European Aviation Safety Agency

EASA

TYPE-CERTIFICATE DATA SHEET

Number : IM.E.040
Issue : 01
Date : 29 August 2008
Type : Rolls-Royce Corporation AE 2100 Series Engines

Variants

AE 2100A
AE 2100D2
AE 2100D2A

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I. General

1. Type/Variants:

Type: AE 2100
Variants: AE 2100A, AE 2100D2 and AE 2100D2A

2. Type Certificate Holder:

Rolls-Royce Corporation
P.O. Box 420
Indianapolis, Indiana
46206-0420 United States of America

3. Manufacturer:

Rolls-Royce Corporation
P.O. Box 420
Indianapolis, Indiana
46206-0420 United States of America

4. Certification Application Date for EASA Certification:

11 March 2008 for the AE 2100D2A variant

5. EASA Certification Reference Date:

For all variants: 15 February 1990

6. EASA Certification Date:

AE 2100A: 21 March 1994

(EASA Type Certification for the AE 2100A engine model is granted, in accordance with Article 2a paragraph 1(a) of EU Commission Regulation EC 375/2007 amending EU Commission Regulation 1702/2003, based on the DGAC-F Engine Type Certificate No. M-IM 36 issued prior to 28 September 2003.)

AE 2100D2: 18 June 2001

(EASA Type Certification for the AE 2100A engine model is granted, in accordance with Article 2a paragraph 1(a) of EU Commission Regulation EC 375/2007 amending EU Commission Regulation 1702/2003, based on the ENAC Engine Type Certificate No. MO 116 issued prior to 28 September 2003.)

AE 2100D2A: 29 August 2008

II. Certification Basis

1. FAA Certification Basis:

Refer to FAA TCDS number TE1CH

2. EASA Certification Basis:

2.1 EASA Certificantion Basis for the AE 2100A variant (reference JAA Engine Data Sheet No. JAA/E/93-002, Issue 3, dated 26 August 1994)

Airworthiness Standards:	JAR-E Change 8, Effective 4 May 1990
Special Conditions:	SC1 – Ingestion of Rain SC2 – Ingestion of Hail
Equivalent Safety Findings:	JAR-E840 Rotor Integrity
Deviations:	None
Environmental protection requirements:	ICAO Annex 16 Volume II, Emissions

2.2 EASA Certificantion Basis for the AE 2100D2 variant (reference ENAC TCDS No. MO 116)

Airworthiness Standards:	JAR-E Change 8, Effective 4 May 1990 and JAR-E Change 10, Effective 15 August 1999 for requirements E30, E50(b) (AMJ20X-1), E60(f), E110, E150(c)(1), E510, E520(b)&(d), E525, E530(a),(f)&(h), E560(d)(3)(i), E640(b), E650(b),(c),€&(f), E690(b), E700, E740(f)(4)(ii), E820, E840(a)&(b), E850, E860
Special Conditions:	SC1 – Ingestion of Rain SC2 – Ingestion of Hail– Emissions

2.3 EASA Certificantion Basis for the AE 2100D2A variant

Airworthiness Standards:	JAR-E Change 8, Effective 4 May 1990 and JAR-E Change 10, Effective 15 August 1999 for requirements E30, E50(b) (AMJ20X-1), E60(f), E110, E150(c)(1), E510, E520(b)&(d), E525, E530(a),(f)&(h), E560(d)(3)(i), E640(b), E650(b),(c),€&(f), E690(b), E700, E740(f)(4)(ii), E820, E840(a)&(b), E850, E860 CS-E790 “Ingestion of Rain and Hail”, published December 03, 2007

Special Conditions:	None
Deviations:	None
Equivalent Safety Findings:	None
Environmental protection requirements:	ICAO Annex 16, Volume II, second edition, including Amendment 5, effective 24 November 2005, as applicable to turboprop engines

III.Technical Characteristics

1. Type Design Definition:

AE 2100A Engine Assembly: P/N 23053610 and P/N 23060202 (see Note 8)
AE 2100D2 Engine Assembly: P/N 23070302
AE 2100D2A Engine Assembly: P/N 23085027

2. Description:

All variants:

Free turbine turboprop engine, modular design, 14 stage axial compressor, annular combustor, 2 stage gas generator turbine, 2 stage power turbine, front mounted propeller reduction gearbox, bottom mounted power section accessory gearbox, full authority digital engine controls.
Propeller Mount: Flange Type
Output Shaft Gear Ratio: 13,98:1

3. Dimensions:

The dimensions of all variants are as follows:

	AE 2100A, P/N 23053610	AE 2100A, P/N 23060202	AE 2100D2	AE 2100D2A
Overall Length	2.94 m (115.68 inches)	3.00 m (118.14 inches)	2.97 m (116.99 inches)	2.97 m (116.99 inches)
Overall Height (max.)	1.26 m (49.62 inches)	1.34 m (52.92 inches)	1.33 m (52.53 inches)	1.33 m (52.53 inches)

