

European Aviation Safety Agency

EASA TYPE-CERTIFICATE DATA SHEET

Number : IM.E.016
Issue : 04
Date : 18 May 2011
Type : Williams International Co.
FJ44 Series Engines

Models
FJ44-1A
FJ44-1AP
FJ44-2A
FJ44-2C
FJ44-3A
FJ44-3A-24
FJ44-4A

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I. General

1. Type/Models:

FJ44-1A, FJ44-2A, FJ44-2C, FJ44-3A, FJ44-3A-24, FJ44-4A

2. Type Certificate Holder:

Williams International Co., LLC
Walled Lake
Michigan 48390-0200
USA

3. Manufacturer: Williams International Co.

4. EASA Certification/JAA Validation Application Date:

FJ44-1A	FJ44-1AP	FJ44-2A	FJ44-2C	FJ44-3A
28 February 1991	20 February 2004	12 September 1996	31 July 2000	22 February 2002
FJ44-3A-24	FJ44-4A			
1 December 2004	11 September 2008			

5. Validation Reference Date: 8 December 1989

6. EASA Certification Date:

FJ44-1A	FJ44-1AP	FJ44-2A	FJ44-2C	FJ44-3A
24 November 1992	8 March 2006	9 July 2001	9 July 2001	30 November 2005
FJ44-3A-24	FJ44-4A			
30 November 2005	18 May 2011			

EASA Type Certification for the FJ44-1A, FJ44-2A and FJ44-2C engine models is granted, in accordance with article 2 paragraph 3 (a)(i) of EU Commission Regulation EC 1702/2003, based on the CAA United Kingdom validation letter issued following the JAA Validation Recommendation.

II. Certification Basis

1. FAA Certification Basis details: see FAA TCDS E3GL

2. EASA Certification Basis:

2.1 Airworthiness Standards:

2.1.1 FJ44-1A

JAR-E change 7 plus amendment E/89/1, effective 24 October 1989
Emissions and Fuel Venting : ICAO Annex 16, Volume II, 2nd Edition, 1993.

2.1.2 FJ44-2A and FJ44-2C

JAR-E change 9, effective 21 October 1994
Emissions and Fuel Venting : ICAO Annex 16, Volume II, 2nd Edition, 1993.

2.1.3 FJ44-3A and FJ44-3A-24

JAR-E amendment 11 dated 1 November 2001
Emissions and Fuel Venting: EC 1702 Annex Part 21A.18(b) dated 27 September 2003

2.1.4 FJ44-1AP

JAR-E amendment 11 dated 1 November 2001
Emissions and Fuel Venting: EC 1702 Annex Part 21A.18(b) dated 27 September 2003

2.1.5 FJ44-4A

CS-E Amendment 1 dated 10 December 2007
Emissions and Fuel Venting: EC 1702 Annex Part 21A.18(b) dated 20 February 2008

2.2 Special Conditions:

2.2.1 FJ44-1A

PC338-1: Ingestion of Rain and Hail

2.2.2 FJ44-2A and FJ44-2C

PC338-1: Ingestion of Rain and Hail
N1 Overspeed

2.2.3 FJ44-3A and FJ44-3A-24

Programmed Logic Devices

2.2.4 FJ44-4A

None

2.3 Deviations: None.

2.4 Equivalent Safety Findings:

2.4.1 FJ44-1A

JAR-E850: Compressor Fan and Turbine Shafts

III. Technical Characteristics

1. Type Design Definition:

FJ44-1A	Parts List 45700-104
FJ44-1AP	Parts List 72100-200
FJ44-2A	Parts Lists 56000, 56000-103, 56000-104
FJ44-2C	Parts List 60500, 60500-103
FJ44-3A	Parts List 67000-200, 67000-202
FJ44-3A-24	Parts List 75000-200
FJ44-4A	Parts List 73200-200

2. Description:

The FJ44-1A is a twin spool turbofan with a single-stage fan and single-stage axial compressor directly driven by a two-stage turbine, a single-stage centrifugal compressor driven by a single stage turbine, an annular combustor and a full length bypass duct.

The FJ44-2A is similar to the FJ44-1A except that a new fan, two additional stages of IP compression, an exhaust mixer and an electronic fuel control unit (EFCU) have been incorporated.

