deice or operate the deice equipment until recertified. There is a 12 month period after expiration date for recurrent/requalification training.**
2. **More than 12 months since expiration date - employee must complete full initial training program.**



TRAINING RESPONSIBILITIES

AODT/FEDEX TECHOPS TRAINING RESPONSIBILITIES:

1. **FedEx TechOps Training develops, delivers, and tracks the initial de/anti-icing training.**

2. **FedEx TechOps Training instructors develop and deliver recurrent and re-qualification de/anti-icing training in conjunction with DE's.**

3. **Each FedEx Express Ramp and FedEx TechOps Training maintain a record of personnel who are trained and qualified to conduct de/anti-icing operations at that Ramp.**

DE RESPONSIBILITIES

1. **FedEx TechOps Training initially trains and qualifies all Designated Examiners for de/anti-icing recurrent training program.**

2. **DEs must be de/anti-ice qualified on the equipment they are to conduct exams on.**

3. **All DEs must complete a 1 day training class conducted by FedEx TechOps Training that covers exam techniques, documentation and Designated Examiner responsibilities, and the proper operation of assigned equipment as well as aircraft application techniques.**

4. **DEs remain current and qualified to conduct recurrent and re-qualification training as long as they maintain their currency on the equipment and aircraft and conduct at least two sessions each calendar year.**

5. **A TechOps Training Instructor or a FedEx AMT Designated Examiner initially trains a Vendor Trainer to conduct FedEx Deice training for their company's employees.**

DESIGNATED EXAMINER CHECKLIST

EQUIPMENT TYPE/MODEL _____	DE	OPERATOR
Operator has reviewed the De-ice Study Guide and a video on De-ice procedures.		
Operator has demonstrated the ability to pre-trip the deice equipment.		
Operator has demonstrated the ability to use the Misco® / Palm Abbe refractometer.		
Operator has demonstrated the ability to properly operate the de-ice equipment.		
Operator has demonstrated the ability to complete the applicable de/ anti-ice forms.		
Operator is aware of all safety rules and precautions.		
Operator is familiar with the Winter Operations Manual.		
Operator has demonstrated the proper ground to basket communication technique.		
Operator has taken the applicable FLC test and received a passing grade of 90%.		

_____ / _____ _____ / _____

DESIGNATED EXAMINER SIGNATURE DATE EMPLOYEE SIGNATURE DATE

NOTE:THE FLC TEST SHOULD ONLY BE TAKEN AFER ALL OTHER STEPS ARE COMPLETE

There are two types of glycol used for de/anti-icing aircraft.

1.Ethylene glycol (not commonly used)
2. Propylene glycol

NOTE: Observe safety precautions while working with glycol and wear the recommended protective clothing and equipment.

Glycol is used for:

1. Aircraft deicing consists of the removal of frost, ice and snow from the aircraft.

NOTE: You will be spraying a solution of this fluid mixed with water, heated from 140ºF to180ºF to de-ice aircraft.

2. Anti-icing is a precautionary measure that prevents frost, ice or snow from accumulating on the protected surfaces of the aircraft.

WARNING: **DO NOT APPLY TYPE I FLUID IN 100% CONCENTRATION.**

TYPE I FLUID IS APPROVED FOR ALL AIRCRAFT TYPES.

Type I de/anti-icing fluids are typically heated water, glycol, or various mixtures of each which provides excellent frozen contamination removal.

Under precipitation conditions the holdover time is very short.

Ice can be removed from aircraft by spray application of a heated solution of de/anti-icing fluid and/or water.

Type I fluid provides:

1. **Excellent deicing capabilities.**
2. **Good refreeze protection. (during times with little or no precipitation)**
3. **Minimum holdover time.**

NOTE: **Type I must have a refractometer reading of at least 18° F below outside ambient temperature. Refer to the FedEx WOM if fluid does not meet the above parameters.**

WARNING: **WHEN SPRAYING 100% TYPE II OR TYPE IV FLUIDS, THE NOZZLE MUST BE FULLY OPENED TO PREVENT SHEARING OF THE FLUID. (OPEN BASKET TRUCKS)**

SAE Type II/IV de/anti-icing fluids are thicker than Type I fluids and possess a protective feature that keeps frozen contamination from adhering to the aircraft.

These fluids are typically applied unheated to a clean aircraft.

Under precipitation conditions the holdover time is excellent.

Type II/IV fluid provides:

1. **Minimum deicing capabilities.**
2. **Good refreeze protection.**
3. **Excellent holdover time.**

Examples of approved Type II De/anti-icing fluids

1. **Kilfrost ABC-2000**
2. **Kilfrost ABC-K Plus**
3. **Safewing 1951**

Examples of approved Type IV fluid:

1. **Safewing 2001**
2. **Safewing Launch**
3. **Artic Shield**
4. **Flightguard AD-480**
5. **Kilfrost ABC-S / Kilfrost ABC-S Plus**
6. **Polar Guard**
7. **Max-Flight 04**

Hazards Associated with Propylene glycol:

1. **No chronic health effects expected from normal use.**
2. **Acute short term health effects are limited to slight eye irritation and a slight ingestion hazard.**

For inhalation:

Not expected to present a significant hazard under anticipated conditions of normal use.

When swallowed:

WARNING: NEVER GIVE ANYTHING BY MOUTH TO AN UNCONSCIOUS PERSON.

1. **If large quantities are swallowed, and the victim is completely conscious, give (2) glasses of lukewarm water.**
2. **Do not induce vomiting. (The risk of damage to the lungs exceeds the poisoning risk)**
3. **Seek immediate medical assistance.**

For eye contact:

WARNING: AVOID WEARING CONTACT LENSES WHILE WORKING WITH GLYCOL.

1. **Immediately rinse with clean water for 20 - 30 minutes. Retract eyelids often.**
2. **Obtain emergency medical attention if pain, blinking, tears or redness persists.**

For skin contact:

Not expected to present a significant skin hazard under anticipated conditions of normal use.

CAUTION: **TO AVOID EYE AND SKIN IRRITATION AND BURNS: ALWAYS WEAR PROTECTIVE CLOTHING AND EYE PROTECTION.**

Avoid swallowing glycol and wash face and hands with soap and water after using de/ anti-icing equipment.

Management is responsible for providing safety equipment . Such equipment may include but not limited to the following:

1. **Eye protection**
2. **Safety shoes**
3. **Safety harness (Mandatory for open basket operator)**
4. **Headsets for communications**

The use of safety belts are no longer allowed. You must wear an approved safety harness while operating the boom in an open basket truck.

GENERAL

1. Removing ice and snow from aircraft surfaces is necessary prior to takeoff. Federal Aviation Regulation 121.629 (b) states: "No person may take off an aircraft when frost, snow, or ice is adhering to the wings, control surfaces, propellers, engine inlets, or other critical surfaces of the aircraft.

2. Exposure to weather conditions on the ground that are conducive to ice formation can cause an accumulation and/or adherence of frost, snow, or ice on aircraft surfaces and components that can adversely affect aircraft performance, stability, and control. This procedure contains instructions for de/anti-icing all FedEx Express aircraft with snow, frost, or ice adhering to the surfaces.

3. Ice or snow adhering to the aircraft can cause improper airflow and a resultant loss of lift on wings, stabilizers, and control surfaces. Even small amounts of surface roughness due to frost, ice, or snow on leading edges can cause significant performance degradation. Snow and rain can freeze between a control surface and structure, restricting proper control surface movement. In addition, snow and ice could increase total aircraft weight and exceed the flying capabilities of the aircraft.

4. The "Clean Aircraft Concept" embodied in FAR 121.629 and required by the FAA and FedEx Express demands that takeoff be accomplished only after the pilot-in-command is assured that all critical areas of the aircraft are free of ice, snow, or frost.

5. The Director of Operations is the officer responsible (per FAR 119.65) for the FedEx Express de/anti-icing program. The Director of Operations assigns authority to the Deice program manager for the purpose of administration and oversight of the FedEx Express approved ground de/anti-icing program unless documented otherwise. Refer to the WOM 1-0-3 for a detailed list of responsibilities.

. Aircraft Maintenance in conjunction with hub operations is responsible for de/anti-icing Fedex Express aircraft in Memphis. At Field locations, qualified personnel from Maintenance or Ramp Operations or vendor support are responsible for de/anti-icing FedEx Express aircraft. Refer to the Winter Operations Manual for specific information on local winterization plan.

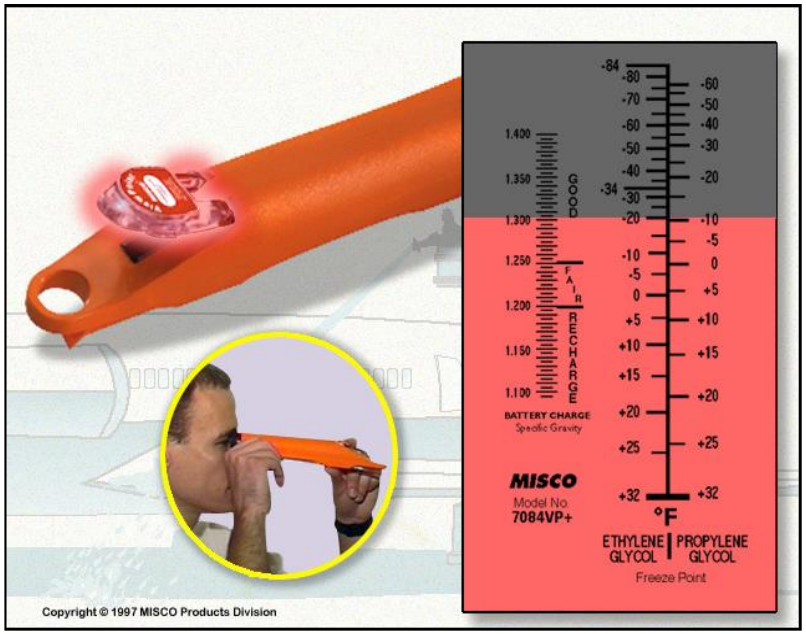
NOTE: Before applying any fluid to the aircraft, brief the flight crew (when present) on your intentions and details of the De/anti-icing plan. Always communicate any changes during operations with the flight crew, (e.g.,truck problem, delays).

Basic Principles of Deicing

1. **The captain has the authority to order de/anti-icing when ever deemed necessary, and has the final decision at the time of acceptance prior to departure.**
2. **The captain is responsible for the anti-icing condition of the aircraft during ground maneuvering prior to takeoff.**
3. **The captain and/or the Primary and Secondary de/anti-icing personnel are responsible for deciding the need to remove ice/snow and anti-icing methods and fluid types to be used as required by the local de/anti-icing plan.**
4. **The de/anti-icing operation involves many variables: temperature, type and rate of precipitation, type and thickness of accumulation, wind, etc., that cannot be fully anticipated in a procedure.**
5. **The deicer must judge the effectiveness of de/anti-icing and adjust techniques to suit conditions.**
6. **If there is any question concerning the effectiveness of procedures or mixtures recommended, more conservative techniques should be employed**
7. **During extended layovers, remove accumulations as early as possible as conditions warrant.**
8. **It is better to perform several snow removal operations rather than trying to remove an excessive accumulation at launch time.**

Aircraft deicing consists of the removal of frost, ice and snow from the aircraft.

Anti-icing is a precautionary measure that prevents frost, ice or snow from accumulating on the protected surfaces of the aircraft.



WARNING: TYPE I DEICE FLUID SHOULD HAVE A REFRACTOMETER READING OF AT LEAST 18°F BELOW OUTSIDE AMBIENT TEMPERATURE

HOLDOVER TIME AND TEMPERATURE LIMITS

1. **Holdover time is the estimated time anti-icing fluid prevents frozen contamination from forming on the protected surfaces of the aircraft under average weather conditions.**

2. **Due to the many variables that influence holdover times, these times are not definitive.**

3. **The actual period of protection may be extended or reduced depending on the particular conditions at the time.**

4. **The captain assesses current weather conditions at the time of departure and determines holdover time.**

5. **The Lowest Operational Use Temperature (LOUT) for a specific SAE Type II/IV fluid is the lowest temperature at which the fluid has been tested and certified as acceptable in accordance with the appropriate aerodynamics acceptance tests while maintaining the 13 degree F freeze point temperature buffer.**

6. **The LOUT for Type II and Type IV fluids s the higher of the freezing point plus 13 degree F and the lowest temperature at which the fluid or fluid mixture meets the aerodynamic acceptance criteria.**

WARNING: THE HOLDOVER CHARTS DEPICTED ARE FOR TRAINING PURPOSES ONLY.

Freezing Point (FP) and Lowest Outside Ambient Temperature (LOUT) for 100% Type II and Type IV Fluids		
Fluid Name	**FP °F**	**LOUT °F**
Dow Flightguard AD-480 Type IV	-33	-15
SPCA AD-480 Type IV	-33	-15
Kilfrost ABC-3 Type II	-33	-20
Kilfrost ABC-2000 Type II	-34	-18
Kilfrost ABC-S Type IV	-35	-18
Kilfrost ABC-S Plus Type IV	-35	-18
Lyondell ARCTIC Shield Type IV	-30	-12
Octagon Max-Flight 04 Type IV	-31	-18
Safewing MP II 1951 Type II	-33	-20
Safewing MP IV 2001 Type IV	-32	-19
Safewing MP IV Launch Type IV	-32	-19
Dow UCAR ULTRA+ Type IV	-75	-11

HOLDOVER TIME AND TEMPERATURE LIMITS (TYPE 1)

Type 1 Holdover Chart		Approximate holdover times under various weather conditions (hours-minutes)					
OAT °C	OAT °F	Frost	Freezing Fog	Snow	Freezing Drizzle	Light Freezing Rain	Rain On Cold Soaked Wing
above 0°	above32°	0:45	0:12-0:30	0:06-0:15	0:05-0:08	0:02-0:05	0:02-0:05
0°/-10°	+32°/+14°	0:45	0:06-0:15	0:06-0:15	0:05-0:08	0:02-0:05	N/A
-11°and below	+14°and below	0:45	0:06-0:15	0:06-0:15	NOT APPROVED FOR USE		

WARNING: THE HOLDOVER CHARTS DEPICTED ARE FOR TRAINING PURPOSES ONLY.

HOLDOVER TIME AND TEMPERATURE LIMITS (TYPE IV)

MAX FLIGHT TYPE IV HOLDOVER CHART

OAT °C	OAT °F	CONCEN-TRATION %	***FROST	FREEZING FOG	SNOW	**FREEZING DRIZZLE	LIGHT FREEZING RAIN	RAIN ON COLD SOAKED WING
Above 0	Above 32	100	18:00	2:00-3:00	1:15-2:00	0:55-2:00	0:35-1:00	0:10-0:50
0 to –3	+32 to+27	100	12:00	2:00-3:00	0:50-1:35	0:55-2:00	0:35-1:00	
-4 to –14	+27 to +7	100	12:00	0:40-3:00	0:25-0:50	*0:30-1:10	*0:20-0:40	
-15 to –25	+6 to –13	100	12:00	0:20-2:00	0:20-0:40			
Below-25	Below-13	100						

WARNING: THE HOLDOVER CHARTS DEPICTED ARE FOR TRAINING PURPOSES ONLY.

BASKET TO DRIVER COMMUNICATION

Deice Vehicle communications

To ensure all deice personnel understand de/anti-ice instructions, all ground personnel must adhere to the following procedures:

A) The basket operator is in charge of deice vehicle movement and also acts as marshaller/guideperson when fluid is not being applied

B) When acting as marshaller/guideperson the basket operator must insure safe movement of the vehicle as a top priority.

C) When backing the vehicle, the boom should be centered if possible and raised to sufficient height to give the basket operator a clear view behind the vehicle.

D) When backing the vehicle, if the area behind the vehicle is not visible from the basket, the basket operator must exit the basket, walk behind the vehicle, and instruct the driver using hand signals.

E) When Operating the Tempest Deicer, the main boom should be higher than, or even with the jib boom. This will help prevent aircraft strikes.

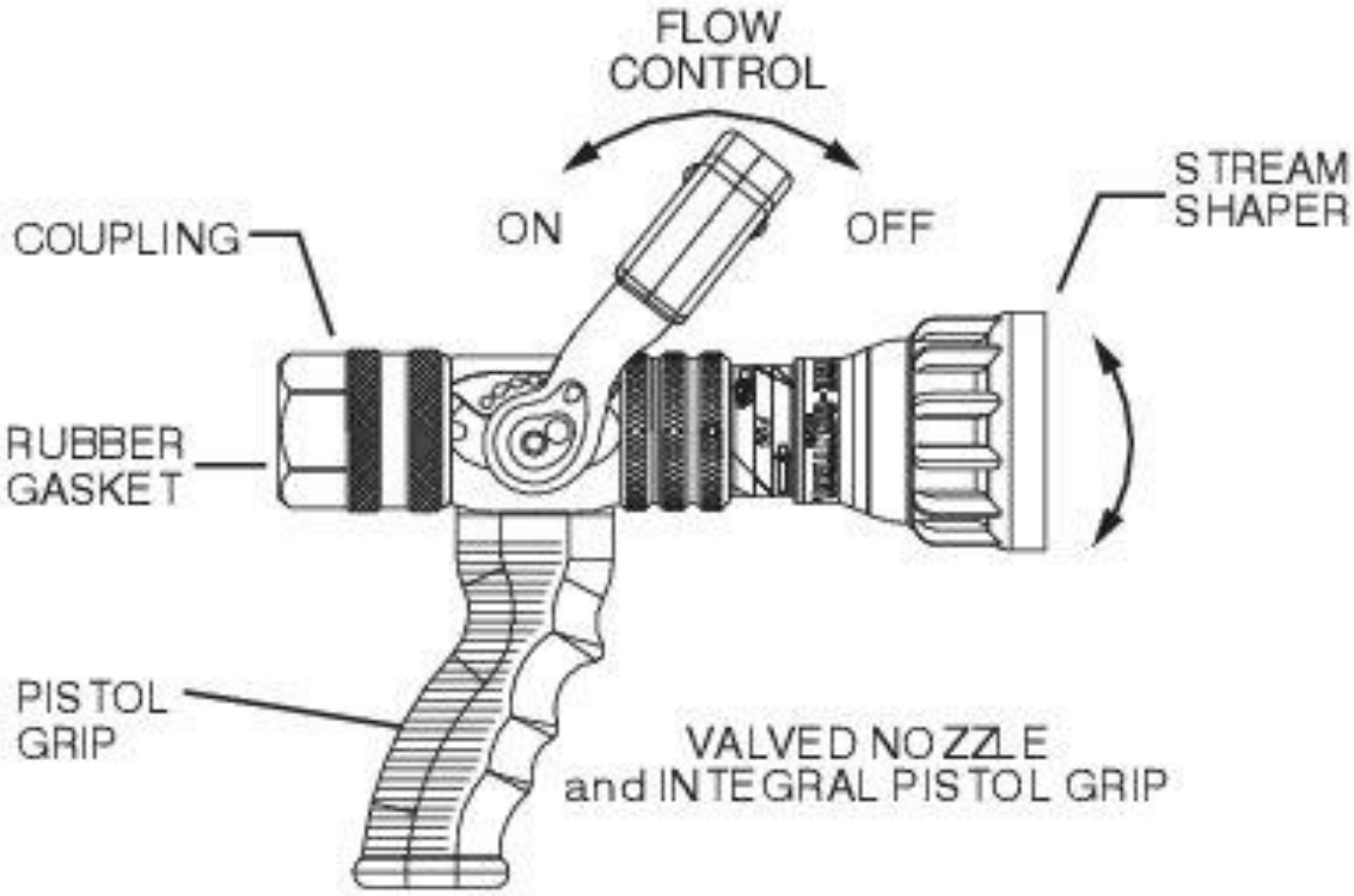
F) When talking on the new digital radios, squeeze the key on the mike, wait one second before talking, then wait one second before releasing the key on the mike. Hold mike 8" from mouth while talking.

F) Basket-to-vehicle communications standard commands are:

a. **Starting De-ice or Anti-ice**
b. **Stopping De-ice or Anti-ice**
c. **Move Forward**
d. **Move Back**
e. **Stop (stop, stop, stop !!!)**
f. **Turn Left**
g. **Turn Right**
h. **Truck is secure**

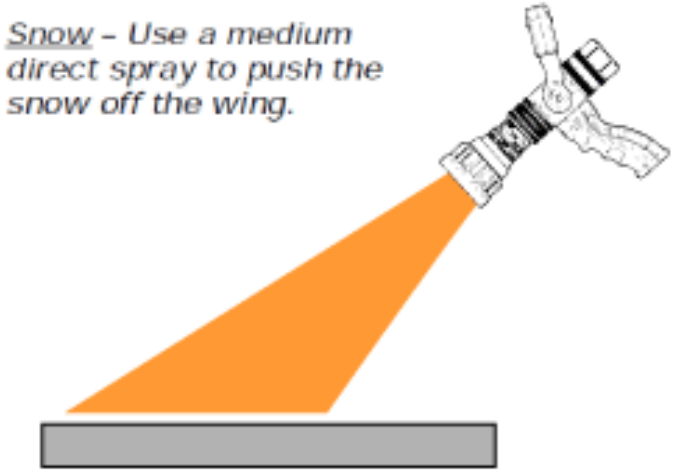
CAUTION

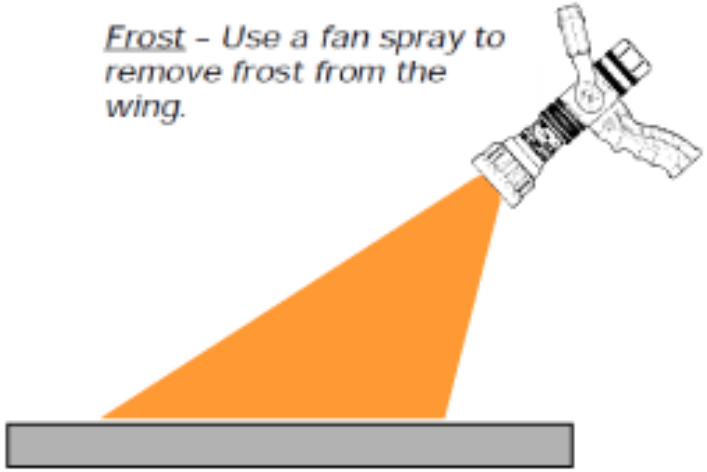
WHEN MOVING THE DEICE VEHICLE, THE BOOM OPERATOR IS RESPONSIBLE FOR THE SAFE MOVEMENT AROUND THE AIRCRAFT. COMMUNICATION IS MANDATORY BETWEEN THE BOOM OPERATOR AND THE DRIVER AT ALL TIMES.

