EUROPEAN AVIATION SAFETY AGENCY

CERTIFICATION FLIGHT STANDARDS

# Operational Evaluation Board Report

**Date: 28.04.2014**

## Manufacturer: AIRBUS HELICOPTERS Deutschland

## EC145 (BK117)

## (C-2, C-2e & D-2)

European Aviation Safety Agency
Postfach 10 12 53
D-50412 Köln, Germany

# EC145 (BK 117) C-2 and C-2e


# EC145 (BK 117) D-2

# Revision Record

| Revision No. | Section | Pages No. | Date |
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# Operational Evaluation Board – OPS / FCL Subgroup

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# AIRBUS HELICOPTERS Experts involved in the process

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|---|---|---|---|
| Volker BAU | Chief Test Pilot | AIRBUS HELICOPTERS | |
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| Joachim BALIK | Head of Training - FTO | AIRBUS HELICOPTERS | until 03/2013 |
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# Executive Summary

## 1. Manufacturer Application

AIRBUS HELICOPTERS Manufacturer has made a formal application to EASA Experts Department – Certification Directorate to a full OEB for the evaluation of the **EC145 (BK 117 D-2)** for an Initial and Additional Type Rating course. In addition the **BK 117 C-2 & C-2e** helicopters have been evaluated and compared and in both ways to the **EC145 (BK 117 – D-2 )** as difference Type Rating Courses.

## 2. Scope of the evaluations

The OEB recommends for approval by NAAs

- Update Type Rating List & Licence Endorsement List
- Pilot Initial Type Rating Training minimum syllabus (ITR)
- Pilot Additional Type Rating Training minimum syllabus (ATR)
- Pilot Difference Type Rating Training minimum syllabus
- Instrument Rating Extension
- Currency and Recent experience
- Training area and special emphasis

## 3. Team Composition and Regulatory Framework

Captain Roel Huysmans (EASA) has made a Training Program evaluation - Test “T5” on the EC145 (BK 117 D-2) . This test leads the full type rating course with no credit for prior experience. In addition the OEB has evaluated the commonalities between BK 117 D-2 as “base aircraft” and BK 117 C-2 & C-2e as candidate aircrafts.

EASA /OEB Section Rotorcraft Manager Jean-Marc Sacazes and AIRBUS HELICOPTERS experts have participated actively to this Operational Evaluation Board (Refer to the list page 6).

EASA conducted this evaluation in accordance with EASA Air Operations and Air Crew requirements. This evaluation was based on Common procedures Document (CPD) and CS-FCD.

*Note on references and reference texts:*
*Where references are made to requirements and where extracts of reference texts are provided, these are at the amendment state at the date of publication of the report. Readers should take note that it is impractical to update these references to take account of subsequent amendments to the source documents.*

EASA – Deputy Head of Expert Department
Flight Group-Certification Directorate

# Abbreviations / Acronyms

## General

| | |
|---|---|
| AC | Alternate Current (electrical) |
| AEO | All Engines Operative |
| AFCS | Automatic Flight Control System (Autopilot) |
| AHD | Airbus Helicopters Deutschland |
| AMC | Acceptable Means of Compliance |
| AOC | Aircraft Operator Certificate |
| ARIS | Anti Resonance Isolation System |
| ATPL (H) | Airline Transport Pilot Licence (Helicopter) |
| ATO | Approved Training Organisation |
| ATR | Additional Type Rating |
| CPD | Common Procedures Document (for FAA-TCCA-FAA) |
| CPDS | Central Panel Display System |
| CPL (H) | Commercial Pilot Licence (Helicopter) |
| DC | Direct Current (electrical) |
| EASA | European Aviation Safety Agency |
| ECD | Eurocopter Deutschland |
| ECU | Engine Control Unit |
| EECU | Electronic Engine Control Unit |
| EFIS | Electronic Flight Instrument System |
| EMB | Electrical Master Box |
| EPU | External Power Unit |
| FADEC | Full Authority Digital Engine Control |
| FCDS | Flight Control Display System (digital flight instruments) |
| FCU | Fuel Control Unit |
| FLI | First Limit Indicator |
| FLM | Flight Manual |
| FTD | Flight Training Device |
| FNPT | Flight and Navigation Procedure Trainer |
| FRP | Fibre Reinforced Plastic |
| FSTD | Flight Simulation Training Device |
| FTO | Flying Training Organisation |
| GM | Guidance Material |
| GPU | Ground Power Unit |
| IFR | Instrument Flight Rules |
| IR | Instrument Rating |
| ITR | Initial Type Rating |
| JAA | Joint Aviation Authority |
| JAR-FCL 1 | Joint Aviation Requirements – Flight Crew Licenses (Aeroplane) |
| JAR-FCL 2 | Joint Aviation Requirements – Flight Crew Licenses (Helicopter) |
| JAR-OPS 3 | Joint Aviation Requirements Operations 3 (Helicopter commercial air transport) |
| JOEB | Joint Operational Evaluation Board |
| MDR | Master Difference Requirements |
| MEH | Multi Engine Helicopter |
| MEL | Minimum Equipment List |
| MET | Multi Engine Turbine |
| MGB | Main Gear Box |
| MMEL | Master Minimum Equipment List |
| MSL | Mean Sea Level |
| NAAs | National Aviation Authorities |
| N/A | Not Applicable |
| ODR | Operator Differences Requirements |

| | |
|---|---|
| OEI | One Engine Inoperative |
| OEB | Operational Evaluation Board |
| PPL (H) | Private Pilot Licence (Helicopter) |
| RPM | Revolutions per Minute |
| TGB | Tail rotor Gear Box |
| TRI (H) | Type Rating Instructor (Helicopter) |
| T/R | Tail Rotor |
| TRTC | Type Rating Training Course |
| TRTO | Type Rating Training Organisation |
| VEMD | Vehicle and Engine Monitoring Display |
| VNE | Velocity - Never Exceed |
| VTOSS | Velocity Take Off Safety Speed |
| Vy | Velocity - for best rate of climb |
| Vx | Velocity - for best angle of climb |
| YAW-SAS | Yaw – Stability Augmentation System |
| WAT | Weight / Altitude / Temperature |

**Helicopter Model designators along historic evolution of this helicopter within EADS group**

| | |
|---|---|
| BO | Bölkow |
| BK | Bölkow / Kawasaki |
| EC | Eurocopter |
| MBB | Messerschmidt Bölkow Blohm |
| AH | AIRBUS HELICOPTERS |

Part-ARA ....Annex VI to Commission Regulation (EU) No 290/2012 of 30 March 2012 amending Regulation (EU) No 1178/2011 laying down technical requirements and administrative procedures related to civil aviation aircrew pursuant to Regulation (EC) No 216/2008 of the European Parliament and of the Council (as amended)

Part-ARO ....Annex II to Commission Regulation (EU) No 965/2012 of 05 Oct 2012 laying down technical requirements and administrative procedures related to air operations pursuant to Regulation (EC) No 216/2008 of the European Parliament and of the Council (as amended)

Part-CAT .....Annex IV to Commission Regulation (EU) No 965/2012 of 05 Oct 2012 laying down technical requirements and administrative procedures related to air operations pursuant to Regulation (EC) No 216/2008 of the European Parliament and of the Council (as amended)

Part-FCL.....Annex I to Commission Regulation (EU) No 1178/2011 of 3 November 2011 laying down technical requirements and administrative procedures related to civil aviation aircrew pursuant to Regulation (EC) No 216/2008 of the European Parliament and of the Council (as amended)

Part-ORA.....Annex VII to Commission Regulation (EU) No 290/2012 of 30 March 2012 amending Regulation (EU) No 1178/2011 laying down technical requirements and administrative procedures related to civil aviation aircrew pursuant to Regulation (EC) No 216/2008 of the European Parliament and of the Council (as amended)

Part-ORO .....Annex III to Commission Regulation (EU) No 965/2012 of 05 Oct 2012 laying down technical requirements and administrative procedures related to air operations pursuant to Regulation (EC) No 216/2008 of the European Parliament and of the Council (as amended)

Part-SPA .....Annex V to Commission Regulation (EU) No 965/2012 of 05 Oct 2012 laying down technical requirements and administrative procedures related to air operations pursuant to Regulation (EC) No 216/2008 of the European Parliament and of the Council (as amended)

# 1. Purpose and applicability

Data is being submitted by AIRBUS HELICOPTERS in support of the OEB process for the E**C145 (BK 117 D-2)** and also data regarding the differences between the **EC145 (BK 117) C2, C2e and D2** variants.
The operator differences tables (ODR) provided by the manufacturer include a comparison of the those variants (see Appendix 4).