The FJ44-2C is similar to the FJ44-2A except that an integrated hydromechanical fuel control (IFCU) has been incorporated.

The FJ44-3A is similar to the FJ44-2C except that an increased diameter fan and a dual channel Full Authority Digital Engine Control (FADEC) have been incorporated.

The FJ44-3A-24 is similar to the FJ44-3A except that it has a reduced thrust rating.

The FJ44-1AP is similar to the FJ44-1A except that an increased pressure ratio fan, a new combustor, a new LP turbine, a dual channel FADEC and a new full length by-pass duct and exhaust mixer have been incorporated.

The FJ44-4A is similar to the FJ44-3A, geometrically larger by a factor of 1.1, and incorporates a composite inlet and aerodynamically improved IP Compressor design.

For each engine model number, there may be minor differences in the engine configuration, including the addition of optional components, based upon specific airframe installation requirements. See Engine Assembly Part No. identified in Part III.1 for specific engine configuration.

3. Equipment:

Engine equipment is specified by the applicable Type Design Definition.

4. Dimensions:

	FJ44-1A	FJ44-1AP	FJ44-2A and FJ44-2C	FJ44-3A and FJ44-3A-24	FJ44-4A
Overall Length	1.35m (53.3 ins)	1.47 (57.9)	1.52m (59.8 ins)	1.58m (62.4 ins)	1.74m (68.6ins)
Overall Height	0.75m (29.6 ins)	.79 (31.1)	0.75m (29.6 ins)	0.79m (31.1 ins)	0.82m (32.3ins)

5. Dry Weight kg (lb):

FJ44-1A	FJ44-1AP	FJ44-2A	FJ44-2C	FJ44-3A and FJ44-3A-24	FJ44-4A
208.7 (460)	212.3 (468)	240.5 (530)	235.9 (520)	242.7 (535)	304.0(670)

See Note 1

6. Ratings:

Model	Static Thrust daN (lbf)	
	Take off (5 minutes)	Maximum Continuous
FJ44-1A	845 (1900)	845 (1900)
FJ44-1AP	847 (1965)	867 (1950)
FJ44-2A	1023 (2300)	1023 (2300)
FJ44-2C	1068 (2400)	1068 (2400)
FJ44-3A	1254 (2820)	1254 (2820)
FJ44-3A-24	1107 (2490)	1107 (2490)
FJ44-4A	1610 (3,621)	1531 (3,443)

See Notes 2 and 3.

7. Control System:

The FJ44-1A has a Hydromechanical Fuel Control with High Pressure Rotor (N2) speed governing.
The FJ44-2A has a single channel electronic fuel control with N2 speed governing in hydromechanical mode.
The FJ44-2C has a hydromechanical integrated fuel control with N2 speed governing.
The FJ44-3A, FJ44-3A-24, FJ44-1AP and FJ44-4A have a dual channel Full Authority Digital Engine Control system.

8. Fluids (Fuel/Oil/Additives)

Refer to applicable Maintenance Manual for approved fuels, oils and additives.

9. Aircraft Accessory Drives:

The following information applies to the engine accessory gearbox drives for FJ44-1A, FJ44-1AP, FJ44-2A, FJ44-2C, FJ44-3A, FJ44-3A-24 models.

Drive	Rotation Direction Facing Pad	Speed Ratio to N2*	Maximum Continuous Torque Nm (in.lb)	Maximum Overload Torque** Nm (in.lb)	Maximum Static Torque+ Nm (in.lb)	Maximum Weight kg (lb)	Maximum Overhung Moment Nm (in.lb)
Starter	CW	0.2859	See Installation Instructions as identified in Part V.	See Installation Instructions as identified in Part V.	-74.58 (-660)	17.24 (38)	23.73 (210)
High Speed Accessory++	CW	0.1906	6.55 (58)	9.60 (85)	11.30 (100)	2.27 (5)	1.69 (15)
Low Speed Accessory++	CW	0.1092	11.41 (101)	16.95 (150)	11.30 (100)	4.54 (10)	3.39 (30)

* 100% High Pressure Rotor Speed (N2) is 41,200 rpm

** 5 minutes per 4 hour operating period

+ start or breakaway torque is negative for torque into drive pad

++ engine is equipped with either a low speed or a high speed accessory drive pad

The following information applies to the engine accessory gearbox drives for FJ44-4A model.