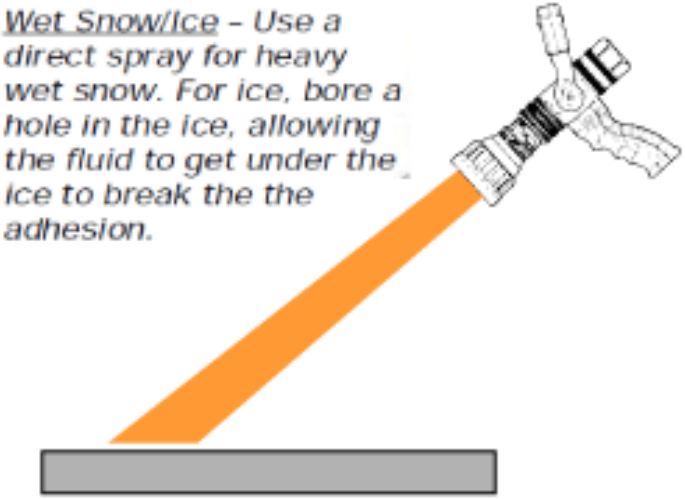


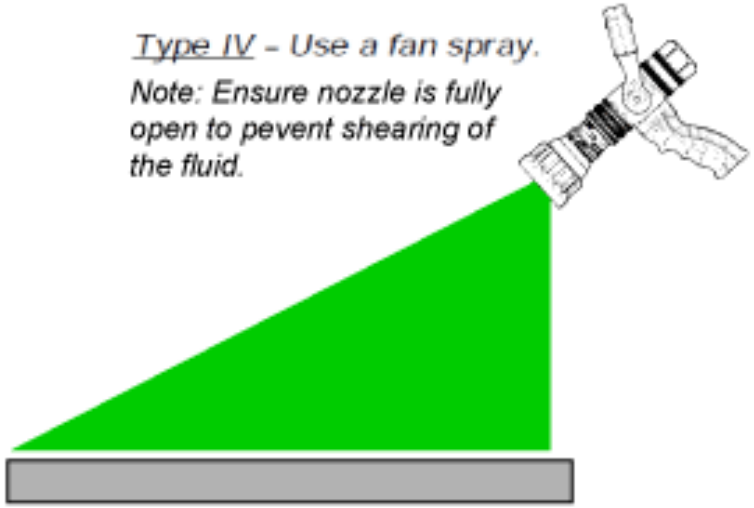
WARNING: NOZZLE MUST BE FULL OPEN WHEN SPRAYING TYPE IV FLUID.

DE/ANTI-ICING FLUID SUGGESTED SPRAY PATTERNS









Do not spray anti-ice fluid forward of the main cargo door

NOTE; **WHEN REMOVING ICE, ALLOW FLUID TIME TO PENETRATE AND BREAK THE BOND BETWEEN THE ICE AND METAL.**

Preventative Anti-icing (Pretreatment)

Aircraft may be anti-iced prior to dispatch in an effort to protect the aircraft surfaces. These surfaces include the top of fuselage aft of the main cabin doors. This may be done even with expectations that the holdover time may be exceeded.

Type II or IV fluid may be applied directly to the aircraft without an initial deicing operation as long as both of the following conditions apply.

1. **There is no active freezing precipitation**
2. **Aircraft surfaces are clean (i.e., no ice, frost, snow, or slush is present on aircraft surfaces).**

Aircraft surfaces should be monitored to ensure that the fluid does not freeze to aircraft surfaces after being subjected to either excessive precipitation or a drop in OAT.

NOTE: **Remove dry snows using brooms, snow blowers (heat blowers), or ropes.**

Pretreatment is ineffective and should not be preformed under the following conditions:

1. **Precipitation is not expected to adhere to the aircraft (e.g., dry snow, warm OAT, etc.)**
2. **Moderate to heavy rain or freezing is expected, as it washes away the anti-icing fluid in a short period of time.**
3. **Heavy snow depending on the duration, OAT and layover time.**

NOTE: **Remove dry snows using brooms, snow blowers (heat blowers), or ropes.**

CAUTION: DO NOT APPLY TYPE II OR TYPE IV FLUID FORWARD OF THE MAIN ENTRY DOORS.

CAUTION: WHEN SPRAYING TYPE II/IV FLUIDS, THE NOZZLE MUST BE FULLY OPEN TO PREVENT SHEARING OF THE FLUID.

CAUTION: WHEN APPLYING ANTI-ICE FLUID, ONLY APPLY ONE BRAND AND TYPE OF FLUID TO A SINGLE AIRCRAFT

Pre-Step Deicing Procedure may be used to remove large amounts of frozen contamination in order to reduce the amount de/anti-icing fluids during a one-step or a two-step procedure.

The Pre-Step can be accomplished using brooms, forced air and heated fluids.

During prolonged heavy storms, deicing should be preformed at regular intervals to prevent heavy buildup of frozen contamination.

One step de/anti-icing

De/anti-icing fluids are applied for the removal of Frost, ice and snow and without an additional application of de/anti-icing fluids.

This is done with a hot mixture of Type I, II or IV de/anti-icing fluid and water in which the concentration is determined with regard to ambient temperature.

Apply a moderate amount of De/anti-icing fluids to drive off all fluids that have absorbed snow, ice, and slush during the deicing process.

Consider the use of a two-step procedure when longer holdover protection is required.

1. **Heated De/anti-icing fluids are applied.**
2. **Concentration of fluid mixture is determined with regard to outside ambient temperature (OAT).**
   a. **Freezing point (FP) of fluid mixture must be at least 18ºF lower than OAT.**
   b. **Fluid may only be used if the OAT is at or above the lowest operational use temperature (LOUT).**
   c. **Fluid must be heated to at least 140ºF at the nozzle.**

Two-Step De/Anti-icing

Two step de/anti-icing is done using both deicing and anti-icing fluids.

The first step is to remove frost, snow or ice from the aircraft surfaces (deicing) using heated deicing fluid.

Freezing point of the fluid mixture should be al least 18º F lower than OAT.

During heavy frozen precipitation conditions with limited resources it may become necessary to complete the two-step procedure area by area.

The use of Type I fluid with forced air assistance is allowed as a first step of the two-step procedure.

1. This is considered a pre-step process.
2. Forced air at this stage is must be followed by an application of hot de/anti-icing fluid.

The second step (anti-icing) is an application of de/anti-icing fluid to surfaces free of ice and snow accumulations. FedEx personnel applies Type IV fluid in 100 % concentration in the anti-icing step.
If necessary, spray area by area.

The second step is performed to provide additional protection from re-freezing and ice and snow accumulations (additional holdover time)

In precipitation conditions the second step must be performed immediately before the first step fluid freezes (typically within 3 minutes).

The application of the anti-icing fluid uses a spraying technique that covers the first step fluid with a sufficient amount of anti-icing fluid completely covering the surfaces with an adequate film thickness.

If refreezing occurs following the initial treatment, both first and second steps must be repeated.

Record the time that the second step begins for communication to the flight crew.

Where refreezing occurs following the initial treatment, both first and second steps must be repeated.

NOTE: DEICE BASKET MUST REMAIN AT LEAST THREE FEET AWAY FROM ANY SURFACE OF THE AIRCRAFT TO AVOID ACCIDENTAL AIRCRAFT STRIKE.

1. When an engine with the potential to accumulate snow or ice is not in use, install all plugs and covers provided for intake or exhaust ducts and the various appendages, such as pitot tubes.

2. Immediately after aircraft arrival and engine spool down, the engines, cowls, spinner, and both sides of the fan blades must be inspected for ice accumulation. Ice accumulation on the blades can be difficult to see if clear.

3. Prior to or during deicing operations, the engines, cowls, spinners, and fan blades are inspected for ice or snow accumulation.

4. Snow and ice accumulations are removed by one of the following methods <u>performed or supervised by Aircraft Maintenance:</u>

   A. Accumulation can be blown from the inlet/exhaust fan ducts with forced air, removed with a broom or heated deicing fluid. If forced air is used, caution must be taken to avoid blowing snow down the core of the engine.

   B. If frost or ice accumulation is present in the lower inlet/exhaust fan ducts, application of heated fluid may be used to remove contamination. If heavy contamination cannot be sufficiently removed without damaging any part of the aircraft engine, maintenance manual procedures must be used.

   C. Procedure for Engine Inlet Deicing with Fluid

      1. To correctly spray an engine inlet, the deice operator must position himself at a height above the lowest point of the engine inlet, to the side, but slightly forward of the engine.

      2. To remove contamination from the inlet of an engine, deicing fluid is sprayed in a mist or fine spray pattern into the engine inlet area. The fluid will contact the vanes and first stage blades.

         A. The fluid must be allowed to penetrate and separate any contamination from the engine inlet, vanes, and blades, e.g., 30 seconds.

         B. An angular application will allow the fluid to swirl in the fan stream and help to ensure it does not get into the core

D. Next, a stronger stream is applied from the same angle to flush contamination from the inlet area.

E . When the stronger stream of fluid is used to flush the inlet area, the action of directing it at the outer edge of the fan blades can be used to check the rotation of the N1 fan. Caution must be exercised to minimize the amount of fluid that is entering the engine. the utmost care must be taken to prevent de/anti-icing fluid from entering the core of the engine.

WARNING: DO NOT ATTEMPT REMOVING SNOW/ ICE FROM ENGINE INLETS WITH ENGINES RUNNING.

5. Aircraft de/anti-icing fluids are only approved for use on aircraft.

6. DO NOT USE ANY aircraft de/anti-ice fluids on any GSE, e.g., dollies, crew stairs, storage racks, etc.

7. Cryotech E-36 can be used to remove ice and snow from crew stairs only. Use of E-36 on all other types of GSE is prohibited.

WARNING: If applied to electrical wiring and components, E-36 will cause serious corrosion.

WARNING: Do not load snow/ice/water-laden ULDs into an aircraft. Melting snow, ice, or water can cause serious mechanical problems such as electrical failures and frozen control cables during flight.

MD10 / MD11 Aircraft

1. **A record must be made of the NO. 2 engine inlet inspections for MD10, MD10-10, MD10-30, and MD11 aircraft.**

WARNING: IT IS POSSIBLE TO SUSTAIN DAMAGE TO THE NO. 2 ENGINE DUE TO ICE ACCUMULATION IN THE DUCT AREA AND THE TOP OF THE FUSELAGE.

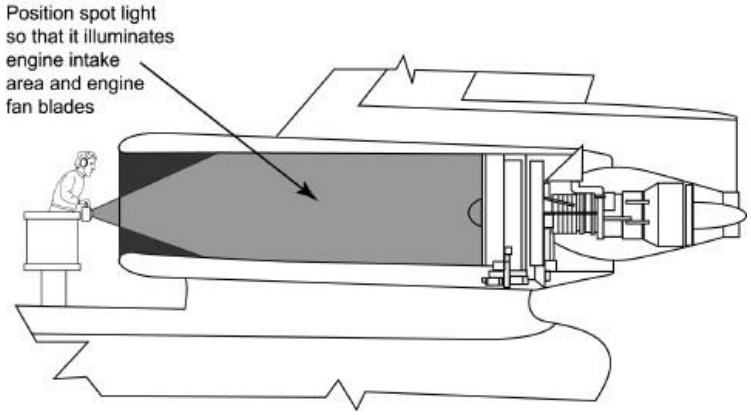
INSPECT AND REMOVE ANY SNOW OR ICE ACCUMULATION FROM BOTH THE TOP OF THE FUSELAGE AND NO. 2 ENGINE INLET.

NOTE: Inspect No. 2 engine inlet duct area and top of fuselage for accumulation of snow and ice.

2. **Prior to starting number 2 engine on any airplane that has been parked during icing conditions (Freezing rain, snow, sleet) for any period of time during which ice or snow may have accumulated on the airplane in the area of the number 2 engine, inspect to detect ice and snow accumulation on top of the fuselage and in the inlet of the number 2 engine. If ice or snow accumulation is found, prior to further flight, remove the ice or snow accumulation."**

4. **To inspect the No. 2 engine, place the deicing vehicle nose first on the aft side of the aircraft slightly forward of the No. 2 engine intake. Place the deicing basket in front of the engine intake and ensure the mechanic has an unobstructed view of the inlet area.**

WARNING: **WHEN PLACING THE DEICING BASKET IN FRONT OF THE ENGINE INTAKE, CONSIDER THE WEATHER CONDITIONS AND ENSURE ENOUGH DISTANCE BETWEEN IT AND THE INTAKE TO AVIOD CONTACT.**



5. **Check for ice and/or snow accumulation on the fuselage, inlet area, and fan blades and in the bell mouth area in front of the inlet adapter.**

6. **If ice or snow contaminants are present, they must be removed prior to flight.**

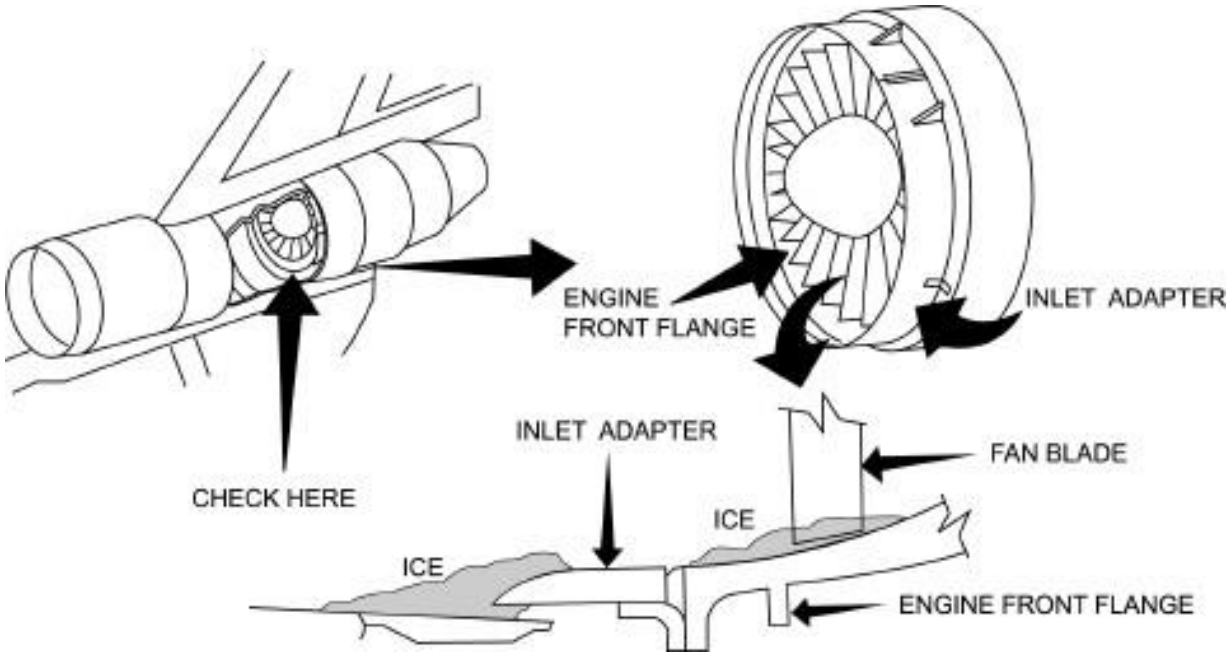
7. **Deicing fluid may be sprayed along the engine cowling in such a manner that it flows down the cowling to the areas where the contaminants have accumulated.**

8. **If fluid is present in the inlet area, ensure the fluid is draining and not collecting.**

WARNING: **CONTAMINANTS SHOULD NEVER BE FORCED BACK INTO THE ENGINE BLADES. DO NOT USE A HIGH PRESSURE SETTING TO REMOVE CONTAMINATES. LET THE HEAT OF THE FLUID MELT THE CONTAMINATES. ALL CONTAMINATES MUST BE REMOVED PRIOR TO FLIGHT**

CAUTION

ALL FLUID SHOULD BE DRAINED FROM THE BELLMOUTH AREA WITHIN APPROXIMATELY 1 MINUTE AFTER DEICING. IF THE FLUID HAS NOT DRAINED, EXAMINE FURTHER TO DETERMINE WHY FLUID IS COLLECTING. CHECK THE DRAIN OUTLET TO DETERMINE IF FLUID IS DRAINING FROM IT. A COLLECTION OF FLUID COULD INDICATE ICE HAS FORMED IN THE DRAIN HOSE OR BELLMOUTH AREA. IF YOU CANNOT DETERMINE THAT THE FLUID CONTAMINATION HAS BEEN REMOVED, THE AIRCRAFT SHOULD BE CONSIDERED UNAIRWORTHY. NO ONE SHOULD ENTER THE INLET UNDER UNSAFE WINTER CONDITIONS. APPROPRIATE SAFETY MEASURES MUST BE TAKEN PRIOR TO ENTERINGTHE INLET.



RATIONALE

Recent operational impact driven by engine icing conditions highlights the need to increase awareness and improve processes for safety of our operation.

FLEET TYPE

A300, A310, B757, B767, B777, MD10, MD11

ENGINE ICING, INSPECTION AND REMOVAL

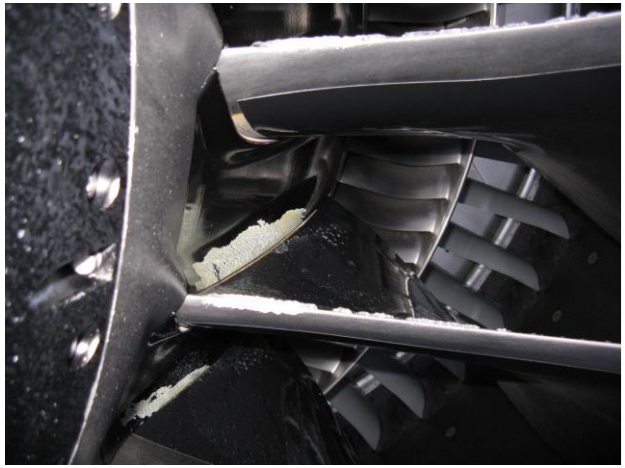
During the winter season deicing operations is critical to AC safety. Proper inspection and deicing of the flight control surfaces are key to safe flight. Just as critical to safe operations are the engine inspections for icing. Properly inspecting engines upon arrival and prior to departure in severe weather not only ensures a safe flight, it will prevent very costly damage to the AC engine inlets, blades, and liner assemblies.

Engine icing occurs when AC taxi of fly through winter weather conditions where precipitation is in transition from a liquid to a solid, and outside temperatures are at the "not so perfect" spot. When AC transition from altitude, cold soaked, to lower altitudes where moisture may be present, icing can build up on blades, spinners, and exit guide vanes. This can also happen on ground taxi and on climb out. The build up during operations can drive an out of balance condition causing damage.

Damage can also occur when the ice sheds from the rotating blades. Ice can form on the ground after shut down when blowing snow is thawed by the hot engine core, allowing water to run down into the inlet areas only to refreeze. Refrozen melt water in the inlet can break loose while the engine is in operation causing severe damage.

Please review the Winter Operations Manual, along with the appropriate AMM, for guidance in inspecting and removal of ice by fleet type.

Any engine can build ice during operations during ideal conditions; it has been observed that the newest fleet in our operation (B777) tends to build ice much easier than our remaining fleets. All reasons behind this are not known, but it is expected that the icing on the composite blades is due to the lower speed of rotation of the blades ad total surface areas. For this reason, critical focus for the 777 engines is key to safety and to prevent damaged.



WARNING: **TAKEOFF WITH FROST ON THE FUEL TANK UNDERWING SURFACES IS PERMITTED, PROVIDED IT IS NOT EXCESSIVE.**

A COATING OF FROST THICKER THAN 1/8 INCH SHOULD BE REMOVED BEFORE DEPARTURE.

OPERATION WITH FROST ADHERING ON AREAS OF THE WING OTHER THAN THE LOWER SURFACE FUEL TANK REGION IS NOT PERMITTED.

WARNING: **A SAFETY HARNESS EQUIPPED WITH A 4-5 FT SHOCK ABSORBING LANYARD MUST BE WORN AT ALL TIMES BY THE PERSON PERFORMING DEICING OPERATIONS FROM THE BASKET POSITION ON THE DEICING UNIT. A SEAT BELT MUST BE WORN BY A PERSON DEICING FROM INSIDE AN ENCLOSED BASKET POSITION ON A DEICE UNIT.**

1. **It is permissible to pre-deice before loading the aircraft to remove ice and snow.**
2. **If the crew members are at the aircraft, advise them of your intentions before applying de/anti-icing fluids.**
3. **Ensure that loading/unloading operations are complete and that all ground personnel are clear of aircraft.**
4. **Ensure that the flight crew or qualified maintenance personnel have completed the following prior to deicing:**
   - **A. Turned off all air sources (Air-conditioning packs, bleeds, and APU air)**
   - **B. Configured the aircraft for de-icing.**

WARNING: GLOVES, GOGGLES AND PROTECTIVE RAIN GEAR SHOULD BE WORN. SURFACES TREATED WITH DE/ANTI-ICING FLUIDS ARE EXTREMELY SLIPPERY.

WARNING: TREAT BOTH SIDES OF THE AIRCRAFT SYMMETRICALLY. (LEFT HAND AND RIGHT HAND SIDES OF THE AIRCRAFT EVEN IF ONLY ONE SIDE IS CONTAMINATED).

CAUTION: ALWAYS TEST THE BRAKES ON THE DEICING UNIT AT LEAST 50 FT OUT FROM THE AIRCRAFT BEFORE APPROCHING THE AIRCRAFT.

5. Ensure that fluid is not sprayed directly on personnel.
6. Personnel performing the de/anti-icing are responsible to ensure that all ice and snow is removed from the aircraft.
7. Apply de/anti-icing fluid to the highest point on the aircraft, using a sweeping motion.
   A. There should be a time interval of several seconds between sweeps to allow sufficient time for the heated solution to melt and loosen the ice or snow when deicing. Position the basket close to the aircraft to reduce heat loss of the deice fluid.
8. The best deicing equipment positions,spray pattern and flow for a particular de/anti-icing task are determined by the variables present at the time (wind direction and force, thickness of ice or snow and the amount of congestion near the aircraft, ect.)

