CIVIL AVIATION GUIDANCE MATERIAL – 8104

# DESIGN OF MODIFICATIONS

## CAAM PART 21 SUBPART D

CIVIL AVIATION AUTHORITY OF MALAYSIA

**ISSUE 01**
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# Introduction

This Civil Aviation Guidance Material 8104 (CAGM – 8104) is issued by the Civil Aviation Authority of Malaysia (CAAM) to provide guidance for design of modifications on Malaysian aircraft pursuant to Civil Aviation Directives (CAD) 8104 – Design of Modifications (CAAM Part 21 Subpart D) and CAD 8105 – Supplemental Type Certificate (CAAM Part 21 Subpart E).

These guidelines may be used to ensure compliance with the respective provisions of the relevant CAD's issued. Notwithstanding the Regulation 204 and Regulation 205 of the Malaysian Civil Aviation Regulations 2016 (MCAR 2016), when the CAGMs issued by the CAAM are complied with, the related requirements of the CAD's may be deemed as being satisfied and further demonstration of compliance may not be required.

**(Captain Chester Voo Chee Soon)**
Chief Executive Officer
Civil Aviation Authority of Malaysia

## Civil Aviation Guidance Material components and Editorial practices

This Civil Aviation Guidance Material is made up of the following components and are defined as follows:

**Standards:** Usually preceded by words such as *"shall"* or *"must"*, are any specification for physical characteristics, configuration, performance, personnel or procedure, where uniform application is necessary for the safety or regularity of air navigation and to which Operators must conform. In the event of impossibility of compliance, notification to the CAAM is compulsory.

**Recommended Practices:** Usually preceded by the words such as "*should"* or "*may*", are any specification for physical characteristics, configuration, performance, personnel or procedure, where the uniform application is desirable in the interest of safety, regularity or efficiency of air navigation, and to which Operators will endeavour to conform.

**Appendices:** Material grouped separately for convenience, but forms part of the Standards and Recommended Practices stipulated by the CAAM.
**Definitions:** Terms used in the Standards and Recommended Practices which are not self-explanatory in that they do not have accepted dictionary meanings. A definition does not have an independent status but is an essential part of each Standard and Recommended Practice in which the term is used, since a change in the meaning of the term would affect the specification.

**Tables and Figures:** These add to or illustrate a Standard or Recommended Practice, and which are referred to therein, form part of the associated Standard or Recommended Practice and have the same status.

**Notes:** Included in the text, where appropriate, Notes give factual information or references bearing on the Standards or Recommended Practices in question but not constituting part of the Standards or Recommended Practices;

**Attachments:** Material supplementary to the Standards and Recommended Practices or included as a guide to their application.

It is to be noted that some Standards in this Civil Aviation Guidance Material incorporates, by reference, other specifications having the status of Recommended Practices. In such cases, the text of the Recommended Practice becomes part of the Standard.

The units of measurement used in this document are in accordance with the International System of Units (SI) as specified in CAD 5. Where CAD 5 permits the use of non-SI alternative units, these are shown in parentheses following the basic units. Where two sets of units are quoted it must not be assumed that the pairs of values are equal and interchangeable. It may, however, be inferred that an equivalent level of safety is achieved when either set of units is used exclusively.

Any reference to a portion of this document, which is identified by a number and/or title, includes all subdivisions of that portion.

Throughout this Civil Aviation Guidance Material, the use of the male gender should be understood to include male and female persons

# Record of Revisions

Revisions to this CAGM shall be made by authorised personnel only. After inserting the revision, enter the required data in the revision sheet below. The *'Initials'* has to be signed off by the personnel responsible for the change.

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## Table of Contents

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# 1 General

## 1.1 Purpose

1.1.1 This CAGM provides guidance and information to demonstrate compliance with the requirements pertaining to design of modifications.

## 1.2 Terms

1.2.1 The term ‘modification’ or ‘changes to the type certificate’ or ‘changes to the type design’ is consistently and interchangeably used in CAD 8104 and CAD 8105, as well as in the related CAGMs. This term does not refer to changing the document that reflects the type certificate (TC) but to the elements of the TC as defined in paragraph 14 of CAD 8102. It means that the processes for the approval of changes, as described in the said two CADs, do not only apply to changes to the type design, but may also apply to changes to:

a) the operating limitations;

b) the type certificate data sheet (TCDS) for airworthiness and emissions;

c) the applicable type certification basis and environmental protection requirements with which the applicant has to demonstrate compliance;

d) any other conditions or limitations prescribed for the product by CAAM;

e) the applicable operational suitability data (OSD) certification basis;

f) the OSD; and

g) the TCDS for noise.

*Note. – OSD is only applicable to aircraft TCs and not to engine or propeller TCs. Therefore, changes to OSD are only relevant for changes to aircraft TCs.*

1.2.2 When any amendment to a TC or TCDS document is requested, the amendment may be made via the appropriate ‘modification’ approval as prescribed in CAD 8104 and this CAGM.

## 1.3 Abbreviations

| | | |
|---|---|---|
| EASA | = | European Union Aviation Safety Agency |
| DOA | = | Design Organisation Approval |
| NAA | = | National Aviation Authority |
| OSD | = | Operational Suitability Data |
| STC | = | Supplemental Type Certificate |
| TC | = | Type Certificate |

TCDS = Type Certificate Data Sheet

## 1.4 References

1.4.1 The following references to external publications are made in this CAGM:

a) Appendix A to GM 21.A.91 of EASA Part-21

b) EASA CS-MMEL

c) EASA CS-FCD

d) EASA CS-CCD

e) Appendix A to GM 21.A.91 EASA Part-21

f) AMC 21.A.15(b) of EASA Part-21

g) Appendix A to AMC 21.A.15(b) of EASA Part-21

h) AMC 21.A.20(c) of EASA Part-21

i) GM 21.A.20(d) of EASA Part-21

j) GM 21.A.20 of EASA Part-21

k) GM 21.A.21(b) of EASA Part-21

l) GM 21.A.101 of EASA Part-21

# 2 Classification of Modifications (CAD 8104 3)

## 2.1 CAD 8104 3.2 – Introduction

2.1.1 The term 'appreciable effect' affecting the airworthiness of the product or affecting any of the other characteristics mentioned in CAD 8104 paragraph 3.2, where 'airworthiness' is interpreted in the context of a product in conformity with type design and in condition for safe operation. It provides complementary guidelines to assess a modification in order to fulfil the requirements of CAD 8104 paragraph 3 and CAD 8105 paragraph 7 where classification is the first step of a procedure.

*Note. – For classification of Repairs see CAGM 8106.*

2.1.2 Although this CAGM provides guidance on the classification of major modifications, as opposed to minor modifications as defined in CAD 8104 paragraph 3, this CAGM and CAD 8104 paragraph 3 are deemed entirely compatible.

## 2.2 CAD 8104 3.3 – Purpose of Classification

2.2.1 Classification of modification into MAJOR or MINOR is to determine the approval route to be followed, i.e., either paragraph 6 or paragraph 7 of CAD 8104, or alternatively whether application and approval has to be made in accordance with CAD 8105.

## 2.3 CAD 8104 3.3 – Assessment of a Modification for Classification

2.3.1 Modification / Changes to the TC

CAD 8104 paragraph 3 addresses all modifications / changes to any of the aspects of a TC. This includes changes to a type design, as defined in CAD 8102 paragraph 15, as well as to the other constituents of a TC, as defined in CAD 8102 paragraph 14.