Drive	Rotation Direction Facing Pad	Speed Ratio to N2*	Maximum Continuous Torque Nm (in.lb)	Maximum Overload Torque** Nm (in.lb)	Maximum Static Torque+ Nm (in.lb)	Maximum Weight kg (lb.)	Maximum Overhung Moment Nm (in-lb.)
Starter	CW	0.3146	See Installation Instructions as identified in Part V.	See Installation Instructions as identified in Part V.	-74.58 (-660)	17.24 (38)	24.86 (220)
High Speed Accessory	CCW	0.3146	See Installation Instructions as identified in Part V.	See Installation Instructions as identified in Part V.	14.12 (125)	17.24 (38)	24.86 (220)
Low Speed Accessory	CW	0.1506	15.25 (135)	22.03 (195)	15.25 (135)	4.54 (10)	5.65 (50)

* 100% High Pressure Rotor Speed (N2) is 37,450 rpm

** 5 minutes maximum in any 4-hour operating period

+ Start or breakaway torque is negative for torque into drive pad

10. Maximum Permissible Air Bleed Extraction: (See Notes 5 & 6)

10.1 High Pressure Bleed (% of core airflow)

Model	Maximum Both Ports	Maximum One Port	Minimum	Maximum Starting
FJ44-1A	13.0	6.5	0	143.2 mm ² (0.222 in ²) sharp edge orifice, equivalent flow
FJ44-1AP	12.0 or 17.01 kg/min (37.5lbs/min) Whichever is less	6.0 or 17.01 kg/min (37.5lbs/min) Whichever is less		143.2 mm ² (0.222 in ²) sharp edge orifice, equivalent flow
FJ44-2A	12.0 or 20.41 kg/min (45 lb/min) whichever is less	6.0 or 20.41 kg/min (45 lb/min) whichever is less	0	143.2 mm ² (0.222 in ²) sharp edge orifice, equivalent flow
FJ44-2C	12.0 or 20.41 kg/min (45 lb/min) whichever is less	6.0 or 20.41 kg/min (45 lb/min) whichever is less	0	143.2 mm ² (0.222 in ²) sharp edge orifice, equivalent flow
FJ44-3A	20.0 or 22.68 kg/min (50 lb/min) whichever is less	10.0 or 22.68 kg/min (50 lb/min) whichever is less	12.9 mm ² (0.020 in ²) sharp edge orifice, equivalent flow	143.2 mm ² (0.222 in ²) sharp edge orifice, equivalent flow
FJ44-3A-24	20.0 or 22.68 kg/min (50 lb/min) whichever is less	10.0 or 22.68 kg/min (50 lb/min) whichever is less	34.2 mm ² (0.053 in ²) sharp edge orifice, equivalent flow	143.2 mm ² (0.222 in ²) sharp edge orifice, equivalent flow
FJ44-4A	21.32 kg/min (47 lb./min)	21.32 kg/min (47 lb./min)	0	173.5 mm ² (0.269 in ²) sharp edge orifice, equivalent flow

10.2 IP Compressor Bleed

IP compressor bleed is optional for the engine models identified below. See part list identified in Part III.1 for specific engine configuration. Bleed flow is limited to the flow which can be extracted from the single bleed port when discharged to ambient static pressure. See Operating Instructions identified in Part V to determine effect of bleed on engine performance. IP compressor bleed is available on the following engine models :

FJ44-2A
FJ44-2C

10.3 Fan Bleed

Fan bleed is optional for the engine models identified below. See parts list identified in Part III.1 for specific engine configuration. Bleed flow is limited to the flow which can be extracted from one bleed port when discharged to ambient static pressure. See Operating Instructions identified in Part V to determine the effect of bleed on engine performance. Fan bleed is available on the following engine models :

- FJ44-1AP
- FJ44-2A
- FJ44-2C
- FJ44-3A
- FJ44-3A-24
- FJ44-4A

IV.Operational Limits:

1. Temperature Limits:

1.1 Maximum Interturbine Temperature (ITT) (Measured average of six thermocouples)

Model	Take off (5 minutes)°C (°F)	Maximum Continuous °C (°F)	Transient °C (°F)	Maximum Starting
FJ44-1A	820 (1508)	796 (1465)	832 for 10 seconds	See Operating Instructions
FJ44-1AP	855 (1571)	835 (1535)	---	See Operating Instructions
FJ44-2A	820 (1508)	805 (1481)	835 (1535) for 10 seconds	See Operating Instructions
FJ44-2C	820 (1508)	805 (1481)	835 (1535) for 10 seconds	See Operating Instructions
FJ44-3A	877 (1610)	841 (1545)	891 (1635) for 10 seconds	See Operating Instructions
FJ44-3A-24	877 (1610)	841 (1545)	891 (1635) for 10 seconds	See Operating Instructions
FJ44-4A	855 (1,571)	835 (1,535)	No transient permitted	See Operating Instructions

Refer to Engine Operating Instructions for time/temperature envelope and inspection requirements when limits are exceeded.

1.2 Fuel Temperature:

Refer to relevant Installation Manual

1.3 Oil Temperature: (Measured at oil cooler exit)

Model	Maximum °C (°F)	Minimum Start and Idle (ground & flight)°C (°F)	Minimum Takeoff °C (°F)
FJ44-1A	121 (250)	-40 (-40)	10 (50)
FJ44-1AP	135 (275) 149 (300) for 5 minutes	-40 (-40)	10 (50)
FJ44-2A	135 (275) 149 (300) for 5 minutes	-40 (-40)	10 (50)
FJ44-2C	135 (275) 149 (300) for 5 minutes	-40 (-40)	10 (50)
FJ44-3A	135 (275) 149 (300) for 5 minutes	-40 (-40)	10 (50)
FJ44-3A-24	135 (275) 149 (300) for 5 minutes	-40 (-40)	10 (50)
FJ44-4A	135 (275) 149 (300) for 5 minutes	-40 (-40)	10 (50)

1.4 Ambient Temperature:

Model	Maximum °C (°F)	Minimum °C (°F)	Minimum Starting °C (°F)
FJ44-1A	121 (250)	-54 (-65)	-40 (-40)
FJ44-1AP	149 (300)	-54 (-65)	-40 (-40)
FJ44-2A	121 (250)	-54 (-65)	-40 (-40)
FJ44-2C	149 (300)	-54 (-65)	-40 (-40)
FJ44-3A	149 (300)	-54 (-65)	-40 (-40)
FJ44-3A-24	149 (300)	-54 (-65)	-40 (-40)
FJ44-4A	149 (300)	-54 (-65)	-40 (-40)

2. Maximum Permissible Rotor Speeds:

2.1 Low Pressure Rotor (N1) - rpm (%)

Model	Take off	Maximum Continuous	Transient
FJ44-1A	18000 (104.4)	18000 (104.4)	18160 (105.3) for 20 s
FJ44-1AP	17700 (102.6)	17700 (102.6)	no transient permitted
FJ44-2A	18150 (105.2)	18150 (105.2)	18350 (106.4) for 30 s
FJ44-2C	18300 (106.1)	18300 (106.1)	18500 (107.3) for 30 s
FJ44-3A	18500 (102.8)	18500 (102.8)	18700 (103.9) for 20 s
FJ44-3A-24	18500 (102.8)	18500 (102.8)	18700 (103.9) for 20 s
FJ44-4A	17,139 (104.8)	17,139 (104.8)	17,303 (105.8) for 2 min

2.2 High Pressure Rotor (N2) - rpm (%)

Model	Take off	Maximum Continuous	Transient
FJ44-1A	40900 (99.3)	40900 (99.3)	N/A
FJ44-1AP	41200 (100.0)	40900 (99.3)	N/A
FJ44-2A	40700 (98.8)	40700 (98.8)	N/A
FJ44-2C	40900 (99.3)	40900 (99.3)	N/A
FJ44-3A	41200 (100.0)	41200 (100.0)	41500 (100.7) for 20 s
FJ44-3A-24	41200 (100.0)	41200 (100.0)	41500 (100.7) for 20 s
FJ44-4A	37,773 (100.9)	37,773 (100.9)	38,045 (101.6) for 2 min

If limits are exceeded, refer to Engine Operating Instructions for maintenance action.

