

AIRCRAFT INSTRUMENTS, EQUIPMENT AND DOCUMENTS FOR FLIGHT

AIR NAVIGATION ORDER

VERSION	**:**	**5.0**
DATE OF IMPLEMENTATION	**:**	**25-03-2021**
OFFICE OF PRIME INTEREST	**:**	**Airworthiness Directorate**

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TYPE OF DOCUMENT	AIR NAVIGATION ORDER (ANO).		
STATUS OF DOCUMENT	CONTROLLED		

A. AUTHORITY:

A1. This Air Navigation Order (ANO) is issued by Director General Civil Aviation Authority in pursuance of Rules 4, 5, 180, 248, 252, 253, sub-rule (3) & (5) of 333, sub-rule (3) of 334, 360, 363 and all other enabling provision of Civil Aviation Rules 1994 (CARs 94).

B. PURPOSE:

B1. In addition to the minimum equipment necessary for the issuance of a Certificate of Airworthiness, the instruments, equipment and documents prescribed in this Air Navigation Order shall be installed or carried in condition, as appropriate, in aeroplane/ helicopter according to the aeroplane/ helicopter used and to the circumstances under which the flight is to be conducted. The prescribed instruments and equipment, including their installation, shall be approved or accepted by PCAA.

B2. This ANO prescribes requirements for aircraft equipment in relations to its intended flight and shall be read in conjunction with latest revision of relevant Air Navigation Orders issued by Flight Standards Directorate of Pakistan Civil Aviation Authority.

B3. Serviceability of installed equipment/instruments as defined in this ANO shall be controlled through approved Minimum Equipment List (MEL), except as otherwise specified for FDR and CVR in Para D3.12 and Para D4.5 of this ANO, respectively.

C. SCOPE:

C1. This ANO is applicable to all type certified aeroplanes/ helicopters registered in Pakistan and involved in type of operations as specified herein, for which "**Certificate of Airworthiness**" is issued by Airworthiness Directorate.

C2. **Section "A"** of this ANO is applicable for aeroplanes involved in operations under RPT/ Charter/ TPRI AOC categories (i.e. Commercial Air Transport "CAT" operations only). This section is also applicable to all helicopters involved in either private operations or operations under any AOC category.

C3. **Section "B"** of this ANO is applicable for Aeroplanes involved in operations under "Aerial Works and Private Category" (Non-CAT only).

D. DESCRIPTION:

SECTION A

Para D2 through para D30 as given below are applicable to Aeroplanes involved in operations under RPT/Charter/TPRI AOC categories (i.e. Commercial Air Transport "CAT" operations only). The aforementioned paras i.e. D2 through D30 are also applicable to all helicopters involved in either private operations or operations under any AOC category.

D1. DEFINITIONS:

D1.1 For detailed definitions refer to latest issue of AWNOT-017-AWRG.

D2. INSTRUMENTS/ EQIPMENT/ DOCUMENTS:

D2.1 **All aeroplanes / helicopters on all flights**: An aeroplane/ helicopter shall be equipped with instruments which will enable the flight crew to control the flight path of the Aeroplane/ helicopter, carry out any required procedural maneuvers and observe the operating limitations of the aeroplane/ helicopter in the expected operating conditions.

D2.2 **First Aid / Medical kits**: An Aeroplane/ helicopter shall be equipped with accessible and adequate medical supplies.

D2.3 **Fire extinguisher**: An Aeroplane/ helicopter shall be equipped with at least one portable fire extinguisher, located at:

D2.3.1 in the pilot's compartment; and

D2.3.2 each passenger compartment that is separate from the pilot's compartment and that is not readily accessible to the flight crew.

D2.4 **Seat safety belts, harnesses and infant restraint devices**: An Aeroplane/ helicopter shall be equipped with following:

D2.4.1 A seat belt for each seat, restraining belts for each berth; and

D2.4.2 A safety harness for each flight crew seat. The safety harness for each pilot seat shall incorporate a device, which will automatically restrain the occupant's torso in the event of rapid deceleration.

D2.5 **Means of ensuring information and instructions to passengers**: Means of ensuring that the following information and instructions are conveyed to passengers:

D2.5.1 When seat belts are to be fastened

D2.5.2 When and how oxygen equipment is to be used if the carriage of oxygen is required;

D2.5.3 Restriction on smoking;

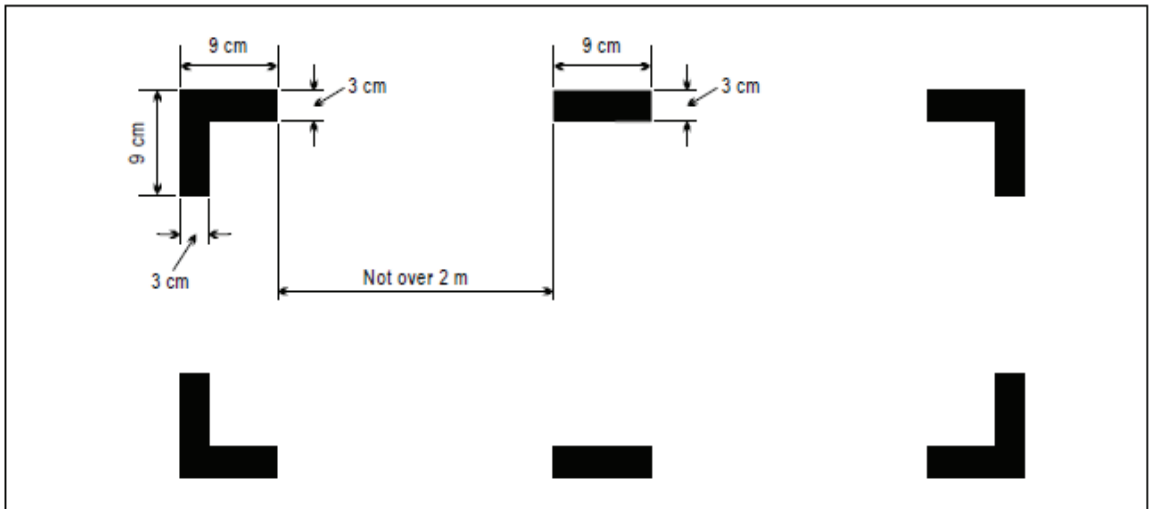
D2.5.4 Location and usage of life jackets and/or equivalent individual flotation devices where their carriage is required; and

D2.5.5 Location and method of opening emergency exits.

D2.6 **Electrical Fuses:**

D2.6.1 If fuses are used, spare electrical fuses of appropriate ratings for replacement of those accessible in flight.

D2.7 **Markings of break-in points:** If areas of the fuselage suitable for break-in by rescue crews in emergency are marked on an Aeroplane/ helicopter such areas shall be marked as shown below. The color of the markings shall be red or yellow, and if necessary, they shall be out-lined in white to contrast with the background. If the corner marking are more than 2m apart, intermediate lines 9 cm x 3 cm shall be inserted so that there is no more than 2m between adjacent markings.



D3. FLIGHT DATA RECORDERS AND AIRCRAFT DATA RECORDINGS SYSTEM

D3.1 All turbine-engined aeroplanes of a maximum certificated take-off mass of 5700 kg or less for which the application for type certification is submitted to a Contracting State on or after 1 January 2016 shall be equipped with;

D3.1.1 an Flight data recorder (FDR) which shall record at least the first 16 parameters listed in Table A-1 of Appendix A; or

D3.1.2 a Class C airborne image recorder (AIR) or aircraft data recording system (ADRS) which shall record at least the flight path and speed parameters displayed to the pilot(s), as defined in para 8.1 of Appendix A; or

D3.1.3 an ADRS which shall record at least the first 7 parameters listed in Table A-3 of Appendix A.

D3.2 All aeroplanes of a maximum certificated take-off mass of over 27,000 kg for which the individual certificate of airworthiness is first issued on or after 1 January 1989 shall be equipped with an FDR which shall record at least the first 32 parameters listed in Table A-1 of Appendix A.

D3.3 All aeroplanes of a maximum certificated take-off mass of over 5700 kg, up to and including 27,000 kg, for which the individual certificate of airworthiness is first issued on or after 1 January 1989, shall be equipped with an FDR which shall record at least the first 16 parameters listed in Table A-1 of Appendix A.

D3.4 All turbine-engined aeroplanes, for which the individual certificate of airworthiness was first issued before 1 January 1989, with a maximum certificated take-off mass of over 5700 kg, except those in Para D3.6, shall be equipped with an FDR which shall record at least the first 5 parameters listed in Table A-1 of Appendix A.

D3.5 All turbine-engined aeroplanes, for which the individual certificate of airworthiness was first issued on or after 1 January 1987 but before 1 January 1989, with a maximum certificated take-off mass of over 27,000 kg that are of types of which the prototype was certificated by the appropriate national authority after 30 September 1969 shall be equipped with an FDR which shall record at least the first 16 parameters listed in Table A-1 of Appendix A.

D3.6 All aeroplanes of a maximum certificated take-off mass of over 5700 kg for which the individual certificate of airworthiness is first issued after 1 January 2005 shall be equipped with an FDR which shall record at least the first 78 parameters listed in Table A-1 of Appendix A.

D3.7 All aeroplanes of a maximum certificated take-off mass of over 5700 kg for which the application for type certification is submitted to a Contracting State on or after 1 January 2023 shall be equipped with an FDR capable of recording at least the 82 parameters listed in Table A-1 of Appendix A.

D3.8 All helicopters of a maximum certificated take-off mass of over 3175 kg for which the individual certificate of airworthiness is first issued on or after 1 January 2016 shall be equipped with an FDR which shall record at least the first 48 parameters listed in Table A-4 of Appendix A.

D3.9 All helicopters of a maximum certificated take-off mass of over 7000 kg, or having a passenger seating configuration of more than nineteen, for which the individual certificate of airworthiness is first issued on or after 1 January 1989 shall be equipped with an FDR which shall record at least the first 30 parameters listed in Table A-4 of Appendix A.

D3.10 All turbine-engined helicopters of a maximum certificated take-off mass of over 2250 kg, up to and including 3175 kg, for which the application for type certification was submitted to a Contracting State on or after 1 January 2018, shall be equipped with:

D3.10.1 an FDR which shall record at least the first 48 parameters listed in Table A-4 of Appendix A; or

D3.10.2 a Class C AIR or AIRS which shall record at least the flight path and speed parameters displayed to the pilot(s), as defined in para 8.1 of Appendix A; or

D3.10.3 an ADRS which shall record the first 7 parameters listed in Table A-5 of Appendix A.

D3.11 All helicopters of a maximum certificated take-off mass of over 3,175 kg for which the application for type certificate is submitted to a Contracting State on or after 1 January 2023 shall be equipped with an FDR capable of recording at least the first 53 parameters listed in Table A-4 of Appendix A.

D3.12 All aeroplane/ helicopter registered in Pakistan with a maximum certificated take-off mass of over 5700 kg and is operated by the holder of an Air Operator Certificate in RPT, TPRI or Charter categories, shall not commence a flight unless it is equipped with a **serviceable** flight data recorder. The applicability of type of FDR based on different weight category, date of first CoA issued, application date of Type Certificate etc., shall be applicable in accordance with Para D3.1 to D3.11 above.

D3.13 All Flight recorders installed on aeroplane/ helicopter shall have securely attached an automatically activated underwater locating Beacon (ULB) operating at a frequency of 37.5 kHz and this device (ULB) shall operate for a minimum of 90 days. Automatic deployable flight recorder (ADFR) shall have an integrated automatically activated ELT.

D3.14 **Recording technology:** FDRs, ADRS, shall not use engraving metal foil, frequency modulation (FM), photographic film or magnetic tape.

D3.15 **Duration:** All FDRs installed on aeroplane shall retain the information recorded during at least the last 25 hours of their operation. For FDRs installed on helicopter, the information recorded during at least the last 10 hours of their operation shall be retained.

D4. COCKPIT VOICE RECORDERS AND COCKPIT AUDIO RECORDING SYSTEM:

D4.1 All turbine-engined aeroplanes of a maximum certificated take-off mass of over 2250 kg, up to and including 5700 kg, for which the application for type certification is submitted to a Contracting State on or after 1 January 2016 and required to be operated by more than one pilot shall be equipped with either a Cockpit Voice Recorder (CVR) or a Cockpit Audio Recording System (CARS).

D4.2 All aeroplanes of a maximum certificated take-off mass of over 5700 kg for which the individual certificate of airworthiness is first issued on or after 1 January 1987 shall be equipped with a CVR.

D4.3 All turbine-engined aeroplanes, for which the individual certificate of airworthiness was first issued before 1 January 1987, with a maximum certificated take-off mass of over 27,000 kg that are of types of which the prototype was certificated by the appropriate national authority after 30 September 1969 shall be equipped with a CVR.

D4.4 All helicopters of a maximum certificated take-off mass of over 7000 kg shall be equipped with a CVR. For helicopters not equipped with an FDR, at least main rotor speed shall be recorded on the CVR.

D4.5 All aeroplane/ helicopter registered in Pakistan with a maximum certificated take-off mass of over 27,000 kg and which is operated by the holder of an Air Operator Certificate in RPT, TPRI or Charter categories, shall not commence a flight unless it is equipped with a **serviceable** Cockpit Voice Recorder. The applicability of type of CVR based on different weight category, date of first CoA issued, application date of Type Certificate etc., shall be applicable in accordance with Para D4.1 to D4.4 above.

D4.6 All Cockpit Voice Recorders installed on aeroplane/ helicopter shall have securely attached an automatically activated Underwater Locating Beacon (ULB) operating at a frequency of 37.5 kHz and this device (ULB) shall operate for a minimum of 90 days.

D4.7 **Recording technology:** CVRs and CARS shall not use magnetic tape or wire.

D4.8 **Duration**:

D4.8.1 All CVRs shall retain the information recorded during at least the last 2 hours of their operation.

D4.8.2 All aeroplanes of a maximum certificated take-off mass of over 27,000 kg for which the individual certificate of airworthiness is first issued on or after 1 January 2022 shall be equipped with a CVR which shall retain the information recorded during at least the last 25 hours of its operation.