*Note:*
*To enable an easy reading of this report, the EC145 (BK 117) C2, C2e and D2 are sometimes named and grouped under "EC145 / BK117 variants".*

This report is the result of an evaluation and comparison based on **Pilot Initial, Additional and difference Type Rating Minimum Training Syllabus** for the variants of the EC145 (BK 117) provided by AIRBUS HELICOPTERS Training Academy and ATO's already approved by LBA (Germany) and by other NAA's.

This document:

- Provides a general description of all the EC145 (BK 117 C2, C2e and D2).
- Updates the Type Rating List and Licence Endorsement List including all BK117 variants.
- Makes recommendations for minimum training syllabus for the EC145 (BK117 C2, C2e and D2). variants to:

    - Initial Type Rating (ITR)
    - Additional Type Rating (ATR)
    - Instrument Rating Extension (IR)
    - CAT.A Training
    - Differences training
    - Currency and Recent experience
    - Training area of special emphasis

# 2. General description of the EC145 (BK 117)

## History

The EC145 (BK 117) was developed in a joint co-operative design between MBB Germany (part of Eurocopter) and Kawasaki Heavy Industries Japan.
As BK117 A1 it had its first flight on June. 12th 1979 and received its type certification in 1982. The BK117 A2 was only used for evolution tests but never certified. To provide more engine power the helicopter was several times modified between 1985 and 1992 to the following versions; BK117 A3, A4, B1, B2 and C1.
To get more cabin space and make use of modern cockpit display / flight control systems, the development of a new variant was launched in 1999. Since the formation of a new joint company (MBB / Aerospatiale) called **EUROCOPTER** the brand name **EC145** was used for any further development of the BK117. The first variant got certified in December 2000 as **EC145 / BK117 C-2**.
The development of the same variant as a high payload / low empty mass version featuring a "low cost / minimum weight" Garmin helicopter glass cockpit has begun in 2011 and will receive certification in 2013. This variant is designated as **EC145 / BK117 C-2e.**
To provide more OEI and AEO power (especially for high altitude and class one performance), and to install a low noise Fenestron Anti Torque system together with high end / latest technology cockpit display and AFCS systems, the development continued with a version, called **EC145 / BK117 D-2**. It had its first flight in July 2010 and will receive certification in 2014.

*Note:*
*Since the training has to be prepared and organized even before a variant is completely certified, the OEB has decided to implement version EC145 / BK117 C-2e and EC145 / BK117 D-2 in this Document.*

## General

The EC145 / BK117 in general is approved in the Rotorcraft Airworthiness Category, under FAR 29 first issue February 1, 1965 including amendments 29-1 through 29-16. Up from version B2, several additional FAR 29 / JAR 29 amendments are included.
The EC145 / BK117 is a medium weight twin-engine turbine multi-purpose helicopter, featuring a fully separated fuel system, dual hydraulic system, dual electrical system and a redundant lubrication system for the main transmission.
The helicopter in its basic configuration is certified for land operation under day and night Visual Meteorological Conditions (VMC). With special equipment installed and operative and under observance of the procedures and limitations, the helicopter is also certified for land operation under day and night Instrument Meteorological Conditions (IMC).

- Cockpit Versions and Flight Instrumentation

Depending on the variant, the EC145 / BK117's are equipped with two different cockpit display and three different flight instrumentation systems (see pages 19/20/21):

- **CPDS** (Central Panel Display System) installed in **EC145 / BK117 C-2 and C-2e**, a multifunction digital cockpit display system combined with **FCDS or Garmin 500H** flight instrumentations.

- **HELIONIX** (multifunction cockpit displays) installed in **EC145 / BK117 D-2**, a Eurocopter designed modular / open architecture digital cockpit- and flight instrumentation system including AFCS.

Engine Versions
Depending on the designators on the FLM, respective engine versions are installed:

- EC145 / BK117 C-2 equipped with Turbomeca Arriel 1E2 engines.
- EC145 / BK117 C-2e equipped with Turbomeca Arriel 1E2 engines.
- EC145 / BK117 D-2 equipped with Turbomeca Arriel 2E engines.

Engines of C-2 / C-2e are in the 600 KW class and the engine of the D-2 is in the 800 KW class.

For Version C-2 and C-2e the general maximum take-off mass is 3585 kg.

For Version D-2 the general maximum take-off mass is 3650 kg

**Fuselage**
The fuselage serves as platform for the helicopter systems, crew, passengers and payload.
The exterior shape of the fuselage is aerodynamically optimized and includes various cowlings (MGB, Engine, Aft, Tail rotor fairing) and service covers (i.e. Nose, Forward, Middle, Tank, Tail boom / Fin). The modular concept simplifies the assembly of the helicopter and permits the replacement of individual modules without the necessity of disassembling the entire fuselage.

The main components of the fuselage are:

Main fuselage structure: (transmission deck, side shells, engine deck, rear attachment cone, cabin floor, subfloor structure and bottom shell) It is the part of the fuselage that carries all the loads transmitted by the main transmission, the main rotor system and all loads caused by the engines, landing gear and tail unit.
It consists of the body structure and floor structure. The structures are predominantly produced as aluminium-alloy body structures which are rigidly attached to each other.
The transmission deck takes up the load of the lifting system. It is attached by rivets to the side panels and includes six mounts for the main transmission installation.
The engine deck is riveted to the transmission deck and to the side panels. The engine deck is equipped with mounts to which the engine is attached through its mounting struts.
Integral with the upper surface of the engine deck is the rear structure attachment cone.
As the engine deck is part of the firewall-system, the skin is made from titanium sheet metal.

Cabin structure: (cabin frame and roof structure)
It is a one-piece structural component, constructed as a hollow profile made of composite material, mainly carbon-fibre, but also glass-fibre and KEVLAR is used. The framework provides the structural support for mounting the windshields, the nose windows, the pilot/copilot doors and the sliding doors to the passenger compartment.

Tail Unit
*(EC145 / BK117 C-2 and C-2e)*
It is connected to the fuselage by the tail boom mounting cone and stabilizes the helicopter in flight through two vertical stabilizers and a tail rotor. The tail boom consists of a conical tube and a vertical fin which are made of light-weight semi-monocoque aluminum construction.

*(EC145 / BK117 D-2)*
It is connected to the main fuselage by the attachment cone and stabilizes the helicopter in flight through its vertical fin. It contains an integrated fan-in-fin rotor (Fenestron concept). The tail unit is a sandwich design made of carbon glass hybrid preprag with NOMEX core inside.

Doors and windshields
The helicopter fuselage is fitted with six doors to provide access to the cockpit, passenger cabin and cargo compartment. The doors are a carbon-glass-fiber composite construction. The windshields and windows are made from acrylic glass.

Cabin and cargo floor
The cabin and cargo floor extends through cockpit, cabin, and cargo compartment at the same level. The floorboard is an aluminum alloy honeycomb sandwich construction with a maximum floor load of 6000 N/m2.

**Landing gear**
The landing gear carries the weight of the helicopter on the ground and absorbs landing impact loads. It is attached through four fittings and bearing rings to the floor structure of the fuselage. It is made of aluminium and consists of two cross tubes and two skids which are clamped together with skid shoes.
To prevent the fuselage from being over-stressed during touch down, the bearing rings on the cross tubes are swivelling in their brackets so that all forces are absorbed by bending the cross tubes only. A skid track of 2,4 m, the rigid construction of the landing gear and the hinge less main rotor system provides the helicopter with good stability when on the ground and disables ground resonances.
The landing gear may be fitted with optional equipment like emergency flotation system, FLIR, etc.

**Seating**
In its basic configuration the EC145 / BK117 uses a 10 seat arrangement.

Cockpit:
There are 2 crew seats in the cockpit of which the co-pilot seat on the left hand side may be used as passenger seat during single pilot operations.

Cabine:
In the forward cabin section are 3 passenger seats facing aft to the flight direction while the middle section of the cabin has got 2 seats left and right facing forward with centre access to the rear section of the cabin. In the rear section are 3 passenger seats facing forward to the flight direction.

Several other seat arrangements are certified and described in the optional section of the flight manual (i.e. VIP / High density / Medical seats, etc.).

**Main Rotor and blades**
The main rotor system is designed as a hingeless rotor system with four blades. The main rotor head is bolted directly to the rotor mast. The rotor star is made of titanium. It contains the retaining assembly and the bearings for the inner sleeve. At the top, the lubrication housing is located. The bearings are lubricated through a bore drilled into the top of each arm of the star.

Main Rotor Blades
The main rotor blades are made of light weight construction glass and carbon fibers reinforced plastics. A blade fitting assembly attached to the blade mounting fork is the connection between the main rotor blade and the main rotor head. Each blade is retained by the main blade bolt and a secondary blade bolt. The main blade bolt is hollow to permit installation of dynamic balance weights. The Diameter of the blades is 11 Meter. A vibration absorber, installed to the blade neck reduces the vibrations which mainly occur during low speed and flare maneuvers. The vibration absorber consists of a set of pendulum balls attached to a shaft.
The blade contour (without the root section) has negative trapezoidal blade geometry with a parabolic swept--back tip and a negative twist totaling 9.6°. The blade cord length increases towards the blade tip.

