



EUROPEAN AVIATION SAFETY AGENCY



Maintenance Training Evaluation Board (OEB) Report Diamond Aircraft DA-42 Series



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Operational Evaluation Board - Maintenance Training Subgroup



Dragos Budeanu

EASA Maintenance Training Section Manager

Franz Graser

Austro Control

**Report prepared by:
Dragos Budeanu**

Manufacturer Experts Involved in this Evaluation

- **Peter Wollanka** - Training Manager
Part-147 Maintenance Training Organisation AT.147.02
- **Markus Tastscher** - Quality Manager
Part-147 Maintenance Training Organisation AT.147.02
Part-145 Maintenance Organisation AT.145.073

Executive Summary

Evaluation Background and Scope

The EASA Certification Directorate has requested Certification Flight Standards to perform an OEB Catch-up process for the Diamond 42 (DA-42) aeroplane and include the maintenance training assessment as part of this process.

Based on this mandate, the Certification Flight Standards OEB created and tasked a dedicated Maintenance Training Subgroup to proceed with the evaluation of the maintenance training courses provided by Diamond Aircraft Industries GmbH in support of their DA-42 Series products under their Part-147 approval and oversight of Austro Control.

Synopsis of Evaluation

This report documents the maintenance training evaluation based on the review of DA-42 training courses syllabi and training materials produced and imparted by the Diamond Aircraft Part-147 Maintenance Training Organisation as well as the discussions and interviews conducted at Austro Control in Vienna and Diamond Aircraft Industries GmbH in Wiener Neustadt.

Applicability

The report is published to assist the National Aviation Authorities (NAAs) in their licensing of Maintenance Certifying Staff for DA-42 Series aeroplane in compliance with Part-66 provisions and with additional focus on considerations to be taken into account for eligibility and examinations regarding the applicable type rating endorsement.

The report is valid until amended, superseded or withdrawn by subsequent operational evaluation determinations.

Evaluation conclusion and recommendation

The Maintenance Training Subgroup concluded that:

while the evaluation did not reveal any objective elements that would support a change in the present requirements stipulated by Appendix I to Aircraft Type Ratings for Part-66 Aircraft Maintenance Licence in Table 9 regarding Diamond DA-42 Series Type Rating endorsement,

the maintenance training elements developed and provided by the DA-42 TCHolder to support the operation of his product should be considered by the NAAs in developing their applicable licensing examinations as well as in encouraging any voluntary DA-42 Series type training courses submitted to their approval and oversight.



Evan Nielsen

EASA, Head of Certification Flight Standards

13. December 2010

1. General Description of the DA-42 Series aeroplane

The DA 42 Series is a modern glass-cockpit and composite structure aeroplane, twin-engine, four seat, low wing mono-plane with retractable tricycle landing gear. The aeroplane is propelled by two piston diesel engines driving 3-blade propellers. It has a cantilever wing and a 'T' tail.

Fuselage

The aeroplane structure is fiber reinforced plastic composite. The semi-monocoque fuselage is a carbon-fiber reinforced-plastic (CFRP) shell with glass-fiber reinforced-plastic (GFRP) bulkheads and stiffeners. The one-piece canopy has a large quantity of wrap-around glazing. This gives a good all-round view from the cockpit. A glazed rear passenger door on the left side of the aeroplane gives access to the rear seats. The passenger door lifts up to give good access and is supported in the open position by a gas strut.

Wings and Empennage

A wing center section is attached to the bottom of the fuselage center section. The wing center section has the two engine nacelles, the wing stubs and the fuselage center-section floor. The engine nacelles give the fixing points for the engines. The wing stubs have the attachment points for the outer wings. The center section has the main landing gear bays and landing gear leg attachments.

Electrically operated flaps and mechanical ailerons are attached to the trailing edge of the wings.

The horizontal stabilizer is a semi-monocoque structure.

Landing Gear

The tricycle landing gear is fully retractable and hydraulically operated. The main landing gear legs are attached to mounting points in the wing center-section. The main landing gear retracts into integral compartments in the wing center section. Landing gear doors seal the landing gear bays when the gear is retracted. The nose landing gear is steerable and is attached to the lower front of the fuselage. The nose landing gear bay is integral with the front fuselage and doors seal the bay when the gear is retracted.

Flight Controls

The flight control system uses conventional ailerons, elevator and rudder. The DA 42 Series has two control sticks and two rudder pedal assemblies to operate the primary flight controls. Push-pull rods operate the ailerons and the elevator. Cables operate the rudder. An electric motor operates the flaps via push-pull rods. The elevator has both an electric and a manual trim system. A handwheel and Bowden cable operate the elevator trim mechanically. The rudder has a mechanical trim system which uses a rotary drive and Bowden cable to operate a rudder trim tab.

