



**CHAPTER 2.4**

**AEROPLANE INSTRUMENTS,  
EQUIPMENT  
AND FLIGHT DOCUMENTS**

*Note.— Specifications for the provision of aeroplane communication and navigation equipment are contained in Chapter 2.5.*

**2.4.1 General**

In addition to the minimum equipment necessary for the issuance of a certificate of airworthiness, the instruments, equipment and flight documents prescribed in the following paragraphs shall be installed or carried, as appropriate, in aeroplanes according to the aeroplane used and to the circumstances under which the flight is to be conducted. The prescribed instruments and equipment, including their installation, shall be acceptable to the State of Registry.

**2.4.2 Aeroplanes on all flights**

2.4.2.1 An aeroplane shall be equipped with instruments which will enable the flight crew to control the flight path of the aeroplane, carry out any required procedural manoeuvres and observe the operating limitations of the aeroplane in the expected operating conditions.

2.4.2.2 An aeroplane shall be equipped with:

- a) an accessible first-aid kit;
- b) portable fire extinguishers of a type which, when discharged, will not cause dangerous contamination of the air within the aeroplane. At least one shall be located in:
  - 1) the pilot's compartment; and
  - 2) each passenger compartment that is separate from the pilot's compartment and that is not readily accessible to the flight crew;

*Note.— Refer to 2.4.2.3 for fire extinguishing agents.*



- c) 1) a seat or berth for each person over an age to be determined by the State of Registry; and  
2) a seat belt for each seat and restraining belts for each berth;
- d) the following manuals, charts and information:
- 1) the flight manual or other documents or information concerning any operating limitations prescribed for the aeroplane by the certificating authority of the State of Registry, required for the application of Chapter 2.3;
  - 2) current and suitable charts for the route of the proposed flight and all routes along which it is reasonable to expect that the flight may be diverted;
  - 3) procedures, as prescribed in **Annex 2**, for pilots-in-command of intercepted aircraft;
  - 4) visual signals for use by intercepting and intercepted aircraft, as contained in **Annex 2**; and
  - 5) the journey log book for the aeroplane;
- e) where the aeroplane is fitted with fuses that are accessible in flight, spare electrical fuses of appropriate ratings for replacement of those fuses.
- 2.4.2.3 Any agent used in a built-in fire extinguisher for each lavatory disposal receptacle for towels, paper or waste in an aeroplane for which the individual certificate of airworthiness is first issued on or after 31 December 2011 and any extinguishing agent used in a portable fire extinguisher in an aeroplane for which the individual certificate of airworthiness is first issued on or after 31 December 2016 shall:
- a) meet the applicable minimum performance requirements of the State of Registry; and
  - b) not be of a type listed in the 1987 *Montreal Protocol on Substances that Deplete the Ozone Layer* as it appears in the Eighth Edition of the *Handbook for the Montreal Protocol on Substances that Deplete the Ozone Layer*, Annex A, Group II.

*Note.— Information concerning extinguishing agents is contained in the UNEP Halons Technical Options Committee Technical Note No. 1 – New Technology Halon Alternatives and FAA Report No. DOT/FAA/AR-99-63, Options to the Use of Halons for Aircraft Fire Suppression Systems.*

