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THE CIVIL AVIATION ACT,
(CAP. 80)

REGULATIONS

THE CIVIL AVIATION (ENVIRONMENTAL PROTECTION-AEROPLANE CARBON DIOXIDE EMISSIONS) REGULATIONS, 2026

ARRANGEMENT OF REGULATIONS

Regulation *Title*

SCHEDULES

THE CIVIL AVIATION ACT,
(CAP. 80)

REGULATIONS

(Made under section 5)

THE CIVIL AVIATION (ENVIRONMENTAL PROTECTION-AEROPLANE CARBON DIOXIDE EMISSIONS) REGULATIONS, 2026

PART I
PRELIMINARY PROVISIONS

Citation

1. These Regulations may be cited as the Civil Aviation (Environmental Protection-Aeroplane Carbon Dioxide Emissions) Regulations, 2026.

Application

2. Subject to the provisions of these Regulations, these Regulations shall apply to-

(a) aeroplane registered in the United Republic, wherever it operates; and

(b) aeroplane of other states operating in the United Republic.

Interpretation

3. In these Regulations, unless the context otherwise requires-

Cap. 80 "Act" means the Civil Aviation Act;

"aeroplane" means a power-driven heavier-than-air aircraft, deriving its lift in flight chiefly from aerodynamic reactions on surfaces which remain fixed under given conditions of flight;

"cockpit crew zone" means the part of the cabin that is exclusively designated for flight crew use;

"derived version of a Carbon dioxide -certified aeroplane" means anaeroplane which incorporates changes in type design that either increase its maximum take-off

mass, or that increase its carbon dioxide emissions evaluation metric value by more than:

(a) 1.35 per cent at a maximum take-off mass of 5 700 kg, decreasing linearly to;

(b) 0.75 per cent at a maximum take-off mass of 60 000 kg, decreasing linearly to;

(c) 0.70 per cent at a maximum take-off mass of 600 000 kg; and

(d) a constant 0.70 per cent at maximum take-off masses greater than 600 000 kg;

"derived version of a non-Carbon dioxide- certified aeroplane" means an individual aeroplane that conforms to an existing type certificate, but which is not certified to, these Regulations, and to which changes in type design are made prior to the issuance of the aeroplane's first certificate of airworthiness that increase its carbon dioxide emissions evaluation metric value by more than 1.5 per cent or are considered to be significant carbon dioxide change;

"equivalent procedure" means a test or analysis procedure which, while differing from the one specified in these Regulations of, in the technical judgement of the certificating authority yields effectively the same carbon dioxide emissions evaluation metric value as the specified procedure;

"maximum passenger seating capacity" means the maximum certificated number of passengers for the aeroplane type design;

"maximum take-off mass" or in it is acronym known as "MTOM" means the highest of all take-off masses for the type design configuration;

"performance model" means an analytical tool or method validated from corrected flight test data that can be used to determine the Specific Air Range values for calculating the carbon dioxide emissions evaluation metric value at the reference conditions;

"reference geometric factor" means an adjustment factor based on a measurement of aeroplane fuselage size derived from a two-dimensional projection of the fuselage;

"specific air range" or in it is acronym known as "SAR" means the distance an aeroplane travels in the cruise flight phase per unit of fuel consumed;

"state of design" means the state having jurisdiction over the organisation responsible for the type design;

"type certificate" means a document issued by a state to define the design of an aircraft, engine or propeller type and to certify that this design meets the appropriate airworthiness requirements of that state; and

"type design" means the set of data and information necessary to define an aircraft, engine or propeller type for the purpose of airworthiness determination.

PART II
CERTIFICATION STANDARD FOR AEROPLANE CARBON DIOXIDE EMISSIONS BASED ON THE CONSUMPTION OF FUEL-ADMINISTRATION

Application of Part II

4. This Part shall apply to all aeroplanes included in the classifications defined for carbon dioxide emissions certification purposes in Part III of these Regulations.

Carbon dioxide emissions certification

5.-(1) The Authority shall, on satisfactory evidence that the aeroplane complies with carbon dioxide emissions certification requirements that are at least equal to the applicable requirements specified in these Regulations, accept and issue an acceptance certificate.

(2) The Authority shall recognise as valid a carbon dioxide emissions certification granted by another state provided that the requirements under which such certification was granted are at least equal to the applicable requirements specified in these Regulations.

(3) The requirements applicable to carbon dioxide emission certification shall be those applicable on the date of submission to the Authority for either a type certificate in the case of a new type, approval of a change in type design in the case of a derived version, or under equivalent application procedures prescribed by the Authority.

(4) Unless otherwise specified in this Part, the date to be used by Authority in determining the applicability of these

Regulations shall be the date on which the application for a type certificate was submitted to the state of design, or the date of submission under an equivalent application procedure prescribed by the certificating authority of the state of design.

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(5) An application shall be effective for the period specified in the Civil Aviation (Airworthiness) Regulations, appropriate to the aeroplane type, except in special cases where the certificating authority grants an extension.

(6) Where the effective period is extended, the date to be used in determining the applicability of these Regulations shall be the date of issue of the type certificate, or approval of the change in type design, or the date of issue of approval under an equivalent procedure prescribed by the state of design, less the effective period.

(7) For derived versions of non- carbon dioxide - certified aeroplane and derived versions of carbon dioxide - certified aeroplane, the applicability of these Regulations refers to the date on which the application for the certification of the change in type design was made.

