



**GOVERNMENT OF INDIA
OFFICE OF DIRECTOR GENERAL OF CIVIL AVIATION
TECHNICAL CENTRE, OPP SAFDARJANG AIRPORT, NEW DELHI**

**CIVIL AVIATION REQUIREMENTS
SECTION 2 - AIRWORTHINESS
SERIES 'I', PART V
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EFFECTIVE: FORTHWITH

SUBJECT: FLIGHT DATA RECORDERS

1. PURPOSE:

Rule 57 of Aircraft Rules, 1937 requires that every aircraft shall be fitted and equipped with instruments and equipment, including radio apparatus and special equipment as may be specified according to the use and circumstances under which the flight is to be conducted.

This part of Civil Aviation Requirement lays down the requirements for fitment of Flight Data Recorders on aircraft registered in India. All aircraft imported/purchased or leased for operation in India shall meet the applicability requirements laid down in this CAR.

This CAR has been issued under the provisions of Rule 29C of the Aircraft Rules, 1937.

2. DEFINITIONS:

Flight Recorder: Any type of recorder installed in the aircraft for the purpose of complementing accident/incident investigation.

Note: Detailed guidance on flight data recorders is contained in Appendix-I.

3. APPLICABILITY REQUIREMENTS:

3.1 Aeroplanes- Flight Data Recorders- Types of FDR

3.1.1 Type I FDR and Type IA FDR shall record the parameters required to determine accurately the aeroplane flight path, speed, attitude, engine power, configuration and operation.

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

Note: Parameter to be recorded by Type I , IA ,II and IIA* are listed in Appendix-II

3.2 Operations

3.2.1 All turbine-engined aeroplanes of a maximum certificated take-off mass of 5700kg or less for which a type certificate is first issued on or after 1 January 2016 shall be equipped with a Type II FDR:

Note—*Type certificate first issued refers to the date of issuance of the original “Type Certificate” for the aero plane type, not the date of certification of particular aeroplane variants or derivative models.*

3.2.2 **Recommendation**—*All turbine-engined aeroplanes of a maximum certificated take-off mass of 5700kg or less for which the individual certificate of airworthiness is first issued on or after 1 January 2016 should be equipped with a Type II FDR:*

3.2.3 All aeroplanes of a maximum certificated take-off mass of over 27000kg for which the individual certificate of airworthiness is first issued on or after 1 January 1989 shall be equipped with a Type I FDR.

3.2.4 All aeroplanes of a maximum certificated take-off mass of over 5700kg, up to and including 27000kg, for which the individual certificate of airworthiness is first issued on or after 1 January 1989, shall be equipped with a Type II FDR.

3.2.5 **Recommendation**—*All multi-engined turbine-engined aeroplanes of a maximum certificated take-off mass of 5700kg or less for which the individual certificate of airworthiness is first issued on or after 1 January 1990 should be equipped with a Type IIA FDR.*

3.2.6 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 5700kg, except those in 3.2.7, should be equipped with an FDR which shall record time, altitude, airspeed, normal acceleration, heading and such additional parameters as are necessary to determine pitch attitude, roll attitude, radio transmission keying and power on each engine.

3.2.7 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 27000kg that are of types of which the prototype was certificated by the appropriate national authority after 30 September 1969 shall be equipped with a Type II FDR.

3.2.8 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 5700kg shall be equipped with an FDR which shall record time, altitude, airspeed, normal acceleration and heading.

3.2.9 **Recommendation**—*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 27000kg that are of types of which the prototype was certificated by the appropriate national authority after 30 September 1969 should be equipped with an FDR which should record, in addition to time, altitude, airspeed, normal acceleration and heading, such additional parameters as are necessary to meet the objectives of determining:*

- a) *the attitude of the aeroplane in achieving its flight path; and*
- b) *the basic forces acting upon the aero plane resulting in the achieved flight path and the origin of such basic forces.*

3.2.10 All aeroplanes of a maximum certificated take-off mass of over 5700kg for which the individual certificate of airworthiness is first issued after 1 January 2005 shall be equipped with a Type IA FDR.