Main Rotor Mast
The main rotor mast is hollow, forged as one-piece and made of steel alloy.

Control Elements
A swashplate is used to connect the rotor to the stationary components of the control system.
It is mounted to a sliding sleeve, free to slide on a main gearbox mounted support tube.
A scissor assembly enables a synchronous rotation of the swashplate bearing ring with the rotor mast. Four rotating control rods enable the control inputs from the rotating part of the swash plate to the pitch horns (connecting link) for angle adjustments of the blade mounting forks = rotor blades.

Rotor related Indications
The indicating system consists of a rotor RPM indicator, a visual and aural rotor RPM warning and a mast moment indication.
The rotor RPM is sensed with an inductive system. The signal is processed to a warning unit and indicated at the rotor RPM indicator. The warning unit works with electrical power of the helicopter. The pilot is warned by a warning light and aural signal when minimum, high or maximum rotor RPM is exceeded.
Since the main motor system is hinge less, the rotor mast has to carry certain bending moments during slope landings or very rapid control inputs. To indicate such rotor mast bending moments a Mast Moment (MM) indication system is installed.

## Tail Rotor

*(EC145 / BK117 C-2 and C-2e)*
The tail rotor is a semi rigid two bladed rotor with a central flapping hinge. The direction of rotation is counter-clockwise (seen from the tail rotor transmission). The tail rotor (seen from the rear) is located at the upper end of the vertical fin on the left side of the tail rotor transmission.
For aerodynamically reasons the tail rotor axis is tilted 3° downward (inclination of the tail rotor axis) and 4° rearward (sweep back of the rotor axis).
The tail rotor blades are made of composite material, mainly glass fibre, foam filler with a stainless steel tip protection. The blade has a rectangular shape with a trapezoidal root. The cross-section is designed asymmetrically and 2 types of tail rotor blades are used, untwisted and twisted blades.

*(EC145 / BK117 D-2)*
The tail rotor is a shrouded fan-in-fin rotor (Fenestron concept) and installed in a duct in the Fenestron structure which is part of the tail fin and made of composite material. A stator is installed in the duct of the Fenestron structure to which the tail rotor gearbox is attached.
The tail rotor is equipped with ten unevenly-spaced rotor blades made of carbon fibre. This design produces overlapping acoustic vibrations which in turn creates a low noise level.
The vertical fin together with the integral Fenestron structure forms a unit. The upper region of the vertical fin has an aerodynamic function, while the Fenestron structure below encloses the tail rotor system. With this design and sufficient forward speed, the helicopter is able to continuo to fly even in case of a complete tail rotor drive failure.

## Drive System

The drive system transmits engine power to the Main Rotor, to its associated auxiliary units (like HYD pumps / Oil cooler fans etc.) and to the Tail Rotor drive.
As the engines are free turbine type engines, there is no clutch. A free wheel is integrated in each main transmission input drive, enabling independent drive of one or two engines as well as autorotation of the main transmission gear above the engine input speed.
The engines input rotate with approx. 6000 RPM (at 100% N2) which is reduced for the Main rotor output to 383 RPM.
*(EC145 / BK117 C-2 and C-2e)*
The tail rotor drive output (at 100% N2) is 2396 RPM which is increased by the intermediate gearbox to 2995 RPM and reduced again by the tail rotor gearbox down to 2169 RPM used by the Tail rotor.

*(EC145 / BK117 D-2)*
The tail rotor drive output (at 100% N2) is 2396 RPM which is increased by the tail rotor gearbox to 3117 RPM used by the fan-in-fin rotor (Fenestron concept).

The drive system consists of:

Engine Driveshaft's:
The drive shafts transmit the power of the engines to the main transmission. They are connected with flexible couplings to the engines and to the freewheeling units of the main transmission. The flexible couplings are used to correct any variations in length or misalignment between the engine outputs and the main transmission inputs.

Main transmission:
The main transmission transfers the power from both engines to the main rotor system, to the auxiliary drives and tail rotor drive. All mounting points, attachment fittings and oil lines are integrated into the transmission casing. It contains a wet sump oil system for lubrication and cooling. For redundancy, the lubrication system comprises two oil pumps located in the lower casing of the gearbox. A connecting pad at the tail rotor drive provides the attachment point for the rotor brake disc adapter and tail rotor driveshaft.

## Flight Controls

Main rotor

Below the cockpit floor, ball bearing control cables (Flexball cables) are connected to cyclic stick and collective pitch, passing through the nose section of the cabin and the windshield frame to the cabin roof leading to the main rotor hydraulic actuators.
Above the cabin and in front of the main transmission are the duplex hydraulic actuators. They are linked with the Flexball cables to the cyclic- stick- and collective linkages on their un-boosted side and to the mixing levers / swash-plate on their boosted side.
After the swash-plate, rotating control rods are connected to pitch horns (connecting link) for angle adjustments of the blade mounting forks = rotor blades.

Tail rotor control

*(EC145 / BK117 C-2 and C-2e)*
The pedal assembly for tail rotor control is connected below the cockpit floor with control rods to a bell crank lever. From here a ball bearing control cable (Flexball cable) leads to a bell crank below the intermediate gearbox. A control rod, located between the intermediate gearbox and tail rotor gearbox features an integrated electrical actuator (part of the standard YAW-SAS) and an integrated hydraulic boost actuator (part of HYD system No.2). This control rod moves a bell crank which is connected to the tail rotor gearbox and moves the stationary section of the tail rotor sliding sleeve. The rotating section of the sliding sleeve is connected to pitch links which are used to adjust the blade mounting forks, means the tail rotor blades.

*(EC145 / BK117 D-2)*
The pedal assembly for tail rotor control is connected below the cockpit floor with control rods to a bell crank lever. From here a ball bearing control cable (Flexball cable) leads to two electrical actuators which are located inside the Fenestron structure (part of the standard Autopilot system). A control rod leads from these yaw actuators to an input lever which moves a piston in the duplex hydraulic boosted Fenestron Actuator. The inputs transmitted to a control spider which changes the blade pitch angles of the Fenestron.

## Rotor brake

A hydro-mechanical rotor brake system is used. The rotor brake control lever is installed right side of the pilot seat above the floor. A cable runs to the hydraulic assembly (fluid reservoir / brake cylinder / damper) mounted on the main transmission. From here a hydraulic line leads to the brake calliper which is mounted on a brake support on the main transmission above the tail rotor drive.
The tail rotor drive pad provides the attachment point for the rotor brake disc adapter to which the brake disk is mounted. If the rotor brake lever is locked for a longer period of time, the hydraulic pressure will slowly decrease and the brake function will be lost with time.
When the brake control lever is pulled a micro switch will activate the caution light ROTOR BRAKE.
For EC145 / BK117 C-2 (SN 9311 and subsequent), C-2e and D2 the system has been improved by adding additionally another micro switch on the brake support which forces the caution to come on when the brake calliper moves (by any reason) out of its neutral position.

## Engines

The EC145 / BK117 C-2 and C-2e are equipped with two Turbomeca ARRIEL 1E2 engines.

The EC145 / BK117 D-2 is equipped with two Turbomeca ARRIEL 2E engines (FADEC controlled)

*(EC145 / BK117 C-2 and C-2e)* The ARRIEL 1E2
Is a lightweight, free turbine, turbo-shaft engine. The engine integrates a single stage axial and a single stage centrifugal compressor. The compressor is connected to and driven by a dual stage gas producer turbine ($N_1$). The air leaving the compressor is routed to the annular combustion chamber, into which metered fuel is sprayed through a centrifugal fuel injection and ignited. Gas leaving the combustion chamber is directed to and drives the two stage axial gas generator turbine ($N_1$). This gas is directed to the power turbine ($N_2$) which drives the reduction gearbox. Here the RPM is reduced, the torque measured and the power transmitted to the power output flange. The engine is equipped with a fuel control system for gas generator and power turbine speed. The fuel control rules the gas generator speed as a function of power lever or twist grip setting and anticipator (governor) signals (air signals). The “anticipator” controls a constant output speed as a function of power on demand (collective setting, trim- and flyweight adjustments).

