

Part 6
Required Instruments & Equipment

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SUBPART A: GENERAL

6.001 APPLICABILITY

- (a) This Part prescribes the requirements for the aircraft instruments and equipment applicable to:
 - (1) All domestic and international flight operations of Vietnam-registered aircraft;
 - (2) All aircraft operated in commercial air transport by the holder of an Air Operator Certificate issued by the CAAV; and;
 - (3) Operations of aircraft from other ICAO member within Vietnam (ICAO).
- (b) This Part is applicable to all owners, operators and flight crew of aircraft registered in Vietnam and the persons and organizations that provide maintenance services for those aircraft.

6.003 DEFINITIONS

- (a) For the purpose of this Part, the following definitions shall apply:

Note: Additional aviation-related terms are defined in Part 1 of these regulations.

- (1) **Emergency locator transmitter (ELT):** A generic term describing equipment which broadcast distinctive signals on designated frequencies and, depending on application, may be automatically activated by impact or be manually activated. An ELT may be any of the following:
 - (i) Automatic fixed ELT (ELT(AF)): An automatically activated ELT which is permanently attached to an aircraft;
 - (ii) Automatic portable ELT (ELT(AP)): An automatically activated ELT which is rigidly attached to an aircraft but readily removable from the aircraft;
 - (iii) Automatic deployable ELT (ELT(AD)): An ELT which is rigidly attached to an aircraft and which is automatically deployed and activated by impact, and, in some cases, also by hydrostatic sensors. Manual deployment is also provided;
 - (iv) Survival ELT (ELT(S)): An ELT which is removable from an aircraft, stowed so as to facilitate its ready use in an emergency, and manually activated by survivors.
- (2) **Flight recorder:** Any type of recorder installed in the aircraft for the purpose of complementing accident/incident investigation.

6.005 ACRONYMS

The following acronyms are used in this Part:

AOC - Air Operator Certificate
DME – Distance Measuring Equipment
ELT – Emergency Locator Transmitter
ILS – Instrument Landing System
IFR – Instrument Flight Rules
IMC - Instrument Meteorological Conditions
MEL – Minimum Equipment List
MNPS - Minimal Navigation Performance Specifications
PBE - Protective Breathing Equipment
RVSM – Reduced Vertical Separation Minimum
VFR – Visual Flight Rules
VMC - Visual Meteorological Conditions
VOR – VHF Omnidirectional Range

6.007 GENERAL INSTRUMENT & EQUIPMENT REQUIREMENTS

- (a) All aircraft shall be equipped with instruments which will enable the flight crew to—
 - (1) Control the flight path of the aircraft;
 - (2) Carry out any required manoeuvres; and
 - (3) Observe the operating limitations of the aircraft in the expected operating conditions
- (b) In addition to the minimum equipment necessary for the issuance of a certificate of airworthiness, the instruments and equipment prescribed in this Part shall be:
 - (1) Installed or carried, as appropriate, in aircraft;
 - (2) According to the specific aircraft used;
 - (3) To the circumstances under which the flight is to be conducted; and;
 - (4) Acceptable to, and/or approved by, the CAAV.
- (c) All required instruments and equipment shall be approved and installed in accordance with applicable airworthiness requirements approved by the CAAV.
- (d) Prior to operation of any aircraft not registered in Vietnam by a Vietnam AOC holder that uses an airworthiness inspection programme approved or accepted by the State of Registry, the owner/operator shall ensure that instruments and equipment required by Vietnam but not installed in the aircraft are properly installed and inspected in accordance with the requirements of the State of Registry.
- (e) No flight shall be allowed to commence unless the required equipment:
 - (1) Meets the minimum performance standard and the operational and airworthiness requirements of all relevant standards, including Annex 10, Volume I of ICAO;
 - (2) Is installed such that the failure of any single unit required for either communication or navigation purposes, or both, will not result in the inability to communicate and/or navigate safely on the route being flown; and;
 - (3) Is in operable condition for the kind of operation being conducted, except as provided in the MEL.

- (f) If equipment is to be used by one flight crew member at his station during flight, it shall be installed so as to be readily operable from his or her station;
- (g) When a single item of equipment is required to be operated by more than one flight crew member, it shall be installed so that the equipment is readily operable from any station at which the equipment is required to be operated.
- (h) The aircraft shall be equipped with spare fuses and bulbs of appropriate ratings for the replacement of those accessible in flight. There shall be 03 spares for each specific rating and type of fuses and bulbs.
- (i) In addition to the requirements of this Part, the CAAV may prescribe such additional instruments or equipment as necessary for the safety of particular flight operations

SUBPART B: AIRCRAFT INSTRUMENTS & EQUIPMENT

6.010 POWER SUPPLY, DISTRIBUTION & INDICATION SYSTEM

- (a) No person may operate an aeroplane unless it is equipped with:
 - (1) A power supply and distribution system that meets the airworthiness requirements for certification of an aeroplane in the applicable category, or;
 - (2) For large and turbine powered aircraft, a power supply and distribution system that is able to produce and distribute the load for the required instruments and equipment, with use of an external power supply if any one power source or component of the power distribution system fails;
 - (3) A means for indicating the adequacy of the power being supplied to required flight instruments.
- (b) For large and turbine powered aircraft, engine-driven sources of energy, when used, shall be on separate engines.

6.013 ENGINE INSTRUMENTS: ALL FLIGHTS

- (a) No person may operate an aircraft in flight unless it is equipped with:
 - (1) A tachometer for each engine;
 - (2) An oil pressure gauge for each engine using pressure system;

- (3) A temperature gauge for each liquid-cooled system;
 - (4) An oil temperature gauge for each air-cooled system;
 - (5) A manifold pressure gauge for each altitude engine; and;
 - (6) A means for indicating the fuel quantity in each tank to be used.
- (b) For commercial air transport, no person may operate a reciprocating engine aircraft with a maximum gross weight of more than 5700 kg max takeoff mass unless it also is equipped with:
- (1) A device for each reversible propeller, in indicate to the pilot when the propeller is in reverse pitch;
 - (i) The device may be actuated at any point in the reversing cycle between the normal low pitch stop position and full reverse pitch, but it may not give an indication at or above the normal low pitch stop position;
 - (ii) The source of indication shall be actuated by the propeller blade angle or be directly responsive to it.
 - (2) A carburetor air temperature indicator for each engine;
 - (3) A cylinder head temperature indicator for each air-cooled engine;
 - (4) A fuel pressure indicator for each engine;
 - (5) A fuel flow meter an oil quantity indicator for each oil-tank when a transfer or separate oil reserve supply is used.
 - (6) An oil-in temperature indicator for each engine;
 - (7) An independent fuel pressure warning device for each engine or a master warning device for all engines with a means for isolating the individual warning circuits from the master warning device.
- (c) The CAAV may allow or require different instrumentation for turbine engine powered aircraft to provide an equivalent level of safety.

6.014 TREND & HEALTH MONITORING SYSTEMS: COMMERCIAL AIR TRANSPORT

- (a) For commercial air transport operations, no person may operate a:
- (1) Single-engine turbine-engined aircraft at night or in IFR unless that aircraft is equipped with an automatic engine trend monitoring system;
 - (2) Performance Class 3 helicopter in IMC unless equipped with a vibration health monitoring for the tail- rotor drive system; or
 - (3) Helicopter which has a maximum certificated take-off mass in excess of 3175 kg or a maximum passenger seating configuration of more than 9, unless that aircraft is equipped with a vibration health monitoring system.

6.015 FLIGHT INSTRUMENTS: ALL FLIGHTS

- (a) No person may operate an aircraft in flight unless it is equipped with a means of measuring displaying:
 - (1) A magnetic compass;
 - (2) A time in hours, minutes and seconds;
 - (3) Pressure altitude, such as a sensitive pressure altimeter calibrated in feet with sub-scale settings, calibrated in hectopascals or millibars, adjustable for any barometric pressure likely to be set in flight;
 - (4) A airspeed indicator calibrated in kmh (or knots); and;
 - (5) Other additional instruments or equipment as prescribed.
- (b) No person may operate an aeroplane with speed limitations expressed in terms of Mach number unless there is a properly installed Mach number indicator;
- (c) Those flight instruments that are used by any one pilot shall be so arranged as to permit that pilot to see the indications readily from their station with the minimum practicable deviation from the position and line of vision normally assumed when looking forward along the flight path.
- (d) When a means is provided for transferring an instrument from its primary operating system to an alternative system, the means shall include a positive positioning control and shall be marked to indicate clearly which system is being used.

6.017 FLIGHT INSTRUMENTS: CONTROLLED OR NIGHT FLIGHT.

- (a) No person may operate an aircraft in controlled flight or night flight unless it is equipped with the instruments required for all flights and:
 - (1) A gyroscopic rate-of-turn indicator;
 - (2) A slip-skid indicator;
 - (3) An attitude horizon indicator;
 - (4) A heading indicator.

6.018 ADVANCED COCKPIT AUTOMATION SYSTEMS (GLASS COCKPIT)

- (a) No person may operate an aircraft with advanced cockpit automation systems (glass cockpits) unless it is has adequate system redundancy that provides the flight crew with attitude, heading, airspeed and altitude indications in case of failure of the primary system or display.

6.020 FLIGHT INSTRUMENTS & SYSTEM REQUIREMENTS FOR (IFR)

- (a) No person may operate an aircraft in IFR unless it is equipped with the instruments required for all flights and controlled flights and:
 - (1) An airspeed indicating system with a heated pitot tube or equivalent means of preventing malfunctions due to either condensation or icing;

- (2) For commercial air transport: A minimum of two sensitive pressure altimeters with counter drum- pointer or equivalent presentation;
 - (i) Exception: Commercial air transport single pilot operations in propeller driven aircraft of less than 5700 kg max takeoff mass are only required one sensitive pressure altimeter;
 - (ii) Exception: The requirements of 6.020 may be met by combinations of instruments or integrated flight director systems provided that the safeguards against total failure in three separate instruments are retained.
- (3) For commercial air transport: Two independent static pressure systems. Exception: Propeller driven aircraft of less than 5700 kg max takeoff mass may have one static pressure system which includes an alternate static source;
- (4) A means of indicating whether the power supply is adequate (gyroscopic instruments);
- (5) A means of indicating in the flight crew compartment the outside air temperature;
- (6) An adequate source of electrical energy for all installed electrical and radio equipment, that for commercial air transport shall include:
 - (i) For multi-engine aircraft, at least two generators or alternators each of which is on a separate engine, of which any combination of one-half of the total number are rated sufficiently to supply the electrical loads of all required instruments and equipment necessary for safe emergency operation of the aircraft except that for multi-engine helicopters, the two required generators may be mounted on the main rotor drive train;
 - (ii) Two independent sources of energy (with means of selecting either) of which at least one is an engine-driven pump or generator, each of which is able to drive all required gyroscopic instruments powered by, or to be powered by, that particular source and installed so that failure of one instrument or source, does not interfere with other energy source.

6.023 INSTRUMENTS FOR OPERATIONS REQUIRING TWO PILOTS.

- (a) No person may operate an aircraft in operations requiring two pilots unless each pilot's station has the following flight instruments:
 - (1) An airspeed indicator;
 - (2) A sensitive press altimeter;
 - (3) A vertical speed indicator;
 - (4) A turn and slip indicator (or turn coordinator);
 - (5) An attitude indicator; and
 - (6) A stabilized direction indicator.
- (b) The second-in-command's flight instruments shall meet the same requirements for markings, indications and illumination as those required for the pilot-in-command.

6.025 STAND-BY ATTITUDE INDICATOR: COMMERCIAL AIR TRANSPORT.

- (a) No person may operate the following aircraft in commercial air transport unless they are equipped with a stand-by attitude indicator (artificial horizon) that is clearly visible to the pilots:
 - (1) An aeroplane having a maximum certificated takeoff mass of more than 5700 kg; or
 - (2) An aeroplane having a maximum approved passenger configuration of more than 9 passengers;
 - (3) A helicopter operating in IFR during commercial air transport (Class 1 or 2).
- (b) This stand-by attitude indicator shall:
 - (1) Operate independently of any other attitude indicating system;
 - (2) Be powered continuously during normal operation;
 - (3) After a total failure of the normal electrical generating system, be automatically powered and illuminated for a minimum of 30 minutes from a source independent of the normal electrical system; and;
 - (4) Have an indication on the instrument clearly evident to the flight crew when the emergency power source is being used.
- (c) If this stand-by attitude indicator is usable through flight attitudes of 360 degrees of pitch and roll, it may be used as basis for not having a rate-of-turn gyroscopic instrument.
- (d) Where the stand-by attitude indicator has its own dedicated power supply there shall be an associated indication, either on the instrument or on the instrument pane when this supply is in use.

6.027 AUTO PILOT

- (a) No person may operate an aircraft above FL 290 unless that aircraft is equipped with an autopilot capable of automatically maintaining a selected flight level
- (b) No person may operate an aircraft in airspace for which minimum navigation performance specifications are prescribed unless that aircraft is equipped with an autopilot capable of receiving and automatically tracking the selected navigational equipment inputs.
- (c) For commercial air transport: No person may operate an aeroplane with a single pilot under IFR or at night unless that aeroplane is equipped with an autopilot with at least altitude hold and heading mode.

6.030 IFR HELICOPTER STABILIZATION SYSTEM FOR COMMERCIAL AIR TRANSPORT.

- (a) No person may operate a helicopter in IFR commercial air transport operations without a stabilization system, unless that helicopter was certificated by the State of Manufacture as having adequate stability without such a system.

