WING ARMOR®

AIRCRAFT ANTI-ICER

SAFER FASTER SMARTER

Ground Icing & Business Aviation

Winter Flying…

Safety is the #1 priority when planning your departure…

Here are a few short questions that will test your knowledge of the FAA's "Clean Aircraft Concept" & Aircraft De/Anti-icing…

Most Business Aircraft that have tail mounted engines are…

A. *NOSE HEAVY*

B. *WING HEAVY*

C. *TAIL HEAVY*


Citation X
N979QS

Which type of contamination is responsible for a majority of accidents during Take-off ?

A. SNOW

B. SLUSH

C. ICE

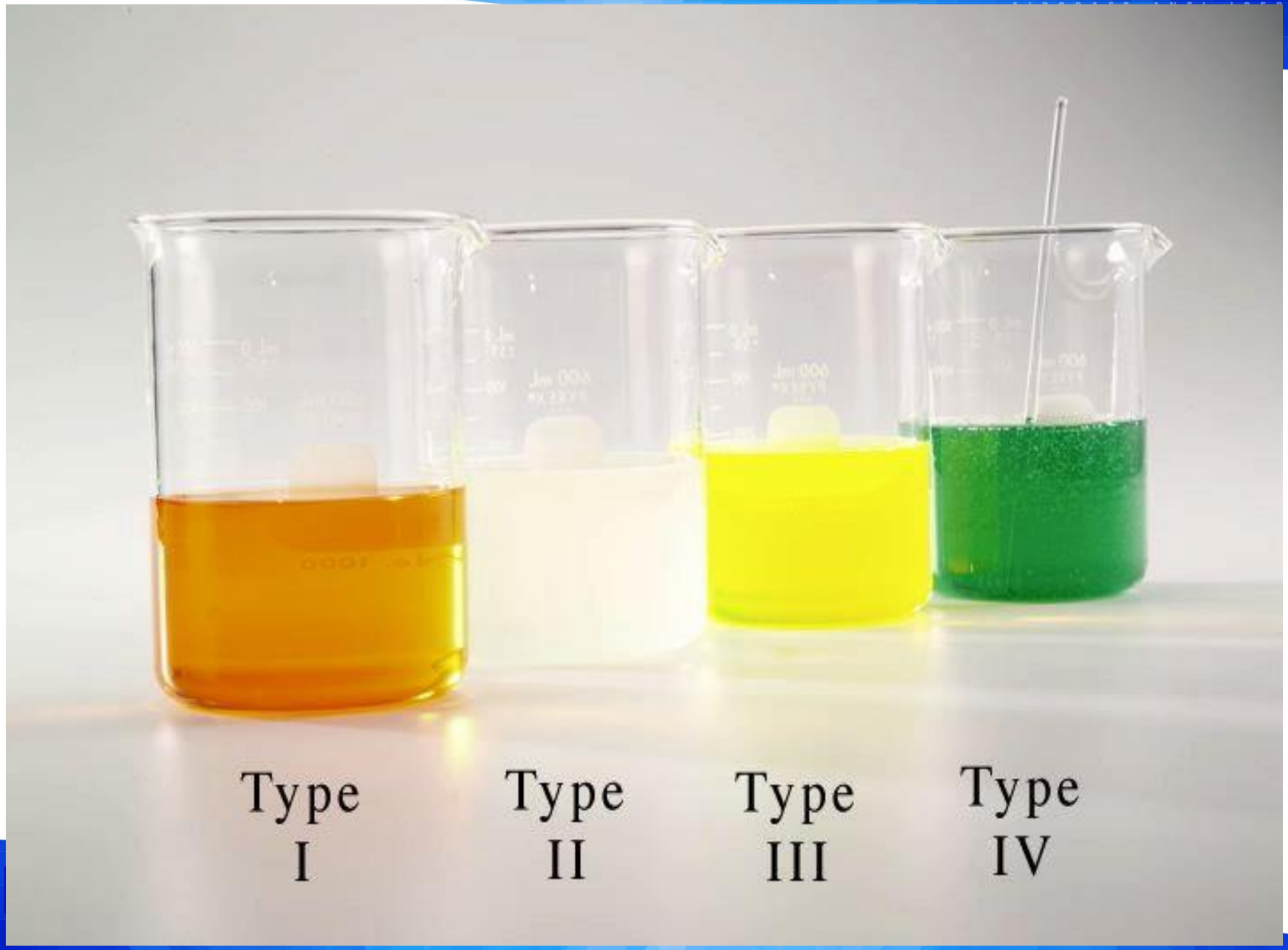
- Ice can be deadly for aircraft, especially on modern laminar-flow wing designs which tend to be intolerant of even the thinnest build-up.
- Mar. 04, 2013 – Annemasse, France – Beechcraft Premier 1A

How many De/Anti-icing Fluid Types are available Worldwide today ?

A. TWO

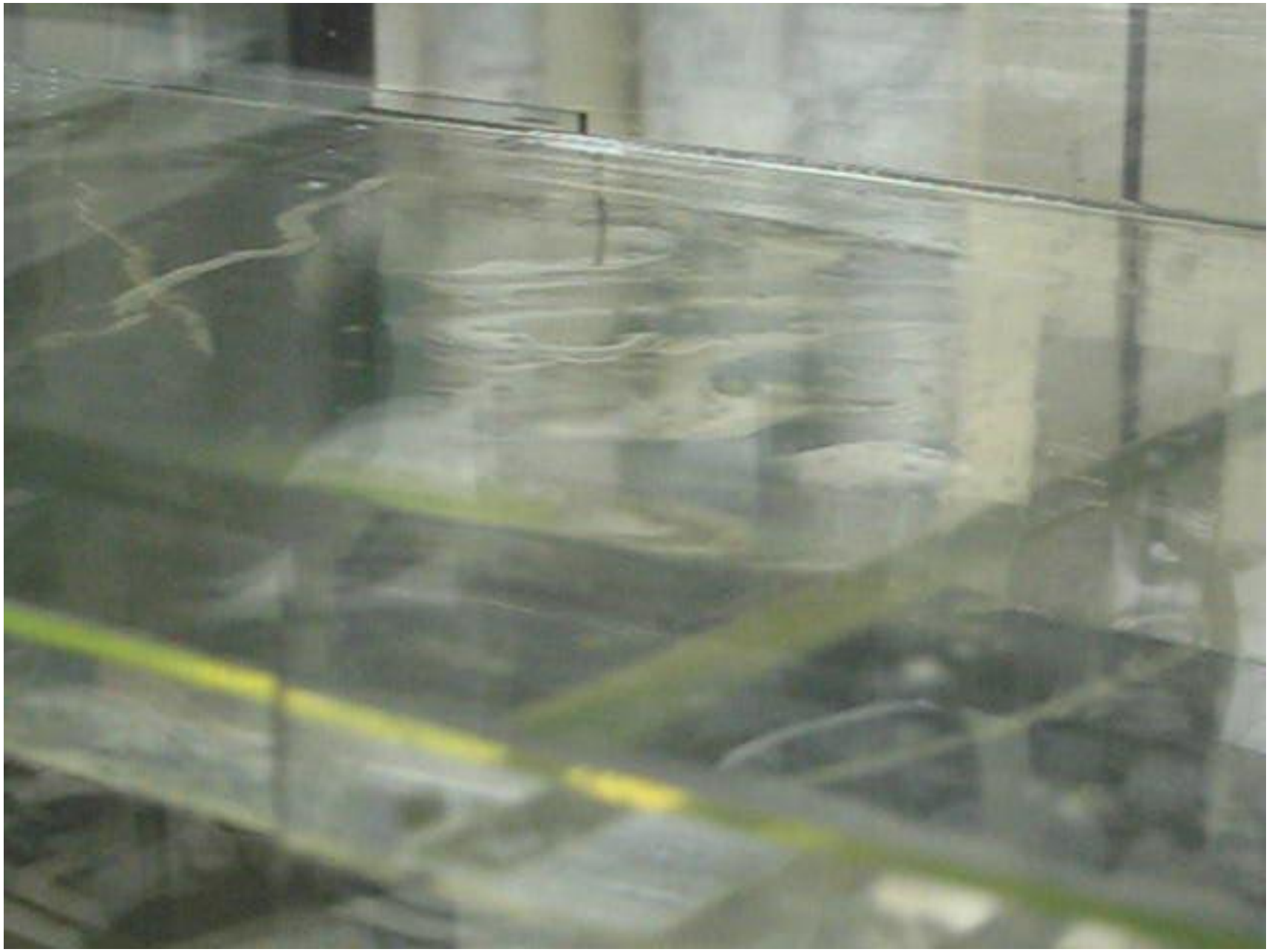
B. THREE

C. FOUR


Type
I
Type
II
Type
III
Type
IV

THERE ARE 4 FLUID TYPES

	Type I	Type II	Type III	Type IV
Main use:	De-ice	Anti-ice	Anti-ice	Anti-ice
Behavior:	Newtonian	Non-Newtonian	Non-Newtonian	Non-Newtonian
Specification:	AMS1424	AMS1428	AMS1428	AMS1428
Aircraft:	Both	Large	Commuter	Large
Icing Protection:	WSET = 3 min	WSET = 30 min	WSET = 25 min	WSET = 80 min
Color:	Orange	Pale straw	Bright yellow	Green



If a pilot finds his aircraft's main gear have frozen to the ground… he can

A. *attempt to taxi forward using thrust*

B. *Wait for warmer weather*

C. *De-ice the Top of the Main Struts*

Business Jets that are deiced with Type I fluids frequently sustain damage to which specific aircraft component ?