CAUTION: THE BOOM SHOULD NEVER BE CLOSER THAN THREE FEET TO THE AIRCRAFT.

CAUTION: THE TRUCK SHOULD NEVER BE CLOSER THAN EIGHT FEET TO THE AIRCRAFT

NOTE: THE ONLY EXCEPTION TO THE RULE IS WHILE CONDUCTING A NO. 2 ENGINE INSPECTION.

9. On wings/tail, spray from the tip inboard to root from highest point of surface camber to lowest. However, it is possible that aircraft configuration and local conditions may dictate a different procedure.

WARNING: REMOVE HEAVY ACCUMULATIONS OF SNOW OR ICE FROM THE TAIL SECTION FIRST TO MINIMIZE AIRPLANE TIPPING CONDITIONS.

NOTE: **Excessive runoff is undesirable. Unheated SAE Type II or Type IV fluid is normally used in domestic operations.**

10. USE THE FOLLOWING PRECAUTIONS

A. **A slippery condition may exist on the ground or equipment following the de/anti-icing process.**

B. **Do not spray a direct spray into any hole or opening.**

C. **Do not spray a direct spray onto anything sticking out of the aircraft.**

D. **Do not spray deicing fluid into the pitot tubes, static vents, ducts, free air temperature probes, window seals, radome seals, air intakes, or exhausts of engines or APU and combustion heaters.**

E. **When spraying horizontal tail surfaces, avoid direct spray of de/anti-icing fluid on the stabilizer seal.**

CAUTION: AVOID SPRAYING FLUID ONTO AIRCRAFT BRAKES.

F. **Do not spray de/anti-icing solution on hot brakes, exhaust tail pipes, and thrust reversers.**

G. **If frozen precipitation is found in/on the landing gear, brakes or wheel assemblies, aircraft maintenance should be notified immediately.**

H. **Do not spray hot de/anti-icing fluid on cold cockpit windows, thermal shock may cause cracking.**

I. **Spray de/anti-icing fluid on the metal above the cockpit windows and allow the fluid to run down over the cockpit windows.**

J. **Traces of type II/IV fluid on cockpit windows should be removed prior to departure.**

K. **Do not direct high velocity spray on angle of attack/airflow sensors, vortex generators, and static wicks.**

L. **After prolonged periods of de/anti-icing, it is advisable to check aerodynamic quiet areas and cavities like balance bays and wing and stabilizer rear spars for residue of thickened de/anti-icing fluids.**

11. Remove all evidence of snow, ice, or slush from the following:

    A. Tail section (rudder, elevators, stabilizer, and tabs).

    B. Wings (ailerons, flaps, leading edge devices and tabs).

NOTE: If the flight crew leaves the flaps in the down position, this indicates they landed in freezing slush and the flap track/flap actuator areas may need to be de/anti-iced.

    C. Speed brakes

    D. Fuselage

    E. Landing gear

    F. pressure outflow valve

NOTE: On Control surfaces, use care not to force snow into the surface control gaps.

12. For the second step (anti-icing):

    A. Record the time anti-icing begins. Advise the flight crew of the beginning time.

    B. Perform the second step before the first step fluid freezes, typically within 3 minutes.

    C. The anti-icing fluid should be distributed uniformly.

    D. Use an amount that provides a sufficient fluid coating. All horizontal surfaces must be visually checked during application to ensure fluid is just beginning to drip off the leading and trailing edges.

    E. Apply the fluid starting from the highest point to lowest on critical surfaces and in the same direction the deicing fluid has been applied.

    F. Perform the procedures area by area if necessary.

13. Surfaces to be protected with the anti-icing fluid application:

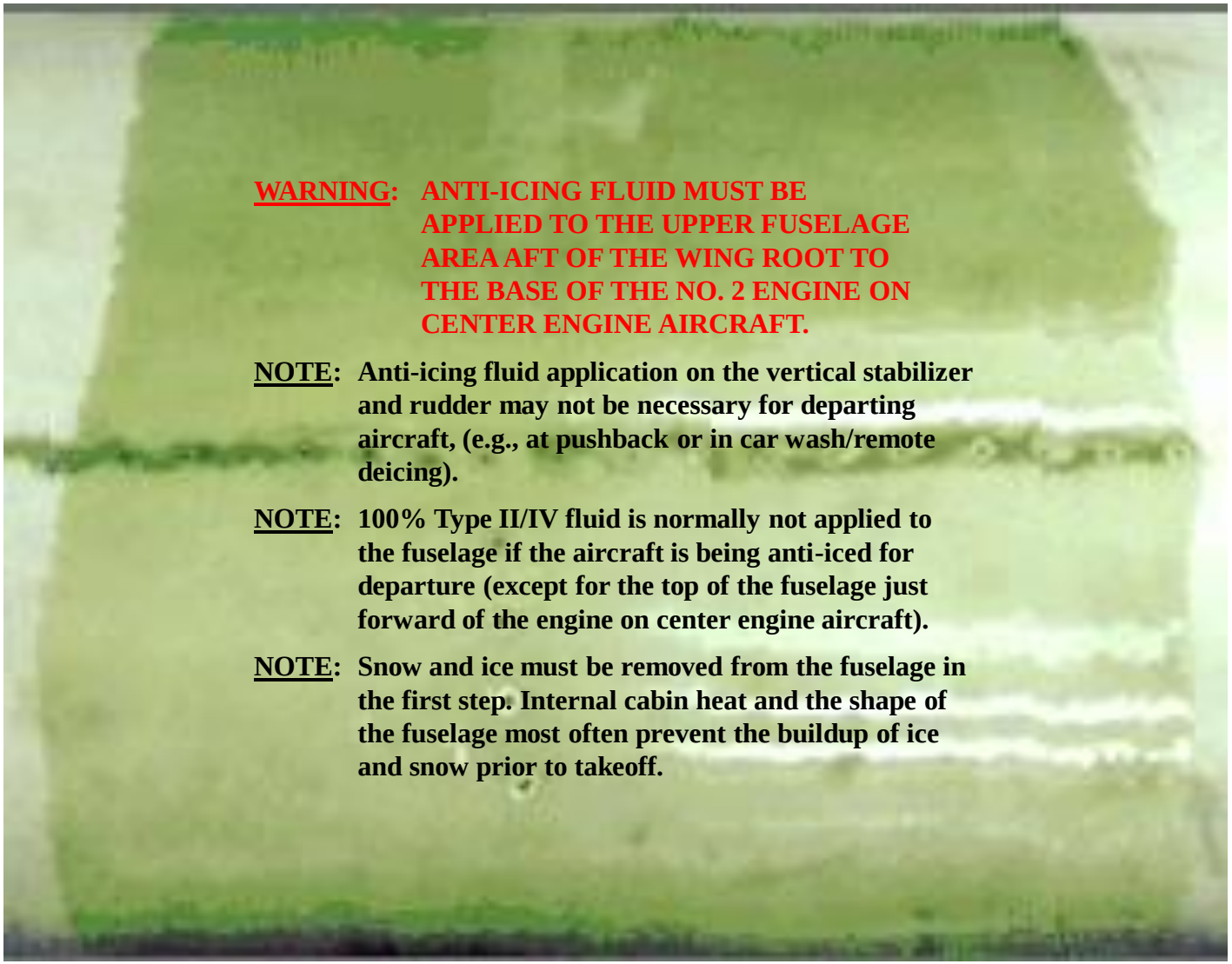
    A. Wing upper surface and leading edge.

    B. Horizontal stabilizer and elevator upper surface and leading edge.

    C. Vertical stabilizer and rudder.

    D. Upper fuselage area forward of the center engine (MD-10 and MD-11).

    E. Fuselage upper surfaces depending on the amount and type of precipitation and expected departure time of aircraft.



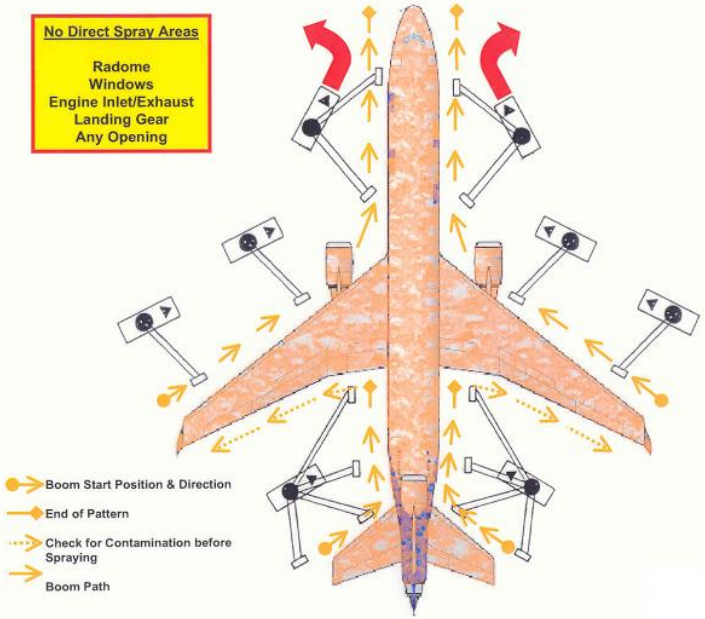
WARNING: **ANTI-ICING FLUID MUST BE APPLIED TO THE UPPER FUSELAGE AREA AFT OF THE WING ROOT TO THE BASE OF THE NO. 2 ENGINE ON CENTER ENGINE AIRCRAFT.**

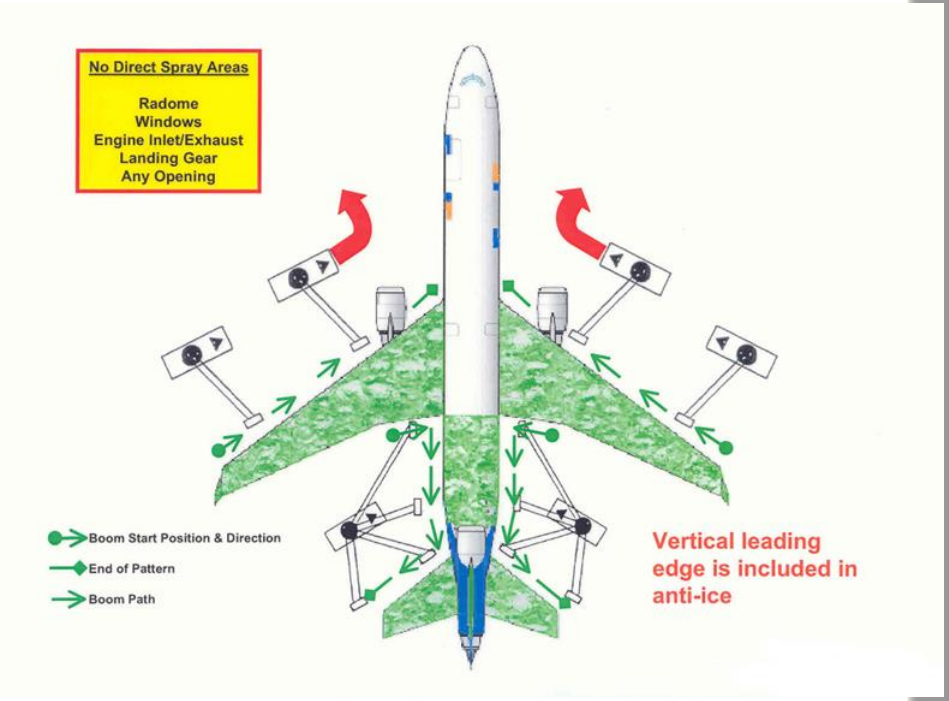
NOTE: **Anti-icing fluid application on the vertical stabilizer and rudder may not be necessary for departing aircraft, (e.g., at pushback or in car wash/remote deicing).**

NOTE: **100% Type II/IV fluid is normally not applied to the fuselage if the aircraft is being anti-iced for departure (except for the top of the fuselage just forward of the engine on center engine aircraft).**

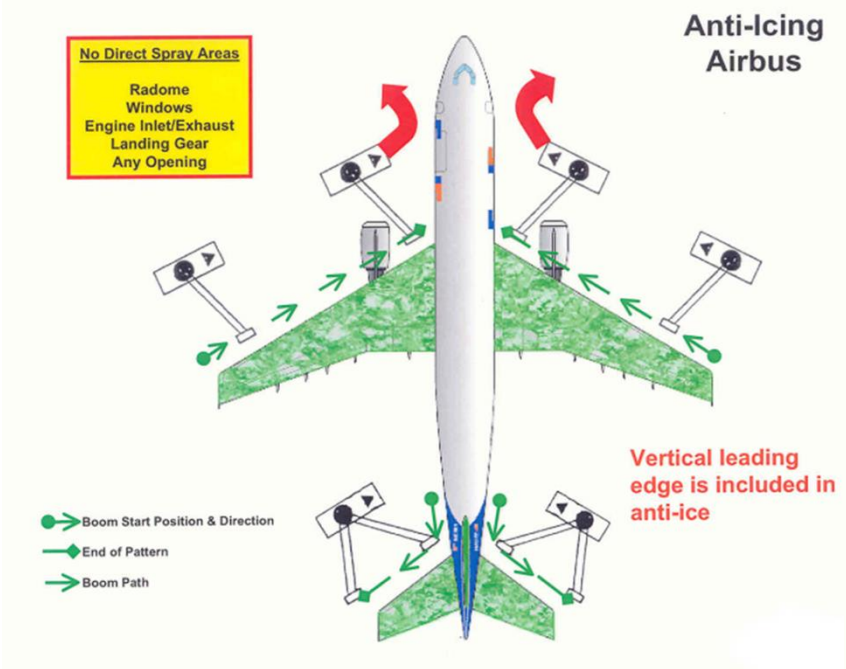
NOTE: **Snow and ice must be removed from the fuselage in the first step. Internal cabin heat and the shape of the fuselage most often prevent the buildup of ice and snow prior to takeoff.**

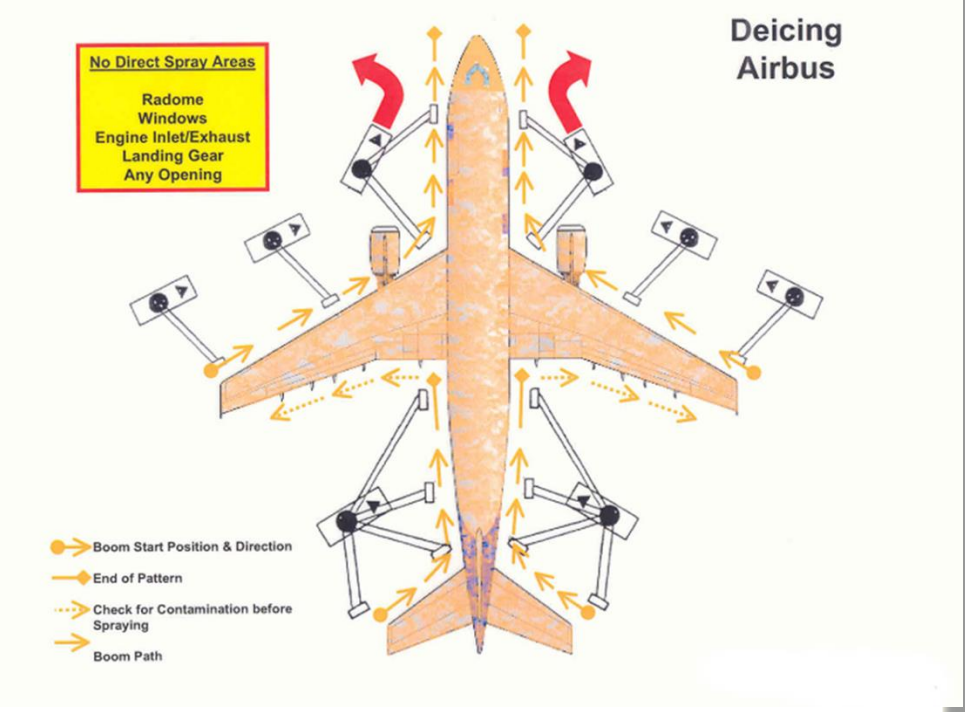
NOTE: THIS INCLUDES
MD10 & MD11
AIRCRAFT.





NOTE: THIS INCLUDES AIRBUS, B757, B767, B777 AIRCRAFT.





FORCED AIR PROCEDURES

CAUTION: THE APPLICATION OF TYPE I FLUID WITH FORCED AIR ASSISTANCE (FORCED AIR WITH FLUID) CAN BE PERFORMED IN THE ONE-STEP PROCEDURE, HOWEVER TYPE I HOLDOVER TIMES ARE NOT APPLICABLE.

CAUTION: THE USE OF FORCED AIR WITHOUT FLUIDS (FORCED AIR ONLY) IS NOT ALLOWED AS A ONE-STEP PROCEDURE DURING CONDITIONS IN WHICH ICE OR SNOW IS ADHERING TO AIRCRAFT SURFACES.

CAUTION: THE USE OF TYPE I FLUID WITH FORCED AIR ASSISTANCE (FORCED AIR WITH FLUID) CAN BE PERFORMED AS THE 1ST STEP OF A TWO-STEP PROCEDURES. A FINAL APPLICATION OF HOT TYPE I OR TYPE IV IS REQUIRED IF HOLDOVER TIMES GUIDELINES ARE TO BE USED.

CAUTION: THE USE OF FORCED AIR ONLY CAN BE PERFORMED DURING THE INITIAL STAGE OF THE 1ST STEP (SNOW AND ICE REMOVAL).

FORCED AIR PROCEDURES

Vehicle mounted forced air systems deliver a high velocity stream of air out of an air nozzle. This stream of air is used to assist in the removal of frozen contaminates and can also be used to improve the delivery of de/anti-icing fluids to aircraft surfaces.

Type I fluid only can be directed into the air stream within the air nozzle (air injection) or it can be sprayed out of the fluid nozzle into the air.

FORCED AIR ONLY

Using forced air without any fluid for initial contaminant removal is allowed and should be very effective for certain conditions (primarily dry snow). When using Forced Air only, observe the following:

1. **Always follow forced air deicing with the application of hot type I fluid (with or without air) when ice or snow is adhering to aircraft surfaces.**

2. **Use Forced Air to remove or assist the removal of non-adhering or loosely adhering frozen contaminants.**

3. **Do not direct the air nozzle at the wind screen or side windows.**

4. **Do not direct the air nozzle perpendicular to any surface.**

5. **Do not allow the air nozzle to come closer than 3 feet to any surface while using a Tempest deicer, and no closer than 5 feet when using a Global 2200 deicer.**

6. **Do not use Forced Air from the rear of any flight control surface.**

7. **Do not direct Forced Air into engines, auxiliary intakes/exhausts, or the orifices of pitot heads, static vents, or directly onto air stream direction detectors (i.e., probes or angle of attack airflow sensors).**

8. **When removing ice, snow, or slush from the landing gear and wheel well areas, use care as debris may cause damage to components.**

9. **When removing ice, snow, or slush from aircraft surfaces, use care to prevent it from entering and accumulating in aerodynamically quiet areas such as control surface hinge areas or from entering engine inlets.**

10. Use care to prevent loose debris from impacting personnel or other aircraft surfaces.

11. When anti-icing is necessary, Forced Air Only must be followed by either deicing or anti-icing.

FORCED AIR/TYPE I FLUID

Forced Air with hot Type I fluid may be used during the deicing process and may be used as the final application.

If Type I fluid with Forced Air is used as the final application, it must be reported to the flight crew as "Forced Air Deicing – No Holdover Time."

When using Forced Air/Type I Fluid, observe the following:

NOTE: All brands of Type I fluids are approved for use with forced air on all equipment types.

IMPORTANT PRECAUTIONS

1. Do not direct the air nozzle at the wind screen or side windows.
2. Do not direct the air nozzle perpendicular to any surface.
3. Do not allow the air nozzle to come closer than 3 feet to any surface.
4. Do not use Forced Air from the rear of any flight control surface.
5. Do not direct Forced Air into engines, auxiliary intakes/exhausts, or the orifices of pitot heads, static vents, or directly onto air stream direction detectors (i.e., probes or angle of attack airflow sensors).
6. When removing ice, snow, or slush from the landing gear and wheel well areas, use care as debris may cause damage to components.
7. When removing ice, snow, or slush from aircraft surfaces, use care to prevent it from entering and accumulating in aerodynamically quiet areas such as control surface hinge areas or from entering engine inlets.

8. **Use care to prevent loose debris from impacting personnel or other aircraft surfaces.**

9. **When anti-icing is necessary, Forced Air/Type I fluid must be followed by either deicing or anti-icing fluid. This allows the use of either Type I or Type IV holdover time guidelines.**

10. **If Type I holdover times are used, apply a moderate amount of Type I WITHOUT air to drive off all fluids that have absorbed snow, ice, and slush during the deicing process.**

FORCED AIR/TYPE IV APPROVED FLUID

Operators must demonstrate by spraying and viscosity testing that a specific Type II, III, or IV fluid can be used with specific forced air application equipment without significant shearing to the fluid in order to use forced air application. Below is a list of some of the approved fluids for use with forced air application using the LMD AirFirst and Tempest II deicing vehicles:

- **(a) Clariant Safewing 2001 Type IV**
- **(b) Clariant Safewing Launch Type IV**
- **(c) Octagon Max-Flight 04 Type IV**
- **(d) Kilfrost ABC-S Type IV**
- **(e) Kilfrost ABC-S Plus Type IV**
- **(f) Lyondell Arctic Shield Type IV**

WARNING: THE APPLICATION OF TYPE IV FLUID USING THE AIR AND FLUID INJECTION SYSTEM IS PROHIBITED. TYPE IV MAY ONLY BE APPLIED USING THE TASK FORCE FLUID NOZZLE, WHICH IS LOCATED ABOVE THE AIRFIRST NOZZLE.

WARNING: WHEN USING FORCED AIR TO ASSIST IN THE APPLICATION OF TYPE IV FLUID, THE TYPE IV FLUID MUST BE SPRAYED FROM THE FLUID NOZZLE AND ALLOWED TO FALL INTO THE AIR EXITING THE AIRFIRST NOZZLE.