D4.8.3 All aeroplanes that are required to be equipped with CARS, and for which the individual certificate of airworthiness is first issued on or after 1 January 2025, shall be equipped with a CARS which shall retain the information recorded during at least the last two hours of their operation.

D4.9 **Cockpit voice recorder alternate power source:**

D4.9.1 An alternate power source shall automatically engage and provide 10 minutes, plus or minus one minute, of operation whenever aeroplane power to the recorder ceases, either by normal shutdown or by any other loss of power. The alternate power source shall power the CVR and its associated cockpit area microphone components.

D4.9.2 All aeroplanes of a maximum certificated take-off mass of over 27,000 kg for which the application for type certification is submitted to a Contracting State on or after 1 January 2018 shall be provided with an alternate power source, as defined in Para D4.9.1 that powers the forward CVR in the case of combination recorders.

D5. DATA LINK RECORDERS

D5.1 All aeroplanes /helicopter for which the individual certificate of airworthiness is first issued on or after 1 January 2016, which use any of the data link communications applications in accordance with para 10 of Appendix A and are required to carry a CVR, shall record the data link communications messages on a crash-protected flight recorder.

D5.2 All aeroplanes /helicopters for which the individual certificate of airworthiness was first issued before 1 January 2016, that are required to carry a CVR and are modified on or after 1 January 2016 to use any of the data link communications applications referred to in para 10 of Appendix A, shall record the data link communications messages on a crash-protected flight recorder, unless the installed data link communications equipment is compliant with a type certificate issued or aircraft modification first approved prior to 1 January 2016.

D5.3 **Duration**: The minimum recording duration shall be equal to the duration of the CVR.

D5.4 **Correlation**: Data link recording shall be able to be correlated to the recorded cockpit audio.

D6. FLIGHT CREW-MACHINE INTERFACE RECORDINGS

D6.1 All aeroplanes of a maximum take-off mass of over 27,000 kg for which the application for type certification is submitted to a Contracting State on or after 1 January 2023 shall be equipped with a crash-protected flight recorder which shall record the information displayed to the flight crew from electronic displays, as well as the operation of switches and selectors by the flight crew as per para 9 of Appendix-A

D6.2 **Duration**: The minimum flight crew-machine interface recording duration shall be at least for the last two hours.

D6.3 **Correlation**: Flight crew-machine interface recordings shall be able to be correlated to the recorded cockpit audio.

D7. FLIGHT RECORDERS - GENERAL

D7.1 **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.

D7.2 **Continued serviceability:** Operational checks and evaluations of recordings from the flight recorder systems shall be conducted to ensure the continued serviceability of the recorders. For details refer Para 6 and Para 7 of Appendix-A.

D7.3 **Combination recorders:** All aeroplanes of a maximum certificated take-off mass of over 15,000 kg 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 equipped with both a CVR and an FDR, shall be equipped with two combination recorders (FDR/CVR). One recorder shall be located as close to the cockpit as practicable and the other recorder located as far aft as practicable.

D8. FLIGHT RECORDER DATA RECOVERY

D8.1 All aeroplanes of a maximum certificated take-off mass of over 27,000 kg and authorized to carry more than nineteen passengers for which the application for type certification is submitted to a Contracting State on or after 1 January 2021, shall be equipped with a means approved by the PCAA, to recover flight recorder data in a timely manner.

D9. AEROPLANES / HELICOPTERS ON FLIGHTS OVER WATER

D9.1 **Seaplanes**: All seaplanes for all flights shall be equipped with:

D9.1.1 one life jacket, or equivalent individual flotation 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;

D9.1.2 equipment for making the sound signals for Preventing Collisions at sea; and

D9.1.3 one sea anchor (drogue).

Note: "Seaplanes" includes amphibians operated as seaplanes

D9.2 **Landplanes:** Land Planes shall carry at least one life jacket or equivalent individual flotation 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 when flying:

D9.2.1 over water and at a distance of more than 93 km (50 NM) away

D9.2.2 when taking off or landing at an aerodrome where, the take-off or approach path is so disposed over water that in the event of a mishap there would be a likelihood of a ditching.

Note 1: "Landplanes" includes amphibians operated as landplanes.
Note 2: Life jackets accessible from seats or berths located in crew rest compartments are required only if the seats or berths concerned are certified to be occupied during take-off and landing.

D9.3 **All aeroplanes on long-range over-water flights:** Aeroplanes are considered operating flights on "*long range over water*", when used over routes on which the aeroplane may be over water and at more than a distance corresponding to 120 minutes at cruising speed or 740 km (400 NM), whichever is the lesser, away from land suitable for making an emergency landing in the case of one engine becoming inoperative (for twin engined aircraft) and failure of two engines for aeroplane having three or more engines. All other aeroplanes are considered operating flights on "*long range over water*", when used over routes on which the aeroplane may be over water and at more than a distance corresponding to 30 minutes at cruising speed or 185 km (100 NM), whichever is the lesser.

D9.3.1. In addition to the equipment prescribed in Para D9.1 and Para D9.2 whichever is applicable, the following equipment shall be installed in all aeroplanes operating flights on "*long range over water*":

D9.3.1.1 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;

D9.3.1.2 equipment for making the pyrotechnical distress signals; and

D9.3.1.3 all aeroplanes of a maximum certificated take-off mass of over 27,000 kg, a securely attached underwater locating device (ULD) operating at a frequency of 8.8 kHz. This automatically activated underwater locating device shall operate for a minimum of 30 days and shall not be installed in wings or empennage.

D9.3.2. Each life jacket shall be equipped with a means of electric illumination for the purpose of facilitating the location of persons, except where the requirement of is met by the provision of individual flotation devices other than life jackets.

D9.4 **All helicopters on flights over water:** All helicopters intended to be flown over water shall be fitted with a permanent or rapidly deployable means of flotation so as to ensure a safe ditching of the helicopter when:

D9.4.1 engaged in offshore operations, or other overwater operations; or

D9.4.2 flying over water in hostile environment at a distance from land corresponding to more than 10 minutes at normal cruise speed when operating in performance Class 1 or 2;

D9.4.3 flying over water in a non-hostile environment when operating in performance Class 1; or

D9.4.4 flying over water beyond autorotational or safe forced landing distance from land when operating in performance Class 3.

D9.5 **Emergency equipment required:**

D9.5.1 Helicopters operating in performance Class 1 or 2 and operating in accordance with the provisions of Para D9.4 shall be equipped with:

D9.5.1.1 one life jacket, or equivalent individual flotation 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.

D9.5.1.2 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. When two life rafts are fitted, each shall be able to carry all occupants in the overload state; and

D9.5.1.3 equipment for making the pyrotechnical distress signals

D9.5.2 Helicopters operating in performance Class 3 when operating beyond autorotational distance from land but within a distance from land specified by PCAA (Flight Standards Directorate) shall be equipped with one life jacket, or equivalent individual flotation 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.

D9.5.3 Helicopters operating in performance Class 3 when operating beyond the distance specified in Para D9.5.2 shall be equipped as in Para D9.5.1.

D9.5.4 In the case of helicopters operating in performance Class 2 or 3, when taking off or landing at a heliport where, in the event of a mishap there would be likelihood of a ditching, shall carry at least the equipment required in Para 9.5.1.1.

D9.5.5 Each life jacket and equivalent individual flotation device, when carried in accordance with Para D9.4, shall be equipped with a means of electric illumination for the purpose of facilitating the location of persons.

D9.6 **All helicopters on flights over designated sea areas**: Helicopters, when operating over sea areas which have been designated as areas in which search and rescue would be especially difficult, shall be equipped with life-saving equipment (including means of sustaining life) as may be appropriate to the area overflown.

D10. AEROPLANES/ HELICOPTERS ON FLIGHTS OVER DESIGNATED LAND AREAS

D10.1 Aeroplanes/ Helicopters, when operated across/over land areas which have been designated 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.

D11. AEROPLANES /HELICOPTER ON HIGH ALTITUDE FLIGHTS

D11.1 An aeroplane/ helicopter intended to be operated at flight altitudes at which the atmospheric pressure is less than 700 hPa in personnel compartments shall be equipped with oxygen storage and dispensing apparatus capable of storing and dispensing the required oxygen supplies.

D11.2 An aeroplane/ helicopter intended to be operated at flight altitudes at which the atmospheric pressure is less than 700 hPa but which is provided with means of maintaining pressures greater than 700 hPa in personnel compartments shall be provided with oxygen storage and dispensing apparatus capable of storing and dispensing the required oxygen supplies.

D11.3 Pressurized aeroplanes newly introduced into service on or after 1 July 1962 and 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.

D11.4 An aeroplane/ helicopter intended to be operated at flight altitudes at which the atmospheric pressure is less than 376 hPa, or which, if operated at flight altitudes at which the atmospheric pressure is more than 376 hPa, cannot descend safely within four minutes to a flight altitude at which the atmospheric pressure is equal to 620 hPa and for which the individual certificate of airworthiness is first issued on or after 9 November 1998, shall be provided with automatically deployable oxygen equipment. The total number of oxygen dispensing units shall exceed the number of passenger and cabin crew seats by at least 10 per cent.

D11.5 All pressurized aeroplanes operating above an altitude where the atmospheric pressure is less than 376 hPa, shall be equipped with a quick-donning type of oxygen mask, for all flight crew members at the flight duty station. The oxygen mask shall readily supply oxygen upon demand.

Note: Approximate altitude in the Standard Atmosphere corresponding to the value of absolute pressure used in this text is as follows:

Absolute pressure	Metres	Feet
700 hPa	*3000*	*10,000*
620 hPa	*4 000*	*13,000*
376 hPa	*7 600*	*25 000*

D12. AEROPLANES / HELICOPTER OPERATING IN ICING CONDITIONS

D12.1 All aeroplanes / helicopter shall be equipped with suitable de-icing and/or anti-icing devices when operated in circumstances in which icing conditions are reported to exist or are expected to be encountered.

D13. AEROPLANES/HELICOPTERS OPERATED AS VFR FLIGHTS

D13.1 All aeroplanes/helicopters when operated as VFR flights, shall be equipped with:

D13.1.1 a magnetic compass;
D13.1.2 an accurate timepiece indicating the time in hours, minutes and seconds;
D13.1.3 a sensitive pressure altimeter;
D13.1.4 an airspeed indicator;

D13.2 All helicopters when operated as VFR flights at night shall be equipped with following equipment, in addition to requirements of Para D13.1:

D13.2.1 an attitude indicator (artificial horizon) for each required pilot and one additional attitude indicator;
D13.2.2 a slip indicator;
D13.2.3 a heading indicator (directional gyroscope);
D13.2.4 a rate of climb and descent indicator;
D13.2.5 the lights required in flight or operating on the movement area of an heliport;
D13.2.6 two landing lights;
D13.2.7 illumination for all instruments and equipment that are essential for the safe operation of helicopter that are used by the flight crew;
D13.2.8 lights in all passenger compartments; and
D13.2.9 a flashlight for each crew member station.

D13.3 All aeroplane conducting VFR flights, which are operated as controlled flights shall be equipped with instruments mentioned in Para D14 (i.e. equipment for IFR Flights)
Note: Any flight which is subject to an air traffic control clearance, is categorized as controlled flight.

D14. AEROPLANES/HELICOPTERS OPERATED IN ACCORDANCE WITH INSTRUMENT FLIGHT RULES

D14.1 All aeroplanes/ helicopters 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:

D14.1.1 a magnetic compass;
D14.1.2 an accurate timepiece indicating the time in hours, minutes and seconds;
D14.1.3 two sensitive pressure altimeters with counter drum-pointer or equivalent presentation;
D14.1.4 an airspeed indicating system with means of preventing malfunctioning due to either condensation or icing;
D14.1.5 a turn and slip indicator;
D14.1.6 an attitude indicator (artificial horizon); For helicopter only, one attitude indicator for each required pilot and one additional attitude indicator;
D14.1.7 a heading indicator (directional gyroscope);
D14.1.8 a means of indicating whether the power supply to the gyroscopic instrument is adequate;
D14.1.9 a means of indicating in the flight crew compartment the outside air temperature;
D14.1.10 a rate-of-climb and descent indicator;

D14.2 All helicopters when operated as IFR flights at night shall be equipped with lights as specified in Para D13.2.

D14.3 **Emergency power supply for electrically operated attitude indicating instruments:**

D14.2.1 All aeroplanes of a maximum certificated take-off mass of over 5700 kg newly introduced into service after 1 January 1975 shall be fitted with an emergency power supply, independent of the main electrical generating system, for the purpose of operating and illuminating, for a minimum period of 30 minutes, an attitude indicating

instrument (artificial horizon), clearly visible to the pilot-in-command. The emergency power supply shall be automatically operative after the total failure of the main electrical generating system and clear indication shall be given on the instrument panel that the attitude indicator(s) is being operated by emergency power.

D14.2.2 All helicopters when operating in accordance with IFR shall be fitted with an emergency power supply, independent of the main electrical generating system, for the purpose of operating and illuminating, for a minimum period of 30 minutes, an attitude indicating instrument (artificial horizon), clearly visible to the pilot-in-command. The emergency power supply shall be automatically operative after the total failure of the main electrical generating system and clear indication shall be given on the instrument panel that the attitude indicator(s) is being operated by emergency power.

D15. AEROPLANES WHEN OPERATED AT NIGHT

D15.1 All aeroplanes when operated at night shall be equipped with:

D15.1.1 all equipment specified in Para D14 (Equipment for IFR Flights).

D15.1.2 the lights required for aircraft in flight or operating on the movement area of an aerodrome;

D15.1.3 two landing lights; or alternately a single landing light having two separately energized filaments

D15.1.4 illumination for all instruments and equipment that are essential for the safe operation of the aeroplane/ helicopter that are used by the flight crew;

D15.1.5 lights in all passenger compartments; and

D15.1.6 an independent portable light for each crew member station.

