
Type Acceptance Report

TAR 3/21B/34 – Revision 1

Diamond DA 40 Series

TABLE OF CONTENTS

EXECUTIVE SUMMARY	1
1. INTRODUCTION	1
2. FOREIGN TYPE CERTIFICATE DETAILS	1
3. TYPE ACCEPTANCE CERTIFICATE	3
4. TYPE DATA	4
5. ADDITIONAL NEW ZEALAND REQUIREMENTS	8
ATTACHMENTS	9
APPENDIX 1	9

Executive Summary

New Zealand Type Acceptance has been granted to the Diamond DA 40 Series based on validation of EASA Type Certificate number A.022. There are no special requirements for import.

Applicability is currently limited to the Models and/or serial numbers detailed in Appendix 1, which are now eligible for the issue of an Airworthiness Certificate in the Standard Category in accordance with NZCAR §21.177, subject to any outstanding New Zealand operational requirements being met. (See Section 5 of this report for a review of compliance of the basic type design with the operating Rules.) Additional variants or serial numbers approved under the foreign type certificate can become type accepted after supply of the applicable documentation, in accordance with the provisions of NZCAR §21.43(b).

1. Introduction

This report details the basis on which Type Acceptance Certificate No.3/21B/34 was granted in the Standard Category in accordance with NZCAR Part 21 Subpart B.

Specifically the report aims to:

- (a) Specify the foreign type certificate and associated airworthiness design standard used for type acceptance of the model(s) in New Zealand; and
- (b) Identify any special conditions for import applicable to any model(s) covered by the Type Acceptance Certificate; and
- (c) Identify any additional requirements which must be complied with prior to the issue of a NZ Airworthiness Certificate or for any subsequent operations.

2. Foreign Type Certificate Details

Manufacturer: Diamond Aircraft Industries GmbH (Austria) – TC Holder
Diamond Aircraft Industries Inc. (Canada)

Type Certificate: Musterzulassungsschein No. FZ 021 – JAA
Issued by: Austro Control (The Austrian Civil Aviation Authority)
Original Type Certificate. Now replaced by:

Type Certificate EASA.A.022
European Aviation Safety Agency

1. Model: DA 40

MCTOW 1150 kg (2535 lb.) – Normal Category

Max. No. of Seats: 4

Noise Category: JAR 36, Subpart C and ICAO Annex 16, Chapter X, Appendix 6
[69.28 dB(A)]

Engine: Lycoming IO-360-M1A

Type Certificate: 1E10
Issued by: Federal Aviation Administration

Propeller: mt-Propeller MTV-12-B/180-17()

Type Certificate: 32.130/67
Issued by: Luftfahrt-Bundesamt

2. Model: DA 40 D

MCTOW 1150 kg (2535 lb.)

Max. No. of Seats: 4

Noise Category: JAR 36, Subpart C and ICAO Annex 16, Chapter X, Appendix 6
[Std exhaust: 78.7 dB(A); with OÄM 40-096 muffler: 69.5 dB(A)]

Engine: Thielert TAE 125-01

Type Certificate: JAA/E/02-030
Issued by: Joint Aviation Authorities

Propeller: mt-Propeller MTV-6-A/187-129

Type Certificate: 32.130/57
Issued by: Luftfahrt-Bundesamt

3. Model: DA 40 F

MCTOW 1150 kg (2535 lb.)

Max. No. of Seats: 4

Noise Category: ICAO Annex 16, Volume1, Part 2, Chapter10 [74.8 dB(A)]

Engine: Lycoming O-360-A4M

Type Certificate: 286
Issued by: Federal Aviation Administration

Propeller: Sensenich 76EM8S10-0-63

Type Certificate: P4EA
Issued by: Federal Aviation Administration

3. Type Acceptance Certificate

The application for New Zealand type acceptance of the Diamond DA40D was from the manufacturer, dated 29 April 2003. The first-of-type example was serial number D4.037, registered ZK-SFH. The Diamond DA 40 Series is a low-wing four-seat light monoplane with an all-composite airframe and T-tail. The DA 40 and DA 40F Models have conventional aviation piston engines while the DA40D has a geared turbocharged FADEC-equipped water-cooled compression-ignition engine with single pilot control.