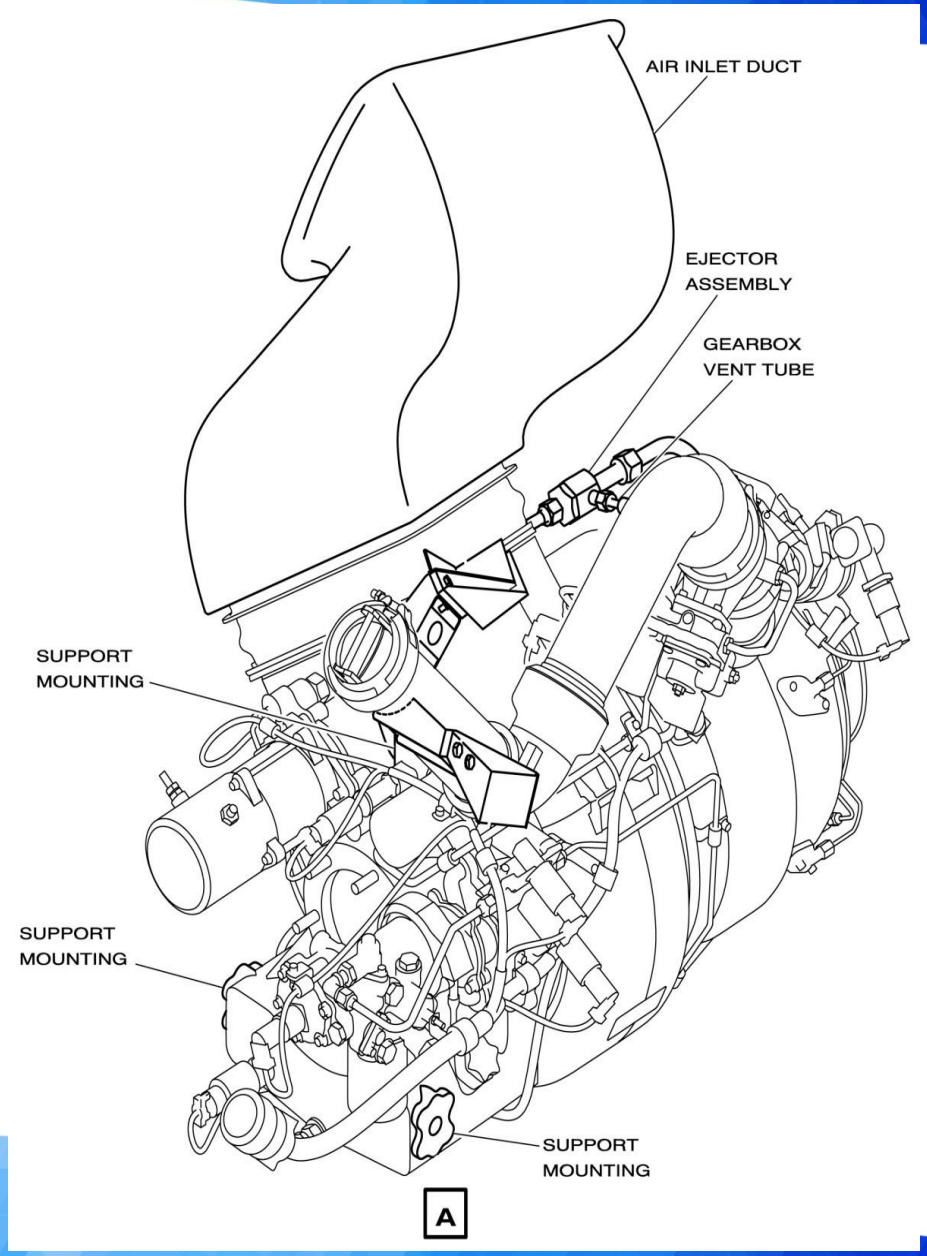
A. *Cockpit windows*

B. *Auxilary Power Unit*

C. *Static Wicks*


DANGER
HOT EXHAUST


DANGER: NO
DE-ICING FLUID
IN THIS AREA


AIR INLET DUCT
EJECTOR
ASSEMBLY
GEARBOX
VENT TUBE
SUPPORT
MOUNTING
SUPPORT
MOUNTING
SUPPORT
MOUNTING
A

A Frost Allowance of 1/8” is permitted for Take-off on which part of most aircraft ?

A. *Fuselage*

B. *Below the Wing*

C. *Vertical Stabilizer*

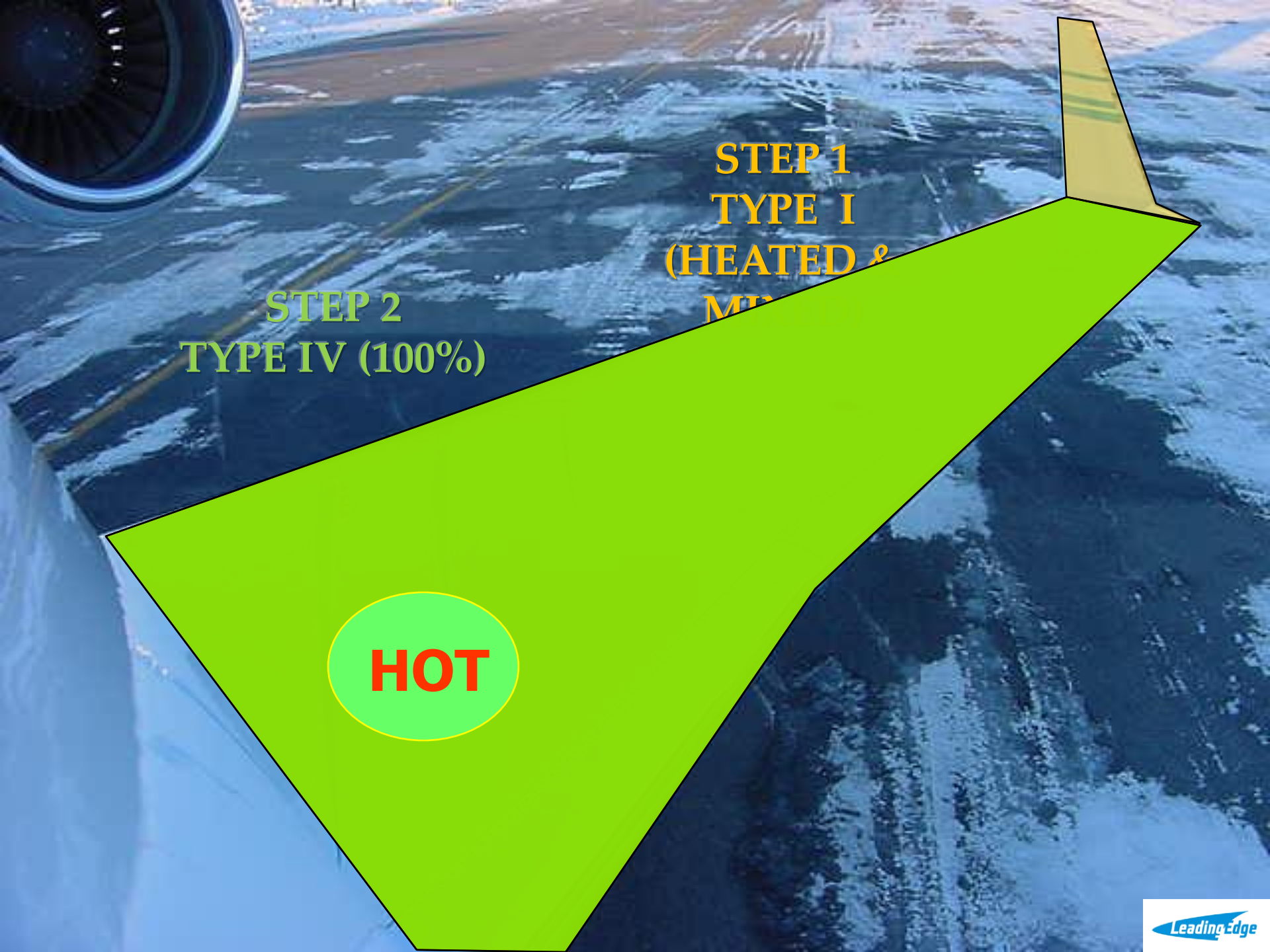

Fuel Frost
3mm or 1/8 inch
5 1:28 PM

When does Holdover Time begin during the De/anti-icing process ?

A. *Start of Type I*

B. *End of Type I*

C. *Start of Final Fluid Application*


STEP 1
TYPE I
(HEATED &
STEP 2
TYPE IV (100%)
HOT

What quantity of Type IV Fluid needs to be applied on business Jets ?