2.3.2 Classification process

The flow chart 'Classification process' in Appendix A to GM 21.A.91 of EASA Part-21 dated March 2021 or later published revisions may be acceptable to be referred to for the classification process.

CAD 8104 paragraph 3 requires all modifications / changes to be classified as either major or minor, using the criteria of CAD 8104 paragraph 3.

Wherever there is doubt as to the classification of a modification, CAAM should be consulted for clarification.

A simple design change planned to be mandated by an airworthiness directive may be considered for reclassification as minor due to the involvement of CAAM

in the continued airworthiness process when this is agreed between CAAM and the design organisation approval (DOA) holder.

The reasons for a classification decision should be recorded.

2.3.3 Complementary guidance for classification of modifications

A modification / change to the TC is judged to have an 'appreciable effect on the mass, balance, structural strength, reliability, operational characteristics, noise, fuel venting, exhaust emission, operational suitability or other characteristics affecting the airworthiness, environmental protection or operational suitability of the product' and, therefore, should be classified as major, in particular but not only, when one or more of the following conditions are met:

a) where the change requires an adjustment of the type certification basis or the OSD certification basis (special conditions or equivalent safety findings) other than elect to comply with later airworthiness codes;

b) where the applicant proposes a new interpretation of the airworthiness codes used for the type certification basis or the OSD certification basis that has not been published in CAAM guidance material or otherwise agreed with CAAM;

c) where the demonstration of compliance uses methods that have not been previously accepted as appropriate for the nature of the change;

d) where the extent of new substantiation data necessary to comply with the applicable airworthiness codes and the degree to which the original substantiation data has to be re-assessed and re-evaluated is considerable;

e) where the change alters the airworthiness limitations or the operating limitations;

f) where the change is made mandatory by an airworthiness directive or the change is the terminating action of an airworthiness directive (ref. paragraph 3 of CAD 8101), see Note 1; and

g) where the design change introduces or affects functions where the failure effect is classified as catastrophic or hazardous.

*Note 1. – A change previously classified as minor and approved prior to the airworthiness directive issuance decision needs no reclassification. However, CAAM retains the right to review the change and reclassify / reapprove it if found necessary.*

*Note 2. – The conditions listed in (a) through (g) above are an explanation of the criteria noted in CAD 8104 paragraph 3.*

For an understanding of how to apply the above conditions, it is useful to take note of the examples given in Appendix A to GM 21.A.91 of EASA Part-21 dated March 2021 or later published revisions.

2.3.4 Additional notes and examples for classification of modifications

The effect of a major modification is usually confined to a single area, system or component of an aircraft, engine or propeller. Some examples of modifications that are generally regarded as major modifications are:

a) in the case of aircraft, the modification includes general avionics upgrade, relocation of galley, installation of non-essential auxiliary power unit, substitution of one structural bonding method for another, installation of wheel skis, installation of quieter exhaust system, increase in fuel tank capacity, installation of new type passenger seats, or mass increase of less than five per cent;

b) in the case of an aircraft engine, the modification includes change in oil tank design, fan blade re-design, software changes, bearing change, change in limits on exhaust gas temperature, changes to the engine by replacing aircraft engine structural parts with parts not supplied by the original manufacturer or parts not specifically approved by CAAM, change from one hydro-mechanical control to another hydro-mechanical control, change in crankshaft, redesigned cylinder head, valves or pistons or conversions of any sort for the purpose of using fuel of a rating or grade other than that listed; and

c) in the case of propellers, the modification includes changes in blade design, changes in hub design or changes to a component in the control system.

A minor modification is a design change that has a negligible, or no appreciable, effect on the noise, balance, structural strength, reliability, operational characteristics or other characteristics affecting the airworthiness of the aeronautical product or its environmental characteristics. The accomplishment of minor modifications normally involves use of standard or generally accepted practices.

2.3.5 Complementary guidance on the classification of changes to OSD

This paragraph provides firstly general guidance on minor OSD change classification, and secondly additional guidance specific to each OSD constituent.

Changes to OSD are considered minor when they:

a) incorporate optional information (representing improvements / enhancements);

b) provide clarifications, interpretations, definitions or advisory text; or

c) do not change the intent of the OSD document, e.g. changes to:

d) titles, numbering, formatting, applicability;

e) order, sequence, pagination; or

f) sketches, figures, units of measurement, and correction of editorial mistakes such as:

g) spelling; or

h) reference numbers.

Given the structure and individual intent of the separate OSD constituents, the interpretation of 'appreciable' is also affected by the specific nature of the applicable airworthiness codes for that constituent. Therefore, specific guidance on each of the OSD constituents is provided hereafter.

i) Master minimum equipment list (MMEL)

1. A change to the MMEL is judged to have an 'appreciable effect on the operational suitability of the aircraft' and, therefore, should be classified as major, in particular but not only when one or more of the following conditions are met:

   i) where the change requires an adjustment of the OSD certification basis;

   ii) where the applicant proposes changes to the means of compliance with the requirements used for the OSD certification basis (i.e. MMEL safety methodology);

   iii) where the extent of substantiation data and the degree to which the substantiation data has to be assessed and evaluated is considerable, in particular but not only when:

      A. the substantiation data involving the review of failure conditions that are classified as hazardous or catastrophic has to be evaluated;

      B. the assessment of the failure effects (including next worst failure / event effects) on crew workload and the applicable crew procedures has to be evaluated; or

      C. the capability of the aircraft to perform types of operation (e.g. extended-range twin operations (ETOPS), instrument flight rules (IFR)) under MMEL is extended.

2. A change to the MMEL is judged not to have an 'appreciable effect on the operational suitability of the aircraft' and, therefore, should be classified as minor, in particular but not only when one or more of the following conditions are met:

   <u>Modifications to an existing item when:</u>

      A. the change only corresponds to the applicability of an item for configuration management purposes;

      B. the change corresponds to the removal of an item;

C. the change corresponds to the increase in the number of items required for dispatch; and

D. the change corresponds to a reduction in the rectification interval of an item.

Addition of a new item when:

A. it is considered as non-safety-related (refer to EASA CS-MMEL, EASA GM2 MMEL.110); or

B. it is indicated as eligible for minor change classification in Appendix 1 to EASA CS-MMEL GM1 MMEL.145.

j) Flight crew data (FCD)

1. FCD change related to change to the type design

When classifying the FCD change as minor or major, the method of EASA CS-FCD, Subpart D should be used.

i) An analysis should be performed to assess the change impact on the FCD through the allocation of difference levels realised with operator difference requirement (ODR) tables as per EASA CS FCD.400. In this case, the base aircraft is the aircraft without the type design change, whereas the candidate aircraft is the aircraft which includes the type design change.

A. If a no more than level B difference is assigned for training, checking and currency for the candidate aircraft, the related FCD change should be classified as minor.

B. If a difference level C, D or E for training, checking and currency is assigned to the candidate aircraft, the related FCD change should be classified as major.

ii) Notwithstanding the above, the change to FCD should be classified as major when a T1 or T2 test is found necessary by the applicant to confirm that the aircraft with the type design change is not a new type for pilot type rating.

