

# SESSION 21: AIRCRAFT SYSTEMS — ANTI-ICING AND DE-ICING SYSTEMS

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1. The fundamental distinction between anti-ice and de-ice systems is that anti-ice systems:

- A. Remove ice only after it accumulates to a set thickness
- B. Operate exclusively on turbine aircraft
- C. Prevent ice from forming, while de-ice systems remove ice after it forms
- D. Function only on the ground before departure

2. Pneumatic de-icing boots remove ice by:

- A. Heating the leading edge electrically
- B. Spraying glycol fluid onto the surface
- C. Vibrating the wing at high frequency
- D. Inflating and deflating to crack and shed accumulated ice

3. Pneumatic de-icing boots should be activated:

- A. Continuously before entering any visible moisture
- B. Only on the ground before departure
- C. Only after landing to clear residual ice
- D. After ice has accumulated to the minimum effective thickness

4. A TKS "weeping wing" system prevents and removes ice by:

- A. Dispensing a glycol-based fluid through porous panels to lower the freezing point

- B. Inflating rubber boots along the leading edge
- C. Routing engine bleed air through the wing structure
- D. Heating the surface with electrical elements

5. Thermal anti-ice systems on many turbine aircraft use:

- A. Hot engine bleed air ducted to the leading edges
- B. Inflatable pneumatic boots
- C. Glycol fluid from a reservoir
- D. High-frequency mechanical vibration

6. Electrically heated elements are most commonly used to anti-ice which components?

- A. The entire wing leading edge
- B. The pitot tube, stall warning vane, and sometimes the windscreen and propeller
- C. The fuel tanks and lines
- D. The landing gear assemblies

7. Pitot heat is classified as an anti-icing device because it:

- A. Removes ice after the pitot tube is already blocked
- B. Prevents ice from forming in the pitot tube
- C. Heats the static ports only
- D. Functions only during the descent phase

8. Pitot heat should be activated:

- A. Only after airspeed indications become erratic

- B. Only when ice is visible on the windscreen
- C. Before entering visible moisture near freezing temperatures
- D. Solely during the takeoff roll

9. "Ice bridging," a concern with older de-icing boots, refers to:

- A. Ice forming a shell over partially inflated boots that the boots can no longer break
- B. Ice forming a bridge between the wings
- C. Two aircraft sharing the same icing layer
- D. Ice spanning the gap between the pitot tube and static port

10. A "FIKI" certification means the aircraft is:

- A. Limited to flight in freezing fog only
- B. Equipped with pitot heat alone
- C. Prohibited from all flight in visible moisture
- D. Approved for Flight Into Known Icing conditions

11. A non-FIKI aircraft that encounters icing in flight should treat the situation as:

- A. An emergency requiring immediate escape from the icing environment
- B. A routine condition requiring no special action
- C. Acceptable as long as pitot heat is on
- D. Manageable indefinitely if airspeed is increased

12. Even a FIKI-certified aircraft has icing limits because:

- A. Its systems work only above 18,000 feet

- B. Certification covers only ground operations
- C. Certification is for defined icing conditions, not unlimited exposure or freezing rain/SLD
- D. FIKI systems must be activated only after landing

13. Propeller anti-ice or de-ice is important because ice on the propeller:

- A. Improves thrust by adding mass
- B. Degrades thrust efficiency and can cause dangerous imbalance and vibration
- C. Has no effect on engine performance
- D. Affects only the spinner cosmetically

14. Windscreen anti-ice or defrost is operationally important because:

- A. It prevents fuel from freezing
- B. Loss of forward visibility through an iced windscreen is hazardous, especially for landing
- C. It powers the navigation lights
- D. It is required only for night VFR

15. A heated stall-warning vane or transducer is an anti-ice provision that ensures:

- A. The landing gear extends in icing
- B. The autopilot remains engaged
- C. The stall warning system continues to function when ice could otherwise disable it
- D. The transponder transmits correctly

16. Activating de-icing boots too early, before sufficient ice accumulates, historically risked:

- A. Draining the battery completely

- B. Overheating the leading edge
- C. Damaging the windscreen
- D. Ice bridging over the boots, reducing their effectiveness

17. Anti-ice systems are generally activated:

- A. After ice has already accumulated on the surfaces
- B. Only during the descent and approach
- C. Only when the autopilot is engaged
- D. Before entering icing conditions, to prevent ice from forming

18. The "known icing" condition that triggers regulatory and operational concern exists when:

- A. The temperature is above 10°C with clear skies
- B. Visible moisture is present at temperatures at or below freezing
- C. The aircraft is parked overnight in a hangar
- D. Winds aloft exceed 50 knots

19. A pilot of a FIKI aircraft encountering freezing rain (supercooled large droplets) should recognize that:

- A. The conditions may exceed the certified protection and warrant immediate escape
- B. FIKI certification guarantees safe flight in all freezing rain
- C. The boots alone will fully protect the aircraft indefinitely
- D. Freezing rain is less hazardous than freezing drizzle