CAUTION: **THE USE OF SAE TYPE II/IV FLUIDS IN 100% CONCENTRATION OR 75/25 MIXTURE IS NORMALLY LIMITED TO AIRCRAFT WITH A ROTATION SPEED HIGHER THAN 100 KNOTS.**

THIS IS TO ENSURE THE SUFFICIENT FLOW-OFF OF THE FLUID DURING TAKEOFF.

1. **SAE Type I,II/IV de/anti-icing fluids are approved for all FedEx trunk aircraft.**

2. **IMPORTANT FOR FEEDER AIRCRAFT**

   The pilot or operator maintenance personnel must request and supervise the deicing of feeder aircraft.

NOTE: **REFER TO THE FEDEX WOM AND GMM FOR QUESTIONS REGARDING FEEDER DEICE QUALIFICATIONS.**

ALL Aircraft

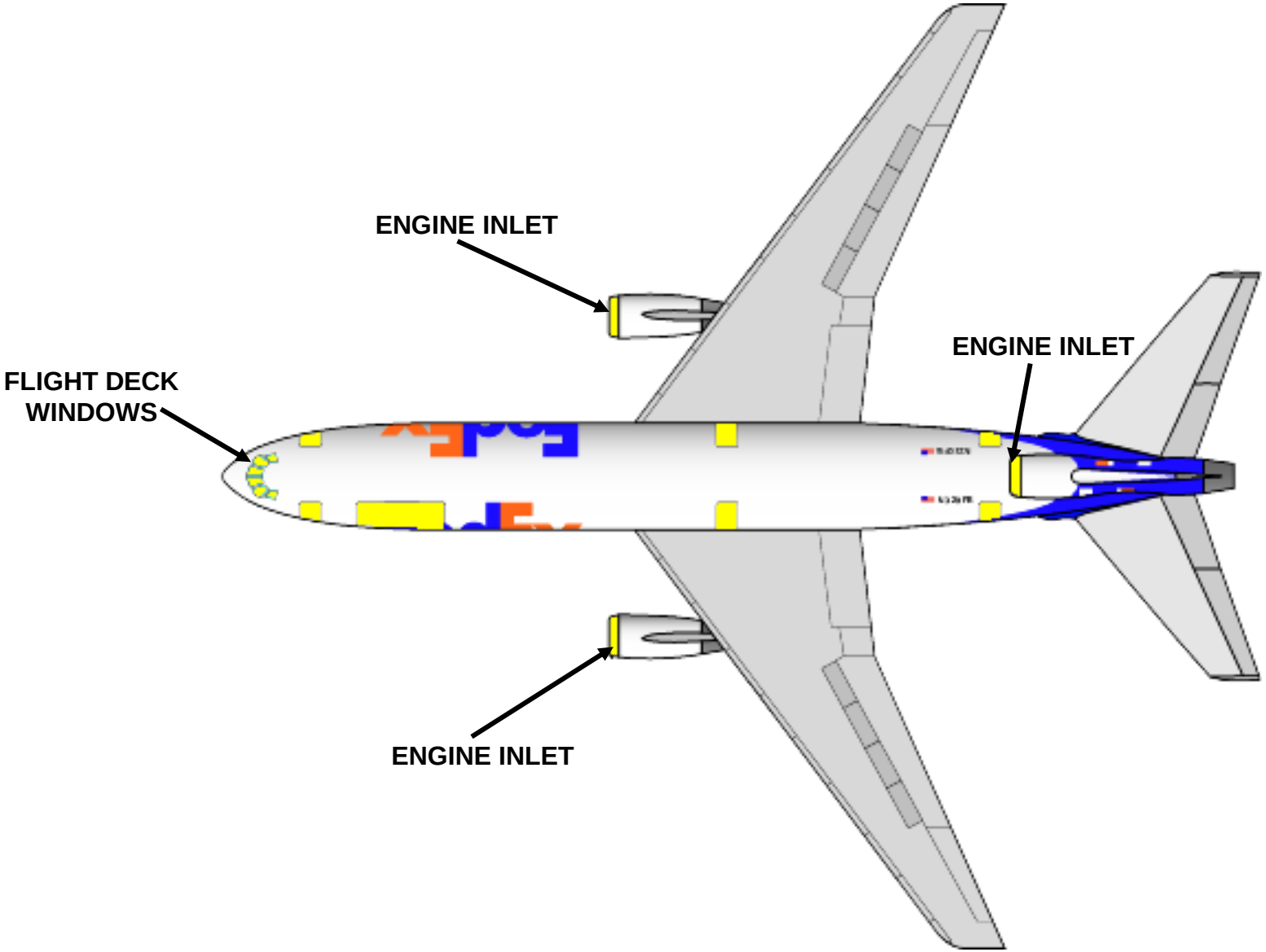
1. **Prior to de/anti-icing a flight crew member or aircraft maintenance must verify that the engine and APU bleed valves are closed.**

2. **Control surfaces, static ports, wing and tail surfaces, nose and main gear area must be free of ice and snow.**

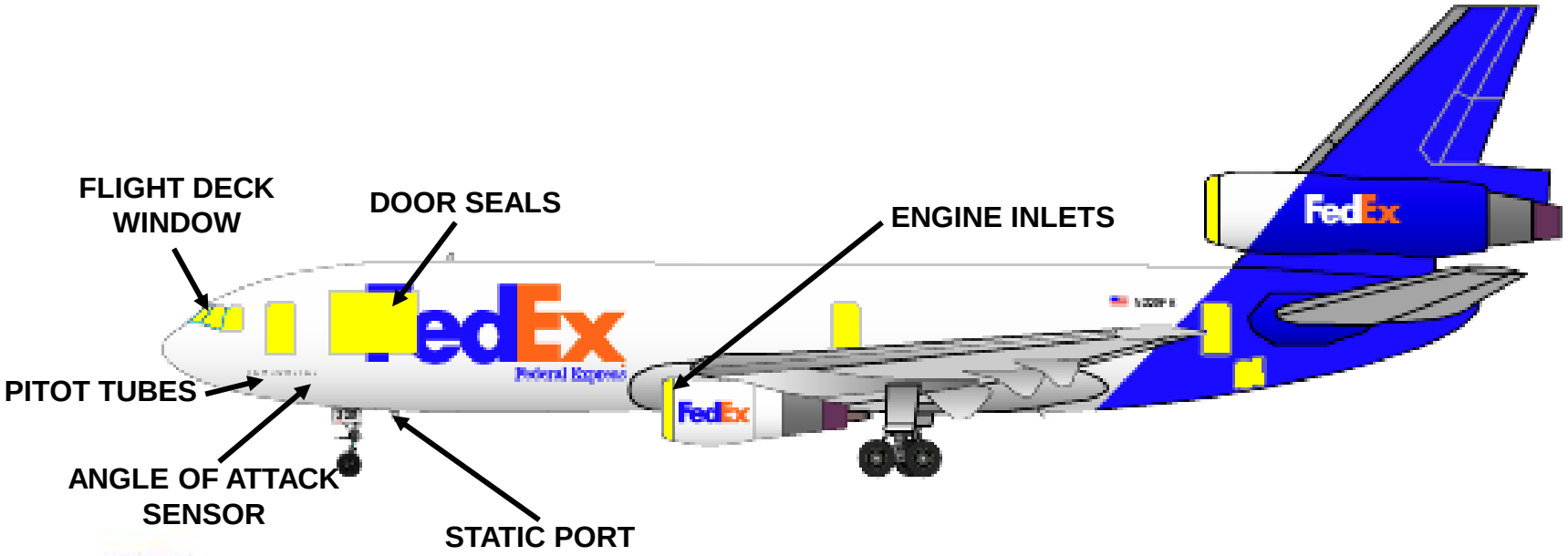
3. **Inspect top of fuselage, the area around each engine and the engine inlets for accumulation of snow and ice.**

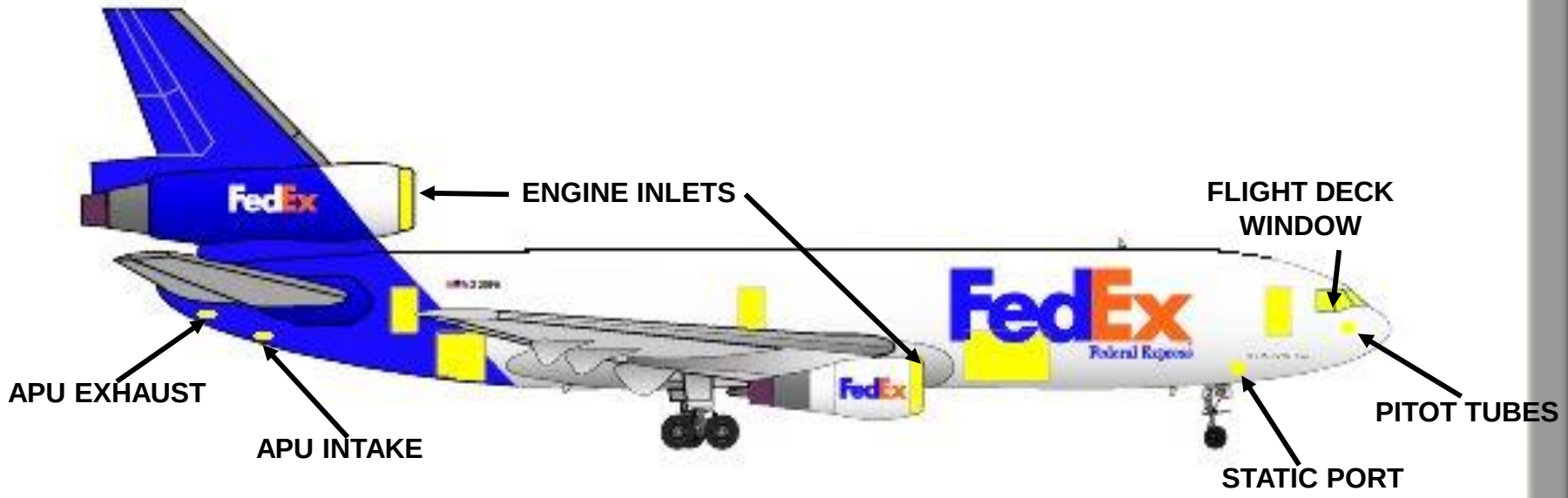
4. **Inspect wing engine inlets for accumulation of snow and ice.**

DO NOT DIRECTLY SPRAY AREAS INDICATED



DO NOT DIRECTLY SPRAY AREAS INDICATED





DO NOT DIRECTLY SPRAY AREAS INDICATED

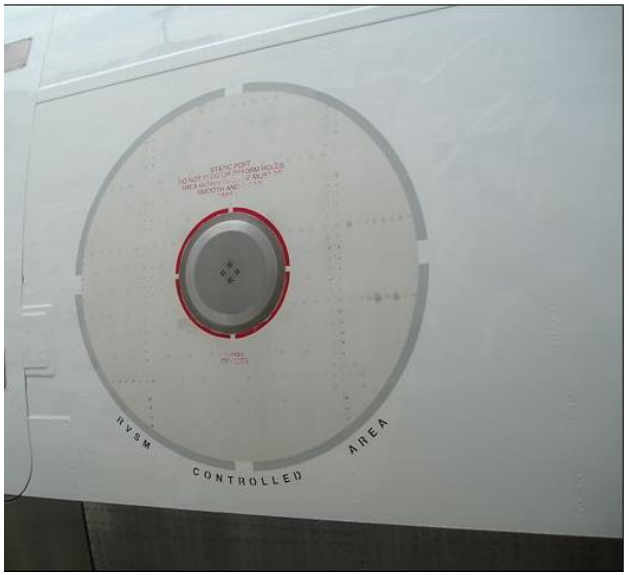
STATIC PORT

STATIC PORT

ANGLE OF ATTACK SENSOR

PRESSURE OUTFLOW VALVE

DO NOT DIRECTLY SPRAY AREAS INDICATED



STATIC PORT

STATIC WICKS

STABILIZER SEAL

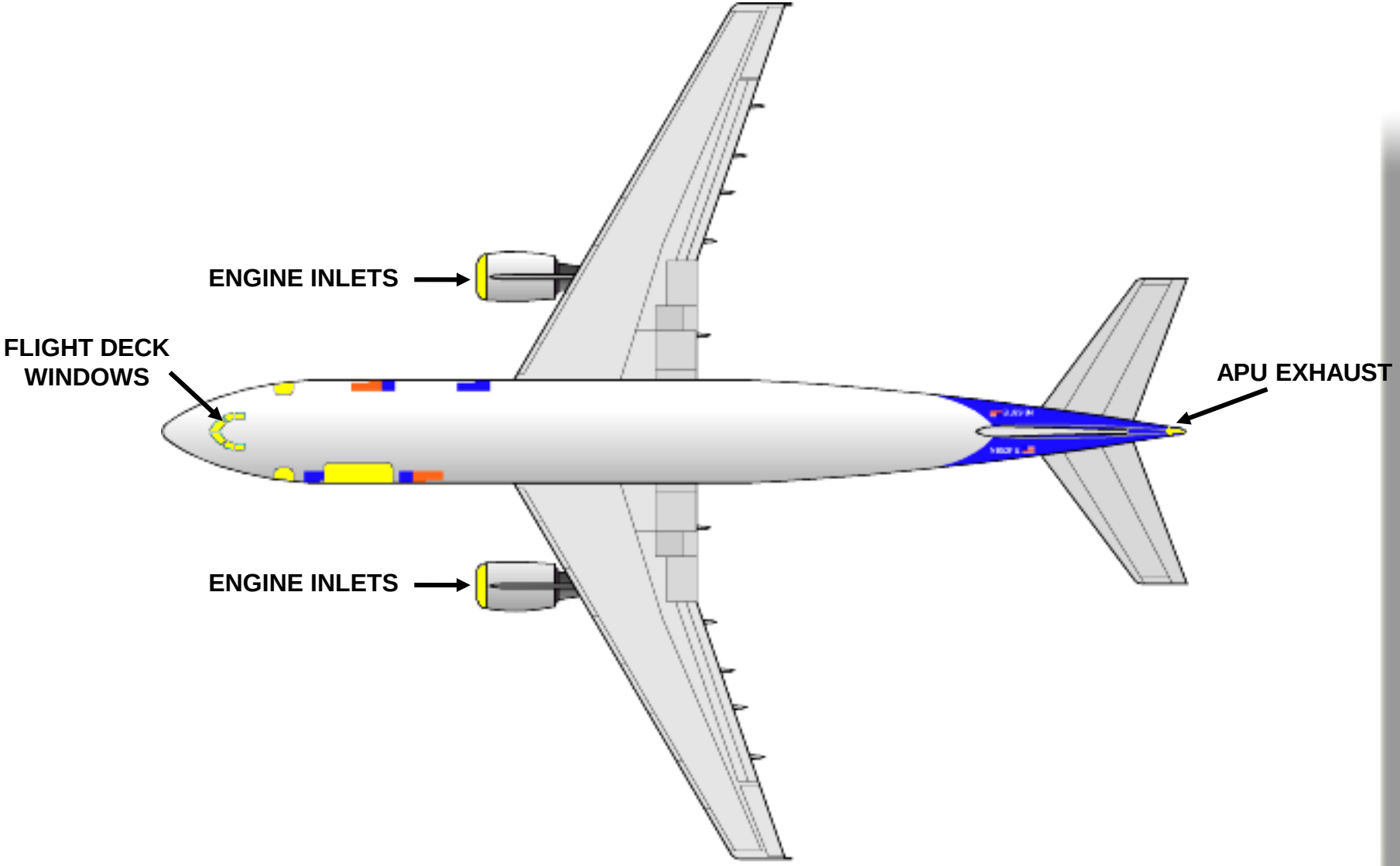
STATIC PORTS

DO NOT DIRECTLY SPRAY AREAS INDICATED

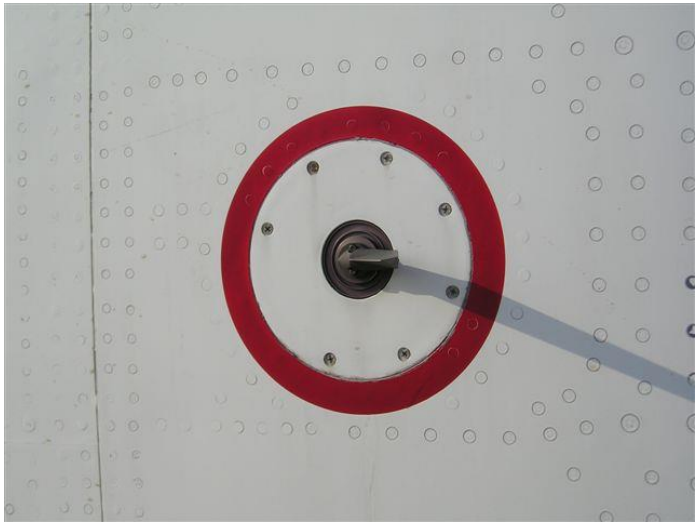
STATIC PORT

ENGINE INLET & LANDING GEAR

DO NOT DIRECTLY SPRAY AREAS INDICATED



DO NOT DIRECTLY SPRAY AREAS INDICATED



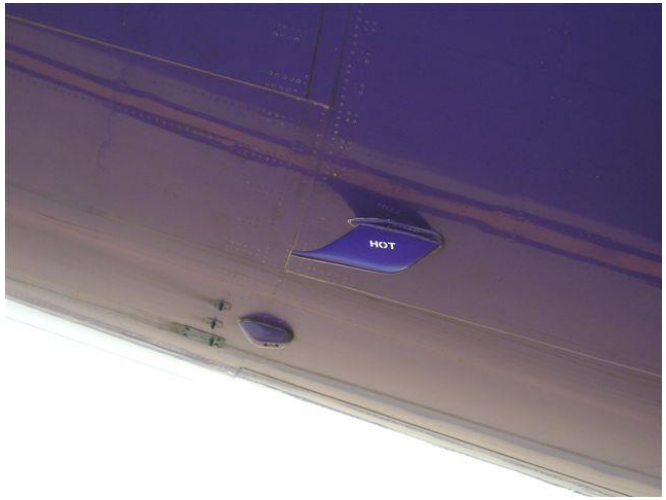
ANGLE OF ATTACK SENSOR

STATIC PORTS

ENGINE INLETS

LANDING GEAR

DO NOT DIRECTLY SPRAY AREAS INDICATED



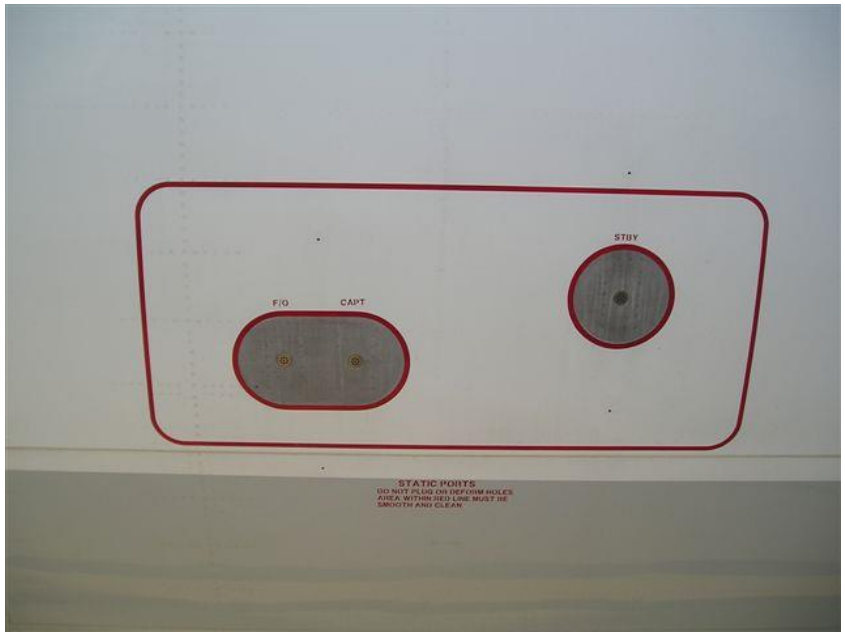
DRAIN MAST

APU EXHAUST

STABILIZER SEAL

STATIC WICKS

DO NOT DIRECTLY SPRAY AREAS INDICATED



STATIC PORTS (BOTH SIDES)

PITOT TUBES

1. **Do not point a spray of deicing / anti-icing fluid directly at or into the pitot inlets, TAT probes or static ports.**
2. **Do not point a spray of deicing / anti-icing fluid directly into the engine, APU, air scoops, vents or drains.**

   Make sure that ice / snow is not pushed into the areas around the flight controls during ice and snow removal
4. **Before the doors are closed for flight, put anti-icing fluid on these areas:**
   1. **The Pressure relief doors**

NOTE: **DAMAGE TO AIRCRAFT EICAS COMPUTER CAN RESULT FROM HIGH PRESSURE FLUID ENTERING THE EQUIPMENT BAY THROUGH THE NEGATIVE PRESSURE RELIEF DOORS. CAUTION SHOULD BE USED WHEN DEICING NEAR THE NEGATIVE PRESSURE RELIEF DOORS.**

5. **Do not spray high pressure deice fluid directly on negative pressure relief doors**

CAUTION: **BE CAREFUL WHEN YOU REMOVE THE ICE AND SNOW FROM THE WING AND TAIL SURFACES NEAR THE VORTEX GENERATORS. IF YOU ARE NOT CAREFUL, YOU CAN CAUSE DAMAGE TO THE VORTEX GENERATORS**

6. **Remove all snow from the nose radome area. If you do not do this, the snow will blow aft and decrease the pilots vision on the takeoff. Caution should be used when spraying composite areas on the aircraft. Use a 45 degree angle and fan your spray pattern to avoid possible damage to composite materials.**

WARNING: **MAKE SURE THE APU INLET AREA IS CLEAR BEFORE YOU START THE APU. THE APU CAN BE DAMAGED BY ICE OR SNOW THAT HAS COLLECTED IF IT GOES INTO THE INLET. ALSO, PERSONS MUST STAY CLEAR OF THE APU EXHAUST AREA WHEN THE UNIT IS OPERATING. INJURY OR DEATH CAN OCCUR IN THESE AREAS**