A. 1 Gallon per Square Foot

B. 2-6 Gallons per 100 Square Feet

C. 1 Quart per Square Foot

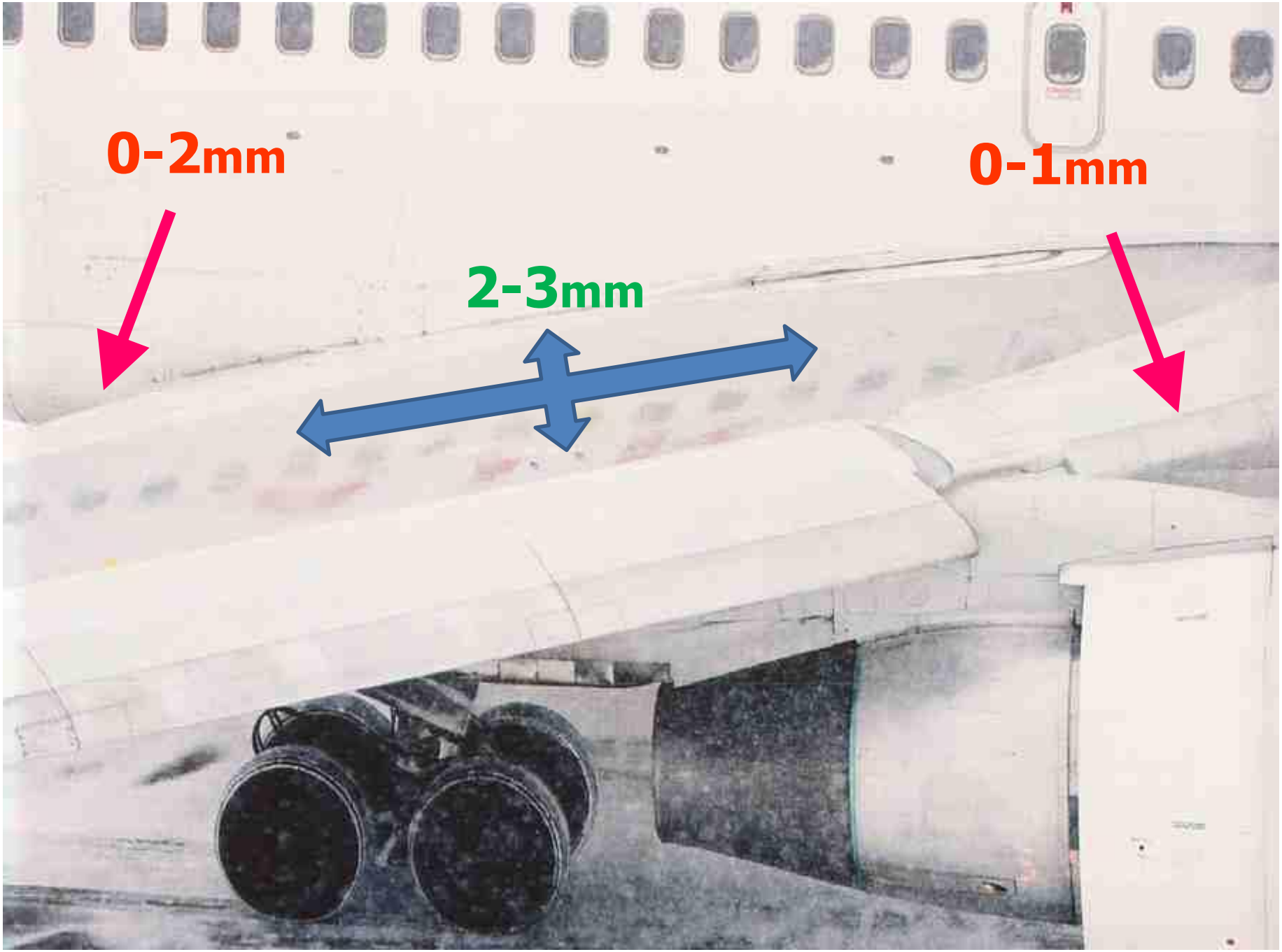
ANTI-ICING FLUID QUANTITY

HOW MUCH FLUID SHOULD BE APPLIED ?

TYPE IV

1-3 mm thick - Over 1 square meter = 1-3 liters

(2 - 6 gals / 100ft²) 3 Gallons = 1.5 mm is being Recommended by Type IV Fluid Manufacturers


0-2mm
0-1mm
2-3mm

ANTI-ICING FLUID QUANTITY

AREA / SQUARE FEET

AIRCRAFT	WING	STAB.	TOTAL GAL.
LEAR 31	269	54	8 - 24
CL-604	452	97	13 - 39
B-737	980	291	31 - 93
MD-80	1,206	215	35 - 105
B-767	3,046	667	91 - 273
B-747	5,651	1,216	168 - 505

What is required during Deicing to establish a Holdover Time ?

A. *Type I at 140 Degrees F min. plus 2 Gallons per 100 Square Feet*

B. *Type I at 100 Degrees F min. only*

C. *Type I at 220 Degrees F max. in sufficient quantities*

HOT FLUID = ENERGY

SAE Type I - Fluid Holdover Guidelines

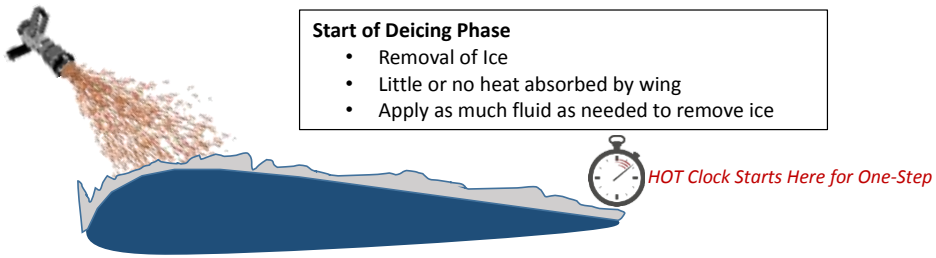
Notes: # 1 (Snow, snow pellets & grains)

TO USE THESE TIMES, THE FLUID MUST BE HEATED TO A MINIMUM TEMPERATURE OF 60 ºC (140 ºF) AT THE NOZZLE AND AT LEAST 1 LITER/M² (= 2 GALS/100FT²)

MUST BE APPLIED TO DEICED SURFACES

Heat Transfer During Type I Deicing and Anti-Icing Phases

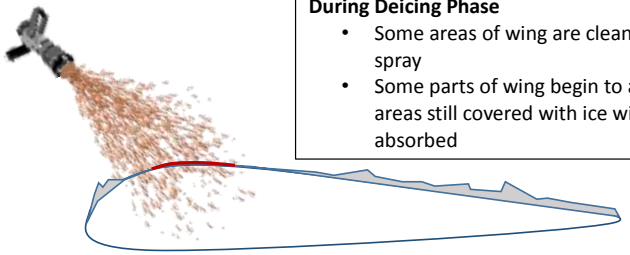
#1



Start of Deicing Phase
- Removal of Ice
- Little or no heat absorbed by wing
- Apply as much fluid as needed to remove ice

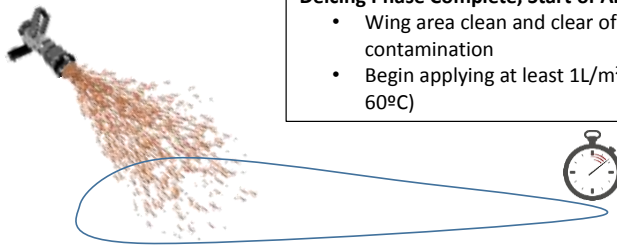
HOT Clock Starts Here for One-Step

#2



During Deicing Phase
- Some areas of wing are clean and exposed to spray
- Some parts of wing begin to absorb heat, other areas still covered with ice with little or no heat absorbed

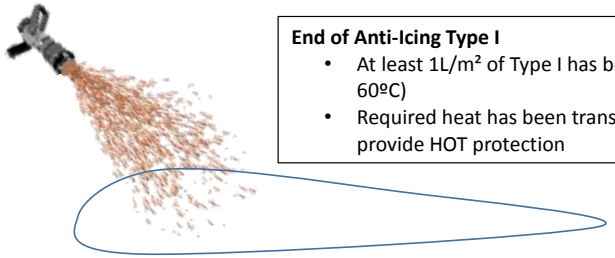
#3



Deicing Phase Complete, Start of Anti-Icing Type I
- Wing area clean and clear of ice or contamination
- Begin applying at least 1L/m² of Type I fluid (min 60ºC)

HOT Clock Starts Here for Two-Step

#4



End of Anti-Icing Type I
- At least 1L/m² of Type I has been applied (min 60ºC)
- Required heat has been transferred to wing to provide HOT protection

What minimum speed must an aircraft exceed on Take-off if it's approved to use Type IV fluid ?

A. 85 KTS

B. 120 KTS

C. 100 KTS

An aircraft using Type IV Fluid must exceed 100 Knots on Take-off.

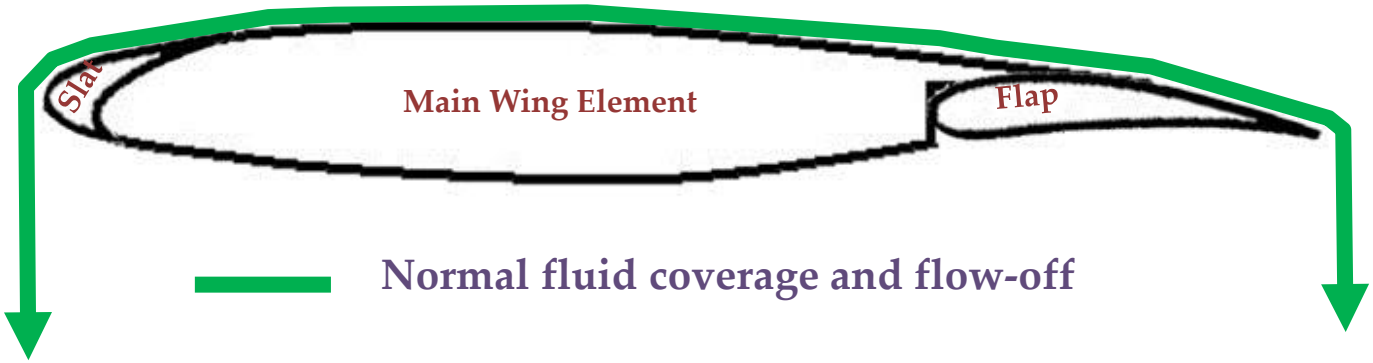
If a Pilot extends the Aircraft's Slats & Flaps prior to deicing… do they have the same Holdover Time ?