2.3 Reference (100%) Shaft Speeds

Model	Low Pressure Rotor (N1) rpm	High Pressure Rotor (N2) rpm
FJ44-1A	17245	41200
FJ44-1AP	17245	41200
FJ44-2A	17245	41200
FJ44-2C	17245	41200
FJ44-3A	18000	41200
FJ44-3A-24	18000	41200
FJ44-4A	16,360	37,450

3. Pressure Limits:

3.1 Fuel Pressure Limits:

Refer to applicable Operating Instructions

3.2 Oil Pressure Limits, kPa (psig) Measured at Oil Cooler Exit:

	Maximum		Minimum		
		5 min, above N ₂ =32960rpm	above N ₂ =32960rpm	Idle to N ₂ =32960rpm	5 min, Idle to N ₂ =32960rpm
FJ44-1A	620.5 (90)	689.4 (100)	310.3 (45)	241.3 (35)	172.4 (25)
FJ44-1AP	827.4 (120)	896.3 (130)	310.3 (45)	241.3 (35)	158.6 (23)
FJ44-2A	620.5 (90)	689.4 (100)	310.3 (45)	241.3 (35)	158.6 (23)
FJ44-2C	620.5 (90)	689.4 (100)	310.3 (45)	241.3 (35)	158.6 (23)
FJ44-3A	620.5 (90)	689.4 (100)	310.3 (45)	241.3 (35)	158.6 (23)
FJ44-3A-24	620.5 (90)	689.4 (100)	310.3 (45)	241.3 (35)	158.6 (23)

	Maximum		Minimum		
		5 min, above N ₂ =29,960rpm	above N ₂ =29,960rpm	Idle to N ₂ =29,960rpm	5 min, Idle to N ₂ =29,960rpm
FJ44-4A	827.4 (120)	896.3 (130)	275.8 (40)	206.8 (30)	158.6 (23)

4. Installation Assumptions:

The installation assumptions are quoted in the applicable Engine Installation Manual.

5. Dispatch Limitations:

Dispatch of aircraft fitted with FJ44-1AP, FJ44-3A, FJ44-3A-24 or FJ44-4A engines is permitted with certain control system faults present subject to the limitations identified in Chapter 5 of the Airworthiness Limitations Section (ALS) of the applicable Maintenance Manual.

V. Operating and Service Instructions

Model	Maintenance Manual	Engine Manual	Installation Instructions	Operating Instructions
FJ44-1A	50773	50774	50772	50771
FJ44-1AP	73568	73569	75274	75274
FJ44-2A	56210	56217	56208	56209
FJ44-2C	64135	64136	63784	63785
FJ44-3A	68585	68659	68583	68584
FJ44-3A-24	68585	68659	68583	68584
FJ44-4 A	110990	110992	110675	110675

VI. Notes

1. STANDARD EQUIPMENT

Engine dry weight includes the following standard equipment: oil cooler; integral oil tank; accessory drives; customer bleed interfaces; rotor speed transducers; ITT thermocouples and wiring harnesses; fuel and oil filter impeding by-pass sensors; fuel flowmeter mounting provisions. Engine dry weight does not include starter; propelling nozzle; or ignition system electrical source.

ENGINE GEARBOX MOUNTED EQUIPMENT:

Model	Lubrication Pump	Fuel Control	Fuel Pump	Permanent Magnet Alternator (PMA)
FJ44-1A	Standard equipment	Standard equipment (HMU)	Standard equipment	-
FJ44-1AP	Standard equipment	Standard equipment (FDU)	Integral with FDU	Integral with FDU
FJ44-2A	Standard equipment	Standard equipment (HMU)	Standard equipment	-
FJ44-2C	Standard equipment	Standard equipment (IFCU)	Integral with IFCU	-
FJ44-3A	Standard equipment	Standard equipment (FDU)	Integral with FDU	Integral with FDU
FJ44-3A-24	Standard equipment	Standard equipment (FDU)	Integral with FDU	Integral with FDU
FJ44-4A	Standard equipment	Standard equipment (FDU)	Integral with FDU	Integral with FDU