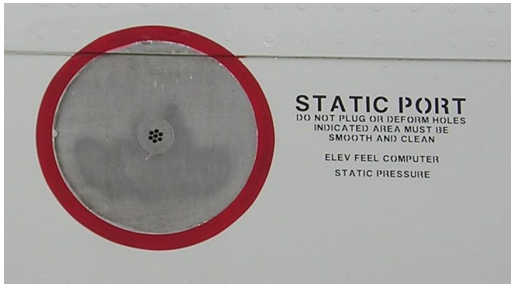
7. **For the safety reasons, do not operate the engines or the APU during deice / anti-ice operations. But, if it is necessary to do the deice / anti-ice procedures during engine and / or APU operation, do the following steps.**
   - **A. Make sure the engine and/or APU is at idle speed.**
   - **B. Do not point the spray of deicing / anti-icing fluids directly into the engine and/or APU inlet.**
   - **C. Close the valves of the air conditioning packs to the cabin to reduce fumes in the cockpit.**
   - **D. Turn bleed air switches for APU/Engine to off before deicing begins. Do not reopen until fumes have evaporated.**

8. **Do not spray fluid directly into the following areas.**
   - **A. The inlet ducts for the engines or APU.**
   - **B. Exhausts**
   - **C. Thrust reversers**
   - **D. Engine Inlet**
   - **E. Probes attached to the strut**
   - **F. Engine Bleed Air Ducts**

CAUTION: EXAMINE THE ENGINE INTAKE AREAS IMMEDIATELY AFTER ENGINE SHUTDOWN FOR ICE. REMOVE THE ICE BEFORE THE TEMPERATURE OF THE ENGINE DECREASES AND BEFORE YOU INSTALL THE ENGINE PROTECTIVE PLUGS AND COVERS. IF YOU INSTALL THE PLUGS BEFORE THE TEMPERATURE OF THE ENGINE DECREASES, THE REMAINING HEAT IN THE ENGINE WILL MELT THE ICE TO WATER. THIS WATER WILL FLOW TO THE BOTTOM OF THE FAN SECTION AND FREEZE AGAIN WHEN THE TEMPERATURE OF THE ENGINE IS BELOW FREEZING. THIS WILL LOCK THE TIPS OF THE FAN LOWER BLADES IN ICE

B757 DO NOT SPRAY AREAS

9. **Do not spray the following areas directly with high pressure fluid.**
   - **A. Cockpit Windows**
   - **B. Pitot Tubes**
   - **C. Static Ports**
   - **D. Static Wicks**
   - **E. Vortex Generator**
   - **F. Antennas**
   - **G. Negative Pressure Doors**
   - **H. Pressure Outflow Valves**
   - **I. Angle of Attack Sensors**
   - **J. Door seals**
   - **K. Engine or APU Intakes or Exhaust**
   - **L. Thrust Reversers**
   - **M. Brakes**
   - **N. Landing Gear**
   - **O. Wheel Well Area**



DO NOT DIRECTLY SPRAY AREAS INDICATED

APU Intake

Negative Pressure Doors

Angle of Attack Sensor

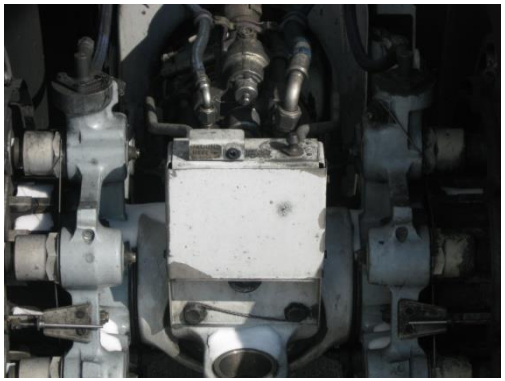
Negative Pressure Doors

DO NOT DIRECTLY SPRAY AREAS INDICATED

Pitot Tubes

Pressure Outflow valve

Landing Gear Area



Brakes

DO NOT DIRECTLY SPRAY AREAS INDICATED

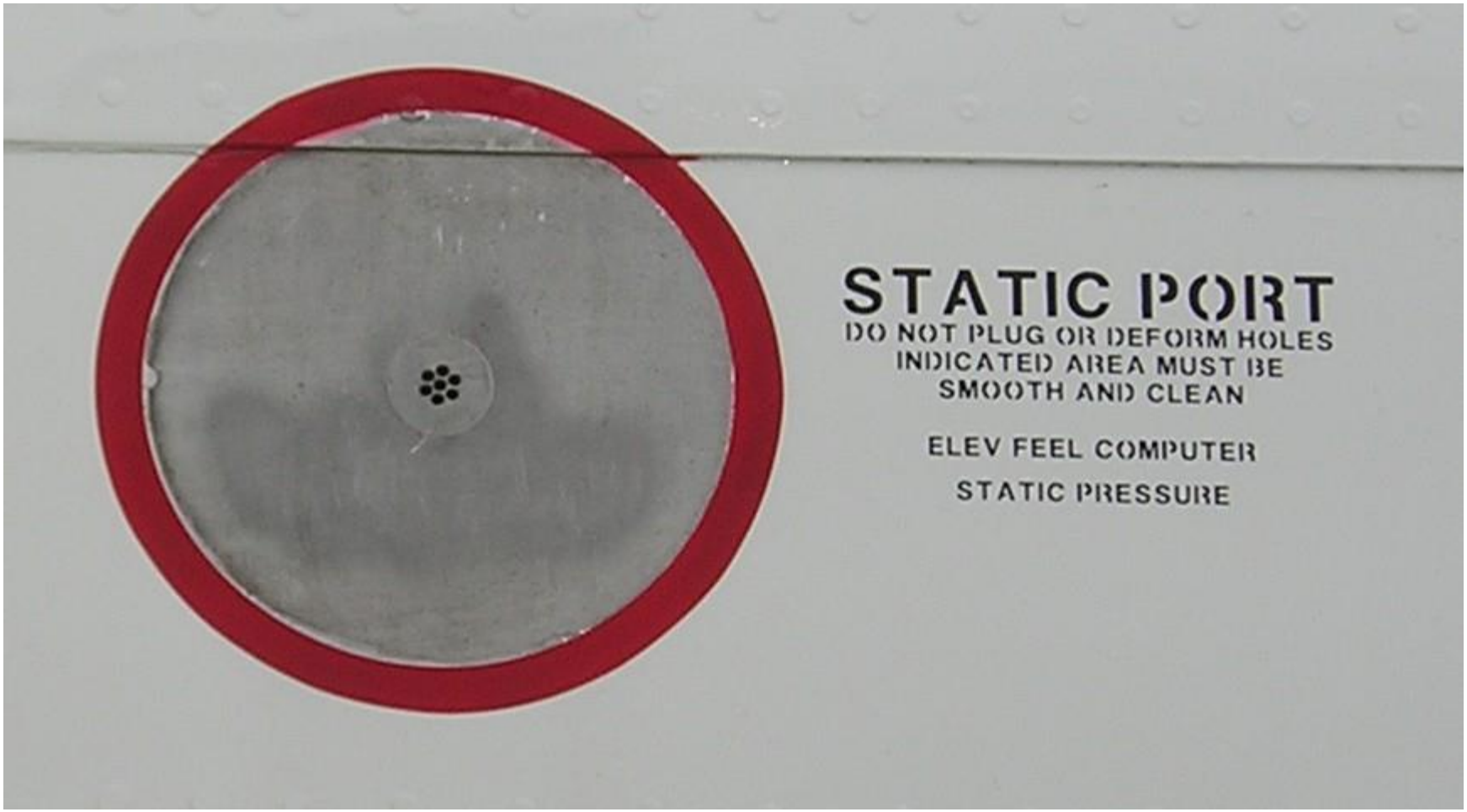
Engine Intakes

Cockpit Windows

Antenna

APU Exhaust

DO NOT DIRECTLY SPRAY AREAS INDICATED



Static Ports

CAUTION: THE REPEATED APPLICATION OF TYPE II AND TYPE IV DEICING/ANTI-ICING FLUIDS, WITHOUT THE SUBSEQUENT APPLICATION OF TYPE I DEICING/ANTI-ICING FLUID OR HOT WATER, MAY CAUSE A RESIDUE TO COLLECT IN AERODYNAMICALLY QUIET AREAS. THIS RESIDUE MAY REHYDRATE AND FREEZE UNDER CERTAIN TEMPERATURE, HIGH HUMIDITY AND/OR RAIN CONDITIONS. THIS RESIDUE MAY BLOCK OR IMPEDE CRITICAL FLIGHT CONTROL SYSTEMS. THIS RESIDUE MAY REQUIRE REMOVAL.

CAUTION: DO NOT POINT A SOLID FLOW OF FLUID DIRECTLY AT THE SURFACE. APPLY FLUID AT A LOW ANGLE TO PREVENT DAMAGE TO THE AIRPLANE SURFACES. DO NOT USE HIGH PRESSURE SPRAY TO BLOW THE ICE AND SNOW OFF THE AIRPLANE SURFACES.

NOTE: **MAINTENANCE PERSONS MUST CLOSELY INSPECT THE AIRPLANE BEFORE DEPARTURE TO MAKE SURE THERE WILL BE NO ICE, SNOW, OR FROST ON THE WING FOR TAKEOFF.**

1. Do not point a spray of deicing/anti-icing fluid directly at or into the pitot inlets, TAT probes or static ports.
2. Do not point a spray of hot deicing fluid or hot water directly at cold windows.
3. The AC packs should be shut off prior to deicing.
4. Do not point a spray of deicing/anti-icing fluid directly into the engine, APU, scoops, vents, drains, Cabin Air Compressor, or RAM Air inlets.
5. Make sure that ice and/or snow is not pushed into the areas around the flight controls during ice and snow removal.
6. Do not use hard or sharp tools to remove ice from the airplane surface.
7. The right and left sides of the wing and the right and left sides of the horizontal stabilizer must get the same deicing/anti-icing procedure.

NOTE: **IF CONTAMINATION EXISTS ONLY IN A LIMITED AREA (SUCH AS A SPOILER PANEL) AND THERE IS NO ACTIVE PRECIPITATION, IT IS PERMITTED TO DEICE ONLY THAT AREA, BUT THE SAME AREA SHOULD ALSO BE TREATED ON THE OTHER WING.**

8. If SAE Type II or Type IV fluids are used, then remove all of the deicing/anti-icing fluid from the cockpit windows before departure. Make sure you closely examine windows with wipers installed. Make sure that fluid is removed from all forward areas where it can flow back on the windshield during taxi and takeoff. These areas must be clean before departure.

NOTE: **DEICING/ANTI-ICING FLUID CAN BE REMOVED BY RINSING WITH TYPE I FLUID.**

WARNING: **YOU MUST REMOVE DEICING/ANTI-ICING FLUID RESIDUES BEFORE TOO MUCH COLLECTS. RESIDUES CAN COLLECT IN AERODYNAMICALLY QUIET AREAS. THESE RESIDUES CAN PREVENT THE MOVEMENT OF CRITICAL FLIGHT CONTROL SYSTEMS. THIS CAN CAUSE SYSTEM DAMAGE AND DANGEROUS FLIGHT CONDITIONS..**

WARNING: **DO NOT APPLY WATER TO THE CONTROL CABLES WHEN THE TEMPERATURE IS AT OR BELOW 32 DEGREES FAHRENHEIT. ICE CAN FORM ON THE CABLES AND PREVENT THE OPERATION OF IMPORTANT FLIGHT CONTROL SYSTEMS DURING FLIGHT.**

9. When there is slush on the runways, examine the airplane when it gets to the ramp. Look for slush that has collected on the airplane or damage to the airplane surfaces.
   - **A.** Examine the areas that follow for ice that collected and damage to the skin panels.
     a) The Leading Edge
     b) The Flaps
     c) The Flap Wells
     d) The Vertical Stabilizer
     e) The rudder
     f) The bottom and top surfaces of the horizontal stabilizers and elevators.
   - **B.** Examine the wheel well areas for ice, slush and snow that has collected. Deice as necessary.
   - **C.** Examine the skin panels behind wheel wells for damaged edges.

10. Retract the wing flaps, slats, and spoilers during icing conditions or when the snow falls. If it is necessary to operate these controls, make sure they are not blocked by ice or snow before you retract them.

NOTE: IF AN AIRPLANE COMES TO THE GATE WITH THE FLAPS NOT FULLY RETRACTED DURING ICING CONDITIONS OR WHEN THE SNOW FALLS, EXAMINE THOSE FLAPS THAT ARE NOT FULLY RETRACTED. LOOK FOR ICE OR SNOW THAT HAS COLLECTED BEFORE THEY ARE RETRACTED.

11. **Wings and Horizontal Tail Surfaces.**

A. The wing, including winglets (if installed) and horizontal tail surfaces must have no ice, snow, and frost on them.

a) Leading edge devices

b) Control surfaces, including both upper and lower surfaces of the horizontal stabilizer and the left and right sides of the vertical stabilizer.

c) Tab Surfaces

d) The top wing surface

B. The leading edge surfaces must have no ice, snow or frost on them. Examine the areas between the movable surfaces and the surfaces that do not move to make sure there is no ice.

C. The right and left sides of the horizontal stabilizer must get the same deicing/anti-icing procedure.

12. **Fuselage and Vertical Tail Surfaces**

CAUTION: BE CAREFUL WHEN YOU REMOVE ICE AND SNOW FROM THE FUSELAGE AREAS WHERE THERE ARE LIGHTS AND ANTENNA. IF YOU ARE NOT CAREFUL, YOU CAN CAUSE DAMAGE TO THE EQUIPMENT.

A. The fuselage and the vertical tail surfaces, including the left and right sides of the vertical stabilizer, must have no ice or snow on them. This will decrease the aerodynamic drag and the weight of the airplane.

NOTE: THIN HOAR FROST IS PERMITTED ON THE TOP SURFACES OF THE FUSELAGE IF ALL THE VENTS AND PORTS ARE CLEAR. THIN HOAR FROST IS A WHITE DEPOSIT OF CONSTANT THICKNESS WITH A SHARP CRYSTALLINE TEXTURE. IT USUALLY OCCURS ON SURFACES THAT ARE OUTSIDE ON A COLD NIGHT WITH NO CLOUDS. HOAR FROST IS THIN. YOU CAN SEE ITEMS ON THE SURFACE BELOW THE LAYER OF FROST, SUCH AS PAINT LINES, MARKS OR LETTERS.

B. Remove all of the snow from the nose radome area. If you do no do this, the snow will blow back and decrease the pilot's vision on takeoff.

C. Do not apply hot deicing fluid or hot water directly on the pilots' windshield or passenger windows. You can let the fluid flow over the windows after you apply it to the top of the cabin. This is permitted since the fluid will be cool when it gets to the windows ice.

D. If SAE Type II or IV fluids are used, then all of the deicing / anti-icing fluid on cockpit windows must be removed prior to departure. Look closely at the windows with wipers installed. Also, look at all forward areas where fluid can flow aft on the windshield during taxi and takeoff. These areas must be clear before departure.

NOTE: **DEICING/ANTI-ICING FLUID CAN BE REMOVED BY RINSING WITH APPROVED CLEANER AND A SOFT CLOTH OR FLUSHING WITH TYPE I FLUID.**

13. **Engines and APU**

WARNING: **PERSONS MUST STAY CLEAR OF THE DANGEROUS AREA IN FRONT OF OR IN BACK OF AN ENGINE WHEN THEY OPERATE. INJURY OR DEATH OF PERSONS CAN OCCUR IN THESE AREAS.**

WARNING: **MAKE SURE THE APU INLET IS CLEAR BEFORE YOU START THE APU. THE APU CAN BE DAMAGED BY ICE OR SNOW THAT HAS COLLECTED IF IT GOES INTO THE INLET. ALSO, PERSONS MUST STAY CLEAR OF THE APU EXHAUST AREA WHEN THE UNIT IS OPERATING. INJURY OF DEATH OF PERSONS CAN OCCUR IN THESE AREAS.**

A. For the safety of persons, do not operate the engines or the APU during deicing / anti-icing operations. But, if it is necessary to conduct deice / anti-icing procedures during engine and/or APU operation, do the steps that follow.

a. Make sure the engine and/or the APU is at idle speed.
b. Do not point the spray of the deicing / anti-icing fluids directly into the engine and/or APU inlet

CAUTION: **DO NOT START THE ENGINES IN AREAS WHERE THERE ARE PUDDLES OF DEICING OR ANTI-ICING FLUID. MOVE THE AIRPLANE TO A DIFFERENT LOCATION. THE FLUID CAN GO INTO THE ENGINE COMPRESSOR. THESE FLUIDS CAN CAUSE THE COMPRESSOR TO STALL AND CAUSE THE ENGINE TO SURGE.**

WARNING: **DO NOT POINT THE DEICING FLUIDS DIRECTLY INTO THE APU OR ENGINE INLETS, EXHAUSTS, DUCTS, AND PITOT-STATIC PROBES. THESE FLUIDS CAN CAUSE DAMAGE TO THE EQUIPMENT AND MAKE THE AIR DATA INCORRECT.**

B. Do not direct spray of deicing/anti-icing fluid directly in the areas listed below.

a. The inlet ducts for the engine or APU
b. Exhausts
c. Engine thrust reversers
d. Engine inlet
e. Probes attached to the strut
f. Engine bleed air ducts

C. Make sure the APU inlet door moves freely.

D. Remove ground-accumulated ice from fan blades before flight.

NOTE: **ICE THAT HAS ACCUMULATED ON THE FAN BLADES WHILE THE AIRPLANE HAS BEEN ON THE GROUND FOR A PROLONGED STOP, SUCH AS A PLANE THAT HAS BEEN PARKED OVERNIGHT, IS CONSIDERED GROUND ACCUMULATED ICE. GROUND ACCUMULATED ICE MUST BE REMOVED BEFORE ENGINE START.**

NOTE: **ICE THAT HAS ACCUMULATED ON THE FAN BLADES WHILE THE ENGINE IS RUNNING IS CONSIDERED OPERATIONAL ICE. OPERATIONAL ICE IS ALLOWED BEFORE DEPARTURE BECAUSE IT CAN BE REMOVED BY ENGINE RUN-UPS DURING**

14. **Brakes**

A. Do not direct a spray of deicing or anti-icing fluids at the wheels or brakes.

NOTE: **CARBON BRAKES WHICH HAVE BEEN INTENTIONALLY SOAKED WITH DEICING FLUIDS SHOULD BE REMOVED AND DECONTAMINATED PER THE PROCEDURES FOUND IN THE APPLICABLE SUPPLIERS COMPONENT MAINTENANCE MANUAL.**

B. Apply the parking brake to reduce incidental contamination of brake friction surfaces when operational feasible.

C. Manually remove snow or ice accumulation from the wheels, brakes or tires. A hot air blower may be used for this purpose.

15. **Landing Gear and Doors**

A. Make sure there is not a layer of ice and/or snow on the movable parts and the position indication switches for the landing gear. This could prevent the correct operation of the landing gear. Make sure you do not remove lubricants or make the lubricants thinner when you apply deicing/anti-icing fluids. Parts that are not lubricated can seize of not operate without the correct servicing.

NOTE: **AIRCRAFT MAINTENANCE IS RESPONSIBLE FOR DEICING THE LANDING GEAR AND IN THE WHEEL WELL AREAS.**

CAUTION: **DO NOT MOVE THE AIRPLANE IF THE TIRES FREEZE TO THE GROUND. MAKE SURE THE WHEELS TURN WHEN YOU MOVE THE AIRPLANE. USE WARM AIR OR DEICING FLUID TO RELEASE THE TIRES FROM THE GROUND OR TO REMOVE FROZEN MATERIAL.**

16. **Wings / Fuel Tanks**

A. Frost can occur on the bottom of the wings in the fuel tank areas in temperatures above freezing. This is caused by the condensation of moisture in the air when it touches on the cold surfaces that are below freezing. The frost will usually melt when you add fuel that is at a higher temperature. If the frost continues and is more than 1/8 inch thick, remove before takeoff.

B. Carefully examine the top of the wing to see if there is clear ice. Use the equipment that is necessary to get sufficient access to the top of the wing to do this check. It is possible that the clear ice can only be found by touch. You must remove clear ice and anti-ice the wing, if it is necessary, before takeoff.

17. **Engine Operation**

CAUTION: REMOVE ICE AND SNOW FROM THE ENGINE. IF YOU DO NOT REMOVE THE ICE AND SNOW, DAMAGE TO THE ENGINE CAN OCCUR.

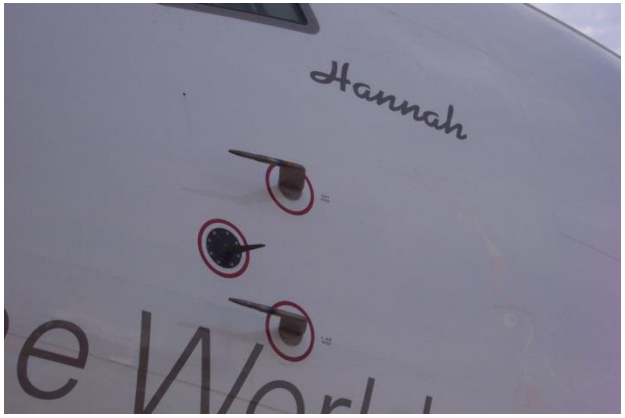
A. Large pieces of ice and/or snow that go into the engine inlet can cause damage to the internal engine parts. Remove all the ice and snow from the engine inlet ducts and fan blades before you start the engines.

B. Before you start the engines make sure there are no fluids around the exhaust areas that could ignite.

DO NOT DIRECT SPRAY AREAS 767

Engine Intakes

APU Intake



Pitot Tubes & Angle
of Attack Sensor

Static Ports

CAUTION: DO NOT POINT A SOLID FLOW OF FLUID DIRECTLY AT THE SURFACE. APPLY THE FLUID AT A LOW ANGLE TO PREVENT DAMAGE TO THE AIRPLANE AND SURFACES. DO NOT USE HIGH PRESSURE SPRAY TO BLOW THE ICE AND SNOW OFF THE AIRPLANE SURFACES.