20. Glycol-based weeping wing systems have a limitation in that they:

- A. Operate only above the freezing level

- B. Require engine bleed air to function
- C. Add significant weight that affects the CG
- D. Have a finite fluid supply that can be exhausted in prolonged icing

21. The correct mental model for a non-FIKI aircraft and icing is:

- A. Any icing is an emergency demanding prompt exit from the conditions
- B. Light icing is acceptable for the duration of the flight
- C. Icing is manageable with pitot heat and reduced power
- D. Icing only matters during the approach phase

22. Carburetor heat, while related to icing, addresses:

- A. Structural ice on the wing leading edges
- B. Ice on the propeller blades
- C. Induction/carburetor icing that restricts the air-fuel charge to the engine
- D. Ice on the pitot tube

23. A complete anti-ice/de-ice preflight assessment for an icing-capable aircraft confirms:

- A. Only that pitot heat operates
- B. That all installed ice protection systems are operative and adequate fluid/pressure is available
- C. That the windscreen is clean
- D. That the autopilot is engaged

24. The decision to use ice protection systems should be integrated with:

- A. The weight and balance computation only

- B. The transponder code assignment
- C. The overall icing avoidance and escape strategy, not relied upon as a license to remain in icing
- D. The fuel price at the destination

25. The fundamental principle governing all ice protection systems is that they:

- A. Eliminate the need to plan around icing
- B. Permit unlimited flight in any icing condition
- C. Replace the pilot's responsibility to avoid hazardous icing
- D. Are aids to escape or transit icing, not a substitute for avoiding hazardous icing conditions

## **ANSWER KEY & EXPLANATIONS – SESSION 21**

1. C. Prevent vs. remove — Anti-ice systems prevent ice from forming, while de-ice systems remove ice after it forms.
2. D. Inflate/deflate — Pneumatic de-icing boots inflate and deflate to crack and shed accumulated ice.
3. D. After min thickness — Boots are activated after ice accumulates to the minimum effective thickness.
4. A. Glycol through panels — TKS weeping wing systems dispense glycol-based fluid through porous panels to lower the freezing point.
5. A. Bleed air — Thermal anti-ice on many turbine aircraft uses hot engine bleed air ducted to the leading edges.

6. B. Pitot/vane/windscreen/prop — Electrically heated elements commonly anti-ice the pitot tube, stall warning vane, and sometimes the windscreen and propeller.

7. B. Prevents pitot ice — Pitot heat is an anti-icing device because it prevents ice from forming in the pitot tube.

8. C. Before visible moisture near freezing — Pitot heat should be activated before entering visible moisture near freezing temperatures.

9. A. Ice shell over boots — Ice bridging is ice forming a shell over partially inflated boots that the boots can no longer break.

10. D. Flight Into Known Icing — FIKI certification means the aircraft is approved for Flight Into Known Icing conditions.

11. A. Emergency escape — A non-FIKI aircraft encountering icing must treat it as an emergency requiring immediate escape.

12. C. Defined conditions only — Even FIKI aircraft have limits because certification is for defined icing conditions, not unlimited exposure or freezing rain/SLD.

13. B. Thrust loss/imbalance — Propeller ice degrades thrust efficiency and can cause dangerous imbalance and vibration.

14. B. Forward visibility — Windscreen anti-ice/defrost matters because an iced windscreen impairs forward visibility, especially for landing.

15. C. Stall warning function — A heated stall-warning vane ensures the stall warning system continues to function when ice could otherwise disable it.

16. D. Ice bridging — Activating boots too early historically risked ice bridging over the boots, reducing effectiveness.

17. D. Before icing — Anti-ice systems are activated before entering icing conditions to prevent ice from forming.

18. B. Visible moisture  $\leq$  freezing — Known icing exists when visible moisture is present at temperatures at or below freezing.

19. A. May exceed protection — Freezing rain (SLD) may exceed a FIKI aircraft's certified protection and warrants immediate escape.

20. D. Finite fluid — Glycol weeping wing systems have a finite fluid supply that can be exhausted in prolonged icing.

21. A. Any icing = emergency — For a non-FIKI aircraft, any icing is an emergency demanding prompt exit from the conditions.

22. C. Induction icing — Carburetor heat addresses induction/carburetor icing that restricts the air-fuel charge to the engine.

23. B. Systems operative/fluid available — A complete assessment confirms all installed ice protection systems are operative and adequate fluid/pressure is available.

24. C. Part of avoidance strategy — Ice protection use is integrated with the overall avoidance and escape strategy, not relied on as a license to remain in icing.

25. D. Aids, not substitute — Ice protection systems are aids to escape or transit icing, not a substitute for avoiding hazardous icing conditions.