



CHALLENGER 350

BD-100-1A10

POWERPLANT

STUDY GUIDE · CARD SYSTEM

A card-system reference for the CL350 Honeywell HTF7350 powerplant. Each page covers one focused topic — engine construction, FADEC, starting, indications, reversers, oil, fuel, and limitations.

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POWERPLANT CONTENTS

01	Five Things You Must Know	2-4
02	Engine Specifications	2-5
03	Engine Construction	2-5
04	Fadec	2-6
05	Starting & Ignition	2-7
06	Engine Indications	2-8
07	Oil System	2-9
08	Thrust Reversers	2-10
09	EICAS — Warning Messages	2-11
10	EICAS — Caution + Advisory	2-11
11	EICAS — Status	2-12
12	Quick Recall — Numbers Grid	2-13
13	Limitations Summary	2-14

01

FIVE THINGS YOU MUST KNOW

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

HTF7350

Honeywell turbofan — model designation (AS907-2-1A)

7,372 lb

Takeoff thrust — each engine

4.2 : 1

Bypass ratio

ISA +15°C

Flat-rated to — APR provides flat-rated thrust to ISA +20°C

Dual-channel
FADEC

Full authority digital engine control — each engine independent

TIP Five baseline facts about the powerplant: model name, thrust, bypass ratio, flat-rating limit, and FADEC architecture. The cards drill each system in detail.



02

ENGINE SPECIFICATIONS · STUDY CARDS

Core data for the Honeywell HTF7350 (AS907-2-1A) installed in the CL350.

ENGINE MODEL	TAKEOFF THRUST	BYPASS RATIO
Full designation? - Honeywell HTF7350 - Military designation: AS907-2-1A - High-bypass turbofan, FAR Part 33 certified	Pounds of thrust per engine at takeoff? 7,372 lb thrust at takeoff power settings - Each engine independently rated - Aft fuselage pylon-mounted	Airflow split at the fan? 4.2 : 1 bypass ratio (per CL350 FCOM; the older AS907-1-1A used 4.3) - Fan air bypasses core — majority of cruise thrust - Bypass and core exhaust mix at mixer nozzle
FLAT RATING	INSTALLATION	ENGINE WEIGHT
Temperature flat-rating limit? - Engine flat-rated to ISA +15°C; APR provides flat-rated thrust to ISA +20°C (APR only) - Full flat-rated thrust maintained to these temperature limits at sea level - Certification: FAR Part 36 Stage 4 noise	Where and how mounted? - Two engines on aft fuselage pylon structures - Accessory gearbox (AGB) on bottom of engine - AGB driven by N2 shaft via tower shaft / bevel gears	Dry weight of HTF7350? 1,364 lb dry weight - Two-spool, direct drive turbofan engine — N1 (LP) and N2 (HP) are separate independent spools - Dual ignition exciters per engine

03

ENGINE CONSTRUCTION · STUDY CARDS

Two independent shaft assemblies operating concentrically — N1 (low pressure) and N2 (high pressure).

N1 SECTION (LP)	N2 SECTION (HP)	COMBUSTOR
Components of the low-pressure spool? - Single-stage wide-chord fan — 22 titanium blades - Three-stage low-pressure turbine - Direct drive configuration	Components of the high-pressure spool? - Four-stage axial + single-stage centrifugal compressor - Two stages of variable geometry (VG) inlet guide vanes - Two-stage HP turbine · accessory gearbox	Combustion section details? - Through-flow annular combustor 16 fuel nozzles arranged circumferentially 2 igniter plugs at 5 and 7 o'clock positions
FAN CONTAINMENT	VARIABLE GEOMETRY	AGB COMPONENTS
Fan blade containment material? - Aluminum honeycomb containment ring - Aramid fiber wrap for blade containment 22 wide-chord titanium blades	What does the VG system control? - VG axial compressor driven by HP turbine - Controls inlet guide vanes and first-stage stator vanes - FADEC coordinates VG and fuel flow	What is driven by the accessory gearbox? - EDP 1 or 2 (hydraulic) · DC generator · fuel pump/FMU - Air turbine starter · integral oil reservoir - PMA (FADEC power) · engine lubrication pumps

FADEC · STUDY CARDS

Full Authority Digital Engine Control — dual-channel, independent per engine.