(8) The date to be used by the Authority in determining the applicability of these Regulations shall be the date on which the application for the change in type design was submitted to the State that first certified the change in type design.

(9) Where the provisions governing the applicability of these Regulations refer to the date on which the certificate of airworthiness was first issued to an individual aeroplane, the date to be used by the Authority in determining the applicability of these Regulations shall be the date on which the first certificate of airworthiness was issued by another state.

(10) The Authority shall publish the certified carbon dioxide emissions evaluation metric value granted or validated by the Authority.

(11) The use of equivalent procedures in lieu of the procedures specified in the Schedules to these Regulations shall be approved by the Authority.

(12) The Authority may recognise valid aeroplane exemptions granted by another state having jurisdiction over the organisation responsible for production of the aeroplane provided that an acceptable process was used.

(13) The Authority shall issue acceptance certificate if it is satisfied that aeroplane meet the Carbon dioxide emissions certification requirements.

(14) Where, after emission evaluation, the Authority is satisfied that emission certification of an aeroplane complies with the requirements under these Regulations, it shall issue an acceptance certificate.

(15) The Authority shall, on satisfactory evidence that the aeroplane complies with carbon dioxide emissions certification requirements that are at least equal to the applicable requirements specified in these Regulations, accept and issue an acceptance certificate.

PART III
CERTIFICATION STANDARD FOR AEROPLANE EMISSIONS BASED ON THE CONSUMPTION OF FUEL - SUBSONIC JET AEROPLANES OVER 5,700 KG AND PROPELLER-DRIVEN AEROPLANES OVER 8,618 KG

Application of Part III

6.-(1) This Part shall, with the exception of amphibious aeroplanes, aeroplanes initially designed or modified and used for specialised operational requirements, aeroplanes designed with zero reference geometric factor, and those aeroplanes specifically designed or modified and used for fire-fighting purposes, be applicable to-

(a) subsonic jet aeroplanes, including their derived versions, of greater than 5,700 kg maximum take-off mass, for which the application for a type certificate was submitted on or after 1 January 2020, except for those aeroplanes of less than or equal to 60,000 kg maximum take-off mass with a maximum passenger seating capacity of 19 seats or less;

(b) subsonic jet aeroplanes, including their derived versions, of greater than 5,700 kg and less than or equal to 60,000 kg maximum take-off mass with a maximum passenger seating capacity of 19 seats or less, for which the application for a type certificate was submitted on or after 1 January, 2023;

(c) all propeller-driven aeroplanes, including their derived versions, of greater than 8,618 kg maximum take-off mass, for which the application for a type certificate was submitted on or after 1 January 2020;

(d) derived versions of non- carbon dioxide -certified subsonic jet aeroplanes of greater than 5,700 kg maximum certificated take-off mass, for which the application for certification of the change in type design was submitted on or after 1 January 2023;

(e) derived versions of non- carbon dioxide certified propeller-driven aeroplanes of greater than 8,618 kg maximum certificated take-off mass, for which the application for certification of the change in type design was submitted on or after 1 January 2023;

(f) individual non-carbon dioxide certified subsonic jet aeroplanes of greater than 5,700 kg maximum certificated take-off mass, for which a certificate of airworthiness was first issued on or after 1 January, 2028

(g) individual non-carbon dioxide certified propeller-driven aeroplanes of greater than 8,618 kg maximum certificated take-off mass, for which a certificate of airworthiness was first issued on or after 1 January, 2028.

(2) Notwithstanding subregulation (1), aeroplanes on the Authority's register shall not require demonstration of compliance with the provisions of this Part for time-limited engine changes.

(3) Subject to subregulation (2), changes in type design shall specify that the aeroplane may not be operated for a period of more than ninety days, unless compliance with the provisions of this Part is shown for that change in type design and applies only to changes resulting from a required maintenance action.

(4) Notwithstanding subregulation (1), this Part shall not apply to aeroplane granted an exemption by certificating authority having jurisdiction over the organisation responsible for production of such aeroplane.

(5) Where an aeroplane is exempted in accordance with subregulation (4), the authority shall issue an exemption document, and the grant of the exemption shall be noted in the permanent aeroplane record.

(6) Subject to subregulation (5), the Authority shall take into account the number of exempted aeroplanes that will be produced and their impact on the environment.

(7) Exemptions shall be reported by aeroplane serial number and made available via an official public register.

Carbon dioxide emissions evaluation metric

7.-(1) The metric shall be defined in terms of the average of the $^{1}/_{SAR}$ values for the three reference masses defined in regulation 8 and the reference geometric factor defined in the First Schedule.

(2) Subject to subregulation (1), the metric value quantified in units of kg/km shall be calculated using the following formula:

$$CO_2 \text{ emissions evaluation metric value} = \frac{\left(^{1}/_{SAR}\right)_{AVG}}{(RGF)^{0.24}}$$

(3) Subject to the equation specified in subregulation (2), the carbon dioxide emissions evaluation metric shall be specific air range (SAR) based metric adjusted to take into account fuselage size.

Reference aeroplane masses

8.-(1) The $^{1}/_{SAR}$ value shall be established at each of the following three reference aeroplane masses, when tested in accordance with these Regulations:

(a) high gross mass: 92 per cent maximum take-off mass;

(b) mid gross mass: simple arithmetic average of high gross mass and low gross mass; and

(c) low gross mass: (0.45 × MTOM) + (0.63 × ($MTOM^{0.924}$)).