2. Stand-alone changes to FCD are not related to any type design changes. They may be triggered for example by in-service experience or by the introduction of data at the request of the applicant after type certification.

i) Introduction of credits in training, checking or currency should be classified as major. Example: addition of further-differences training, common take-off and landing credits, etc.

ii) Stand-alone changes to FCD that correspond to a change of the intent of a data should be classified as major. Example: addition of a training area of special emphasis (TASE) or prerequisite, expansion of a TASE. (c) Cabin crew data (CCD)

k) Cabin crew data (CCD)

1. OSD change related to change to the type design

When classifying the OSD CCD change as minor or major, the method from EASA CS-CCD, Subpart B should be used.

i) An analysis should be performed to assess the change impact on the OSD CCD through the identification of the difference and its impact on operation in the aircraft difference table (ADT) as per EASA CS CCD.200. In this case, the base aircraft is the aircraft without the type design change, whereas the candidate aircraft is the aircraft which includes the type design change.

A. If the difference has no impact on the operation of an element of the ADT for the candidate aircraft, the related OSD CCD change should be classified as minor.

B. If the difference has an impact on the operation of an element of the ADT for the candidate aircraft, the related OSD CCD change should be classified as major.

ii) Notwithstanding the above, the change to OSD CCD should be classified as major when an ADT analysis is found necessary by the applicant to confirm that the aircraft with the type design change is not a new type for cabin crew.

2. Stand-alone changes to OSD CCD are not related to any type design changes. They may be triggered for example by in-service experience or by the introduction of data at the request of the applicant after type certification.

i) Stand-alone changes to cabin aspects of special emphasis (CASE) should be classified as major. Example: addition of further CASE, expansion of CASE.

ii) When classifying stand-alone changes to type-specific data for cabin crew the method from EASA CS-CCD, Subpart B should be used. An analysis should be performed to assess the change impact on the type-specific data through the identification of the difference and its impact on operation in the ADT as per EASA CS CCD.200.

A. If the change does not concern a determination element of EASA CS CCD.205, the stand-alone change should be classified as minor.

B. If the change has no impact on the operation of an element of the ADT, the stand-alone change should be classified as minor.

C. If the change has an impact on the operation of an element of the ADT, the stand-alone change should be classified as major.

l) Simulator data (SIMD)

The OSD constituent 'simulator data' does not include the data package that is necessary to build the simulator. It includes only the definition of the scope of validation source data to support the objective qualification of a simulator. So, when this guidance discusses changes to 'simulator data', this concerns only changes to the 'definition of scope of validation source data' and not changes to the data package.

1. A change to the SIMD should be classified as major, in particular but not only when one or more of the following conditions are met:

   i) when a change to the SIMD introduces validation source data from an engineering platform where the process to derive such data has not been audited by CAAM in the initial SIMD approval; or

   ii) when the process to derive validation source data from an engineering platform is changed.

2. A change to the SIMD could be classified as minor, in particular but not only when one or more of the following conditions are met:

   i) changes to engineering validation data independent of the aircraft due to improvements or corrections in simulation modelling (e.g. aerodynamics, propulsion);

   ii) configuration changes to the aircraft where the process to derive validation source data from an engineering platform is unchanged;

   iii) changes to validation source data by using better, more applicable flight test data; or

   iv) editorial changes to the validation data roadmap (VDR).

m) Maintenance certifying staff data (MCSD)

*(RESERVED)*

2.3.6 Complementary guidance for the classification of changes to aircraft flight manuals (AFMs)

The following changes to the AFM are deemed to be minor; other changes should be considered as major:

a) revisions to the AFM associated with changes to the type design / modification that are classified as minor in accordance with CAD 8104 paragraph 3;

b) revisions to the AFM that are not associated with changes to the type design / modifications (also identified as stand-alone revisions) which fall into one of the following categories:

   1. changes to limitations or procedures that remain within already certified limits (e.g. weight, structural data, noise, etc.);

2. consolidation of two or more previously approved and compatible AFMs into one, or the compilation of different parts taken from previously approved and compatible AFMs that are directly applicable to the individual aircraft (customisation); and

3. the introduction into a given AFM of compatible and previously approved AFM amendments, revisions, appendices or supplements; and (c) administrative revisions to the AFM, defined as follows:

c) administrative revisions to the AFM, defined as follows:

1. for the AFMs issued by the TC holder:

i) editorial revisions or corrections to the AFM;

ii) changes to parts of the AFM that do not require approval by CAAM;

iii) conversions of previously CAAM-approved combinations of units of measurement added to the AFM in a previously approved manner;

iv) the addition of aircraft serial numbers to an existing AFM where the aircraft configuration, as related to the AFM, is identical to the configuration of aircraft already covered by that AFM; and

v) the removal of references to aircraft serial numbers no longer applicable to that AFM,

2. for AFM supplements issued by STC holders:

i) editorial revisions or corrections to the AFM supplement;

ii) changes to parts of the AFM supplement that are not required to be approved by CAAM;

iii) conversions of previously CAAM-approved combinations of units of measurement added to the AFM supplement in a previously approved manner;

iv) the addition of aircraft serial numbers to an existing AFM supplement where the aircraft configuration, as related to the AFM supplement, is identical to that of the aircraft already in that AFM supplement; 'identical' means here that all the aircraft have to belong to the same type and model/variant;

v) the addition of a new STC to an existing AFM supplement, when this supplement is fully applicable to the new STC; and

vi) the removal of references to aircraft serial numbers that are no longer applicable to that AFM supplement.

2.3.7 Complementary guidance for classification of changes to environmental protection characteristics may be acceptable to be referred to Section 8 of Appendix A to GM 21.A.91 EASA Part-21 dated March 2021 or later published revisions.

2.3.8 An applicant seeking foreign National Aviation Authority (NAA) approval of its modification design, which has received prior CAAM or a Malaysian DOA approval, should coordinate its request with CAAM during consultation with the foreign NAA to clarify potential differences in the modification classification / category, and consequently their approval requirements.

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# 3 Application (CAD 8104 5)

## 3.1 CAD 8104 5.1 – Form and Manner

3.1.1 The applicant should file an application using the application forms for the approval of design of major modification and design of major repair (CAAM/AW/8104-02) or for the approval of design of minor modification and design of minor repair (CAAM/AW/8104-03), which may be downloaded from CAAM website, together with prescribed fees in Civil Aviation (Fees and Charges) Regulations 2016.

3.1.2 The forms should be completed in accordance with the instructions embedded at the bottom of the application forms, and sent to CAAM by in-person or regular mail. During certain special circumstances (e.g. travel restriction order, urgent cases, etc.) the form can be submitted to CAAM Head of Initial Airworthiness Section via e-mail. However, the physical copy of the form should be submitted as soon as possible.

3.1.3 In conjunction with the form required in CAD 8104 paragraph 5.1, the applicant should provide to CAAM relevant information pertaining to the proposed design of modifications. Information on the proposed modification should include, at a minimum, the following:

a) the name and address of the applicant to which the approval will be issued;

b) the make and model of the affected aeronautical product (registration and/or serial number) and its type certificate number (or approval reference);

c) the title, detailed description, and purpose of the proposed modification, including any changes affecting the noise and emissions level of the aircraft or engine;

d) the type of approval requested (i.e. amendment / change of a type certificate, supplemental type certificate or approval for design of major modification or approval for design of minor modification);

e) the proposed airworthiness standards, including environmental standards if applicable, to which the proposed modification is designed and with which it is intended to comply;

f) documentation and/or substantiating data of the design change;

g) for a local applicant, an indication on the need for a concurrent or subsequent approval by another NAA (if applicable); and

h) for a foreign applicant (approval of design of minor modification to Malaysian aircraft only), evidence of prior approval by the NAA of the State that has jurisdiction over the individual or organization responsible for the modification.