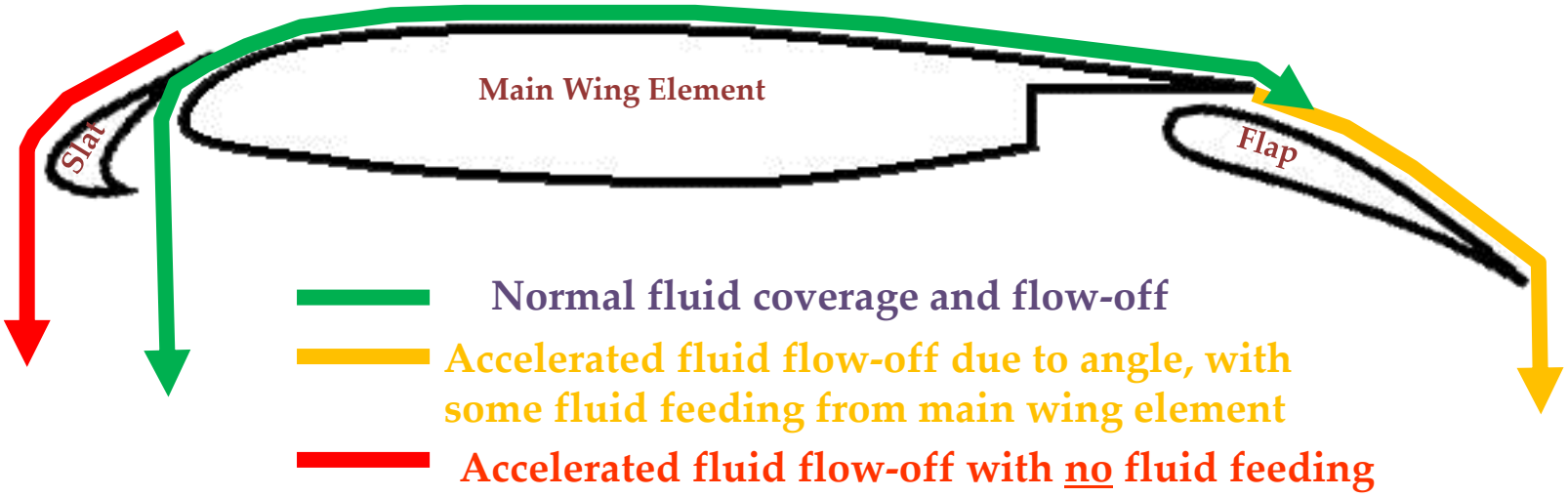
A. Yes

B. Depends on the Aircraft Type

C. No

EARLY FLUID FAILURE BY 24% RETRACTED VS EXTENDED FLAPS AND SLATS





CHANGES TO 2017-18 GUIDANCE MATERIAL

Transport Canada

76% adjusted holdover/allowance times

FEDERAL AVIATION ADMINISTRATION

76% adjusted holdover/allowance times

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING

TABLE 4-90%. FAA 90 PERCENT ADJUSTED HOLDOVER TIME GUIDELINES FOR SAE TYPE IV FLUIDS

Outside Air Temperature[1]		Type IV Fluid Concentration Neat-Fluid/Water (Volume %/Volume %)	Approximate Holdover Times Under Various Weather Conditions (hours: minutes)					
Degrees Celsius	Degrees Fahrenheit		Freezing Fog or Ice Crystals	Snow, Snow Grains or Snow Pellets[2,3]	Freezing Drizzle[4]	Light Freezing Rain	Rain on Cold Soaked Wing[5]	Other[6]
-3 and above	27 and above	100/0	1:39-2:38	0:32-1:03	0:45-1:21	0:32-0:50	0:09-1:08	
		75/25	0:59-1:35	0:27-0:50	0:41-1:03	0:27-0:41	0:08-0:45	
		50/50	0:18-0:32	0:06-0:14	0:14-0:18	0:07-0:09	CAUTION: No holdover time guidelines exist	
below -3 to -14	below 27 to 7	100/0	0:18-1:12	0:23-0:45	0:18-0:54[7]	0:09-0:23[7]		
		75/25[8]	0:23-0:45	0:18-0:36	0:14-0:59[7]	0:09-0:23[7]		
below -14 to -25 or LOUT	below 7 to -13 or LOUT	100/0[9]	0:14-0:36	0:14-0:27				

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

THIS TABLE IS FOR USE WHEN FLAPS/SLATS ARE DEPLOYED PRIOR TO DE/ANTI-ICING

TABLE 1A-76%. 76 PERCENT ADJUSTED HOLDOVER TIME GUIDELINES FOR SAE TYPE I FLUID ON CRITICAL AIRCRAFT SURFACES COMPOSED PREDOMINANTLY OF ALUMINUM

Outside Air Temperature[1,2]		**Wing Surface** Aluminum	**Approximate Holdover Times Under Various Weather Conditions (hours:minutes)**							
Degrees Celsius -3 and above	**Degrees Fahrenheit** 27 and above		**Freezing Fog or Ice Crystals** 0:10-0:15	**Snow, Snow Grains or Snow Pellets[3]**			**Freezing Drizzle[5]** 0:08-0:12	**Light Freezing Rain** 0:02-0:05	**Rain on Cold Soaked Wing[6]** 0:02-0:05	**Other[7]**
				Very Light[4] 0:16-0:20	**Light[4]** 0:10-0:16	**Moderate** 0:05-0:10				
below -3 to -6	below 27 to 21	Aluminum	0:07-0:12	0:13-0:15	0:07-0:13	0:05-0:07	0:05-0:08	0:02-0:05	CAUTION: No holdover time guidelines exist	
below -6 to -10	below 21 to 14	Aluminum	0:05-0:09	0:10-0:12	0:05-0:10	0:04-0:05	0:04-0:06	0:02-0:05		
Below -10	below 14	Aluminum	0:05-0:08	0:06-0:07	0:04-0:06	0:02-0:04				

During Deicing… the average temperature lost as a Type I fluid flows through air is…

A. 10 Degrees F every 3 feet

B. 5 Degrees F every 3 feet

C. 18 Degrees F every 3 feet


Average temperature loss is 10°C or 18ºF every 3 feet that fluid flows through the air.
Basket should be 3 to 5 feet above a/c surface

At what point during a departure in snow must a Pilot conduct an external Pre-takeoff Contamination Check ?

A. *If Minimum Holdover Time is exceeded*

B. *If there are more than 5 aircraft ahead of you for takeoff*

C. *If Maximum Holdover Time is exceeded*

EVALUATION OF THE 5-MINUTE RULE:

PRE-TAKEOFF CONTAMINATION INSPECTION/CHECK

APS Aviation Inc.

ISO 9001:2008

SAE G-12 HOLDOVER TIME COMMITTEE

TERMINOLOGY

TRANSPORT CANADA

Pre Takeoff Contamination Inspection

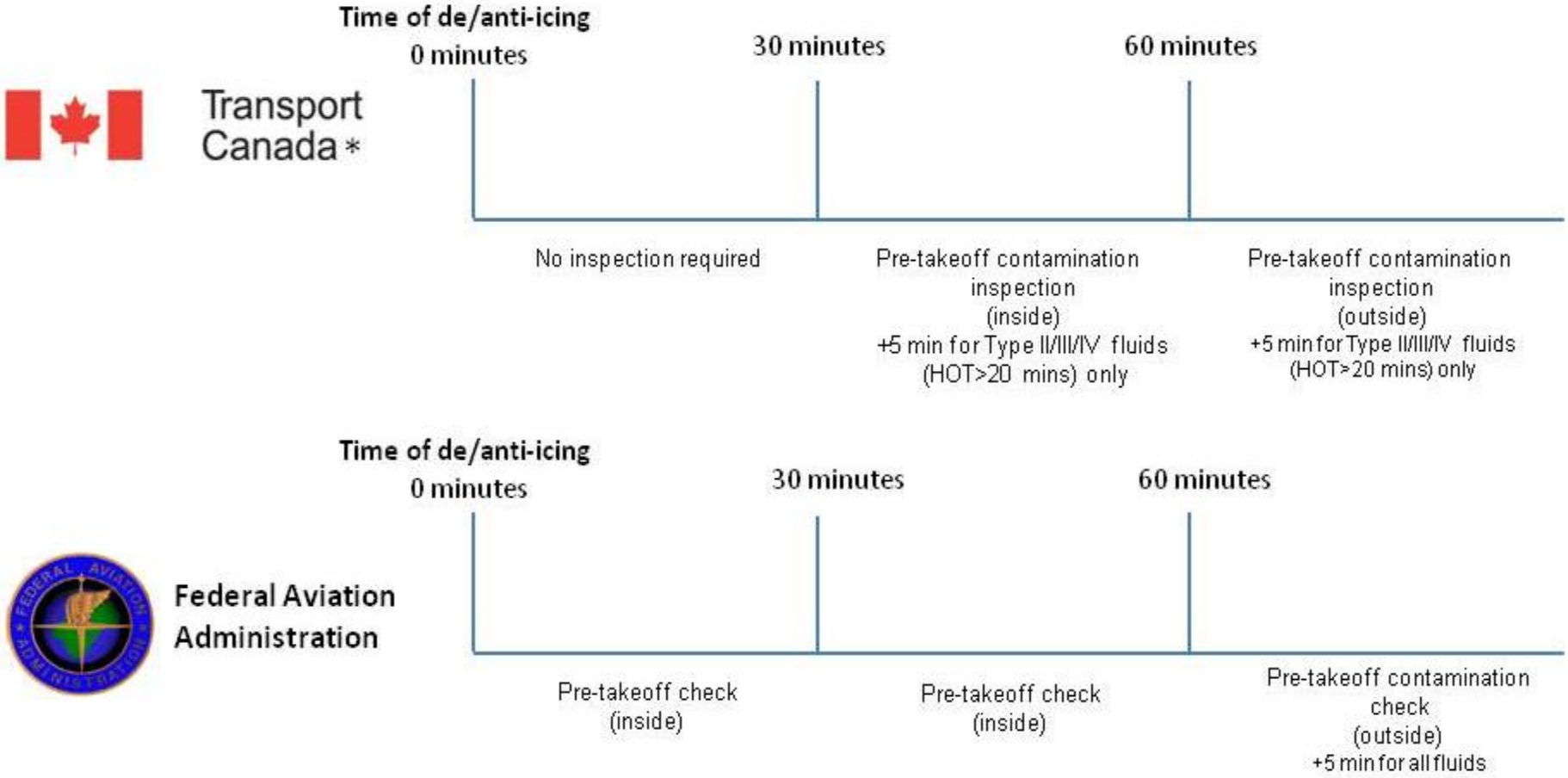
FEDERAL AVIATION ADMINISTRATION

Pre Takeoff Contamination Check

PTCI or **PTCC** is an inspection conducted by a qualified person immediately prior to takeoff to ensure the aircraft is free of frozen contaminants.