D16. AEROPLANES OPERATED ABOVE 15000 M (49,000 FT) - RADIATION INDICATOR

D16.1 All aeroplanes intended to be operated above 15,000 m (49,000 ft) shall carry equipment to measure and indicate continuously the dose rate of total cosmic radiation being received (i.e. the total of ionizing and neutron radiation of galactic and solar origin) and the cumulative dose on each flight. The display unit of the equipment shall be readily visible to a flight crew member.

D17. MACH NUMBER INDICATOR

D17.1 All aeroplanes with speed limitations expressed in terms of Mach number shall be equipped with a Mach number indicator.

Note: This does not preclude the use of the airspeed indicator to derive Mach number.

D18. GROUND PROXIMITY WARNING SYSTEMS (GPWS)

D18.1 All turbine-engined aeroplanes of a maximum certificated take-off mass in excess of 5700 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.

D18.2 The operator shall implement database management procedures (in MCM/CAME or others means acceptable to PCAA), that ensure the timely distribution and update of current terrain and obstacle data to the ground proximity warning system.

D18.3 All piston-engined aeroplanes of a maximum certificated take-off mass in excess of 5700 kg or authorized to carry more than nine passengers shall be equipped with a ground proximity warning system which provides the warnings in; *excessive descent rate, excessive altitude loss after take-off or go-around, warning of unsafe terrain clearance and a forward-looking terrain avoidance function*.

D18.4 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.

D18.5 A ground proximity warning system shall provide, unless otherwise specified herein, warnings of the following circumstances:

D18.5.1 excessive descent rate;

D18.5.2 excessive terrain closure rate;

D18.5.3 excessive altitude loss after take-off or go-around;

D18.5.4 unsafe terrain clearance while not in landing configuration:

D18.5.4.1 gear not locked down;

D18.5.4.2 flaps not in a landing position; and

D18.5.5 excessive descent below the instrument glide path.

D19. CABIN CREW SEATS

D19.1 Aeroplanes for which the individual certificate of airworthiness is first issued on or after 1 January 1981 shall be equipped with a forward or rearward facing (within 15 degrees of the longitudinal axis of the aeroplane) seat, fitted with a safety harness for the use of each cabin crew member.

D19.2 All helicopters shall be equipped with a forward or rearward facing (within 15 degrees of the longitudinal axis of the helicopter) seat, fitted with a safety harness for the use of each cabin crew member.

D20. EMERGENCY LOCATOR TRANSMITTER

D20.1 All aeroplane/ helicopter shall be equipped with at least one Emergency locator transmitter (ELT) of any type, except as provided for in Para D20.2, D20.3, D20.4, D20.5 & D20.6.

D20.2 Except as provided for in Para D20.3, all aeroplanes authorized to carry more than 19 passengers shall be equipped with at least one automatic ELT or two ELTs of any type.

D20.3 All aeroplanes authorized to carry more than 19 passengers for which the individual certificate of airworthiness is first issued after 1 July 2008 shall be equipped with either:

D20.3.1 at least two ELTs, one of which shall be automatic; or

D20.3.2 at least one ELT and a capability to meet the requirements of Para D21 (*Location of an Aeroplane In Distress*)

D20.4 All aeroplanes authorized to carry 19 passengers or less for which the individual certificate of airworthiness is first issued after 1 July 2008 shall be equipped with at least one automatic ELT.

D20.5 All helicopters operating in performance Class 1 and 2 shall be equipped with at least one automatic ELT. When engaged in offshore operations, or other over water operations, shall be equipped with at least one automatic ELT and one survival ELT "ELT(S)" in a raft or life jacket.

D20.6 All helicopters operating in performance Class 3 shall be equipped with at least one automatic ELT. When operating flights over water in a hostile environment at a distance from land corresponding to more than 10 minutes at normal cruise speed in performance class1 & 2, shall be equipped with at least one automatic ELT and one survival ELT "ELT(S)" in a raft or life jacket.

D21. LOCATION OF AN AEROPLANE IN DISTRESS

D21.1 All aeroplanes of a maximum certificated take-off mass of over 27,000 kg for which the individual certificate of airworthiness is first issued on or after 1 January 2023, shall autonomously transmit

information from which a position can be determined by the operator at least once every minute, when in distress. For further details regarding compliance and equipment requirements, refer Appendix-B.

D22. AIRBORNE COLLISION AVOIDANCE SYSTEM (ACAS II)

D22.1 All turbine-engined aeroplanes of a maximum certificated take-off mass in excess of 5700 kg or authorized to carry more than 19 passengers shall be equipped with an Airborne Collision Avoidance System (ACAS II).

D23. PRESSURE-ALTITUDE REPORTING TRANSPONDERS

D23.1 All aeroplanes shall be equipped with a pressure-altitude reporting transponder

D23.2 All aeroplanes for which the individual certificate of airworthiness is first issued after 1 January 2009, shall be equipped with a data source that provides pressure-altitude information with a resolution of 7.62 m (25 ft), or better.

D23.3 Except as may be otherwise authorized by the PCAA, all helicopters shall be equipped with a pressure-altitude reporting transponder.

D24. MICROPHONES

D24.1 Aeroplanes/ helicopters shall be equipped with boom or throat microphones, for all flight crew members required to be on flight deck duty.

D25. AEROPLANES OPERATED BY A SINGLE PILOT UNDER THE INSTRUMENT FLIGHT RULES (IFR) OR AT NIGHT

D25.1 All aeroplanes that are approved by Flight Standards Directorate for single pilot operations under IFR or at night shall be equipped with:

D25.1.1 a serviceable autopilot that has at least altitude hold and heading select modes;
D25.1.2 a headset with a boom microphone or equivalent; and
D25.1.3 means of displaying charts that enables them to be readable in all ambient light conditions

D26. COMMUNICATION EQUIPMENT

D26.1 An aeroplane /helicopter shall be provided with radio communication equipment capable of:

D26.1.1 conducting two-way communication for aerodrome control purposes;

D26.1.2 receiving meteorological information at any time during flight; and

D26.1.3 conducting two-way communication at any time during flight with at least one aeronautical station

D26.2 The radio communication equipment required in accordance with Para D26.1 shall provide for communications on the aeronautical emergency frequency 121.5 MHz.

D26.3 For operations where communication equipment is required to meet an RCP (Required Communication Performance) specification for performance-based communication (PBC) , an aeroplane/ helicopter shall, in addition to the requirements specified in Para D26.1:

D26.3.1 be provided with communication equipment which will enable it to operate in accordance with the prescribed RCP specification(s);

D26.3.2 have information relevant to the aeroplane RCP specification capabilities listed in the flight manual or other aeroplane documentation approved by the State of Design or PCAA; and

D26.3.3 have information relevant to the aeroplane RCP specification capabilities included in the MEL.

D27. NAVIGATION EQUIPMENT

D27.1 An aeroplane/ helicopter shall be provided with navigation equipment which will enable it to proceed:

D27.1.1 in accordance with its operational flight plan; and

D27.1.2 in accordance with the requirements of air traffic services;

except when, if not so precluded by the PCAA, navigation for flights under VFR is accomplished by visual reference to landmarks.

D27.2 For operations where a navigation specification for Performance-Based Navigation (PBN) has been prescribed, an aeroplane/ helicopter shall, in addition to the requirements specified in Para D27.1:

D27.2.1 be provided with navigation equipment which will enable it to operate in accordance with the prescribed navigation specification(s);

D27.2.2 have information relevant to the aeroplane/ helicopter navigation specification capabilities listed in the flight manual or other aeroplane/ helicopter documentation approved by the State of the Design or PCAA; and

D27.2.3 have information relevant to the aeroplane navigation specification capabilities included in the MEL.

Note: Airworthiness Notice "AWNOT-070-AWRG" may be referred for guidance on PBN.

D27.3 For flights in defined portions of airspace where, based on Regional Air Navigation Agreement, Minimum Navigation Performance Specifications (MNPS) are prescribed, an aeroplane shall be provided with navigation equipment which:

D27.3.1 continuously provides indications to the flight crew of adherence to or departure from track to the required degree of accuracy at any point along that track; and

D27.3.2 has been authorized by the State of the Operator for the MNPS operations concerned.

D27.4 For flights in defined portions of airspace where, based on Regional Air Navigation Agreement, a Reduced Vertical Separation Minimum (RVSM) of 300m (1000 ft) is applied between FL 290 and FL 410 inclusive; the aeroplane shall be provided with equipment which is capable of:

D27.4.1 indicating to the flight crew the flight level being flown;

D27.4.2 automatically maintaining a selected flight level;

D27.4.3 providing an alert to the flight crew when a deviation occurs from the selected flight level. The threshold for the alert shall not exceed ± 90 m (300 ft); and

D27.4.4 automatically reporting pressure-altitude;

D27.5 The aeroplane/ helicopter shall be sufficiently provided with navigation equipment to ensure that, in the event of the failure of one item of equipment at any stage of the flight, the remaining equipment will enable the aeroplane to navigate in accordance with Para D27.1 and, where applicable, Para D27.2, D27.3 and D27.4.

D27.6 On flights, which are intended to land in instrument meteorological conditions, an aeroplane/ helicopter shall be provided with radio equipment capable of receiving signals providing guidance to a point from which a visual landing can be effected. This equipment shall be capable of providing such guidance for each aerodrome at which it is intended to land in instrument meteorological conditions and for any designated alternate aerodromes.

D28. SURVEILLANCE EQUIPMENT

D28.1 An aeroplane/ helicopter shall be provided with surveillance equipment which will enable it to operate in accordance with the requirements of air traffic services.

D28.2 For operations where surveillance equipment is required to meet an RSP specification for Performance-Based Surveillance (PBS), an aeroplane/ helicopter shall, in addition to the requirements specified in Para D28.1:

D28.2.1 be provided with surveillance equipment which will enable it to operate in accordance with the prescribed RSP specification(s);

D28.2.2 have information relevant to the aeroplane/ helicopter RSP specification capabilities listed in the flight manual or other aeroplane/ helicopter documentation approved by the PCAA or State of Design; and

D28.2.3 have information relevant to the aeroplane RSP specification capabilities included in the MEL.

D29. ELECTRONIC NAVIGATION DATA MANAGEMENT

D29.1 The operator shall implement procedures (in MCM/CAME or other means acceptable to PCAA) that ensure the timely distribution and insertion of current and unaltered electronic navigation data to all necessary aircraft.

D30. DOCUMENTS FOR FLIGHT

D30.1 An aeroplane/ helicopter shall be provided with manuals, placards or other documents specified below, in accordance with its applicability:

D30.1.1 Flight manual, placards or other documents stating the approved limitations with which the aeroplane is considered airworthy as defined by the appropriate Airworthiness requirements, and additional instructions and information necessary for the safety of the Aeroplane

D30.1.2 Certificate of Registration

D30.1.3 Certified true Copy of AOC

D30.1.4 Certificate of Airworthiness

D30.1.5 Certificate of Maintenance Review

D30.1.6 Certificate of Release to Service

D30.1.7 Certificate for Radio Installation

D30.1.8 PTA License for Radio Set Operators

D30.1.9 Accepted & Updated weight and balance schedule

D30.1.10 Noise Certificate issued in accordance with the latest issue of Airworthiness Notice No. AWNOT-062-AWRG.

D30.1.11 Copy of Approved MEL

D30.1.12 Updated Dent & Repair chart

D30.1.13 Certified true Copy of the agreement summary of Article 83 *bis* agreement

SECTION B

Para D31 through Para D56 are applicable only to Aeroplanes involved in operations under "Aerial Works and Private Category" (Non-CAT operations only)

D31. INSTRUMENTS/ EQUIPMENT/ DOCUMENTS FOR AEROPLANNE:

D31.1 All Aeroplane operating shall be equipped with instruments, which will enable the flight crew to control the flight path of the Aeroplane, carry out any required procedural maneuvers and observe the operating limitations of the Aeroplane in the expected operating conditions.

D31.2 An aeroplane shall be equipped with accessible first aid kit.

D31.3 For aeroplanes with a maximum certificated take-off mass exceeding 5700 kg OR are equipped with one or more turbojet engines, shall be equipped with:

D31.3.1 accessible and adequate medical supplies appropriate to the number of passengers the aeroplane is authorized to carry;

D31.3.2 a safety harness for each flight crew seat. The safety harness for each pilot seat shall incorporate a device which will automatically restrain the occupant's torso in the event of rapid deceleration;

D31.3.3 means of ensuring that the following information and instructions are conveyed to passengers:

D31.3.3.1 when seat belts are to be fastened;
D31.3.3.2 when and how oxygen equipment is to be used if the carriage of oxygen is required;
D31.3.3.3 restrictions on smoking;
D31.3.3.4 location and use of life jackets or equivalent individual flotation devices where their carriage is required;
D31.3.3.5 location of emergency equipment; and
D31.3.3.6 location and method of opening emergency exits.

D31.4 An Aeroplane shall be equipped with at least one portable fire extinguisher, located at:

D31.4.1 in the pilot's compartment; and

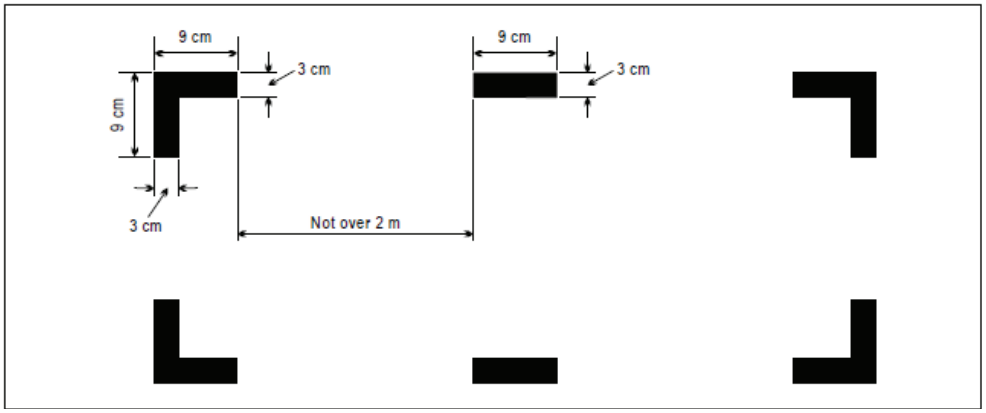
D31.4.2 each passenger compartment that is separate from the pilot's compartment and that is not readily accessible to the flight crew.