Engine and Propeller

The DA 42 Series is powered by two diesel engines designed and manufactured by either Thielert or Austro Engine. The engines drive each a three blade variable pitch and feathering propeller designed and manufactured by MT Propeller. The aeroplane has a single lever engine – propeller operation.

The Austro engine is a liquid-cooled, in-line four-stroke four cylinder engine with double overhead camshaft (DOHC) with four valves per cylinder. The valves are actuated by the cam follower. The direct fuel injection is realized by means of a common rail technique and the engine is charged by a turbo charger in combination with an intercooler. The propeller is

activated by an integrated gearbox with an integral torsional vibration damper. All engine components are controlled by an EECU system.

The Thielert engine is a liquid cooled 4-cylinder in line four stroke with double overhead camshaft (DOHC). The valves are actuated by the cam follower. The direct fuel injection operates based on the common rail technique and turbocharging. The engine is controlled by a FADEC system. The propeller is driven through an integrated gearbox with a clutch. The engine is equipped with an electric starter and an alternator.

Fuel System

The aeroplane has aluminum fuel tank assemblies in each wing. Each fuel tank has three chambers which are mounted between the wing spars. The outer fuel chamber of each assembly has a fuel filler. Flexible hoses connect the fuel tanks to the fuel distribution system. Each tank can feed either engine via a fuel cross-feed system. Fuel level sensors are installed in the inner and outer fuel tank chambers.

Auxiliary fuel tanks are optional equipment. The auxiliary fuel tanks consist of a single fuel chamber in each engine nacelle and have their own fuel tank filler and a fuel transfer pump.

Electrical System

The aeroplane has two sources of electrical power. A 24 V battery supplies electrical power when the engines are not running. Engine generators provide electrical power when minimum one of the engines is running. Switches and circuit breakers control all electrical devices. A key switch controls the engine starting system.

Avionics

The DA 42 Series has a full range of flight instruments contained in a Garmin integrated cockpit system (ICS). The ICS has two display screens. Both of them are able to show all the aeroplane flight instrumentation data, navigation data, engine data and other aeroplane system data. An audio control panel is located between the two display screens. The audio control panel integrates and controls the aeroplane radio, navigation and intercom systems. The ICS also displays all the aeroplane warnings, cautions and alerts. The ICS can also be configured to show ground and flight check lists.

The aeroplane's autopilot system is either a KAP 140 digital flight control system that provides roll, pitch, and pitch trim steering with altitude preselect or a GFC 700 Garmin digital flight control system that provides roll, pitch, pitch trim, and yaw steering with altitude control. The GFC 700 autopilot system is controlled via the MFD of the Garmin G1000 ICS.

2. Regulatory requirement for DA-42 Series Maintenance Type Training

The present in force regulation stipulates,

in Appendix I - Aircraft type ratings for Part-66 aircraft maintenance licence - to Annex IV - Acceptable Means of Compliance to Part-66 - of Decision No. 2003/19/RM (of the Executive Director of the Agency) to Commission Regulation (EC) No 2042/2003 on the continuing airworthiness of aircraft and aeronautical products, parts and appliances, and on the approval of organisations and personnel involved in these tasks,

that the DA-42 Series aeroplane is eligible for type examinations and group ratings and, thus, it does not require type training and individual type rating (see below the applicable excerpt from the above mentioned document):

9. Aeroplane multiple piston engines – composite structure (AMPE-CS), eligible for type examinations and group ratings

TC holder	Type rating endorsement
DIAMOND AIRCRAFT Industries	Diamond DA42 Series (Thielert)
	Diamond DA42 Series (Austro Engine)

3. Evaluation Activity

3.1. Scope

The mandate given to the OEB Maintenance Training Subgroup was to evaluate the maintenance training courses provided by Diamond Aircraft Industries GmbH in support of their DA-42 Series products within their Part-147 approval and oversight exercised by Austro Control and assess if this training is appropriately covering the needs raised during the operation of the DA-42 Series aeroplane.

Based on the results of this evaluation the Maintenance Training Subgroup was requested to make applicable recommendations regarding the maintenance training courses for the DA-42 Series aeroplane.

3.2. Documents reviewed in the evaluation process

The Maintenance Training Subgroup proceeded to a detailed evaluation of a representative sample of the documentary framework for the Diamond Aircraft Industries GmbH Part -147 training courses regarding the DA-42 Series aeroplane.

The following documents were reviewed as part of the evaluation:

- DA42 (Austro Engine) – Type Training Course / B1.2, C - Training Manual - Diamond Maintenance Training Division, Issue: July 2010
- Maintenance Training Organisation Exposition of Diamond Aircraft - AT.147.02 – Rev. 4, Issue: 2010-07-14
- Practical Training Task List / Cat. B1.2, C for Difference course: Thielert (Diamond DA42 Series) to Austro Engine (Diamond DA42 Series) – Rev.0, Issue: July - 2009
- DA42 NG AMM – Rev. 1, Issue: 15 Oct 2009

3.3. Assessment phases

The initial evaluation consisted in a review performed by the Maintenance Training Section of EASA Certification Flight Standards based in particular on the first two listed documents in paragraph 3.2. This first assessment phase was performed in order to identify how some general and specific type training elements are addressed (e.g. : training syllabus content; quality and update of training material; theoretical and practical training balance and duration; use of a/c parts, mock-up, and/or training devices to support the training delivery).