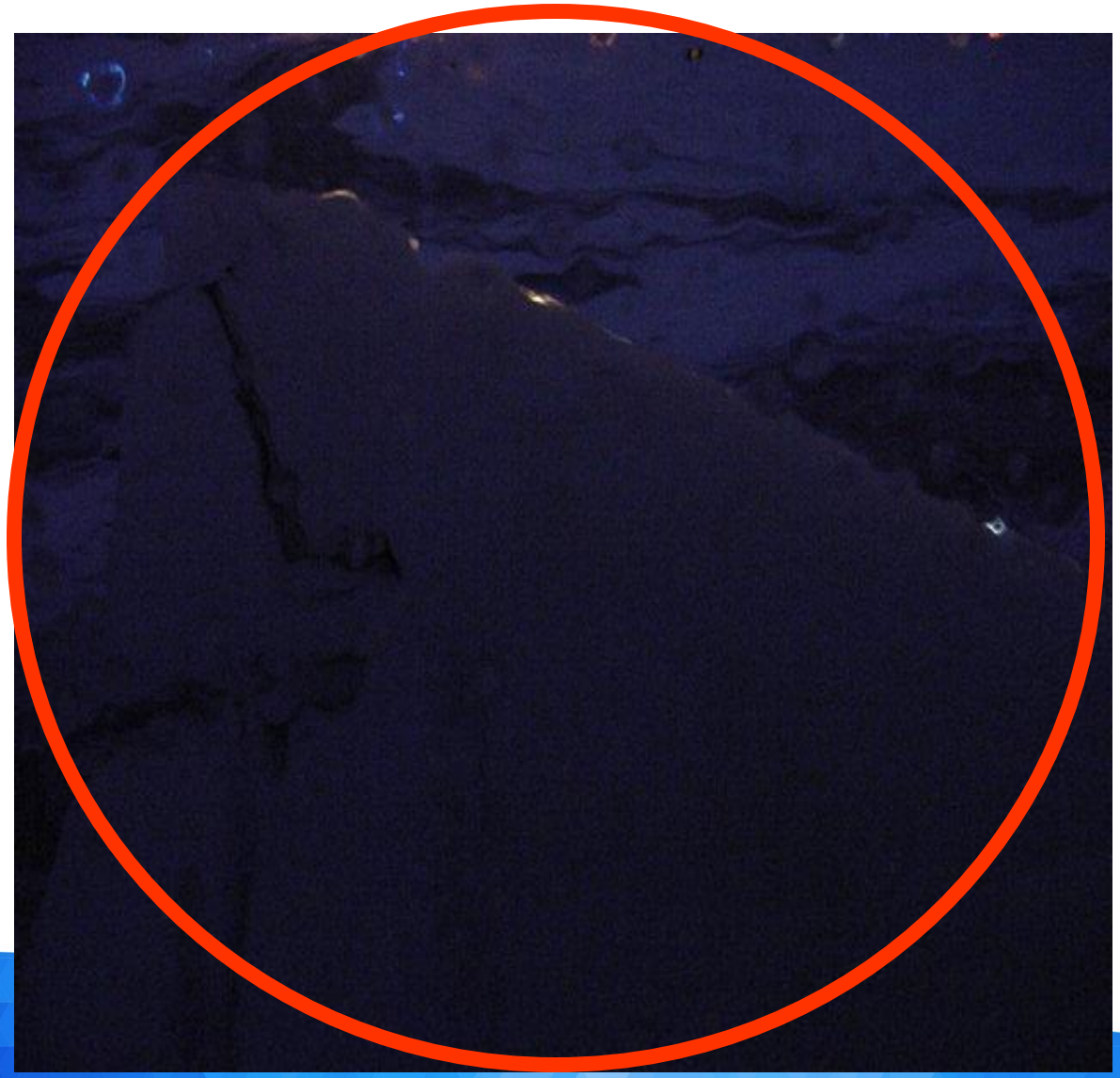
Definition of pre-takeoff contamination inspections/checks

(example with HOT 30 to 60 mins)



* This applies to operators that have established an aircraft inspection program in accordance with the operating and flight rule standards.

Oh, Say Can You See ?



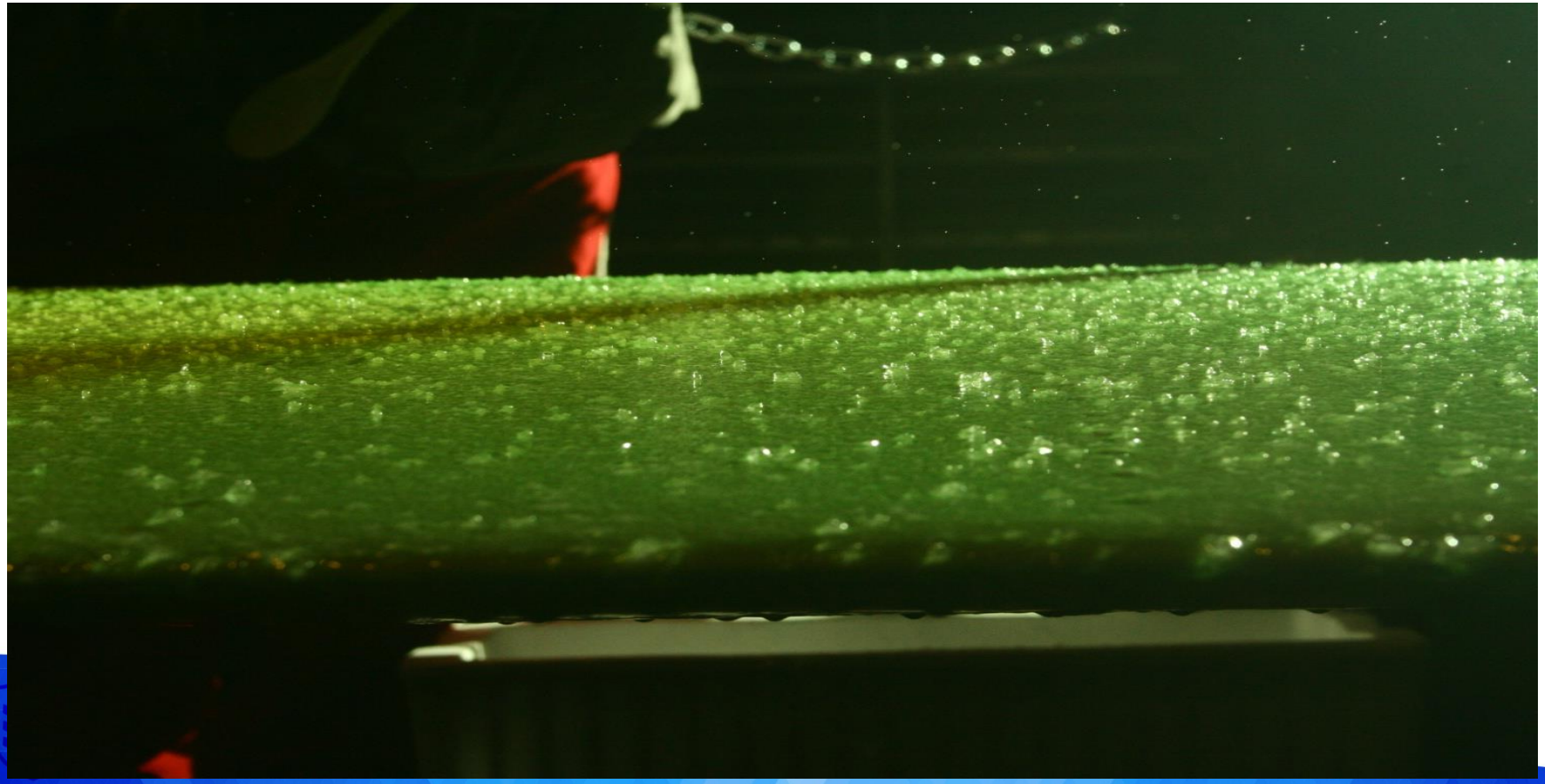
What sign indicates that a Type IV Fluid has lost it's effectiveness on the wing ?

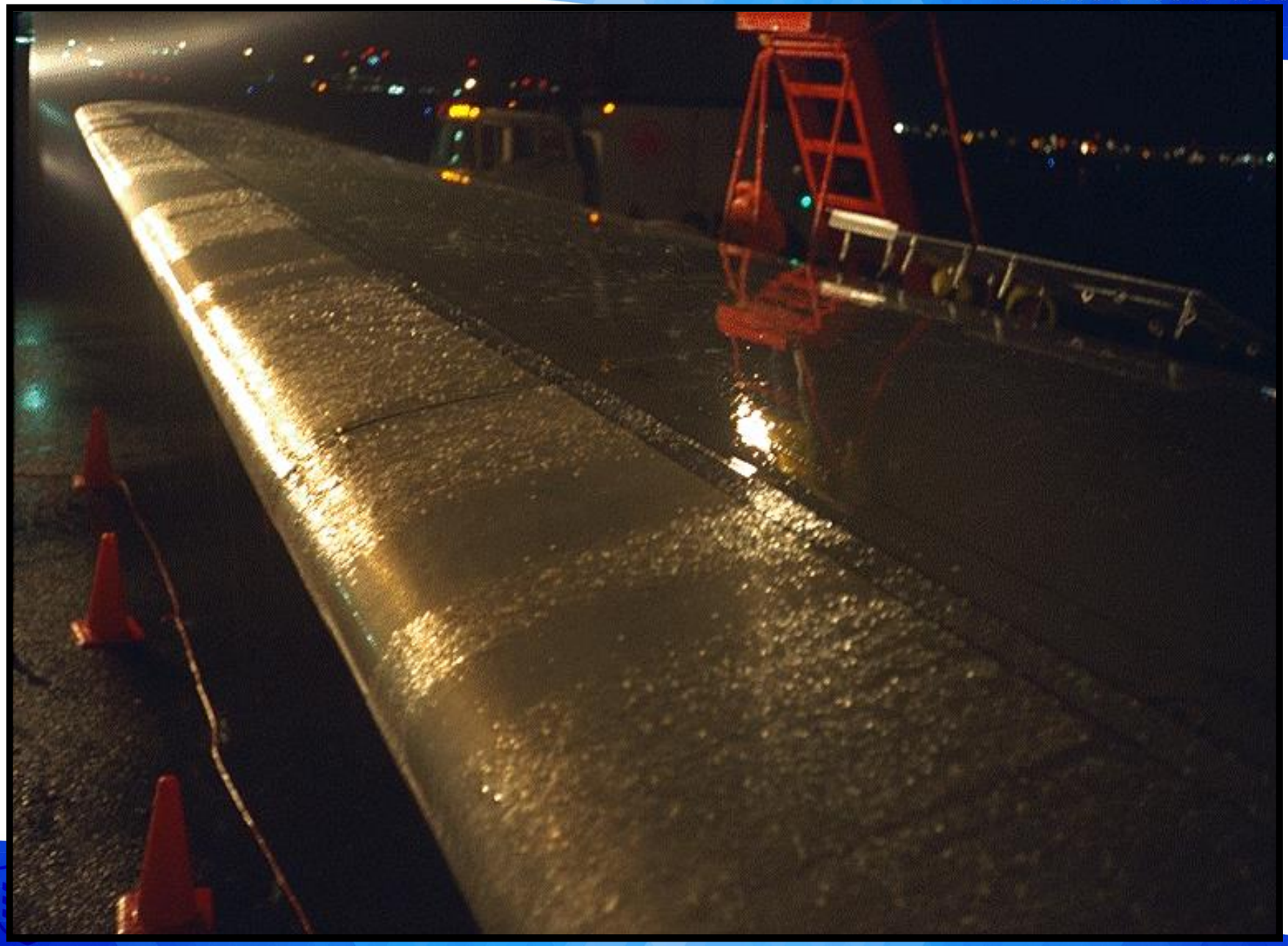
A. *Snow melts on contact with the fluid*

B. *Snow bounces off the wing surface*

C. *Snow does not melt on contact with the fluid*

Signs of Fluid Failure include accumulations of snow or ice on the surface, Loss of gloss and ice crystals suspended in the fluid.