D31.5 A seat belt for each seat and restraining belts for each berth;

D31.6 Where the aeroplane is fitted with fuses that are accessible in flight, spare electrical fuses of appropriate ratings for replacement of those fuses.

D31.7 **Markings of break-in points:**

D31.7.1 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:



D31.7.2 The color of the markings shall be red or yellow, and if necessary they shall be outlined in white to contrast with the background. If the corner marking are more than 2m apart, intermediate lines 9 cm x 3 cm shall be inserted so that there is no more than 2m between adjacent markings.

D32. ALL AEROPLANES OPERATED AS VFR FLIGHTS:

D32.1 All aeroplanes when operated as VFR flights shall be:

D32.1.1 equipped with a means of measuring and displaying magnetic heading, barometric altitude and indicated airspeed;

D32.1.2 equipped with, or shall carry, a means of measuring and displaying time in hours, minutes and seconds; and

D33. AEROPLANES ON FLIGHTS OVER WATER:

D33.1 **Seaplanes:** Seaplanes for all flights shall be equipped with:

D33.1.1 one life jacket, or equivalent individual flotation device, for each person on board, stowed in a position readily accessible from the seat or berth;
D33.1.2 equipment for making the sound signals for Preventing Collisions at Sea;
D33.1.3 one anchor; and
D33.1.4 One sea anchor (drogue), when necessary to assist in manoeuvring.
Note: "Seaplanes" includes amphibians operated as seaplanes

D33.2 **Aeroplanes on extended flights over water:**

D33.2.1 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.

D33.2.2 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 Para D33.2.1, ensure that the aeroplane is equipped with:

D33.2.2.1 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;

D33.2.2.2 equipment for making the pyrotechnical distress signals;

D33.3 **Aeroplanes on long-range over-water flights:**

D33.3.1 Aeroplanes involved in long-range over-water flights, in addition to the equipment required in Para 33.2, ensure that the aeroplane may appropriately be equipped with:

D33.3.1.1 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 lifesaving equipment, including means of sustaining life, as is appropriate to the flight to be undertaken; and

D33.3.1.2 equipment for making the distress signals.

D33.3.2 Each life jacket shall be equipped with a means of electric illumination for the purpose of facilitating the location of persons, except where the requirement of is met by the provision of individual flotation devices other than life jackets.

D34. AEROPLANES ON FLIGHTS OVER DESIGNATED LAND AREAS

D34.1 Aeroplanes, when operated across land areas which have been designated by the PCAA 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.

D35. AEROPLANES ON HIGH ALTITUDE FLIGHTS

D35.1 Aeroplanes intended to be operated at high altitudes shall be equipped with oxygen storage and dispensing apparatus capable of storing and dispensing the required oxygen supplies required.

D35.2 Pressurized Aeroplanes for which the individual certificate of airworthiness is first issued on or after 1 January 1990, 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.

D35.3 For aeroplanes with a maximum certificated take-off mass exceeding 5700 kg OR are equipped with one or more turbojet engines, for which the individual certificate of airworthiness was first issued before 1 January 1990, must be equipped with:

D35.3.1 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.

D35.3.2 An aeroplane intended to be operated at flight altitudes at which the atmospheric pressure is less than 700 hPa in personnel compartments shall be equipped with oxygen storage and dispensing apparatus capable of storing and dispensing the required oxygen.

D35.3.3 An aeroplane intended to be operated at flight altitudes at which the atmospheric pressure is less than 700 hPa but which is provided with means of maintaining pressures greater than 700 hPa in personnel compartments shall be provided with oxygen storage and dispensing apparatus capable of storing and dispensing the required oxygen.

Note: 376hPa corresponds to approximate altitude of 7600 meters or 25,000 feet
620 hPa corresponds to approximate altitude of 4000 meters or 13,000 feet
700 hPa corresponds to approximate altitude of 3000 meters or 10,000 feet

D36. AEROPLANES OPERATED IN ACCORDANCE WITH THE INSTRUMENT FLIGHT RULES

D36.1 All 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 means of measuring and displaying:

D36.1.1 magnetic heading (standby compass);

D36.1.2 barometric altitude;

D36.1.3 indicated airspeed, with a means of preventing malfunctioning due to either condensation or icing;

D36.1.4 turn and slip;

D36.1.5 aircraft attitude;

D36.1.6 stabilized aircraft heading;

D36.1.7 whether the supply of power to the gyroscopic instruments is adequate;

D36.1.8 the outside air temperature;

D36.1.9 rate-of-climb and descent;

D36.1.10 time in hours, minutes and seconds; (or carry others means to comply with this requirement)

D36.2 All aeroplanes with a maximum certificated take-off mass exceeding 5700 kg OR are equipped with one or more turbojet engines, in addition to the requirements contained in Para D36.1, shall be equipped with two independent altitude measuring and display systems, 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.

D37. AEROPLANES WHEN OPERATED AT NIGHT

D37.1 Aeroplanes, when operated at night, shall be equipped with:

D37.1.1 the equipment specified in Para D36 (i.e. equipment for IFR flights); and

D37.1.2 the lights required for aircraft in flight or for operating on the movement area of an aerodrome;

D37.1.3 a landing light;

D37.1.4 illumination for all flight instruments and equipment that are essential for the safe operation of the aeroplane that are used by the flight crew;

D37.1.5 lights in all passenger compartments; and

D37.1.6 an independent portable light for each crew member station.

D38. MACH NUMBER INDICATOR

D38.1 Aeroplanes with speed limitations expressed in terms of Mach number shall be equipped with a means of displaying Mach number.

D39. GROUND PROXIMITY WARNING SYSTEMS (GPWS)

D39.1 All turbine-engined aeroplanes of a maximum certificated take-off mass in excess of 5700 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.

D39.2 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.

D39.3 A ground proximity warning system shall provide, at a minimum, warnings of at least the following circumstances:

D39.3.1 excessive descent rate;

D39.3.2 excessive altitude loss after take-off or go-around; and

D39.3.3 unsafe terrain clearance.

D39.4 A ground proximity warning system installed in turbine-engined aeroplanes of a maximum certificated take-off mass in excess of 5700 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:

D39.4.1 excessive descent rate;

D39.4.2 excessive terrain closure rate;

D39.4.3 excessive altitude loss after take-off or go-around;

D39.4.4 unsafe terrain clearance while not in landing configuration;

D39.4.5 gear not locked down;

D39.4.6 flaps not in a landing position; and

D39.4.7 excessive descent below the instrument glide path.

D40. EMERGENCY LOCATOR TRANSMITTER (ELT)

D40.1 All Pakistan registered aeroplanes shall be equipped with at least one ELT of any type, except as provided for in Para D40.2.

D40.2 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.

D41. PRESSURE-ALTITUDE REPORTING TRANSPONDER

D41.1 Aeroplanes shall be equipped with a pressure-altitude reporting transponder.

D41.2 Unless exempted by PCAA, aeroplanes operating as VFR flights shall be equipped with a pressure-altitude reporting transponder.

D42. FLIGHT RECORDERS

D42.1 All aeroplanes of a maximum certificated take-off mass of over 5700 kg for which the application for type certification is submitted on or after 1 January 2023 shall be equipped with an FDR capable of recording at least the 82 parameters listed in Table A-6 of Appendix A.

D42.2 All aeroplanes of a maximum certificated take-off mass of over 5700 kg for which the individual certificate of airworthiness is first issued on or after 1 January 2005 shall be equipped with an FDR which shall record at least 78 parameters listed in Table A-6 of Appendix A.

D42.3 All aeroplanes of a maximum certificated take-off mass of over 27,000 kg for which the individual certificate of airworthiness is first issued on or after 1 January 1989 shall be equipped with an FDR which shall record at least the first 32 parameters listed in Table A-6 of Appendix A.

D42.4 All Flight recorders installed on aeroplane shall have securely attached an automatically activated underwater locating device/Beacon (ULB) operating at a frequency of 37.5 kHz and this device (ULB) shall operate for a minimum of 90 days.

D42.5 **Recording technology:** FDRs, ADRS, AIRs or AIRS shall not use engraving metal foil, frequency modulation (FM), photographic film or magnetic tape.

D42.6 **Duration:** All FDRs shall retain the information recorded during at least the last 25 hours of their operation.

D43. COCKPIT VOICE RECORDERS AND COCKPIT AUDIO RECORDING SYSTEMS

D43.1 All turbine-engined aeroplanes of a maximum certificated take-off mass of over 5700 kg for which the application for type certification is submitted to a Contracting State on or after 1 January 2016 and required to be operated by more than one pilot shall be equipped with a CVR.

D43.2 All aeroplanes of a maximum certificated take-off mass of over 27,000 kg for which the individual certificate of airworthiness is first issued on or after 1 January 1987 shall be equipped with a CVR.

D43.3 All Cockpit voice recorders installed on aeroplane shall have securely attached an automatically activated underwater locating device/Beacon (ULB) operating at a frequency of 37.5 kHz and this device (ULB) shall operate for a minimum of 90 days.

D43.4 **Recording technology**: Cockpit voice recorders (CVRs) and Cockpit audio recording systems (CARS) shall not use magnetic tape or wire.

D43.5 **Duration:**

D43.5.1 All CVRs shall retain the information recorded during at least the last 2 hours of their operation.

D43.5.2 All aeroplanes that are required to be equipped with Cockpit audio recording systems (CARS), and for which the individual certificate of airworthiness is first issued on or after 1 January 2025, shall be equipped with a CARS which shall retain the information recorded during at least the last two hours of their operation.

D43.5.3 All aeroplanes of a maximum certificated take-off mass of over 27,000 kg for which the individual certificate of airworthiness is first issued on or after 1 January 2022 shall be equipped with a CVR capable of retaining the information recorded during at least the last 25 hours of its operation.

D44. DATA LINK RECORDERS

D44.1 All aeroplanes for which the individual certificate of airworthiness is first issued on or after 1 January 2016, which use any of the data link communications applications referred to in Para 10 of Appendix-A and are required to carry a CVR as per Para D43, shall record the data link communications messages on a crash-protected flight recorder.

D44.2 All aeroplanes for which the individual certificate of airworthiness was first issued before 1 January 2016, that are required to carry a CVR as per Para D43 and are modified on or after 1 January 2016 to install and use any of the data link communications applications referred to in Para 10 of Appendix-A, shall record the data link communications messages on a crash-protected flight recorder, unless the installed data link communications equipment is compliant with a type certificate issued or aircraft modification first approved prior to 1 January 2016.
Note: The "aircraft modifications" refer to modifications to install the data link communications equipment on the aircraft (e.g. structural, wiring).

D44.3 **Duration:** The minimum recording duration shall be equal to the duration of the CVR.

D44.4 **Correlation**: Data link recording shall be able to be correlated to the recorded cockpit audio.

D45. FLIGHT RECORDERS - GENERAL

D45.1 **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.

D45.2 **Continued serviceability:** Operational checks and evaluations of recordings from the flight recorder systems shall be conducted to ensure the continued serviceability of the recorders. For details refer Para 6 and Para 7 of Appendix-A.

D46. AEROPLANE COMMUNICATION EQUIPMENT

D46.1 An aeroplane to be operated in accordance with the instrument flight rules or at night shall be provided with radio communication equipment. Such equipment shall be capable of conducting two-way communication with aeronautical stations.

D46.2 When compliance with Para D46.1 requires that more than one communication equipment unit be provided, each shall be independent of the other or others to the extent that a failure in any one will not result in failure of any other.

D46.3 An aeroplane to be operated in accordance with VFR, but as a controlled flight, shall, unless exempted by the PCAA, be provided with radio communication equipment capable of conducting two-way communication at any time during flight with aeronautical stations.
Note: Any flight which is subject to an air traffic control clearance, is categorized as controlled flight.

D46.4 An aeroplane operating flights under the provisions of Para D33.2 (*Extended flights over water*) or Para D35 (*Flights over designated land areas*) shall be equipped with radio communication equipment capable of conducting two-way communication with aeronautical stations, unless exempted by PCAA.

D46.5 The radio communication equipment required in accordance with Para D46.1 to Para D46.4 above, shall provide for communication on the aeronautical emergency frequency 121.5 MHz.

D46.6 For operations where communication equipment is required to meet an RCP specification for performance based communication (PBC), an aeroplane shall, in addition to the requirements specified in Para D46.1 to Para D46.5 :

D46.6.1 be provided with communication equipment which will enable it to operate in accordance with the prescribed RCP specification(s);

D46.6.2 have information relevant to the aeroplane RCP specification capabilities listed in the flight manual or other aeroplane documentation approved by the State of Design or State of Registry; and

D46.6.3 where the aeroplane is operated in accordance with a MEL, have information relevant to the aeroplane RCP specification capabilities included in the MEL.

D46.7 For aeroplanes with a maximum certificated take-off mass exceeding 5700 kg OR are equipped with one or more turbojet engines, in addition to the requirements of Para D46.1 to Para D46.5, shall be provided with radio communication equipment capable of:

D46.7.1 conducting two-way communication for aerodrome control purposes;

D46.7.2 receiving meteorological information at any time during flight; and

D46.7.3 conducting two-way communication at any time during flight with at least one aeronautical station and with such other aeronautical stations as prescribed by PCAA

D46.8 For aeroplanes with a maximum certificated take-off mass exceeding 5700 kg OR are equipped with one or more turbojet engines, the equipment installation shall be such that the failure of any single unit required for communications, navigation or surveillance purposes or any combination thereof will not result in the failure of another unit required for communications, navigation or surveillance purposes.

D47. NAVIGATION EQUIPMENT

D47.1 An aeroplane shall be provided with navigation equipment which will enable it to proceed:

D47.1.1 in accordance with its flight plan; and

D47.1.2 in accordance with the requirements of air traffic services;

except when, if not so precluded by PCAA, navigation for flights under VFR is accomplished by visual reference to landmarks.

