CHALLENGER 350

BD-100-1A10

ICE AND RAIN

STUDY GUIDE · CARD SYSTEM

A flashcard-style reference for the CL350 ATA 30 Ice and Rain Protection system. Covers ice detection, wing and engine anti-ice, air data probe heating, windshield protection, bleed leak detection, and all EICAS messages — grounded in the REVISED source.

ATA 30 · ICE AND RAIN PROTECTION

Section ICE · Revision: Original

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ICE RAIN CONTENTS

01 FIVE THINGS YOU MUST KNOW

The five highest-value facts for the oral. Memorize numbers cold.

2	Bleed leak detection zones for EICAS presentation; 4 are ice-related (a subset)
8 zones	High-pressure valve limit — bleed pressure to wing anti-ice
36 ±3 psi	Pressure threshold that triggers L/R WING A/I PRESS HI caution
46 psi	Maximum APU RPM limit
3 sections	Windshield heater element segments per windshield

TIP Five baseline facts: detectors, protected zones, anti-ice pressures, and windshield segments. The cards that follow drill every subsystem in detail.

02 ICE DETECTION SYSTEM · STUDY CARDS

ICE DETECTOR BASICS

How many detectors and where are they?

- Two detectors — one per fuselage side
- Mounted above nose landing gear doors
- Powered by 28 VDC

DETECTION PRINCIPLE

How does a vibrating-probe detector work?

- Probe vibrates at high frequency
- Ice accumulation lowers vibration frequency
- Internal heater de-ices; cycle repeats

REDUNDANCY RULE

How many detectors needed to trigger a CAS message?

- Only ONE detector signal needed
- Second detector provides redundancy
- Both failed → **ICE DETECTOR FAIL** (C)

ICE DETECTED — TWO VERSIONS

What distinguishes the (C) from the (A)?

- (C) Caution — anti-ice systems NOT yet active
- (A) Advisory — anti-ice systems already on
- Amber ICE icon on PFD when (C) active

DETECTOR TEST

How is the ice detector test performed?

- Select ICE DET on SYSTEMS TEST panel
- Push test switch — electronics and heaters checked
- Successful pass: **ICE DETECTED** (C) caution illuminates and ICE icon appears on PFD (NOT "PROBE
- HEAT TEST OK" — that is the separate PROBES test result)

03 WING ANTI-ICE SYSTEM · STUDY CARDS

HEAT SOURCE

What heats the wing leading edges?

- High-pressure engine bleed air
- Hot air enters via piccolo tubes
- Air exhausted through vent holes on wing underside

NORMAL CONFIGURATION

Which engine heats which wing in NORM?

- Left engine heats left wing
- Right engine heats right wing
- WING SOURCE rotary switch at NORM

CROSS-FEED MODES

What do FROM L and FROM R do?

- FROM L — left engine supplies both wings
- FROM R — right engine supplies both wings
- Crossbleed valve opens; opposite HPV closes

IASC ROLE

What do the Integrated Air System Controllers do?

- Two dual-channel IASCs control wing anti-ice
- Regulate bleed air to maintain correct leading-edge temps
- Also manage bleed leak detection

WING ANTI-ICE VALVES

What position are valves spring-loaded to?

- Spring-loaded CLOSED
- Close on loss of power, bleed pressure, or duct failure
- Also close when FROM L or FROM R selected

TEMPERATURE SENSORS

How many sensors per wing?

- Dual sensors in outboard section of each wing
- Dual sensors in inboard section of each wing
- Inboard modulates valves; outboard monitors temp

04 BLEED LEAK DETECTION · STUDY CARDS

SYSTEM PURPOSE

Why does the bleed leak detection system exist?

- Detect hot air leaks from bleed/ anti-ice ducts
- Protect structure from overheating
- Prevent fire hazards

DETECTION ZONES

How many zones and what are the key ones?

- 8 zones total for EICAS presentation; 4 zones are icerelated (a subset)
- L/R pylon ducts — dual sensing loops
- L/R wing anti-ice ducts — dual sensing loops

LOOP TYPES

Single vs dual sensing loops — what's the difference?

- Single loops: main bleed and trim air ducts
- Dual loops: engine pylons and wing leading edges
- Dual loops reduce false indications; allow MEL dispatch

DOWNSTREAM LEAK RESPONSE

What happens when a downstream wing duct leak is detected?