*(EC145 / BK117 D-2)* The ARRIEL 2E
Is a lightweight, free turbine, turbo-shaft engine. The engine integrates a single stage axial and a single stage centrifugal compressor. The compressor is connected to and driven by a dual stage gas producer turbine ($N_1$). The air leaving the compressor is routed to the annular combustion chamber, into which metered fuel is sprayed through a centrifugal fuel injection and ignited. Gas leaving the combustion chamber is directed to and drives the two stage axial gas generator turbine ($N_1$). This gas is directed to the power turbine ($N_2$) which drives the reduction gearbox. Here the RPM is reduced, the torque measured and the power transmitted to the power output flange.
Two Electronic Engine Control Units (EECU) work in conjunction with an electrical stepper motor located within the Fuel Metering Unit to change the fuel flow as required. This system ensures an automatic control of the engine output speed and fast response to changes in power demand.

*Note:*
*The ARRIEL 2E utilizes a dual channel computerized electronic engine control. Since such systems are fully automated they are commonly known as FADEC. This designation is used in the helicopter documentation whenever the electronic engine control system is meant.*

## Ignition system

*(EC145 / BK117 C-2 and C-2e)*
Two spark igniter plugs are installed in the combustion housing which are supplied by two independent ignition units. To start the engine, the respective twist grip has to be set onto the 20° position and the starter switch has to be set to the START position where it is held electro-magnetically. This initiates a semi-automatic start procedure Two start injectors inject start fuel to the combustion chamber and the two igniters ignite the atomized fuel during engine start. The system is energized as soon as the starter switch (located on the Main Switch Panel) is set to START. At sufficient self-sustaining speed (40 - 50% $N_1$) the starter switch is released automatically and ignition stops.

*(EC145 / BK117 D-2)*
The engine start of the D2 version is fully automated and controlled by the respective FADEC.

## Fuel system

The fuel system comprises two fuel tanks, a fuel supply system, a refueling and grounding equipment and a monitoring system. The main tank and supply tank with overflow to the main tank and sufficient separated quantity for approximately 20 min. flight time are installed under the cabin floor. Fuel is stored in under-floor compartments using two bladder type fuel cells comprising a main tank and a supply tank. The supply tank comprises two separate sections, with different capacities, each supplying one engine. This ensures that the engines may not fail at the same time when running out of fuel. From the supply tank, located directly aft of the main tank, fuel is transferred to the engines. The main and the supply tank are interconnected via spill ports and transfer lines. The volume above the spill ports of the main and supply tank is a part of the main tank capacity.

## Electrical System

The electrical power supply systems generate and distribute power for operation and control of the helicopter systems. The EC145 / BK117 electrical systems operate on 28 VDC. When supplied by the battery, they operate on 24 VDC. An additionally AC system is installed.

The electrical power supply consists of:
- power generation
- power distribution
- external power receptacle
- AC power system.• Power Generation
  The power generation consists of two generators, a battery and the corresponding distribution or master boxes.

- Power Distribution
  Several bus bars are installed in the distribution or master boxes, the overhead panel and circuit breaker panels, to which all electrical consumers of the helicopter are connected by means of circuit breakers.

- External Power Receptacle
  It is possible to supply the electrical power system with DC power by an External Power Unit. The voltage of the EPU should be adjusted to 28 VDC.
  If the voltage of the EPU is higher than the voltage of the battery, the EPU is automatically selected as power source. If not, the system will not accept the EPU for power distribution.

- AC Power System
  The AC power system generates two different AC voltages (26 VAC, 115 VAC) out of 28 VDC using static inverters. The helicopter is equipped with one system (SYS 2) as a standard or two systems (SYS 2 and SYS 1) as an option. The AC voltages are distributed to the consumers via

bus bars. They are used for navigation and AFCS / Optional systems.

**Hydraulic System**

The hydraulic system is used to boost the manual control inputs of the pilot. Like in many helicopters, the main rotor system cannot be controlled without hydraulic assistance. For this reason the system is completely redundant for main rotor control.
For tail rotor control the yaw axis on versions C-2 and C-2e is designed as a simplex system and supplied by HYD system No. 2 only. The D-2 version features a duplex system.

*(EC145 / BK117 C-2 and C-2e)*
The system consists of;
- Two identical pressure supply systems (located on top of the cabin, in front of the main XMSN)
- Three main rotor actuators (MHA = Mechano Hydraulic Actuators / duplex type) for collective, lateral and longitudinal axis (located on top of the cabin, in front of the main XMSN)
- One Tail rotor actuator (MHA = Mechano Hydraulic Actuator (simplex type) located between the Tail rotor gearboxes
- Indicating and testing system (installed in the cockpit)

*(EC145 / BK117 D-2)*
The system consists of;
- Two identical pressure supply systems (located on top of the cabin, in front of the main XMSN)
- Three main rotor actuators (MHA = Mechano Hydraulic Actuators / duplex type) for collective, lateral and longitudinal axis (located on top of the cabin, in front of the main XMSN)
- Two Tail rotor (Fenestron) actuators (MHA = Mechano Hydraulic Actuators / duplex type) to control the yaw axis control. They are installed inside the stator hub of the Fenestron.
- Indicating and testing system (installed in the cockpit)

The hydraulic systems work with an operating pressure of approx. 105 bar and a return pressure of approx. 1.40 -- 1.75 bar. They use hydraulic fluid acc. MIL--H 5606 (F) standard.
The capacity of the systems varies between 1.0 and 1.4 liter.
The reservoirs have a capacity of approx. 0.8 l.
All systems are closed systems, so it is not possible to refill the system without a special tool.

## Instrument Panels

*(EC145 / BK117 C-2) digital CPDS cockpit with FCDS flight instrumentation*

*(EC145 / BK117 C-2e) digital CPDS cockpit with Garmin G500H flight instrumentation*

*(EC145 / BK117 D-2) digital HELIONIX cockpit and flight instrumentation system including AFCS*