Type Acceptance Certificate No. 3/21B/34 was granted on 25 July 2003 to the Diamond Model DA 40 D based on validation of Austrian Type Certificate number FZ 021-JAA (Austro Control has JAA PCA status for the DA 40), and includes the Thielert TAE125 engine and MTV-6 propeller based on validation of LBA Type Certificate no.s 4631 and 32.130/57 respectively. There are no special requirements for import into New Zealand.

This report was raised to Revision 1 to include the original DA 40 and the new DA 40 F models, after application from the manufacturer dated 18 October 2005. The opportunity was also taken to note the change to an EASA type certificate. Type acceptance of both models was granted on 26 April 2006.

The DA40 is a development of the original two-seat DV20 Katana. The initial model had the 180 hp Lycoming IO-360-M1A, while the DA 40 D was modified to install the 135 hp Thielert diesel engine, in accordance with Major Modification OÄM 40-100. The changes needed to accomplish this included new engine mount, cowlings, intercooler, water and oil coolers, and exhaust system. The fuel system was modified, the electrical system changed to 12V, an engine ECU fitted, and the throttle quadrant modified for single-power-lever-control (SPLC) operation. The Thielert TAE125, now marketed as the Centurion 1.7, is a conversion of a Mercedes-Benz four-cylinder inline automotive diesel engine. The engine cannot be overhauled, but has a claimed Time-Before-Replacement life of 2400 hours. The DA 40 F is a further derivative with an alternative engine and propeller combination aimed at the US market. The DA 40 and DA 40 F are available with the Garmin G1000 EFIS flight instrumentation system.

4. Type Data

The type data requirements of NZCAR Part 21B Para §21.43 have been satisfied by supply of the following documents:

(1) Type certificate:

JAA Aeroplane Data Sheet JAA/23/00-001 DA 40 Series - Iss.9 dated 18-Jun-2003
Austro Control Type Certificate Number FZ 021-JAA – DA 40, DA 40 D
(for information only: LBA TC Nr. 1105 – DA 40 D approved 13 January 2003)
Above now superseded by EASA type certification:

EASA Type Certificate EASA.A.022 for Diamond DA 40 issued 21 January 2005
EASA Type Certificate Data Sheet A.022 – Issue 02; 15, April, 2005
– Model DA 40 approved 24 October 2000
– Model DA 40 D approved 24 October 2000
– Model DA 40 F approved 15 April 2005

JAR-E Engine Data Sheet No. JAA/E/02-030 – Issue 7 dated May 17, 2004
LBA TCDS Nr 4631 Thielert TA 125 – Issue 5 dated 07.Mai 2004

LBA TCDS Nr. 32-130/57 MTV-6 – Issue 5 dated 08.11.2002

LBA TCDS Nr. 32-130/67 MTV-12 – Issue 6 dated 17.10.2002

(2) Airworthiness design requirements:

The certification basis of the Basic Model DA 40 is JAR-23 issued 11-Mar-1994, and JAR-1, at Change 5 issued 15-Jul-1996, plus elect-to-comply with NPA 23-3 ACJ Material and 23-6 Printing errors. For the DA 40 D this was upgraded to JAR-23 including Amendment 1. This is an acceptable certification basis in accordance with NZCAR Part 21B Para §21.41 and Advisory Circular 21-1A, because JAR-23 is accepted as an equivalent to FAR 23, the basic standard for Normal Category Airplanes called up under Part 21 Appendix C. For the DA 40 and DA 40 F there were four Special Conditions, while for the DA 40 D six Special Conditions were complied with and there were five findings of equivalent safety. These have been reviewed and accepted by the CAA. There are no non-compliances and no additional special conditions have been prescribed by the Director under §21.23.

The certification basis of the TAE125 is JAR-E, Change 10, dated August 15, 1999, while that of the MTV-6 is FAR Part 35, with Amendments 35-1 through 35-6. These meet NZCAR Part 21 Appendix C standards for engines and propellers, respectively.

(3) Certification compliance listing:

Doc. No. 6.07.00 Chapter 1 – Report Means of Compliance DA 40
Revision 10 dated 02-Dec-2004 – approved by ACG as PCA (JAA) 25 April 2005
Doc. No. 6.07.00 Chapter O-100/5 – Project Description – DA40 with TAE 125
CRI A-01 Issue 17 dated 08.03.2005 – Type Certification Basis
Part A – Initial Certification Basis for the Basic DA 40
Part B – Final Certification Basis (Includes Major Design Changes)

CRI applicable to the DA 40 and DA 40 F Models:

CRI F-01 Special Condition – Protection from the Effects of HIRF – Standard SC specifying the HIRF environment to be met for electrical and electronic systems and equipment, the failure of which would prevent the continued safe flight and landing of the aircraft.