6.033 REQUIRED AIRCRAFT LIGHTING

- (a) No person may operate an aircraft in flight or on the movement area of an aerodrome at night unless it is equipped as prescribed in Appendix 1 to 6.033 with properly installed:
 - (1) Aircraft navigation lights;
 - (2) An anti-collision lights;
- (b) No person may operate an aircraft in flight or on the movement area of an aerodrome at night unless it is also equipped with:
 - (1) For general aviation operations, a landing light;
 - (2) For helicopter operations, a landing light that is trainable in the vertical plane;
 - (3) For commercial air transport operations, two landing lights ;
 - (4) Aeroplane which are equipped with a single landing light having two separately energized filaments will be in compliance with the two landing light requirement;
- (c) No person may operate an aircraft in flight or on the movement area of an aerodrome at night unless it is also equipped with:
 - (1) Illumination for all instruments and equipment that are essential for the safe operation of the aircraft by the flight crew;
 - (2) A means of displaying charts that enables them to be readable in all ambient light conditions;
 - (3) Lights in all passenger compartments; and
 - (4) An independent portable light at each crew member station.

6.035 EQUIPMENT FOR SPECIAL ALTIMETRY (RVSM)

- (a) No person may operate an aircraft in defined RVSM airspace unless the aircraft capable of compliance with the RVSM tolerances as detailed in Appendix 1 to 6.035 and is equipped with:
 - (1) Two independent pressure altitude reporting systems indicating to the flight crew the flight level being flown;
 - (2) An altitude alerting system providing an alert to the flight crew when a deviation not to exceed ± 90 m (300 ft) occurs from the selected flight level;
 - (3) An altitude holding system, capable of automatically maintaining a selected flight level; and
 - (4) A transponder with altitude reporting capability which can be connected to the altitude holding system.
- (b) To maintain qualification for RVSM approval, an operator shall have the height-keeping performance monitored for:
 - (1) A minimum of two aeroplanes of each aircraft type grouping, at least once every two years or within intervals of 1 000 flight hours per aeroplane, whichever period is longer; and
 - (2) An aircraft type grouping consists of a single aeroplane, at least every two years.

6.037 COCKPIT WIND SHIELD WIPERS

- (a) No person may operate an aircraft with a maximum certificated takeoff mass of more than 5700 kg unless it is equipped at each pilot station with a wind shield wiper or equivalent means to clear a portion of the wind shield during precipitation.

6.040 FLIGHT IN ICING CONDITIONS

- (a) No person may operate an aircraft in icing conditions unless it is equipped with suitable anti-icing or de-icing devices adequate for flight in the conditions that are reported to exist or are expected to be encountered.
- (b) The anti-icing or de-icing equipment shall provide for prevention or removal of ice on wind shield, wings, empennage, propellers and other parts of the aeroplane where ice formation will adversely affect the safety of the aircraft.
- (c) No person may operate an aeroplane in expected or actual icing conditions at night unless it is equipped with a means to illuminate or detect the formation of ice. This illumination must be of a type that will not cause glare or reflections that would handicap crew members in the performance of their duties.

6.043 WEATHER RADAR: COMMERCIAL AIR TRANSPORT

- (a) No person may operate an aircraft carrying passengers unless it has an operative weather radar or significant weather detection equipment installed if that aircraft:
 - (1) Is turbojet-engined or pressurized;
 - (2) Has a maximum certificated takeoff mass of more than 5700 kg or a maximum approved passenger seating configuration in excess of than 9 seats; or
 - (3) Is a helicopter.
- (b) No person may operate an aircraft in commercial air transport having a maximum approved passenger seating of more than nine seats in commercial air transport unless it has an approved weather radar or thunderstorm detection device installed;
- (c) When weather detection equipment is required for the operation, no person may begin a passenger flight under IFR or night VFR, when current weather reports indicate that thunderstorms or other potentially hazardous conditions than could be detected by the installed weather radar or thunderstorm detection device may reasonably be expected along the route, unless that equipment is operating satisfactorily;
- (d) No person may begin a commercial air transport passenger flight under IFR or night VFR, when current weather reports indicate that thunderstorms or other potentially hazardous conditions than could be detected by the installed weather radar or thunderstorm detection device may reasonably be expected along the route, unless that equipment is operating satisfactorily.
- (e) If the weather radar or thunderstorm detection device becomes inoperative on a commercial air transport passenger aircraft en route, the aircraft must be operated under the instructions and procedures specified in the AOC holder's Operations Manual;
- (f) An alternate electrical power supply is not required for the weather radar or thunderstorm detection device.

6.045 SPECIAL SEAPLANE EQUIPMENT

- (a) No person may operate a seaplane unless it is equipped with:
 - (1) An anchor;
 - (2) A sea anchor (drogue), to assist in aircraft manoeuvring;
 - (3) An air horn for making the sound signals prescribed in the international regulations for preventing collisions at sea, and,
 - (4) Individual flotation devices as required by 6.170.

Note: See Appendix 1 to 6.047 for the combined instruments and navigational equipment requirements.

6.046 ELECTRONIC FLIGHT BAGS (EFB)

- (a) Unless the operational use of EFB has been approved by the CAAV for the operator and aircraft, no person may operate an aircraft where an EFB:
 - (1) Is used as a primary source of information to perform functions required by airworthiness, airspace or operational requirements; and/or
 - (2) Is to be relied upon as a source of information essential to the safe operation of an aeroplane.
- (b) The EFB equipment and its associated installation hardware, including interaction with aeroplane systems if applicable, shall meet the appropriate airworthiness certification requirements.
- (c) No person may operate an aircraft using an EFB unless it has been determined ensure that, in the event of an EFB failure, sufficient information is readily available to the flight crew for the flight to be conducted safely.

6.047 ALL-WEATHER OPERATIONS.

- (a) No person may operate an aircraft in the following operations unless the aircraft is equipped as prescribed:
 - (1) Category II Instrument Approaches;
 - (2) Category III Instrument Approaches; or;
 - (3)) Low Visibility (below 800 m RVR [2400 ft]) Takeoffs.

Note: See Appendix 1 to 6.047 for the combined instruments and navigational equipment requirements

SUBPART C: COMMUNICATIONS & NAVIGATION EQUIPMENT

6.050 RADIO COMMUNICATION EQUIPMENT: GENERAL

- (a) No person may operate an aircraft that is not equipped with radio communications equipment:

- (1) In controlled flight;
 - (2) Under instrument flight rules; or
 - (3) At night.
- (b) The installed radio communications equipment shall be capable of:
- (1) Conducting two-way communication for the purposes of controlled flight;
 - (2) Receiving meteorological information at any time during flight; and
 - (3) Conducting two-way communication at any time during flight with at least one aeronautical station and with such other aeronautical stations and on such frequencies as may be prescribed by the appropriate authority;
 - (4) Communications on the aeronautical emergency frequency 121.5 MHz and/or 406 MHz; and
 - (5) Compliance with the RCP type prescribed for the airspace being transited.
- (c) Aircraft operated under instrument flight rules will have two independent methods of receiving communications from air traffic service.
- (d) When more than one radio communications unit is required for the flight operation, each unit 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.
- (e) No person may operate an aircraft in IFR operations requiring two pilots unless it is equipped with an audio selector panel accessible to both pilots.
- (f)
- (g) Each person operating an aircraft that does not have the required radio communication equipment shall obtain prior permission before operating in airspace requiring such equipment.

6.052 REQUIRED COMMUNICATION PERFORMANCE

- (a) For flights in defined portions of airspace or on routes where a Required Communication Performance (RCP) type has been prescribed, no person may operate an aircraft unless:
- (1) The communication equipment which will enable it to operate in accordance with the prescribed RCP types is installed and operational; and
 - (2) The CAAV has authorized the operator for operations in such airspace.

6.053 RADIO COMMUNICATION EQUIPMENT: COMMERCIAL AIR TRANSPORT.

- (a) No person may operate an aircraft in commercial air transport unless equipped with two independent radio communications equipment installations which, for the route and airspace flown, are capable of conducting two-way radio communication at any time during flight with:
- (1) At least one aeronautical station; and;

- (2) Any other aeronautical stations and frequencies which may be prescribed by the appropriate authority of the area being navigated;
 - (3) In accordance with the RCP type(s) authorized by the CAAV for operations in that airspace.
- (b) No person may operate an aircraft in commercial air transport unless equipped with radio communications equipment capable of receiving meteorological information at any time during the flight.

6.055 HEADSET & BOOM MICROPHONE.

- (a) No person may operate an aircraft in commercial air transport unless there is a boom or throat microphone available at each required flight crew member duty station.
- (b) No person may operate an aircraft with a single pilot under IFR or at night in commercial air transport unless that aircraft is equipped with a headset with boom microphone or equivalent and a transmit button on the control wheel.
- (c) No person may operate a helicopter in controlled flight unless that aircraft is equipped with a headset with boom microphone or equivalent and a transmit button on the control wheel.
- (d) Persons operating aeroplanes in controlled flight should have a boom or throat microphone available at each required flight crew member duty station.

6.057 ALTITUDE REPORTING TRANSPONDER

- (a) Unless exempted by the CAAV, no person may operate an aircraft unless it is equipped with a pressure-altitude reporting transponder that is operative and operates in accordance with the provisions of ICAO Annex 10, Volume IV.
 - (1) The aircraft will be assigned a distinct serialized 24-bit address identity code supplied by the CAAV for the transponder, this must be programmed prior to operation of the aircraft.
- (b) No person may operate an aircraft at altitudes above FL 290 unless it is equipped with a system that is automatically reporting pressure altitudes.
- (c) No person may operate an aircraft in commercial air transportation unless it is equipped with a pressure-altitude reporting transponder:
 - (1) For domestic flights, that operates in accordance with the requirements of the Vietnam ATS.
 - (2) For international flights, with a data source that provides pressure-altitude information with a resolution of 7.62 m (25 ft), or better.

- (d) Due to upgrading international requirements, operators should endeavour to ensure that installations of Mode S transponders are provided with the airborne/on-the-ground status, if the aeroplane is equipped with an automatic means of detecting such status.

6.060 NAVIGATION EQUIPMENT: GENERAL.

- (a) No person may operate an aircraft unless it is equipped with navigation equipment which will enable it to proceed in accordance with:
 - (1) The flight plan;
 - (2) Prescribed RNP (required navigational performance) types; and;
 - (3) The requirements of air traffic services.
- (b) Navigation under visual flight rules (VFR) may be accomplished without navigation equipment by visual reference to landmarks, if not precluded by the appropriate authority for the:
 - (1) Route and airspace;
 - (2) Meteorological conditions; or
 - (3) Type of aircraft.
- (c) No person may operate an aircraft unless that aircraft is equipped with sufficient navigation equipment to ensure that, in the event of failure of one item of equipment at any stage of the flight, the remaining equipment will enable the aircraft to continue navigating in accordance with the requirements of this Article.
- (d) Each radio navigation system shall have an independent antenna installation, except that, where rigidly supported non-wire antenna installations of equivalent reliability are used, only one antenna is required.
- (e) When more than one navigation unit is required for the flight operation, each unit 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.

6.063 NAVIGATIONAL ACCURACY (RNP & MNPS)

- (a) An aircraft shall have installed and operational navigation equipment which will enable it to be operated in accordance with the navigational accuracy required for the RNP type prescribed for the airspace or routes included in the flight plan.
- (b) No person may operate an aircraft where MNPS are prescribed, unless it is equipped with:
 - (1) For unrestricted operations, two independent long range navigation systems; or
 - (2) For notified special routes, one long range navigation system.
- (c) The navigation equipment required for operations in RNP or MNPS airspace shall be visible and usable by either pilot seated at their duty stations.

(d) No person may operate an aircraft where MNPS are prescribed, unless it is equipped with:

(1) For unrestricted operations, two independent long range navigation systems; or

(2) For notified special routes, one long range navigation system.

6.065 NAVIGATION EQUIPMENT: IFR APPROACH

(a) No person may operate an aircraft in situations which would require a landing approach to an airport in instrument meteorological conditions unless that aircraft is equipped with the appropriate radio equipment required to accomplish the published instrument approach for the planned destination and alternate airports.

(b) The navigation equipment installed on the aircraft will be capable of receiving signals providing guidance to a point from which a visual landing can be effected.

6.067 ELECTRONIC NAVIGATION DATA MANAGEMENT

(a) No person may operate an aircraft employing electronic navigation data products that have been processed for application in the air and on the ground unless:

(1) Has been approved by the CAAV with the operator's procedures for ensuring that the timely distribution, insertion and use of current and unaltered electronic navigation data and;

(2) The products delivered have met acceptable standards of integrity and;

(3) That the products are compatible with the intended function of the equipment that will use them.

(b) No person may operate an aircraft employing electronic navigation data products unless the current and unaltered electronic navigation data has been inserted prior to flight. Aircraft operators are only allowed to continue to use the electronic navigation data version has expired within 10 days after the expiration date, provided the electronic data related to mining areas tested for comparison with documented route of effect and confirm that the data is not altered.

6.068 OPERATIONAL BENEFITS FOR APPROACH & LANDING

(a) No operator shall permit and no pilot shall conduct operations which gain operational benefits using one or more of the following equipment unless the installation, serviceability and procedures have been approved by the CAAV:

(1) Automatic Landing;

(2) Head-Up Display

(3) Enhanced Vision Systems;

(4) Combined Vision Systems;

- (5) Night Vision Imaging Systems.

SUBPART D: WARNING EQUIPMENT & INDICATORS

6.070 WARNING SYSTEMS: GENERAL

- (a) No person may operate a turbojet aircraft unless it is equipped with an installed aural MACH overspeed warning.
- (b) Pressurized aeroplanes intended to be operate at flight altitudes at which the atmospheric pressure is less than 376 hPa (25,000 ft) shall be equipped with a device to provide positive warning to the flight crew of any dangerous loss of pressurization.
- (c) No person may operate an aircraft of more than 5700 kg certificated takeoff mass in commercial air transport without a means of indicating pitot heater failure.