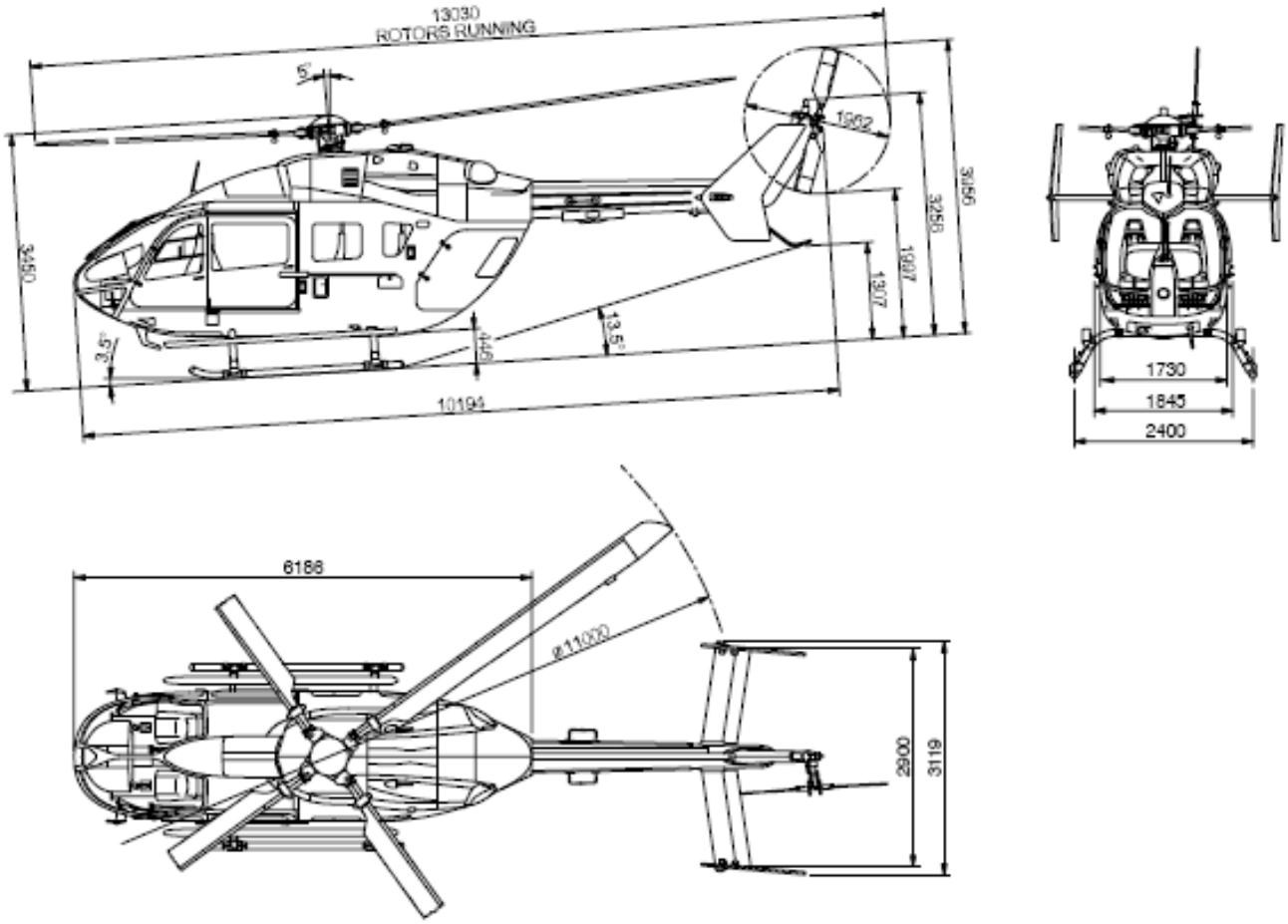
# 3. Helicopter main characteristics

## 3.1 Sum up of main characteristics of the EC145 (BK117)

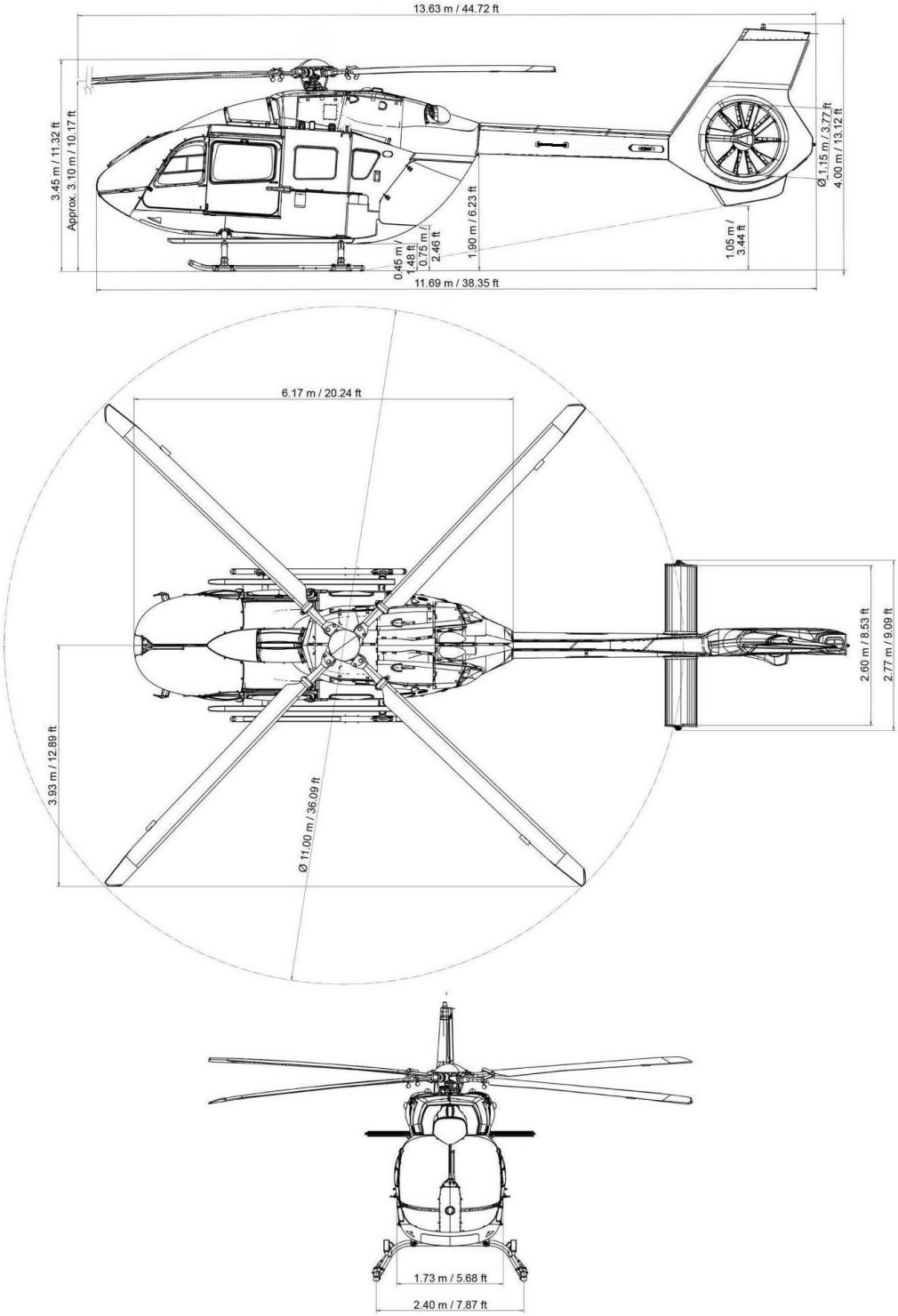
| *Reading mode; Column by column, from left to right side* ⟶ | | | C-2 | C-2e | D-2 |
|---|---|---|---|---|---|
| Dimensions | Fuselage | Length (Rotor turning) | 13,03 m | identical | 13,60 |
| | | Width | 1,85 m | identical | identical |
| | | Height (Rotor turning) | 3,96 m | identical | 4,00 m |
| | Main rotor | Diameter | 11,00 m | identical | identical |
| | Tail rotor | | 1,96 m | identical | (Fenestron) 1,15m |
| Engines | | | Turbomeca ARRIEL 1 E 2 | identical | Turbomeca ARRIEL 2 E |
| Fuel tanks | Capacity | | 694 kg | identical | 729 kg |
| Air Speed | PWR ON | Absolute VNE | 150 kt | identical | identical |
| | PWR OFF | | OEI = 110 kt AR = 90 kt | identical | identical |
| Rotor Speed (continuous operation) | Power ON | AEO | 100% - 4% / + 4% | identical | 100% - 4% / + 7% |
| | Autorotation | AEI | 100% - 15% / + 4% | identical | 100% -15% / + 9% |
| Maximum Operating | Pressure Altitude | | 18.000 ft | identical | 20.000 ft |
| MTOW with Internal load | | | 3585 kg | identical | 3650 kg |
| MTOW with external load | | | 3585 kg | identical | 3650 kg |
| Category A | Density Altitude | Clear Heliport | 12 000 ft | identical | identical |
| | | VTOL operations | 12 000 ft | identical | identical |

## 3.2 Exterior dimensions

*EC145 / BK117 C-2 and C-2e*



## *EC145 / BK117 D-2*



# 4. Operator Difference Requirement (ODR) Tables

Operator difference requirements are those operator specific requirements necessary to address differences between a base aircraft and one or more variants, when operating in mixed fleet flying, or when seeking credit in transition programs. ODRs include both a description of differences and a corresponding list of training, checking, and currency compliance methods which address pertinent OEB and regulatory requirements

Operator Difference Requirement tables have been produced by AIRBUS HELICOPTERS to evaluate through the OEB " EC145 (BK 117) C-2, C-2e and D-2" for Pilot Initial, Additional and Difference Training courses. *(See Appendix 4)*

# 5. Optional specific equipment

No optional equipment is provided requiring specific training according Part-FCL regulations at the time of the report.

# 6. Master Difference Requirement (MDR) Tables

## 6.1 Difference Level Summary

The Common Procedures Document (CPD) describes one acceptable method and guidelines for conducting an Operational Evaluation of an aircraft type or a variant certificated. As such the document offers an acceptable method for compliance with the intent of the applicable regulatory requirements.

The methods and guidelines presented in this document are not the only acceptable methods for ensuring compliance with the appropriate regulatory sections. Operators may use other methods if those methods will provide the necessary level of safety and are acceptable to the regulatory authority.

Difference levels are summarised in the table below for training, checking, and recent experience. This table is an extract only and complete descriptions of difference levels for training, checking and recent experience are given in OPS/FCL Common Procedures Document.

## 6.2 Training, Checking and Recurrent Training difference requirements table

The Common Procedures Document has been established basically for fixed wing evaluations, so it appears that adaptions and alleviations to comply with JAR-FCL and to PART-FCL regulation, specific elements dedicated to helicopter are necessary.

Numbers of regulatory OPS / FCL and operational aspects concern typically helicopter matters like:

- At least one hour flying time for Multi Engine type difference training
- No Helicopter Class Rating
- Limited number of available Flight Simulation Training Devices

OEB has concluded that the Master Differences Requirements for the " EC145 (BK 117) C-2, C2-e and D-2" are at the levels as shown in the table below:

| | | From Helicopter | | |
|---|---|---|---|---|
| | | **C-2** | **C-2e** | **D-2** |
| **To Helicopter** | **C-2** | N/A | D / A / D | D / D / D |
| | **C-2e** | A / A / A | N/A | D / D / D |
| | **D-2** | D / D / D | D / D / D | N/A |

The main elements which require level "D" difference training are the different cockpit and flight instrumentation systems, the engine control and tail rotor control differences and the four axis autopilot which is new in function and control in regard to C-2 or C-2e which result in different normal and emergency procedures.