(2) Subject to subregulation (1), the maximum take-off mass shall be expressed in kilograms.

(3) Carbon dioxide emissions certification for maximum take-off mass shall also represent the certification of Carbon dioxide emissions for take-off masses less than maximum take-off mass.

(4) Applicants may, in addition to the mandatory certification of carbon dioxide metric values for maximum take-off mass, voluntarily apply for the approval of Carbon dioxide metric values for take-off masses less than maximum take-off mass.

Maximum permitted Carbon dioxide emissions evaluation metric value

9.-(1) The carbon dioxide emissions evaluation metric value shall be determined in accordance with the evaluation methods specified in the Second Schedule.

(2) The carbon dioxide emissions evaluation metric value shall not exceed the value defined as follows:

(a) for aeroplanes specified in regulation 6(1) (a), (b) and (c) with a maximum take-off mass less than or equal to 60 000 kg:

$$\text{Maximum permitted value} = 10^{(-2.73780 + (0.681310 * \log_{10}(MTOM)) + (-0.0277861 * (\log_{10}(MTOM))^2))};$$

(b) for aeroplanes specified in regulation 6(1) (a) and (c) with a maximum take-off mass greater than 60 000 kg, and less than or equal to 70 395 kg:

Maximum permitted value = 0.764;

(c) for aeroplanes specified in regulation 6(1) (a) and (c) with a maximum take-off mass greater than 70 395 kg:

$$\text{Maximum permitted value} = 10^{(-1.412742 + (-0.020517 * \log_{10}(MTOM)) + (0.0593831 * (\log_{10}(MTOM))^2))};$$

(d) for aeroplanes specified in regulation 6(1) (d), (e), (f) and (g) with a maximum certificated take-off mass less than or equal to 60 000 kg:

$$\text{Maximum permitted value} = 10^{(-2.57535 + (0.609766 * \log_{10}(MTOM)) + (-0.0191302 * (\log_{10}(MTOM))^2));}$$

(e) for aeroplanes specified in regulation 6(1) (d), (e), (f) and (g) with a maximum certificated take-off mass greater than 60 000 kg, and less than or equal to 70 107 kg:

Maximum permitted value = 0.797; and

(f) for aeroplanes specified in regulation 6(1)(d), (e), (f) and (g) with a maximum take-off mass greater than 70 107 kg:

$$\text{Maximum permitted value} = 10^{(-1.39353 + (-0.020517 * \log_{10}(MTOM)) + (0.0593831 * (\log_{10}(MTOM))^2)).}$$

Reference conditions for determining aeroplane specific air range

10.-(1) The reference conditions shall consist of the following conditions within the approved normal operating envelope of the aeroplane:

(a) the aeroplane gross masses prescribed in regulation 8;

(b) a combination of altitude and airspeed selected by the applicant;

(c) steady (unaccelerated), straight and level flight;

(d) aeroplane in longitudinal and lateral trim;

(e) International Civil Aviation Organisation (ICAO) standard day atmosphere;

(f) gravitational acceleration for the aeroplane travelling in the direction of true North in still air at the reference altitude and a geodetic latitude of 45.5 degrees, based on g_0;

(g) fuel lower heating value equal to 43.217 MJ/kg (18 580 BTU/lb);

(h) a reference aeroplane centre of gravity position selected by the applicant to be representative of a mid-centre of gravity point relevant to design cruise performance at each of the three reference aeroplane masses;

(i) a wing structural loading condition selected by the applicant for representative operations conducted in accordance with the aeroplane's payload capability and manufacturer standard fuel management practices;

(j) applicant selected electrical and mechanical power extraction and bleed flow relevant to design cruise performance and in accordance with manufacturer recommended procedures;

(k) engine handling or stability bleeds operating according to the nominal design of the engine performance model for the specified conditions; and

(l) engine deterioration level selected by the applicant to be representative of the initial deterioration level (a minimum of 15 take-offs or 50 engine flight hours).

(2) Where the test conditions are not the same as the reference conditions, the corrections for the differences between test and reference conditions shall be applied as specified in the Second Schedule.

Test procedures

11-(1) The specific air range values that form the basis of the Carbon dioxide emissions evaluation metric value shall be established either directly from flight tests or from a performance model validated by flight tests.

(2) The test aeroplane shall be representative of the type design for which certification is requested.

(3) The test and analysis procedures shall be conducted in an approved manner to yield the Carbon dioxide emissions evaluation metric value as described in Second Schedule.

(4) Subject to subregulation (3), the procedures shall address the entire flight test and data analysis process, from pre-flight actions to post-flight data analysis.

PART IV
EXEMPTIONS

Requirements for application for exemption

12.-(1) A person may apply to the Authority for an exemption from any provision of these Regulations.

(2) Save for cases of emergency, a person requiring exemptions from any provision of these Regulations shall make an application to the Authority at least sixty days prior to the proposed effective date, giving the following information:

(a) name and contact address including electronic mail and fax if any;
(b) telephone number;
(c) a citation of the specific requirement from which the applicant seeks exemption;
(d) justification for the exemption;
(e) a description of the type of operations to be conducted under the proposed exemption;
(f) the proposed duration of the exemption;
(g) an explanation of how the exemption would be in the public interest;

(h) a detailed description of the alternative means by which the applicant will ensure a level of safety equivalent to that established by the regulation in question;

(i) a safety risk assessment carried out in respect of the exemption applied for;

(j) where the applicant handles international operations and seeks to operate under the proposed exemption, an indication whether the exemption would contravene any provision of these Regulations; and

(k) any other relevant information that the Authority may require.