6.073 LANDING GEAR AURAL WARNING DEVICE

- (a) No person may operate an aircraft with retractable landing gear unless it is equipped with an aural warning device that functions continuously any time the landing gear is not fully extended and locked and the wing- flap setting exceeds the position:
 - (1) Specified in the AFM for maximum certificated go-around climb configuration; or
 - (2) Where landing gear extension is normally performed.
- (b) This warning system must ensure:
 - (1) May not have a manual shutoff;
 - (2) Must be in addition to the any power lever-actuated device; and;
 - (3) May utilize any part of the power lever-actuated device.

6.075 ALTITUDE ALERTING SYSTEM

- (a) No person may operate the following aircraft unless it is equipped with an altitude alerting system:
 - (1) A turbojet powered aeroplane;
 - (2) A turbine powered aeroplane:
 - (i) Having passenger seating of more than 9 seats;
 - (ii) With a certificated takeoff mass of more than 5700 kg.
- (b) The altitude alerting system will be capable of alerting the flight crew:
 - (1) Upon approaching a pre-selected altitude in either (ascent or descent);
 - (2) By at least an aural signal, when deviating above or below a pre-selected altitude;
 - (3) The threshold for the alert shall not exceed plus or minus 90 m (300 ft)

6.077 GROUND PROXIMITY WARNING SYSTEM

- (a) No person may operate an aircraft unless it is equipped with a ground proximity warning system, if the aircraft has:
 - (1) For aeroplanes, a maximum takeoff mass in excess of 5,700 kg.
 - (2) For helicopters engaged in IFR operations–
 - (i) A maximum takeoff mass in excess of 3,175 kg; or
 - (ii) A maximum passenger configuration in excess of 9 seats.
- (b) A ground proximity warning system shall provide automatically a timely and distinctive warning to the flight crew when the aircraft is in potentially hazardous proximity to the earth's surface;
- (c) The installed ground proximity warning system shall include a forward looking terrain avoidance function which provides warning of unsafe terrain clearance;
- (d) The ground proximity warning system must automatically provide by means of aural signals, which may be supplemented by visual signals, and distinctive warning to the flight crew of when the aeroplane is in potentially hazardous proximity to the earth's surface, including:
 - (1) Excessive descent rate;
 - (2) Excessive terrain closure rate;
 - (3) Excessive altitude loss after takeoff or go-around;
 - (4) Unsafe terrain clearance while not in landing configuration:
 - (i) Gear not locked down;
 - (ii) Flaps not in landing position.
 - (5) Excessive descent below the instrument glide path.

6.080 AIRBORNE COLLISION AVOIDANCE SYSTEM (ACAS)

- (a) No person may operate a turbine-engined aeroplane with a maximum certificated takeoff mass in excess of 5700 kg or authorized to carry more than 19 passengers, unless it is equipped with an airborne collision avoidance system (ACAS II) that conforms to the relevant portions of ICAO Annex 10, Volume IV.
- (b) The following aircraft should be equipped with an ACAS II:
 - (1) All airplanes;
 - (2) All helicopters; and
 - (3) Any other aircraft category and class that intends to use the services of ATC.
- (c) When installed, the ACAS shall operate in accordance with the relevant provisions of Annex 10, Volume IV.

6.083 FORWARD LOOKING WIND SHEAR WARNING SYSTEM: TURBOJET AIRCRAFT

- (a) All turbojet aeroplanes of a maximum certificated takeoff mass in excess of 5700 kg or authorised to carry more than nine passengers should be equipped with a forward-looking wind shear warning system.
- (b) This system should be capable of providing the pilot with an aural and visual warning of wind shear ahead of the aircraft and the information required to permit the pilot to safely commence and continue a missed approach or go-around or to execute an escape manoeuvre if necessary.

6.085 RADIATION INDICATOR: COMMERCIAL AIR TRANSPORT.

- (a) No person may operate an aeroplane above 15,000 m (49,000 ft) unless that aircraft is equipped with equipment to measure and indicate continuously:
 - (1) The dose rate of total cosmic radiation being received (i.e. the total of ionizing and neutron radiation of galactic and solar origin);
 - (2) To measure and constantly indicate cumulative dose on each flight
- (b) The display unit of the radiation equipment shall be readily visible to a flight crew member.

6.087 STATIC SYSTEM WARNINGS

- (a) No person may operate an aircraft under IFR unless that aircraft has a means of indicating pitot heat failure with amber light in clear view of a flight crew member. The indication provided shall be designed to alert the flight crew if either:
 - (1) The heating system is switched "off," and
 - (2) The pitot heating system is switched "on" and any pitot tube heating element is inoperative.

SUBPART E: RECORDERS

6.090 FLIGHT RECORDERS: GENERAL

- (a) Flight recorders shall:
 - (1) 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;
 - (2) Flight recorders shall meet the prescribed performance, crashworthiness and fire protection specifications.
 - (3) Not be switched off during flight;
 - (4) Be deactivated upon completion of a flight following an accident or incident;
 - (5) Following an accident or serious incident, the flight recorders shall not be reactivated before their disposition as determined in accordance with Part 19 and Annex 13.
- (b) Crash protected flight recorders comprise one or more of the following systems:
 - (1) A flight data records (FDR);
 - (2) A cockpit voice recorder (CVR);

- (3) An airborne image records (AIR); and/or
- (4) A data link recorder (DLR)
- (c) Lightweight flight recorders comprise one or more of the following systems:
 - (1) An aircraft data recording system (ADRS);
 - (2) A cockpit audio recording system (CARS)
 - (3) An airborne image recording system (AIRS); and/or
 - (4) A data link recording system (DLRS).
- (d) The operator of the aircraft required to have flight recorder(s) shall conduct operational checks and evaluations of recordings from the flight recorder systems to ensure the continued serviceability of the recorders as prescribed and approved by the CAAV in accordance with Appendix 1 to 6.090.
- (e) The operator shall ensure the capability to be able to provide the FDR and ADRS parameters for the aircraft in electronic format to the CAAV for accident and incident investigation, taking into account the international industry specifications for such data.
- (f) Image and data link information may be recorded on either CVR, FDR, CARS or ADRS.

6.091 CONSTRUCTION & INSTALLATION OF FLIGHT RECORDERS

- (a) 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.
- (b) Non-Deployable flight recorder containers shall:
 - (1) Be either bright orange or bright yellow;
 - (2) Have reflective tape affixed to the external surface to facilitate its location under water; and
 - (3) Have securely attached an automatically activated underwater locating device operating at a frequency of 37.5 kHz. At the earliest practicable date but not later than 1 January 2018, this device shall operate for a minimum of 90 days.
- (c) Automatic deployable flight recorder containers shall:
 - (1) Be painted a distinctive orange colour, however the surface visible from outside the aircraft may be of another colour;
 - (2) Carry reflective material to facilitate their location; and
 - (3) Have an integrated automatically activated ELT
- (d) Operators shall not use the following flight data recorder medium in Vietnam-registered aircraft:
 - (1) Engraving metal foil;

- (2) Photographic film;
- (3) Analogue data using frequency modulation; or
- (4) After 1 January 2016, Magnetic tape.
- (e) Operators shall not use magnetic tape or wire cockpit voice recorders in Vietnam-registered aircraft.

6.092 FLIGHT DATA RECORDERS: GENERAL

- (a) General Characteristics
 - (1) The general characteristics and capability of the flight recorders shall include: (1) The parameters for recording required to determine accurately the:
 - (i) For Types I and IA FDRs: aeroplane flight path, speed, attitude, engine power, configuration and operation.
 - (ii) Types II and IIA FDRs: aeroplane flight path, speed, attitude, engine power and configuration of lift and drag devices.
 - (iii) For a Type IV FDR: helicopter flight path, speed, attitude, engine power and operation.
 - (iv) For a Type IVA FDR: helicopter flight path, speed, attitude, engine power, operation and configuration.
 - (v) For a Type V FDR: helicopter flight path, speed, attitude and engine power.
 - (2) Refer to Appendices 1 and 2 to The CAAV has prescribed the essential parameters in Appendix 1 to 6.090 (Aeroplanes) and Appendix 2 to 6.090 (Helicopters).
 - (3) The capability to retain the information recorded during the last:
 - (i) For a Type I and II: 25 hours of operation.
 - (ii) For a Type IIA: 30 minutes of operation.
 - (iii) For a Type IV and V: 10 hours of operation.
- (b) The FDR system shall be recalibrated:
 - (1) At least every five years to determine any discrepancies in the engineering conversion routines for the mandatory parameters, in accordance with the requirements of the aircraft manufacturer to ensure that the parameters are being recorded within the calibration tolerances; and
 - (2) When the parameters of altitude and airspeed are provided by sensors that are dedicated to the FDR system, there shall be a re-calibration performed as recommended by the sensor manufacturer, or at least every two years.

6.093 FLIGHT DATA RECORDERS: AEROPLANES

- (a) No person shall operate a turbine-engined aeroplane of a maximum certificated take-off mass of 5 700 kg or less for which an individual certificate of airworthiness or a type certificate is first issued on or after 1 January 2016 unless it is equipped with: a Type II FDR; or a Class C AIR or

- AIRS capable of recording flight path and speed parameters displayed to the pilot(s); or an ADRS capable of recording the essential parameters prescribed in Appendix 3 to 6.093.
- (b) No person shall operate an aeroplane of a maximum certificated take-off mass of over 5,700 kg, for which the individual certificate of airworthiness is first issued after 1 January 2005, unless it is equipped with a Type IA FDR.
 - (c) No person shall operate an aeroplane of a maximum certificated take-off mass of over 27,000 kg for which the individual certificate of airworthiness is first issued after 1 January 1989, unless it is equipped with a Type I FDR.
 - (d) For commercial air transport, no person shall operate an aeroplane of a maximum certificated take-off mass of over 5,700 kg, up to and including 27,000 kg, for which the individual certificate of airworthiness is first issued after 1 January 1989, unless it is equipped with a Type II FDR.
 - (e) No person should operate a multi-engined turbine powered aeroplanes of a maximum certificated take-off mass of 5,700 kg or less for which the individual certificate of airworthiness is first issued on or after 1 January 1990 unless it is equipped with a Type IIA FDR.
 - (f) No person shall operate a turbine-engined aeroplane, 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 5,700 kg, except those in paragraph (k), unless it is equipped with an FDR which shall record time, altitude, airspeed, normal acceleration and heading.
 - (g) No person shall operate a turbine-engined aeroplane, 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 5 700 kg, except those in paragraph (k), unless it is 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.
 - (h) No person shall operate a turbine-engined aeroplane, 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 unless it is equipped with a Type II FDR.
 - (i) No person shall operate a turbine-engined aeroplane of a maximum certificated take-off mass of over 5,700 kg, for which the individual certificate of airworthiness is first issued before 1 January 1987, unless it is equipped with an FDR which shall record time, altitude, airspeed, normal acceleration and heading.
 - (j) No person shall operate a turbine-engined aeroplane, 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 unless it is 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:
 - (1) The attitude of the aeroplane in achieving its flight path; and
 - (2) The basic forces acting upon the aeroplane resulting in the achieved flight path and the origin of such basic forces.
 - (k) All aeroplanes for which the application for type certification is submitted to a Contracting State on or after 1 January 2016 and which are required to be fitted with an FDR shall record the following parameters at a maximum sampling and recording interval of 0.0625 seconds for normal, lateral and longitudinal acceleration; and 0.125 seconds for pilot input and/or control surface position of primary controls (pitch, roll, yaw).

6.094 FLIGHT DATA RECORDERS: HELICOPTERS

- (a) No person shall operate a turbine-engined helicopters of a maximum certificated take-off mass of over 2,250 kg, up to and including 3,180 kg for which the application for type certification or individual certificate of airworthiness was submitted to a Contracting State on or after 1 January 2018 shall be equipped with:
 - (1) A Type IV A FDR; or
 - (2) A Class C AIR capable of recording flight path and speed parameters displayed to the pilot(s); or
 - (3) An ADRS capable of recording the essential parameters defined in Appendix 1 to 6.094.
- (b) All helicopters of a maximum certificated take-off mass of 3,180 kg or less for which the individual certificate of airworthiness is first issued on or after 1 January 2018 should be equipped with one of the choices provided in paragraph (a) of this Section.
- (c) No person shall operate a helicopter of a maximum certificated take-off mass of over 3,180 kg for which the individual certificate of airworthiness is first issued on or after 1 January 2016 unless it is equipped with a Type IVA FDR
- (d) No person shall operate a helicopter of a maximum certificated take-off mass of over 7,000 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 unless it is equipped with a Type IV FDR.
- (e) No person shall operate a helicopter of a maximum certificated take-off mass of over 3,180 kg, up to and including 7,000 kg, for which the individual certificate of airworthiness is first issued on or after 1 January 1989, unless it is equipped with a Type V FDR.

6.095 COCKPIT VOICE RECORDERS & AUDIO RECORDING SYSTEMS

- (a) A CVR shall be capable of retaining the information recorded during at least the last 2 hours, for:
 - (1) Aeroplanes required to have a CVR; or
 - (2) Helicopters that receive type certification after 1 January 2003;
- (b) No person may operate an aircraft required to have a CVR unless it is equipped with al alternate power sources that automatically engages and provides 10 minutes, plus or minus 1 minute, of operation whenever the power to the recorder ceases, either by normal shutdown or any other loss of power.
- (c) The alternate CVR power sources shall power the CVR and its associated cockpit area microphone components and the CVR shall be located as close as practicable to this alternate power source.
- (d) The alternate CVR source shall be separate from the power source that normally provides power to the CVR.

- (1) The use of the aircraft batteries or other power sources is acceptable provided that the requirements for “separate” power sources are met and electrical power to essential and critical loads is not compromised.
 - (2) When the CVR function is combined with other recording functions within the same unit, powering the other functions is allowed.
- (e) No person may operate an aeroplane of a maximum certificated take-off mass of over 27 000 kg that is issued a Type Certificate or individual certificate of airworthiness after 1 January 2018 unless the required alternate power source powers:
- (1) At least one CVR; or
 - (2) In the case of combination recorders, the forward CVR.