3.2.11 All aeroplanes which are required to record normal acceleration, lateral acceleration and longitudinal acceleration for which a type certificate is first issued on or after 1 January 2016 and which are required to be fitted with an FDR shall record those parameters at a maximum sampling and recording interval of 0.0625 seconds.

3.2.12 All aeroplanes which are required to record pilot input and/or control surface position of primary controls (pitch, roll, yaw) for which a type certificate is first issued on or after 1 January 2016 and which are required to be fitted with an FDR shall record those parameters at a maximum sampling and recording interval of 0.125 seconds.

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

3.3 Discontinuation

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

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

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

3.3.4 The use of photographic film FDRs shall be discontinued.

3.3.5 **Recommendation**— *The use of magnetic tape FDRs should be discontinued.*

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

3.4 Duration

All FDRs shall be capable of retaining the information recorded during at least the last 25 hours of their operation, except for the Type IIA FDR which shall be capable of retaining the information recorded during at least the last 30 minutes of its operation.

4. APPLICABILITY REQUIREMENTS:

4.1 Helicopter- Flight Data Recorders-Types of FDR

4.1.1 A Type IV FDR shall record the parameters required to determine accurately the helicopter flight path, speed, attitude, engine power and operation.

4.1.2 A Type IVA FDR shall record the parameters required to determine accurately the helicopter flight path, speed, attitude, engine power, operation and configuration.

4.1.3 A Type V FDR shall record the parameters required to determine accurately the helicopter flight path, speed, attitude and engine power.

Note: Parameters to be recorded by Type IV , IVA and VA are listed in Appendix-III

4.2 Operation

4.2.1 All helicopters of a maximum certificated take-off mass of over 3180kg for which the individual certificate of airworthiness is first issued on or after 1 January 2016 shall be equipped with a Type IVA FDR.

4.2.2 All helicopters of a maximum certificated take-off mass of over 7000kg, 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 a Type IV FDR.

4.2.3 Recommendation— *All helicopters of a maximum certificated take-off mass of over 3180kg, up to and including 7000kg, for which the individual certificate of airworthiness is first issued on or after 1 January 1989, should be equipped with a Type V FDR.*

4.3 Discontinuation

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

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

4.3.3 The use of photographic film FDRs shall be discontinued.

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

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

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

4.4 Duration

Types IV, IVA and V FDRs shall be capable of retaining the information recorded during at least the last ten hours of their operation.

5. DATA LINK RECORDERS

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

5.1 Applicability

5.1.1 All aeroplanes/helicopters for which the individual certificate of airworthiness is first issued on or after 1 January 2016, which utilize any of the data link communications applications listed in 3.1.2 of Appendix-I and are required to carry a CVR, shall record on a flight recorder the data link communications messages.

5.1.2 All aeroplanes/helicopters which are modified on or after 1 January 2016 to install and utilize any of the data link communications applications listed in 3.1.2 of Appendix-I and are required to carry a CVR shall record on a flight recorder the data link communications messages.

Note 4— *Data link communications are currently conducted by either ATN-based or FANS 1/A-equipped aircraft.*

~~**Note 2**— *A Class B AIR (Airborne Image Recorder) could be a means for recording data link communications applications messages to and from the aeroplanes/helicopters where it is not practical or is prohibitively expensive to record these data link communications applications messages on FDR or CVR.*~~

5.2 Duration

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

5.3 Correlation

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

6. FLIGHT RECORDERS — GENERAL

6.1 Construction and Installation

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

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

6.2 Operation

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

6.2.2 To preserve flight recorder records, flight recorders shall be deactivated upon completion of flight time following an accident or incident. The flight recorders shall not be reactivated before their disposition as determined in accordance with the instructions issued by DGCA

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

Note 2— *An operator shall ensure, to the extent possible, in the event the aeroplane becomes involved in an accident or incident, the preservation of all related flight recorder records and, if necessary, the associated flight recorders, and their retention in safe custody pending their disposition in accordance with instruction issued by DGCA.*