(3) Where the applicant seeks emergency processing of an application for exemption, the application shall contain supporting facts and reasons for not filing the application within the time specified in subregulation (2) and satisfactory reason for deeming the application an emergency.

(4) The Authority may, where it does not satisfy itself with the reasons given for the emergency, in writing, refuse an application made under subregulation (3).

(5) The application for exemption shall be accompanied by a fee to be prescribed by the Authority.

Publication of the request for exemption

13.-(1) The Authority shall review the application for exemption and upon being satisfied that the application complies with the requirements of regulation 12, publish a detailed summary of the application for comments, within a prescribed time, in either-

(a) the *Gazette*;

(b) aeronautical information circular; or

(c) widely circulated newspaper.

(2) Where application requirements have not been fully complied with, the Authority shall request the applicant, in writing, to comply with the necessary requirements prior to publication or making a decision.

(3) Where the request is for emergency relief, the Authority shall publish the decision as soon as possible after processing the application.

Evaluation of request

14.-(1) Where the application requirements have been satisfied, the Authority shall conduct an evaluation of the request to-

(a) determine whether an exemption is in the public interest;

(b) determine, after a technical evaluation, whether the applicant's proposal would provide a level of safety equivalent to that established by the relevant regulation, although where the Authority decides that a technical evaluation of the request would impose a significant burden on the Authority's technical resources, the Authority may deny the exemption on that basis;

(c) determine of whether the grant of the exemption would contravene these Regulations; and

(d) grant or deny the exemption based on the preceding elements, and with or without conditions.

(2) The Authority shall notify the applicant in writing of, the decision to grant or deny the request and publish a detailed summary of its evaluation and decision.

(3) The summary referred to in sub-regulation (2) shall specify the duration of the exemption and any conditions or limitations of the exemption.

(4) Where the exemption affects a significant population of the aviation community of the United Republic of Tanzania, the Authority shall publish the summary in aeronautical information circular.

PART V
MISCELLANEOUS PROVISIONS

Suspension and revocation

15.-(1) The Authority may, where a person contravenes any condition prescribed in the acceptance certificate or exemption document granted under these Regulations, revoke or suspend such certificate or document.

(2) The Authority shall, before suspending or revoking the acceptance certificate or exemption document, issue fourteen days' notice, to holder in writing stating its intention to suspend or revoke the acceptance certificate, or exemption document and the reasons thereof.

(3) A holder of acceptance certificate, or exemption document may, within fourteen days from the receipt of notice, submit his response to the Authority.

(4) The Authority may, where a holder of acceptance certificate or exemption document fails to respond within prescribed period or provide unsatisfactory response, continue to suspend or revoke the acceptance certificate or exemption document, as the case may be.

Offences and penalties

16. A person who contravenes any provision of these Regulations commits an offence and on conviction shall be liable to the penalty provided in the Act.

FIRST SCHEDULE

(Made under regulation 7(1))

REFERENCE GEOMETRIC FACTOR

1. Reference geometric factor is a non-dimensional parameter used to adjust (1/SAR)AVG. reference geometric factor is based on a measure of fuselage size normalized with respect to 1 m2, and is derived as follows:

(a) for aeroplanes with a single deck determine the area of a surface (expressed in m2) bounded by the maximum width of the fuselage outer mould line (Outer Mould Line) projected to a flat plane parallel with the main deck floor; and

(b) for aeroplanes with an upper deck determine the sum of the area of a surface (expressed in m2) bounded by the maximum width of the fuselage Outer Mould Line projected to a flat plane parallel with the main deck floor, and the area of a surface bounded by the maximum width of the fuselage Outer Mould Line at or above the upper deck floor projected to a flat plane parallel with the upper deck floor is determined; and

(c) determine the non-dimensional reference geometric factor by dividing the areas defined in 1 a) or 1 b) by 1 m2.

(i). Reference geometric factor includes all pressurized space on the main or upper deck including aisles, assist spaces, passage ways, stairwells and areas that can accept cargo and auxiliary fuel containers. It does not include permanent integrated fuel tanks within the cabin or any unpressurized fairings, nor crew rest/work areas or cargo areas that are not on the main or upper deck (e.g. 'loft' or under floor areas). Reference geometric factor does not include the cockpit crew zone.

(ii). The aft boundary to be used for calculating reference geometric factor is the aft pressure bulkhead. The forward boundary is the forward pressure bulkhead except for the cockpit crew zone.

(iii). Areas that are accessible to both crew and passengers are excluded from the definition of the cockpit crew zone. For aeroplanes with a cockpit door, the aft boundary of the cockpit crew zone is the plane of the cockpit door. For aeroplanes having optional interior configurations that include

different locations of the cockpit door, or no cockpit door, the boundary shall be determined by the configuration that provides the smallest cockpit crew zone. For aeroplanes certified for single-pilot operation, the cockpit crew zone shall extend half the width of the cockpit.

(iv). Figures S2-1 and S2-2 provide a notional view of the reference geometric factor boundary conditions.