FADEC ARCHITECTURE

How many channels? How do they operate?

- Dual-channel per engine — one in control, one standby
- Channels alternate control on successive starts
- Cross-channel data sharing via crosstalk bus

FADEC POWER

Power sources for FADEC?

- Aircraft 28 VDC — during start and N2 <45%
- PMA (permanent magnet alternator) — primary at N2>45%
- PMA mounted on AGB — three-phase output to each ECU

PRIMARY CONTROL

What does FADEC control directly?

- Fuel flow scheduling via FMU
- Variable geometry compressor guide vanes (CGVs)
- Bleed valve control · ignition control

OVERSPEED PROT.

How does FADEC handle N1/N2 overspeed?

- N1 overspeed: automatic fuel flow reduction
- N2 overspeed: fuel flow reduction + engine shutdown if exceeded
- Both FADEC channels respond independently on N1 overspeed

THRUST MGMT

Automatic thrust functions of FADEC?

- Computes N1 target (TO/CLB/CRZ) and displays bug on gauge
- Automatic Power Reserve (APR) on engine failure
- N1/N2 sync · thrust reverser operation

N1 LOCK POINT

When are N1 calculations locked during takeoff?

- Locked at 65 kt on the takeoff roll
- Unlocked above 400 ft AGL or thrust lever retarded from TO
- Continuously updated for Mach, delta temp, pressure alt

FADEC — PROTECTION SUMMARY

- N1/N2 Overspeed — automatic fuel flow reduction; N2 shutdown if exceeded
- ITT Limiting — FADEC modulates fuel flow to stay within ITT limits
- Compressor Stall — VG + surge bleed valve + both igniters
- Flameout — auto-relight: both igniters on sub-idle ITT drop or N2 decel
- Thrust lever at stick-shaker AOA → FADEC energizes both ignition channels



05

STARTING & IGNITION - STUDY CARDS

Air turbine starter (ATS) converts pneumatic energy to mechanical rotation through the AGB.

AIR SOURCES

What can supply starting air?

- APU bleed air (normal start source)
- Ground cart high-pressure air
- Cross-bleed from operating engine

START VALVE

When does the start valve open?

- Opens at pneumatic pressure >32 psi
- ENGINE RUN → RUN, STARTER → START (hold 1 sec)
- FADEC initiates start sequence automatically

STARTER CUTOUT

When does the starter disengage?

- Automatic at 46.2% N2
- Start valve closes - ATS disengages ignition terminates
- N2 idle varies with altitude/temp — approx 46%

IGNITION — GROUND

How many igniters on a ground start?

- Single igniter — FADEC alternates each start
- Start limit: ITT red triangle at 650°C during start
- Both igniters used on air starts

IGNITION — AUTO

When does FADEC auto-energize igniters?

- Air starts — both igniters
- Compressor stall protection at stick-shaker AOA — both
- Flameout detected — both igniters until recovery

THERMAL BOW

Restart window requiring dry motor?

- Risk: 15–180 minutes after shutdown
- Dry motor to 19%–23% N2 (target 21% ±2%) or 15 seconds, whichever comes first
- Start 3–40 min after dry motor; repeat if window exceeded

STARTER FAIL ON — CAUTION

- If start valve fails to close after achieving 50% N2: **L (R) STARTER FAIL ON** (C) CAS
- IGNITION switch NORM → automatic (single ground / both air)
- IGNITION switch ON → continuous ignition on both igniters

ENGINE INDICATIONS · STUDY CARDS

Primary and secondary engine parameters displayed on the EICAS/MFD engine synoptic.

N1 — FAN SPEED

Display format and significance?