6.097 RECORDING OF DATA LINK COMMUNICATIONS

- (a) The operator shall ensure that, on aircraft which utilize any of the data link communications applications listed in Appendix 1 to 6.097 and are required to carry a CVR, all data link communications to and from the aircraft are recorded on a flight recorder.
- (b) The minimum data link recording duration shall be equal to the duration of the CVR, and shall be correlated to the recorded cockpit audio.
- (c) Sufficient information to derive the content of the data link communications message and, whenever practical, the time the message was displayed to or generated by the crew shall be recorded.
- (d) The data link recorder performance shall conform to internationally acceptable performance requirements.

6.098 COMBINATION RECORDERS

- (a) No person may operate an aeroplane of a maximum certificated take-off mass of over 5,700 kg 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, unless it is equipped with two combination recorders (FDR/CVR).
- (b) No person may operate an aeroplanes of a maximum certificated take-off mass of over 15,000 kg for which the requirement of paragraph (a) applies, unless one recorder is located as close to the cockpit as practicable and the other recorder is located as far aft as practicable.
- (c) Unless otherwise specified in these regulations, aircraft required to be equipped with a FDR and a CVR may alternatively be equipped with the following number of combination (FDR/CVR) recorders:
 - (1) Two - for all aeroplanes of a certificated takeoff mass of over 5 700kg.
 - (2) One - for all multi-engined turbine powered aeroplanes of less than 5 700kg.
- (d) Other aircraft required to have both an FDR and a CVR may use a combination recorder to meet these equipment requirements.

SUBPART F: CREW PROTECTION EQUIPMENT

6.100 SECURITY OF THE FLIGHT DECK

- (a) In all aircraft which are equipped with a flight crew compartment door:
 - (1) This door shall be capable of being locked; and
 - (2) A means shall be provided by which cabin crew can discreetly notify the flight crew in the event of suspicious activity or security breaches in the cabin.
- (b) No person may operate an aircraft having a maximum seating capacity of more than 19 passengers unless there is installed a lockable door to restrict entry to the flight deck. This door shall be lockable from within the flight deck only.
- (c) All passenger-carrying aeroplanes of a maximum certificated take-off mass in excess of 45,500 kg or with a passenger seating capacity greater than 60 shall be equipped with an approved flight crew compartment door that is designed to resist penetration by small arms fire and grenade shrapnel, and to resist forcible intrusions by unauthorized persons.
 - (1) This door shall be capable of being locked and unlocked from either pilot's station.
 - (2) A means shall be provided for monitoring from either pilot's station the entire door area outside the flight crew compartment to identify persons requesting entry and to detect suspicious behaviour or potential threat.

6.103 FLIGHT CREW SAFETY HARNESS

- (a) No person may operate an aircraft unless there is an operational safety harness installed for each required flight crew member seat. This safety harness shall include shoulder strap(s) and a seat belt which may be used independently.
- (b) The safety harness shall incorporate a device that will automatically restrain the occupant's torso in the event of a rapid deceleration.
- (c) This safety harness should incorporate a device to prevent a suddenly incapacitated pilot from interfering with the flight controls.

6.105 QUICK DONNING TYPE OXYGEN MASK

- (a) No person may operate a pressurized aircraft at altitudes above 376 hPA (25,000 feet) unless there is available at each flight crew duty station a quick donning type of oxygen mask that will readily supply oxygen upon demand.

6.107 CABIN CREW SEATS & SAFETY HARNESS

- (a) No person may operate an aircraft for which a cabin attendant(s) is required unless each seat provided is:
 - (1) Forward or rearward facing (within 15 degrees of the longitudinal axis of the aircraft) and;
 - (2) Fitted with a safety harness.
- (b) Each seat shall be located at floor level in the passenger compartment and adjacent to the emergency exits to facilitate emergency evacuation.
- (c) Each cabin attendant seat shall be provided with sufficient oxygen masks for the occupants in the event of a depressurization.

6.110 PROTECTIVE BREATHING EQUIPMENT (PBE)

- (a) No person may operate the following aircraft in commercial air transport, unless it is equipped with a PBE to protect the eyes, nose and mouth of all required crew members and provide oxygen or breathing gas for a period not less than 15 minutes.
 - (1) An aircraft with a maximum certified takeoff mass of more than 5700 kg; or
 - (2) An aircraft with a maximum seating capacity of more than 19 seats.
- (b) This equipment shall be conveniently located and easily accessible from each required duty station.
- (c) The PBE for each cabin attendant shall be portable.
- (d) The PBE, while in use, shall not prevent required communication.
- (e) For cargo aircraft, a PBE shall not be located in the cargo compartment, but immediately prior to entry into that compartment, and near a required fire extinguisher.

SUBPART G: PASSENGER RELATED EQUIPMENT

6.120 PASSENGER SEATS & SEAT BELTS

- (a) No person may operate an aircraft carrying passengers unless it is equipped with:
 - (1) Each seat for occupant on board who has reached their second birthday;
 - (2) A seat belt for each seat and a restraining belt.

6.123 PASSENGER INFORMATION

- (a) No person shall operate an aircraft having an approved passenger seating configuration of more than 9 passengers unless it is equipped with at least one passenger information sign notifying when:
 - (1) Safety belts should be fastened; and;
 - (2) Smoking is prohibited.
- (b) These signs shall be so constructed that a crew member can turn them on and off from a duty station.
- (c) There shall be sufficient signs located in the passenger cabin so that, when illuminated, they will be legible to each passenger.

6.125 PUBLIC ADDRESS SYSTEM

- (a) No person may operate an aircraft with a maximum approved seating configuration of more than 19 passengers unless it is equipped with a public address system.
- (b) This public address system shall be:

- (1) Audible and intelligible at all passenger seats, toilets and cabin crew duty and work stations;
- (2) Capable of operation within 10 seconds by any required crew member;
- (3) There must be a micro phone near by accessible by at least one seated crew member at each separate or pair of floor level emergency exits.

6.127 INTERPHONE SYSTEMS

- (a) No person may operate an aircraft on which a flight crew of more than one is required unless it is equipped with a flight deck interphone system, including headsets and microphones, which provide audible and intelligible communications between the required crew members.
- (b) No person may operate an aircraft having a maximum approved passenger seating configuration of more than 19 passengers unless it is equipped with a crew member interphone system which provides for signaling and two-way communications between all required crew members.
- (c) This crew member interphone system shall:
 - (1) Be capable of operation independently of the public address system;
 - (2) Be capable of operation within 10 seconds by any required crew member, including those at remote work stations;
 - (3) There must be a 01 pilot-crew interphone nearby and accessible by at least one seated crew member at each separate or pair of floor level emergency exits
 - (4) Have a signaling capability which provides for differentiation between normal and emergency calls;
 - (5) Provide, on the ground, a means of two-way communication between ground personnel and at least two flight crew members.

6.130 MEGAPHONES: COMMERCIAL AIR TRANSPORT

- (a) No person may operate an aircraft carrying more than 59 passengers in commercial air transport unless it is equipped with the required number of battery-powered megaphones readily accessible to the crew members assigned to direct emergency evacuation.
- (b) The required number and location of megaphones are:
 - (1) For an aircraft with a seating capacity of 60 to 99 passengers - one megaphone at the most rearward location readily accessible to a cabin attendant duty station;
 - (2) For an aircraft with more than 99 passengers - an additional megaphone installed at the forward end of the passenger compartment.
 - (3) For aeroplanes with more than one passenger deck, in all cases when the total passenger seating configuration of a deck is more than 60, at least one megaphone is required on the deck.

6.133 EMERGENCY EXITS

- (a) No person may operate an aircraft carrying passengers unless it has adequate emergency exit provisions for emergency evacuations and ditching.
- (b) Each passenger-carrying emergency exit (other than over-the-wing) that is more than 6 feet from the ground with the aeroplane on the ground and the landing gear extended, shall have an approved means to assist the occupants in descending to the ground.
- (c) Each passenger emergency exit, its means of access and its means of opening shall be conspicuously marked both inside and outside.
- (d) The location of each passenger emergency exit shall be indicated by a sign visible to occupants approaching along the main passenger aisle.
- (e) Each passenger-carrying aeroplane shall be equipped with a slip-resistant escape route that meets the requirements under which that aeroplane was type-certificated.
- (f) Each passenger-carrying aeroplane that is required to have cabin attendant(s) shall have flashlight stowage provisions accessible from their duty stations.

Note: See Appendix 1 to 6.133 for additional exit requirements

6.135 PASSENGER COMPARTMENT & EXITS

- (a) No person may conduct any passenger-carrying operation unless it has:
 - (1) A key for each door that separates a passenger compartment from another compartment that has emergency exit provisions;
 - (2) Unlock each door that leads to a compartment that is normally accessible to passengers;
 - (3) A placard on each door used to access a required passenger emergency exit, indicating that such door shall be open during takeoff and landing.

6.137 MATERIALS FOR CABIN INTERIORS

- (a) Upon the first major overhaul of an aeroplane cabin or refurbishing of the cabin interior, all materials in each compartment used by the crew or passengers that do not meet the current airworthiness requirements, shall be replaced with materials that meet the requirements.
- (b) Seat cushions, except those on flight crew member seats, in any compartment occupied by crew or passengers shall meet requirements pertaining to fire protection.

6.140 MATERIALS FOR CARGO & BAGGAGE COMPARTMENTS

- (a) Each Class C or D cargo compartment greater than 200 cubic feet in volume in a transport (category aeroplane type certified after January 1, 1958) shall have ceiling and sidewall liner panels which are constructed of:
 - (1) Glass fibre reinforced resin;
 - (2) flame resistance materials;
 - (3) Aluminium, in the case of installations approved prior to March 20, 1989.

6.143 EMERGENCY LIGHTING SYSTEM

- (a) No person may operate an aircraft with a maximum approved passenger configuration of more than nineteen passengers unless it is equipped with an emergency lighting system that is independent of the main lighting system.
- (b) The emergency light system must:
 - (1) Illuminate each passenger exit marking and locating sign;
 - (2) Provide enough general lighting in the passenger cabin; and;
 - (3) Include floor proximity emergency escape path marking.

SUBPART H: EMERGENCY EQUIPMENT

6.150 EMERGENCY EQUIPMENT: ALL AIRCRAFT

- (a) Each item of emergency and flotation equipment shall be:
- (b) Readily accessible to the crew and, with regard to equipment located in the passenger compartment, to passengers without appreciable time for preparatory procedures;
 - (1) Clearly identified and clearly marked to indicate its method of operation;
 - (2) Marked as to date of last inspection;
 - (3) Marked as to contents when carried in a compartment or container.

6.153 FIRST AID KIT

- (a) No person may operate an aircraft unless it is equipped with at least the minimum number of accessible first aid kits specified in the adjacent graph:

Number of passenger seats	Number of first aid kits
0-99	1
100-199	2
200-299	3
300 and more	4

- (b) The installed first aid kit shall contain the minimum contents prescribed by the CAAV.

6.156 UNIVERSAL PRECAUTION KIT: COMMERCIAL AIR TRANSPORT

- (a) No person may operate an aircraft in commercial air transport that is required to carry cabin crew as part of the operating crew, unless it is equipped with one universal precaution kit for the use of cabin crew members in managing incidents of ill health associated with a case of suspected communicable disease, or in the case of illness involving contact with body fluids.
- (b) A minimum of two universal precaution kits are required for aeroplanes authorized to carry more than 250 passengers)
- (c) The installed universal precaution kit shall contain the minimum contents prescribed in the Appendix 1 to 6.156.

6.157 PORTABLE FIRE EXTINGUISHERS

- (a) No person may operate an aircraft unless it has the minimum number of portable fire extinguishers of a type which, when discharged, will not cause dangerous contamination of the air within the aeroplane. The type and quantity of extinguishing agent shall be suitable for the kinds of fires likely to occur in the compartment where the extinguisher is intended to be used. For passenger compartments, the extinguisher shall be designed to minimise the hazard of toxic gas concentrations.
- (b) The minimum number of portable fire extinguishers shall not be less than:
 - (1) One properly installed fire extinguisher in the pilot's compartment; and ;
 - (2) At least one portable fire extinguisher shall be provided and conveniently located for use in each Class E and at least one shall be located in each upper and lower lobe galley;
 - (3) One properly installed in each passenger compartment that is separate from the pilot's compartment and that is not readily accessible to the flight crew;
- (c) Any portable fire extinguisher so fitted in accordance with the certificate of airworthiness of an aircraft may count as one of the required extinguishers .
 - (4) At least one portable fire extinguisher shall be conveniently located in the passenger compartment of aircraft having a passenger seating capacity of 30 or less:
 - (5) For each aircraft having a passenger seating capacity of more than 30, there shall be at least the number of portable fire extinguishers specified in the adjacent figure conveniently located and uniformly distributed throughout the compartment.

Passenger seats	Fire extinguishers
30-60	2
61-200	3
201-300	4
301-400	5
401-500	6
501-600	7
601 or more	8

- (6) The minimum number of fire extinguishers located in the passenger compartment (based on maximum passenger seating capacity) shall be:

- (i) For 31 to 60 passengers: 1 extinguisher;
- (ii) For 61 passenger seats and above: 2 extinguishers.

6.160 LAVATORY FIRE EXTINGUISHER

- (a) No person may operate a passenger carrying aircraft of more than 5700 kg maximum certificated takeoff mass unless each lavatory is equipped with a built-in fire extinguisher for the wastepaper disposal.
- (b) This built-in fire extinguisher must be designed to discharge automatically into each disposal receptacle upon occurrence of a fire in the receptacle.
- (c) Any agent used in a built-in fire extinguisher for each lavatory disposal receptacle for towels, paper or waste in an aircraft for which the individual certificate of airworthiness is first issued on or after 31 December 2011 and any extinguishing agent used in a portable fire extinguisher in an aircraft for which the individual certificate of airworthiness is first issued on or after 31 December 2016 shall:
 - (1) Meet the applicable minimum performance requirements of the State of Registry; and
 - (2) Not be of a type listed in the 1987 Montreal Protocol on Substances that Deplete the Ozone Layer as it appears in the Eighth Edition of the Handbook for the Montreal Protocol on Substances that Deplete the Ozone Layer, Annex A, Group II.