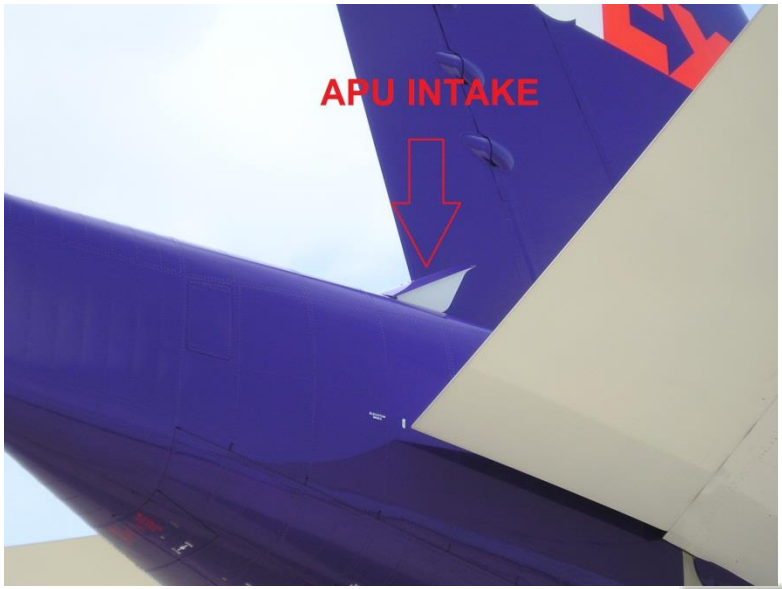
1. **Do not open the cargo doors if it is not necessary. Remove the ice and snow from the cargo containers before you put them on the airplane. Before the doors are closed for flight, put anti-icing fluid on these areas.**
   - **(a) The pressure relief doors**

CAUTION: BE CAREFUL WHEN YOU REMOVE THE ICE AND SNOW FROM THE WING SURFACES NEAR THE VORTEX GENERATORS. IF YOU ARE NOT CAREFUL YOU CAN CAUSE DAMAGE TO THE VORTEX GENERATORS WITH HIGHT PRESSURE FLUID FROM THE DEICE FLUID NOZZLE

NOTE: CAUTION SHOULD BE USED WHEN SPRAYING COMPOSITE AREAS ON THE AIRPLANE SURFACE. HIGH PRESSURE FLUID COULD DAMAGE THESE AREAS. ADJUST SPRAY PATTERN AND FLUID DELIVERY ANGLE AS NECESSARY TO PREVENT DAMAGE TO AIRPLANE SURFACE.

CAUTION: DO NOT START THE ENGINES IN AREAS WHERE THERE ARE PUDDLES OF DEICING FLUID OR ANTI-ICING FLUID. MOVE THE AIRPLANE TO A DIFFERENT LOCATION. THE FLUID CAN GO INTO THE ENGINE COMPRESSOR. THE FLUIDS CAN CAUSE COMPRESSOR STALL, AND ENGINE SURGE.

CAUTION: MAKE SURE THE APU INLET AREA IS CLEAR BEFORE YOU START THE APU. THE APU CAN BE DAMAGED BY ICE OR SNOW THAT HAS COLLECTED WHEN IT IS INGESTED INTO THE INLET.



CAUTION: EXAMINE THE ENGINE INTAKE AREAS IMMEDIATELY AFTER SHUTDOWN FOR ICE THAT IS THERE. REMOVE ICE WHILE THE TEMPERATURE OF THE ENGINE DECREASES AND BEFORE YOU INSTALL THE ENGINE PROTECTIVE PLUGS AND COVERS. IF YOU INSTALL THE PLUGS BEFORE THE TEMPERATURE OF THE ENGINE DECREASES, THE REMAINING HEAT IN THE ENGINE WILL MELT THE ICE TO WATER. THIS WATER WILL FLOW TO THE BOTTOM OF THE FAN SECTION. IT WILL FREEZE AGAIN WHEN THE TEMPERATURE OF THE ENGINE IS BELOW FREEZING. THIS WILL LOCK THE TIPS OF THE FAN LOWER BLADES WITH ICE.

2. **Make sure that no ice or snow is on the Angle of Attack sensors and that they are free to move. Carefully apply deicing fluid if needed to help free these sensors when frozen.**

WARNING: **Catastrophic APU failure and loss of Aircraft power may occur if deice fluid is ingested into an operating APU inlet.**

APU Precautions

1. **The APU inlet is located on the right side of the fuselage at the base of the vertical stabilizer.**

2. **Do not spray fluid directly into the APU. Spraying fluid directly into the APU may cause loss of Aircraft power and catastrophic failure of the APU.**

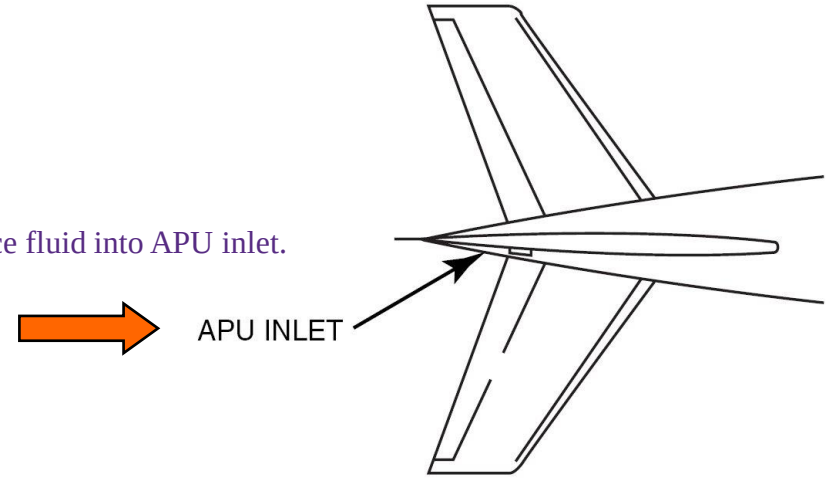
3. **The APU inlet door is closed when the APU is not in operation and opens toward the front when operating.**

4. **The standard procedure calls for the APU to be OFF for all deicing operations to prevent catastrophic failure due to ingestion of deice fluid.**

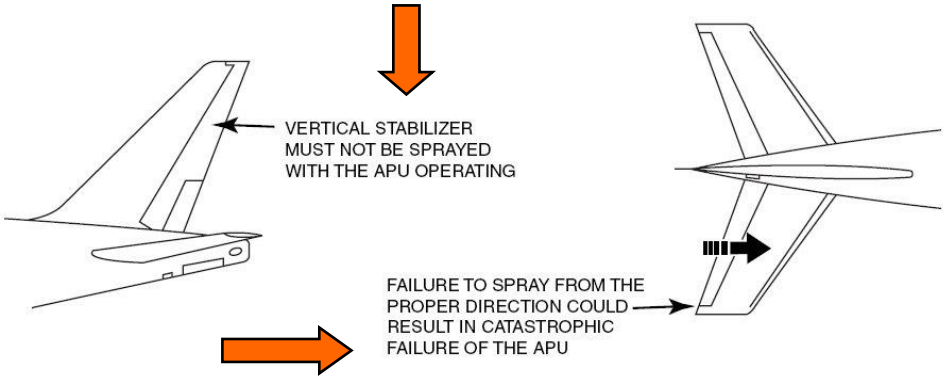
NOTE: **Deicing with APU operating is acceptable on an exception basis only.**

5. **The B-777 horizontal stabilizer must be sprayed from the trailing edge to the leading edge if the APU is in operation. The B-777 vertical stabilizer must not be sprayed while the APU is operating. Failure to spray in the proper direction could result in catastrophic failure of the APU.**

Do not spray deice fluid into APU inlet.

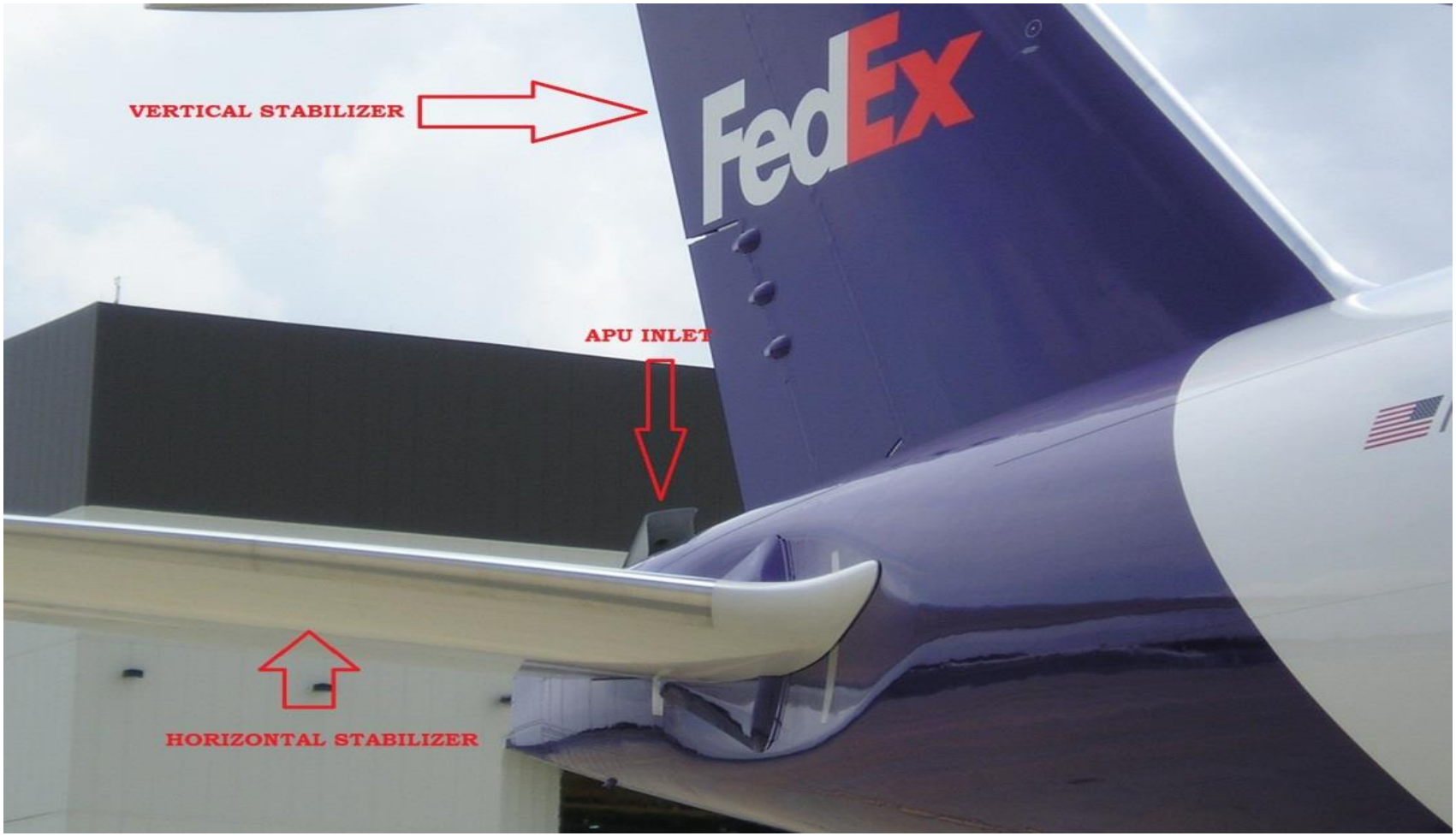


When spraying with APU operating, do not spray Vertical Stabilizer



When spraying with APU operating, spray horizontal stabilizer from trailing edge toward leading edge

DO NOT DIRECTLY SPRAY AREAS INDICATED



NOTE: **When deicing the horizontal stabilizer with the APU operating, fluid must be sprayed from the trailing edge toward the leading edge. Do not spray the vertical stabilizer when the APU is operating.**

CAUTION: DO NOT SPRAY FLUID INTO APU INLET. CATASTROPHIC APU FAILURE WILL OCCUR.

DO NOT DIRECTLY SPRAY AREAS INDICATED

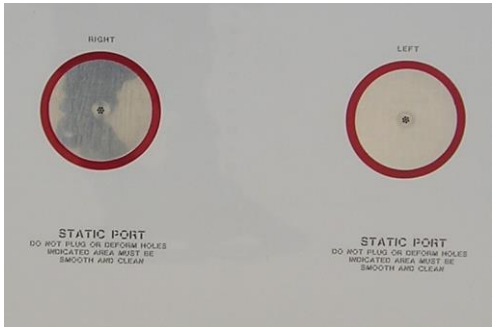
Holes and Opening

Negative Pressure Doors

Angle of Attack Sensor & Pitot Tubes

Aircraft Windshield

Notify Aircraft Maintenance to deice wheel wells and LG



Static Ports

DO NOT DIRECTLY SPRAY AREAS INDICATED

Anything protruding from aircraft

Brakes

Static Wicks

Engine inlets and Exhaust

Pressure outflow valves

APU Exhaust

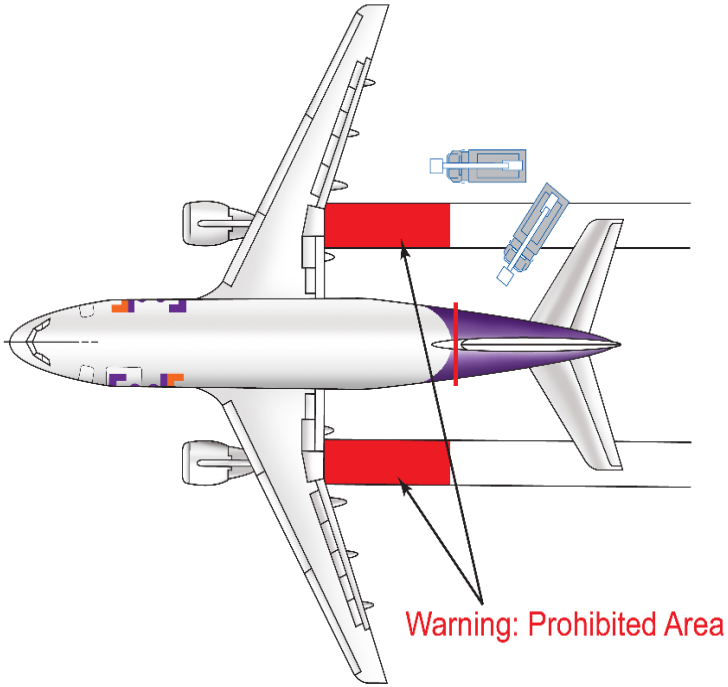
1. **It is standard operating procedure at the deice pads operated by FedEx for all aircraft engines to be running on the following aircraft types:**
   - **A. 757**
   - **B. 767**
   - **C. A300/A310**
   - **D. MD10**
   - **E. MD11**
   - **F. 777 (not standard but allowed if the location is equipped with extended reach deicers)**

NOTE: **A deice pad coordinator must be used to oversee and coordinate engines running deicing at MEM, EWR, IND and CDG.**

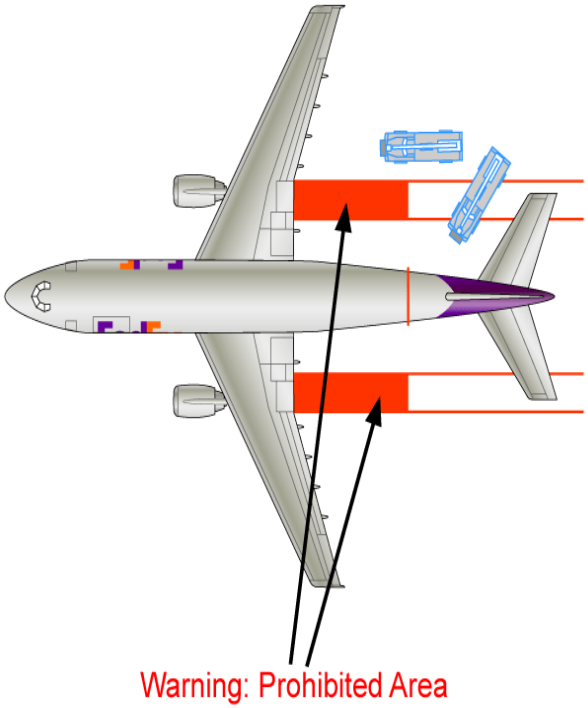
2. **Jet Exhaust Precautions**
   - **A. Deice operations are authorized in Jet exhaust with velocity of 100 mph or less.**
   - **B. Deice operations are prohibited in jet exhaust greater than 100 mph.**

Deice Truck Position for Off Gate Deicing

A310-200/300

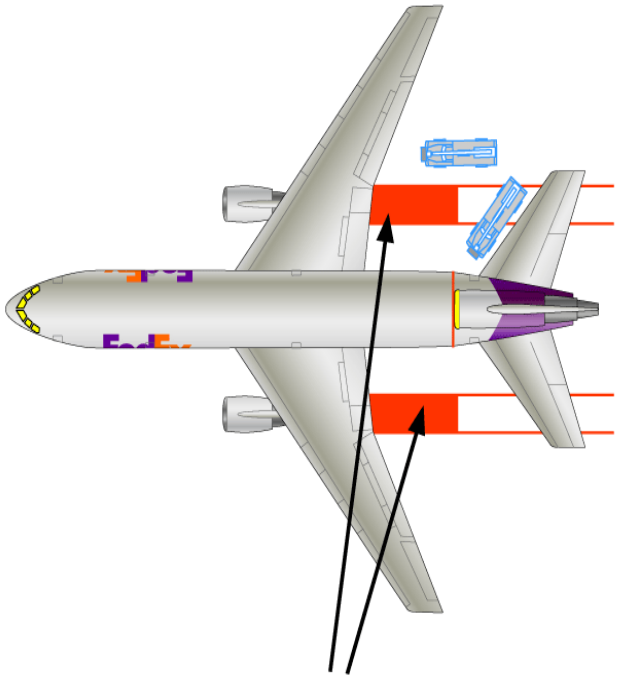


A300-600

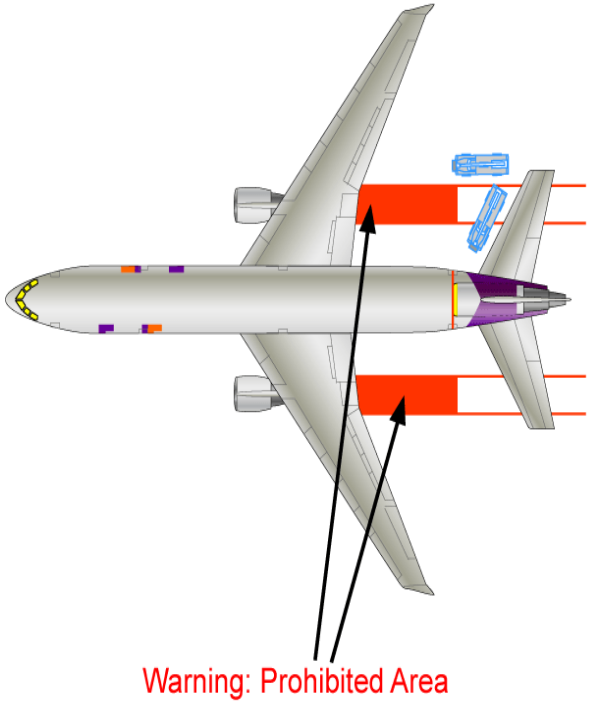


Deice Truck Position for Off Gate Deicing

MD10



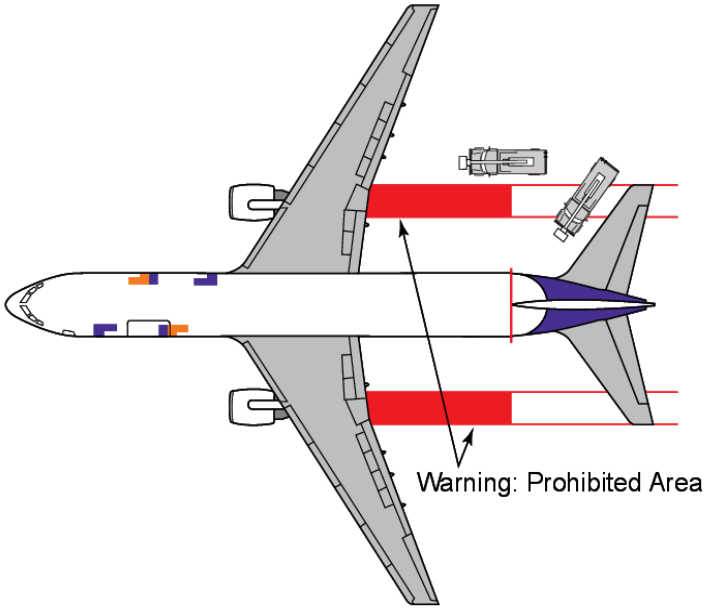
MD11



Deice Truck Position for Off Gate Deicing

B757

B767

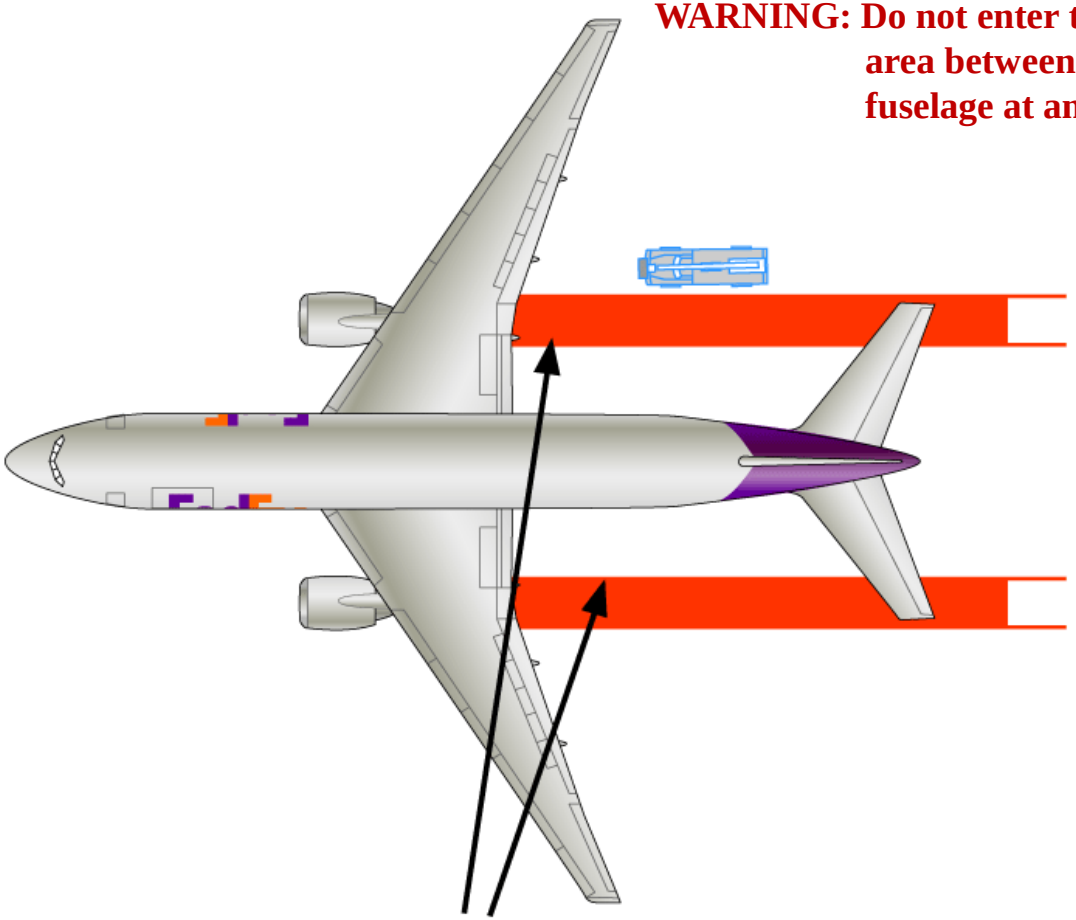


Deice Truck Position for Off Gate Deicing

The B777 is equipped GE90-100 series engines rated at 110,100 lb of thrust. Engine idle thrust can produce jet exhaust up to 100 mph extending to the tail section of the aircraft.