- Primary thrust indicator — displayed as %
- FADEC computes and displays N1 target bug
- Thrust mode annunciations: APR · TO · CLB · CRZ · REV

N2 — CORE SPEED

Display and color coding?

- Digital readout only (no analog arc)
- Green: normal ($\leq 100\%$) · Yellow/Red: exceedance
- 5-second flash on exceedance

ITT

Scale and key limits?

- Expanded scale 600–1050°C
- Start limit red triangle: 650°C (ground) / 800°C (in flight)
- 950°C continuous · 955°C transient (T/O, Reverse, APR)

OIL PRESSURE

Normal range and warning threshold?

- Digital readout in psi
- L (R) ENG OIL PRESS LOW warning <28 psi
- L (R) ENG OIL PRESS HIGH caution (excessively high)

OIL TEMPERATURE

Limit and caution?

- Digital readout in °C
- L (R) ENG OIL TEMP HIGH caution >138°C
- Do not operate above idle N2 until oil temp exceeds 5°C

VIBRATION

Fan vibration monitoring?

- Continuous fan vibration monitoring
- L (R) ENGINE VIBRATION caution when limit exceeded
- Amber VIB icon retained on affected engine; the icon and L (R) ENGINE VIBRATION caution return on subsequent landings/shutdowns until the engine ECU or aircraft is powered down/up to clear



07

OIL SYSTEM - STUDY CARDS

Integral tank system — lubrication and cooling for all bearings, gears, and splines.

OIL CAPACITY

Total and FULL mark?

- Approx 8 quarts (7.6 liters) total capacity
- FULL mark at 5.7 quarts
- Service if more than 1 quart below FULL

NO-DISPATCH BAND

When is dispatch not allowed?

- NO DISPATCH band: 1.6 quarts below FULL
- Remote Oil Level Sensor (ROLS) transmits data to refuel panel
- Check oil level 5–30 minutes after shutdown

OIL CIRCULATION

Supply path components?

- Engine-driven pump → oil filter (65 psi bypass) → chip detector
- Fuel/oil heat exchanger cools oil / warms fuel
- Distributed to bearings and AGB

SCAVENGE PATH

Return path?

- Two scavenge pumps return oil to integral tank
- Chip detector monitors for metal contamination
- Air/oil separator vents tank

OIL MONITORING

Redundant pressure monitoring?

- Pressure switch AND separate pressure transmitter
- Switch → **L (R) ENG OIL PRESS LOW** (W) warning
- Transmitter → **L (R) ENG OIL PRESS HIGH** (C) caution

OIL TEMP LIMIT

When is idle-only required?

- Do not exceed idle N2 until oil temp >5°C
- L (R) ENG OIL TEMP HIGH caution >138°C
- Engine fuel temperature is indicated on the FUEL synoptic page. Engine oil temperature is annunciated via the **L (R) ENG OIL TEMP HIGH** (C) caution message.

08

THRUST REVERSERS · STUDY CARDS

Hydraulically operated pivot-door reversers — ground use only, multiple safety interlocks.

SYSTEM TYPE**What type of reverser and actuation?**

- Hydraulically operated pivot-door thrust reverser
- Ground use only — cannot deploy in flight
- Multiple safety interlocks prevent in-flight deployment

DEPLOYMENT**Sequence to deploy reversers?**

- Thrust levers to IDLE · lift reverser levers
- Move thrust levers aft to REV detent
- White REV icon (transit) → Green REV icon (deployed)

STOWING**Sequence to stow reversers?**

- Return thrust levers to IDLE
- Reverser levers automatically lower
- White REV icon during transit → icon extinguishes when stowed

SAFETY INTERLOCKS**What prevents inadvertent deployment?**

- WOW OR wheel spin-up signal (OR logic, not AND) is sufficient to release the two tertiary locks. The solenoid valve is controlled from thrust lever microswitches, WOW, and wheel spin-up signals.
- Primary locks (hydraulic + electro-hydraulic) + tertiary locks
- FADEC limits thrust to idle if unsafe condition detected