6.163 LAVATORY SMOKE DETECTOR

- (a) No person may operate a passenger carrying aircraft of more than 5700 kg maximum certificated takeoff mass unless each lavatory in the aeroplane is equipped with a smoke detector system that provides:
 - (1) A warning light in the flight deck; or
 - (2) A warning light or audio warning in the passenger cabin, taking into account the position of the cabin attendants during various phases of flight.

6.164 MEANS FOR ATTENUATING BOMB BLAST

- (a) When required by the CAAV, an AOC holder shall provide, for use at the least-risk bomb location, a specialized means of attenuating and directing the blast.

6.165 CRASH AXE: COMMERCIAL AIR TRANSPORT

- (a) No person may operate an aircraft with a maximum certificated takeoff mass of more than 5700 kg unless it is equipped with a crash axe appropriate to effective use in that type of aeroplane, stored in a place not visible to passengers on the aeroplane.

6.167 OXYGEN STORAGE & DISPENSING APPARATUS

- (a) No person may commence a flight in an aircraft intended to be operated at altitudes requiring the use of supplemental oxygen unless it is equipped with adequate oxygen storage and dispensing apparatus.
- (b) The oxygen apparatus, the minimum rate of oxygen flow, and the supply of oxygen shall meet applicable airworthiness standards for aircraft type certification in the transport category as specified by the CAAV.

- (c) No person may operate an aircraft at flight altitudes where the atmospheric pressure is less than 700 hPa unless it is equipped with oxygen masks and oxygen, located so as to be within the immediate reach of flight crew members while at their assigned duty station.
- (d) No person may operate an aircraft at flight altitudes where the atmospheric pressure is less than 700 hPa, but more than 376 hPa, unless there are adequate oxygen for all occupants at those altitudes and the oxygen masks are used in accordance with the minimum donning requirements specified in Appendix 1 to 7.720
- (e) No person may operate a pressurized aircraft at flight altitudes where the atmospheric pressure is less than 376 hPa (above 25,000 feet) unless:
 - (1) Flight crew member oxygen masks are of a quick donning type;
 - (2) Sufficient spare outlets and masks and/or sufficient portable oxygen units with masks are distributed evenly throughout the cabin to ensure immediate availability of oxygen to each required cabin crew member regardless of his location at the time of cabin pressurisation failure
 - (3) An oxygen-dispensing unit connected to oxygen supply terminals is installed so as to be automatically deployable (immediately available) to each occupant, wherever seated.
 - (i) The total number of dispensing units and outlets shall exceed the number of seats by at least 10%.
 - (ii) The extra units are to be evenly distributed throughout the cabin.
 - (iii)
- (f) The amount of supplemental oxygen for sustenance required for a particular operation shall be determined on the basis of flight altitudes and flight duration as outlined in Appendices 1 and 2 to 6.167, consistent with the operating procedures established for each operation in the Operations Manual and with the routes to be flown, and with the emergency procedures specified in the Operations Manual.

Note: See Appendix 1 to 6.167 to determine the amount of supplemental oxygen needed for non-pressurized

See Appendix Appendix 2 to 6.167 to determine the amount of supplemental oxygen needed for non-pressurized and pressurized aircraft.

6.170 INDIVIDUAL FLOTATION DEVICES

- (a) No person may operate a seaplane on any flight or other aircraft on a flight that transits a body of water including takeoff and landing, unless it is equipped with one life jacket or equivalent individual flotation device for each person on board.
- (b) All life jackets or equivalent individual flotation devices shall be stowed in a position easily accessible from the seat or berth of the person for whose use it is provided.
- (c) For all flights in which a survival raft is required, each individual flotation devices shall be fitted with an approved survivor locator light.
- (d) For single-engine and restricted performance aircraft operations overwater outside of gliding or autorotational distance from shore, the life jacket shall be worn constantly unless the occupant is wearing an integrated survival suit that includes the functionality of the life jacket.

6.171 SURVIVAL SUIT

- (a) For commercial air transport, no person may operate a helicopter offshore unless equipped with a survival suit for all occupants when the:
 - (1) Sea temperature is less than 10 degrees Centigrade; or
 - (2) Estimated rescue time exceeds the calculated survival time based on the sea state and ambient flight conditions.

6.173 LIFE RAFTS

- (a) No person may operate an aeroplane unless it is equipped with life rafts in sufficient number to accommodate all of the persons on board in the event of ditching when the route of flight will be overwater for:
 - (1) 120 minutes at cruising speed or 400 nautical miles, whichever is lesser, for aeroplanes capable of continuing the flight to an airport with the critical power unit(s) becoming inoperative at any point along the route or planned diversions;
 - (2) 30 minutes at cruising speed or 100 nautical miles, whichever is lesser, for all other aircraft.
- (b) The operator of any flight over water shall consider the necessity to carry life rafts and life-saving equipment specified in this Section and Sections 6.175, 6.177 and 6.178 based on a determination of the risks to survival of the occupants of the aeroplane in the event of a ditching, taking into account the operating environment and conditions such as, but not limited to—
 - (1) Sea state and sea and air temperatures;
 - (2) The distance from land suitable for making an emergency landing; and
 - (3) The availability of search and rescue facilities.
- (c) No person may operate a helicopter overwater unless is it fitted with a permanent or rapidly deployable means of flotation so as to ensure a safe ditching when:
 - (1) For operations in Performance Class 1 and 2, flying over water at a distance from land corresponding to more than 10 minutes at normal cruise speed; or
 - (2) For operations in Performance Class 3, flying over water beyond auto rotational or safe forced landing distance from land.
- (d) For commercial air transport passenger-carrying operations in aircraft of more than 5700 kg, the buoyancy and seating capacity of the rafts must accommodate all occupants of the aircraft in the event of a loss of one raft of the largest rated capacity.
- (e) For commercial air transport passenger-carrying operations in helicopters, 50% of all required rafts (where the quantity is two or more) will have a means of deployment by remote.
- (f)
- (g) The required life rafts and associated equipment must be easily accessible in the event of ditching without appreciable time for preparatory procedures. This equipment must be installed in conspicuously marked, approved locations.
- (h) For helicopters, life rafts which are not deployable by remote control and which have a mass of more than 40 kg shall be equipped with some means of mechanically assisted deployment.

6.175 SURVIVAL KIT

- (a) No person may operate an aircraft over designated land areas where search and rescue would be especially difficult without carrying life saving equipment including means of sustaining life.
- (b) No person may operate over water at distances that require the carriage of life rafts unless each raft is equipped with life saving equipment including means of sustaining life;
- (c) The survival kit shall contain the minimum contents prescribed by the CAAV.

6.177 DEVICES FOR EMERGENCY SIGNALING

- (a) No person may operate an aircraft over designated land areas where search and rescue would be especially difficult without carrying devices to make the necessary ground-to-air emergency signals to facilitate rescue.
- (b) No person may operate over water at a distance that require the carriage of life rafts unless each raft contains the equipment for make the necessary pyrotechnical distress signals.
- (c) The devices for emergency signaling shall be approved by the State of manufacturer and be acceptable to the CAAV.

6.180 EMERGENCY LOCATOR TRANSMITTER (ELT)

- (a) No person may operate an aircraft unless it is equipped with an automatically activated ELT.
- (b) No person may operate an aircraft authorized to carry more than 19 passengers unless it is equipped with at least two ELTs, one of which shall be automatic.
- (c) No person may operate an aircraft over designated land or sea areas where search and rescue would be especially difficult unless it is equipped with a second ELT.
- (d) No person may operate an aircraft overwater outside gliding distance to land unless there is immediately available at least one ELT in a raft or life jacket.
- (e) No person may operate an aircraft over water at distances that require the carriage of life rafts unless it is equipped:
 - (1) For aeroplanes, with a second ELT.
 - (2) For helicopters, a ELT in each life raft.
- (f)
- (g) ELT equipment carried to meet the requirements of paragraphs (a) through (e) shall operated in accordance with the relevant provisions of Annex 10, Volume III.
- (h) The operators of aircraft should consider the following regarding ELTs:

- (1) The decisions regarding choice of ELTs, their type and placement on the aircraft and associated floatable life support systems to ensure optimal crash and fire protection and give the greatest chance of activation in event of an accident are critical to search and rescue.
 - (2) The placement of control and witching devices (activation monitors) of automatic fixed ELTS and their associated operational procedures should take into consideration the need for:
 - (i) Rapid detection of inadvertent activation; and
 - (ii) Convenient manual switching by crew members.
- (i) Batteries used in ELTs shall be replaced (or recharged if the battery is rechargeable) when:
- (1) The transmitter has been in use for more than one cumulative hour; or
 - (2) 50 percent of their useful life (or for rechargeable batteries, 50 percent of their useful life of charge) has expired.
- (j)
- (k) The expiration date for a replacement or recharged ELT battery shall be legibly marked on the outside of the transmitter.
- (l) The battery useful life (or useful life of charge) requirements do not apply to batteries (such as water-activated batteries) that are essentially unaffected during probable storage intervals.

6.183 HELICOPTER EMERGENCY FLOTATION MEANS

- (a) No person may operate a helicopter intentionally over water unless it has a properly installed permanent or rapidly deployable means of floatation to ensure a safe ditching of the helicopter when the flight is:
- (1) More than 10 minutes from shore, in the case of Performance Class 1 or 2 helicopters; or
 - (2) Beyond auto rotational or gliding distance to shore, in the case of Performance Class 3 helicopters.

6.184 UNDERWATER LOCATING DEVICE

- (a) At the earliest practicable date but not later than 1 January 2018, no person may operate an aeroplane of a maximum certificated take-off mass of over 27 000 kg, unless an underwater locating device operating at a frequency of 8.8 kHz is securely attached to the aircraft.
- (b) This automatically activated underwater locating device shall be capable of operation for a minimum of 30 days and shall not be installed in wings or empennage.

6.185 MARKING OF BREAK-IN POINTS

- (a) No person may operate an aircraft for which areas of the fuselage suitable for break-in by rescue in an emergency are marked unless those markings correspond to the following figure and meet the following requirements:
- (1) The colour of the markings shall be red or yellow, and if necessary, they shall be outlined in white to contrast with the background;
 - (2) If the corner markings 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.

6.187 FIRST AID OXYGEN DISPENSING UNITS

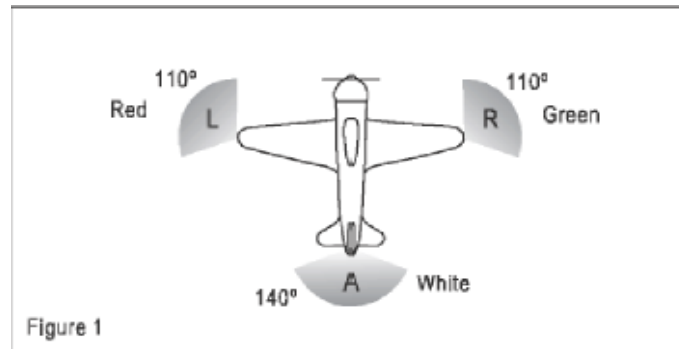
- (a) No AOC holder may conduct a passenger carrying operation in a pressurized aeroplane at altitudes above 25,000 feet, when a cabin crew member is required to be carried, unless it is equipped with:
 - (1) Undiluted first-aid oxygen for passengers who, for physiological reasons, may require oxygen following a cabin depressurisation;
 - (2) A sufficient number of dispensing units, but in no case less than two, with a means for cabin crew to use the supply.

APPENDICES

APPENDIX 1 TO 6.033: LIGHTS TO BE DISPLAYED BY AEROPLANES

3.0 Navigation lights to be displayed in the air:

- (1) Angles of coverage.

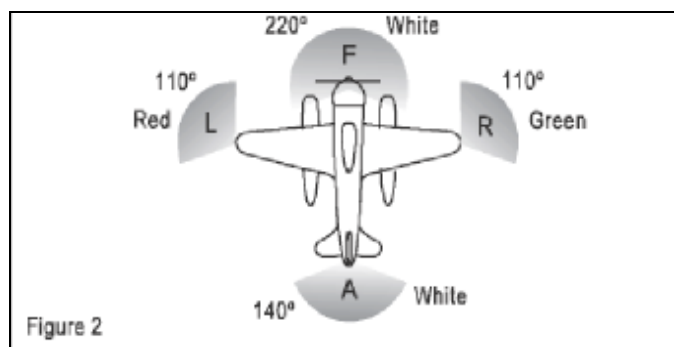


- (i) Angle of coverage A is formed by two intersecting vertical planes making angles of 70 degrees to the right and 70 degrees to the left respectively, looking aft along the longitudinal axis to a vertical plane passing through the longitudinal axis;
 - (ii) Angle of coverage F is formed by two intersecting vertical planes making angles of 110 degrees to the right and 110 degrees to the left respectively, looking forward along the longitudinal axis to a vertical plane passing through the longitudinal axis;
 - (iii) Angle of coverage L is formed by two intersecting vertical planes, one parallel to the longitudinal axis of the aeroplane, and the other 110 degrees to the left of the first, when looking forward along the longitudinal axis;
 - (iv) Angle of coverage R is formed by two intersecting vertical planes, one parallel to the longitudinal axis of the aeroplane, and the other 110 degrees to the right of the first, when looking forward along the longitudinal axis;
- (2) Horizontal plane. The plane containing the longitudinal axis and perpendicular to the plane of symmetry of the aeroplane;
 - (3) Longitudinal axis of the aeroplane. A selected axis parallel to the direction of flight at a normal cruising speed, and passing through the centre of gravity of the aeroplane;
 - (4) Making way. An aeroplane on the surface of the water is "making way" when it is under way and has a velocity relative to the water.
 - (5) Under command. An aeroplane on the surface of the water is "under command" when it is able to execute manoeuvres as required by the International Regulations for Preventing Collisions at Sea for the purpose of avoiding other vessels.
 - (6) Under way. An aeroplane on the surface of the water is "under way" when it is not aground or moored to the ground or to any fixed object on the land or in the water.
 - (7) Vertical planes. Planes perpendicular to the horizontal plane.
 - (8) As illustrated in Figure 1, the following unobstructed navigation lights shall be displayed:
 - (i) a red light projected above and below the horizontal plane through angle of coverage L;
 - (ii) a green light projected above and below the horizontal plane through angle of coverage R;
 - (iii) a white light projected above and below the horizontal plane rearward through angle of coverage A.