6.3 Continued Serviceability

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

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

6.4 Flight Recorder Electronic Documentation

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

Note—*Industry specification for documentation concerning flight recorder parameters may be found in the ARINC 647A, Flight Recorder Electronic Documentation, or equivalent document.*

6.5 Combination Recorders

6.5.1 Recommendation—*All aeroplanes of a maximum certificated take-off mass of over 5700kg for which the type certificate is first issued on or after 1 January 2016 and which are required to be equipped with both a CVR and an FDR, should be equipped with two combination recorders (FDR/CVR).*

6.5.2 All aeroplanes of a maximum certificated take-off mass of over 15000kg for which the type certificate is first issued 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.

6.5.3 Recommendation—*All aeroplanes of a maximum certificated take-off mass over 5700kg, required to be equipped with an FDR and a CVR, may alternatively be equipped with two combination recorders (FDR/CVR).*

Note—*The requirement of 6.5 may be satisfied by equipping the aeroplanes with two combination recorders (one forward and one aft) or separate devices.*

6.5.4 Recommendation—*All multi-engined turbine-powered aeroplanes of a maximum certificated take-off mass of 5700kg or less, required to be equipped with an FDR and/or a CVR, may alternatively be equipped with one combination recorder (FDR/CVR).*

6.6 Flight Recorder Records

An operator shall ensure, to the extent possible, in the event the aero plane becomes involved in an accident or incident, the preservation of all related flight recorder records and, if necessary, the associated flight recorders, and their retention in safe custody pending their disposition in accordance with instruction issued by DGCA.

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GUIDANCE ON FLIGHT DATA RECORDERS (FDR)

1. GENERAL REQUIREMENTS

1.1 The flight recorder systems containers shall:

- a) be painted a distinctive orange or yellow colour;
- b) carry reflective material to facilitate their location; and
- c) have securely attached an automatically activated underwater locating device.

1.2 The flight recorder systems shall be installed so that:

- a) the probability of damage to the recordings is minimized;
- b) they receive electrical power from a bus that provides the maximum reliability for operation of the flight recorder systems without jeopardizing service to essential or emergency loads;
- c) there is an aural or visual means for pre-flight checking that the flight recorder systems are operating properly; and
- d) if the flight recorder systems have a bulk erasure device, the installation shall be designed to prevent operation of the device during flight time or crash impact.

1.3 The flight recorder systems, when tested by methods approved by the appropriate certificating authority, shall be demonstrated to be suitable for the environmental extremes over which they are designed to operate.

1.4 Means shall be provided for an accurate time correlation between the flight recorder systems recordings.

1.5 The manufacturer shall provide the appropriate certificating authority with the following information in respect of the flight recording systems:

- a) manufacturer's operating instructions, equipment limitations and installation procedures;
- b) parameter origin or source and equations which relate counts to units of measurement; and
- c) manufacturer's test reports.

2. FLIGHT DATA RECORDER (FDR)

2.1 The flight data recorder shall start to record prior to the aeroplane moving under its own power and record continuously until the termination of the flight when the aeroplane is no longer capable of moving under its own power.

2.2 Parameters to be recorded (For Aero plane Operations)

2.2.1 Flight data recorders shall be classified as Type I, Type IA, Type II and Type IIA depending upon the number of parameters to be recorded and the duration required for retention of the recorded information.

2.2.2 The parameters that satisfy the requirements for FDRs are listed in the paragraphs below. The number of parameters to be recorded shall depend on aeroplane complexity. The parameters without an asterisk (*) are mandatory parameters which shall be recorded regardless of aeroplane complexity. In addition, the parameters designated by an asterisk (*) shall be recorded if an information data source for the parameter is used by aeroplane systems or the flight crew to operate the aeroplane. However, other parameters may be substituted with due regard to the aeroplane type and the characteristics of the recording equipment.