D47.2 For operations where a navigation specification for performance-based navigation (PBN) has been prescribed, an aeroplane shall, in addition to the requirements specified in Para D47.1:

D47.2.1 be provided with navigation equipment which will enable it to operate in accordance with the prescribed navigation specification(s); and

D47.2.2 have information relevant to the aeroplane navigation specification capabilities listed in the flight manual or other aeroplane documentation approved by the State of Design or PCAA; and

D47.2.3 where the aeroplane is operated in accordance with a MEL, have information relevant to the aeroplane navigation specification capabilities included in the MEL.
Note: Airworthiness Notice "AWNOT-070-AWRG" may be referred for guidance on PBN.

D47.3 For flights in defined portions of airspace where, based on Regional Air Navigation Agreement, minimum navigation performance specifications (MNPS) are prescribed, an aeroplane shall be provided with navigation equipment which continuously provides indications to the flight crew of adherence to or departure from track to the required degree of accuracy at any point along that track; and

D47.4 For flights in defined portions of airspace where, based on Regional Air Navigation Agreement, a reduced vertical separation minimum (RVSM) of 300 meter (1000 ft) is applied between FL 290 and FL 410 inclusive; the aeroplane shall be provided with equipment which is capable of:

D47.4.1 indicating to the flight crew the flight level being flown;

D47.4.2 automatically maintaining a selected flight level;

D47.4.3 providing an alert to the flight crew when a deviation occurs from the selected flight level. The threshold for the alert shall not exceed ±90 m (300 ft); and

D47.4.4 automatically reporting pressure-altitude;

D47.5 The aeroplane shall be sufficiently provided with navigation equipment to ensure that, in the event of the failure of one item of equipment at any stage of the flight, the remaining equipment will enable the aeroplane to navigate in accordance with Para D47.1 and where applicable Para D47.2, D47.3 and D47.4.

D47.6 On flights in which it is intended to land in instrument meteorological conditions, an aeroplane shall be provided with radio equipment capable of receiving signals providing guidance to a point from which a visual landing can be effected. This equipment shall be capable of providing such guidance for each aerodrome at which it is intended to land in instrument meteorological conditions and for any designated alternate aerodromes.

D48. SURVEILLANCE EQUIPMENT

D48.1 An aeroplane shall be provided with surveillance equipment which will enable it to operate in accordance with the requirements of air traffic services.

D48.2 For operations where surveillance equipment is required to meet an RSP specification for performance-based surveillance (PBS), an aeroplane shall, in addition to the requirements specified in Para D48.1:

D48.2.1 be provided with surveillance equipment which will enable it to operate in accordance with the prescribed RSP specification(s);

D48.2.2 have information relevant to the aeroplane RSP specification capabilities listed in the flight manual or other aeroplane documentation approved by the State of Design or PCAA; and

D48.2.3 where the aeroplane is operated in accordance with a MEL, have information relevant to the aeroplane RSP specification capabilities included in the MEL.

D49. AEROPLANES IN ICING CONDITIONS

D49.1 All aeroplanes shall be equipped with suitable de-icing and/or anti-icing devices when operated in circumstances in which icing conditions are reported to exist or are expected to be encountered.

D50. EMERGENCY POWER SUPPLY FOR ELECTRICALLY OPERATED ATTITUDE INDICATING INSTRUMENTS

D50.1 Aeroplanes of a maximum certificated take-off mass of over 5700 kg newly introduced into service after 1 January 1975 shall be fitted with an emergency power supply, independent of the main electrical generating system, for the purpose of operating and illuminating, for a minimum period of 30 minutes, an attitude indicating instrument (artificial horizon), clearly visible to the pilot-in-command. The emergency power supply shall be automatically operative after the total failure of the main electrical generating system and clear indication shall be given on the instrument panel that the attitude indicator(s) is being operated by emergency power.

D51. WEATHER-DETECTING EQUIPMENT

D51.1 Pressurised aeroplanes with a maximum certificated take-off mass exceeding 5700 kg OR are equipped with one or more turbojet engines, when carrying passengers shall be equipped with operative weather-detecting equipment capable of detecting thunderstorms whenever such aeroplanes are being operated in areas where such conditions may be expected to exist along the route either at night or under instrument meteorological conditions.

D52. CABIN CREW SEATS

D52.1 For aeroplanes with a maximum certificated take-off mass exceeding 5700 kg OR are equipped with one or more turbojet engines, for which the individual certificate of airworthiness is first issued on or after 1 January 1981, shall be equipped with a forward or rearward facing seat (within 15 degrees of the longitudinal axis of the aeroplane) and fitted with a safety harness for the use of each cabin crew member.

D53. AIRBORNE COLLISION AVOIDANCE SYSTEM (ACAS II)

D53.1 All turbine-engined aeroplanes of a maximum certificated take-off mass in excess of 15,000 kg, or authorized to carry more than 30 passengers, for which the individual airworthiness certificate is first issued after 1 January 2007, shall be equipped with an airborne collision avoidance system (ACAS II).

D54. MICROPHONES

D54.1 Aeroplanes with a maximum certificated take-off mass exceeding 5700 kg OR are equipped with one or more turbojet engines, shall be equipped with boom or throat microphones for all flight crew members required to be on flight deck duty.

D55. ELECTRONIC NAVIGATION DATA MANAGEMENT

D55.1 The operator shall implement procedures (as acceptable to PCAA) that ensure the timely distribution and insertion of current and unaltered electronic navigation data to all necessary aircraft.

D56. DOCUMENTS FOR FLIGHT

D56.1 An aeroplane shall be provided with manuals, placards or other documents specified below, in accordance with its applicability:

D56.1.1 Flight manual, placards or other documents stating the approved limitations with which the Aeroplane is considered airworthy as defined by the appropriate Airworthiness requirements, and additional instructions and information necessary for the safety of the Aeroplane

D56.1.2 Certificate of Registration

D56.1.3 Certified true Copy of AOC

D56.1.4 Certificate of Airworthiness

D56.1.5 Certificate of Maintenance Review

D56.1.6 Certificate of Maintenance

D56.1.7 Certificate of Release to Service

D56.1.8 Certificate for Radio Installation

D56.1.9 PTA License for Radio Set Operators

D56.1.10 Accepted & Updated weight and balance schedule

D56.1.11 Noise Certificate issued in accordance with the latest issue of Airworthiness Notice No. AWNOT-062-AWRG.

D56.1.12 Copy of Approved MEL

D56.1.13 Updated Dent & Repair chart

D56.1.14 Certified true Copy of the agreement summary of Article 83 *bis* agreement

D57. AMENDMENTS AND MODIFICATIONS:

D57.1 Any subsequent amendments or modifications to this ANO may be processed and incorporated through Airworthiness Directorate, HQ CAA, in consultation with Chief Legal Services, HQ CAA as and when required or deemed expedient or appropriate.

E. EVIDENCES (ACRONYMS / RECORDS / REFERENCES):

E1. ACRONYMS:

E1.1	AAIB	AIRCRAFT ACCIDENT INVESTIGATION BOARD
E1.2	ADRS	AIRCRAFT DATA RECORDING SYSTEMS
E1.3	AIRS	AIRBORNE IMAGE RECORDING SYSTEM
E1.4	AIR	AIRBORNE IMAGE RECORDER
E1.5	ANO	AIR NAVIGATION ORDER
E1.6	CARs 1994	CIVIL AVIATION RULES 1994
E1.7	CARS	COCKPIT AUDIO RECORDING SYSTEM
E1.8	CVR	COCKPIT VOICE RECORDER
E1.9	DLR	DATA LINK RECORDER
E1.10	DLRS	DATA LINK RECORDING SYSTEM
E1.11	ELT	EMERGENCY LOCATOR TRANSMITTER
E1.12	FDR	FLIGHT DATA RECORDER
E1.13	FM	FREQUENCY MODULATION
E1.14	PCAA	PAKISTAN CIVIL AVIATION AUTHORITY
E1.15	PTA	PAKISTAN TELECOMMUNICATION AUTHORITY
E1.16	ULB	UNDERWATER LOCATOR BEACON

E2. RECORDS:

Nil

E3. REFERENCES

E3.1 ANO-007-FSXX
E3.2 AWNOT-065-AWRG
E3.3 AWNOT-062-AWRG

IMPLEMENTATION:

This Air Navigation Order shall be implemented with effect from **25th March, 2021** and shall supersede ANO-007-AWRG-4.0 dated 16/07/2018, and has overriding effect over all other regulations inconsistent and in contradiction with this regulation shall be amended to the extent of inconsistency and contradiction.

(KHAQAN MURTAZA)
Flight Lieutenant (R)
Director General
Pakistan Civil Aviation Authority

Dated: 30th Mar, 2021

(Engr. LUQMAN RASHEED)
Director Airworthiness
Pakistan Civil Aviation Authority
Dated:- 18th March, 2021
File No. HQCAA/1040/707/AWRG/I

APPENDIX-A

FLIGHT DATA RECORDER AND AIRCRAFT DATA RECORDING SYSTEMS

APPLICABILITY:

1. Appendix-A is applicable to aeroplanes / helicopters in accordance with the provisions of ANO-007-AWRG.

GENERAL:

2. The material in this Appendix concerns flight recorders intended for installation in aeroplanes/ helicopters. Crash-protected flight recorders comprise one or more of the following:

- a Flight Data Recorder (FDR),
- a Cockpit Voice Recorder (CVR),
- an Airborne Image Recorder (AIR),
- a Data Link Recorder (DLR).

3. When image or data link information is required to be recorded on a crash-protected flight recorder, it is permissible to record it on either the CVR or the FDR.

4. Lightweight flight recorders comprise one or more of the following:

- an Aircraft Data Recording System (ADRS),
- a Cockpit Audio Recording System (CARS),
- an Airborne Image Recording System (AIRS),
- a Data Link Recording System (DLRS).

5. When image or data link information is required to be recorded on a lightweight flight recorder, it is permissible to record it on either the CARS or the ADRS.

6. ADDITIONAL REQUIREMENTS:

6.1 The measurement range, recording interval and accuracy of parameters on installed equipment shall be verified by methods approved by PCAA as per requirements stipulated in Airworthiness Notice “AWNOT-065-AWRG”.

6.2 Documentation concerning parameter allocation, conversion equations, periodic calibration and other serviceability/maintenance information shall be maintained by the operator. The documentation needs to be sufficient to ensure that the concerned authorities (PCAA, AAIB) have the necessary information to read out the data in engineering units.

7. INSPECTIONS OF FLIGHT RECORDER SYSTEMS

7.1 Recording inspections of FDR systems or ADRS shall be carried out by the operator through approved procedure. The recording inspection Intervals should be made part of approved Aircraft Maintenance Program in light of Type Certificate Holder’s Maintenance Planning Document or TSO Holder’s Component Maintenance Manual recommendations. Guidance on compliance with the requirements of “recording inspections” and inspection intervals has been detailed in Airworthiness Notice “AWNOT-065-AWRG”. When carrying inspections of the FDR system as per approved procedures, a flight recorder system shall be considered **unserviceable** if there is a significant period of poor quality data, unintelligible signals, or if one or more of the mandatory parameters is not recorded correctly. A report of the recording inspection shall be made available PCAA, as and when requested.

7.2 Calibration of the FDR system for those parameters which have sensors dedicated only to the FDR and are not checked by other means, recalibration shall be carried out at least every five years or in accordance with the recommendations of the sensor manufacturer or FDR TSO Holder to determine any discrepancies and to ensure that parameters are being recorded within the calibration tolerances. When the parameters of “altitude and airspeed” are provided by sensors that are dedicated to the FDR system, there shall be a recalibration performed as recommended by the sensor manufacturer, or at least every two years.

8. PARAMETERS TO BE RECORDED

8.1 The parameters that satisfy the requirements for flight path and speed, as displayed to the pilot(s) are listed below. The parameters without an (*) are mandatory parameters which shall be recorded. In addition, the parameters

designated by an (*) shall be recorded if an information source for the parameter is displayed to the pilot and is practicable to record:

No.	For Aeroplane	For Helicopter
1	Pressure altitude	Pressure altitude
2	Indicated airspeed or calibrated airspeed	Indicated airspeed
3	Heading (primary flight crew reference)	Outside air temperature
4	Pitch attitude	Heading
5	Roll attitude	Normal acceleration
6	Engine thrust/power	Lateral acceleration
7	Landing-gear status*	Longitudinal acceleration (body axis)
8	Total or outside air temperature*	Time or relative time count
9	Navigation data*: drift angle, wind speed, wind direction, latitude/longitude	Navigation data*: drift angle, wind speed, wind direction, latitude/longitude
10	Time*	Radio altitude*
11	Radio altitude*	---

8.2 The parameters that satisfy the mandatory requirements for ADRS are the first 7 parameters in **Table A-3**(for Aeroplane) and **Table A-5** (for Helicopters).

8.3 The parameters in **Table A-1, Table A-4 and Table A-6**, without an (*) are mandatory parameters which shall be recorded on Flight Data Recorders (FDRs), as per the applicability defined in the relevant section of ANO-007-AWRG.

9. FLIGHT CREW-MACHINE INTERFACE RECORDINGS FOR AERPLANES ONLY

9.1 The operation of switches and selectors and the information displayed to the flight crew from electronic displays shall be captured by sensors or other electronic means, in accordance with the applicability defined in the relevant section of ANO-007-AWRG.

9.2 The recording of operation of switches and selectors by the flight crew shall include the following:

- any switch or selector that will affect the operation and the navigation of the aircraft; and
- selection of normal and alternate systems.

9.3 The recording of the information displayed to the flight crew from electronic displays shall include the following:

- primary flight and navigation displays;
- aircraft system monitoring displays;
- engine indication displays;
- traffic, terrain, and weather displays;
- crew alerting systems displays;
- stand-by instruments; and
- installed EFB to the extent it is practical.

9.4 If image sensors are used, the recording of such images shall not capture the head and shoulders of the flight crew members while seated in their normal operating position.