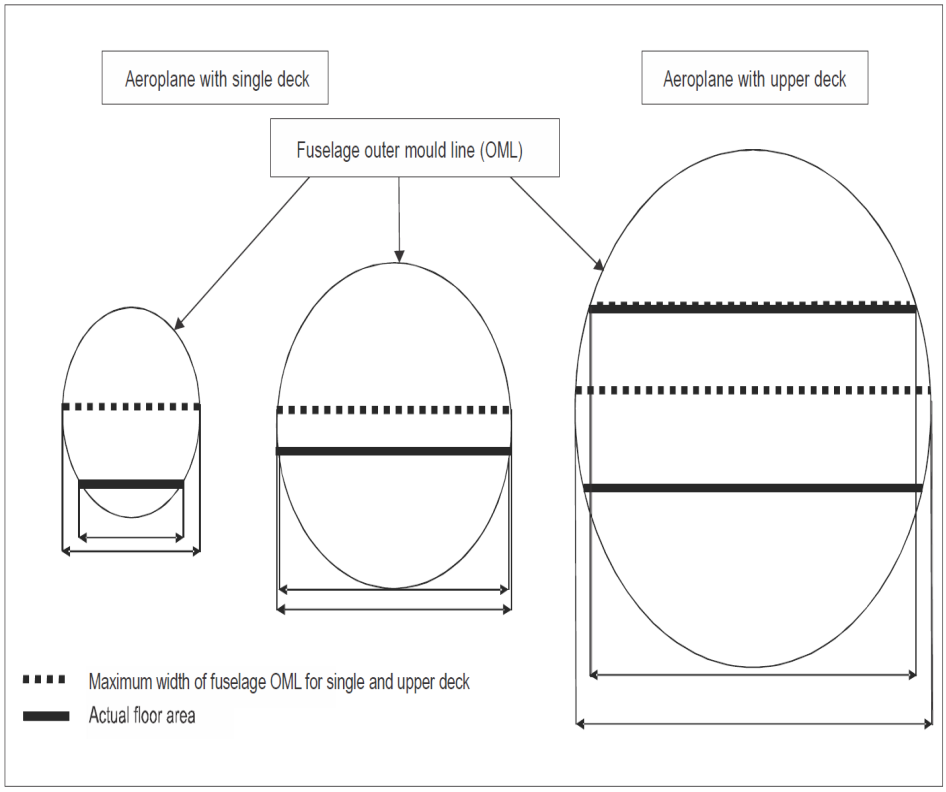

Figure S2-1.Cross-sectional view

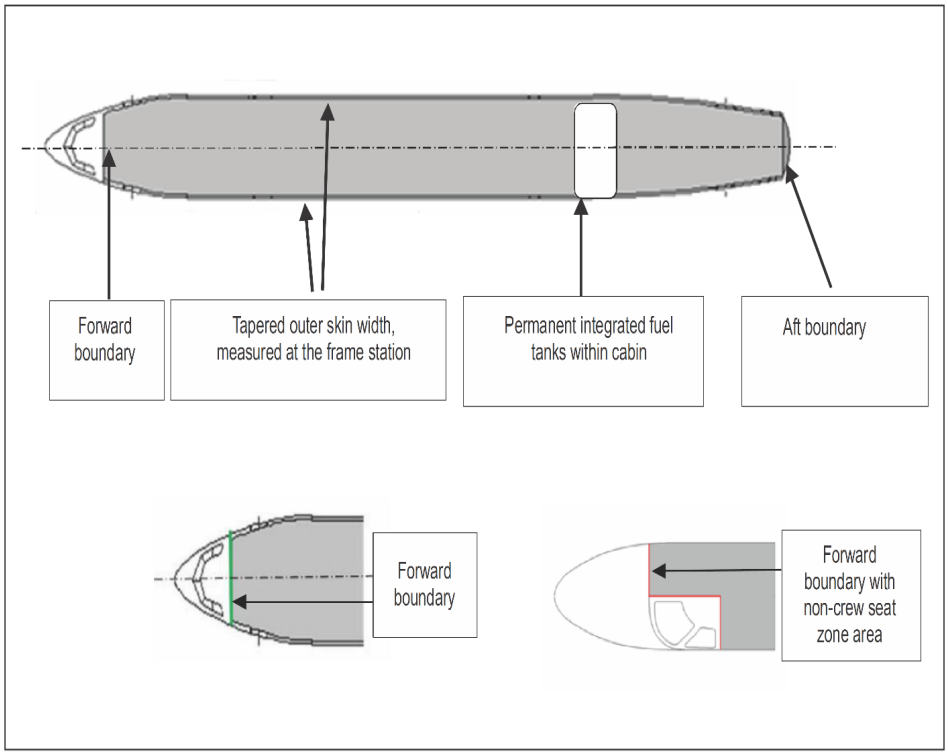

Figure S2-2. Longitudinal view

SECOND SCHEDULE

(Made under regulations 9(1), 10(2) and 11(3))

DETERMINATION OF THE AEROPLANE CARBON DIOXIDE EMISSIONS EVALUATION METRIC VALUE

1. SUBSONIC JET AEROPLANES OVER 5 700 kg
2. PROPELLER-DRIVEN AEROPLANES OVER 8 618 kg

1. INTRODUCTION

The process for determining the carbon dioxide emissions evaluation metric value includes:

(a) determination of reference geometric factor (see First Schedule);
(b) determination of the certification test and measurement conditions and procedures for the determination of specific air range (see clause 3 of this Schedule), either by direct flight test or by way of a validated performance model, including:-

(i). measurement of parameters needed to determine specific air range (see clause 4 of this Schedule);
(ii). correction of measured data to reference conditions for specific air range (see clause 5 of this Schedule); and
(iii). validation of data for calculation of the certified carbon dioxide emissions evaluation metric value (see clause 6 of this Schedule);

(a) calculation of the carbon dioxide emissions evaluation metric value (see clause 7 of this Schedule); and
(b) reporting of data to the certificating authority (see clause 8 of this Schedule).