2.2.2.1 The following parameters shall satisfy the requirements for flight path and speed:

- Pressure altitude
- Indicated airspeed or calibrated airspeed
- Air-ground status and each landing gear air-ground sensor when practicable
- Total or outside air temperature
- Heading (primary flight crew reference)
- Normal acceleration
- Lateral acceleration
- Longitudinal acceleration (body axis)
- Time or relative time count
- Navigation data*: drift angle, wind speed, wind direction, latitude/longitude
- Groundspeed*
- Radio altitude*

2.2.2.2 The following parameters shall satisfy the requirements for attitude:

- Pitch attitude
- Roll attitude
- Yaw or sideslip angle*
- Angle of attack*

2.2.2.3 The following parameters shall satisfy the requirements for engine power:

- Engine thrust/power: propulsive thrust/power on each engine, cockpit thrust/power lever position
- Thrust reverse status*
- Engine thrust command*
- Engine thrust target*
- Engine bleed valve position*
- Additional engine parameters*: EPR, N1, indicated vibration level, N2, EGT, TLA, fuel flow, fuel cut-off lever position, N3

2.2.2.4 The following parameters shall satisfy the requirements for configuration:

- Pitch trim surface position
- Flaps*: trailing edge flap position, cockpit control selection
- Slats*: leading edge flap (slat) position, cockpit control selection
- Landing gear*: landing gear, gear selector position
- Yaw trim surface position*
- Roll trim surface position*
- Cockpit trim control input position pitch*
- Cockpit trim control input position roll*
- Cockpit trim control input position yaw*
- Ground spoiler and speed brake*: Ground spoiler position, ground spoiler selection, speed brake position, speed brake selection
- De-icing and/or anti-icing systems selection*
- Hydraulic pressure (each system)*
- Fuel quantity in CG trim tank *
- AC electrical bus status*
- DC electrical bus status*
- APU bleed valve position*
- Computed centre of gravity*

2.2.2.5 The following parameters shall satisfy the requirements for operation:

- Warnings
- Primary flight control surface and primary flight control pilot input: pitch axis, roll axis, yaw axis
- Marker beacon passage
- Each navigation receiver frequency selection
- Manual radio transmission keying and CVR/FDR synchronization reference
- Autopilot/autothrottle/AFCS mode and engagement status*
- Selected barometric setting*: pilot, first officer
- Selected altitude (all pilot selectable modes of operation)*
- Selected speed (all pilot selectable modes of operation)*
- Selected Mach (all pilot selectable modes of operation)*
- Selected vertical speed (all pilot selectable modes of operation)*
- Selected heading (all pilot selectable modes of operation)*
- Selected flight path (all pilot selectable modes of operation)*: course/DSTRK, path angle
- Selected decision height*
- EFIS display format*: pilot, first officer
- Multi-function/engine/alerts display format*
- GPWS/TAWS/GCAS status*: selection of terrain display mode including pop-up display status, terrain alerts, both cautions and warnings, and advisories, on/off switch position
- Low pressure warning*: hydraulic pressure, pneumatic pressure
- Computer failure*

- Loss of cabin pressure*
- TCAS/ACAS (traffic alert and collision avoidance system/airborne collision avoidance system)*
- Ice detection*
- Engine warning each engine vibration*
- Engine warning each engine over temperature*
- Engine warning each engine oil pressure low*
- Engine warning each engine over speed*
- Wind shear warning*
- Operational stall protection, stick shaker and pusher activation*
- All cockpit flight control input forces*: control wheel, control column, rudder pedal cockpit input forces
- Vertical deviation*: ILS glide path, MLS elevation, GNSS approach path
- Horizontal deviation*: ILS localizer, MLS azimuth, GNSS approach path
- DME 1 and 2 distances*
- Primary navigation system reference*: GNSS, INS, VOR/DME, MLS, Loran C, ILS
- Brakes*: left and right brake pressure, left and right brake pedal position
- Date*
- Event marker*
- Head up display in use*
- Para visual display on*

Note 1— *Parameter guidance for range, sampling, accuracy and resolution are as contained in the EUROCAE ED-112, Minimum Operational Performance Specification (MOPS) for Crash Protected Airborne Recorder Systems, or equivalent documents.*

Note 2— *It is not intended that aeroplanes issued with an individual certificate of airworthiness before 1 January 2016 be modified to meet the range, sampling, accuracy or resolution guidance detailed in this Appendix.*

2.2.2.6 *Type IA FDR.* This FDR shall be capable of recording, as appropriate to the aeroplane, at least the 78 parameters in Appendix-II.