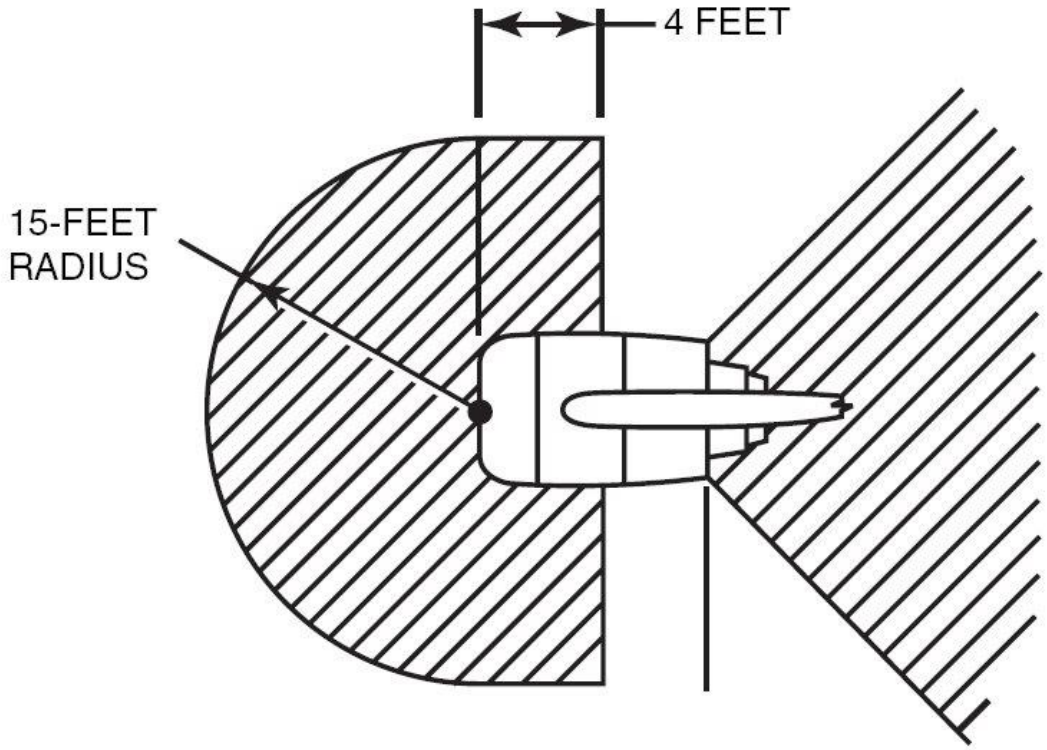
B777

WARNING: Do not enter the jet exhaust area and the area between the jet blast and the fuselage at any time.



WARNING: All aircraft engines can generate sufficient suction to pull a person or other loose items into the inlet duct.

Ensure the Deice truck maintains a safe distance of 15 feet from the center of the engine intake. Stay away from dangerous areas at the front and sides of the engine during operation. The engine can generate sufficient suction to pull a person or other loose items into the inlet duct.



PROPER TOOLS FOR NON-FLUID SNOW REMOVAL

THIS IS NOT THE WAY TO DO IT!

WARNING: DO NOT STAND ON WING OR STABILIZER WHILE SWEEPING SNOW. USE A SUPPORT STAND PLACED NEXT TO THE AIRCRAFT (APPROPRIATE SAFETY DEVICES MUST BE UTILIZED).

WARNING: BECAUSE THE AIRCRAFT MAY TIP WHEN COVERED WITH SNOW, BEGIN THE DEICING PROCEDURE BY REMOVING ACCUMULATIONS FROM THE TAIL SECTION; THEN WORK TOWARD THE NOSE OF THE AIRCRAFT.

WARNING: DRY SNOW THAT IS NOT ADHERING TO COLD, SOAKED WINGS OR CONTROL SURFACES SHOULD BE REMOVED WITH BROOMS AND /OR LEAF BLOWERS. USING DEICE FLUID COULD CAUSE DRY SNOW TO ADHERE TO THE AIRCRAFT

CAUTION: USE EXTREME CARE WHILE SWEEPING WING AND TAIL SURFACES WHERE VORTEX GENERATORS ARE INSTALLED. BUMPING VORTEX GENERATORS WITH THE SOLID PART OF BROOMS COULD BREAK OR DEFLECT GENERATORS.

CAUTION: DO NOT USE HARD OR SHARP TOOLS TO SCRAPE OR CHIP ICE FROM AIRCRAFT.

1. Remove heavy accumulations of snow from the tail section first to minimize airplane tipping conditions.
2. Remove snow accumulations in excess of 2-inches by using brooms, squeegees, and cotton ropes.
3. Caution should be used in areas around static wicks and antennas.
4. When removing snow from the wing area, snow must be pushed or blown (Forced air not included) toward the leading edge, starting at the wing tip and moving toward the wing root.
5. A hand held snow blower may be used when snow is dry and loose.

CAUTION: PROTRUDING EQUIPMENT (ANTENNAS, PITOT TUBES, TEMPERATURE PROBES, ANGLE OF ATTACK SENSORS, ETC.) MAY BE DAMAGED BY MOVEMENT OF ROPE. EXTREME CARE SHOULD BE EXERCISED IN THESE AREAS.

6. The fuselage can be cleared by use of a rope laid over the fuselage and “see-sawed” across the surface, moving the snow away from the engine inlets toward the front of the aircraft.

POST CHECK AFTER DE/ANTI-ICING

Check of Completed Deicing

Visually inspect the following areas to ensure that each one is free of ice and snow:

1. **Pitot tubes.**
2. **Balance bays.**
3. **Area in front of cockpit windows.**
4. **Fuselage in front of the No. 2 engine. (MD-10 & MD-11).**
5. **Air inlets and outlets of the APU.**
6. **Air inlets and outlets of the A/C packs.**
7. **Pod and/or wing engine inlets.**
8. **Wing, tail and control surfaces must be free of ice and snow. Observe individual flakes to ensure that they are being absorbed into the fluid.**
9. **The aircraft cannot be cleared for takeoff if there are patches or sheets of ice on the surface of the anti- icing fluid.**

Check of Engines Prior to Start

1. **Visually check engine inlets to ensure that they are free of ice and snow.**
2. **Under certain freezing precipitation condition (e.g., blowing snow, wind up tail pipe, freezing fog, etc.), visually inspect the front and rear side of cowlings and engines for buildup to ensure that they are free from ice and snow.**

NOTE: Off Gate De/Anti-icing (carwash/central deice facility), completion of all engine inlet inspection will occur in the gate prior to pushback.

Check Flight Controls

Ensure that primary flight controls move freely.

NOTE: The flight crew can verify free movement prior to push back.

NOTE: Pre-Take-Off Contamination check can be accomplished by a qualified AMT or Flight crew member who have successfully completed the PTOCC training if the hold overtime is in question.

P.T.O.C.C. Training can be accomplished by logging onto the MYHRA system.

IN-GATE COMMUNICATIONS

During the final anti-icing process and prior to departure, advise the flight crew via appropriate methods, (e.g., inter-phone, in person, VHF radio) of the following:

1. **Prior to conducting any de/anti-icing, the lead or person responsible for the operation must coordinate with all applicable parties and insure the following are completed:**

   a) **Confirms with the flight crew specific de/anti-ice instructions and that the aircraft is configured for deicing.**
   b) **Advises specific aircraft de/anti-ice instructions to deice crew**
   c) **Confirms with each truck that they are complete and clear of the aircraft.**
   d) **Provides information as stated in WOM 10-0-3.**
   e) **Clears aircraft for normal pushback procedure**

NOTE: **When Type II/IV fluids are used, it is important that flight crews know as early as possible what brand of Type II/IV fluid will be applied to the aircraft. There are specific holdover time guidelines for specific brands of Type II/IV fluids; flight crew members need this information as they prepare holdover time estimations.**

f) **If communication is lost between the vehicle and the basket, the operation must stop and not proceed until communication is re-established. The vehicle driver or basket operator must also communicate the situation to the coordinator (when applicable).**

g) **If communication is lost between the vehicle and the coordinator (if applicable), re-establish communication before proceeding to the next step.**

2. **During the final application process and prior to departure, advise the flight crew via appropriate methods, (e.g., interphone, in person, VHF radio) of the following. Refer to Appendix 99-10, FOM Chapter 8 for additional information.**

Ground crews provide de/anti-icing application (i.e., application time, fluid type, brand name, etc.) to the flight crew after all equipment is clear of the aircraft

WARNING: To prevent possible serious ground accidents, do not provide application information until all equipment is clear of the aircraft.

A. Type of fluid used for the final anti-icing application, expressed in one of the following ways.
   1. Forced air Deicing-No Holdover Time
   2. Type I fluid
   3. Type II fluid and brand name and mixture percentage
   4. Type IV fluid and brand name and mixture percentage

NOTE: Ensure you communicate the exact brand name to the flight crew.

NOTE: Percentages of Type I mixtures are not reported to flight crews. Ground deicing personnel must ensure that the freezing point of the final application mixture of Type I fluid and water is at least 18°F below the outside ambient temperature when Type I fluid is applied in a one-step procedure.

B. Time of beginning the final de/anti-icing fluid application (not required when forced air deicing with Type I fluid is used as the final application).

NOTE: This time is used to calculate the holdover time

C. Employee number and initials of the lead or person responsible for the deicing of the individual aircraft.

D. Verification that the post de/anti-icing check is complete

OFF GATE (DEICE PAD) DE/ANTI-ICING COMMUNICATION

NOTE: Refer to the WOM 6-6 for Off Gate Deicing Information and the WOM chapter 10 for Communication information.

1. All Ground, Maintenance, and Flight crews MUST use the same off-gate communication information
2. Reference the standard Off-Gate Communications template in Flight Operations Manual, Chapter 8.35 Winter Operations; De/Anti-icing Procedures; Flight Crew Communications.
3. The Off-Gate Communications template is required in MEM, IND, EWR, and CDG. The template must be strictly adhered to at all times.

4. **Ground crews provide de/anti-icing application (i.e., application time, fluid type, brand name, etc.) to the flight crew after all equipment is clear of the aircraft**

WARNING: To prevent possible serious ground accidents, do not provide application information until all equipment is clear of the aircraft.

1. **Pre-Event Briefing**

Prior to de/anti-icing operations lead personnel should brief the deice crew on key elements of the local operation. Key elements include but are not limited to the following:

A) Ramp and Weather Conditions
B) Basic Safety
- **a) PPE (Personal Protection Equipment)**
- **b) Equipment positioning; proper distance from aircraft**

C) Communications
- **a) Basket to Driver (basket is primary)**
- **b) Lead to operators**

D) Freeze point check
- **a) Compare to OAT**
- **b) Insure minimum guidelines are met**

2. **Deice Vehicle communications**

To ensure all deice personnel understand de/anti-ice instructions, all ground personnel must adhere to the following procedures:

A) The basket operator is in charge of deice vehicle movement and also acts as marshaller/guideperson when fluid is not being applied

B) When acting as marshaller/guideperson the basket operator must insure safe movement of the vehicle as a top priority.

C) When backing the vehicle, the boom should be centered if possible and raised to sufficient height to give the basket operator a clear view behind the vehicle.

D) When backing the vehicle, if the area behind the vehicle is not visible from the basket, the basket operator must exit the basket, walk behind the vehicle, and instruct the driver using hand signals.

E) Basket-to-vehicle communications standard commands are:
- **a. Starting De-ice or Anti-ice**
- **b. Stopping De-ice or Anti-ice**
- **c. Move Forward**
- **d. Move Back**
- **e. Stop (stop, stop, stop !!!)**
- **f. Turn Left**
- **g. Turn Right**
- **h. Truck is secure**

A record of aircraft de/anti-icing must be made and retained at each station performing de/anti-icing for a minimum of 7 days.

A second copy is forwarded to the district maintenance manager.

Aircraft de/anti-icing must be recorded on one of the the following forms:

1. **Aircraft De/Anti-icing Log FedEx M-0493, or**
2. **Vehicle Assignment / De/Anti-icing Record, FedEx M-3025A / M-3025B, or**
3. **Aircraft Maintenance Log, FedEx M-1807, or**
4. **If time permits, make an entry in the Electronic Aircraft Maintenance Log and produce an Airworthiness Release Document.**

NOTE: If two or more de/anti-icing units are used to de/anti-ice an aircraft, a record must be made for each de/anti-icing unit used.

NOTE: It is NOT a requirement to leave a copy of the FedEx aircraft de/anti-icing log aboard pre-treated aircraft.

NOTE: When hot Type I fluid is applied using forced air as the final application, a comment must be included on the de/anti-icing log stating that forced air was used in the final application.

Compliance Records

A record must be made of the inspection of NO2 Engine inlet for the MD10, MD10-10, MD10-30 and MD11 aircraft.

Prior to the end of the work shift, the mechanic must make an entry in the Electronic Aircraft Maintenance Log (EAML), for the accomplishment of this inspection. This is the permanent record and the entry must indicate that you did or did not find an accumulation of snow/ice.

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AIRCRAFT DE/ANTI-ICING LOG

Aircraft Number	Date (mm/dd/yy)	Station ID	Deicing Location (E.g. gate number , pad number, etc.)	Engines Running Deicing ☐ Yes ☐ No

Weather Conditions

Outside Ambient Temperature _____ ☐ °F ☐ °C

☐ No Precipitation ☐ Heavy ☐ Freezing Rain ☐ Wet Snow ☐ Clear Ice ☐ Light ☐ Light Freezing Rain ☐ Dry Snow ☐ Frost ☐ Freezing Drizzle ☐ Rime Ice ☐ Fog

Source of Information:

Deicing Fluid (Fluid used in 1-step or first step of 2-step de/anti-icing procedure)

☐ Type I
☐ Type II Mix Ratio _____
☐ Type IV Mix Ratio _____

Start Time _____
Finish Time _____
Amount Used _____ ☐ Gallons ☐ Liters

Brand Name if Type II or Type IV Fluid used _____

☐ Forced Air used during Deice Operation

Anti-Icing Fluid (Used in 2nd step of 2-step de/anti-icing procedure or applied to a clean aircraft)

☐ Type I
☐ Type II Mix Ratio _____
☐ Type IV Mix Ratio _____

Start Time _____
Finish Time _____
Amount Used _____ ☐ Gallons ☐ Liters

Brand Name if Type II or Type IV Fluid used _____

☐ Forced Air used during Anti-Icing Fluid Application

Vehicle Number/ID	Type I Fluid Freezing Point ☐ °F ☐ °C	Vehicle Driver Name/Employee No. (print name)	Vehicle Bucket Operator Name/Employee No. (print name)

Final Application Check Completed: ☐

Employee Number/Initials _____

Vendor Name

Comments

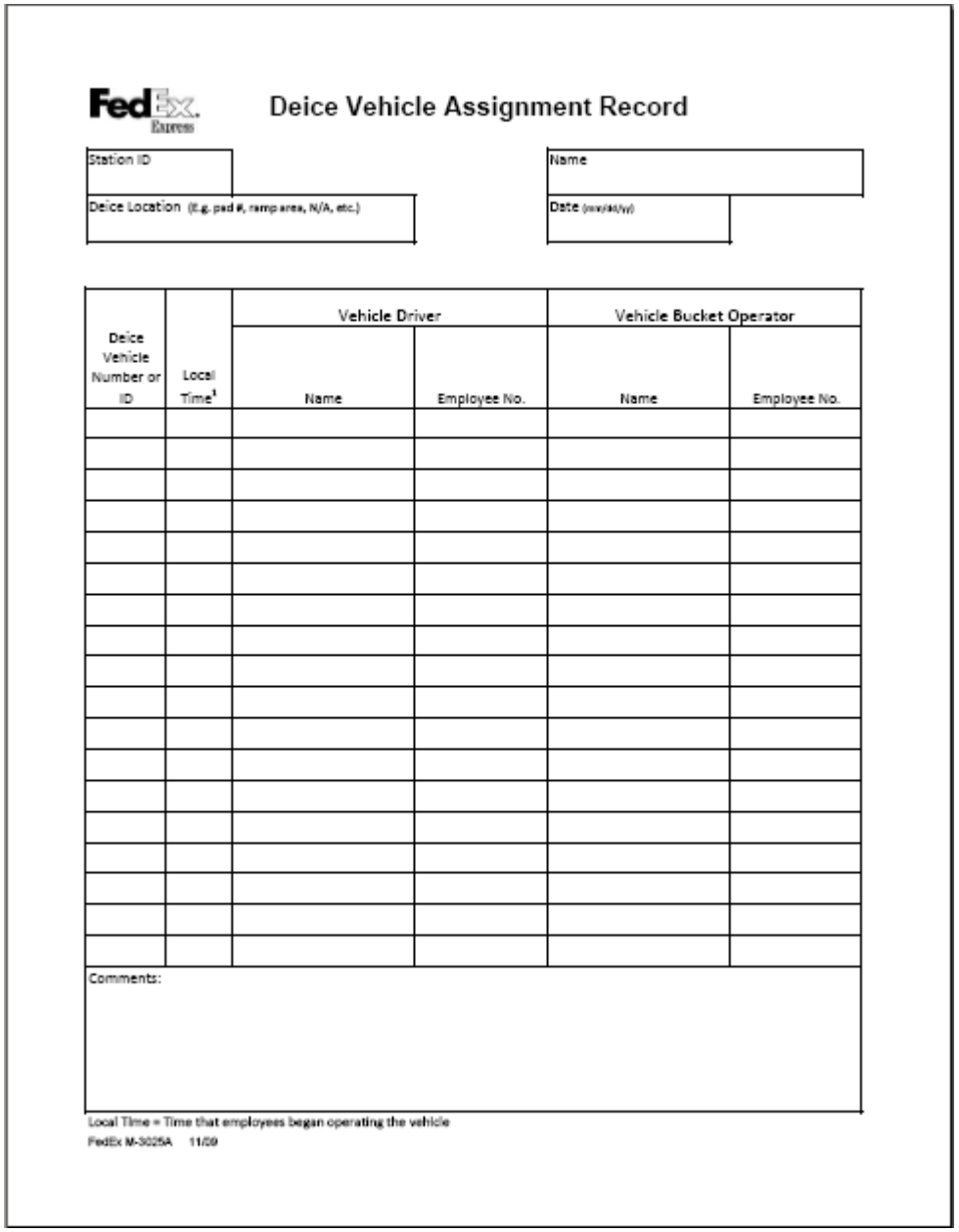
No. 2 Engine Inlet Inspection for MD-10-10, MD-10-30 and MD-11 Aircraft

Inspect No. 2 Engine Inlet	Authorized Mechanic's Signature	Employee Number

FedEx M-0493 11/19

M-0493

M-3025A



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Deice Vehicle Assignment Record

Station ID	Name
Deice Location (E.g. pad #, ramp area, N/A, etc.)	Date (mm/dd/yy)

Deice Vehicle Number or ID	Local Time[1]	Vehicle Driver		Vehicle Bucket Operator	
		Name	Employee No.	Name	Employee No.