CRI F-03 Special Condition – Protection from the Effects of Lightning Strikes; Indirect Effects – Specifies the aircraft system design provisions, functionality requirements and the acceptable test standards for environment and test waveforms, lightning zoning and the indirect effects of lightning (EUROCAE Documents ED-81, ED-84 and ED-91).

CRI O-01 Glider Towing – This was issued to specify the detailed technical standards to be used for a glider towing approval in the absence of any JAA harmonized requirements.

CRI O-02 Tow Rope Retraction Unit – This was issued to specify technical requirements for an electric tow cable retraction mechanism in the absence of any JAA harmonized guidance.

CRI applicable to the DA 40 D Model:

CRI D-01 Equivalent safety Finding JAR 23.777, 23.779, 23.871, 23.1141 – SPLC are not covered by existing requirements. To ensure equivalence to existing split lever functions means must be established for pre-flight power verification checks and propeller governing checks.

CRI E-04 Propeller Type Certification JAR 23.905 – JAR Advisory material requires propellers to be type certificated against JAR-P. The mtv-6 is certified against FAR 35, which requires individual validation by some JAA Countries. (France and the UK)

CRI E-05 Special Condition – Use of Jet Fuel – Rules did not envisage use of Jet Fuel for reciprocating engines. Interpretation was required for rules which state turbine only (particularly because kerosene-based fuels absorb greater amounts of water than gasoline fuels and potential for fuel system icing), and for some reciprocating engine rules which were not actually applicable.

CRI E-06 Special Condition – Use of Diesel Fuel – Rules did not envisage use of diesel fuel for reciprocating engines. Clarification of some rules was required, particularly because the EN590 specification allows much wider production variations. (However the TAE 125 is approved for operation with any fuel mixture ratio of Jet A-1 [ASTM 1655] and Diesel [EN 590])

CRI E-07 Equivalent Safety Finding JAR 23.1061(b), JAR 23.1063 – Rules do not cover the use of a closed loop cooling system, which is state of the art for automobiles. Expansion tank and overflow bottle capacity must be sufficient to ensure safe operation following loss of cooling fluid, and both must be able to withstand the vibration, inertia and fluid loads experienced. A low fluid level warning device will also be provided for the pilot.

CRI E-08 Equivalent Safety Finding – The diesel has no ignition system but is electronically controlled. Electrical system and battery reliability and independence requirements were addressed and an engine shut-down means equivalent to an ignition switch provided.

CRI E-09 Special Condition – The engine uses three attachment points with softer than usual shock mounts, to reduce vibration. Vibration levels for all possible failure modes were evaluated, including starting and stoppage. The effect on the fatigue spectrum and flutter were also considered.

CRI E-10 Special Condition JAR 23.361 – A diesel with much higher compression ratio has its maximum torque at a lower RPM value. Substantiation of the torque factor of 2 was required, either by test and analysis, or by comparison with the original Lycoming IO-360 installation.

CRI E-11 Equivalent Safety Finding – Impact of elevated fuel temperature on fuel system hot weather operation and fuel tank flammability and structural strength required. This is because

the engine has a significant return fuel flow at relatively high temperature (up to 80°C), and the aluminium tanks are installed within the composite wings which reduces airflow cooling.

CRI F-05 Equivalent Safety Finding JAR 23.1305, 23.1521 – A Manifold Pressure gauge is not an adequate indication of power for a single-control-lever diesel engine. The DA 40D instead has a power indicator, and a cooling fluid temp. gauge is used in lieu of a CHT indicator.

CRI F-06 Special Condition JAR 23.1309 – Applies to the integrated FADEC control of the engine and propeller propulsion system. The aircraft must be protected from unacceptable effects or faults due to a single cause, including software problems, electrical power and data supply integrity, local events, environmental effects and lightning and other electromagnetic effects.

FAA Memo – Equivalent Level of Safety; ACE-03-01 – One ELOS was granted by the FAA for the auxiliary fuel level indication system in the DA40 equipped with long range fuel tanks per Optional Design Change OÄM 40-071/b. The level indication system is reliable but not fully accurate. However AFM guidance on how to deal with the level measurement band of uncertainty was accepted as meeting §23.1337(b). This ELOS was carried across to the Garmin G1000 STC.