The information above may be combined with the certification programme required in CAD 8104 paragraph 5.2 appropriately. Please refer paragraph 3.3 of this CAGM for guidance in producing the certification programme.

3.1.4 For a foreign applicant of design of minor modification who wishes to incorporate its modification approval on Malaysian aircraft, evidence of prior approval by the NAA of the State that has jurisdiction over the individual or organization responsible for the modification is required, and the application should be submitted through the NAA.

3.1.5 The applicant should identify and describe the proposed modification to the aeronautical product with details.

3.1.6 The application for approval could involve a single modification or a collection of modifications.

3.1.7 Changes to an aeronautical product can include physical design changes, changes to an operating envelope, and/or performance changes.

3.1.8 An applicant for design of modification should consider all previously installed modifications or repairs including any Airworthiness Directives (AD) to the affected aeronautical product that are relevant to the proposed modification. It is important that the effects of the proposed modification on other systems, components, equipment or appliances of the affected aeronautical product be properly identified. The intent is to encompass all aspects where there is a need for re-evaluation, that is, where the substantiation presented for the aeronautical product being modified should be reviewed, updated or rewritten.

*Note.– Alternative Method of Compliance (AMOC) by State of Design maybe required to continue compliance to an AD should the modification affect an AD.*

## 3.2 CAD 8104 5.1 – Documents Necessary for Operation of a Modified Aircraft

3.2.1 If the proposed modification changes any of the information necessary for the safe operation of the aircraft which were developed concurrently with type certification of the aeronautical product, the applicant should prepare the appropriate revision to this information and submit it to CAAM for approval or acceptance. Following approval or acceptance by CAAM, the revised information should be distributed to all known operators which embodies the modification, or published in a form and manner prescribed by CAAM and subsequently provided as part of the modification approval documentation.

## 3.3 CAD 8104 5.2 – Certification Programme for A Modification / Change to A TC or an STC

3.3.1 A certification programme should be submitted for the application of design of modifications containing information as specified in this paragraph.

3.3.2 For major and minor modifications:

3.3.2.1 The description of the change referred to in CAD 8104 paragraph 5.2(a) should include an explanation of the purpose of the change, the pre-modification and post-modification configuration(s) of the product, schematics / pictures, and any other detailed features and boundaries of the physical change (this may be supplemented by drawings or outlines of the design, if this helps to understand the design change), as well as the identification of the changes in areas of the product that are functionally affected by the change, and the identification of any changes to the approved manuals.

3.3.2.2 An area affected by the change is any area, system, component, part, or appliance of the aeronautical product that is physically and/or functionally changed.

3.3.2.3 Identification of reinvestigations referred to in CAD 8104 paragraph 5.2(b) necessary to demonstrate compliance (i.e. the certification compliance plan), does not mean the demonstration of compliance itself, but the list of affected items of the applicable certification basis for which a new demonstration is necessary, together with the means (e.g. calculation, test or analysis) by which it is proposed to demonstrate compliance.

3.3.2.4 The means of compliance is usually dictated by the specific item of the certification basis, and generally fall into one or any combination of the following:

a) *Test* – is performed when the requirement explicitly calls for a demonstration by test (physical, actual or simulation). Examples of test are flight test, ground test, fatigue test, simulation, fire or flammability test, environmental test (e.g. salt spray), functional test, bird strike test, and engine ingestion test;

b) *Analysis* – is performed when the requirement explicitly calls for a demonstration by analysis (qualitative, quantitative or comparative), or when the applicant can demonstrate, based on previously accepted test results, the validity of using analysis in lieu of testing. Examples of analysis are failure modes and effects analysis, flight performance data reduction and expansion, structural loads analysis, and software evaluation; and

c) *Inspection or evaluation* – is performed against an item that does not require test or analysis, but relies on observation, judgment, verification, evaluation or a statement of attestation from the applicant or its vendors/contractors.

3.3.2.5 Before submitting the application for a modification / change, the analysis and classification activities of CAD 8104 paragraph 3 and CAD 8104 paragraph 8 should be performed using the corresponding paragraphs of this CAGM. For

repair designs, the analysis of CAD 8104 paragraph 3 should be performed using guidance under CAD 8106.

3.3.3 Additional Guidance Pertaining to Certification Compliance Plan for Major and Minor Modifications

3.3.3.1 Certification Compliance Plan (CCP)

The certification compliance plan (as part of the certification programme) is the primary document in the design of modification approval process that serves both as a checklist and official record of compliance. The applicant should prepare a certification compliance plan and establish its contents with the agreement of CAAM. The certification compliance plan should, at a minimum, contain the following information:

a) itemized breakdown of the certification basis;

b) proposed means of compliance for each item (test, analysis, inspection, or combination of these, or finding of equivalent level of safety);

c) lists of tests to be conducted (e.g. ground test, flight test and fire / flammability test);

d) identification of substantiation reports to be submitted (as proof of compliance);

e) identification of persons responsible for making findings of compliance;

f) the level of involvement of CAAM or the applicant in the findings of compliance or witnessing of tests; and

g) modification project schedule, including the established milestones and when final approval is expected.

3.3.3.2 Level of Involvement

For the design of major modification, a DOA holders may be granted the authority to make a finding of compliance on behalf of CAAM. A finding of compliance by the DOA holders is a finding of compliance by CAAM. The procedure for the recording of the finding of compliance by the DOA holder must be specified in the design organisation manual. Some findings of compliance, however, may be the exclusive responsibility of CAAM and cannot be delegated, or that CAAM may limit a DOA holder into making recommendations only instead of making a finding of compliance. The exact role of the DOA holders should be clearly identified in the certification compliance plan and agreed to by CAAM. The levels of involvement of CAAM, applicant and delegates will be defined taking into account such factors as limitations of the DOA holders, complexity of the modification, availability of technical resources, and time constraints of the modification approval project.

3.3.3.3 Demonstration of Compliance

The demonstration of compliance requires that the applicant submit substantiating data (design data, reports, analysis, drawings, processes, material specifications, operations limitations, aircraft flight manuals, and ICA). The data should be complete and in a logical format for review by CAAM. Where the demonstration of compliance involves a test, a test plan should be developed and approved by CAAM prior to any actual test being performed. Official certification tests are to be witnessed by CAAM personnel or by a DOA, when authorized.

The applicant should give CAAM access to the aeronautical product being modified in order to make any inspections, test, and engineering assessment or conduct any flight or ground test that is necessary to determine compliance with the certification item. However, the applicant should perform its own inspection and test necessary to demonstrate compliance prior to presenting the modified aeronautical product to CAAM for testing or evaluation.

3.3.4 For a major modification:

3.3.4.1 AMC 21.A.15(b) of EASA Part-21 dated March 2021 or later published revisions should also be used as applicable to the modification / change.