The second part of the evaluation consisted in a visit and interviews conducted at Austro Control in Vienna and at Diamond Aircraft Industries GmbH in Wiener Neustadt. This second phase of the assessment captured the inputs of the NAA and TCH experts identified on page 3 and was performed in order to validate the initial (desktop audit) conclusions as well as the alignment of the training documentation with the “in field” requirements and expectations.

3.4. Conclusion of the evaluation

The training approach taken voluntarily by Diamond Maintenance Training Division and endorsed by NAA approval and oversight from Austro Control is to provide Type Training courses for the DA-42 Series above and beyond the minimum requirements stipulated by EASA regulation (see Appendix 1).

While the evaluation did not reveal any objective elements that would support a change in the present requirements stipulated in the regulation, the training approach mentioned above is perceived as a strong and welcome commitment to adequately support a product that cumulates a series of top of the line technologies which are not yet a common place in

the general aviation sector: glass cockpit, Diesel engines, engine and propeller Electronic Control Unit (ECU) control with single lever engine operation, composite a/c structure.

The evaluated training courses ratio of practical training duration to theoretical training duration is roughly 2:1 both for the initial Type Training as well as for any Difference Training within the DA-42 Series. Although not a standard practice in the aviation training industry and not required by the in force EASA regulation, the Engine Ground Run is integrated in the Type Rating course (i.e. initial or difference training - practical training segment).

The continuous update of the training documentation to the OEM technical documentation standard is insured by the appropriate link of the technical training documents to the AMM.

Diamond Aircraft Industries GmbH maintains a free and full accessibility on its website to the latest set of AMMs. The company also mandates the Type Training for all its Service Centres Maintenance Certifying Staff around the world.

There is no documented/reported instance that Diamond Maintenance Training Division is aware of, or which the Maintenance Training Subgroup has knowledge of, in which a maintenance training element did cause or contribute, could have precluded or mitigated a DA-42 Series in service difficulty, incident or accident.

4. OEB Recommendations for Maintenance Training

Based on the objective elements of the DA – 42 Series maintenance training evaluation, the OEB Maintenance Training Subgroup makes the following recommendations:

- There is no perceived need, for the moment, to change the Aircraft Maintenance Licence Requirements for the DA-42 Series aircraft from the present regulatory stipulation of “Aeroplane multiple piston engines – composite structure (AMPE-CS), eligible for type examinations and group ratings” and require a mandatory type training and individual type rating. Nevertheless, this recommendation is open to re-assessment once the number of a/c types in the Table 9 AMPE-CS will increase beyond the present products of a single TC Holder – Diamond Aircraft Industries.
- The NAAs are advised to encourage the initiative of any MTO seeking approval and oversight of a DA-42 Type Training course and developing such a course to be added to its Part-147 scope of approval. The approval of any subject limited training course, and in particular Engine Training Courses, in a formal training context should also be considered and strongly encouraged whenever possible.
- Attending Engine OEM training courses (for Thielert and/or Austro Engine) should be considered by the individual operators and maintenance organizations if operating and maintaining such an engine type is in the scope of their approval.
- Whenever they conduct a type examination on the DA-42 Series, the NAAs should revise their examination subject data-bank to capture the content of the latest revision of the DA-42 AMM documents available from the OEM. This recommendation is also applicable to any type examination performed by third parties and accepted by the NAAs.
- The NAAs should strictly observe the differentiating knowledge and skill elements validation through adequate examination of the candidate before granting any type rating endorsement for a DA-42 Thielert to DA-42 Austro Engine (or vice versa) applicant.
- The DA-42 TC Holder incidents and accidents database should capture any applicable maintenance training learnt lessons and make them available to all concerned Training Providers and Examiners.

5. Appendices

- Appendix 1 - Aircraft type ratings for Part-66 aircraft maintenance licence, Annex I to ED 2009 – 016/R
- Appendix 2 - DA42 (Austro Engine) – Type Training Course / B1.2, C - Training Manual
- Diamond Maintenance Training Division, Issue: July 2010
- Appendix 3 - Maintenance Training Organisation Exposition of Diamond Aircraft - AT.147.02 – Rev. 4, Issue: 2010-07-14
- Appendix 4 - DA42 NG AMM – Rev. 1, Issue: 15 Oct 2009
- Appendix 5 - Practical Training Task List/Cat. B1.2, C for Difference course: Thielert (Diamond DA42 Series) to Austro Engine (Diamond DA42 Series) – Rev.0, Issue: July - 2009