4. Dry Weight:

AE 2100A, P/N 23053610: 715.77 kg (1578 lb)
AE 2100A, P/N 23060202: 737.91 kg (1627 lb)
AE 2100D2: 805.49 kg (1776 lb)
AE 2100D2A: 805.49 kg (1776 lb)

5. Ratings (Static Shaft Power):

	AE 2100A, P/N 23053610	AE 2100A, P/N 23060202	AE 2100D2	AE 2100D2A
Maximum Continuous	2787 KW (3738 HP)	2787 KW (3738 HP)	3458 KW (4637 HP)	3458 KW (4637 HP)
Take-off, 5 minutes	3096 KW (4152 HP)	3096 KW (4152 HP)	3458 KW (4637 HP)	3458 KW (4637 HP)

6. Control System:

All variants: Goodrich Full Authority Digital Electronic Control (FADEC), Quantity 2.
Goodrich Fuel Pump & Metering Unit (FPMU).
Goodrich Compressor Variable Geometry (CVG) Actuator.

7. Fluids:

Fuel Specifications, AE 2100 A: ASTM-D-1655 Type Jet A, Jet A-1
Mil-T-5624 Grade JP-5
Mil-DTL-83133 Grade JP8

Fuel Specifications, AE 2100D2 & AE 2100D2A (see Notes 6 and 7): ASTM-D-1655 Type Jet A, Jet A-1
ASTM-D-6615 Type Jet B
Mil-T-5624 Grade JP-4 and JP-5
Mil-DTL-83133 Grade JP8, JP8+100
TS-1

Oil Specifications, all variants: Synthetic oil conforming to MIL-PRF-23699D or MIL-PRF-23699E or MIL-PRF-7808L Grade III. Refer to the applicable Engine Operations Manual and Engine Maintenance Manual for approved brands.

8. Ignition:

All variants: Unison Industries, Inc. dual capacitance discharge, high energy type exciters, dual igniter plugs

9. Accessory Drive Provisions:

9.1 AE 2100A, P/N 23053610 and P/N 23060202

Accessory	Rotation	Speed Ratio	Max torque (Nm) (Continuous)	Max torque (Nm) (Static)	Max overhung moment (Nm)
Power Section Accessory Gearbox					
Starter	Clockwise	1.0000	122 (1080 in.lb)	366 (3240 in.lb)	9 (80 in.lb)
Gearbox Mounted Accessory Drive Gearbox					
Generator	Clockwise	1.1258	42 (373 in.lb)	237 (2100 in.lb)	28 (250 in.lb)
Pitch Control Unit	No drive provided (mounted pad only)	N/A	N/A	N/A	11.3 (100 in.lb)
Prop Oil Pump	Counterclockwise	0.3506	13.5 (120 in.lb)	56.5 (500 in.lb)	4.5 (40 in.lb)
Hydraulic Pump	Clockwise	0.5942	14.1 (125 in.lb)	50 (450 in.lb)	5 (100 in.lb)
Oil Tank					
Feather Pump*	No drive provided (mounted pad only)	N/A	N/A	N/A	2.1 (19 in.lb)
*:The feather pump is an aircraft supplied component					

9.2 AE 2100D2 and AE 2100D2A

Accessory	Rotation	Speed Ratio	Max torque (Nm) (Continuous)	Max torque (Nm) (Static)	Max overhung moment (Nm)
Power Section Accessory Gearbox					
Starter	Clockwise	1.0000	122 (1080 in.lb)	366 (3240 in.lb)	11.4 (101 in.lb)
Gearbox Mounted Accessory Drive Gearbox					
Generator	Clockwise	0.8432	92 (815 in.lb)	339 (3000 in.lb)	68 (600 in.lb)
Pitch Control Unit	No drive provided (mounted pad only)	N/A	N/A	N/A	15.6 (138 in.lb)
Prop Oil Pump	Counterclockwise	0.3833	9 (83 in.lb)	113 (1000 in.lb)	4.5 (40 in.lb)
Hydraulic Pump	Clockwise	0.2571	169 (1500 in.lb)	497 (4400 in.lb)	5 (43 in.lb)

9. Maximum Permissible Air Bleed Extraction (in % of the total engine inlet airflow):

	Model			
Bleed Location	AE 2100A (P/N 23053610)	AE 2100A (P/N 23060202)	AE 2100D2	AE 2100D2A
Compressor, 8th Stage	3.7	N/A	N/A	N/A
Compressor, 10th Stage	N/A	4.75	8.0	8.0
Compressor, 14th Stage	8.0	9.2	15.0	15.0

IV.Operational Limits:

1. Temperature Limits:

Measured Gas Temperature (same as T4.5 and ITT), °C:

	All Variants
Takeoff (5 minutes)	852 (1566 °F)
Maximum Continuous	833 (1532 °F)
Starting	815 (1500 °F)

1.2 Oil Inlet Temperature, °C :

	AE 2100A, P/N 23053610	AE 2100A, P/N 23060202	AE 2100D2	AE 2100D2A
Maximum Steady State	85 (185 °F)	87 (190 °F)	85 (185 °F)	85 (185 °F)
Maximum Transient (5 minutes)	93 (200 °F)	93 (200 °F)	93 (200 °F)	93 (200 °F)
Minimum (MIL-PRF-23699D)	-40 (-40 °F)	-40 (-40 °F)	-40 (-40 °F)	-40 (-40 °F)
Minimum (MIL-PRF-23699E)	-40 (-40 °F)	-40 (-40 °F)	-40 (-40 °F)	-40 (-40 °F)
Minimum (MIL-PRF-7808L Grade III)	-53 (-65 °F)	-53 (-65 °F)	-53 (-65 °F)	-53 (-65 °F)

1.3 Fuel Pump Inlet Temperature, °C

	All Variants
Minimum	-53 (-65 °F), or that temperature corresponding to 12 centistokes (Cs) fuel viscosity, whichever is higher
Maximum Steady State	57 (135 °F)

1.4 External Engine Component Maximum Temperatures:

Refer to the engine Installation Design Manual, CSP34003 for the AE 2100A (P/N 23053610), CSP34006 for the AE 2100A (P/N 23060202), CSP34069 for the AE 2100D2 and AE 2100D2A.

2. Maximum Permissible Rotor Speeds (rpm):

	AE 2100A P/N23053610 and AE 2100A P/N23060202			AE 2100D2 and AE 2100D2A		
	Gas Generator	Power Turbine	Prop Shaft	Gas Generator	Power Turbine	Prop Shaft
Steady State	15404	15375	1100	15404	14267	1020.7
Transient	15558	16298	1166	15558	16298	1166

3. Maximum Permissible Engine Shaft Torque (Nm) :

	AE 2100A P/N23053610 and AE 2100A P/N23060202	AE 2100D2 and AE 2100D2A
Takeoff (5minutes)	1993 (1328 ft lb)	2348 (1732 ft lb)
Maximum Continuous	1800 (1328 ft lb)	2348 (1732 ft lb)
Transient	2318 (1710 ft lb)	2621 (1933 ft lb)

4. Pressure Limits :

4.1 Fuel Pressure Limits :

	AE 2100A, P/N 23053610	AE 2100A, P/N 23060202	AE 2100D2	AE 2100D2A
Minimum	Fuel true vapour pressure (TVP) plus 20.7 kPa (3psi)	For Jet-A fuel fuel true vapour pressure (TVP) plus 20.7 kPa (3psi). For Jet-B fuel fuel true vapour pressure (TVP) plus 78.7 kPa (11.4psi).	For Jet-A fuel fuel true vapour pressure (TVP) plus 20.7 kPa (3psi). For Jet-B fuel fuel true vapour pressure (TVP) plus 78.7 kPa (11.4psi).	For Jet-A fuel fuel true vapour pressure (TVP) plus 20.7 kPa (3psi). For Jet-B fuel fuel true vapour pressure (TVP) plus 78.7 kPa (11.4psi).
Maximum	358.5 kPa (52 psig)	358.5 kPa (52 psig)	379.2 kPa (55 psig)	379.2 kPa (55 psig)

4.2 Oil Pressure Limits:

	AE 2100A, P/N 23053610	AE 2100A, P/N 23060202	AE 2100D2	AE 2100D2A
Power Section (maximum)	551.5 kPa (80 psig)	620.5 kPa(*) (90 psig)	620.5 kPa (90 psig)	620.5 kPa (90 psig)
Power Section (minimum)	275.8 kPa (40 psig)	275.8 kPa (40 psig)	275.8 kPa (40 psig)	275.8 kPa (40 psig)
Prop gearbox (maximum)	1447.8 kPa (**) (210 psig)	1447.8 kPa (**) (210 psig)	1447.8 kPa (**) (210 psig)	1447.8 kPa (**) (210 psig)
Prop gearbox (maximum)	172.4 kPa (25 psig)	137.9 kPa (20 psig)	103.5 kPa (15 psig)	103.5 kPa (15 psig)
*: Power section maximum oil pressure is 620.5 kPa (90 psig) if Service Bulletin AE 2100A-79-045 has been complied with, otherwise limit remains at 551.5 kPa (80 psig). **:Power section and gearbox pressures may reach 1723.6 kPa (250 psig) for up to 2.5 minutes during initial starting and warm-up.				

5. Installation Assumptions:

Refer to the applicable Installation and Engine Operation Manuals.