## 3.4 CAD 8104 5.2 a) 3) – Interaction of changes to the type design and changes to operational suitability data (OSD)

3.4.1 In general, it has to be assumed that modification / changes to the type design can have an effect on the OSD.

3.4.2 Due to the alleviating nature of the OSD constituent master minimum equipment list (MMEL), the impact of design changes on the MMEL can be treated differently from the impact on other OSD constituents. Therefore, a separate paragraph 3.5 of this CAGM is available to explain the interaction between design changes and the MMEL. The following guidance is, therefore, only applicable to the other OSD constituents: flight crew data (FCD), cabin crew data (CCD), simulator data (SIMD), and maintenance certifying staff data (MCSD).

3.4.3 In assessing the interactions between the changes to the type design and to the OSD, the following can be taken into consideration (see Figure 1):

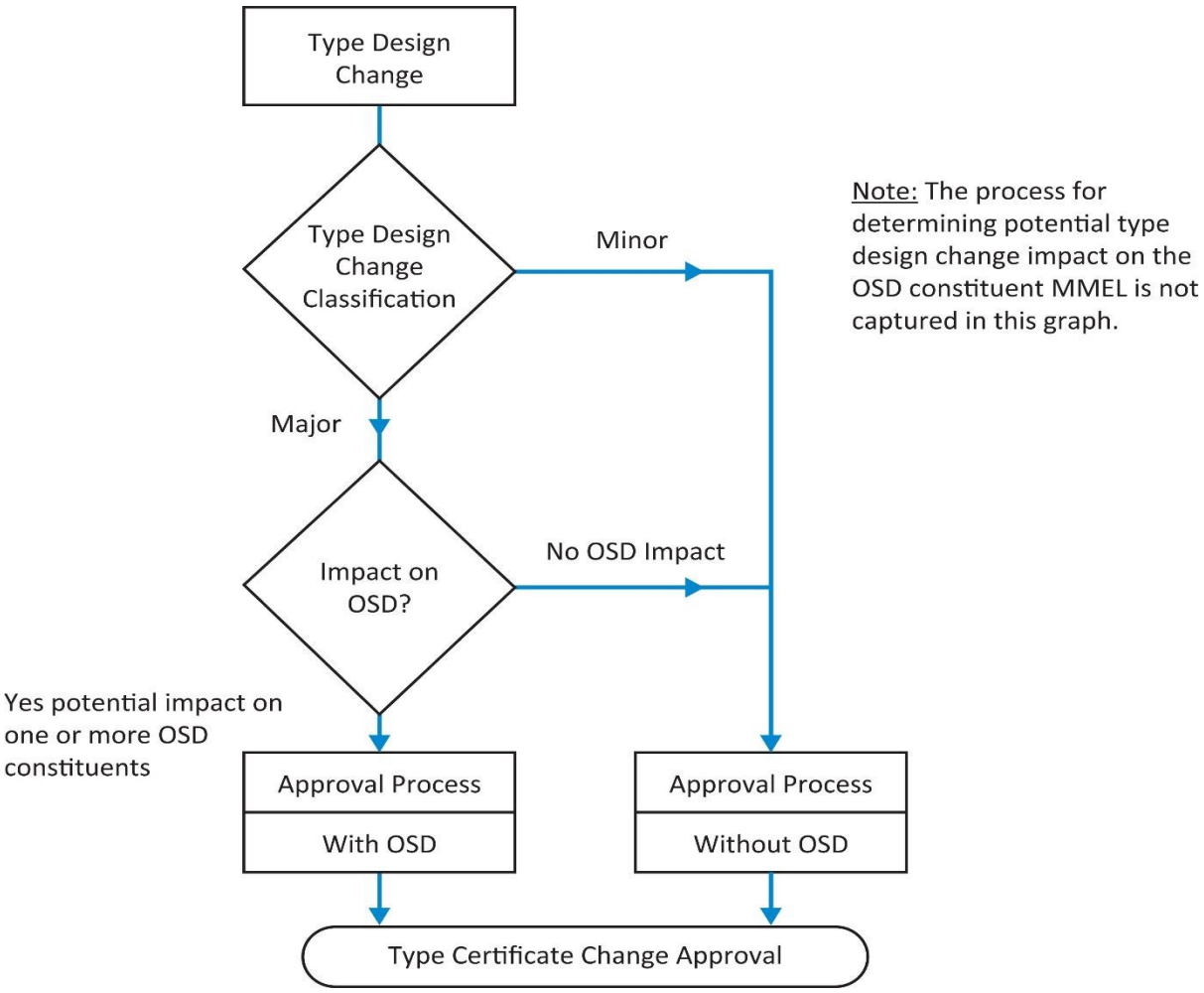


***Figure 1: Interactions between the changes to the type design and to the OSD***

3.4.4 Changes to the type certificate (TC) that only include a minor change to the type design ('stand-alone' type design changes) do not have an effect on the OSD. No dedicated assessment of the effects of the minor type design change on the OSD is needed in this case.

3.4.5 TC changes that only include a major type design change do not need to be assessed for their effect on the OSD in case the experience of the applicant has demonstrated that similar changes do not have an effect on the OSD. Examples of major type design changes and their expected effect on OSD constituents are identified in Table 1 below.

| Discipline | Example of major type design change | Expected impact on OSD constituent | | | |
|---|---|---|---|---|---|
| | | FCD | SIMD | CCD | MCSD |
| Structure | (i) Changes such as a cargo door cut-out, fuselage plugs, change to dihedral, addition of floats. | No | No | No | tbd[1] |
| | (ii) Changes to material, processes or methods of manufacture, or to primary structural elements such as spars, frames and critical parts. | No | No | No | tbd |
| | (iii) Changes that adversely affect fatigue or damage tolerance or life limit characteristics. | No | No | No | tbd |
| | (iv) Changes that adversely affect aeroelastic characteristics. | No | No | No | tbd |
| | (v) Aircraft weight changes such as maximum zero fuel weight (MZFW) changes or reduction in maximum take-off weight (MTOW) for operational considerations. | No | No | No | No |
| Cabin safety | (i) Changes which introduce a new cabin layout of a sufficient extent to require a reassessment of the emergency evacuation capability, or which adversely affect other aspects of passenger or crew safety in aeroplanes with more than 19 passenger seats. | No | No | Yes, potential impact | No |
| | (ii) Changes which introduce new cabin layout of a sufficient extent to require a reassessment of the emergency evaluation capability, or which adversely affect other aspects of passenger or crew safety in aeroplanes with 19 or less passenger seats. | No | No | No (unless assessment identifies need for CCD | No |
| | (iii) Installation of observer seat. | No | No | Yes, potential impact | No |
| Flight | (i) Software changes that do not affect the pilot interface. | No | No | No | No |
| | (ii) Software changes that affect the pilot interface. | Yes, potential impact | No | No | No |
| Systems | (i) Updating the aircraft cockpit voice recorder (CVR) or flight data recorder (FDR) to meet a later standard. | No | No | No | No |

[1] To consult CAAM

| | | | | | |
|---|---|---|---|---|---|
| Propellers | (i) Changes to:<br>— diameter, aerofoil, planform, material, and blade retention system. | No | No | No | No |
| Engines | (i) Power limit change | No | No | No | No |
| Rotors and drive systems | *[Reserved]* | | | | |
| Environment | (i) A change that introduces either an increase in the noise certification level(s) or a reduction in the noise certification level(s) for which the applicant wishes to take credit. | No | No | No | No |
| Power plant installation | (i) Modifications to the fuel system and tanks (number, size, or configuration) | No | No | No | tbd |
| Avionics | Comprehensive flight deck upgrade, such as conversion from entirely federated, independent electromechanical flight instruments to highly-integrated and combined electronic display systems with extensive use of software and/or complex electronic hardware | Yes, potential impact | No | No | tbd |

***Table 1: Examples of major type design changes and their expected impact on OSD Constituents***

## 3.5 CAD 8104 5.2 a) 3) – Interaction of changes to the type design and changes to the master minimum equipment list (MMEL)

3.5.1 In general, it has to be assumed that changes to the type certificate (TC) that affect the type design can have an effect on the MMEL.