CLOSE UP OF FAILURE ON LEADING EDGE

LOUT is the Lowest Operational Use Temperature of a Fluid… Where can we find the LOUT of Type I, II, III & IV Fluids ?

A. *LOUT can be obtained from the fluid Manufacturer*

B. *LOUT can be found on the Fluid Specific Holdover Time Tables*

C. *LOUT can be found in Table 41 of the FAA's Holdover Time Tables*

What surfaces of Business Aircraft experience significant reductions in Holdover Time when Type IV Anti-icing Fluids are used ?

A. *Top of the Fuselage*

B. *Vertical Stabilizer*

C. *Radome*

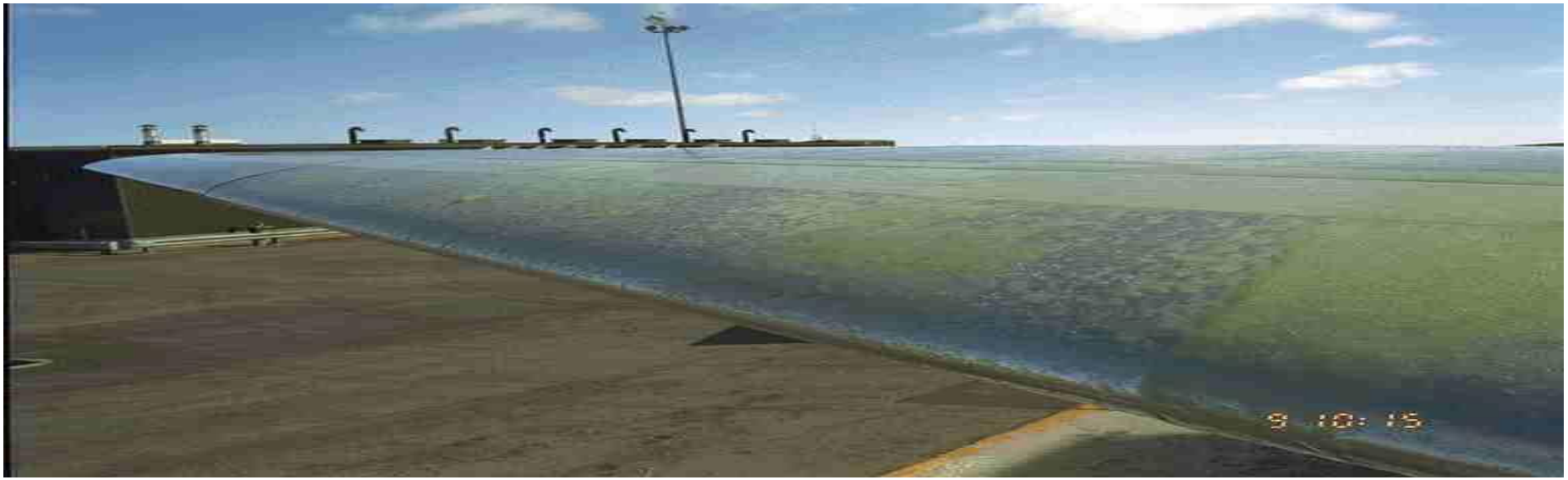
Anti-icing Fluids on vertical surfaces fail faster due to Gravity… usually half the time of a wing !

How frequently should De-icing Service Providers test their equipment to ensure that proper Type IV fluid Viscosity is achieved On-Wing ?

A. *Once every two years Pre-Season*

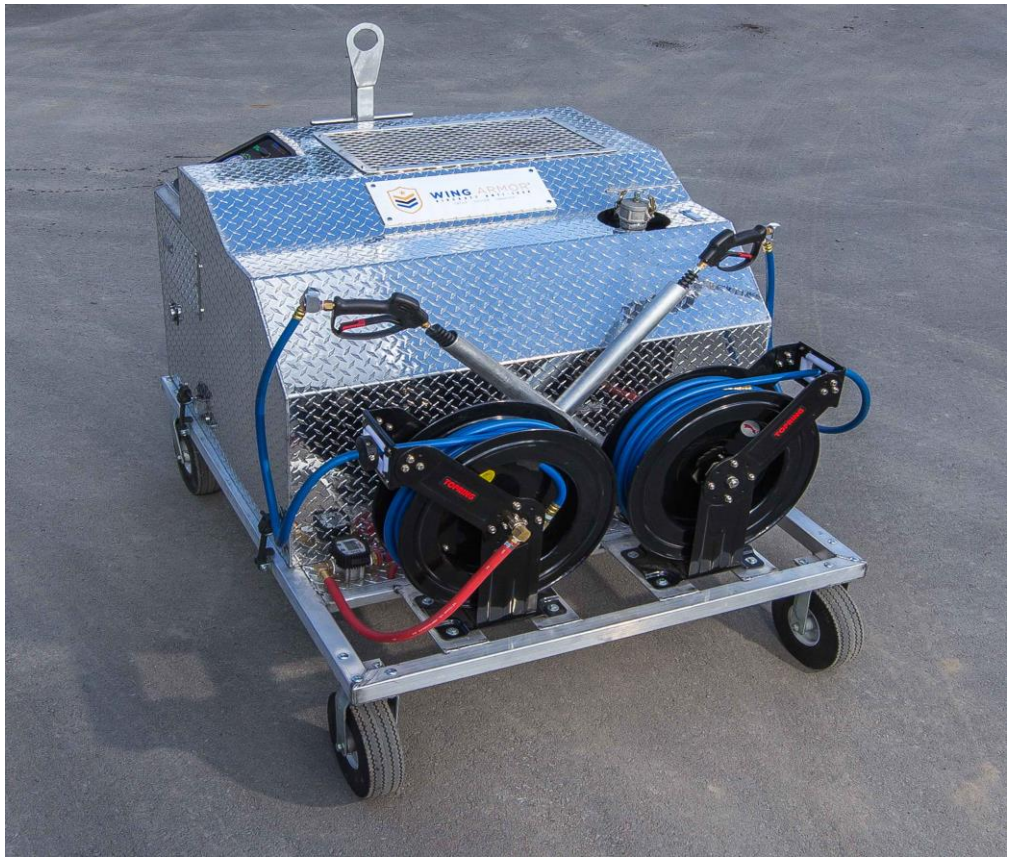
B. *Pre-Season and Mid-Season Viscosity Spray Tests*

C. *Only once a year when they order new fluid*



Anti-icing Fluid Viscosity tests are required Pre-Season and Mid-Season. This procedure will ensure That "Lowest On Wing Viscosity" is being met & provided to aircraft operators that request Type IV Fluids…

APS Aviation Inc.



CQ4357.001

Wing Armor® Anti-Icing System Spray Test Evaluation

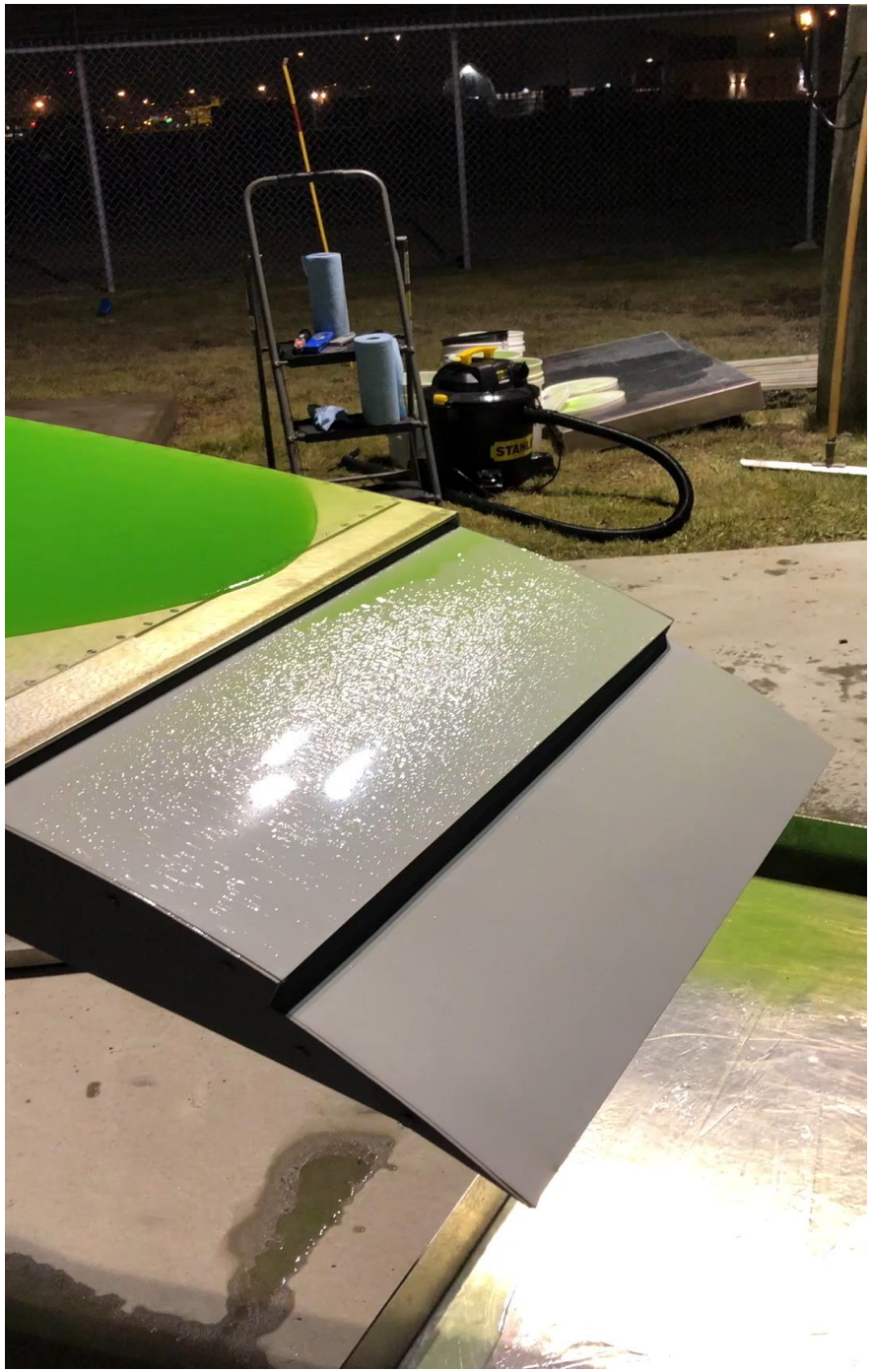
Prepared for:
Leading Edge Deicing Specialists