Note. — The instructions and procedures ensure uniformity of compliance tests, and permit comparison between various types of aeroplanes.

2. METHODS FOR DETERMINING SPECIFIC AIR RANGE

2.1 Specific air range may be determined by either direct flight test measurement of specific air range test points, including any corrections of test data to reference conditions, or by the use of a performance model approved by the certificating authority. A performance model, if used, shall be validated by actual specific air range flight test data.

2.2 In either case, the specific air range flight test data shall be acquired in accordance with the procedures defined in this regulations and approved by the certificating authority.

2.3 Validation of the performance model shall only need to be shown for the test points and conditions relevant to showing compliance with the Standard. Test and analysis methods, including any algorithms that may be used, should be described in sufficient detail.

3. SPECIFIC AIR RANGE CERTIFICATION TEST AND MEASUREMENT CONDITIONS

3.1 General

3.1.1 This section prescribes the conditions under which specific air range certification tests shall be conducted and the measurement procedures that shall be used.

3.1.2 An application for certification of a carbon dioxide emissions metric value may involve only a minor change to the aeroplane type design. The resultant change in the carbon dioxide emissions metric value could often be established reliably by

way of an equivalent procedure without the necessity of resorting to a complete test.

3.2 Flight test procedure

3.2.1 **Pre-flight**

The pre-flight procedure shall be approved by the certificating authority and shall include the following elements:

(a) ***Aeroplane conformity***. The test aeroplane shall be confirmed to be in conformance with the type design for which certification is sought.

(b) ***Aeroplane weighing***. The test aeroplane shall be weighed. Any change in mass after the weighing and prior to the test flight shall be accounted for.

(c) ***Fuel lower heating value***. A sample of fuel shall be taken for each flight test to determine its lower heating value. Fuel sample test results shall be used for the correction of measured data to reference conditions. The determination of lower heating value and the correction to reference conditions shall be subject to the approval of the certificating authority.

2) The fuel lower heating value shall be determined in accordance with methods which are at least as stringent as those defined in ASTM specification D4809-131.

3) The fuel sample shall be representative of the fuel used for each flight test and should not be subject to errors or variations due to fuel being uplifted from multiple sources, fuel tank selection or fuel layering in a tank.

(d) ***Fuel specific gravity and viscosity***. A sample of fuel shall be taken for each flight test to determine its specific gravity and viscosity when volumetric fuel flow meters are used.

1) The fuel specific gravity shall be determined in accordance with methods which are at least as stringent as those defined in ASTM specification D4052-11[2].

2) The fuel kinematic viscosity should be determined in accordance with methods which are at least as stringent as those defined in ASTM specification D445-15[3].

Note. *— When using volumetric fuel flow meters, the fuel viscosity is used to determine the volumetric fuel flow from the parameters measured by a volumetric fuel flow meter. The fuel specific gravity (or density) is used to convert the volumetric fuel flow to a mass fuel flow.*

3.2.2 **Flight test method**

3.2.2.1 The flight tests shall be performed in accordance with the following flight test method and the stability conditions described in 3.2.3.

3.2.2.2 Test points shall be separated by a minimum duration of two minutes, or separated by an exceedance of one or more of the stability criteria limits described in 3.2.3.1.

3.2.2.3During the test conditions flown to determine SAR, the following criteria shall be adhered to:

(a) the aeroplane is flown at constant pressure altitude and constant heading along isobars to the extent that is practicable;
(b) the engine thrust or power setting is stable for unaccelerated level flight;
(c) the aeroplane is flown as close as practicable to the reference conditions to minimize the magnitude of any corrections;
(d) there are no changes in trim or engine power or thrust settings, engine stability and handling bleeds, and electrical and mechanical power extraction (including bleed flow). Any changes in the use of aeroplane systems that may affect the specific air range measurement should be avoided; and

(e) movement of on-board personnel is kept to a minimum.

3.2.3 **Test condition stability**

3.2.3.1 For a specific air range measurement to be valid, the following parameters shall be maintained within the indicated tolerances for a minimum duration of 1 minute during which the specific air range data is acquired:

(a) Mach number within ±0.005;
(b) ambient temperature within ±1°C;
(c) heading within ±3 degrees;
(d) track within ±3 degrees;
(e) drift angle less than 3 degrees;
(f) ground speed within ±3.7 km/h (±2 kt);
(g) difference in ground speed at the beginning of the test condition from the ground speed at the end of the test condition within ±2.8 km/h/min (±1.5 kt/min); and
(h) pressure altitude within ±23 m (±75 ft).

3.2.3.2 Alternatives to the stable test condition criteria listed above may be used provided that stability can be sufficiently demonstrated to the certificating authority.

3.2.3.3 Test points that do not meet the stable test criteria defined in 3.2.3.1 should normally be discarded. However, test points that do not meet the stability criteria listed in 3.2.3.1 may be acceptable subject to the approval of the certificating authority, and would be considered as an equivalent procedure.