3.5.2 Due to its alleviating nature, the MMEL is developed to improve aircraft use, thereby providing a more convenient and economical air transportation for the public.

3.5.3 Therefore, not introducing MMEL relief for new equipment, system or function has no effect on the safety of the operation. The introduction of MMEL relief for new equipment can, therefore, be treated as a stand-alone MMEL change, separately from the design change, and can be processed at a later date than the date of entry into service of the aircraft including the design change.

3.5.4 Not modifying an MMEL item whose validity is altered by a type design modification may, however, have an effect on the safety of the operation. The applicant for a change to the TC that changes the type design should, therefore, identify whether this change needs to be supplemented by a change to the MMEL. However, the update of an MMEL relief for an already addressed equipment, system or function can be treated at a later date than the date of entry into service of the aircraft including the design change, provided that the change to the MMEL is of an alleviating nature. When the change to the MMEL is not of an alleviating nature, it has to be approved according to paragraph 7.3 b) and paragraph 7.4 of CAD 8104.

3.5.5 It may be assumed that a change to the type design requires a change to the MMEL if any of the following conditions are fulfilled:

a) the change affects an existing MMEL item in a more restrictive manner: there is a change to equipment, system or function linked to an MMEL item, or a change to the operational limitations and procedures linked to an MMEL item;

b) the change invalidates the assumptions used to justify an existing MMEL item, and requires a more restrictive MMEL item; and

c) the change invalidates any dispatch conditions of the MMEL.

3.5.6 Examples of the above three conditions, where no change to the MMEL is required:

a) introduction of new equipment, system or function in the type design;

b) the change has no adverse impact on the qualitative and quantitative assessment used to justify an MMEL item; and

c) the dispatch conditions do not need to be more restrictive if the current intent of (o) or (m) procedures (as referred in EASA CS MMEL.125) is not impacted.

3.5.7 The following diagram summarises the interaction between type design changes and changes to MMEL (see Figure 2).

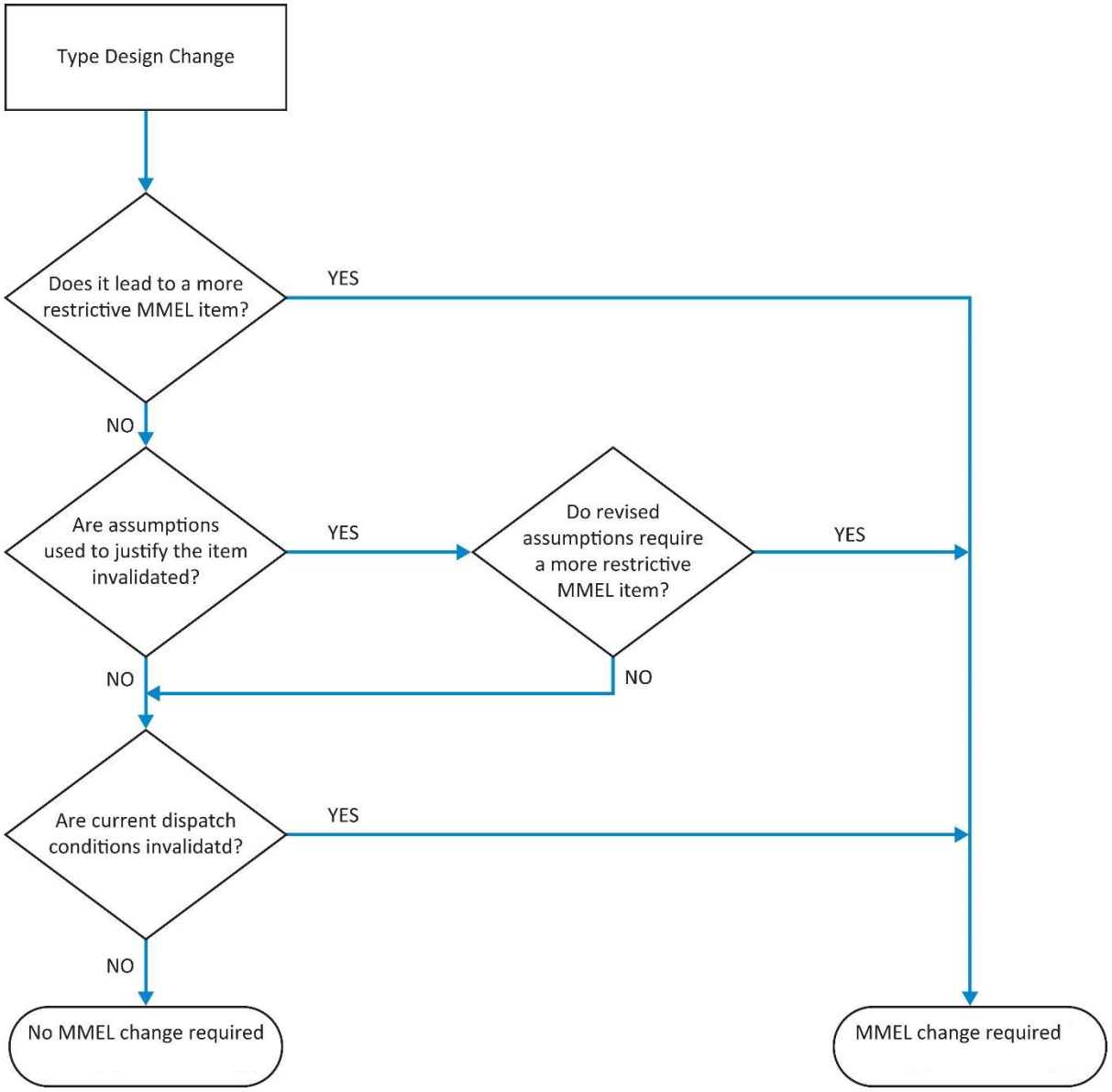


***Figure 2 : Interaction between type design changes and changes to MMEL***

## 3.6 CAD 8104 5.1 – Statement of Compliance

3.6.1 For each major or minor modifications which requires CAAM approval, upon accomplishment of the project, the applicant should fill and submit Statement of Compliance – STC / Modifications / Repairs Form No. CAAM/AW/8104-04 (SOC form) which can be obtained from CAAM website.

3.6.2 The SOC form must list the following as applicable:

a) the certification programme / certification compliance plan;

b) the documentation and/or substantiating data of the design change;

c) the instructions for the embodiment / installation of the change (e.g. service bulletin, modification bulletin, production work order, etc.)

d) documents necessary for operation of a modified aircraft;

e) compliance test reports; and

f) any other documents required by CAAM.