# 7. Type Rating List and Licence Endorsement List

The proposal of this OEB is to update the Type Rating List and the Licence Endorsement List as following:

## 7.1 Type Rating List

- Table 9 / Type Rating List (Helicopters)

| 1<br>Manufacturer | 2<br>Helicopter | 3 | 4<br>Licence endorsement |
|---|---|---|---|
| **AIRBUS HELICOPTERS** | | | |
| *-ME Turbine-* | BK117 C-2 | (D) | EC145 (BK117) |
| | BK117 C-2e | | |
| | BK117 D-2 | | |

This table 9 matrix contains only Helicopters that have been evaluated through a JOEB, an OEB or a Catch-Up process. Associated reports are published on the EASA-Flight Standards Website and Pilot Training courses are available from the Manufacturers.

## 7.2 Licence Endorsement List

- Table 18 / Licence Endorsement List - Type Ratings (Helicopters)

| 1<br>Manufacturer | 2<br>Helicopter | 3 | 4<br>Licence endorsement |
|---|---|---|---|
| **AIRBUS HELICOPTERS** | | | |
| *-ME Turbine-* | BK117 A-3<br>BK117 A-4<br>BK117 B-1<br>BK117 B-2 | (D) | BK117 |
| | BK117 C-1 | | |

# 8. Specification for Training

## 8.1 General

The Type Rating Training courses proposed by AIRBUS HELICOPTERS Deutschland Training Academy for the " EC145 (BK 117) C-2, C2-e and D-2 fulfill the minimum requirements of EASA PART-FCL. This Training Academy provides a variety of training and conversion training courses.

The assessment is based on the aircraft Pilot Initial and Additional Type Rating Training syllabi, and as well the difference training between variants proposed by AIRBUS HELICOPTERS Deutschland Training Academy approved by LBA Germany and to Training courses from other European ATOs' already approved by their national Authorities.

OEB recommends Pilot training syllabi divided into the following phases for approval in Approved Training Organizations.

- Prerequisites for entry onto the specific course
- Theoretical knowledge instruction syllabus and test summary
- Helicopter flight training courses
- FSTD flight training courses (when available)
- Additional Synthetic Training Device instructions (i.e. Avionic Trainer, when available)
- Skill test

## 8.2 Course pre-entry requirements

For the issue of a first type rating for a single-pilot multi-engine helicopter, all students must fulfill the pre-entry requirements of the PART-FCL. 720.H(c)(1) or (2):

(c) Single pilot multi-engine helicopters.

An applicant for the issue of a first type rating for a Single pilot multi-engine helicopter shall:

(1) (i) have passed the ATPL(H) theoretical knowledge examinations; or
(ii) hold a certificate of completion of a preentry course conducted by an approved training organization. The course shall cover the following subjects of the ATPL(H) theoretical knowledge course.

(2) in the case of applicants who have not completed an integrated flying training course as ATPL(H)/IR, ATPL(H), or CPL(H)/IR, have completed at least 70 hours as pilot in command of helicopters.

## 8.3 Licensing requirements

The AMC 2 FCL.725 (a) of the PART-FCL requires for an initial issue of a SPH, ME (H) CS and FAR 27 and 29, an approved flight instruction of at least **8** flight hours in the helicopter or when using FTD 2/3, at least 4 hour in helicopter and at least 10 hours in total excluding skill test.
(See Appendix 2).

*Note:*
*These requirements have to be considered as the bare minimum, additional training could be necessary depending on :*

- *complexity of the aircraft type, handling characteristics, level of technology*
- *previous experience of the applicant*
- *availability and certifications of FSTDs.*

## 8.4 Initial, Additional Type Rating & Difference training courses

### 8.4.1 Initial Type Rating (ITR)

Candidates for the Initial EC145 / BK117 Type Rating must:

- Hold a valid Helicopter Pilot license,
- Hold a Single-Engine Piston / Turbine Pilot Type Rating
- Comply with the requirements set out in Part-FCL Subpart H – Section 1 & 3
- Have 70 Flight Hours as PIC
- In case of a PPL(H) license holder; hold a Multi Engines Turbine pre-entry course.

### 8.4.2 Additional Type Rating (ATR)

Candidates for an Additional EC145 / BK117 Type Rating must:

- Hold a valid Pilot license,
- Hold a Multi-Engine Turbine Pilot Type Rating
- Comply with the requirements set out in Part-FCL Subpart H – Section 1 & 3

### 8.4.3 Difference training courses in between variants:

| | | From Helicopter | | |
|---|---|---|---|---|
| | | **C-2** | **C-2e** | **D-2** |
| **To Helicopter** | **C-2** | - | **Δ 2** | **Δ 4** |
| | **C-2e** | Familiarisation Training | - | |
| | **D-2** | **Δ 1** | **Δ 3** | - |

**(Δ 1)** From **C-2** to **D-2** **(Δ 2)** From **C-2e** to **C-2**
**(Δ 3)** From **C-2e** to **D-2** **(Δ 4)** From **D-2** to **C-2** or **C-2e**

*Note:*
*Basic difference of version C-2 to C-2e is seen in different flight instrumentation only and may be adequately addressed through self-instruction and FLM reading, it is a familiarization training.*

*Basic difference of version C-2e to C-2 is seen in specified flight instrumentation (FCDS) which is commonly associated with an AFCS, thus requiring theoretical and practical instruction, it is a difference training.*

*Basic differences of versions C-2 and C-2e to version D-2 and vice versa are related to different cockpit and flight instrumentation system as well as engine control and tail rotor control differences which lead to different normal and emergency procedures, thus requiring theoretical and practical instructions.*

## 8.5 Initial, Additional & Difference training minimum syllabus summary

The tables below summarise the minimum training hours required for VFR:

- **Initial and Addition Type rating courses**

| VFR Courses | | Initial Type Rating | | | | | | Additional Type Rating | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Applying on: | | C-2 | | C-2e | | D-2 | | C-2 | | C-2e | | D2 | |
| Theoretical course (excl. exam) | Basic Helicopter | 24h | | 24h | | 30h | | 24h | | 24h | | 30h | |
| Exam | | 3h | | 3h | | 3h | | 3h | | 3h | | 3h | |
| Theoretical course (if applicable) | FCDS / Garmin | 5h | | 5h | | 3h | | 5h | | 5h | | 3h | |
| | HELIONIX / AVIONIQUE NOVELLES | 3h | | 3h | | 9h | | 3h | | 3h | | 9h | |
| | AFCS | (5h) | | | | 6h | | (5h) | | | | 6h | |
| | FMS / NAV | 5h | | 5h | | 5h | | 5h | | 5h | | 5h | |
| FSTD / SIM (as certified) | | | 6h | | 6h | | 7h | | 5h | | 5h | | 4h |
| Helicopter | | 8h | 4h | 8h | 4h | 9h | 4h | 6h | 3h | 6h | 3h | 8h | 4h |
| Total | | 8h | 10h | 8h | 10h | 9h | 11h | 6h | 8h | 6h | 8h | 8h | 8h |
| + Skill test | | required | | required | | required | | required | | required | | required | |

Table 1

*Note:*

1. *The flight training time for the additional type on a helicopter may be reduced by approximately 1 hour if the applicant is trained on an equivalent cockpit with FCDS / AFCS or HELIONIX cockpit and if the training helicopter represents such a AIRBUS HELICOPTER family cockpit.*
2. *(*) C-2e -> C-2 AFCS- If applicable-In table 2-This one flight hour flight training for AFCS is not necessary if the customer helicopter C-2 doesn`t have an AFCS (It`s possible to buy a C-2 without AFCS)*
3. *(*) D-2 -> C-2 / C-2e Theory AFCS, if the version has an AFCS, the theoretical training is 5h ( only C-2 ). If the version has no AFCS, the theoretical training is 1h ( C-2 or C-2e ),see tables 1 to 4.*
4. *(*) D-2 -> C-2 / C-2e AFCS – If applicable- This one hour flight training for AFCS is not necessary ( always valid for the C-2e ) if the customer helicopter C-2 doesn`t have an AFCS ( It`s possible to buy a C-2 without AFCS )*

- **Difference Training courses**

| VFR Courses | | Difference Courses | | | |
|---|---|---|---|---|---|
| | | **Δ 1** | **Δ 2** | **Δ 3** | **Δ 4** |
| FROM | | **C-2** | **C-2e** | **C-2e** | **D-2** |
| TO | | **D-2** | **C-2** | **D-2** | **C-2 / C-2e** |
| Theoretical course (no exam) | | 12h | | 12h | 12h |
| Theoretical course | FCDS / Garmin | 3h | 5h | 3h | 5h |
| | HELIONIX / AVIONIQUE NOUVELLES | 9h | | 9h | 5 |
| | AFCS | 5h | (5h) | 5h | (5h / 1h) |
| - if applicable - | FMS / NAV | (2h) | | (2h) | (2h) |
| Helicopter | | 3.5h | - | 3.5h | 3.5h |
| AFCS -if applicable- | | 1h | (1h) | 1h | (1h) |
| + Skill test | | N/A | N/A | N/A | N/A |

Table 2

## 8.6 Theoretical knowledge syllabus and test summary

### 8.6.1 Initial and Additional Type Rating

Theoretical instruction should be provided in accordance with Part-FCL, Subpart H – Section 1
The following sections present a summary of the material which an Initial Type Rating training program should consider. Whilst based on the AIRBUS HELICOPTERS programs, Training providers should ensure their type specific courses cover the pertinent material.