2.4.2.4 *RESERVED.*

2.4.2.5 *RESERVED.*

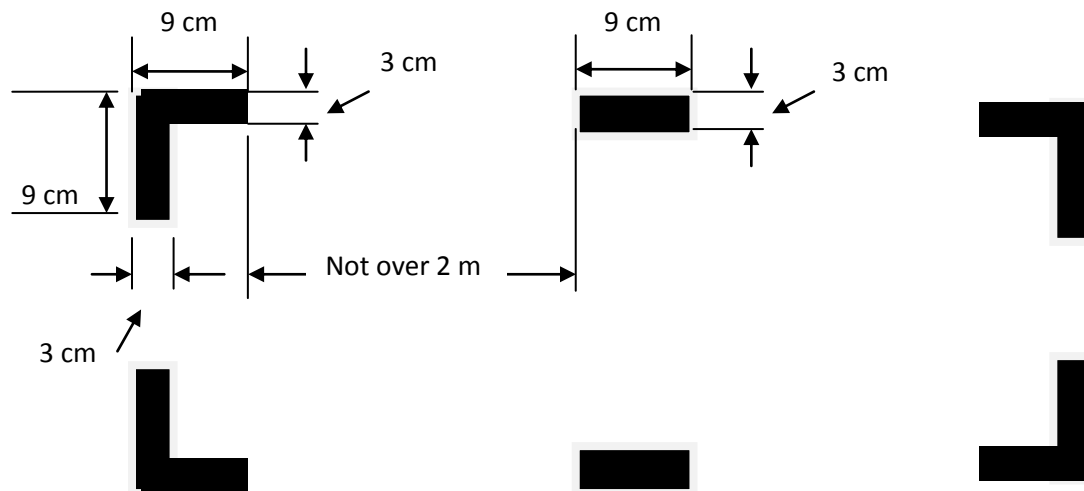
*Note.*— Safety harness includes shoulder strap(s) and a seat belt which may be used independently.

2.4.2.6 Marking of break-in points

2.4.2.6.1 If areas of the fuselage suitable for break-in by rescue crews in emergency are marked on an aeroplane such areas shall be marked as shown below (see figure following). The colour of the markings shall be red or yellow, and if necessary they shall be outlined in white to contrast with the background.

2.4.2.6.2 If the corner markings are more than 2 m apart, intermediate lines  $9\text{ cm} \times 3\text{ cm}$  shall be inserted so that there is no more than 2 m between adjacent markings.

*Note.*— This Standard does not require any aeroplane to have break-in areas.



MARKING OF BREAK-IN POINTS (see 2.4.2.6)



### **2.4.3 Aeroplanes operated as VFR flights**

2.4.3.1 Aeroplanes when operated as VFR flights shall be equipped with:

- a) a means of measuring and displaying:
  - 1) magnetic heading;
  - 2) the time in hours, minutes and seconds;
  - 3) pressure altitude;
  - 4) indicated airspeed; and
- b) such additional equipment as may be prescribed by the appropriate authority.

2.4.3.2 RESERVED

### **2.4.4 Aeroplanes on flights over water**

2.4.4.1 Seaplanes

Seaplanes for all flights shall be equipped with:

- a) one life jacket, or equivalent individual floatation device, for each person on board, stowed in a position readily accessible from the seat or berth;
- b) equipment for making the sound signals prescribed in the International Regulations for Preventing Collisions at Sea, where applicable;
- c) one anchor; and
- d) one sea anchor (drogue), when necessary to assist in manoeuvring.

*Note.*— “Seaplanes” includes amphibians operated as seaplanes.

**2.4.4.2 RESERVED**

### **2.4.4.3 Aeroplanes on extended flights over water**

2.4.4.3.1 All aeroplanes operated on extended flights over water shall be equipped with, at a minimum, one life jacket or equivalent individual floatation device for each person on board, stowed in a position easily accessible from the seat or berth of the person for whose use it is provided.

2.4.4.3.2 The pilot-in-command of an aeroplane operated on an extended flight over water shall determine the risks to survival of the occupants of the aeroplane in the event of a ditching. The pilot-in-command shall take into account the operating environment and conditions such as, but not limited to, sea state



and sea and air temperatures, the distance from land suitable for making an emergency landing, and the availability of search and rescue facilities. Based upon the assessment of these risks, the pilot-in-command shall, in addition to the equipment required in 2.4.4.3.1, ensure that the aeroplane is equipped with:

- a. life-saving rafts in sufficient numbers to carry all persons on board, stowed so as to facilitate their ready use in emergency, provided with such life-saving equipment, including means of sustaining life, as is appropriate to the flight to be undertaken; and
- b. equipment for making the distress signals described in Annex 2.

#### **2.4.5 Aeroplanes on flights over designated land areas**

Aeroplanes, when operated across land areas which have been designated by the State concerned as areas in which search and rescue would be especially difficult, shall be equipped with such signalling devices and life-saving equipment (including means of sustaining life) as may be appropriate to the area overflown.