AIRFRAME MOUNTED EQUIPMENT:

Model	TT2 Sensor	TT2/PT2 Sensor	ECU	FADEC
FJ44-1A	-	-	-	-
FJ44-1AP	-	Standard equipment	-	Standard equipment
FJ44-2A	Standard equipment	-	Standard equipment	-
FJ44-2C	-	-	-	-
FJ44-3A	-	Standard equipment	-	Standard equipment
FJ44-3A-24	-	Standard equipment	-	Standard equipment
FJ44-4A		Standard equipment		Standard equipment

2. ENGINE RATINGS

Engine ratings are based on static un-installed thrust stand performance at the following conditions:

- 0% humidity
- sea level ambient pressure of 101.3kPa (14.69 psia)
- no aircraft accessory gearbox loads
- no aircraft air bleed
- 0% inlet total pressure loss
- exhaust nozzle as specified in the applicable engine installation manual
- flat rate temperatures as shown below

FLAT RATE TEMPERATURES

	FJ44-1A	FJ44-1AP	FJ44-2A	FJ44-2C	FJ44-3A	FJ44-3A-24	FJ44-4A
Maximum continuous	15°C (59°F) and below	15°C (59°F) and below	15°C (59°F) and below	15°C (59°F) and below	12°C (53°F) and below	15°C (59°F) and below	8°C (46°F) and below
Take-off	22°C (72°F) and below	22°C (72°F) and below	22°C (72°F) and below	22°C (72°F) and below	26°C (79°F) and below	22°C (72°F) and below	26°C (79°F) and below

ONE ENGINE INOPERATIVE OPERATION

For the FJ44-1A, FJ44-1AP, FJ44-2C, FJ44-3A, FJ44-3A-24 and FJ44-4A engine models, the take-off

rating and its associated operating limitations may be used for a duration not exceeding 10 minutes for one engine inoperative contingency.

3. THRUST SETTING

Setting of engine thrust is to be based on power setting charts referencing Low Pressure rotor speed (N1). Refer to the applicable engine operating instructions.

4. MOTIVE FLOW

Fuel from the motive flow port on the fuel control unit may be extracted to drive jet or turbine pumps in the aircraft fuel system. Refer to the applicable engine installation instructions.

5. ANTI-ICING AND DE-ICING REQUIREMENTS

The FJ44-1A and FJ44-2C engines meet JAR-E engine icing requirements without the use of an active anti-icing system.

The FJ44-1AP, FJ44-2A and FJ44-3A, FJ44-3A-24 and FJ44-4A engines require an aircraft supplied electrical power source to provide TT2 (FJ44-2A) or TT2/PT2 (FJ44-3A, FJ44-3A-24 and FJ44-4A) sensor anti-icing. Specific requirements for the electrical power source are provided in the applicable engine installation instructions.

For airframe and engine inlet duct icing protection, high pressure bleed air may be extracted up to the maximum bleed extraction limits subject to the restrictions in Note 6.

6. POWER RATINGS FOR HIGH CUSTOMER BLEED AIR USEAGE

Use of large amounts of high pressure bleed air, such as for aircraft anti-icing, may require reduced thrust settings. Refer to the applicable engine operating instructions.

7. AIRWORTHINESS LIMITATIONS SECTION

The EASA approved Airworthiness Limitations Section of the Instructions for Continued Airworthiness is published in the Maintenance Manual, chapter 5 "Airworthiness Limitations".

8. ENGINE MOUNT SYSTEM

Refer to the applicable engine installation instructions for engine mount dimensions and load limits.

9. OPTIONAL AFT MOUNT

The engine manufacturer supplies optional aft mount rings that position the aft mount attachment point to suit specific aircraft installations. Refer to the applicable engine installation instructions for details.

10. ICING CONDITIONS

For ground operation in icing conditions, requirements, limitations, and notes are specified in FJ44-4A Operating Instructions Manual.

11. DISPATCH LIMITATIONS

The engine has been approved for Time Limited Dispatch. The maximum justifiable rectification period for each dispatchable state is specified in the Installation and Operating Instructions Manual; no extension to such rectification period is allowed.