V. Operating and Service Instructions

	AE 2100A, P/N 23053610	AE 2100A, P/N 23060202	AE 2100D2 and AE 2100D2A
Installation Design Manual	CSP34006	CSP34006	CSP34069
Engine Operation Manual	CSP30000	CSP30000	CSP30014
Engine Maintenance Manual	CSP31000	CSP31005	CSP34081

VI. Notes

Note 1: Engine ratings are based on:

-Sea level static conditions, 760 mmHg, ISA +22°C (ISA +39°F) for AE 2100A, ISA +24°C (ISA +44°F) for AE 2100D2 and AE 2100D2A.
-Flat rated to 37° C (AE 2100A), 39° C (AE 2100D2 and AE 2100D2A), compressor inlet temperature.
-100% inlet pressure recovery.
-Exhaust nozzle area (A9) of 1419 cm^2 (220 in^2, AE2100A), 1516 cm^2 (235 in^2, AE 2100D2 and AE 2100D2A).
-Zero relative humidity.
-No inlet air distortion.
-No customer bleed extraction.
-No external power extraction.
-Fuel having and LHV of 42799 KJ/Kg, otherwise conforming to fuels specified for use with this engine.
-Oil conforming to MIL-PRF-23699
-Minimum Specification Engine (100%)

Note 2: Aircraft mounted engine control equipment consists of Qty. 2 FADEC units for all variants.

Note 3: Mandatory replacement times (life limits) established for critical components and mandatory airworthiness inspections for all variants are published in Chapter 5, “TIME LIMITS/MAINTENANCE CHECKS” of the applicable Engine Maintenance Manuals.

Note 4: For the AE 2100A, in actual field service, an engine cycle is defined as any flight consisting of one takeoff and landing, regardless of length of flight. Each touch-and-go is also considered an additional cycle.

For the AE 2100D2 and AE 2100D2A, in actual field service, an engine cycle is defined as any engine start to an idle condition.

AE 2100A Low Cycle Fatigue (LCF) lives are based on an assumed worst case flight cycle, which includes engine start, a 3 second acceleration to a takeoff power of 2787 kW (3738 PSHP), 14824 rpm NG, sea level 35 °C (95° F) day conditions and a 3 second deceleration to shutdown. Actual service mission usage must be monitored to ensure that the engine is

operated within the assumed LCF mission. If actual service proves to be more severe than the LCF mission, rotor lives must be adjusted accordingly.

AE 2100D2 and AE 2100D2A Low Cycle Fatigue (LCF) lives are based on the assumed C-27J aircraft mission profiles. Three missions were selected from the six customer provided missions. The Training, Tactical A, and Short Range Logistics missions were selected to represent the six missions. The missions include a combined series of touch and goes, full stop landings, and simulated airdrops. Actual service mission usage must be monitored to ensure that the engine is operated within the assumed LCF mission. If actual service proves to be more severe than the LCF mission, rotor lives must be adjusted accordingly.

Note 5: Automatic or manual FADEC transfer of control can cause a 6 percent engine power change for up to 5 seconds for the AE 2100A (P/N 23053610).

Note 6: TS-1 is a light kerosene type civilian aviation jet fuel used in the Commonwealth of Independent States (CIS) and eastern European countries. Its physical properties are most similar to JETA/A-1, and JET B fuels.

Note 7: JP8 +100 fuel with the “Betz +100 8Q462” or “AeroShell Performance Additive 100” additives (MIL-DTL-83133E), are approved for use at a concentration level of up to 256 parts per million (ppm) in the AE 2100D2 and AE 2100D2A variants.

Note 8: The AE 2100A, P/N 23053610 variant has bleed offtake from th 8^{th} and 14^{th} compressor stage. The AE 2100A, P/N 23060202 variant is the same as AE 2100A, P/N 23053610, except for having bleed offtake from the 10^{th} and 14^{th} compressor stages, different engine control software, and other associated and unassociated changes. A E2100A engines, P/N 23053610, S/N CAE510009 to S/N CAE510024 inclusive, are eligible to be converted to engine P/N 23060202 via Service Bulletin No. AE 2100A-72-037.

AE 2100D2A: Same as the AE 2100D2 with the exception incorporating Service Bulletins AE 2100D2-72-070 and -071. The AE 2100D2A has identical ratings and limitations as the AE 2100D2 engine.

Initial production AE 2100 engines S/N’s CAE 510001 through CAE 510034 are identified as GMA 2100A and are different in model prefix only. The manufacturer of initial production AE 2100A engines CAE 510001 through CAE 510034, as identified on the engine data plates, is Allison Gas Turbine Division of General Motors. Subsequently engines have been manufactured by Allison Engine Company. The two manufacturers are different in name only.

Note 9: Propellers approved for use with the engines are defined in the applicable Installation Design Manual. The engine propeller installation must be approved as a part of aircraft type certification.