#### **2.4.6 Aeroplanes on high altitude flights**

2.4.6.1 Aeroplanes intended to be operated at high altitudes shall be equipped with oxygen storage and dispensing apparatus capable of storing and dispensing the oxygen supplies required in 2.2.3.8.

2.4.6.2 Aeroplanes for which the individual certificate of airworthiness is first issued on or after 1 January 1990 Pressurized aeroplanes intended to be operated at flight altitudes at which the atmospheric pressure is less than 376 hPa shall be equipped with a device to provide positive warning to the flight crew of any dangerous loss of pressurization.

2.4.6.3 Aeroplanes for which the individual certificate of airworthiness was first issued before 1 January 1990

**Recommendation.**— *Pressurized aeroplanes intended to be operated at flight altitudes at which the atmospheric pressure is less than 376 hPa should be equipped with a device to provide positive warning to the flight crew of any dangerous loss of pressurization.*

#### **2.4.7 Aeroplanes operated in accordance with the instrument flight rules**

Aeroplanes when operated in accordance with the instrument flight rules, or when the aeroplane cannot be maintained in a desired attitude without reference to one or more flight instruments, shall be equipped with:



- a) a means of measuring and displaying:
- 1) magnetic heading (standby compass);
  - 2) the time in hours, minutes and seconds;
  - 3) pressure altitude;
  - 4) indicated airspeed, with a means of preventing malfunctioning due to either condensation or icing;
  - 5) turn and slip;
  - 6) aircraft attitude; and
  - 7) stabilized aircraft heading;

*Note.— The requirements of 5), 6) and 7) may be met by combinations of instruments or by integrated flight director systems provided that the safeguards against total failure, inherent in the three separate instruments, are retained.*

- 8) whether the supply of power to the gyroscopic instruments is adequate;
  - 9) the outside air temperature;
  - 10) rate-of-climb and descent; and
- b) such additional instruments or equipment as may be prescribed by the appropriate authority.

#### **2.4.8 Aeroplanes when operated at night**

Aeroplanes, when operated at night, shall be equipped with:

- a) the equipment specified in 2.4.7; and
- b) the lights required by Annex 2 for aircraft in flight or operating on the movement area of an aerodrome;

*Note.— Specifications for lights meeting the requirements of Annex 2 for navigation lights are contained in Appendix 2.1. The general characteristics of lights are specified in Annex 8. Detailed specifications for lights meeting the requirements of Annex 2 for aircraft in flight or operating on the movement area of an aerodrome are contained in the Airworthiness Manual (Doc 9760).*

- c) a landing light;
- d) illumination for all flight instruments and equipment that are essential for the safe operation of the aeroplane that are used by the flight crew;
- e) lights in all passenger compartments; and
- f) an independent portable light for each crew member station.



**2.4.9 Aeroplanes complying with the noise certification Standards in Annex 16, Volume I**

An aeroplane shall carry a document attesting noise certification.

*Note.— The attestation may be contained in any document, carried on board, approved by the State of Registry.*

**2.4.10 Mach number indicator**

Aeroplanes with speed limitations expressed in terms of Mach number shall be equipped with a means of displaying Mach number.

**2.4.11 Aeroplanes required to be equipped with ground proximity warning systems (GPWS)**

2.4.11.1 All turbine-engined aeroplanes of a maximum certificated take-off mass in excess of 5 700 kg or authorized to carry more than nine passengers shall be equipped with a ground proximity warning system which has a forward-looking terrain avoidance function.

2.4.11.2 RESERVED

2.4.11.3 RESERVED

2.4.11.4 A ground proximity warning system shall provide automatically a timely and distinctive warning to the flight crew when the aeroplane is in potentially hazardous proximity to the earth's surface.

2.4.11.5 A ground proximity warning system shall provide, at a minimum, warnings of at least the following circumstances:

- a) excessive descent rate;
- b) excessive altitude loss after take-off or go-around; and
- c) unsafe terrain clearance.