10. APPLICATIONS TO BE RECORDED ON DATA LINK RECORDER (DLR)

10.1 Where the aeroplane/ helicopter flight path is authorized or controlled through the use of data link messages, all data link messages, both uplinks (to the aeroplane/ helicopter) and downlinks (from the aeroplane/ helicopter), shall be recorded on the aeroplane/ helicopter. As far as practicable, the time the messages were displayed to the flight crew and the time of the responses shall too be recorded.

10.2 Messages applying to the applications listed in **Table A-2** shall be recorded. Applications without the asterisk (*) are mandatory applications which shall be recorded regardless of the system complexity. Applications with an (*) are to be recorded only as far as is practicable given the architecture of the system.

Table A-1: Parameter characteristics for flight data recorders

No.	Parameter	Applicability	Measurement range	Maximum sampling and recording interval (seconds)	Accuracy limits (sensor input compared to FDR readout)	Recording resolution
1	Time (UTC when available, otherwise relative time count or GNSS time sync)		24 hours	4	±0.125%/h	1 s
2	Pressure-altitude		–300 m (–1 000 ft) to maximum certificated altitude of aircraft +1 500 m (+5 000 ft)	1	±30 m to ±200 m (±100 ft to ±700 ft)	1.5 m (5 ft)
3	Indicated airspeed or calibrated airspeed		95 km/h (50 kt) to max VSo (Note 1) VSo to 1.2 VD (Note 2)	1	±5% ±3%	1 kt (0.5 kt recommended)
4	Heading (primary flight crew reference)		360°	1	±2°	0.5°
5	Normal acceleration (Note 8)	Application for type certification is submitted to a Contracting State before 1 January 2016	–3 g to +6 g	0.125	±1% of maximum range excluding datum error of ±5%	0.004 g
		Application for type certification is submitted to a Contracting State on or after 1 January 2016	–3 g to +6 g	0.0625	±1% of maximum range excluding datum error of ±5%	0.004 g
6	Pitch attitude		±75° or usable range whichever is greater	0.25	±2°	0.5°
7	Roll attitude		±180°	0.25	±2°	0.5°
8	Radio transmission keying		On-off (one discrete)	1	----	-----
9	Power on each engine (Note 3)		Full range	1 (per engine)	±2%	0.2% of full range or the resolution required to operate the aircraft
10*	Trailing edge flap and cockpit control selection		Full range or each discrete position	2	±5% or as pilot's indicator	0.5% of full range or the resolution required to operate the aircraft
11*	Leading edge flap and cockpit control selection		Full range or each discrete position	2	±5% or as pilot's indicator	0.5% of full range or the resolution required to operate the aircraft
12*	Thrust reverser position		Stowed, in transit, and reverse	1 (per engine)	-----	-----
13*	Ground spoiler/speed brake selection (selection & position)		Full range or each discrete position	1	±2% unless Higher accuracy uniquely required	0.2% of full range
14	Outside air temperature		Sensor range	2	±2°C	0.3°C
15*	Autopilot/auto throttle/AFCS mode and engagement status		A suitable combination of discretes	1	-----	-----
16	Longitudinal acceleration (Note 8)	Application for type certification submitted to a Contracting State before 1 January 2016	±1 g	0.25	±0.015 g excluding a datum error of ±0.05 g	0.004 g

		Application for type certification submitted to a Contracting State on or after 1 January 2016	±1 g	0.0625	±0.015 g excluding a datum error of ±0.05 g	0.004 g
17	Lateral acceleration (Note 8)	Application for type certification submitted to a Contracting State before 1 January 2016	±1 g	0.25	±0.015 g excluding a datum error of ±0.05 g	0.004 g
		Application for type certification submitted to Contracting State on or after 1 January 2016	±1 g	0.0625	±0.015 g excluding a datum error of ±0.05 g	0.004 g
18	Pilot input and/or control surface position- primary controls (pitch, roll, yaw) (Notes 4 and 8)	Application for type certification submitted to a Contracting State before 1 January 2016	Full range	0.25	±2° unless higher accuracy uniquely required	0.2% of full range or as installed
		Application for type certification submitted to a Contracting State on or after 1 January 2016	Full range	0.125	±2° unless higher accuracy uniquely required	0.2% of full range or as installed
19	Pitch trim position		Full range	1	±3% unless higher accuracy uniquely required	0.3% of full range or as installed
20*	Radio altitude		–6 m to 750 m (–20 ft to 2 500 ft)	1	±0.6 m (±2 ft) or ±3% whichever is greater below 150 m (500 ft) and ±5% above 150 m (500 ft)	0.3 m (1 ft) below 150 m (500 ft) 0.3 m (1 ft) + 0.5% of full range above 150 m (500 ft)
21*	Vertical beam deviation (ILS/GNSS/GLS glide path, MLS elevation, IRNAV/IAN vertical deviation)		Signal range	1	±3%	0.3% of full range
22*	Horizontal beam deviation (ILS/GNSS/GLS localizer, MLS azimuth, IRNAV/IAN lateral deviation)		Signal range	1	±3%	0.3% of full range
23	Marker beacon passage		Discrete	1	-----	-----
24	Master warning		Discrete	1	----	-----
25	Each NAV receiver frequency selection (Note 5)		Full range	4	As installed	----
26*	DME 1 and 2 distance (includes Distance to runway threshold (GLS) and Distance to missed approach point (IRNAV/IAN)) (Notes 5 and 6)		0 – 370 km (0 – 200 NM)	4	As installed	1852 m (1NM)
27	Air/ground status		Discrete	1	----	----
28*	GPWS/TAWS/GCAS status (selection of terrain display mode including pop-up display status) and (terrain alerts, both cautions and warnings, and advisories) and (on/off switch position)		Discrete	1	----	----
29*	Angle of attack		Full range	0.5	As installed	0.3 % of full range
30*	Hydraulics, each system (low pressure)		Discrete	2		0.5% of full range
31*	Navigation data (latitude/longitude, ground speed and drift angle) (Note7)		As installed	1	As installed	----

32*	Landing gear and gear selector position		Discrete	4	As installed	----
33*	Groundspeed		As installed	1	Data should be obtained from the most accurate system	1 kt
34	Brakes (left and right brake pressure, left and right brake pedal position)		(Maximum metered brake range, discretes or full range)	1	±5%	2% of full range
35*	Additional engine parameters (EPR, N1, indicated vibration level, N2, EGT, fuel flow, fuel cut-off lever position, N3, engine fuel metering valve position)	Engine fuel metering valve position: Application for type certification is submitted to a Contracting State on or after 1 January 2023	As installed	Each engine each second	As installed	2% of full range
36*	TCAS/ACAS (traffic alert and collision avoidance system)		Discretes	1	As installed	----
37*	Wind shear warning		Discrete	1	As installed	---
38*	Selected barometric setting (pilot, co- pilot)		As installed	64	As installed	0.1 mb (0.01 in-Hg)
39*	Selected altitude (all pilot selectable modes of operation)		As installed	1	As installed	Sufficient to determine crew selection
40*	Selected speed (all pilot selectable modes of operation)		As installed	1	As installed	Sufficient to determine crew selection
41*	Selected Mach (all pilot selectable modes of operation)		As installed	1	As installed	Sufficient to determine crew selection
42*	Selected vertical speed (all pilot selectable modes of operation)		As installed	1	As installed	Sufficient to determine crew selection
43*	Selected heading (all pilot selectable modes of operation)		As installed	1	As installed	Sufficient to determine crew selection
44*	Selected flight path (all pilot selectable modes of operation) (course/DSTRK, path angle, final approach path (IRNAV/IAN))			1	As installed	----
45*	Selected decision height		As installed	64	As installed	Sufficient to determine crew selection
46*	EFIS display format (pilot, co-pilot)		Discrete(s)	4	As installed	----
47*	Multi- function/engine/alert s display format		Discrete(s)	4	As installed	----
48*	AC electrical bus status		Discrete(s)	4	As installed	----
49*	DC electrical bus status		Discrete(s)	4	As installed	----
50*	Engine bleed valve position		Discrete(s)	4	As installed	----
51*	APU bleed valve position		Discrete(s)	4	As installed	----
52*	Computer failure		Discrete(s)	4	As installed	----
53*	Engine thrust command		As installed	2	As installed	----
54*	Engine thrust target		As installed	4	As installed	2% of full range
55*	Computed centre of gravity		As installed	64	As installed	1% of full range

56*	Fuel quantity in CG trim tank		As installed	64	As installed	1% of full range
57*	Head up display in use		As installed	4	As installed	----
58*	Para visual display on/off		As installed	1	As installed	----
59*	Operational stall protection, stick shaker and pusher activation		As installed	1	As installed	----
60*	Primary navigation system reference (GNSS, INS, VOR/DME, MLS, Loran C, localizer glideslope)		As installed	4	As installed	----
61*	Ice detection		As installed	4	As installed	----
62*	Engine warning each engine vibration		As installed	1	As installed	----
63*	Engine warning each engine over temperature		As installed	1	As installed	----
64*	Engine warning each engine oil pressure low		As installed	1	As installed	----
65*	Engine warning each engine over speed		As installed	1	As installed	----
66*	Yaw trim surface position		Full range	2	±3% unless higher accuracy uniquely required	0.3% of full range
67*	Roll trim surface position		Full range	2	±3% unless higher accuracy uniquely required	0.3% of full range
68*	Yaw or sideslip angle		Full range	1	±5%	0.5°
69*	De-icing and/or anti- icing systems selection		Discrete(s)	4	---	---
70*	Hydraulic pressure (each system)		Full range	2	±5%	100 psi
71*	Loss of cabin pressure		Discrete	1	---	---
72*	Cockpit trim control input position, Pitch		Full range	1	±5%	0.2% of full range or as installed
73*	Cockpit trim control input position, Roll		Full range	1	±5%	0.2% of full range or as installed
74*	Cockpit trim control input position, Yaw		Full range	1	±5%	0.2% of full range or as installed
75*	All cockpit flight control input forces (control wheel, control column, rudder pedal)		Full range (±311 N (±70 lbf), ± 378 N (±85 lbf), ± 734 N (±165 lbf))	1	±5%	0.2% of full range or as installed
76*	Event marker		Discrete	1		
77*	Date		365 days	64		
78*	Actual Navigation performance (ANP) or estimated position error (EPE) or estimated position uncertainty (EPU)		As installed	4	As installed	
79*	Cabin pressure altitude	Application for type certification submitted to Contracting State on or after 1 January 2023	As installed (0 ft to 40 000 ft recommended)	1	As installed	100 ft
80*	Aeroplane computed weight	Application for type certification submitted to a Contracting State on or after 1 January 2023	As installed	64	As installed	1% of full l range
81*	Flight director command	Application for type certification submitted to Contracting State on or after 1 January 2023	Full range	1	± 2°	0.5°
82*	Vertical speed	Application for type certification submitted to a Contracting State on or after 1 January 2023	As installed	0.25	As installed (32 ft/min recommended)	16 ft/min

Table A-1 Notes:

1. Vso stalling speed or minimum steady flight speed in the landing configuration is in Section "Abbreviations and Symbols".
2. VD design diving speed.
3. Record sufficient inputs to determine power.
4. 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 split surfaces, a suitable combination of inputs is acceptable in lieu of recording each surface separately. In aeroplanes with independent pilot input on primary controls, each pilot input on primary controls needs to be recorded separately.
5. If signal available in digital form.
6. Recording of latitude and longitude from INS or other navigation system is a preferred alternative.
7. If signals readily available.
8. It is not intended that aeroplanes issued with an individual certificate of airworthiness before 1 January 2016 be modified to meet the measurement range, maximum sampling and recording interval, accuracy limits or recording resolution description detailed in this Appendix.

Table A-2: Description of Applications for Data Link Recorders

No.	Application type	Application description	Recording Content
1	Data link initiation	This includes any applications used to log on to or initiate data link service. In FANS-1/A and ATN, these are ATS facilities notification (AFN) and context management (CM) respectively.	C
2	Controller/pilot communication	This includes any application used to exchange requests, clearances, instructions and reports between the flight crew and controllers on the ground. In FANS-1/A and ATN, this includes the CPDLC application. It also includes applications used for the exchange of oceanic (OCL) and departure clearances (DCL) as well as data link delivery of taxi clearances.	C
3	Addressed surveillance	This includes any surveillance application in which the ground sets up contracts for delivery of surveillance data. In FANS-1/A and ATN, this includes the automatic dependent surveillance — contract (ADS-C) application. Where parametric data are reported within the message they shall be recorded unless data from the same source are recorded on the FDR.	C
4	Flight information	This includes any service used for delivery of flight information to specific aircraft. This includes, for example, data link aviation weather report service (D-METAR), data link-automatic terminal service (D-ATIS), digital Notice to Airmen (D-NOTAM) and other textual data link services.	C
5	Aircraft broadcast surveillance	This includes elementary and enhanced surveillance systems, as well as automatic dependent surveillance — broadcast (ADS-B) output data. Where parametric data sent by the aeroplane are reported within the message they shall be recorded unless data from the same source are recorded on the FDR.	M*
6	Aeronautical operational control data	This includes any application transmitting or receiving data used for aeronautical operational control purposes (per the ICAO definition of operational control).	M*

Key:
C: Complete contents recorded. M: Information that enables correlation to any associated records stored separately from the aeroplane.
*: Applications to be recorded only as far as is practicable given the architecture of the system.

