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Second Edition
Corrigendum No. 1
(English only)
22/4/15

ENVIRONMENTAL TECHNICAL MANUAL

CORRIGENDUM No. 1

1. Please replace existing pages 2-1, 2-2, 4-15, 4-80, 4-97, 4-101, 4-104, 4-105, 4-109 and Index-(i) by the attached new pages bearing the notation “Corr. 1”, dated 22/4/15.
 2. Record the entry of this corrigendum on page (iii) of the manual.
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Chapter 2

GENERAL GUIDELINES

2.1 APPLICABILITY OF CURRENT AND PREVIOUS AMENDMENTS TO ANNEX 16, VOLUME I

Since the publication of the first edition of Annex 16 many amendments and new editions have been published. Each amendment and new edition retains the older chapters (e.g. Chapter 2), even though they may no longer be applicable to new types of aircraft. Since each new amendment or edition succeeds the previous version, the applicability provisions of each chapter are in principle retained, thus preserving their continuity.

The first section of Chapters 2, 3, 4, 5, 6, 8, 10, 11 and 12 of the Annex, together with the paragraphs concerning applicability in Chapter 1 of the Annex, define the applicability of each chapter. Their applicability to new types is determined by the date the application for the Type Certificate was submitted to the State of Design.

In many instances the chapter and maximum noise levels so determined for a new type are also applicable to its derived versions (e.g. the applicability provisions of Chapter 3 refer to “all ... aeroplanes, including their derived versions”).

In some cases the applicability provisions apply only to derived versions (e.g. Chapter 8, 8.1.3). In these cases the applicability provisions are determined by the date the application for certification of the change in type design was submitted to the certifying authority of the Contracting State that first certificated the change in type design.

Note.— The applicability provisions for derived versions are not dependent on how the associated change, or changes, in type design came about (e.g. amended Type Certificate or Supplemental Type Certificate).

The authority of the State of Design or, in the case of derived versions, the original certifying authority, should ensure that the demonstration of compliance is in accordance with the procedures and recommended practices that are described in the amendment to Annex 16 that is applicable at the date of submittal for either the Type Certificate or approval of the change in type design as required by Chapter 1, 1.10 through 1.13.

Note.— Changes to test procedures and evaluation methods are usually approved by the Committee on Aviation Environmental Protection (CAEP) on the basis that they are “stringency neutral”.

The question arises as to the status of these approvals as each new amendment to the Annex is published.

- a) For the authority of the State of Design in the case of new types, or the original certifying authority in the case of derived versions, the approved certification noise levels corresponding to the amendment to the Annex and revision of this manual that were applicable at the time the application for approval was submitted remain valid and should not be reassessed against any changes made in later amendments or revisions.
- b) Many applications for a Type Certificate or for approval of a change in type design are submitted to authorities other than that of the State of Design or original certifying authority. Often these applications are submitted several years after their submittal to the first certifying authority. During this period many new amendments to the Annex and corresponding revisions of this manual may have been published. In the case of an application for a Type Certificate or an application for the

approval of a change in type design, the applicable Standards are determined according to the provisions of Chapter 1 of the Annex.

For an authority to whom these later submittals are made, the acceptable means of compliance, technical procedures and equivalent procedures would be those described in the amendment to the Annex and the version of this manual that are applicable at the time the applications are submitted to this authority. The applicability provisions of each chapter do not change over time. However the reference and test procedures and the evaluation methods defined in the appendices do, on occasion, change with each new amendment or edition. An applicant may propose, with supporting justification, to the certifying authority to accept the means of compliance and demonstration procedures described in earlier amendments to Annex 16 and equivalent procedures described in earlier versions of this manual on the basis that they are equivalent to the currently applicable ones.

Note.— Bilateral arrangements between Contracting States will facilitate the mutual recognition by other certifying authorities of approvals granted by certifying authorities of the State of Design.

2.2 CHANGES TO AIRCRAFT TYPE DESIGNS INVOLVING “DERIVED VERSIONS”

Many of the equivalent procedures given in this manual relate to derived versions where the procedure used yields the information needed to obtain the certification noise levels of the derived versions by adjusting the noise levels of the “flight datum” aircraft (i.e. the most appropriate aircraft for which the noise levels were measured during an approved flight test demonstration).

The physical differences between the “flight datum” aircraft and the derived version can take many forms, such as an increased take-off mass, an increased engine thrust, changes to the powerplant or propeller or rotor types, etc. Some of these differences will alter the distance between the aircraft and the noise certification reference points, others the noise source characteristics. Procedures used in the determination of the certification noise levels of the derived versions will therefore depend upon the change to the aircraft being considered. However, where several similar changes are being made, such as the introduction of engines from different manufacturers, the procedures used to obtain the certification noise levels of each derivative aircraft should be followed in identical fashion.