Comments:

Local Time = Time that employees began operating the vehicle

FedEx M-3025A 11/09

FedEx Express

De/Anti-Icing Record

Station ID ____________ Local Date ____________
(for 1st operation listed below-mm/dd/yy)

Radio Frequency ____________

Type IV Fluid Brand Name and Mix (%) ____________

Aircraft & Deice Location (gate #, pad #, etc.)	Temperature Scale °C ☐ °F ☐ — Vehicle Number/ID & Type I Fluid Freezing Point						Weather & Aircraft Condition	Check If Forced Air Used for Deicing or Fluid Application	Operational Start & End Times[2] (Local)	Fluid Usage ☐ gallons ☐ liters	Post Application Check Complete	MD-10-10, MD-10-30, and MD-11 No. 2 Engine Inspection (Check appropriate finding and sign for inspection.)	Engines Running Deice (ERD) / Comments
	Vehicle Number/ID	FP[1]	Vehicle Number/ID	FP[1]	Vehicle Number/ID	FP[1]							
Aircraft No.							OAT[3]	Forced Air: ☐ Deicing ☐ Anti-Ice	D	Type I	Employee No.	Ice/Snow ☐ Yes ☐ No Emp. No.	ERD: ☐ Yes ☐ No
Location							Code[4]		A E	Type IV	Employee Initials	AMT Signature	
Aircraft No.							OAT[3]	Forced Air: ☐ Deicing ☐ Anti-Ice	D	Type I	Employee No.	Ice/Snow ☐ Yes ☐ No Emp. No.	ERD: ☐ Yes ☐ No
Location							Code[4]		A E	Type IV	Employee Initials	AMT Signature	
Aircraft No.							OAT[3]	Forced Air: ☐ Deicing ☐ Anti-Ice	D	Type I	Employee No.	Ice/Snow ☐ Yes ☐ No Emp. No.	ERD: ☐ Yes ☐ No
Location							Code[4]		A E	Type IV	Employee Initials	AMT Signature	
Aircraft No.							OAT[3]	Forced Air: ☐ Deicing ☐ Anti-Ice	D	Type I	Employee No.	Ice/Snow ☐ Yes ☐ No Emp. No.	ERD: ☐ Yes ☐ No
Location							Code[4]		A E	Type IV	Employee Initials	AMT Signature	
Aircraft No.							OAT[3]	Forced Air: ☐ Deicing ☐ Anti-Ice	D	Type I	Employee No.	Ice/Snow ☐ Yes ☐ No Emp. No.	ERD: ☐ Yes ☐ No
Location							Code[4]		A E	Type IV	Employee Initials	AMT Signature	
Aircraft No.							OAT[3]	Forced Air: ☐ Deicing ☐ Anti-Ice	D	Type I	Employee No.	Ice/Snow ☐ Yes ☐ No Emp. No.	ERD: ☐ Yes ☐ No
Location							Code[4]		A E	Type IV	Employee Initials	AMT Signature	
Aircraft No.							OAT[3]	Forced Air: ☐ Deicing ☐ Anti-Ice	D	Type I	Employee No.	Ice/Snow ☐ Yes ☐ No Emp. No.	ERD: ☐ Yes ☐ No
Location							Code[4]		A E	Type IV	Employee Initials	AMT Signature	
Aircraft No.							OAT[3]	Forced Air: ☐ Deicing ☐ Anti-Ice	D	Type I	Employee No.	Ice/Snow ☐ Yes ☐ No Emp. No.	ERD: ☐ Yes ☐ No
Location							Code[4]		A E	Type IV	Employee Initials	AMT Signature	

[1] The freezing point for Type I fluid (deice) must be at least 18°F (10°C) lower than the OAT if used as final application fluid (e.g. one-step de/anti-icing).

[2] D=start time for Deice fluid application; A=start time for Anti-Ice fluid application; E=End time for de/anti-ice operation

[3] OAT=Outside Ambient Temperature

[4] Note the weather condition and/or aircraft condition at the time of the de/anti-icing operation using the following codes.
More than one code may be entered for each event:
(0)No Precipitation (1)Light (2)Heavy (3)Freezing Rain (4)Light Freezing Rain (5)Freezing Drizzle (6)Wet Snow (7)Dry Snow (8)Fog (9)Clear Ice (10)Frost (11)Rime Ice

FedEx M-3025B 11/19

Form M-3025B

M-3025B

FedEx Express

Deice Vehicle Inspection

Vehicle Type	LMD	Vehicle ID	12345	Date (local–month/day/year)	06/14/10
Employee Name	Bullwinkle Moose	Employee No.	123456	Start Time of Pre-Ops Inspection (local time)	14:25
Employee Name	Rocket J. Squirrel	Employee No.	654321	Start Time of Post-Ops Inspection (local time)	18:30

☑ = Satisfactory ☒ = Unsatisfactory N=Does Not Apply

Item	Result Pre-Ops	Result Post-Ops	Discrepency/Comment
Walk Around			
Tires (condition)	✓	✓	
Lights, lenses, flashers, reflectors, and beacon	✓	X	Left front flasher in-op
Wipers and horn	✓	✓	
Mirrors, windows, and windshield	✓	✓	
Ladders and rails	✓	✓	
Body Damage	X	X	Dent above right rear tire
Spray Nozzles (visual check)	✓	✓	
Fire Extinguisher	✓	✓	
Deice Job Aid	✓	✓	
Ground Reel (visual check)	✓	✓	
Tank Levels and Gauges			
Main Fuel Tank Level (MT, 1/4, 1/2, 3/4, full or amount)	FULL	FULL	
Auxiliary Fuel Tank Level (MT, 1/4, 1/2, 3/4, full or amount)	3/4	FULL	
Deice Fluid Tank Level ☑ Gal. ☐ Liters	1200	750	
Anti-ice Fluid Tank Level ☑ Gal. ☐ Liters	550	400	
Deice and Anti-ice Tank Gauges	✓	✓	
Bucket Heater Fuel Tank (Tempest vehicle)	N	N	
Brakes and Emergency Brakes	✓	✓	
Radios, Headsets, and Intercom System	✓	✓	
Operating Systems			
Auxiliary engine operation	✓	✓	
Fluid heating system	✓	✓	
Emergency stops	✓	✓	
All boom control stations & emergency system	✓	✓	
Bucket creep	✓	✓	
PLC operations check (FMC 2100 vehicles)	N	N	
PTO operations (FMC 2100 vehicles)	N	N	
Hydrostatic creep drive (FMC 2100 vehicles)	N	N	
Vehicle Secured/Equipment Stowed	✓	✓	

Glycol/Freezing Point Tester–Calibration Check (FP of 32°F or 0°C using water): 32°F

Deice Fluid Freezing Point ☑ °F ☐ °C

Time	14:35	FP	-14	(initial)	Time	FP	(refill)
Time	16:15	FP	-10	(refill)	Time	FP	(refill)
Time		FP		(refill)	Time	FP	(refill)

Battery Switch Off ☑

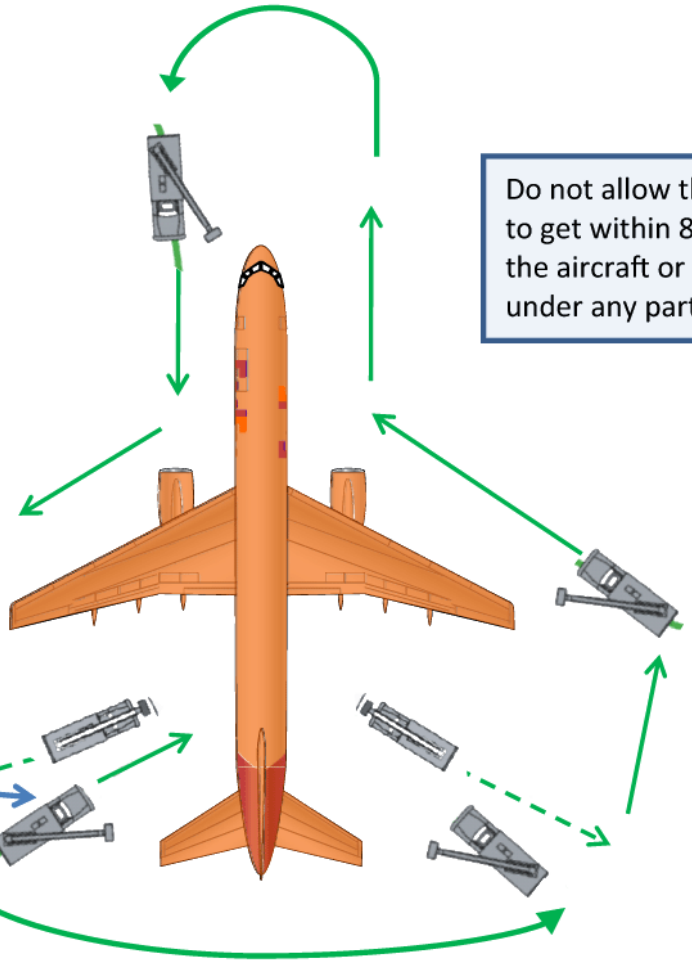
Signature	Bullwinkle Moose	Signature	Rocky Squirrel

Comments: Vehicle parked at GSE Mx

FedEx M-3546 7/10

Form M-3546

DEICE TRUCK POSITONING / SINGLE TRUCK



Do not allow the vehicle to get within 8 feet of the aircraft or to go under any part of the

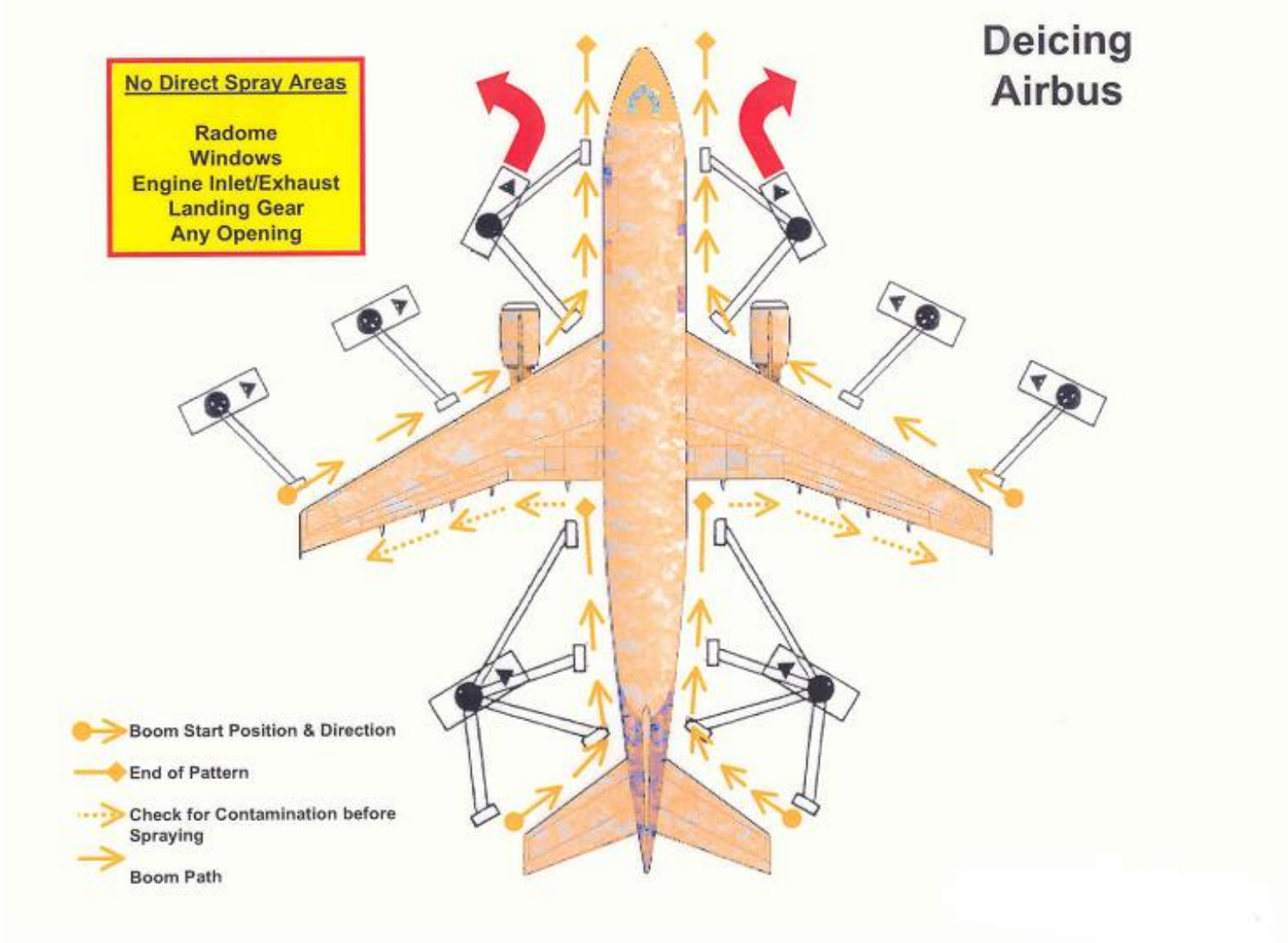
Boom should be centered when backing the vehicle.

Start position

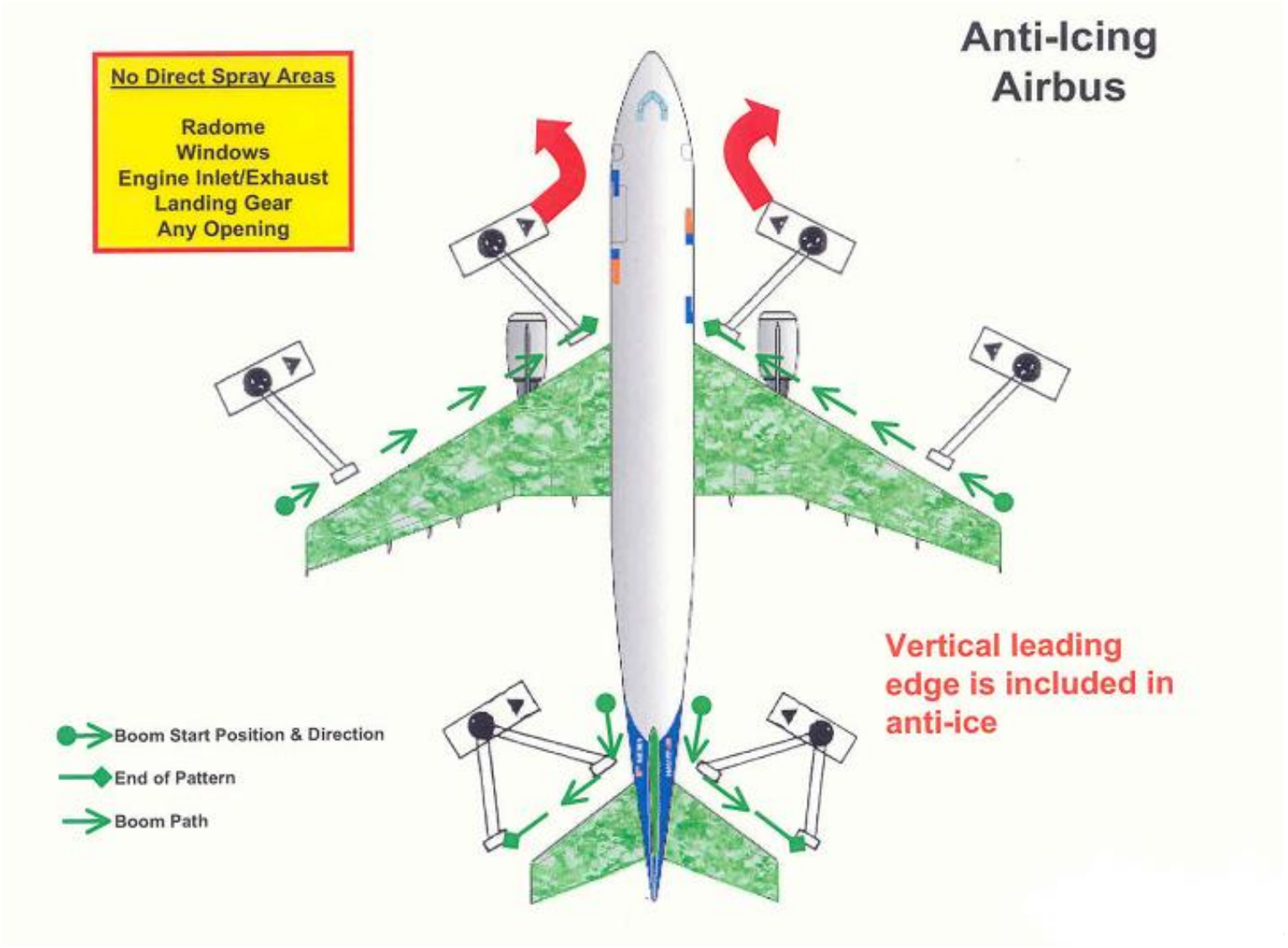
Do not allow the boom, bucket, or nozzle to get closer than 3 feet from the aircraft.

Bucket operator marshals for driver when backing vehicle.

DEICE TRUCK POSITIONING



ANTI-ICING TRUCK POSITIONING



RIGHT TAIL POSITION

LEFT FORWARD POSITION

BOTH ACCIDENTS OCCURRED DUE TO A BREAK DOWN IN COMMUNICATION!

AIRCRAFT STRIKE !

AD = Air Worthiness Directive

AMT = Aircraft Maintenance Technician

APU = Auxiliary Power Unit

C° = Celsius

DE = Designated Examiner

EAML = Electronic Aircraft Maintenance Log

F° = Fahrenheit

FAA = Federal Aviation Administration

FAR = Federal Aviation Regulation

GMM = General Maintenance Manual

LOUT = Lowest Operational Use Temperature

TOT = Technical Operations Training

OAT = Outside Ambient Temperature

PTOCC = Pre Take Off Contamination Check

SAE = Society of Automotive Engineers

Automotive Engineers

Active Frost: Is a condition when frost is forming. Active frost occurs when aircraft surface temperature is at or below 32°F and at or below dew point.

Anti-icing: The application of freezing point depressant fluids (Type II or IV or heated Type I fluid) on clean surfaces of the aircraft, providing protection against the formation of frost, ice, or snow for a limited period of time (Holdover time).

Buffer/Freezing Point: The difference between Outside Ambient temperature and the freezing point of the fluid.

Cold Soaked Wings: The wings of aircraft are said to be cold "soaked" when they contain very cold fuel after flight at high altitude or after refueling with very cold fuel.

Critical Surfaces: A surface of an aircraft which shall be completely free of ice, snow, slush or frost before takeoff. Critical surfaces areas for the trunk fleet are:

- Leading edge, wings, tail, control surfaces
- Pitot heads, static ports, ram-air intakes, instrument sensor pick-up points
- Fuel vents and engine inlets. A/C Inlets/Exhaust, Outflow valves
- Fuselage upper surfaces on center engine aircraft

De/anti-icing: Is a combination of using both deice and anti-ice fluid. This can be performed in one or two steps.

Deicing: Is a procedure by which frost, ice, slush, or snow is removed from the aircraft in order to provide clean surfaces.

Fluid Mixture: Mixture ratios are stated by volume with the percentage of de/anti-icing fluid given first and the percentage of water given second.

Freezing Drizzle: Fairly uniform precipitation composed of fine drops very close together which freezes upon impact with the ground or other exposed objects.

Freezing Fog: (FZFG) Clouds of super-cooled water droplets that form a deposit of ice on objects in cold weather conditions.

Freezing Precipitation: Water condensed from atmospheric vapor falling to earth in super-cooled drops, forming ice on objects

Frost: A crystallized deposit from water vapor on surfaces at or below 0°C (32°F).

Hail: (GR) Precipitation in the form of small balls or other pieces of ice falling separately or falling together in irregular lumps.

Hoarfrost: A deposit of interlocking ice crystals formed by direct sublimation on objects. Thin hoarfrost is a uniform white deposit of fine crystalline texture, which usually occurs on exposed surfaces on a cold cloudless night, and which is thin enough to distinguish surface features underneath, such as paint lines, markings or lettering.

Holdover Time: (H.O.T.) is the estimated time anti-icing fluid will prevent the formation of frozen contamination on the protected surfaces of an aircraft.

Ice Crystals: A fall of unbranched (snow crystals are branched) ice crystals in the form of needles, columns,or plates.

Ice Pellets: (PL) Precipitation of transparent or translucent pellets of ice, which are spherical or irregular, and which have a diameter of .2in or less. When grains hit hard ground they bounce.

- **Light- Scattered pellets that do not completely cover an exposed surface regardless of duration.**
- **Moderate- Slow accumulation on the ground.**
- **Heavy- Rapid accumulation on ground.**

Light Freezing Rain: Precipitation of liquid water particles which freeze upon impact with exposed objects, either in the form of drops, which, in contrast to drizzle, are widely separated.

Moderate & Heavy Freezing Rain: Precipitation of liquid water particles which freeze upon impact with exposed objects.

One Step De/anti-icing: Is carried out using deicing fluid. The fluid used to deice the aircraft remains on the aircraft surfaces to provide limited anti-icing capability.

Post Deicing/Anti-icing Check (Final Check): De/Anti-icing procedures include a check to ensure all critical surfaces are free of adhering contamination performed by qualified ground personnel after the de/anti-icing fluid application has been completed. No aircraft shall takeoff after a de/anti-icing operation unless the aircraft has received a final check by a responsible authorized person.

Pre Takeoff Contamination Check: A check of the critical surfaces for adhering contamination. This check is accomplished after the holdover time has been exceeded and must be completed within 5 minutes prior to takeoff. The check must be accomplished from outside the aircraft by a certified aircraft mechanic.

Pre-treatment: The application of Type II or Type IV fluids on clean aircraft surfaces prior to any frost, snow, freezing rain, or freezing fog conditions. This action minimizes or reduces the accumulation of frozen precipitation on aircraft surfaces and facilitates subsequent deicing.

NOTE: Type I fluids have limited effectiveness when used for pre-treatment purposes.

Protection Level: The freezing point of a Type I fluid/water mixture. The freezing point can be measured with the Misco Glycol Tester using the appropriate scale for propylene glycol or ethylene glycol based fluids.

Rain on Cold Soaked Wing: Water forming ice or frost on the wing surface when the temperature at the aircraft wing surface is at or below 32°F.

Remote-Site Deice: The capability of providing aircraft deice services to aircraft just prior to take-off. Located near the departure runway , departing aircraft which require a re-deice can be accommodated without taxiing back to the main facility.

Rime Ice: A deposit of ice, produced by freezing of super cooled fog or cloud droplets on objects at temperatures below or slightly above freezing. It is composed of grains separated by air, sometimes adorned with crystalline branches.

conical.

Shear Force: Is a force applied laterally on an anti-icing fluid. When applied to a Type II or Type IV the shear force will reduce the viscosity of the fluid; when the shear force is no longer applied, the anti-icing fluid should recover its viscosity. Shear forces are applied whenever the fluid is pumped, forced through an orifice (nozzle) or when subjected to airflow. If excessive shear force is applied, the thickener system could be permanently degraded and the anti-icing fluid my not recover and fluid performance can be effected.

Snow: (SN) Precipitation of small ice crystals or flakes, most of which are branched, star-shaped, or mixed with un-branched crystals. At temperatures higher than 23 °F (–5 °C), the crystals are generally agglomerated into snowflakes.

Snow Grains: (SG) Precipitations of very small, white, and opaque grains of ice.

Snow Pellets: (GS) Precipitations of white, opaque grains of ice. The grains are round or sometimes conical. Diameters range from about .02 to .08 inches.

Two Step De/anti-icing: This consist of two distinct steps. The first step, deicing, is followed by the second step, anti-icing, as a separate process. Anti-icing fluid is applied to protect the relevant surfaces thus providing maximum anti-icing capability.