3.2.4 **Verification of aeroplane mass at test conditions**

3.2.4.1 The procedure for determining the mass of the aeroplane at each test condition shall be subject to the approval of the certificating authority.

3.2.4.2 The mass of the aeroplane during a flight test should be determined by subtracting the fuel used (i.e. integrated fuel flow) from the mass of the aeroplane at the start of the test flight. The accuracy of the determination of the fuel used should be verified by weighing the test aeroplane on calibrated scales either before and after the specific air range test flight, or before and after another test flight with a cruise segment provided that flight occurs within one week or 50 flight hours (at the option of the applicant) of the specific air range test flight and with the same, unaltered fuel flow meters.

4. MEASUREMENT OF AEROPLANE SPECIFIC AIR RANGE

4.1 Measurement system

4.1.1 The following parameters shall be recorded at a minimum sampling rate of 1 Hertz (cycle per second):

(a) airspeed;
(b) ground speed;
(c) true airspeed;
(d) fuel flow;
(e) engine power setting parameter (e.g. fan speed, engine pressure ratio, torque, shaft horse power);
(f) pressure altitude;
(g) temperature;
(h) h) heading;
(i) track; and
(j) fuel used (for the determination of gross mass and CENTRE OF GRAVITY position).

4.1.2 The following parameters shall be recorded at a suitable sampling rate:

(a) latitude;
(b) engine bleed positions and power off-takes; and
(c) power extraction (electrical and mechanical load).

4.1.3 The value of each parameter used for the determination of SAR, except for ground speed, shall be the simple arithmetic average of the measured values for that parameter obtained throughout the stable test condition (see 3.2.3.1).

Note.— The rate of change of ground speed during the test condition is to be used to evaluate and correct any acceleration or deceleration that might occur during the test condition.

4.1.4 The resolution of the individual measurement devices shall be sufficient to determine that the stability of the parameters defined in 3.2.3.1 is maintained.

4.1.5 The overall specific air range measurement system is considered to be the combination of instruments and devices, including any associated procedures, used to acquire the following parameters necessary for the determination of specific air range :

(a) fuel flow;
(b) Mach number;
(c) altitude;
(d) aeroplane mass;
(e) ground speed;
(f) f) outside air temperature;
(g) g) fuel lower heating value; and
(h) Centre of Gravity CENTRE OF GRAVITY.

4.1.6 The accuracy of the individual elements that comprise the overall specific air range measurement system is defined in terms of its effect upon specific air range. The cumulative error associated with the overall specific air range measurement system is defined as the root sum of squares of the individual accuracies.

Note.— Parameter accuracy need only be examined within the range of the parameter needed for showing compliance with the carbon dioxide emissions Standard.

4.1.7 If the absolute value of the cumulative error of the overall specific air range measurement system is greater than 1.5 per cent, a penalty equal to the amount that the Root Sum of Squares value exceeds 1.5 per cent shall be applied to the specific air range value corrected to reference conditions (see Section 5). If the absolute value of the cumulative error of the overall specific air range measurement system is less than or equal to 1.5 per cent, no penalty shall be applied.

5. CALCULATION OF REFERENCE SPECIFIC AIR RANGE FROM MEASURED DATA

5.1 Calculation of SAR

Specific air range is calculated from the following equation:

SAR = TAS/Wf

where:

TAS is the true airspeed; and

Wf is total aeroplane fuel flow.

5.2 Corrections from test to reference conditions

5.2.1 Corrections shall be applied to the measured specific air range values to correct to the reference conditions specified in regulation 10. Corrections shall be applied for each of the following measured parameters that are not at the reference conditions:

Acceleration/deceleration (energy). Drag determination is based on an assumption of steady, unaccelerated flight. Acceleration or deceleration occurring during a test condition affects the assessed drag level. The reference condition is steady, unaccelerated flight.

Aeroelastics. Wing aeroelasticity may cause a variation in drag as a function of aeroplane wing mass distribution. Aeroplane wing mass distribution will be affected by the fuel load distribution in the wings and the presence of any external stores.

Altitude. The altitude at which the aeroplane is flown affects the fuel flow.

Apparent gravity. Acceleration, caused by the local effect of gravity, and inertia, affect the test weight of the aeroplane. The apparent gravity at the test conditions varies with latitude, altitude, ground speed, and direction of motion relative to the Earth's axis. The reference gravitational acceleration is the gravitational acceleration for the aeroplane travelling in the direction of true North in still air at the reference altitude, a geodetic latitude of 45.5 degrees, and based on g_0.

CENTRE OF GRAVITY position. The position of the aeroplane CENTRE OF GRAVITY affects the drag due to longitudinal trim.

Electrical and mechanical power extraction and bleed flow. Electrical and mechanical power extraction, and bleed flow affect the fuel flow.

Engine deterioration level. When first used, engines undergo a rapid, initial deterioration in fuel efficiency. Thereafter, the rate of deterioration significantly decreases. Engines with less deterioration than the reference engine deterioration level may be used, subject to the approval of the certificating authority. In such a case, the fuel flow shall be corrected to the reference engine deterioration level using an approved method. Engines with more deterioration than the reference engine deterioration level may be used. In this case, a correction to the reference condition shall not be permitted.

Fuel lower heating value. The fuel lower heating value defines the energy content of the fuel. The lower heating value directly affects the fuel flow at a given test condition.