2.4.11.6 RESERVED

2.4.11.7 A ground proximity warning system installed in turbine-engined aeroplanes of a maximum certificated takeoff mass in excess of 5 700 kg or authorized to carry more than nine passengers for which the individual certificate of airworthiness was first issued after 1 January 2011 shall provide, as a minimum, warnings of at least the following circumstances:

- a) excessive descent rate;
- b) excessive terrain closure rate;



- c) excessive altitude loss after take-off or go-around;
- d) unsafe terrain clearance while not in landing configuration;
  - 1) gear not locked down;
  - 2) flaps not in a landing position; and
- e) excessive descent below the instrument glide path.

#### **2.4.12 Emergency locator transmitter (ELT)**

2.4.12.1 **Recommendation.**— *All aeroplanes should carry an automatic ELT.*

2.4.12.2 Except as provided for in 2.4.12.3, from 1 July 2008, all aeroplanes shall be equipped with at least one ELT of any type.

2.4.12.3 All aeroplanes for which the individual certificate of airworthiness is first issued after 1 July 2008 shall be equipped with at least one automatic ELT.

2.4.12.4 ELT equipment carried to satisfy the requirements of 2.4.12.1, 2.4.12.2 and 2.4.12.3 shall operate in accordance with the relevant provisions of Annex 10, Volume III.

*Note.*— *The judicious choice of numbers of ELTs, their type and placement on aircraft, and associated floatable life support systems, will ensure the greatest chance of ELT activation in the event of an accident for aircraft operating over water or land, including areas especially difficult for search and rescue. Placement of transmitter units is a vital factor in ensuring optimal crash and fire protection. The placement of the control and switching devices (activation monitors) of automatic fixed ELTs and their associated operational procedures will also take into consideration the need for rapid detection of inadvertent activation and convenient manual switching by crew members.*

#### **2.4.13 Aeroplanes required to be equipped with a pressure-altitude reporting transponder**

2.4.13.1 Aeroplanes shall be equipped with a pressure-altitude reporting transponder which operates in accordance with the relevant provisions of Annex 10, Volume IV.

2.4.13.2 Unless exempted by the appropriate authorities, aeroplanes operating as VFR flights shall be equipped with a pressure-altitude reporting transponder which operates in accordance with the relevant provision of Annex 10, Volume IV.

*Note.*— *These provisions are intended to support the effectiveness of ACAS as well as to improve the effectiveness of air traffic services.*





#### **2.4.14 Microphones**

**Recommendation.**— *When operating under the instrument flight rules all flight crew members required to be on flight deck duty should communicate through boom or throat microphones below the transition level/altitude.*

#### **2.4.15 Aeroplanes equipped with head-up displays (HUD) and/or enhanced vision systems (EVS)**

Where aeroplanes are equipped with HUD and/or EVS, the use of such systems to gain operational benefits shall be approved by the State of Registry.

*Note.*— *Guidance on HUD and EVS is contained in Attachment J to Annex 6, Part I.*

#### **2.4.16 Flight recorders**

*Note 1.*— *Crash protected flight recorders comprise one or more of the following systems: a flight data recorder (FDR), a cockpit voice recorder (CVR), an airborne image recorder (AIR) and/or a data link recorder (DLR). Image and data link information may be recorded on either the CVR or the FDR.*

*Note 2.*— *Lightweight flight recorders comprise one or more of the following systems: an aircraft data recording system (ADRS), a cockpit audio recording system (CARS), an airborne image recording system (AIRS) and/or a data link recording system (DLRS). Image and data link information may be recorded on either the CARS or the ADRS.*

*Note 3.*— *Detailed guidance on flight recorders is contained in Appendix 2.3.*

##### **2.4.16.1 Flight data recorders and aircraft data recording systems**

*Note 1.*— *FDR and AIR performance requirements are as contained in the EUROCAE ED-112, Minimum Operational Performance Specification (MOPS) for Crash Protected Airborne Recorder Systems, or equivalent documents.*

*Note 2.*— *ADRS performance requirements are as contained in the EUROCAE ED-155, Minimum Operational Performance Specification (MOPS) for Lightweight Flight Recording Systems, or equivalent documents.*

*Note 3.*— *Parameters to be recorded are listed in Tables 2.3-1 and 2.3-3 of Appendix 2.3.*

##### **2.4.16.1.1 Types**

2.4.16.1.1.1 Types I and IA FDRs shall record the parameters required to determine accurately the aeroplane flight path, speed, attitude, engine power, configuration and operation.