3.6.3 The SOC form should be signed by the applicant (or the authorized person on behalf of the organization) to which the approval will be issued.

## 3.7 CAD 8104 5.1, CAD 8105 4.1 – Issuance of Approval

3.7.1 In line with CAD 8104 and CAD 8105, approval of a design of major modification is issued using one of the three forms of approval below, provided the proposed modification is not so extensive as to require a new type certificate:

a) *Change to / amendment of a type certificate*. The holder of a type certificate can make an application to amend a type certificate in accordance with CAD 8104. The holder retains the overall responsibility for the type design of an aircraft, engine or propeller. Common examples of design changes leading to an amendment of a type certificate may be the addition of a new model designation or derivative of an aircraft, engine or propeller, the revision of operating conditions or limitations listed in the type certificate data sheet, or changes to aircraft passenger or cabin configuration;

b) *Supplemental type certificate (STC)*. An STC is an approval of a major modification for non-type certificate holder covering those areas or aspects of an aeronautical product that were modified. It should be noted that an aeronautical product that does not have a type certificate cannot be issued a modification approval under an STC (e.g. appliances, parts, components, instruments). Further, an STC should not be issued for approval of minor modifications, or approval of replacement parts or repair, unless its installation represents a modification; and

c) *Approval of design of major modification*. The holder of a type certificate can make an application for approval of design of major modification in

accordance with CAD 8104. Modifications that are candidates for this approval category typically involve on demand design changes by air operators, maintenance and/or design organizations, and manufacturers to support varying maintenance and operational needs under time constraints. Examples of modifications that can be approved under this category are: product improvements by manufacturers (introduced through Service Bulletins), airline type modifications relating to operational reliability or passenger configuration changes, repair design, field-type modifications that do not involve extensive or multidiscipline engineering analysis.

3.7.2 For approval of a design of minor modification, the approval is issued in form of *Approval of design of minor modification* which may be issued to a type certificate or non-type certificate holder.

3.7.3 The person or organization (holder) to which the modification approval was granted has responsibility for the approved design change. If multiple participants (e.g. joint design ventures, partnerships, sub-contracting or similar arrangements) are involved in the modification, CAAM will require one person or organization to be responsible for the overall design change, and to whom the approval will be issued.

3.7.4 An approval granted for a design of modification should remain valid until otherwise specified or notified by CAAM.

# 4 Requirements for Approval of Design of a Minor Modification (CAD 8104 6)

## 4.1 CAD 8104 6 – Applicability

4.1.1 Paragraph 6 of CAD 8104 has to be complied with by applicants for the approval of a minor modification / change to a type certificate (TC), and by design organisation approval (DOA) holders that approve minor changes under their own privileges.

4.1.2 Paragraph 6.4 of CAD 8104, however, only applies to projects for which an application is submitted to CAAM. For DOA holders that approve modifications / minor changes under their privileges, the substantiating data and the statement of compliance required by paragraph 6.4 of CAD 8104 should be produced but do not need to be submitted to CAAM. They should be, however, kept on record and submitted to CAAM upon request during its DOA continued surveillance process.

## 4.2 CAD 8104 6 – The approval process

4.2.1 The approval process comprises the following steps:

*Note. – Steps a), b) and e) should be followed only by applicants for minor changes approved by CAAM. DOA holders that approve minor changes under their privileges should refer to guidance under CAD 8401 as applicable to their approval process.*

a) Application

When the minor modification / change is to be approved by CAAM, an application should be submitted to CAAM as described in paragraph 5.1 and paragraph 5.2 of CAD 8104, and in paragraph 3.1 of this CAGM.

b) Certification programme

The certification programme should consist of the information defined in paragraphs 5.2 a) and b) of CAD 8104. Please refer to paragraph 3.3 of this CAGM for further information.

c) Certification basis (see paragraph 4.3 below)

d) Demonstration of compliance (see paragraph 4.4 below)

e) Statement of compliance

The applicant shall submit to CAAM the substantiation data for the modification and a statement that compliance has been demonstrated in accordance with paragraph 6.2 of CAD 8104. The Statement of Compliance – STC / Modifications / Repairs Form No. CAAM/AW/8104-04 (SOC form) should be submitted.

## 4.3 CAD 8104 6.2 – Certification basis

4.3.1 The certification basis for a minor modification / change consists of a subset of the elements of the product's certification basis 'incorporated by reference in the type certificate' (see also the additional guidance below on the meaning of airworthiness codes that became applicable after those 'incorporated by reference in the type certificate'), which have been identified in accordance with paragraph 5.2 b) of CAD 8104 due to a reinvestigation of compliance being necessary because compliance was affected by the minor change (see also additional guidance below on the meaning of 'specific configurations').

4.3.2 The certification basis 'incorporated by reference in the type certificate' is the certification basis for the product as recorded in the type certificate data sheet (TCDS) for the product type / model in the configuration(s) identified in accordance with paragraph 5.2 a) 1) of CAD 8104.

4.3.3 The certification basis contains the applicable airworthiness and (for aircraft only) operational suitability data airworthiness codes (e.g. EASA CS-OSD), environmental protection requirements specified by reference to their amendment level, as complemented by special conditions, equivalent safety findings, deviations, an 'elect to comply', etc., as applicable. See also the additional guidance below on the meaning of 'Minor changes affecting OSD constituents'.

4.3.4 By derogation from the above, airworthiness codes that became applicable after those incorporated by reference in the TC may be used for the approval of a minor change (see the guidance below on airworthiness codes that became applicable after those 'incorporated by reference in the type certificate').

4.3.5 If other changes are required for the embodiment of the minor change, the certification basis corresponding to the product modified by these other changes should also be considered when determining the certification basis for the minor change.

## 4.4 CAD 8104 6.2 a) and b) – Demonstration of compliance

4.4.1 The applicant needs to demonstrate compliance with the certification basis established for the minor change for all areas that are either physically changed or functionally affected by the minor change.

a) Means of compliance: the applicant should define and record the means (calculation, test or analysis, etc.) by which compliance is demonstrated. Appendix A to EASA AMC 21.A.15(b) of EASA Part-21 dated March 2021 or later published revisions may be used to describe how compliance is demonstrated.

b) Compliance documents: the compliance demonstration should be recorded in compliance documents. For minor changes, one comprehensive compliance document may be sufficient, provided that it contains evidence of all aspects

of the compliance demonstration. AMC 21.A.20(c) of EASA Part-21 dated March 2021 or later published revisions can also be used, where applicable.

*Note.– See also the additional guidance paragraph 4.5.*

c) Aircraft manuals: where applicable, supplements to manuals (e.g. aircraft flight manual (AFM), aircraft maintenance manual (AMM), etc.) may be issued.

*Note.– See also additional guidance below on embodiment / installation instructions (paragraph 4.6).*

## 4.5 CAD 8104 6.2 a) – Definition of the change to the type certificate

4.5.1 The change to the type certificate should be defined in accordance with paragraph 1.2 of this CAGM.

## 4.6 CAD 8104 6.4 – Embodiment / installation instructions

4.6.1 The instructions for the embodiment/installation of the change (e.g. service bulletin, modification bulletin, production work order, etc.) should be defined. This may include the installation procedure, the required material, etc.