2.2.2.7 *Type I FDR.* This FDR shall be capable of recording, as appropriate to the aeroplane, at least the first 32 parameters in Appendix-II.

2.2.2.8 *Types II and IIA FDRs.* These FDRs shall be capable of recording, as appropriate to the aeroplane, at least the first 16 parameters in Appendix-II .

2.2.2.9 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:

- Pressure altitude
- Indicated airspeed or calibrated airspeed

- Heading (primary flight crew reference)
- Pitch attitude
- Roll attitude
- Engine thrust/power
- Landing-gear status*
- Total or outside air temperature*
- Time*
- Navigation data*: drift angle, wind speed, wind direction, latitude/longitude
- Radio altitude*

2.2.3 Additional information

2.2.3.1 A Type IIA FDR, in addition to a 30-minute recording duration, shall retain sufficient information from the preceding take-off for calibration purposes.

2.2.3.2 The measurement range, recording interval and accuracy of parameters on installed equipment shall be verified by methods approved by the appropriate certifying authority.

2.2.3.3 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 accident investigation authorities have the necessary information to read out the data in engineering units.

2.3. Parameters to be recorded (For Helicopter Operations)

2.3.1 The flight data recorder shall start to record prior to the helicopter moving under its own power and record continuously until the termination of the flight when the helicopter is no longer capable of moving under its own power.

2.3.2 Flight data recorders for helicopters shall be classified as Type IV, IVA and V depending upon the number of parameters to be recorded.

2.3.3 The parameters that satisfy the requirements for Types IV, IVA and V FDRs, are listed in the paragraphs below. The number of parameters to be recorded shall depend on helicopter complexity. The parameters without an asterisk (*) are mandatory parameters which shall be recorded regardless of helicopter complexity. In addition, the parameters designated by an asterisk (*) shall be recorded if an information data source for the parameter is used by helicopter systems or the flight crew to operate the helicopter. However, other parameters may be substituted with due regard to the helicopter type and the characteristics of the recording equipment.

2.3.3.1 The following parameters shall satisfy the requirements for flight path and speed:

- Pressure altitude
- Indicated airspeed
- Outside air temperature
- Heading

- Normal acceleration
- Lateral acceleration
- Longitudinal acceleration (body axis)
- Time or relative time count
- Navigation data*: drift angle, wind speed, wind direction, latitude/longitude
- Radio altitude*.

2.3.3.2 The following parameters shall satisfy the requirements for attitude:

- Pitch attitude
- Roll attitude
- Yaw rate.

2.3.3.3 The following parameters shall satisfy the requirements for engine power:

- Power on each engine: free power turbine speed (Nf), engine torque, engine gas generator speed (Ng), cockpit power control position
- Rotor: main rotor speed, rotor brake
- Main gearbox oil pressure*
- Gearbox oil temperature*: main gearbox oil temperature, intermediate gearbox oil temperature, tail rotor gearbox oil temperature
- Engine exhaust gas temperature (T4)*
- Turbine inlet temperature (TIT)*.

