Australian Government
Civil Aviation Safety Authority

ADVISORY CIRCULAR
AC 21-12 v1.1

Classification of design changes

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Advisory circulars are intended to provide advice and guidance to illustrate a means, but not necessarily the only means, of complying with the Regulations, or to explain certain regulatory requirements by providing informative, interpretative and explanatory material.

Advisory circulars should always be read in conjunction with the relevant regulations.

Audience

This advisory circular (AC) applies to:

- Applicants for approval of design changes
- Approved design organisations
- Authorised persons with design approval privileges.

Purpose

This AC provides guidance on the classification of design changes for the purposes of approval of the changes under Part 21. Classification of design changes is necessary to determine the appropriate approval method and the certification basis for the change.

For further information

For further information, contact CASA's Airworthiness Standards (telephone 131 757).

Status

This version of the AC is approved by the Branch Manager, Airworthiness and Engineering.

Note: Changes made in the current version are not annotated. The document should be read in full.

Version	Date	Details
v1.1	November 2022	Administrative review only.
v1.0	March 2015	Initial AC.

Unless specified otherwise, all subregulations, regulations, Divisions, Subparts and Parts referenced in this AC are references to the *Civil Aviation Safety Regulations 1998 (CASR)*.

Contents

1 Reference material

1.1 Acronyms

The acronyms and abbreviations used in this AC are listed in the table below.

Acronym	Description
AC	Advisory Circular
AFM	Aircraft flight manual
AMC	Acceptable means of compliance
CAR	*Civil Aviation Regulations 1988*
CASA	Civil Aviation Safety Authority
CASR	*Civil Aviation Safety Regulations 1998*
CPR	Changed Product Rule
EASA	European Aviation Safety Authority
FAA	Federal Aviation Administration
GM	Guidance Material
STC	Supplemental type certificate
TC	Type certificate

1.2 Definitions

Terms that have specific meaning within this AC are defined in the table below. Where definitions from the civil aviation legislation have been reproduced for ease of reference, these are identified by 'grey shading'. Should there be a discrepancy between a definition given in this AC and the civil aviation legislation, the definition in the legislation prevails.

Term	Definition
Adequate certification basis	The type certification basis for a changed product under regulation 21.101 is considered adequate when CASA determines that it provides adequate standards for the design change, i.e. when the certification specifications of the applicable airworthiness code and prescribed special conditions provide an appropriate level of safety for the changed product and do not result in any unsafe design features.
Affected area, system, component, part or appliance	Any system, component, part, or appliance which is either physically altered by a proposed design change or, even if not altered physically, its functional characteristics are altered due to the effects of the physical change.
Aeronautical product	The terms aeronautical product or product(s) used in this guidance material includes type certificated aircraft, engines, and propellers.
Airworthy	An aircraft or aeronautical product is airworthy if it is in a state that conforms with its approved design and is in a condition for safe operation.
Approved design	The type design for the aircraft, engine or propeller; and any changes to the type design made in accordance with a Part 21 approval.

Term	Definition
Certification basis	The applicable airworthiness requirements as established in regulation 21.017 and 21.101, as appropriate; special conditions; equivalent level of safety findings; and exemptions applicable to the product to be certificated.
Design change	A change in the approved design of an aircraft, aircraft engine or propeller.
Earlier requirements	The requirements in effect prior to the date of application for the change, but not prior to the existing certification basis
Existing certification basis	The requirements incorporated by reference in the type certificate of the aircraft, aircraft engine or propeller to be changed.
Latest requirements	The requirements in effect on the date of application for the change.
Major change	A change that is not a minor change.
Minor change	A change that has no appreciable effect on the weight, balance, structural strength, reliability, operational characteristics, or other characteristics affecting the airworthiness of an aircraft, aircraft engine or propeller.
Not significant change	A change that is not a significant change or a substantial change.
Previous relevant design changes	Previous design changes, the cumulative effect of which could result in a aircraft, aircraft engine or propeller significantly or substantially different from the original product or model, when considered from the last time the latest regulations were applied.
Product level change	A change or combination of changes that makes the product distinct from other models of the product (for example, range, payload, speed, design philosophy). Product level change is defined at the aircraft, engine, propeller, or APU level of change.
Secondary change	A change is a secondary change if compliance to the latest amendment would not contribute materially to the level of safety and where it is part of and consequential to an overall significant change. A secondary change is a physical change that restores without changing the system, structural capacity, or functionality, but is necessary to support a significant change.
Significant change	A change significant to the extent that it changes at the product level one or more of the following: general configuration, principles of construction or the assumptions used for certification, but not to the extent to be considered a substantial change. The significance of the change is considered in the context of all previous relevant design changes and all related revisions to the applicable regulations. Not all product level changes are significant.
Substantial change	A change which is so extensive that a substantially complete investigation of compliance is required, and consequently a new TC.
Type design	The design that applied for type certification of the aircraft, aircraft engine or propeller. See regulation 21.031 for full details of what is included in the type design.