- **WING ANTI-ICE LEAK** (W) warning posted
- IASC automatically closes wing anti-ice valves
- **L (R) WING ANTI-ICE FAIL** (C) follows isolation

PYLON LEAK RESPONSE

What happens when a pylon bleed leak is detected?

- **L (R) PYLON BLEED LEAK** (W) warning posted
- 1. Autothrottle — DISENGAGE
- 2. Affected thrust lever — IDLE
- 3. If warning stays on: affected engine RUN switch — OFF
- 4. Perform Engine Shutdown In Flight procedure
- Note: NO bleed-isolation step — bleed supply stops only as a consequence of engine shutdown

LEAK DETECTION — ZONE SUMMARY

- 8 zones total for EICAS presentation; 4 zones are ice-related (a subset)
- Pylon zones (×2): dual loops from powerplant to IPV/HPV
- Wing anti-ice zones (×2): dual loops downstream of HPV
- Also: L/R bleed ducts, pack ducts, trim air ducts
- Dual loops → fewer false warnings + MEL dispatch under one failed loop

05 ENGINE ANTI-ICE SYSTEM · STUDY CARDS

HEAT SOURCE

What anti-ices the engine nacelle inlets?

- Engine bleed air — same principle as wing
- L and R systems controlled independently
- L (R) ENG switches on ANTI-ICE panel

NACELLE ANTI-ICE VALVES

Where are the nacelle valves and how do they fail?

- Located on top of each engine, downstream of HP duct
- Electrically operated, pneumatically controlled
- Fail-safe OPEN (nacelle stays protected on failure)

AIR FLOW PATH

How does hot bleed air flow through the nacelle?

- Bleed air → nacelle anti-ice valve → piccolo tube
- Sprayed on inner surface of nacelle leading edge
- Discharged overboard via exhaust duct at nacelle bottom

T2 SENSOR

What does the T2 sensor do?

- Installed in inlet housing of each engine
- Senses engine inlet total air temperature (TAT)
- In-control ECU uses TAT data for power control

ENGINE SPINNER

How is the engine spinner protected from ice?

- Two-piece aluminum forging, conical shape
- Conical shape sheds ice naturally
- No anti-icing heating required

06 AIR DATA PROBE HEATING · STUDY CARDS

PROBE HEAT ACTIVATION

What components are heated when PROBES switch is ON?

- L/R pitot-static probes and standby pitot
- L/R standby static ports and L/R AOA vanes
- TAT probe (flight only)

PITOT STATIC MASTS

How many masts and how many heaters per mast?

- Two pitot-static masts — one per aircraft side
- Each mast has head and mounting base
- Two heaters per mast (head + base)

STANDBY PROBES

Where are the standby pitot and static ports?

- Standby pitot probe — left side of aircraft nose
- One standby static port on each aircraft side
- Activated by PROBES switch

AOA VANES

Where are AOA vanes located?

- One per aircraft side, under side windows
- Positioned behind pitot tubes
- Heated when PROBES switch selected ON

TAT PROBE

Where is the TAT probe and when does it heat?

- One TAT sensor on right side of aircraft
- TAT heater operates IN FLIGHT ONLY
- Provides OAT/TAT data to avionics

07 WINDSHIELD AND WINDOW PROTECTION · STUDY CARDS

SYSTEM SCOPE

Which surfaces are electrically heated?

- Two windshields and two side windows
- Embedded heater elements and temperature sensor elements
- · Rain-resistant coating also applied

WINDSHIELD HEATER DESIGN

How are windshield heaters segmented?

- Three heater sections per windshield
- Heating concentrated in critical visibility area
- Side windows — unsegmented single heater element

TEMPERATURE CONTROL

How is windshield temperature regulated?

- One temperature controller per windshield/window
- Monitors resistance of embedded temperature sensor
- Cycles power on/off to maintain target temperature

SLD INDICATION

What can windshield icing indicate beyond normal icing?

- Side window ice accretion can indicate SLD conditions
- Super-cooled large droplet icing (SLD)
- Exit icing conditions if SLD suspected

OVERHEAT PROTECTION

What happens on windshield overheat?

- Overheat protection circuits remove power
- L (R) WSHLD/WINDOW switch OFF de-energizes surface
- ·Temperature controller can be reset after cooldown

CONTROL SWITCHES

Which switches control windshield and window heating?