2.3.3.4 The following parameters shall satisfy the requirements for operation:

- Hydraulics low pressure
- Warnings
- Primary flight controls — pilot input and/or control output position: collective pitch, longitudinal cyclic pitch, lateral cyclic pitch, tail rotor pedal, controllable stabilator, hydraulic selection
- Marker beacon passage
- Each navigation receiver frequency selection
- AFCS mode and engagement status*
- Stability augmentation system engagement*
- Indicated sling load force*
- Vertical deviation*: ILS glide path, MLS elevation, GNSS approach path — Horizontal deviation*: ILS localizer, MLS azimuth, GNSS approach path — DME 1 and 2 distances*
- Altitude rate*
- Ice detector liquid water content*
- Helicopter health and usage monitor system (HUMS)*: engine data, chip detectors, channel timing, exceedance discretets, broadband average engine vibration

2.3.3.5 The following parameters shall satisfy the requirements for configuration:

- Landing gear or gear selector position*
- Fuel contents*
- Ice detector liquid water content*.

Note. — *Parameter guidance for range, sampling, accuracy and resolution are as contained in the EUROCAE ED-112, Minimum Operational Performance Specifications (MOPS) for Crash Protected Airborne Recorder Systems, or equivalent documents.*

2.3.3.6 Type IVA FDR. This FDR will be capable of recording, as appropriate to the helicopter, at least the 48 parameters in Appendix-III.

2.3.3.7 Type IV FDR. This FDR shall be capable of recording, as appropriate to the helicopter, at least the first 30 parameters in Appendix-III.

2.3.3.8 Type V FDR. This FDR shall be capable of recording, as appropriate to the helicopter, at least the first 15 parameters in Appendix-III.

2.3.3.9 If further recording capacity is available, recording of the following additional information shall be considered:

- a) additional operational information from electronic displays, such as electronic flight instrument systems (EFIS), electronic centralized aircraft monitor (ECAM) and engine indication and crew alerting system (EICAS); and
- b) additional engine parameters (EPR, N1, fuel flow, etc.).

2.3.4 Additional information

2.3.4.1 The measurement range, recording interval and accuracy of parameters on installed equipment is usually verified by methods approved by the appropriate certifying authority.

2.3.4.2 Documentation concerning parameter allocation, conversion equations, periodic calibration and other serviceability/maintenance information shall be maintained by the operator/owner. The documentation shall be sufficient to ensure that accident investigation authorities have the necessary information to read out the data in engineering units.

3. DATA LINK RECORDER (DLR)

3.1 Applications to be recorded

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

Note— *Sufficient information to derive the content of the data link communications message and the time the messages were displayed to the flight crew is needed to determine an accurate sequence of events on board the aircraft/helicopter.*

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

- Data link initiation capability
- Controller–pilot data link communications
- Data link – flight information services

- Automatic dependent surveillance – contract
- Automatic dependent surveillance – broadcast*
- Aeronautical operational control*.

Note— *Descriptions of the applications are contained in Appendix- IV.*

4. INSPECTIONS OF FLIGHT RECORDER SYSTEMS

4.1 Prior to the first flight of the day, the built-in test features for the flight recorders and flight data acquisition unit (FDAU), when installed, shall be monitored by manual and/or automatic checks.

4.2 Annual inspections shall be carried out as follows:

a) an analysis of the recorded data from the flight recorders shall ensure that the recorder operates correctly for the nominal duration of the recording;

b) the analysis of the FDR shall evaluate the quality of the recorded data to determine if the bit error rate (including those errors introduced by recorder, the acquisition unit, the source of the data on the aero plane and by the tools used to extract the data from the recorder) is within acceptable limits and to determine the nature and distribution of the errors;

c) a complete flight from the FDR shall be examined in engineering units to evaluate the validity of all recorded parameters. Particular attention shall be given to parameters from sensors dedicated to the FDR. Parameters taken from the aircraft's electrical bus system need not be checked if their serviceability can be detected by other aircraft systems;

d) the readout facility shall have the necessary software to accurately convert the recorded values to engineering units and to determine the status of discrete signals;

4.3 Flight recorder systems 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.

4.4 A report of the annual inspection shall be made available on request to regulatory authorities for monitoring purposes.

4.5 Calibration of the FDR system:

a) 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 to determine any discrepancies in

the engineering conversion routines for the mandatory parameters and to ensure that parameters are being recorded within the calibration tolerances; and

b) 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.