Reynolds number. The Reynolds number affects aeroplane drag. For a given test condition the Reynolds number is a function of the density and viscosity of air at the test altitude and temperature. The reference Reynolds number is derived from the density and viscosity of air from the ICAO standard atmosphere at the reference altitude.

Temperature. The ambient temperature affects the fuel flow. The reference temperature is the standard day temperature from the ICAO standard atmosphere at the reference altitude.

Note.—Post-flight data analysis includes the correction of measured data for data acquisition hardware response characteristics (e.g. system latency, lag, offset, buffering, etc.).

5.2.2 Correction methods are subject to the approval of the certificating authority. If the applicant considers that a particular correction is unnecessary, then acceptable justification shall be provided to the certificating authority.

5.3 Calculation of specific air range

The specific air range values for each of the three reference masses defined in regulation 8, shall be calculated either directly from the measurements taken at each valid test point adjusted to reference conditions, or indirectly from a performance model that has been validated by the test points. The final specific air range value for each reference mass shall be the simple arithmetic average of all valid test points at the appropriate gross mass, or derived from a validated performance model. No data acquired from a valid test point shall be omitted unless agreed by the certificating authority.

Note*.— Extrapolations consistent with accepted airworthiness practices to masses other than those tested may be allowable using a validated performance model. The performance model should be based on data covering an adequate range of lift coefficient, Mach number, and thrust specific fuel consumption such that there is no extrapolation of these parameters.*

6. VALIDITY OF RESULTS

6.1 The 90 per cent confidence interval shall be calculated for each of the specific air range values at the three reference masses.

6.2 If clustered data is acquired independently for each of the three gross mass reference points, the minimum sample size acceptable for each of the three gross mass specific air range values shall be six.

6.3 Alternatively, specific air range data may be collected over a range of masses. In this case, the minimum sample size shall be 12 and the 90 per cent confidence interval shall be calculated for the mean regression line through the data.

6.4 If the 90 per cent confidence interval of the specific air range value at any of the three reference aeroplane masses exceeds ±1.5 per cent, the specific air range value at that reference mass may be used, subject to the approval of the certificating authority, if a penalty is applied to it. The penalty shall be equal to the amount that the 90 per cent confidence interval exceeds ±1.5 per cent. If the 90 per cent confidence interval of the specific air range value is less than or equal to ±1.5 per cent, no penalty need be applied.

Note.— Methods for calculating the 90 per cent confidence interval are given in the Environmental Technical Manual

7. CALCULATION OF THE CARBON DIOXIDE EMISSIONS EVALUATION METRIC VALUE

The carbon dioxide emissions evaluation metric value shall be calculated according to the formula defined in regulation 7(2).

8. REPORTING OF DATA TO THE CERTIFICATING AUTHORITY

Note.— The information required is divided into: 1) general information to identify the aeroplane characteristics and the method of data analysis; 2) list of reference conditions used; 3) data obtained from the aeroplane test(s); 4) calculations and corrections of specific air range test data to reference conditions; and 5) results derived from the test data.

8.1 General information

The following information shall be provided for each aeroplane type and model for which carbon dioxide certification is sought:

(a) designation of the aeroplane type and model;

(b) general characteristics of the aeroplane, including CENTRE OF GRAVITY range, number and type designation of engines and, if fitted, propellers;

(c) maximum take-off mass;

(d) relevant dimensions needed for calculation of reference geometric factor; and

(e) serial number(s) of the aeroplane(s) tested for carbon dioxide certification purposes and, in addition, any modifications or

(f) non-standard equipment likely to affect the carbon dioxide characteristics of the aeroplane.

8.2 Reference conditions

The reference conditions used for the determination of specific air range (see regulation 10) shall be provided.

8.3 Test data

The following measured test data, including any correct ions for instrumentation characteristics, shall be provided for each of the test measurement points:

(a) airspeed, ground speed and true airspeed;

(b) fuel flow;

(c) pressure altitude;

(d) static air temperature;

(e) aeroplane gross mass and CENTRE OF GRAVITY for each test point;

(f) levels of electrical and mechanical power extraction and bleed flow;

(g) engine performance:

1) for jet aeroplanes, engine power setting; and

2) for propeller-driven aeroplanes, shaft horsepower or engine torque and propeller rotational speed;

(h) fuel lower heating value;

(i) fuel specific gravity and kinematic viscosity if volumetric fuel flow meters are used (see 3.2.1 d));

(j) the cumulative error (Root Sum of Squares) of the overall measurement system (see 4.1.6);

(k) heading, track and latitude;

(l) stability criteria (see 3.2.3.1); and

(m) description of the instruments and devices used to acquire the parameters necessary for the determination of SAR, and their individual accuracies in terms of their effect on specific air range (see 4.1.5 and 4.1.6).

8.4 Calculations and corrections of specific air range test data to reference conditions

The measured specific air range values, corrections to the reference conditions and corrected specific air range values shall be provided for each of the test measurement points.

8.5 Derived data

The following derived information shall be provided for each aeroplane tested for certification purposes:

(a) specific air range (km/kg) for each reference aeroplane mass and the associated 90 per cent confidence interval;
(b) average of the inverse of the three reference mass specific air range values;
(c) reference geometric factor; and
(d) carbon dioxide emissions evaluation metric value.

Dodoma,
22nd December, 2025

MAKAME M. MBARAWA
Minister for Transport