3.1 Lights to be displayed on the water -General:

- (a) The international regulations for preventing collisions at sea require different lights to be displayed in each of the following circumstances:
 - (1) when under way;
 - (2) when towing another vessel or aeroplane;
 - (3) when being towed;
 - (4) when not under command and not making way;
 - (5) when making way but not under command;
 - (6) when at anchor;
 - (7) when aground;
- (b) The lights required by aeroplanes in each case are described below.

3.2 Lights to be displayed when under way on the water.

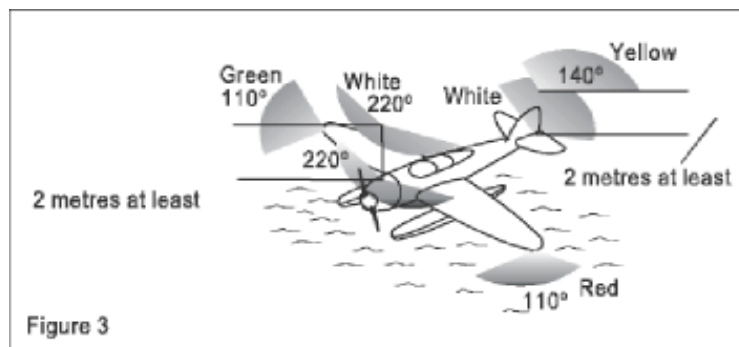


- (a) As illustrated in Figure 2, the following appearing as steady unobstructed lights:

- (1) A red light projected above and below the horizontal through angle of coverage L;
 - (2) A green light projected above and below the horizontal through angle of coverage R;
 - (3) A white light projected above and below the horizontal through angle of coverage A; and
 - (4) A white light projected through angle of coverage F;
- (b) The lights described in 3.2 a), b) and c) should be visible at a distance of at least 3.7 km (2 NM). The light described in 3.2 d) should be visible at a distance of 9.3 km (5 NM) when fitted to an aeroplane of 20 m or more in length or visible at a distance of 5.6 km (3 NM) when fitted to an aeroplane of less than 20 m in length .

3.3 Lights to be displayed when towing another vessel or aeroplane

- (a) In Figure 3, the following appearing as steady, unobstructed lights:

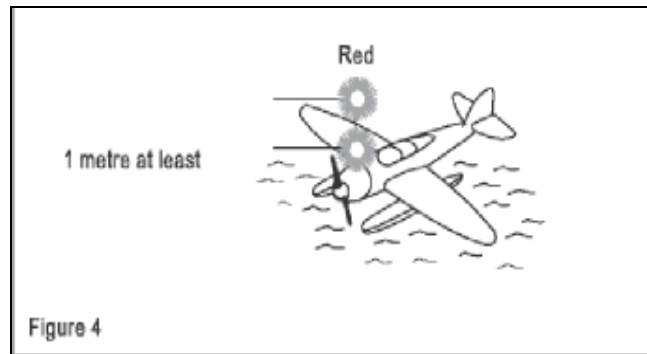


- (1) the lights described in 3.2 (a);
- (2) a second light having the same characteristics as the light described in 3.2(a)(3) and mounted in a vertical line at least 2 m above or below it; and
- (3) a yellow light having otherwise the same characteristics as the light described in 3.2(a)(3) and mounted in a vertical line at least 2 m above it.

3.4 Lights to be displayed when being towed

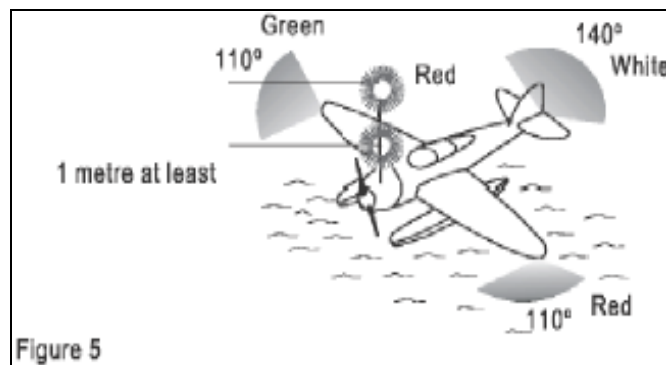
- (a) The lights described in 3.2 (a) (1), (2) and (3) appearing as steady, unobstructed lights..

3.5 Lights to be displayed when not under command and not making way



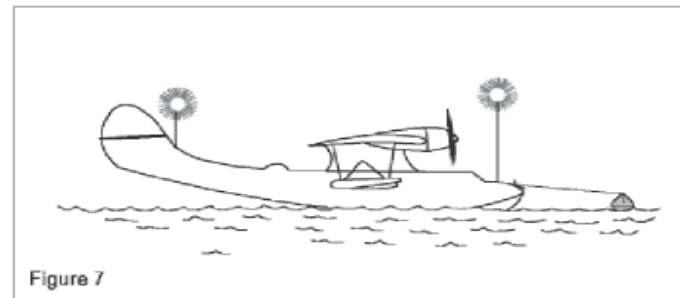
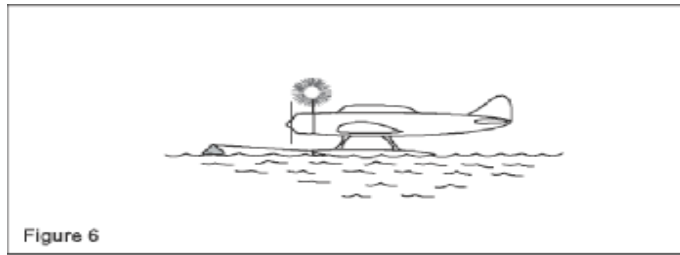
- (a) As illustrated in Figure 4, 2 steady red lights placed where they can best be seen, one vertically over the other and not less than 1 m apart, and of such a character as to be visible all around the horizon at a distance of at least 3.7 km (2 NM).

3.6 Lights to be displayed when making way but not under command

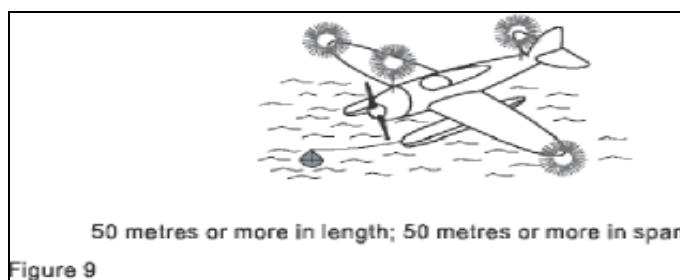
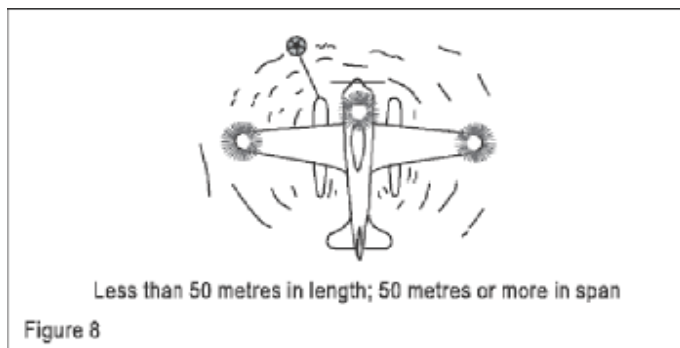


- (a) As illustrated in Figure 5, the lights described in 3.5 plus the lights described in 3.2 (a), (b).

3.7 Lights to be displayed when at anchor



- (a) If less than 50 m in length, where it can best be seen, a steady white light (Figure 6), visible all around the horizon at a distance of at least 3.7 km (2 NM);
- (b) If 50 m or more in length, where they can best be seen, a steady white forward light and a steady white rear light (Figure 7) both visible all around the horizon at a distance of at least 5.6 km (3 NM);



- (c) If 50 m or more in span a steady white light on each side (Figures 8 and 9) to indicate the maximum span and visible, so far as practicable, all around the horizon at a distance of at least 1.9 km (1 NM);

3.8 Lights to be displayed when aground

- (a) The lights prescribed in 3.7 and in addition two steady red lights in vertical line, at least 1 m apart so placed as to be visible all around the horizon.

APPENDIX 1 TO 6.035: RVSM ALTIMETRY SYSTEM PERFORMANCE REQUIREMENTS

- (a) In respect of groups of aeroplanes that are nominally of identical design and build with respect to all details that could influence the accuracy of height-keeping performance, the height-keeping performance capability shall be such that the total vertical error (TVE) for the group of aeroplanes shall have a mean no greater than 25 m (80 ft) in magnitude and shall have a standard deviation no greater than $28 - 0.013z^2$ for $0 \leq z \leq 25$ when z is the magnitude of the mean TVE in metres, or $92 - 0.00422z$ for $0 \leq z \leq 80$ where z is in feet. In addition, the components of TVE shall have the following characteristics:
 - (1) The mean altimetry system error (ASE) of the group shall not exceed 25 m (80 ft) in magnitude;
 - (2) The sum of the absolute value of the mean ASE and of three standard deviations of ASE shall not exceed 75 m (245 ft); and
 - (3) The differences between cleared flight level and the indicated pressure altitude actually flown shall be symmetric
 - (4) About a mean of 0 m, with a standard deviation no greater than 13.3 m (43.7 ft), and in addition, the decrease in the frequency of differences with increasing difference magnitude shall be at least exponential.
- (b) In respect of aeroplanes for which the characteristics of the airframe and altimetry system fit are unique and so cannot be classified as belonging to a group of aeroplanes encompassed by paragraph 1, the height-keeping performance capability shall be such that the components of the TVE of the aeroplane have the following characteristics:
 - (1) The ASE of the aeroplane shall not exceed 60 m (200 ft) in magnitude under all flight conditions; and the differences between the cleared flight level and the indicated pressure altitude actually flown shall be symmetric about a mean of 0 m, with a standard deviation no greater than 13.3 m (43.7 ft), and
 - (2) In addition, the decrease in the frequency of differences with increasing difference magnitude shall be at least exponential.

APPENDIX 1 TO 6.047: REQUIREMENTS FOR ALL-WEATHER OPERATIONS

- (a) Category II Approach Minima. In addition to the instrument and equipment requirements for aircraft operated under IFR with 2 pilots and the specific requirements for the type of aircraft, the following additional equipment and instruments requirements apply:
 - (1) A flight control guidance system that consists of either an automatic approach coupler or a flight director system conforming to the following:
 - (i) A flight director system must display computed information as steering command in relation to an ILS localizer and, on the same instrument, either computed information as pitch command in relation to an ILS glide slope or basic ILS glide slope information;

- (ii) An automatic approach coupler must provide at least automatic steering in relation to an ILS localizer;
 - (iii) The flight control guidance system may be operated from one of the required receiving systems.
- (2) For decision heights below 150 feet, a radio altimeter;
- (3) Warning systems for immediate detection by the pilot of system faults.
- (b) Category IIIA Approach Minima (not less than RVR600 (200 m). In addition to the instrument and equipment requirements for aircraft operated under IFR with 2 pilots, the specific requirements for the type of aircraft and the requirements of Category II, the following additional equipment and instruments requirements apply:
 - (1) A redundant, acceptable flight guidance or control systems that provides:
 - (i) A fail operational or fail passive automatic landing system at least to touchdown;
 - (ii) A fail operational or fail passive manual flight guidance system with suitable head-up or head-down command guidance, and suitable monitoring capability at least to touchdown;
 - (iii) A hybrid system, using automatic landing capability as the primary means of landing at least to touchdown; or
 - (iv) Other system that can provide an equivalent level of performance and safety.
 - (2) An automatic throttle or automatic thrust control system that meets approved criteria as specified in the AFM. However, for operations with a 15 m (50 ft) DH, or other operations that have been specifically evaluated such as for engine inoperative landing capability, automatic throttles may not be required if it has been demonstrated that operations can be safely conducted, with an acceptable work load, without their use;
 - (3) At least two independent navigation receivers/sensors providing lateral and vertical position or displacement information, typically with the first pilot's station receiving the information from one and the second pilot's station receiving the information from the other. The navigation receivers/sensors shall meet the criteria specified for CAT IIIA operations;
 - (4) At least two approved radio altimeter systems that meet the performance requirements criteria as specified in the AFM, typically with the first pilot's station receiving information from one and the second pilot's station receiving information from the other;
 - (5) Failure detection, annunciation, and warning capability, as determined acceptable by criteria in the AFM;
 - (6) Missed approach guidance provided by one or more of the following means:
 - (i) Attitude displays that include suitable pitch attitude markings, or a pre-established computed pitch command display;
 - (ii) An approved flight path angle display, or
 - (iii) An automatic or flight guidance go-around capability.
 - (7) Suitable forward and side flight deck visibility for each pilot as specified in the AFM;
 - (8) Suitable wind shield rain removal, ice protection, or defog capability as specified in the AFM.