FADEC & REVERSERS**FADEC role in reverser operation?**

- FADEC interface — coordinates reverser + engine thrust
- Limits max N1 as aircraft slows (controllability protection)
- Interlock balks control thrust lever movement when unsafe

REV PROHIBITION**Speed restriction for reverse thrust?**

- Reverse thrust above idle prohibited below 40 KIAS
- Takeoff power time limit: 5 minutes
- Deploy/stow icons: WHITE = in transit · GREEN = deployed



09 EICAS · WARNING MESSAGES

WARNING MESSAGES

Immediate crew action required

Message	Meaning	Aural Alert
L (R) ENG OIL PRESS LOW	Low oil pressure detected by pressure switch — Warning level — TO/LAND inhibit	TO/LAND

10 EICAS · CAUTION & ADVISORY

CAUTION MESSAGES

Timely crew awareness/action needed

Message	Meaning	Inhibits
L (R) ENG OIL PRESS HIGH	Excessively high engine oil pressure	TO/LAND
L (R) ENG OIL TEMP HIGH	Engine oil temperature exceeds limit (>138°C)	TO/LAND
L (R) STARTER FAIL ON	Start valve failed to close after achieving 50% N2 — TO/LAND inhibit	TO/LAND
L (R) ENGINE VIBRATION	Fan vibration monitoring limit exceeded — amber VIB icon displayed — TO/LAND inhibit	TO/LAND
ENGINES FUEL BYPASS	Both engine fuel filters (10-micron) in bypass mode — TO/LAND inhibit	TO/LAND
L (R) ENGINE FLAMEOUT	Engine flameout detected — auto-relight initiated — no inhibit	—

ADVISORY MESSAGES

Crew awareness - no immediate action required

Message	Meaning	Inhibits
L (R) ENGINE OIL CHIP	Chip detector — metal contamination detected in engine oil	TO/LAND
L (R) ENGINE OIL BYPASS	Imminent bypass of the oil filter	TO/LAND
L (R) ENGINE FUEL BYPASS	One engine fuel filter (10-micron) in bypass mode	TO/LAND

11 EICAS - STATUS

STATUS MESSAGES

Information only - no crew action required

Message	Meaning	
AUTO APR OFF	Automatic Power Reserve system disabled	—



12

QUICK RECALL · NUMBERS GRID

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

7,372 lb Takeoff thrust	4.2 : 1 Bypass ratio	ISA +15°C Flat rating (APR: +20°C)	22 Fan blades (titanium)
16 Fuel nozzles	2 Igniters per engine	46.2% N2 Starter cutout	>45% N2 PMA powers FADEC
650°C ITT Ground start limit	800°C ITT Air start limit	950°C ITT Continuous limit	955°C ITT Transient (T/O/APR)
<28 psi Oil press LOW warn	>138°C Oil temp HIGH caut	8 qt Oil capacity (total)	65 psi Oil filter bypass

13

LIMITATIONS SUMMARY

The hard numbers you must not exceed or must respect for takeoff and dispatch.

ITT — GROUND START	650°C	Maximum ITT during ground start — red triangle limit
ITT — IN-FLIGHT START	800°C	Maximum ITT during air start — in-flight limit
ITT — CONTINUOUS	950°C	Maximum ITT continuous operation
ITT — TRANSIENT	955°C	Maximum ITT transient — Takeoff / Reverse / APR
OIL TEMP — MAX	138°C	Maximum oil temperature; L (R) ENG OIL TEMP HIGH caution above this
OIL PRESS — LOW	<28 psi	L (R) ENG OIL PRESS LOW warning; do not exceed idle until oil temp >5°
TAKEOFF POWER LIMIT	5 min	Maximum duration at normal takeoff power setting
REV — MIN SPEED	40 KIAS	Reverse thrust above idle prohibited below 40 KIAS



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