Draft

Appendix-II

PARAMETER GUIDANCE FOR FLIGHT DATA RECORDERS – AEROPLANES

Serial number	Parameter	Measurement Range	Maximum sampling and Recording interval (seconds)	Accuracy limits (sensor input compared to FDR read-out)	Recording resolution
1	Time (UTC when available, otherwise relative time count or GPS time sync)	24 hours	4	±0.125% per hour	1 second
2	Pressure-altitude	-300 m (-1000 ft) to maximum certificated altitude of aircraft +1500 m (+5000 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_{S0} (Note 1) V_{S0} 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 (Note 3)	-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 4)	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	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 discrete	1	---	---
Note: – For General Aviation Aeroplane the preceding 15 parameters satisfy the requirements for a Type II FDR.					
16	Longitudinal acceleration (Note 3)	±1 g	0.25	±0.015 g excluding a datum	0.004 g

Serial number	Parameter	Measurement Range	Maximum sampling and Recording interval (seconds)	Accuracy limits (sensor input compared to FDR read-out)	Recording resolution
error of ± 0.05 g					
Note: – For Commercial Air Transport Aeroplane the preceding 16 parameters satisfy the requirements for a Type II FDR.					
17	Lateral acceleration (Note 3)	± 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) (Note 5 and 6)	Full range	0.25	$\pm 2^\circ$ unless higher accuracy uniquely required	0.2% of full range or as installed
19	Pitch trim position	Full range	1	$\pm 3\%$ unless higher accuracy uniquely required	0.3% of full range or as installed
20*	Radio altitude	– 6m to 750m (–20 ft to 2500 ft)	1	± 0.6 m (± 2 ft) or $\pm 3\%$ whichever is greater below 150m (500 ft) and $\pm 5\%$ above 150m (500ft)	0.3m (1 ft) below 150 m (500 ft). 0.3m (1 ft) + 0.5% of full range above 150m (500 ft).
21*	Vertical beam deviation (ILS/GPS/GLS glide path, MLS elevation, IRNAV/IAN vertical deviation)	Signal range	1	$\pm 3\%$	0.3% of full range
22*	Horizontal beam deviation (ILS/GPS/GLS localizer, MLS azimuth, IRNAV/IAN lateral deviation)	Signal range	1	$\pm 3\%$	0.3% of full range
23	Marker beacon passage	Discrete	1	---	---
24	Master warning	Discrete	1	---	---
25	Each NAV receiver frequency selection (Note 7)	Full range	4	As installed	
26*	DME 1 and 2 distance (Notes 7 and 8)	0 – 370 km (0 – 200 NM)	4	As installed	1852 m (1 NM)
27	Air/Ground status	Discrete	1	---	---
28*	GPWS (Ground Proximity Warning System)	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 9)	As installed	1	As installed	---
32*	Landing gear and gear selector position	Discrete	4	As installed	---
Note: – The preceding 32 parameters satisfy the requirements for a Type I FDR.					
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, discrete or full range)	1	±5%	2% of full range
Serial number	Parameter	Measurement Range	Maximum sampling and Recording interval (seconds)	Accuracy limits (sensor input compared to FDR read-out)	Recording resolution
35*	Additional engine parameters (EPR, N1, indicated vibration level, N2, EGT, fuel flow, fuel cut-off lever position, N3)	As installed	Each engine each second	As installed	2% of full range
36*	TCAS/ACAS (traffic alert and collision avoidance system)	Discrete	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/alerts 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
Serial number	Parameter	Measurement Range	Maximum sampling and Recording interval (seconds)	Accuracy limits (sensor input compared to FDR read-out)	Recording resolution
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, glide slope)	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(s)	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*	ANP or EPE or EPU	As installed	4	As installed	

Note: – The preceding 78 parameters satisfy the requirements for a Type IA FDR.

Notes—

1. V_{S0} stalling speed or minimum steady flight speed in the landing configuration is in Section “Abbreviations and Symbols”.
2. V_D design diving speed.
3. Refer to 3.2.40 11 for increased recording requirements.
4. Record sufficient inputs to determine power.
5. 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.
6. Refer to 3.2.12 for increased recording requirements.
7. If signal available in digital form.
8. Recording of latitude and longitude from INS or other navigation system is a preferred alternative.
9. If signals readily available.