2.3 CHANGES TO AIRCRAFT TYPE DESIGNS INVOLVING “NO-ACOUSTICAL CHANGES”

Aircraft/engine model design changes and airframe/engine performance changes may result in very small changes in aircraft certification noise levels that are not acoustically significant. These changes are referred to as no-acoustical changes (NACs). For this manual NACs, which do not result in modification of an aircraft’s certification noise levels, are defined as:

- a) changes in aeroplane certification noise levels approved by the certifying authority which do not exceed 0.10 dB at any noise measurement point and which an applicant does not track;
- b) cumulative changes in aeroplane certification noise levels approved by the certifying authority whose sum is greater than 0.10 dB but not more than 0.30 dB at any noise measurement point and for which an applicant has an approved tracking procedure;
- c) for helicopters certificated according to the Standards of Chapter 8 of the Annex, changes in any one of the certification noise levels approved by the certifying authority which do not exceed 0.30 EPNdB; and

GM A2 3.9.4
[Pink noise specifications]

1) *Pink noise*

Pink noise contains equal energy in each octave band or fractional octave band (e.g. the octave from 100 Hz to 200 Hz contains the same amount of energy as the octave from 1 kHz to 2 kHz, although for the lower-frequency octave, it is distributed over a frequency range 10 times narrower).

2) *Pink noise usage*

Because of the dynamic nature of the pink noise signal, longer samples produce statistically better measurements. A minimum duration of 30 seconds of pink noise should be recorded.

AMC A2 3.9.5
[Measurement system field calibration]

1) *Measurement system field calibration (all components of the measurement system, except microphones)*

All components of the measurement system, except microphones, should be tested while deployed in the field, using pink noise at a level within 5 dB of the calibration level (see 3.9.5 of Appendix 2 of the Annex). The signal should be recorded for a duration of at least 30 seconds so that one-third octave band system frequency response adjustments can be determined and applied during analysis. The pink noise generator should be calibrated within 6 months of the measurement and is acceptable for certification use only if its output in each one-third octave band does not change by more than 0.2 dB between calibrations.

AMC A2 3.9.8
[Field acoustical calibrations]

1) *Field acoustical calibrations*

All components of the system, excluding the windscreen, should be in place at this time, including cables, attenuators, gain and signal-conditioning amplifiers, filters (including pre-emphasis) and power supplies. During calibration, attenuators and gain stages should be set to prevent overload and to maintain the calibration signal level on the reference level range within the limits specified in 3.6.6 of Appendix 2 of the Annex. If any switchable filters that could affect the calibration signal are utilized during measurements, then calibrations should be performed both with and without these filters enabled. Components of the electrical system should not be added, removed or replaced without re-calibrating the entire system immediately before and after each change.

AMC A2 3.9.6
[Windscreen loss adjustments]

1) *Determination of windscreen data adjustments*

The physical condition of a windscreen can significantly affect its performance, and manufacturer-provided windscreen data adjustments for insertion loss are valid only for new, or clean, dry windscreens. For these adjustments, a single set of values based upon windscreen insertion loss tests at grazing

incidence may be used when the angles of incidence of sound emitted from an aircraft are within $\pm 30^\circ$ of grazing incidence. For other cases, the windscreen insertion loss adjustments should be determined and applied on the basis of intervals between angles tested not exceeding 30° .

When the windscreen data adjustments provided by the manufacturer are presented in the form of curves, care should be taken to include the insertion loss throughout each one-third octave band, rather than just at the nominal midband frequency. Windscreen insertion loss can vary substantially within the frequency range of a single band and shall be averaged or faired to more accurately correct one-third octave band data for the presence of the windscreen. Windscreen data adjustments may also be obtained by free-field calibration in an anechoic chamber.

AMC A2 3.10.1

[Measurement system background noise]

1) *Measurement system noise*

Since measurement system noise can add energy to measured aircraft noise levels, the background noise measurement described in 3.10.1 of Appendix 2 of the Annex should be made with all gain stages and attenuators set as they would be used during the aircraft noise certification measurements. If it is expected that multiple settings will be required during the measurements, background noise data should be collected at each of these settings. Care should be taken to ensure that the background noise is truly representative of that present during the aircraft noise certification tests.

2) *Mean background noise assessments*

At least 30 seconds of background noise data shall be time-averaged to determine the mean level for each one-third octave band. The PNL value for this averaged spectrum should then be calculated using the procedures defined in 4.1.3 a) of Appendix 2 of the Annex. The aircraft noise level data should also be analysed and PNL values calculated for each spectral record. The maximum aircraft PNL value should be at least 20 dB above the PNL of the averaged background noise spectrum for the data to be considered acceptable.

4.1.4 Calculation of EPNL from measured data

GM A2 4.2

[Instantaneous sound pressure levels]

1) *Instantaneous sound pressure levels*

For the purposes of this procedure, “instantaneous” sound pressure levels are considered to be one-third octave band sound pressure levels for each one-half second record obtained using a continuous exponential averaging process, as described in 3.7.5 of Appendix 2 of the Annex, or its equivalent.