*Note:*
*If an initial type rating for a turbine powered aircraft is required, the candidate must first undergo a turbine engine course.*

| **Theoretical knowledge for Initial and Additional Type Rating Syllabus** | | **C-2** | **C-2e** | **D-2** |
|---|---|---|---|---|
| Helicopter structure, transmissions, rotors and equipment, normal and abnormal operation of the systems, analogue flight instruments | | 15h | 15h | 17h |
| Limitations (*) | | 3h | 3h | 3h |
| Performance, flight planning and monitoring | | 2h | 2h | 3h |
| Weight and balance, servicing | | 1h | 1h | 3h |
| Emergency procedures (**) | | 3h | 3h | 4h |
| Special requirements for helicopters fitted commonly with; -if applicable- | FCDS / Garmin | 5h | 5h | 3h |
| | HELIONIX / AVIONIQUE NOVELLES | 3h | 3h | 9h |
| | AFCS | (5h) | | 6h |
| | FMS / NAV | (5h) | (5h) | (5h) |
| Optional equipment | | In addition | In addition | In addition |
| **TOTAL THEORETICAL KNOWLEDGE SYLLABUS** | | **42h** | **37h** | **53h** |
| Theoretical examination session | | 3h | 3h | 3h |
| **TOTAL** | | **45h** | **40h** | **56h** |

Table 3

(*) *basic FLM limitations, without OPT limits*

(**) *basic theoretical instruction elements are covered during the ground training course but all FLM Emergency procedures will be briefed during flight training briefing phase.*

On completion of the theoretical knowledge training, the trainee is assessed via a multiple-choice questionnaire, a minimum of 50 questions is recommended. The test is covering the program for total theoretical knowledge syllabus. To obtain the type rating, the threshold for passing is 75% of correct answers in the written examination on a range of multiple choice or computerized questions.

### 8.6.2 Difference training courses in between variants

Theoretical instruction should be provided in accordance with Part-FCL by considering the previous experience of the applicant.

| **Theoretical knowledge for difference training in between variants** | | **Δ 1** | **Δ 2** | **Δ 3** | **Δ 4** |
|---|---|---|---|---|---|
| | FROM | **C-2** | **C-2e** | **C-2e** | **D-2** |
| | TO | **D-2** | **C-2** | **D-2** | **C-2 / C-2e** |
| Helicopter structure, transmissions, rotors and equipment, normal and abnormal operation of the systems, analogue flight instruments | | 6h | | 6h | 6h |
| Limitations (*) | | 1h | | 1h | 1h |
| Performance, flight planning and monitoring | | 1h | | 1h | 1h |
| Weight and balance, servicing | | 1h | | 1h | 1h |
| Emergency procedures (**) | | 3h | | 3h | 3h |
| Special requirements for helicopters fitted commonly with; -if applicable- | FCDS / Garmin | 3h | 5h | 3h | 5h |
| | HELIONIX / AVIONIQUE NOVELLES | 9h | | 9h | 5h |
| | AFCS | 5h | (5h) | 5h | (5h/1h) |
| | FMS / NAV | (2h) | | (2h) | (2h) |
| Optional equipment | | In addition | In addition | In addition | In addition |
| **TOTAL THEORETICAL KNOWLEDGE SYLLABUS** | | **29h** | **10h** | **29h** | **29h / 25h** |
| Theoretical examination session | | -- | -- | -- | -- |

Table 4

(*) *basic FLM limitations, without Optional Equipment limits*

(**) *basic theoretical instruction elements are covered during the ground training course but all FLM Emergency procedures will be briefed during flight training briefing phase.*

## 8.7 Flight training course summary (VFR)

### 8.7.1 Initial Type Rating (ITR)

| Initial MEH / VFR Type Rating (ITR) | | | | | | |
|---|---|---|---|---|---|---|
| | C-2 or C-2e | | | D-2 | | |
| **Helicopter & Flight Simulation Training Device** (as Qualified) | FTD or FFS and Helicopter | | Helicopter only | FTD or FFS and Helicopter | | Helicopter only |
| | FTD or FFS | Heli | | FTD or FFS | Heli | |
| **Normal Procedures**<br>Pre-flight, cockpit, engine start, Shut down, Hover Maneuvers | 1h | 1h | 1.5h | 2h | 1h | 2h |
| Traffic circuits,<br>normal and steep take-offs and landings | | | | | | |
| Advanced flight maneuvers like;<br>Characteristics of rigid rotors, Quick stop, steep turn, max cruise and never exceed speed, HOGE | | | | | | |
| Operational take off / landing like;<br>Slope and crosswind take-offs and landings | | | | | | |
| **Emergency Procedures**<br>OEI during cruise,<br>Clear Area CAT A take off and landing AEO and OEI training procedures | 2.75h | 1.5h | 3.25h | 3h | 1h | 3h |
| Autorotation from higher altitudes with demo of rotor characteristics and warnings | | | | | | |
| Autorotation with power recovery | | | | | | |
| Tail rotor failure / tail rotor control failure | | | | | | |
| Governor or FADEC failures (as applicable) | | | | | | |
| **Flight with Max Gross Mass**<br>Hover, limited power take off and landing, steep take offs and landings, OEI procedures | 0.5h | | 0.5h | | | 0.5h |
| **Repetition**<br>Normal and emergency procedures | 0.5h | 0.5h | 0.5h | 0.5h | 1h | 0.5h |
| **Additional equipment training**<br>COM/NAV system, Training mode, and FCDS / G500H / HELIONIX / AFCS (VFR), | 1.25h | 1h | 2.25h | 1.5h | 1h | 3h |
| **Total Flight Training** | **10h** | | **8h** | **11h** | | **9** |
| **Skill Test**<br>*In accordance with Part FCL Appendix 9* | required | | required | required | | required |

Table 5

*Note:*
*During the flight "1", the Type Rating Instructor will evaluate the trainee level.*

*The flight training course corresponds to the basic aircraft certification and satisfies the conditions of Part FCL, Section H, taking into account the type of license held and the experience of the candidate.*

*Each helicopter flight session could be extended or reduced by 15 minutes at the discretion of the instructor. Additional flight could be necessary at the discretion of the instructor if the trainee has not successfully demonstrated the ability to perform all maneuvers with a high degree of proficiency.*

*Depending on the configuration of the aircraft used and on customer's request, additional flights may also be performed to enhance basic initial type rating training (minimum syllabus).*

### 8.7.2 Additional Type Rating (ATR)

| Additional MEH / VFR Type Rating (ATR) | | | | | | |
|---|---|---|---|---|---|---|
| | C-2 or C-2e | | | D-2 | | |
| **Helicopter & Flight Simulation Training Device** (as Qualified) | FTD or FFS and Helicopter | | Helicopter only | FTD or FFS and Helicopter | | Helicopter only |
| | FTD or FFS | Heli | | FTD or FFS | Heli | |
| **Normal Procedures** Pre-flight, cockpit, engine start, Shut down, Hover Maneuvers | 0.75h | 0.25h | 1h00 | 1h | 1h | 2h |
| Traffic circuits, normal and steep take-offs and landings | | | | | | |
| Advanced flight maneuvers like; Characteristics of rigid rotors, Quick stop, steep turn, max cruise and never exceed speed, HOGE | | | | | | |
| Operational take off / landing like; Slope and crosswind take-offs and landings | | | | | | |
| **Emergency Procedures** OEI during cruise, Clear Area CAT A take off and landing AEO and OEI training procedures | 2h | 1.25h | 2h15 | 1.5h | 1h | 2h |
| Autorotation from higher altitudes with demo of rotor characteristics and warnings | | | | | | |
| Autorotation with power recovery | | | | | | |
| Tail rotor failure / tail rotor control failure | | | | | | |
| Governor or FADEC failures (as applicable) | | | | | | |
| **Flight with Max Gross Mass** Hover, limited power take off and landing, steep take offs and landings, OEI procedures | 0.5h | | 0.5h | 0.5h | | 0.5h |
| **Repetition** Normal and emergency procedures | 0.5h | 0.5h | 0.75h | | 1h | 0.5h |
| **Additional equipment training** COM/NAV system, Training mode ops, and FCDS / G500H / HELIONIX / AFCS (VFR ops), | 1.25h | 1h | 1.5h | 1h | 1h | 3h |
| **Total Flight Training** | **8h** | | **6h** | **8h** | | **8h** |
| **Skill Test** *In accordance with Part FCL Appendix 9* | required | | required | required | | required |