2.4.16.1.1.2 Type II FDRs shall record the parameters required to determine accurately the aeroplane flight path, speed, attitude, engine power and configuration of lift and drag devices.

#### 2.4.16.1.2 Operation

*Note.*— Airborne image recorders classification is defined in 4.1 of Appendix 2.3.

2.4.16.1.2.1 **Recommendation.**— All turbine-engined aeroplanes of a maximum certificated take-off mass of 5 700 kg or less for which the individual certificate of airworthiness is first issued on or after 1 January 2016 should be equipped with:

- a) a Type II FDR; or
- b) a Class C AIR capable of recording flight path and speed parameters displayed to the pilot(s); or
- c) an ADRS capable of recording the essential parameters defined in Table 2.3-3 of Appendix 2.3.

2.4.16.1.2.2 All aeroplanes for which the application for type certification is submitted to a Contracting State on or after 1 January 2016, and which are required to be fitted with an FDR, shall record the following parameters at a maximum recording interval of 0.125 seconds:

— Pilot input and/or control surface position – primary controls (pitch, roll, yaw).

*Note 1.*— For aeroplanes with control systems in which movement of a control surface will back drive the pilot's control, "or" applies. For aeroplanes with control systems in which movement of a control surface will not back drive the pilot's control, "and" applies. In aeroplanes with independent moveable surfaces, each surface needs to be recorded separately. In aeroplanes with independent pilot input on primary controls, each pilot input on primary controls needs to be recorded separately.

*Note 2.*— "The application for type certification that is submitted to a Contracting State" refers to the date of application of the original "Type Certificate" for the aeroplane type, not the date of certification of particular aeroplane variants or derivative models.

#### 2.4.16.1.3 Discontinuation

2.4.16.1.3.1 The use of engraving metal foil FDRs shall be discontinued.

2.4.16.1.3.2 **Recommendation.**— The use of analogue FDRs using frequency modulation (FM) should be discontinued.



2.4.16.1.3.3 The use of analogue FDRs using frequency modulation (FM) shall be discontinued by 1 January 2012.

2.4.16.1.3.4 The use of photographic film FDRs shall be discontinued.

2.4.16.1.3.5 **Recommendation.**— *The use of magnetic tape FDRs should be discontinued by 1 January 2011.*

2.4.16.1.3.6 The use of magnetic tape FDRs shall be discontinued by 1 January 2016.

#### 2.4.16.1.4 Duration

All FDRs shall be capable of retaining the information recorded during at least the last 25 hours of their operation.

#### 2.4.16.2 Cockpit voice recorders and cockpit audio recording systems

*Note 1.— CVR performance requirements are as contained in the EUROCAE ED-112 Minimum Operational Performance Specification (MOPS) for Crash Protected Airborne Recorder Systems, or equivalent documents.*

*Note 2.— CARS performance requirements are as contained in the EUROCAE ED-155, Minimum Operational Performance Specification (MOPS) for Lightweight Flight Recording Systems, or equivalent documents.*

#### 2.4.16.2.1 Operation

2.4.16.2.1.1 **Recommendation.**— *All turbine-engined aeroplanes of a maximum certificated take-off mass of 5 700 kg or less for which the individual certificate of airworthiness is first issued on or after 1 January 2016 and required to be operated by more than one pilot should be equipped with either a CVR or a CARS.*

#### 2.4.16.2.2 Discontinuation

2.4.16.2.2.1 The use of magnetic tape and wire CVRs shall be discontinued by 1 January 2016.

2.4.16.2.2.2 **Recommendation.**— *The use of magnetic tape and wire CVRs should be discontinued by 1 January 2011.*

#### 2.4.16.2.3 Duration

2.4.16.2.3.1 All CVRs shall be capable of retaining the information recorded during at least the last 30 minutes of their operation.



2.4.16.2.3.2 From 1 January 2016, all CVRs shall be capable of retaining the information recorded during at least the last two hours of their operation.