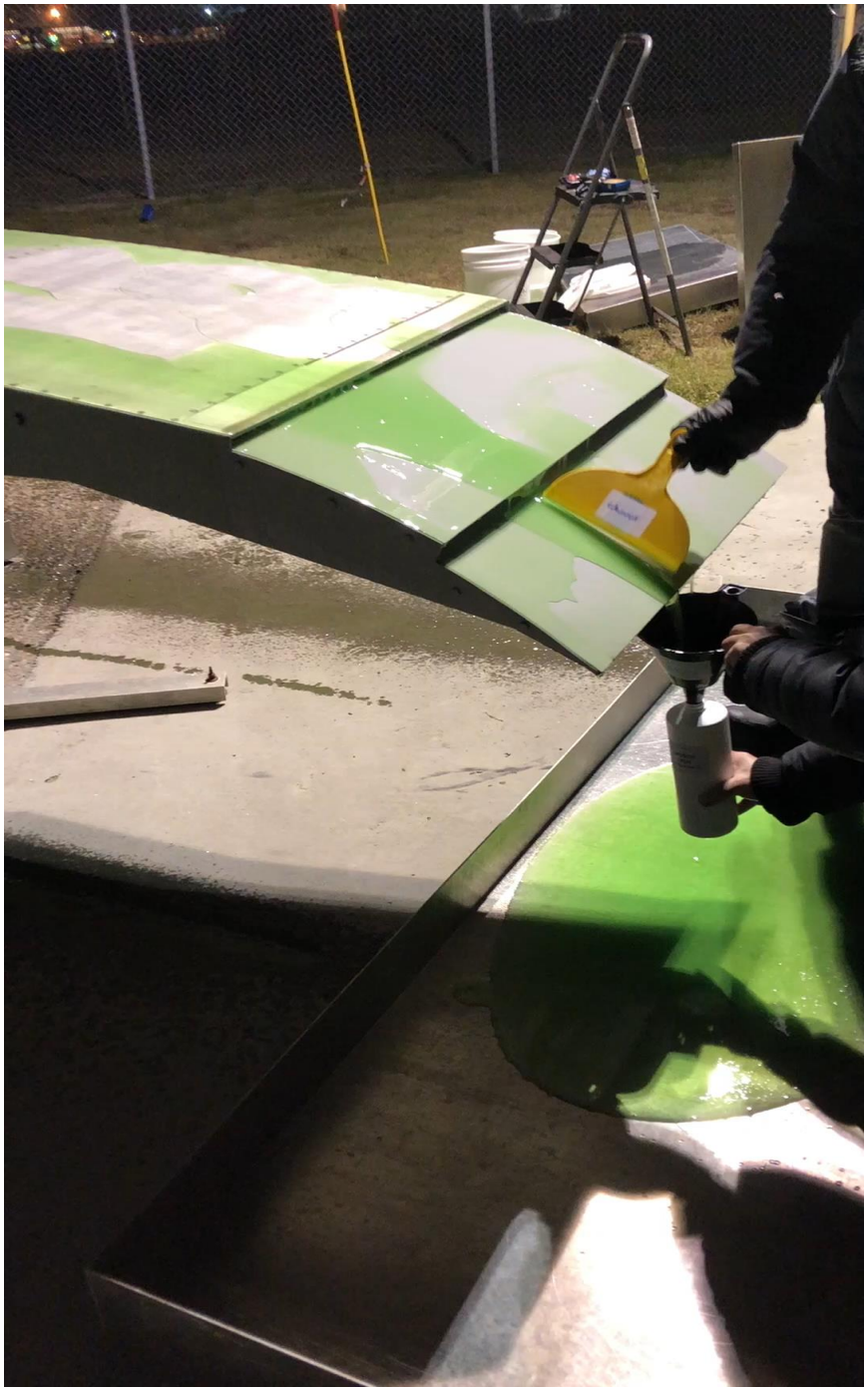
Prepared by:

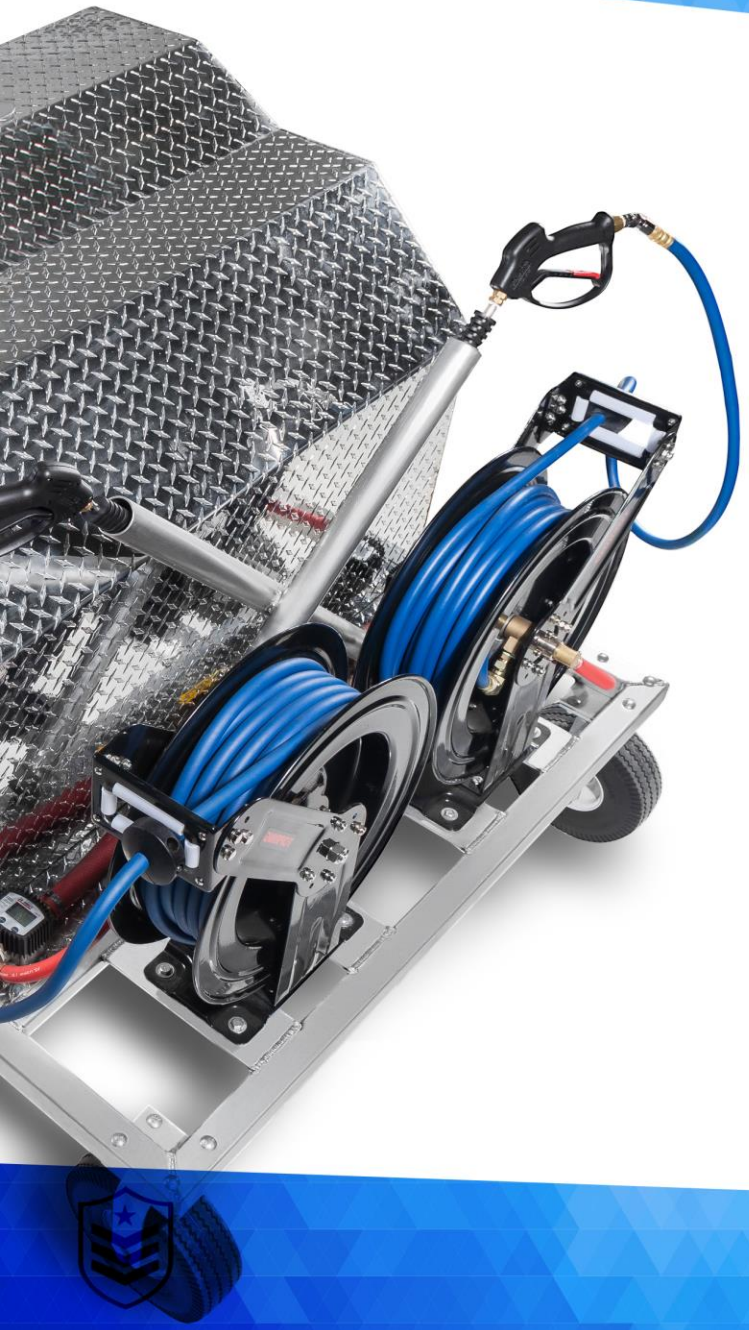
APS Aviation Inc.