- (c) Category IIIB Approach Minima (less than RVR600 (200 m) but not less than RVR400). The following equipment in addition to the instrument and navigation equipment required by paragraphs (a) and (b) of this Appendix:
 - (1) A redundant flight control or guidance system demonstrated in accordance with international acceptable criteria. Acceptable flight guidance or control systems include the following:
 - (i) A fail operational landing system with a fail operational or fail passive automatic rollout system; or
 - (ii) A fail passive landing system (limited to touchdown zone RVR not less than RVR600 with fail passive rollout provided automatically or by a flight guidance system providing suitable head-up or head-down guidance, and suitable monitoring capability, or
 - (iii) A fail operational hybrid automatic landing and rollout system with comparable manual flight guidance system, using automatic landing capability as the primary means of landing; or
 - (iv) Other system that can provide an equivalent level of performance and safety.
 - (2) Acceptable flight guidance or control systems include the following –
 - (i) A Fail Operational landing system with a Fail Operational or Fail Passive automatic rollout system; or
 - (ii) A Fail Passive landing system (limited to touchdown zone RVR not less than RVR600 with Fail Passive rollout provided automatically or by a flight guidance system providing suitable head-up or head-down guidance, and suitable monitoring capability, or
 - (iii) A Fail Operational hybrid automatic landing and rollout system with comparable manual flight guidance system, using automatic landing capability as the primary means of landing; or
 - (iv) Other system that can provide an equivalent level of performance and safety.

- (d) Category IIIC Approach Minima (less than RVR300 (75 m). The following equipment is required in addition to or as a replacement for the instrument and navigation equipment required by paragraphs (a), (b) and (c) of this Appendix:
 - (1) A fail operational automatic flight control system, or manual flight guidance system designed to meet fail operational system criteria, or a hybrid system in which both the fail-passive automatic system and the monitored manual flight guidance components provide approach and flare guidance to touchdown, and in combination provide full fail operational capability, and;
 - (2) A fail operational automatic, manual, or hybrid rollout control system.

APPENDIX 1 TO 6.090: INSPECTIONS FOR FLIGHT RECORDER SYSTEMS

- (a) 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.
- (b) Subject to the approval from the CAAV:
 - (1) Digital FDR systems or ADRS, CVR systems or CARS, AIR systems or AIRS, which have demonstrated a high integrity of serviceability and self-monitoring, shall have recording system inspection intervals of one year extendable to two years.
 - (2) DLR systems or DLRS shall have recording system inspection intervals of two years extendable to four years.
- (c) Annual Recording system inspections shall be carried out as follows:
 - (1) An analysis of the recorded data from the flight recorders shall ensure that the recorder operates correctly for the nominal duration of the recording;
 - (2) The analysis of the FDR or the ADRS 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 aeroplane 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;
 - (3) A complete flight from the FDR or the ADRS shall be examined in engineering units to evaluate the validity of all recorded parameters.
 - (i) Particular attention shall be given to parameters from sensors dedicated to the FDR or the ADRS.

- (ii) Parameters taken from the aircraft's electrical bus system need not be checked if their serviceability can be detected by other aircraft systems;
 - (4) 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;
 - (5) An annual examination of the recorded signal on the CVR or the CARS shall be carried out by replay of the CVR or CARS recording. While installed in the aircraft, the CVR or CARS shall record test signals from each aircraft source and from relevant external sources to ensure that all required signals meet intelligibility standards;
 - (6) Where practicable, during the annual examination, a sample of in-flight recordings of the CVR or CARS shall be examined for evidence that the intelligibility of the signal is acceptable; and
 - (7) An annual examination of the recorded images on the AIR or AIRS shall be carried out by replay of the AIR or AIRS recording. While installed in the aircraft, the AIR or AIRS shall record test images from each aircraft source and from relevant external sources to ensure that all required images meet recording quality standards;
- (d) 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.
 - (e) A report of the annual recording inspection shall be made available on request to the CAAV for monitoring purposes.

APPENDIX 1 TO 6.093: FDR PARAMETERS FOR 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 (-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 (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 (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 discrettes	1		
16	Longitudinal acceleration (Note 3)	±1 g	0.25	±0.015 g excluding a datum error of ±0.05 g	0.004 g
<i>Note.— The preceding 16 parameters satisfy the requirements for a Type II FDR.</i>					
17	Lateral acceleration (Note 3)	±1 g	0.25	±0.015 g excluding a datum error of ±0.05 g	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
18	Pilot input and/or control surface position-primary controls (pitch, roll, yaw) (Note 5) (Note 6)	Full range	0.25	±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/GPS/GLS glide path, MLS elevation, IRNAV/LAN vertical deviation)	Signal range	1	±3%	0.3% of full range
22*	Horizontal beam deviation (ILS/GPS/GLS localizer, MLS azimuth, IRNAV/LAN 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 7)	Full range	4	As installed	
26*	DME 1 and 2 distance (includes Distance to runway threshold (GLS) and Distance to missed approach point (IRNAV/LAN)) (Notes 7 and 8)	0 – 370 km (0 – 200 NM)	4	As installed	1 852 m (1 NMF)
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) (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.

Serial number	Parameter	Measurement range	Maximum sampling and recording interval (seconds)	Accuracy limits (sensor input compared to FDR read-out)	Recording resolution
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
35*	Additional engine parameters (EPR, N ₁ , indicated vibration level, N ₂ , EGT, fuel flow, fuel cut-off lever position, N ₃)	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*	Windshear 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/LAN))		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 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*	ANP or EPE or EPU	As installed	4	As installed	

Note.— The preceding 78 parameters satisfy the requirements for a Type LA FDR.

Notes.—

1. V_{so} 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 6.3.1.2.11 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 6.3.1.2.12 for increased recording requirements.
7. If signal available in digital form.
8. Recording of latitude and longitude from DNS 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 2 TO 6.093: ADRS PARAMETERS FOR AEROPLANES

No.	Parameter name	Parameter category	Minimum recording range	Maximum recording interval in seconds	Minimum recording accuracy	Minimum recording resolution	Remarks
1	Heading (Magnetic or True)	R*	±180 degrees	1	±2 degrees	0.5 degree	* If not available, record rates
2	Pitch attitude	E*	±90 degrees	0.25	±2 degrees	0.5 degree	* If not available, record rates
3	Roll attitude	E*	±180 degrees	0.25	±2 degrees	0.5 degree	* If not available, record rates
4	Yaw rate	E*	±300 degrees/s	0.25	±1% + drift of 360°/hr	2 degree/s	* Essential if no heading available
5	Pitch rate	E*	±300 degrees/s	0.25	±1% + drift of 360°/hr	2 degree/s	* Essential if no pitch attitude available
6	Roll rate	E*	±300 degrees/s	0.25	±1% + drift of 360°/hr	2 degree/s	* Essential if no roll attitude available
7	Positioning system : latitude/longitude	E	Latitude:±90 degrees Longitude:±180 degrees	2 (1 if available)	As installed (0.00015 degree recommended)	0.00005 degree	
8	Positioning system estimated error	E*	Available range	2 (1 if available)	As installed	As installed	* If available
9	Positioning system : altitude	E	-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)	
10	Positioning system : time*	E	24 hours	1	±0.5 second	0.1 second	* UTC time preferred where available.
11	Positioning system : ground speed	E	0-1 000 kt	2 (1 if available)	As installed (±5 kt recommended)	1 kt	
12	Positioning system : channel	E	0-360 degrees	2 (1 if available)	As installed (± 2 degrees recommended)	0.5 degrees	
13	Normal acceleration	E	-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	
14	Longitudinal acceleration	E	±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	
15	Lateral acceleration	E	±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	

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No.	Parameter name	Parameter category	Minimum recording range	Maximum recording interval in seconds	Minimum recording accuracy	Minimum recording resolution	Remarks
16	External static pressure (or pressure altitude)	R	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)	
17	Outside air temperature (or total air temperature)	R	-50° to $+90^{\circ}$ C or available sensor range	2	As installed ($\pm 2^{\circ}$ C recommended)	1 $^{\circ}$ C	
18	Indicated air speed	R	As the installed pilot display measuring system or available sensor range	1	As installed (± 3 % recommended)	1 kt (0.5 kt recommended)	
19	Engine RPM	R	Full range including overspeed condition	Each engine each second	As installed	0.2% of full range	
20	Engine oil pressure	R	Full range	Each engine each second	As installed (5% of full range recommended)	2% of full range	
21	Engine oil temperature	R	Full range	Each engine each second	As installed (5% of full range recommended)	2% of full range	
22	Fuel flow or pressure	R	Full range	Each engine each second	As installed	2% of full range	
23	Manifold pressure	R	Full range	Each engine each second	As installed	0.2% of full range	
24	Engine thrust/power/torque parameters required to determine propulsive thrust/power*	R	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.
25	Engine gas generator speed (Ng)	R	0-150%	Each engine each second	As installed	0.2% of full range	
26	Free power turbine speed (Nf)	R	0-150%	Each engine each second	As installed	0.2% of full range	
27	Coolant temperature	R	Full range	1	As installed ($\pm 5^{\circ}$ C recommended)	1 degree Celsius	
28	Main voltage	R	Full range	Each engine each second	As installed	1 Volt	
29	Cylinder head temperature	R	Full range	Each cylinder each second	As installed	2% of full range	
30	Flaps position	R	Full range or each discrete position	2	As installed	0.5 degree	

No.	Parameter name	Parameter category	Minimum recording range	Maximum recording interval in seconds	Minimum recording accuracy	Minimum recording resolution	Remarks
31	Primary flight control surface position	R	Full range	0.25	As installed	0.2 % of full range	
32	Fuel quantity	R	Full range	4	As installed	1% of full range	
33	Exhaust gas temperature	R	Full range	Each engine each second	As installed	2% of full range	
34	Emergency voltage	R	Full range	Each engine each second	As installed	1 Volt	
35	Trim surface position	R	Full range or each discrete position	1	As installed	0.3% of full range	
36	Landing gear position	R	Each discrete position*	Each gear every two seconds	As installed		* Where available, record up-and-locked and down-and-locked position
37	Novel/unique aircraft features	R	As required	As required	As required	As required	

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Essential parameters
Recommended parameters

APPENDIX 1 TO 6.094: FDR PARAMETERS FOR HELICOPTERS

Serial number	Parameter	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 GPS time sync)	24 hours	4	±0.125% per hour	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	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	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	—	—
<i>Note.— The preceding 15 parameters satisfy the requirements for a Type V FDR.</i>					
16*	Main gearbox oil pressure	As installed	1	As installed	6.895 kN/m ² (1 psi)
17*	Main gearbox oil temperature	As installed	2	As installed	1°C

Serial number	Parameter	Measurement range	Maximum sampling and recording interval (seconds)	Accuracy limits (sensor input compared to FDR readout)	Recording resolution
18	Yaw rate	±400°/second	0.25	±1.5% maximum range excluding datum error of ±5%	±2°/s
19*	Slings 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 NMI)	4	As installed	1 852 m (1 NMI)
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	—	—
<i>Note.— The preceding 30 parameters satisfy the requirements for a Type IV FDR.</i>					
31*	Engine exhaust gas temperature (T ₄)	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)

Serial number	Parameter	Measurement range	Maximum sampling and recording interval (seconds)	Accuracy limits (sensor input compared to FDR readout)	Recording resolution
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)	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	—	—

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

APPENDIX 2 TO 6.094: ADRS PARAMETERS FOR HELICOPTERS

N°	Parameter name	Parameter category	Minimum recording range	Maximum recording interval in seconds	Minimum recording accuracy	Minimum recording resolution	Remarks
1	Heading (Magnetic or True)	R*	±180°	1	±2°	0.5°	*If not available, record rotational rates
2	Pitch attitude	E*	±90°	0.25	±2°	0.5°	*If not available, record rotational rates
3	Roll attitude	E*	±180°	0.25	±2°	0.5°	*If not available, record rotational rates
4	Yaw rate	E*	±300°/s	0.25	±1% + drift of 360°/h	2°/s	*Essential if no heading available
5	Pitch rate	E*	±300°/s	0.25	±1% + drift of 360°/h	2°/s	*Essential if no pitch attitude available
6	Roll rate	E*	±300°/s	0.25	±1% + drift of 360°/h	2°/s	*Essential if no roll attitude available
7	Positioning system: latitude/longitude	E	Latitude: ±90° Longitude: ±180°	2 (1 if available)	As installed (0.00015° recommended)	0.00005°	
8	Positioning system estimated error	E*	Available range	2 (1 if available)	As installed	As installed	*If available
9	Positioning system: altitude	E	-300 m (-1 000 ft) to maximum certificated altitude of helicopter + 1 500 m (5 000 ft)	2 (1 if available)	As installed (±15 m (±50 ft) recommended)	1.5 m (5 ft)	
10	Positioning system: time*	E	24 hours	1	±0.5 s	0.1 s	*UTC time preferred where available.
11	Positioning system: ground speed	E	0-1 000 kt	2 (1 if available)	As installed (±5 kt recommended)	1 kt	
12	Positioning system: track	E	0-360°	2 (1 if available)	As installed (±2° recommended)	0.5°	
13	Normal acceleration	E	-3 g to + 6 g	0.25 (0.125 if available)	As installed (±0.09 g excluding a datum error of ±0.05 g recommended)	0.004 g	