2.4.16.2.3.3 **Recommendation.**— *All aeroplanes for which the individual certificate of airworthiness is first issued on or after 1 January 1990, and that are required to be equipped with a CVR, should have a CVR capable of retaining the information recorded during at least the last two hours of their operation.*

#### 2.4.16.3 Data link recorders

*Note.*— *Data link recorders performance requirements are as contained in the EUROCAE ED-112, Minimum Operational Performance Specification (MOPS) for Crash Protected Airborne Recorder Systems, or equivalent documents.*

##### 2.4.16.3.1 Applicability

2.4.16.3.1.1 All aeroplanes for which the individual certificate of airworthiness is first issued on or after 1 January 2016, which utilize any of the data link communications applications listed in 5.1.2 of Appendix 2.3 and are required to carry a cockpit voice recorder (CVR), shall record on a flight recorder all data link communications messages.

2.4.16.3.1.2 All aeroplanes which are modified on or after 1 January 2016 to install and utilize any of the data link communications applications listed in 5.1.2 of Appendix 2.3 and are required to carry a CVR shall record on a flight recorder the data link communications messages.

*Note 1.*— *Data link communications are currently conducted by either ATN-based or FANS 1/A-equipped aircraft.*

*Note 2.*— *A Class B AIR could be a means for recording data link communications applications messages to and from the aeroplanes where it is not practical or is prohibitively expensive to record those data link communications applications messages on FDR or CVR.*

##### 2.4.16.3.2 Duration

The minimum recording duration shall be equal to the duration of the CVR.

##### 2.4.16.3.3 Correlation

Data link recording shall be able to be correlated to the recorded cockpit audio.

#### 2.4.16.4 Flight recorders — general

##### 2.4.16.4.1 Construction and installation



Flight recorders shall be constructed, located and installed so as to provide maximum practical protection for the recordings in order that the recorded information may be preserved, recovered and transcribed. Flight recorders shall meet the prescribed crashworthiness and fire protection specifications.

*Note 1.— Industry crashworthiness and fire protection specifications for FDR, CVR, AIR and DLR are as contained in the EUROCAE ED-112, Minimum Operational Performance Specification (MOPS) for Crash Protected Airborne Recorder Systems, or equivalent documents.*

*Note 2.— Industry crashworthiness and fire protection specifications for ADRS and CARS are as contained in the EUROCAE ED-155, Minimum Operational Performance Specifications (MOPS) for Lightweight Flight Recording Systems, or equivalent documents.*

#### 2.4.16.4.2 Operation

2.4.16.4.2.1 Flight recorders shall not be switched off during flight time.

2.4.16.4.2.2 To preserve flight recorder records, flight recorders shall be deactivated upon completion of flight time following an accident or incident. The flight recorders shall not be reactivated before their disposition as determined in accordance with Annex 13.

*Note 1.— The need for removal of the flight recorder records from the aircraft will be determined by the investigation authority in the State conducting the investigation with due regard to the seriousness of an occurrence and the circumstances, including the impact on the operation.*

*Note 2.— The pilot-in-command's responsibilities regarding the retention of flight recorder records are contained in 2.4.16.4.3.*

#### 2.4.16.4.3 Flight recorder records

The pilot-in-command, and/or the owner/operator, shall ensure, to the extent possible, in the event the aeroplane becomes involved in an accident or incident, the preservation of all related flight recorder records, and if necessary the associated flight recorders, and their retention in safe custody pending their disposition as determined in accordance with Annex 13.

#### 2.4.16.4.4 Continued serviceability

Operational checks and evaluations of recordings from the flight recorder systems shall be conducted to ensure the continued serviceability of the recorders.

*Note.— Procedures for the inspections of the flight recorder systems are given in Appendix 2.3.*



2.4.16.4.5 Flight recorder electronic documentation

**Recommendation.**— *The documentation requirement concerning FDR and ADRS parameters provided by operators to accident investigation authorities should be in electronic format and take account of industry specifications.*

*Note.*— *Industry specification for documentation concerning flight recorder parameters may be found in the ARINC*

*647A, Flight Recorder Electronic Documentation, or equivalent document.*

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