Table A-3: Parameter Characteristics for Aircraft Data Recording Systems (For Aeroplanes only)

No.	Parameter name	Minimum recording range	Maximum recording interval in seconds	Minimum recording accuracy	Minimum recording resolution	Remarks
1	Heading a) Heading (Magnetic or True)	±180º	1	±2°	0.5°	Heading is preferred, if not available, yaw rate shall be recorded
	b) Yaw rate	±300º/s	0.25	±1% + drift of 360°/h	2°/s	------
2	Pitch a) Pitch attitude	±90º	0.25	±2º	0.5°	Pitch attitude is preferred, if not available, pitch rate shall be recorded
	b) Pitch rate	±300º/s	0.25	±1% + drift of 360°/h	2°/s	-----
3	Roll a) Roll attitude	±180º	0.25	±2º	0.5°	Roll attitude is preferred, if not available, roll rate shall be recorded
	b) Roll rate	±300º/s	0.25	±1% + drift of 360°/h	2°/s	-----
4	Positioning system: a) Time	24 hours	1	±0.5 s	0.1 s	UTC time preferred where available.
	b) Latitude/longitude	Latitude:±90° Longitude:±180°	2 (1 if available)	As installed (0.00015° recommended)	0.00005°	-----
	c) Altitude	–300 m (–1 000 ft) to maximum certificated altitude of aeroplane +1 500 m (5 000 ft)	2 (1 if available)	As installed (±15 m (±50 ft) recommended)	1.5 m (5 ft)	-----
	d) Ground speed	0–1 000 kt	2 (1 if available)	As installed (±5 kt recommended)	1 kt	-----
	e) Track	0–360º	2 (1 if available)	As installed (± 2º recommended)	0.5°	-----
	f) Estimated error	Available range	2 (1 if available)	As installed	As installed	Shall be recorded if readily available
5	Normal acceleration	–3 g to + 6 g (*)	0.25 (0.125 if available)	As installed (± 0.09 g excluding a datum error of ±0.45 g recommended)	0.004 g	
6	Longitudinal acceleration	±1 g (*)	0.25 (0.125 if available)	As installed (±0.015 g excluding a datum error of ±0.05 g recommended)	0.004 g	-----
7	Lateral acceleration	±1 g (*)	0.25 (0.125 if available)	As installed (±0.015 g excluding a datum error of ±0.05 g recommended)	0.004 g	-----
8	External static pressure (or pressure altitude)	34.4 mb (3.44 in-Hg) to 310.2 mb (31.02 in-Hg) or available sensor range	1	As installed (±1 mb (0.1 in-Hg) or ±30 m (±100 ft) to ±210 m (±700 ft) recommended)	0.1 mb (0.01 in-Hg) or 1.5 m (5 ft)	-----
9	Outside air temperature (or total air temperature)	–50° to +90°C or available sensor range	2	As installed (±2°C recommended)	1°C	-----
10	Indicated air speed	As the installed pilot display measuring system or available sensor range	1	As installed (±3 % recommended)	1 kt (0.5 kt recommended)	-----
11	Engine RPM	Full range including overspeed condition	Each engine each second	As installed	0.2% of full range	-----
12	Engine oil pressure	Full range	Each engine each second	As installed (5% of full range recommended)	2% of full range	-----
13	Engine oil temperature	Full range	Each engine each second	As installed (5% of full range recommended)	2% of full range	-----
14	Fuel flow or pressure	Full range	Each engine each second	As installed	2% of full range	-----
15	Manifold pressure	Full range	Each engine each second	As installed	0.2% of full range	-----

16	Engine thrust/power/torque parameters required to determine propulsive thrust/power*	Full range	Each engine each second	As installed	0.1% of full range	* Sufficient parameters e.g. EPR/N1 or torque/Np as appropriate to the particular engine shall be recorded to determine power in both normal and reverse thrust. A margin for possible overspeed should be provided.
17	Engine gas generator speed (Ng)	0-150%	Each engine each second	As installed	0.2% of full range	-----
18	Free power turbine speed (Nf)	0-150%	Each engine each second	As installed	0.2% of full range	-----
19	Coolant temperature	Full range	1	As installed (±5°C recommended)	1° C	-----
20	Main voltage	Full range	Each engine each second	As installed	1 Volt	-----
21	Cylinder head temperature	Full range	Each cylinder each second	As installed	2% of full range	-----
22	Flaps position	Full range or each discrete position	2	As installed	0.5°	-----
23	Primary flight control surface position	Full range	0.25	As installed	0.2 % of full range	-----
24	Fuel quantity	Full range	4	As installed	1% of full range	-----
25	Exhaust gas temperature	Full range	Each engine each second	As installed	2% of full range	-----
26	Emergency voltage	Full range	Each engine each second	As installed	1 Volt	-----
27	Trim surface position	Full range or each discrete position	1	As installed	0.3% of full range	-----
28	Landing gear position	Each discrete position*	Each gear every two seconds	As installed		* Where available, record up-and- locked and down- and-locked position
29	Novel/unique aircraft features	As required	As required	As required	As required	

Table A-4: Parameter Characteristics for Flight Data Recorders (For Helicopters only)

No.	Parameter	Applicability	Measurement range	Maximum sampling and recording interval (seconds)	Accuracy limits (sensor input compared to FDR readout)	Recording resolution
1	Time(UTC when available, otherwise relative time count or GNSS time sync)		24 hours	4	±0.125% /h	1
2	Pressure altitude		–300 m (–1 000 ft) to maximum certificated altitude of aircraft +1 500 m (+5 000 ft)	1	±30 m to ±200 m (±100 ft to ±700 ft)	2
3	Indicated airspeed		As the installed pilot	1	±3%	3

4	Heading		360°	1	±2°	0.5°
5	Normal acceleration		–3 g to +6 g	0.125	±0.09 g excluding a datum error of ±0.045 g	0.004 g
6	Pitch attitude		±75° or 100% of useable range whichever is greater	0.5	±2°	0.5°
7	Roll attitude		±180°	0.5	±2°	0.5°
8	Radio transmission keying		On-off (one discrete)	1	—	—
9	Power on each engine		Full range	1 (per engine)	±2%	0.1% of full range
	Main rotor: Main rotor speed		50–130%	0.51	±2%	0.3% of full range
	Rotor brake		Discrete	---	—	—
11	Pilot input and/or control surface position - primary controls (collective pitch, longitudinal cyclic pitch, lateral cyclic pitch, tail rotor pedal)		Full range	0.5 (0.25 recommended)	±2% unless higher accuracy uniquely required	0.5% of operating range
12	Hydraulics, each system (low pressure and selection)		Discrete	1	—	—
13	Outside air temperature		Sensor range	2	±2°C	0.3°C
14*	Autopilot/ autothrottle/AFCS mode and engagement status		A suitable combination of discretes	1	—	—
15*	Stability augmentation system engagement		Discrete	1	—	—
16*	Main gearbox oil pressure		As installed	1	As installed	6.895 kN/m^2 (1psi)
17*	Main gearbox oil temperature		As installed	2	As installed	1□C
18	Yaw rate		±400°/second	0.25	±1.5% maximum range excluding datum error of ±5%	±2°/s
19*	Sling load force		0 to 200% of certified load	0.5	±3% of maximum range	0.5% for maximum certified load
20	Longitudinal acceleration		±1 g	0.25	±0.015 g excluding a datum error of ±0.05 g	0.004 g
21	Lateral acceleration		±1 g	0.25	±0.015 g excluding a datum error of ±0.05 g	0.004 g
22*	Radio altitude		–6 m to 750 m (–20 ft to 2 500 ft)	1	±0.6 m (±2 ft) or ±3% whichever is greater below 150 m (500 ft) and ±5% above 150 m (500 ft)	0.3 m (1 ft) below 150 m (500 ft), 0.3 m (1 ft) + 0.5% of full range above 150 m (500 ft)
23*	Vertical beam deviation		Signal range	1	±3%	0.3% of full range
24*	Horizontal beam deviation		Signal range	1	±3%	0.3% of full range
25	Marker beacon passage		Discrete	1	—	—
26	Warnings		Discrete(s)	1	—	—
27	Each navigation receiver frequency selection		Sufficient to determine selected frequency	4	As installed	—
28*	DME 1 and 2 distances		0–370 km (0–200 NM)	4	As installed	1 852 m (1 NM)

29*	Navigation data (latitude/longitude, ground speed, drift angle, wind speed, wind direction)		As installed	2	As installed	As installed
30*	Landing gear and gear selector position		Discrete	4	—	—
31*	Engine exhaust gas temperature (T4)		As installed	1	As installed	
32*	Turbine inlet temperature (TIT/ITT)		As installed	1	As installed	
33*	Fuel contents		As installed	4	As installed	
34*	Altitude rate		As installed	1	As installed	
35*	Ice detection		As installed	4	As installed	
36*	Helicopter health and usage monitor system		As installed	—	As installed	—
37	Engine control modes		Discrete	1	—	—
38*	Selected barometric setting (pilot and co-pilot)		As installed	64 (4 recommended)	As installed	0.1 mb (0.01 in Hg)
39*	Selected altitude (all pilot selectable modes of operation)		As installed	1	As installed	Sufficient to determine
40*	Selected speed (all pilot selectable modes of operation)		As installed	1	As installed	Sufficient to determine
41*	Selected Mach (all pilot selectable modes of operation)		As installed	1	As installed	Sufficient to determine
42*	Selected vertical speed (all pilot selectable modes of operation)		As installed	1	As installed	Sufficient to determine
43*	Selected heading (all pilot selectable modes of operation)		As installed	1	As installed	Sufficient to determine
44*	Selected flight path (all pilot selectable modes of operation)		As installed	1	As installed	Sufficient to determine crew selection
45*	Selected decision height		As installed	4	As installed	Sufficient to determine crew selection
46*	EFIS display format (pilot and co-pilot)		Discrete(s)	4	—	—
47*	Multi- function/ engine/alerts display format		Discrete(s)	4	—	—
48*	Event marker		Discrete	1	—	—
49*	GPWS/TAWS/GCAS status (selection of terrain display mode including pop-up display status) and (terrain alerts, both cautions and warnings, and advisories) and (on/off switch position) and (operational status)	Application for Type certification is submitted to a Contracting State on or after 1 January	Discrete	1	As installed	
50*	TCAS/ACAS (traffic alert and collision avoidance system) and (operational status)	Application for type certification is submitted to a Contracting State on or after 1 January 2023	Discrete	1	As installed	
51*	Primary flight controls – pilot input forces	Application for type certification is submitted to a Contracting State on or after 1 January 2023	Full range	0.125 (0.0625 recommended)	± 3% unless higher accuracy is uniquely required	0.5% of operating range

52*	Computed centre of gravity	Application for Type certification is submitted to a Contracting State on or after 1 January 2023	As installed	64	As installed	1% of full range
53*	Helicopter computed weight	Application for type certification is submitted to a Contracting State on or after 1 January 2023	As installed	64	As installed	1% of full range

Table A-5: Parameter Characteristics for Aircraft Data Recorders System (For Helicopters only)

No.	Parameter name	Minimum recording range	Maximum recording interval in seconds	Minimum recording accuracy	Minimum recording resolution	Remarks
1	Heading a) Heading (Magnetic or True)	±180º	1	±2°	0.5°	*Heading is preferred, if not available, yaw rate shall be recorded
	b) Yaw rate	±300º/s	0.25	±1% + drift of 360°/h	2°/s	------
2	Pitch a) Pitch attitude	±90º	0.25	±2º	0.5°	*Pitch attitude is preferred, if not available, pitch rate shall be recorded
	b) Pitch rate	±300º/s	0.25	±1% + drift of 360°/h	2°/s	-----
3	Roll a) Roll attitude	±180º	0.25	±2º	0.5°	*Roll attitude is preferred, if not available, roll rate shall be recorded
	b) Roll rate	±300º/s	0.25	±1% + drift of 360°/h	2°/s	-----
4	Positioning system: a) Time	24 hours	1	±0.5 s	0.1 s	UTC time preferred where available.
	b) Latitude/longitude	Latitude:±90° Longitude:±180°	2 (1 if available)	As installed (0.00015° recommended)	0.00005°	-----
	c) Altitude	–300 m (–1 000 ft) to maximum certificated altitude of aeroplane +1 500 m (5 000 ft)	2 (1 if available)	As installed (±15 m (±50 ft) recommended)	1.5 m (5 ft)	-----
	d) Ground speed	0–1 000 kt	2 (1 if available)	As installed (±5 kt recommended)	1 kt	-----
	e) Track	0–360º	2 (1 if available)	As installed (± 2º recommended)	0.5°	-----
	f) Estimated error	Available range	2 (1 if available)	As installed	As installed	Shall be recorded if readily available
5	Normal acceleration	–3 g to + 6 g (*)	0.25 (0.125 if available)	As installed (± 0.09 g excluding a datum errorof ±0.45 g recommended)	0.004 g	
6	Longitudinal acceleration	±1 g (*)	0.25 (0.125 if available)	As installed (±0.015 g excluding a datum error of ±0.05 g recommended)	0.004 g	-----
7	Lateral acceleration	±1 g (*)	0.25 (0.125 if available)	As installed (±0.015 g excluding a datum error of ±0.05 g recommended)	0.004 g	-----

8	External static pressure (or pressure altitude)	34.4 hPa (1.02 in-Hg) to 310.2 hPa (9.16 in-Hg) or available sensor range	1	As installed (±1 hPa (0.3 in-Hg) or ±30 m (±100 ft) to ±210 m (±700 ft) recommended)	0.1 hPa (0.03 in-Hg) or 1.5 m (5 ft)	-----
9	Outside air temperature (or total air temperature)	–50° to +90°C or available sensor range	2	As installed (±2°C recommended)	1°C	----
10	Indicated air speed	As the installed pilot display measuring system or available sensor range	1	As installed (±3 % recommended)	1 kt (0.5 kt recommended)	-----
11	Main rotor speed (Nr)	50% to 130% or available sensor range	0.5	As installed	0.3% of full range	
12	Engine RPM (*)	Full range including overspeed condition	Each engine each second	As installed	0.2% of full range	* For piston engined helicopters
13	Engine oil pressure	Full range	Each engine each second	As installed (5% of full range recommended)	2% of full range	-----
14	Engine oil temperature	Full range	Each engine each second	As installed (5% of full range recommended)	2% of full range	-----
15	Fuel flow or pressure	Full range	Each engine each second	As installed	2% of full range	-----
16	Manifold pressure (*)	Full range	Each engine each second	As installed	0.2% of full range	* For piston engined helicopters
17	Engine thrust/power/torque parameters required to determine propulsive thrust/power*	Full range	Each engine each second	As installed	0.1% of full range	* Sufficient parameters e.g. EPR/N1 or torque/Np as appropriate to the particular engine shall be recorded to determine power in both normal and reverse thrust. A margin for possible overspeed should be provided. Only for turbine-engined helicopters
18	Engine gas generator speed (Ng) (*)	0-150%	Each engine each second	As installed	0.2% of full range	* Only for turbine-engined helicopters
19	Free power turbine speed (Nf) (*)	0-150%	Each engine each second	As installed	0.2% of full range	* Only for turbine-engined helicopters
20	Collective Pitch	Full Range	0.5	As installed	0.1% of full range	-----
21	Coolant temperature (*)	Full range	1	As installed (±5°C recommended)	1° C	* Only for turbine-engined helicopters
22	Main voltage	Full range	Each engine each second	As installed	1 Volt	-----
23	Cylinder head temperature (*)	Full range	Each cylinder each second	As installed	2% of full range	* Only for turbine-engined helicopters
24	Fuel quantity	Full range	4	As installed	1% of full range	-----
25	Exhaust gas temperature	Full range	Each engine each second	As installed	2% of full range	-----
26	Emergency voltage	Full range	Each engine each second	As installed	1 Volt	-----
27	Trim surface position	Full range or each discrete position	1	As installed	0.3% of full range	-----
28	Landing gear position	Each discrete position*	Each gear every two seconds	As installed	-----	* Where available, record up- and- locked and down- and-locked position
29	Novel/unique aircraft features	As required	As required	As required	As required	-----