## 4.7 CAD 8104 6.2 b) – Minor changes affecting OSD constituents (i.e. master minimum equipment list (MMEL))

4.7.1 Some minor changes to the type design may only have an effect on the MMEL (see paragraph 3.4 of this CAGM). In such cases, paragraph 3.5 of this CAGM is also applicable. This also means that a dedicated assessment of the effects of the minor type design change on the other OSD constituents is not needed.

## 4.8 CAD 8104 6.5 – Meaning of 'specific configurations'

4.8.1 These 'specific configurations' are defined as the combination of the product type / model (on which the minor change will be installed) with (if applicable) the list of those already approved changes (minor, major, supplemental type certificate (STC)) that are required for the installation of the minor change.

## 4.9 CAD 8104 6.3 – Airworthiness codes that became applicable after those incorporated by reference in the type certificate

4.9.1 Minor modifications / changes are those changes that do not affect the airworthiness of the product and thus are, by definition, non-significant as per CAD 8104 paragraph 8. This means that the certification basis for the minor change may consist of the items of the certification basis incorporated by reference in the TCDS of the product type/model, and normally it should not be necessary for a minor change to use airworthiness codes that became applicable after those that are incorporated by reference in the type certificate.

4.9.2 On the other hand, the applicant may elect to use later amendments of the affected airworthiness codes for the compliance demonstration. This does not affect the classification of the change; however, the applicant should also comply with any other airworthiness codes that CAAM considers to be directly related.

4.9.3 If other changes are required for the installation of the minor change (as explained in 'specific configurations'), the certification basis for the minor change should also take into account the corresponding certification basis.

## 4.10 CAD 8104 6.2 d) – Meaning of 'no feature or characteristics'

*Note.– See GM 21.A.20(d) of EASA Part-21 dated March 2021 or later published revisions.*

# 5 Requirements for Approval of Design of a Major Modification (CAD 8104 7)

## 5.1 CAD 8104 7.2 – Requirements for the approval of a major modification

5.1.1 For major changes approval, the applicant should use all AMC 21.A.20(c), as well as the GM 21.A.20 of EASA Part-21 dated March 2021 or later published revisions, in consultation with CAAM.

5.1.2 For the application of paragraph 7.4 of CAD 8104, see GM 21.A.21(b) of EASA Part-21 dated March 2021 or later published revisions, paragraphs 6.3 and 7.4 of CAD 8104, and paragraph 5.3 of CAD 8105.

5.1.3 In accordance with paragraph 7.4 of CAD 8104, the compliance demonstration process always takes into account the specific configuration(s) in the type certificate (TC) to which the major change under approval is applied. These configurations may be defined by type models/variants or by design changes to the type design. The demonstration of compliance covers these applicable specific configurations. Consequently, the approval of the major change excludes any other configurations, in particular those that already exist but are not considered in the compliance demonstration process, as well as those that may be certified in future.

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# 6 Type-Certification Basis, Operational Suitability Data Certification Basis and Environmental Protection Requirements for a Major Change to a Type Certificate (CAD 8104 8)

## 6.1 CAD 8104 8 – Establishing the certification basis of changed aeronautical products

6.1.1 GM 21.A.101 of EASA Part-21 dated March 2021 or later published revisions should be referred for guidance for the application of the 'Changed Product Rule (CPR)', pursuant to paragraph 8 of CAD 8104, *Designation of the applicable airworthiness codes and environmental protection requirements*, and paragraph 9 of CAD 8102, *Changes requiring a new type certificate*, for changes made to type certified aeronautical products. CAAM should be consulted whenever clarification is required due to references made to any EASA legal framework in the EASA reference document.

6.1.2 Notwithstanding requirements in paragraph 8 of Notice 8104, although the approval procedure may remain at ensuring that a modified aeronautical product continues to comply with the certification basis recorded in the type certificate data, it is encouraged for the design of modification to comply to a level of safety higher than that intended by its original certification basis. This requires that modifications demonstrate compliance with design standards that are in effect on the date of application, or with later amendments to the design standards recorded on the type certificate data sheet.

6.1.3 In the application for a modification design approval, the applicant proposes the airworthiness and applicable environmental standards to which it intends to demonstrate compliance. Depending on the modification, additional airworthiness or operational requirements may be imposed by CAAM, or an applicant may be required to show that the aeronautical product meets additional standards in order to receive approval in another State, due to differences in requirements. All these requirements are established collectively to become the certification basis for the modification.

6.1.4 The applicant should participate in any CAAM Initial Airworthiness Section discussion concerning the proposed certification basis, but it remains CAAM's discretion to evaluate and ensure that the certification basis is appropriate for the proposed modification.

## 6.2 CAD 8104 8.7 – Establishment of the Operational Suitability Data (OSD) Certification Basis for Changes to Type Certificates (TCs)

This paragraph provides guidance on the application of CAD 8104 paragraph 8.7 in order to determine the applicable OSD certification basis in accordance with CAD

8104 paragraphs 8.1, 8.2, 8.3, 8.4, 8.5 and 8.6 for major changes to the OSD of type certified aircraft.

6.2.1 Minor changes

Minor changes to the OSD are automatically outside the scope of CAD 8104 paragraph 8. See paragraph 4 of this CAGM for their certification basis.

6.2.2 Major changes

a) If the design change that triggered the change to the OSD constituent is classified as non-significant, the change to the OSD constituent is also non-significant.

b) If the design change that triggered the change to the OSD constituent is classified as significant, the change to the OSD constituent should comply with the latest amendment of the applicable airworthiness codes, unless the exceptions of CAD 8104 paragraph 8.3 apply or unless the OSD change can be classified as minor as per CAD 8104 paragraph 3. The guidance of Section 3.10 of GM 21.A.101 of EASA Part-21 dated March 2021 or later published revisions regarding the exceptions ‘impractical’ and ‘not contributing materially to the level of safety’, can be applied by analogy and as far as it is applicable to OSD changes.

c) Stand-alone changes to an OSD constituent are considered to be non-significant.

d) When a new OSD constituent is added or required to be added, it should comply with the latest amendment of the applicable airworthiness codes.

*e) Reserved.*

*f) Reserved.*

g) CAD 8104 paragraph 8.3 provides an exception from the requirements of CAD 8104 paragraph 8.1 for a change to the OSD of certain aircraft below a specified maximum weight. If an applicant applies for a change to the OSD for an aircraft (other than rotorcraft) of 2 722 kg (6 000 lbs) or less maximum weight, or for a non-turbine-powered rotorcraft of 1 361 kg (3 000 lbs) or less maximum weight, the applicant can demonstrate that the changed OSD complies with the OSD certification basis incorporated by reference in the TC. The applicant can also elect to comply, or may be required to comply, with a later amendment. See also Chapter 4 Section 4.1 (of GM 21.A.101 of EASA Part-21 dated March 2021 or later published revisions) for specific guidance on this requirement.

# 7 Availability of Operational Suitability Data (CAD 8102 21 / CAD 8104 11/ CAD 8105 12)

## 7.1 CAD 8104 11.1 – Availability of Operational Suitability Data

7.1.1 When making data available, the holder of the design approval (TC, modification / change approval, STC) should take into account the applicable security laws.

7.1.2 When making data available, the holder of the design approval can impose conditions addressing the intellectual property nature of the data.

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