If further recording capacity is available, recording of the following additional information should be considered:

a) operational information from electronic display systems, such as electronic flight instrument systems (EFIS), electronic centralized aircraft monitor (ECAM) and engine indication and crew alerting system (EICAS). Use the following order of priority:

- 1) parameters selected by the flight crew relating to the desired flight path, e.g. barometric pressure setting, selected altitude, selected airspeed, decision height, and autoflight system engagement and mode indications if not recorded from another source;
- 2) display system selection/status, e.g. SECTOR, PLAN, ROSE, NAV, WXR, COMPOSITE, COPY, ETC.;
- 3) warnings and alerts;
- 4) the identity of displayed pages for emergency procedures and checklists; and

b) retardation information including brake application for use in the investigation of landing overruns and rejected take-offs.

Appendix-III

PARAMETER GUIDANCE FOR FLIGHT DATA RECORDERS – HELICOPTERS

Serial Number	Parameter	Measurement Range	Maximum Sampling and Recording interval (seconds)	Accuracy limits (sensor input compared to FDR read-out)	Recording resolution
1	Time (UTC when available, otherwise elapsed time)	24 hours	4	±0.125% per hour	1 s
2	Pressure altitude	-300m (-1000ft) to max. certified altitude of aircraft +1500m (+5000ft)	1	±30 m to ±200 m (±100 ft to ±700 ft)	1.5m (5 ft)
3	Indicated airspeed	As the installed pilot display measuring system	1	±3%	1 kt
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
10	Main rotor: Main rotor speed Rotor brake	50-130% Discrete	0.51 -----	±2% -----	0.3% of full range -----
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/Auto throttle/AFCS mode and engagement status	A suitable combination of discrettes	1	-----	-----
15*	Stability augmentation system engagement	Discrete	1	-----	-----
Note: – The preceding 15 parameters satisfy the requirements for a Type V FDR.					
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 max. certified load
Serial Number	Parameter	Measurement Range	Maximum Sampling Recording interval (seconds)	Accuracy limits (sensor input compared to FDR read-out)	Recording resolution
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 2500 ft)	1	±0.6 m (±2 ft) or ±3% whichever is greater below 150m (500 ft) and ±5% above 150 m (500 ft)	0.3 m (1 ft) below 150m (500ft), 0.3m (1ft) + 0.5% of full range above 150m (500ft)
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	Master Warnings	Discrete(s)	1	---	---
27	Each NAV 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	1852 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	---	---
Note: – The preceding 30 parameters satisfy the requirements for a Type IV FDR.					
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	As installed	---
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 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)	As installed	1	As installed	Sufficient to

Serial Number	Parameter	Measurement Range	Maximum Sampling Recording interval (seconds)	Accuracy limits (sensor input compared to FDR read-out)	determine crew selection Recording resolution
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)	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	4	---	---
47*	Multi-function/engine/alerts display format	Discrete	4	---	---
48*	Event marker	Discrete	1	---	---

Note – The preceding 48 parameters satisfy the requirements for a Type IVA FDR.

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Appendix-IV

TABLE AI-2 DESCRIPTION OF APPLICATIONS FOR DATA LINK RECORDERS

Item No.	Application type	Application description	Recoding content
1.	Data link Initiation	This includes any applications used to logon 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 (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, D-METAR, DATIS, D-NOTAM and other textual data link services.	C
5.	Aircraft Broadcast Surveillance	This includes Elementary and Enhanced Surveillance Systems, as well as ADS-B output data. Where parametric data sent by the helicopter 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 AOC purposes (per the ICAO definition of AOC).	M*

Key:

C : Complete contents recorded.

M: Information that enables correlation to any associated records stored separately from the helicopter.

* : Applications that are to be recorded only as far as is practicable given the architecture of the system.