Table 6

*Note:*
*The flight training time for the additional type on a helicopter may be reduced by approximately 1 hour if the applicant is trained on an equivalent cockpit with FCDS / AFCS or HELIONIX cockpit and if the training helicopter represents such a AIRBUS HELICOPTERS family cockpit.*

### 8.7.3 Difference training

| Difference Training | | | | | |
|---|---|---|---|---|---|
| | | Δ 1 | Δ 2 | Δ 3 | Δ 4 |
| FROM | | C-2 | C-2e | C-2e | D2 |
| TO | | D-2 | C-2 | D-2 | C-2 / C-2e |
| **Helicopter and / or Flight Simulation Training Device** (as Qualified) | | FTD / FFS and / or Helicopter | FTD / FFS or Helicopter | FTD / FFS and / or Helicopter | FTD / FFS and / or Helicopter |
| **Normal Procedures** Pre-flight, cockpit, engine start, Shut down, T/O & LDG | | 1.5h | | 1.5h | 1.5h |
| **Emergency Procedures** OEI during cruise, landing and takeoff, Governor / FADEC malfunctions | | 1.5h | | 1.5h | 1.5h |
| Special requirements for helicopters commonly fitted with; -if applicable- | FCDS / GARMIN | | | | 0.5h |
| | HELIONIX / AVIONIQUE NOVELLES | 0.5h | | 0.5h | |
| | AFCS | 1h | 1h | 1h | 1h |
| | FMS / NAV | | | | |
| **Total Flight Training** | | **4.5h** | **1h** | **4.5h** | **4.5h** |
| **Skill Test** *In accordance with Part FCL Appendix 9* | | Not required | Not required | Not required | Not required |

Table 7

*Note:*
*The total flight time for* **Δ 1, Δ 3,** or **Δ 4** *may be individually divided between FSTD and helicopter but must include at least 1hour flight time on a helicopter.*

For Difference training, flight instruction should be provided in accordance with Part FCL. The previous experience of the applicant should be considered and the extent of the training should be based upon these minimum training syllabi.

Special requirements, if applicable - FCDS, AFCS, FMS / NAV and HELIONIX training means;
Only for applicants which do not have previous experience with these systems. The additional time represents training for VFR operations only.

After completing the training on the aircraft considered, the accomplishment is recorded on the applicant's flight log and signed by the TRI/FI.

### 8.7.4 "CAT A" Training, for initial and additional VFR Type Rating

For Operations in hostile and congested environment CAT.A profiles have to be used. Such requirements are an addition to the standard type rating course or may be taught as an individual course

| Cat A procedure Training | | |
|---|---|---|
| | **C-2** or **C-2e** | **D-2** |
| Theoretical course | 6h | 6h |
| **Helicopter or Flight Simulation Training Device** (as Qualified) | FTD / FFS or Helicopter | FTD / FFS or Helicopter |
| **CAT A procedures** All Take-off and landing, Clear Heliport, VTOL-Surface level or elevated heliport, Short field and Confined heliport AEO and OEI procedures | 2h | 2h |
| **Total Flight Training** | **2h** | **2h** |
| **Skill Test** | not required | not required |

Table 8

### 8.7.5 Instrument Rating Extension to:

Initial and Additional MEH - IR Rating

| IR Extension Courses | Initial MEH Type Rating | | Additional MEH Type Rating | |
|---|---|---|---|---|
| Applying on | **EC145 (BK117)** | | **EC145 (BK117)** | |
| Theoretical course | 6h | | 6h | |
| | | | | |
| FTD or FFS (as qualified) | | 5h | | 5h |
| Helicopter | 5h | | 5h | |
| **Total Minimum Flight Training** (FTD / FFS or helicopter) | **5h** | | **5h** | |
| **Skill Test** *In accordance with Part FCL Appendix 9* | As Required | | As Required | |

Table 9

IR extension training courses are detailed and based on AIRBUS HELICOPTERS Deutschland Training Academy syllabus (See Appendix 3)

## 8.8 Training area of special emphasis (TASE)

The OEB recommends the Training Organizations to put particular emphasis for the correct use of:

- OEI Training and limitations, WAT chart and correct take-off / landing profiles
- Manual engine operations (Governor or FADEC malfunctions)
- Tail rotor failure procedures (depending on versions)

Furthermore for the FCDS / AFCS and HELIONIX cockpit, while it is considered to have high level of automatism, to pay particular attention to the correct use of

- ICP (Instrument Control Panel)
- Flight Control displays, settings and emergencies
- AFCS operation, especially upper modes and limitations;
- VFR/IFR approach procedures and limitations;
- GA procedures;
- GARMIN 500/750 operation

OEI Training

C-2/C-2e correct adjustment of the training mode device before every procedure flown.

D-2 never mix the OEI training mode with the FADEC EMER mode.

Limitations

C-2/C-2e if a HUMS system is installed, only certain limitation exceeding(s) are recorded.

D-2 almost any data are recorded inside HELIONIX, DATA RECORDING DEVICE(S) and FADECS.

Performance

C-2/C-2e in regard to the CAT.A certification of these variants the pilots need to learn under which performance conditions the helicopter operates in regard to performance class 1.

D-2 in regard to the CAT.A certification of this variant the pilots need to learn under which performance conditions the helicopter operates in regard to the performance classes. Additionally the focus of the training lies in the changed FLI indication and the slightly changed philosophy in regard to the FLI of the C2/C2e (Blue Line) to determine performance class1 capability

Take-off and landing profiles

The goal is to establish a confidence for new pilots, in regard to engine failures during take-offs and landings. There is always a safe way of landing or fly away after an actual engine failure. In order to achieve this, all the procedures should be instructed as close as possible to the CAT.A profiles, even for operators which are operating only/partially under CAT.B operation. During the type rating training for normal take-off and landing profiles the instructors should set the main focus to the different take-off and landing profiles as described in the FLM's. Different angles for C-2/C-2e and the D-2.

Tail rotor failures

The analysis to perform a fixed pedal, pedal off or power-off autorotation landing is the key factor to perform the correct decision after a tail-rotor/pedal emergency. Due to different tail-rotor systems (C2/C2e – conventional tail rotor design, D2 – Fenestron ® type tail rotor) and the installed/not installed stabilization / autopilot systems, the theoretical knowledge and practical training as far as possible of both systems, must be off absolute comprehension. Only the correct decision leads to a safe landing.
A simulator is not always available for training and refreshing those failures.

# 9. Specification for Testing, Checking, Currency & Recent experience

## 9.1 Skill test

As required by Part-FCL Appendix 9

## 9.2 Proficiency Checks

**9.2.1** As required by Part-FCL Appendix 9

**9.2.2** A Skill/Proficiency check for TRI-IR (FCL.625.H (IR) after an initial, additional or difference type rating and/or as a revalidation or renewal FCL.740 a) or b) shall always be conducted on the variant for which the IR rating is to be intended to be used. Meaning, one may not perform a Skill or Proficiency Check on one variant and extend the IR rating on a different variant.

## 9.3 Currency Requirements

The main differences between the Variants are the indicating systems, FCDS, GARMIN or Helionix, the engine control systems, “Twist grip + VARTOMS” or FADEC and the existence or absence of an autopilot system. Therefore AHD recommends, that Pilots which have not flown for more than 12 months on the variant intended to fly on, should be refreshed in regard to the difference training table shown under 8.6.2. of this OEB report. Nevertheless, the minimum should always be at least one day theoretical refresher training and a minimum of one flight hour, covering normal and emergency procedures, before performing any mission or check flight. This refresher training should always be performed within an approved training organization.

The OEB recommend the following proposal:

To improve standardization the manufacturer recommends ATO’s which are performing flight training with helicopters mentioned within this OEB report, to standardize at least ones every 24 to 36 months their chief flight instructor pilots at the ATO-AIRBUS HELICOPTERS Deutschland (ATO-AHD), or at other by the ATO-AHD approved training organizations.

### 9. 4 Recent Experience Requirements

Recent experience as required by Air Crew and Air Operations regulation.

# 10. Specification for Flight Simulation Training Devices

When this report has been finalized there have been only a few FSTDs available qualified in accordance with JAR-FSTD (H) and compliant with EASA requirements.

# 11. Application of OEB report

This OEB report applies to commercial operations. However, the OEB also recommends private or corporate operations to follow the findings of this report.

# 12. Appendixes

Will be available with the final report