Nº	Parameter name	Parameter category	Minimum recording range	Maximum recording interval in seconds	Minimum recording accuracy	Minimum recording resolution	Remarks
14	Longitudinal acceleration	E	±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	
15	Lateral acceleration	E	±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	
16	External static pressure (or pressure altitude)	R	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)	
17	Outside air temperature (or total air temperature)	R	-50° to +90°C or available sensor range	2	As installed (±2°C recommended)	1°C	
18	Indicated air speed	R	As the installed pilot display measuring system or available sensor range	1	As installed (±3% recommended)	1 kt (0.5 kt recommended)	
19	Main rotor speed (Nr)	R	50% to 130% or available sensor range	0.5	As installed	0.3% of full range	
20	Engine RPM (*)	R	Full range including overspeed condition	Each engine each second	As installed	0.2% of full range	*For piston-engined helicopters
21	Engine oil pressure	R	Full range	Each engine each second	As installed (5% of full range recommended)	2% of full range	
22	Engine oil temperature	R	Full range	Each engine each second	As installed (5% of full range recommended)	2% of full range	
23	Fuel flow or pressure	R	Full range	Each engine each second	As installed	2% of full range	
24	Manifold pressure (*)	R	Full range	Each engine each second	As installed	0.2% of full range	*For piston-engined helicopters

N°	Parameter name	Parameter category	Minimum recording range	Maximum recording interval in seconds	Minimum recording accuracy	Minimum recording resolution	Remarks
25	Engine thrust/power/torque parameters required to determine propulsive thrust/power*	R	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. A margin for possible overspeed should be provided. Only for turbine-engined helicopters.
26	Engine gas generator speed (Ng) (*)	R	0-150%	Each engine each second	As installed	0.2% of full range	*Only for turbine-engined helicopters
27	Free power turbine speed (Nf) (*)	R	0-150%	Each engine each second	As installed	0.2% of full range	*Only for turbine-engined helicopters
28	Collective pitch	R	Full range	0.5	As installed	0.1% of full range	
29	Coolant temperature (*)	R	Full range	1	As installed (=5°C recommended)	1° C	*Only for piston-engined helicopters
30	Main voltage	R	Full range	Each engine each second	As installed	1 Volt	
31	Cylinder head temperature (*)	R	Full range	Each cylinder each second	As installed	2% of full range	*Only for piston-engined helicopters
32	Fuel quantity	R	Full range	4	As installed	1% of full range	
33	Exhaust gas temperature	R	Full range	Each engine each second	As installed	2% of full range	
34	Emergency voltage	R	Full range	Each engine each second	As installed	1 Volt	
35	Trim surface position	R	Full range or each discrete position	1	As installed	0.3% of full range	
36	Landing gear position	R	Each discrete position*	Each gear every two seconds	As installed		*Where available, record up-and-locked and down-and-locked position
37	Novel/unique aircraft features	R	As required	As required	As required	As required	

ey:

Essential parameters

o Recommended parameters

APPENDIX 1 TO 6.097: APPLICATION OF DATA LINK RECORDERS

Item No.	Application type	Application description	Recording 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, D-ATIS, 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 aircraft 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 aircraft.

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

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APPENDIX 1 TO 6.133: EMERGENCY EXIT EQUIPMENT

- (a) The assisting means for a floor level emergency exit shall meet the requirements under which the aeroplane was type certified;
- (b) The location of each passenger emergency exit shall be:
 - (1) Recognisable from a distance equal to the width of the cabin;
 - (2) Indicated by a sign visible to occupants approaching along the main passenger aisle;
- (c) There shall be an emergency exit locating sign:
 - (1) Above the aisle near each over-the-wing passenger emergency exit, or at another ceiling location if it is more practical because of low headroom;
 - (2) Next to each floor level passenger emergency exit, except that one sign may serve two such exits if they both can be seen readily from that sign; and
 - (3) On each bulkhead or divider that prevents fore and aft vision along the passenger cabin, to indicate emergency exits beyond and obscured by it, except that if this is not possible, the sign may be placed at another appropriate location.
- (d) Each passenger emergency exit marking and each locating sign shall be manufactured to meet the interior emergency exit marking requirements under which the aeroplane was type certified, unless the CAAV cites different requirements for compliance with this paragraph.
- (e) No sign may continue to be used if its luminescence (brightness) decreases to below 250 microlamberts.
- (f)
- (g) Sources of general cabin illumination may be common to both the emergency and the main lighting systems if the power supply to the emergency light system is independent of the power supply to the main lighting system.
- (h) The emergency lighting system shall provide enough general lighting in the passenger cabin so that the average illumination, when measured at 40-inch intervals at seat armrest height, on the centreline of the main passenger aisle, is at least 0.05 foot-candles.;
- (i) Each emergency light shall:
 - (1) Be operable manually both from the flight crew station and from a point in the passenger compartment that is readily accessible to a normal cabin crew member seat;
 - (2) Have a means to prevent inadvertent operation of the manual controls;
 - (3) When armed or turned on at either station, remain lighted or become lighted upon interruption of the aeroplane's normal electric power;
 - (4) Provide the required level of illumination for at least 10 minutes at the critical ambient conditions after emergency landing;
 - (5) Have a cockpit control device that has an "on", "off", and "armed" position.

- (j)
- (k) The location of each passenger emergency exit operating handle and instructions for opening the exit shall be shown in accordance with the requirements under which the aeroplane was type certified unless the CAAV cites different requirements for compliance with this paragraph.
- (l) No operating handle or operating handle cover may continue to be used if its luminescence decreases to below 100 microlamberts.
- (m) Access to emergency exits shall be provided as follows for each passenger carrying aeroplane:
 - (1) Each passageway between individual passenger areas, or leading to a Type I or Type II emergency exit, shall be unobstructed and at least 20 inches wide;
 - (2) There shall be enough space next to each Type I or Type II emergency exit to allow a crew member to assist in the evacuation of passengers without reducing the unobstructed width of the passageway below that required in paragraph 1 of this Section;
 - (3) There shall be access from the main aisle to each Type III and Type IV exit. The access from the aisle to these exits shall not be obstructed by seats, berths, or other protrusions in a manner that would reduce the effectiveness of the exit. In addition, the access shall meet the emergency exit access requirements under which the aeroplane was type certificated, unless the CAAV cites different requirements for compliance with this paragraph;
 - (4) If it is necessary to pass through a passageway between passenger compartments to reach any required emergency exit from any seat in the passenger cabin, the passageway shall not be obstructed. However, curtains may be used if they allow free entry through the passageway;
 - (5) No door may be installed in any partition between passenger compartments;
 - (6) If it is necessary to pass through a doorway separating the passenger cabin from other areas to reach any required emergency exit from any passenger seat, the door shall have a means to latch it in open position, and the door shall be latched open during each takeoff and landing. The latching means shall be able to withstand the loads imposed upon it when the door is subjected to the ultimate inertia forces, relative to the surrounding structure, prescribed in the airworthiness standards for type certification in the transport category as cited by the CA.
- (n) Each passenger emergency exit and the means of opening that exit from the outside shall be marked on the outside of the aeroplane with a 2-inch coloured band outlining the exit on the side of the fuselage;
- (o) Each passenger emergency exit marking, including the band, shall be readily distinguishable by contrast in colour and shall comply with the following:
 - (1) If the reflectance of the darker colour is 15 percent or less, the reflectance of the lighter colour shall be at least 45%;
 - (2) If the reflectance of the darker colour is greater than 15 percent, at least a 30 percent difference 30%;
 - (3) Exits that are not in the side of the fuselage shall have external means of opening and applicable instructions marked conspicuously in red or, if red is inconspicuous against the background colour, in bright chrome yellow and, when the opening means for such an

exit is located on only one side of the fuselage, a conspicuous marking to that effect shall be provided on the other side;

- (p)
- (q) Each passenger-carrying aeroplane shall be equipped with exterior lighting that meets the requirements under which that aeroplane was type certificated by the CAAV, unless the CAAV cites different requirement for compliance with this paragraph.
- (r)
- (s)
- (t)
- (u) Each passenger-carrying aeroplane shall be equipped with a slip-resistant escape route that meets the requirements under which that aeroplane was type certificated, unless the CAAV cites different requirements for compliance with this paragraph.
- (v) Each floor level door or exit in the side of the fuselage (other than those leading into a cargo or baggage compartment that is not accessible from the passenger cabin) that is 44 or more inches high and 20 or more inches wide, but not wider than 46 inches, each passenger ventral exit and each tail cone exit, shall meet the requirements of this Section for floor level emergency exits.

- (w)
- (x) Approved emergency exits in the passenger compartments that are in excess of the minimum number of required emergency exits shall meet all of the applicable provisions of this Appendix and shall be readily accessible.
- (y) On each large passenger-carrying turbojet powered aeroplane each ventral exit and tail cone exit shall be:
 - (1) Designed and constructed so that it cannot be opened during flight; and;
Marked with a placard readable from a distance of 30 inches and installed at a conspicuous location near the means of opening the exit, stating that the exit has been designed and constructed so that it cannot be opened during flight.

APPENDIX 1 TO 6.167: SUPPLEMENTAL OXYGEN – NON PRESSURIZED AIRCRAFT

- (a) Flight crew members:
 - (1) Each member of the flight crew on flight deck duty shall be supplied with supplemental oxygen in accordance with the following table;
 - (2) If all occupants of flight deck seats are supplied from the flight crew source of oxygen supply then they shall be considered as flight crew members on flight deck duty for the purpose of oxygen supply.
- (b) Cabin crew members, additional crew members and passengers shall be supplied with oxygen in accordance with the following table:

Note: additional Cabin crew members and crew member shall be considered as passengers for the purpose of oxygen supply

SUPPLY FOR	DURATION AND PRESSURE ALTITUDE
1. All occupants of flight deck seats on flight deck duty	Entire flight time at pressure altitudes above 10,000 feet
2. All required cabin crew members	Entire flight time at pressure altitudes above 13,000 ft and for any period exceeding 30 minutes at pressure altitudes above 10,000 ft but not exceeding 13,000 ft
3. 100% of passengers	Entire flight time at pressure altitudes above 13,000 ft
4. 10% hành khách	Entire flight time after 30 minutes at pressure altitudes greater than 10,000 ft but not exceeding 13,000 ft

APPENDIX 2 TO 6.167: SUPPLEMENTAL OXYGEN – PRESSURIZED AIRCRAFT.

- (a) The amount of supplemental oxygen required shall be determined on the basis of cabin pressure altitude, flight duration and the assumption that a cabin pressurisation failure will occur at the altitude or point of flight that is most critical from the standpoint of oxygen need, and that, after the failure, the aeroplane will descend in accordance with emergency procedures specified in the Aeroplane Flight Manual to a safe altitude for the route to be flown that will allow continued safe flight and landing;
- (b) Following a cabin pressurisation failure, the cabin pressure altitude shall be considered the same as the aeroplane altitude, unless it is that no probable failure of the cabin or pressurisation system will result in a cabin pressure altitude equal to the aeroplane altitude. Under these circumstances, this lower cabin pressure altitude may be used as a basis for determination of oxygen supply.

Note: Under these circumstances, this lower cabin pressure altitude may be used as a basis for determination of oxygen supply.

- (c) Flight crew members:
 - (1) Each member of the flight crew on flight deck duty shall be supplied with supplemental oxygen in accordance with the following table;
 - (2) If all occupants of flight deck seats are supplied from the flight crew source of oxygen supply then they shall be considered as flight crew members on flight deck duty for the purpose of oxygen supply;
 - (3) Flight deck seat occupants, not supplied by the flight crew source, are to be considered as passengers for the purpose of oxygen supply.
- (d) Cabin crew members, additional crew members, and passengers:
 - (1) Cabin crew members and passengers shall be supplied with supplemental oxygen in accordance with the following table;
 - (2) Cabin crew members and additional crew members shall be considered as passengers for the purpose of oxygen supply.
- (e) The oxygen supply requirements, as specified in the following table, for aeroplanes not certificated to fly at altitudes above 25,000 ft, may be reduced to:
 - (1) The entire flight time between 3050m (10000ft) to 3950m (14000ft) cabin pressure altitudes for all required cabin crew members and

- (2) For at least 10% of the passengers if, at all points along the route to be flown, the aeroplane is able to descend safely within 4 minutes to a cabin pressure altitude of 3950m (14000ft)

SUPPLY FOR	DURATION AND CABIN PRESSURE ALTITUDE
1. All occupants of flight deck seats on flight deck duty flight	Entire flight time when the cabin pressure altitude exceeds 13,000 and entire time when the cabin pressure altitude exceeds 10,000 ft but does not exceed 13,000 ft after the first 30 minutes at those altitudes, but in no case less than: (i) 30 minutes for aeroplanes certificated to fly at altitudes not exceeding 7500m (25000ft) (Note 2); (ii) 2 hours for aeroplanes certificated to fly at altitudes more than 7500m (25000ft) (Note 3)
2. All cabin crew members	Entire flight time when cabin pressure altitude 3900m (14000ft) but not less than 30 minutes (Note 2), and entire flight time when cabin pressure altitude is greater than 3000m (10000ft) đến 3900m (13000ft) after the first 30 minutes at these altitudes
3. 100% of passengers	10 minutes or the entire flight time when altitude exceeds 4200m (15000ft) whichever is the greater (Note 4)
4. 30% of passengers	Entire flight time when the cabin pressure altitude exceeds 3950m (14000ft) but does not exceed 4200m (15000ft)
5. 10% of passengers	Entire flight time when the pressure altitude exceeds 3000m (10000ft) ft but does not exceed 4200m (15000ft) after the first 30 minutes at these altitudes

Note 1: The supply provided shall take account of the cabin pressure altitude and descent profile for the routes concerned;

Note 2: The required minimum supply is that quantity of oxygen necessary for a constant rate of descent from the aeroplane's maximum certificated operating altitude to 3000m (10000ft) in 10 minutes and followed by 20 minutes.

The required minimum supply is that quantity of oxygen necessary for a constant rate of descent from the aeroplane's maximum certificated operating altitude to 3000m (10000ft) in 10 minutes and followed by 110 minutes at 10,000 ft. The oxygen required to meet the Crew Protective Breathing Equipment provisions of this Part may be included in determining the supply required.

Note 4: The required minimum supply is that quantity of oxygen necessary for a constant rate of descent from the aeroplane's maximum certificated operating altitude to 4500m (15000ft)