1.3 References

Legislation

Legislation is available on the Federal Register of Legislation website https://www.legislation.gov.au/

Document	Title
Air Navigation (Aircraft Noise) Regulations 1984	
Part 21	Certification and airworthiness requirements for aircraft and parts

International Civil Aviation Organization documents

International Civil Aviation Organization (ICAO) documents are available for purchase from http://store1.icao.int/

Document	Title
ICAO Annex 16	
ICAO Doc 9501	ICAO Environmental Technical Manual

Advisory material

CASA's advisory materials are available at https://www.casa.gov.au/publications-and-resources/guidance-materials

Document	Title
AC 21-8	Approval of modification and repair designs under Subpart 21.M
AC 21-15	Supplemental type certificates
AC 21-23	Technical data
AC 21-601	Australian Technical Standard Order Authorisation

Other documents

EASA documents are available at: http://easa.europa.eu/

FAA documents are available at: http://www.faa.gov/

Document	Title
EASA AMC and GM to Part 21	
EASA CS-25 AMC 25.1309	
FAA AC 21.101-1	
FAA AC 23.1309-1	
FAA AC 25.1309-1	

1.4 Forms

CASA's forms are available at http://www.casa.gov.au/forms

Form number	Title
Form 655	Design Advice
Form 733	Application for Supplemental Type Certificate

2 Background

2.1 Introduction

2.1.1 Part 21 includes various provisions for the approval of design changes. Changes must be classified as either major or minor. Modifications may be further classified as substantial, significant or not significant. Classification of design changes is necessary to determine the appropriate approval method and the certification basis for the change.

2.2 Scope

2.2.1 This AC provides guidance for classification of design changes for type certificated aircraft, aircraft engines and propellers, including aeronautical products for those aircraft, engines and propellers, for the purposes of approval of the design change under Part 21.

2.2.2 This AC is not intended for direct application to non-type certificated aircraft. It also does not cover the classification of defects or damage as major or minor for the purposes of the continuing airworthiness regulations of either Part 42, or Part 4A of the *Civil Aviation Regulations 1988 (CAR)*.

2.3 Approval of design changes

2.3.1 All changes to the approved design of a type certificated aircraft, aircraft engine or propeller must be approved under Part 21.

2.3.2 Alteration to any of the data included within the meaning of the type design, applied to the approved design of the aircraft or aeronautical product, is considered a design change. A design change includes both modifications and repairs, and may be any one or a combination of a physical change, or a change to an operating envelope, performance, operating characteristics, limitations or ICA. A design change may be a single change or a collection of changes.

2.3.3 The general requirements for approval of a design change are the following:

a. the altered aircraft or aeronautical product complies with the applicable airworthiness requirements – the certification basis
b. no feature or characteristic of the design change makes the altered aircraft or aeronautical product unsafe for its intended use.

2.3.4 Subpart 21.D provides for approval of design changes to type certificated aircraft, aircraft engines and propellers as a change in type design. The provisions of Subpart 21.D are for design changes proposed by the type certificate holder.

2.3.5 Subpart 21.E provides for approval of major design changes to type certificated aircraft, aircraft engines and propellers under a supplemental type certificate (STC). See AC 21-15 for more information on STCs.

2.3.6 Subpart 21.M provides the general requirements for approval of modification and repair designs for aircraft, aircraft engines, propellers and appliances. See AC 21-8 for more information on approval of modification/repair designs under Subpart 21.M.

2.4 Certification basis

2.4.1 The certification basis for a change to a type certificated aircraft, aircraft engine or propeller is:

a. the regulations mentioned in the type certificate – the type certification basis; or
b. the applicable regulations in effect on the date of the application, plus any other amendments that CASA is satisfied are directly related.

2.4.2 The certification basis can vary depending on the magnitude and scope of the change. The classification of the design change is therefore necessary to determine whether the existing type certification basis is adequate for approval of the change, or whether the latest version of the requirements must be used.

2.5 Classifications of design changes

2.5.1 Design changes must be classified as either major or minor, as described in regulation 21.093. A minor change is one that has no appreciable effect on the weight, balance, structural strength, reliability, operational characteristics, or other characteristics affecting the airworthiness of an aircraft, aircraft engine or propeller. All other changes are major changes.

2.5.2 Major modifications should be further classified as substantial, significant or not significant.

2.5.3 A substantial change is a change which is so extensive that a substantially complete investigation of compliance is required, and consequently a new TC.

2.5.4 A significant change is a change significant to the extent that it changes at the product level one or more of the following: general configuration, principles of construction or the assumptions used for certification, but not to the extent to be considered a substantial change.

2.5.5 A not significant change is a change that is neither a significant change nor a substantial change, i.e. those changes where there is no change to the general configuration, no change to the principle of construction and the assumptions used for certification are still valid. Minor changes are automatically considered not significant.