- L WSHLD/WINDOW — left windshield and window
- R WSHLD/WINDOW — right windshield and window
- Both switches on ANTI-ICE panel, center pedestal

08 CONTROLS AND INDICATIONS · STUDY CARDS

ANTI-ICE PANEL LOCATION

Where is the anti-ice control panel?

- Center pedestal
- Houses all anti-ice system controls
- WING, ENG, PROBES, and WSHLD/WINDOW switches

WING SWITCH

What does the WING push button switch do?

- Activates wing leading-edge bleed air anti-ice
- Works in conjunction with WING SOURCE rotary switch
- IASC then modulates valves automatically
- AUTO SYNC OFF — confirm AUTO SYNC is OFF during operation

ANTI-ICE SYNOPTIC PAGE

What does the anti-ice synoptic display show?

- Pneumatically operated anti-icing system status
- Ice detection system status and faults
- Visual confirmation of valve positions

WING OVERHEAT PROCEDURE

What is the response to L/R WING OVERHEAT?

- (1) WING ANTI-ICE — OFF
- (2) WING SOURCE — FROM R (or FROM L, alternate source)
- (3) AUTO SYNC — OFF
- (4) WING ANTI-ICE — ON (sensor on source side modulates flow)

ANTI-ICE PANEL — SWITCH SUMMARY

- WING pb — wing leading-edge bleed anti-ice ON/OFF
- WING SOURCE rotary — NORM / FROM L / FROM R
- L ENG / R ENG pb — independent nacelle anti-ice
- L PROBES / R PROBES — pitot, static, AOA, TAT probe heat
- L WSHLD/WINDOW / R WSHLD/WINDOW — windshield and side window heat

09 EICAS · WARNING MESSAGES

WARNING MESSAGES

Immediate crew action required

Message	Meaning	Inhibits
L (R) PYLON BLEED LEAK	Hot air leak detected in engine pylon bleed duct — autothrottle off, affected thrust lever idle; if warning persists, affected engine RUN switch OFF and Engine Shutdown In Flight	**TO/LAND**
L (R) WING OVERHEAT	Wing leading-edge overheat detected — shut off wing anti-ice, select alternate source	**—**
WING ANTI-ICE LEAK	Bleed leak detected in wing anti-ice system.	**TO/LAND**

10 EICAS · CAUTION & ADVISORY

CAUTION MESSAGES

Timely crew awareness/action needed

Message	Meaning	Inhibits
ICE DETECTED	Ice detected and anti-ice systems NOT active — activate wing and engine anti-ice	**TO/LAND**
ICE DETECTOR FAIL	Both ice detectors have failed — redundancy lost, use visual cues	**TO/LAND**
L (R) PITOT HEAT FAIL	The respective pilot mast or base heater has failed	**TO/LAND**
L (R) WING ANTI-ICE FAIL	Wing anti-ice valve isolated after downstream duct leak — system unavailable	**TO/LAND**
L (R) WING A/I PRESS HI	Wing anti-ice bleed pressure exceeded 46 psi — highpressure valve failure	**TO/LAND**

ADVISORY MESSAGES

Crew awareness - no immediate action required

Message	Meaning	Inhibits
ICE DETECTED	Ice detected and anti-ice systems ARE already active — monitor conditions	**TO/LAND**
ICE DETECTOR FAULT	One ice detector has failed — remaining detector still operational	**TO/LAND**

11 EICAS · STATUS

STATUS MESSAGES

Information only - no crew action required

Message	Meaning	Inhibits
PROBE HEAT TEST OK	Air data probe heat test (PROBES test) completed successfully — separate from ICE DET test	—

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QUICK RECALL · NUMBERS GRID

Cover the labels and recite the number; reverse and recite the label. Repeat until automatic.

2 Ice detectors installed	**28 VDC** Ice detector power supply	**8 zones** Bleed leak zones (EICAS); 4 are ice-related	**Dual loops** Pylon & wing anti-ice zones
36 ±3 psi HPV bleed pressure limit	**46 psi** PRESS HI caution threshold	**3 sections** Windshield heater segments	**Fail-open** Nacelle anti-ice valve fail mode
Fail-closed Wing anti-ice valve fail mode	**FROM L/R** Cross-feed wing source modes	**2 heaters** Per pitot-static mast	**Flight only** TAT probe heater operation
1 Standby pitot probe (left side)	**2** Standby static ports (one per side)	**IASC ×2** Dual-channel controllers (wing AI)	**SLD** Side window ice → exit conditions

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