December 21, 2017
Final Version 1.0


4 ft (1.2 m)
10 ft (3.1 m)
9 ft (2.7 m)
3.3 ft (1.1m)





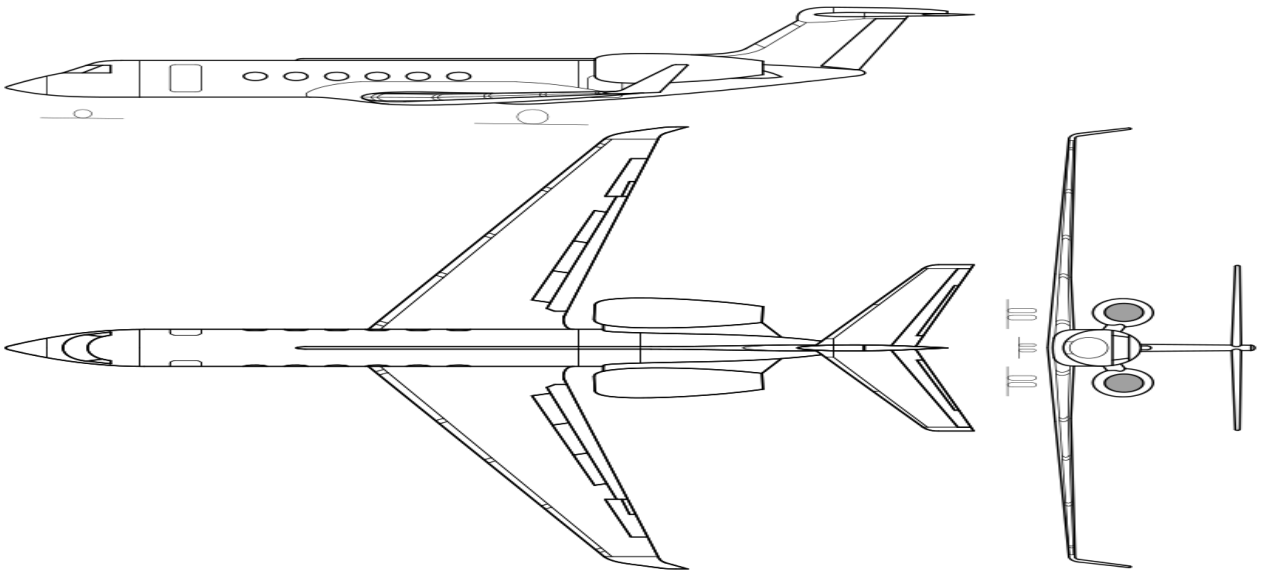


Testing with the WING ARMOR system has shown that it produces minimal shearing effects on the aircraft ground anti-icing fluids

Two on wing samples were taken from two different areas of the airfoil…

For Clariant Launch… there is a net effect of less than 2% of Viscosity Degradation. (Propylene)

For Dow EG106… there is a net effect of less than 1% of Viscosity Degradation. (Ethylene)



WHAT IS THE AVERAGE PRICE TO ANTI-ICE A GULFSTREAM G-550 AIRCRAFT INSIDE A HANGAR ?

AREA of WING: 1,137. sq feet
AREA of STAB: 245. sq feet TOTAL: 1,382. sq feet

Formula to Calculate Anti-Icing Fluid Quantity Required for Holdover Time Protection:
2 to 4 Gal. per 100 sq. feet = 1 to 2 mm of fluid on surface (1.5 mm is Recommended)

1,382 sq. feet Divided by 100 sq. feet = 13.82

13.82 X 3 Gal. (1.5 mm) = 41.46 Gal (Quantity Sufficient to Cover Wings & Stabilizer)

41.46 Gal. X ($10 per Gal Type IV) = $ 414.46 is the Cost to Anti-Ice a Gulfstream G-550.

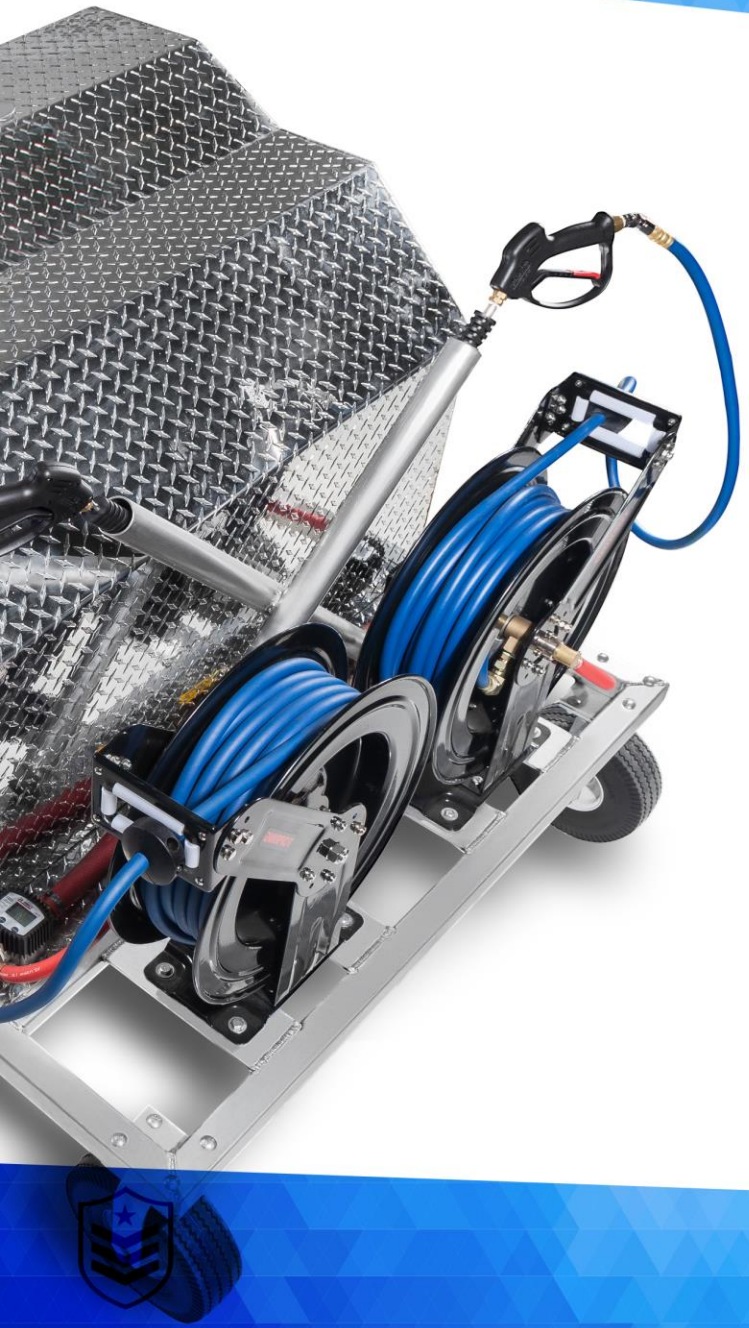
The Average Price to De/Anti-Ice a G-550 at a CDF (Centralized Deicing Facility) or by an FBO costs around $ 10,000 to $ 15,000. Dollars

FOR THE SAME $$$... YOU CAN SPRAY & PROTECT THE SAME G-550... AND FLY IT 36 TIMES !!!

WING ARMOR IS SAFER, FASTER and SMARTER. NOW THAT MAKES SENSE... www.wingarmor.com

Most Deicing Pads at Primary & Secondary Airports utilize "Multiple Truck" operations to enhance "Throughput Times" while de/anti-icing. Medium to Super Large Business Jets can often cost upwards of *$ 10,000.* per de-icing event…

There also can be “Tremendous Overspray” on smaller aircraft and if there’s too long of a delay on the ramp or taxiway, another de-icing might be required…

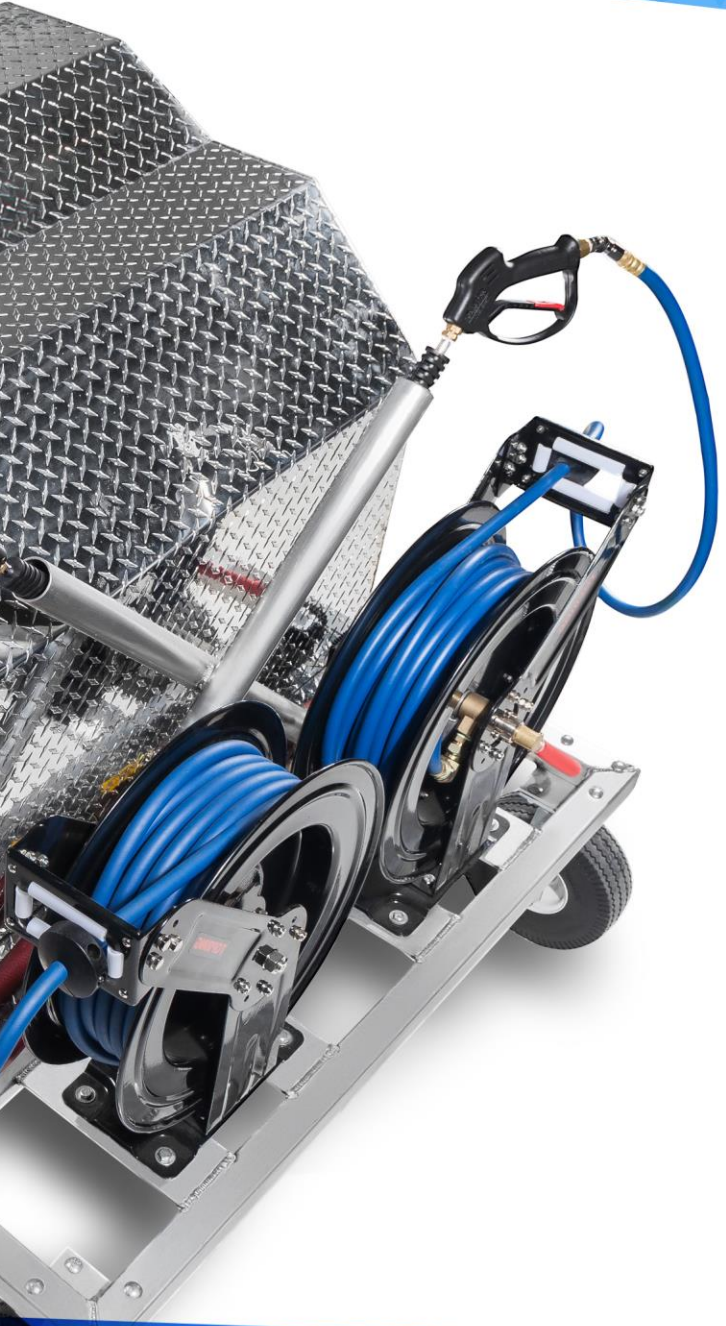


WING ARMOR

A Precision Tool for Business Jet Owners, Corporate Flight Departments & FBO's that require Safe & Effective Aircraft Anti-icing.

WING ARMOR can anti-ice Super Large Business Jets (100 ft. wingspan) rapidly…

increasing the remaining Holdover Time that Pilot's require for safe Take-offs.



SAFER

FASTER

SMARTER

A Solution for Business Aircraft Operators and FBO's that require Safe & Effective Aircraft Anti-icing Equipment and Training !

Call Us Now at

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for a demo!

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