Table A-6: Parameter characteristics for flight data recorders

No.	Parameter	Applicability	Measurement range	Maximum sampling and recording interval (seconds)	Accuracy limits (sensor input compared to FDR readout)	Recording resolution
1	Time (UTC when available, otherwise relative time count or GNSS time sync)		24 hours	4	±0.125%/h	1 s
2	Pressure-altitude		–300 m (–1 000 ft) to maximum certificated altitude of aircraft +1 500 m (+5 000 ft)	1	±30 m to ±200 m (±100 ft to ±700 ft)	1.5 m (5 ft)
3	Indicated airspeed or calibrated airspeed		95 km/h (50 kt) to max V_{So} *(Note 1)* V_{So} to 1.2 V_D *(Note 2)*	1	±5% ±3%	1 kt (0.5 kt recommended)
4	Heading (primary flight crew reference)		360°	1	±2°	0.5°
5	Normal acceleration		–3 g to +6 g	0.125	±1% of maximum range excluding datum error of ±5%	0.004 g
6	Pitch attitude		±75° or usable range whichever is greater	0.25	±2°	0.5°
7	Roll attitude		±180°	0.25	±2°	0.5°
8	Radio transmission keying		On-off (one discrete)	1	----	-----
9	Power on each engine *(Note 3)*		Full range	1 (per engine)	±2%	0.2% of full range or the resolution required to operate the aircraft
10*	Trailing edge flap and cockpit control selection		Full range or each discrete position	2	±5% or as pilot's indicator	0.5% of full range or the resolution required to operate the aircraft
11*	Leading edge flap and cockpit control selection		Full range or each discrete position	2	±5% or as pilot's indicator	0.5% of full range or the resolution required to operate the aircraft
12*	Thrust reverser position		Stowed, in transit, and reverse	1 (per engine)	-----	-----
13*	Ground spoiler/speed brake selection (selection and position)		Full range or each discrete position	1	±2% unless higher accuracy uniquely required	0.2% of full range
14	Outside air temperature		Sensor range	2	±2°C	0.3°C
15*	Autopilot/auto throttle/AFCS mode and engagement status		A suitable combination of discretes	1	-----	-----
16	Longitudinal acceleration	Application for type certification submitted to a Contracting State before 1 January 2016	±1 g	0.25	±0.015 g excluding a datum error of ±0.05 g	0.004 g
17	Lateral acceleration (*Note 3*)	Application for type certification submitted to a Contracting State before 1 January 2016	±1 g	0.25	±0.015 g excluding a datum error of ±0.05 g	0.004 g

18	Pilot input and/or control surface position- primary controls (pitch, roll, yaw) (Notes 4 and 8)	Application for type certification submitted to a Contracting State before 1 January 2016	Full range	0.25	±2° unless higher accuracy uniquely required	0.2% of full range or as installed
		Application for type certification submitted to a Contracting State on or after 1 January 2016	Full range	0.125	±2° unless higher accuracy uniquely required	0.2% of full range or as installed
19	Pitch trim position		Full range	1	±3% unless higher accuracy uniquely required	0.3% of full range or as installed
20*	Radio altitude		–6 m to 750 m (–20 ft to 2 500 ft)	1	±0.6 m (±2 ft) or ±3% whichever is greater below 150 m (500 ft) and ±5% above 150 m (500 ft)	0.3 m (1 ft) below 150 m (500 ft) 0.3 m (1 ft) + 0.5% of full range above 150 m (500 ft)
21*	Vertical beam eviation (ILS/GNSS/GLS glide path, MLS elevation, IRNAV/IAN vertical deviation)		Signal range	1	±3%	0.3% of full range
22*	Horizontal beam deviation (ILS/GNSS/GLS localizer, MLS azimuth, IRNAV/IAN lateral deviation)		Signal range	1	±3%	0.3% of full range
23	Marker beacon passage		Discrete	1	-----	-----
24	Master warning		Discrete	1	----	-----
25	Each NAV receiver frequency selection (Note 5)		Full range	4	As installed	----
26*	DME 1 and 2 distance (includes Distance to runway threshold (GLS) and Distance to missed approach point (IRNAV/IAN)) (Notes 5 and 6)		0 – 370 km (0 – 200 NM)	4	As installed	1 852 m (1 NM)
27	Air/ground status		Discrete	1	----	----
28*	GPWS/TAWS/GCA S status (selection of terrain display mode including pop-up display status) and (terrain alerts, both cautions and warnings, and advisories) and (on/off switch position)		Discrete	1	----	----
29*	Angle of attack		Full range	0.5	As installed	0.3 % of full range
30*	Hydraulics, each system (low pressure)		Discrete	2		0.5% of full range
31*	Navigation data (latitude/longitude, ground speed and drift angle) (Note 7)		As installed	1	As installed	----
32*	Landing gear and gear selector position		Discrete	4	As installed	----

33*	Groundspeed		As installed	1	Data should be obtained from the most accurate system	1 kt
34	Brakes (left and right brake pressure, left and right brake pedal position)		(Maximum metered brake range, discretes or full range)	1	±5%	2% of full range
35*	Additional engine parameters (EPR, N1, indicated vibration level, N2, EGT, fuel flow, fuel cut-off lever position, N3, engine fuel metering valve position)	Engine fuel metering valve position: Application for type certification is submitted to a Contracting State on or after 1 January 2023	As installed	Each engine each second	As installed	2% of full range
36*	TCAS/ACAS (traffic alert and collision avoidance system)		Discretes	1	As installed	----
37*	Wind shear warning		Discrete	1	As installed	---
38*	Selected barometric setting (pilot, co- pilot)		As installed	64	As installed	0.1 mb (0.01 in-Hg)
39*	Selected altitude (all pilot selectable modes of operation)		As installed	1	As installed	Sufficient to determine crew selection
40*	Selected speed (all pilot selectable modes of operation)		As installed	1	As installed	Sufficient to determine crew selection
41*	Selected Mach (all pilot selectable modes of operation)		As installed	1	As installed	Sufficient to determine crew selection
42*	Selected vertical speed (all pilot selectable modes of operation)		As installed	1	As installed	Sufficient to determine crew selection
43*	Selected heading (all pilot selectable modes of operation)		As installed	1	As installed	Sufficient to determine crew selection
44*	Selected flight path (all pilot selectable modes of operation) (course/DSTRK, path angle, final approach path (IRNAV/IAN))		----	1	As installed	----
45*	Selected decision height		As installed	64	As installed	Sufficient to determine crew selection
46*	EFIS display format (pilot, co-pilot)		Discrete(s)	4	As installed	----
47*	Multi-function/engine/alert s display format		Discrete(s)	4	As installed	----
48*	AC electrical bus status		Discrete(s)	4	As installed	----
49*	DC electrical bus status		Discrete(s)	4	As installed	----
50*	Engine bleed valve position		Discrete(s)	4	As installed	----
51*	APU bleed valve position		Discrete(s)	4	As installed	----
52*	Computer failure		Discrete(s)	4	As installed	----
53*	Engine thrust command		As installed	2	As installed	2% of full range
54*	Engine thrust target		As installed	4	As installed	2% of full range

55*	Computed centre of gravity		As installed	64	As installed	1% of full range
56*	Fuel quantity in CG trim tank		As installed	64	As installed	1% of full range
57*	Head up display in use		As installed	4	As installed	----
58*	Para visual display on/off		As installed	1	As installed	----
59*	Operational stall protection, stick shaker and pusher activation		As installed	1	As installed	----
60*	Primary navigation system reference (GNSS, INS, VOR/DME, MLS, Loran C, localizer glideslope)		As installed	4	As installed	----
61*	Ice detection		As installed	4	As installed	----
62*	Engine warning each engine vibration		As installed	1	As installed	----
63*	Engine warning each engine over temperature		As installed	1	As installed	----
64*	Engine warning each engine oil pressure low		As installed	1	As installed	----
65*	Engine warning each engine over speed		As installed	1	As installed	----
66*	Yaw trim surface position		Full range	2	±3% unless higher accuracy uniquely required	0.3% of full range
67*	Roll trim surface position		Full range	2	±3% unless higher accuracy uniquely required	0.3% of full range
68*	Yaw or sideslip angle		Full range	1	±5%	0.5°
69*	De-icing and/or anti-icing systems selection		Discrete(s)	4	---	---
70*	Hydraulic pressure (each system)		Full range	2	±5%	100 psi
71*	Loss of cabin pressure		Discrete	1	---	---
72*	Cockpit trim control input position, Pitch		Full range	1	±5%	0.2% of full range or as installed
73*	Cockpit trim control input position, Roll		Full range	1	±5%	0.2% of full range or as installed
74*	Cockpit trim control input position, Yaw		Full range	1	±5%	0.2% of full range or as installed
75*	All cockpit flight control input forces (control wheel, control column, rudder pedal)		Full range (±311 N (±70 lbf), ± 378 N (±85 lbf), ± 734 N (±165 lbf))	1	±5%	0.2% of full range or as installed
76*	Event marker		Discrete	1		
77*	Date		365 days	64		
78*	Actual Navigation performance (ANP) or estimated position error (EPE) or estimated position uncertainty (EPU)		As installed	4	As installed	

79*	Cabin pressure altitude	Application for type certification submitted to a Contracting State on or after 1 January 2023	As installed (0 ft to 40000 ft recommended)	1	As installed	100 ft
80*	Aeroplane computed weight	Application for type certification submitted to Contracting State on or after 1 January 2023	As installed	64	As installed	1% of full l range
81*	Flight director command	Application for type certification submitted to a Contracting State on or after 1 January 2023	Full range	1	± 2°	0.5°
82*	Vertical speed	Application for type certification submitted to a Contracting State on or after 1 January 2023	As installed	0.25	As installed (32 ft/min recommended)	16 ft/min

Notes for Table A-6:

1. Stalling speed or minimum steady flight speed in the landing configuration is in Section “Abbreviations and Symbols”.
2. VD design diving speed.
3. Record sufficient inputs to determine power.
4. 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 split surfaces, a suitable combination of inputs is acceptable in lieu of recording each surface separately. In aeroplanes with independent pilot input on primary controls, each pilot input on primary controls needs to be recorded separately.
5. If signal available in digital form.
6. Recording of latitude and longitude from INS or other navigation system is a preferred alternative.
7. If signals readily available.
8. It is not intended that aeroplanes issued with an individual certificate of airworthiness before 1 January 2016 be modified to meet the measurement range, maximum sampling and recording intervals, accuracy limits or recording resolution guidance description detailed in this Appendix.

APPENDIX B

LOCATION OF AN AEROPLANE IN DISTRESS

1. PURPOSE AND SCOPE

Location of an aeroplane in distress aims at establishing, to a reasonable extent, the location of an accident site within a 6 NM radius.

2. OPERATION

An aircraft is in a distress condition when it is in a state that, if the aircraft behaviour event is left uncorrected, can result in an accident. Autonomous transmission of position information shall be active when an aircraft is in a distress condition. This will provide a high probability of locating an accident site to within a 6 NM radius. The system used for the autonomous transmission of position information shall be capable of transmitting that information in the event of aircraft electrical power loss, at least for the expected duration of the entire flight.

3. CLARIFICATION OF PURPOSE OF EQUIPMENT

3.1 Information from an aircraft system which either is active, or, when automatically or manually activated, can provide position information which includes a time stamp. This is a performance-based requirement which is not system-specific and may also bring operational benefits.

3.2 Emergency locator transmitter (ELT): The current generation of ELTs were designed to provide the position of impact for a survivable accident. The next generation of ELTs may have the capability to activate a transmission in flight when the conditions for Aircraft in Distress are detected.

3.3 Automatic deployable flight recorder (ADFR): The purpose of an ADFR is to have flight recorder data available soon after an accident, in particular for accidents over water. The integrated ELT provides for both locating the accident site for accident investigation and search and rescue purposes. Being floatable, it will assist in locating the accident site by providing an ELT signal when the wreckage sinks below the surface of the water. It also ensures redundancy for one ELT.

3.4 Underwater Locator Device (ULD): A ULD operating at a frequency of 8.8 kHz is attached to the airframe to locate aeroplane wreckage below the surface of water when an ELT signal is not possible to detect. The ULDs operating at 37.5 kHz are attached to the flight recorders and are used for locating the flight recorders under water.

4. EQUIPAGE COMPLIANCE

The advancement of technology has made it possible to meet the equipage requirements by different means. Table B-1 below provides examples of compliance.

Table B-1

Current	After 1 January 2023
In-service	**Application for type certification is submitted to a contracting State**
Two ELTs Two fixed recorders	Example: A system from which a position can be determined; and one ADFR with an integrated ELT; and one combined recorder; or A system from which a position can be determined and one ELT and two fixed recorders and an additional means to retrieve flight recorder data in a timely manner.