(4) Environmental Certification:

Doc. No. 6.07.00 Chapter O-100/CRI A-03 – Additional National Environmental Requirements – Aircraft Noise – Revision 2 dated 19 Nov 2002 (DA 40 D)

Doc. No. 6.07.06 Chapter CRI A-03 – Additional National Environmental Requirements – Aircraft Noise – Revision 0 dated 26 May 2000 (DA 40)

Noise Measurement Report – DA40F – Date of Measurement: 17.03.2005

(5) Flight manual: ACG-Approved Airplane Flight Manual DA 40 D
Doc. No. 6.01.05-E – CAA Accepted as AIR 2832

JAA-Approved Airplane Flight Manual DA 40
Doc. No. 6.01.01-E – CAA Accepted as AIR 2947

EASA-Approved Airplane Flight Manual DA 40 F
Doc. No. 6.01.02-E – CAA Accepted as AIR 2948

FAA Approved Flight Manual Supplement Garmin G1000
Integrated Avionics System – Garmin P/N 190-00303-02

(6) Illustrated Parts Catalogue:

Doc. No. 6.03.01 IPC DA 40 Series

Doc. No. IPC-02-01 IPC Thielert Centurion 1.7 (TAE125-01)

(7) Maintenance manual and service data for aircraft, engine and propeller:

Doc. No. 6.02.01 Airplane Maintenance Manual DA 40 Series - latest revision and applicable Temporary Revisions
Diamond Aircraft Industries GmbH DA 40 Series Service Bulletins

Garmin G1000 Maintenance Manual – Diamond DA 40 and DA 40 F – Part Number 190-00545-00

Doc. No. IM-02-01 Thielert TAE 125-01 Installation Manual
Doc. No. OM-02-01 Thielert TAE 125-01 Operation and Maintenance Manual
Doc. No. RM-02-01 Repair Manual
TAE Fault Isolation Manual
TAE GmbH Service Bulletins (TM TAE 125-0001 – Subject: life time)

mt-Propeller ATA 61-01-24 (E-124) Operation and Installation Manual
mt-Propeller Entwicklung GmbH Service Bulletins (SB Nr. 1Z – Subject: TBO)

- (8) Agreement from manufacturer to supply updates of data in (5), (6) and (7):

Letter from Manfred Reichel, Chief, Office of Airworthiness, dated 20-Apr-2003

- (9) Other information:

Doc. No. 6.05.01 List of Applicable Publications – DA40-180 Diamond Star
Doc. No. 6.05.01 List of Applicable Publications – DA40-TDI Diamond Star

STC Number SA01254WI – Installation of Garmin G1000 Integrated Avionics System in the Diamond DA 40, DA 40F aircraft

Garmin Dwg. 005-C0004-00 – Master Drawing List STC SA01254WI

5. Additional New Zealand Requirements

Compliance with the retrospective airworthiness requirements of NZCAR Part 26 is a prerequisite for the grant of a type acceptance certificate.

Civil Aviation Rules Part 26

Subpart B - Additional Airworthiness Requirements

Appendix B - All Aircraft

PARA:	REQUIREMENT:	MEANS OF COMPLIANCE:
B.1	Marking of Doors and Emergency Exits	<i>To be determined on an individual aircraft basis</i>
B.2	Crew Protection Requirements – CAM 8 Appdx. B # .35	Not Applicable – Agricultural Aircraft only

Compliance with the following additional NZ operating requirements has been reviewed and were found to be covered by either the original certification requirements or the basic build standard of the aircraft, except as noted:

Civil Aviation Rules Part 91

Subpart F - Instrument and Equipment Requirements

PARA:	REQUIREMENT:	MEANS OF COMPLIANCE:
91.505	Seat belts/Shoulder Harness if Aerobatic; >10 pax; used for Flight Training	JAR §23.785 – See Flight Manual Section 7.6 – 3-point safety harness is fitted to all seats as standard equipment
91.507	Pax Information Signs - Smoking, safety belts fastened	Not Applicable – Less than 10 passenger seats
91.509 Min. VFR	(1) ASI (2) Machmeter (3) Altimeter (4) Magnetic Compass (5) Fuel Contents (6) Engine RPM (7) Oil Pressure	JAR §23.1303(a) – Std Fit * <i>N/A – No Mach limitations</i> JAR §23.1303(b) – Std Fit * JAR §23.1303(c) – Std Fit * JAR §23.1305(a) – Std Fit * ¥ JAR §23.1305(d)(e) – Std Fit * ¤ JAR §23.1305(b) – Std Fit * ¤
	* See Flight Manual Section 2.13 Kinds of Operation for minimum operational equipment fit ¤ Displayed on the Compact Engine Display (CED) – All models ¥ Displayed on the Auxiliary Engine Instrument (AED 125) – Model DA 40 D only	
91.511 Night	(1) Turn and Slip (2) Position Lights	Fitted as Std * See FM §7.4 #14 Fitted as Std * See FM §7.10.1
91.517 IFR	(1) Gyroscopic AH (2) Gyroscopic DI (3) Gyro Power Supply (4) Sensitive Altimeter	Fitted as Std * See FM §7.4 #17 Fitted as Std * See FM §7.4 #29 Fitted as Std * See FM §7.4 #16 UI 5934PD-3 or LUN 1128
	IFR Approval just introduced via major change OAM 40-136	
91.519	IFR Communication and Navigation Equipment	<i>Operational requirement – Compliance as applicable</i>
91.523	Emergency Equipment (a) More Than 10 pax - First Aid Kits per Table 7 - Fire Extinguishers per Table 8 (b) More than 20 pax - Axe readily acceptable to crew (c) More than 61 pax - Portable Megaphones per Table 9	<i>Operational requirement – Compliance as applicable</i> <i>Operational requirement – Compliance as applicable</i> Not Applicable – Less than 20 passenger seats Not Applicable – Less than 61 passenger seats
91.529	ELT - TSO C91a after 1/4/97 (or replacement)	<i>To be determined on an individual aircraft basis</i>
91.531	Oxygen Indicators - Volume/Pressure/Delivery	Not fitted as standard
91.533	Oxygen for Non-Pressurised Aircraft >30 min above FL100 - Supplemental for crew, 10% Pax - Therapeutic for 3% of Pax Above FL100 – Supplemental, Therapeutic, 120 l PBE	Maximum demonstrated operating altitude in Flight Manual is 5,000 m Oxygen system not fitted as standard No Optional Supplement in Flight Manual
91.541	SSR Transponder and Altitude Reporting Equipment	<i>Operational requirement – Compliance as applicable</i>
91.543	Altitude Alerting Device - Turbojet or Turbofan	Not Applicable – Not turbo jet or turbofan powered
91.545	Assigned Altitude Indicator	<i>Operational requirement – Compliance as applicable</i>
A.15	ELT Installation Requirements	<i>To be determined on an individual aircraft basis</i>

Civil Aviation Rules Part 135

Subpart F - Instrument and Equipment Requirements

PARA:	REQUIREMENT:	MEANS OF COMPLIANCE:
135.355	Seating/Restraints – Shoulder harness for flight-crew seats	See compliance with NZCAR §91.505 above
135.357	Additional Instruments (Powerplant and Propeller)	JAR §23.1305 instruments fitted/propeller not reversible
135.359	Night Flight	Operating Rule – Compliance to be determined by operator
	Landing light, Pax compartment	
135.361	IFR Operations	Operating Rule – Compliance to be determined by operator
	Speed, Alt, spare bulbs/fuses	
135.363	Emergency Equipment (Part 91.523 (a) and (b))	Operating Rule – Compliance to be determined by operator
135.367	Cockpit Voice Recorder	Not Applicable – Less than 10 passenger seats
135.369	Flight Data Recorder	Not Applicable – Less than 10 passenger seats
135.371	Additional Attitude Indicator	Not Applicable – Not turbo jet or turbofan powered

Attachments

The following documents form attachments to this report:

Photographs first-of-type example DA 40 D s/n D4.037 ZK-SFH
 Three-view drawing Diamond Aircraft Industries Model DA 40 D
 Copy of EASA Type Certificate Data Sheet EASA.A.022

Sign off

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 David Gill
 Team Leader Airworthiness

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 Checked – AWE5
 Date: 26 April 2006

Appendix 1

List of Type Accepted Variants:

<i>Model:</i>	<i>Applicant:</i>	<i>CAA Work Request:</i>	<i>Date Granted:</i>
DA 40 D	Diamond Aircraft Industries GmbH	3/21B/34	25 July 2003
DA 40, DA 40 F	Diamond Aircraft Industries GmbH	6/21B/1	26 April 2006