3 General considerations

3.1.1 On some occasions, the classification process is initiated at a time when some data necessary to make a classification decision are not yet available. Therefore, the applicant should wait for availability of data before making a decision.

3.1.2 Wherever there is doubt as to the classification of a change, CASA should be consulted for clarification via submission of a Design Advice.

3.1.3 An initial classification may be subsequently reclassified if additional information becomes available (see section 7).

3.1.4 The reasons for a classification decision should be recorded and retained with the technical data for the design.

3.2 Determination of the current approved design of the aircraft or aeronautical product

3.2.1 Prior to classifying the design change, the current approved design must be determined. The approved design is the type design plus any other design changes approved under Part 21, for example, STCs and modification/repair designs.

3.2.2 The type design must be determined to the specific type design configuration that applied for type certification, i.e. the model or series within a model that will be modified.

3.2.3 In relation to a proposed design change, the determination of the approved design need only consider other design changes that affect that particular proposed design change.

4 Classification of repairs

4.1 Clarification of the terms Major/Minor

4.1.1 In line with the definitions given in regulation 21.093, a new repair is classified as 'major' if the result on the approved design has an appreciable effect on structural performance, weight, balance, systems, operational characteristics or other characteristics affecting the airworthiness of the product, part or appliance. In particular, a repair is classified as major if it needs extensive static, fatigue and damage tolerance strength justification and/or testing in its own right, or if it needs methods, techniques or practices that are unusual (i.e., unusual material selection, heat treatment, material processes, jigging diagrams, etc.).

4.1.2 Repairs that require a re-assessment and re-evaluation of the original certification substantiation data to ensure that the aircraft still complies with all the relevant requirements, are to be considered as major repairs.

4.1.3 Repairs whose effects are considered minor and require minimal or no assessment of the original certification substantiation data to ensure that the aircraft still complies with all the relevant requirements, are to be considered ‘minor’.

4.1.4 It is understood that not all the certification substantiation data will be available to those persons/organisations classifying repairs. A qualitative judgement of the effects of the repair will therefore be acceptable for the initial classification. The subsequent review of the design of the repair may lead to it being re-classified, owing to early judgements being no longer valid (see section 7).

4.2 Airworthiness concerns for Major/Minor classification

4.2.1 The following should be considered for the significance of their effect when classifying repairs. Should the effect be considered to be significant then the repair should be classified 'Major'. The repair may be classified as 'Minor' where the effect is known to be without appreciable consequence.

4.2.2 Structural performance

4.2.2.1 Structural performance of the product includes static strength, fatigue, damage tolerance, flutter and stiffness characteristics. Repairs to any element of the structure should be assessed for their effect upon the structural performance.

4.2.3 Weight and balance

4.2.3.1 The weight of the repair may have a greater effect upon smaller aircraft as opposed to larger aircraft. The effects to be considered are related to overall aircraft centre of gravity and aircraft load distribution. Control surfaces are particularly sensitive to the changes due to the effect upon the stiffness, mass distribution and surface profile which may have an effect upon flutter characteristics and controllability.

4.2.4 Systems

4.2.4.1 Repairs to any elements of a system should be assessed for the effect intended on the operation of the complete system and for the effect on system redundancy. The consequence of a structural repair on an adjacent or remote system should also be considered as above, (for example: airframe repair in area of a static port).

4.2.5 Operational characteristics

4.2.5.1 Changes may include:

a. stall characteristics
b. handling
c. performance and drag
d. vibration.

4.2.6 Other characteristics

4.2.6.1 Changes may include:

a. changes to load path and load sharing
b. change to noise and emissions
c. fire protection / resistance.

Note: Considerations for classifying repairs 'Major/Minor' should not be limited to those listed above.

4.3 Examples of 'Major' repairs

4.3.1 A repair that, in order to comply with the applicable airworthiness standards, requires a permanent additional inspection to the approved maintenance programme, necessary to ensure the continued airworthiness of the product. Temporary repairs for which specific inspections are required prior to installation of a permanent repair do not necessarily need to be classified as 'Major'. Also, inspections and changes to inspection frequencies not required as part of the approval to ensure continued airworthiness do not cause classification as 'Major' of the associated repair.

4.3.2 A repair to life limited or critical parts (as identified in the airworthiness limitations section of the ICA or critical parts list respectively).

4.3.3 A repair that introduces a change to the aircraft flight manual (AFM).

5 Classification of modifications

5.1 Purpose of classification

5.1.1 Classification of design changes is necessary to determine the appropriate approval method and the certification basis for the change.

5.2 Introduction

5.2.1 Changes to the type design

5.2.1.1 Regulation 21.031 defines what constitutes the type design. Alteration to any of the data included within the meaning of the type design, applied to the approved design of the aircraft or aeronautical product, is considered a design change.

5.2.2 Classification process

5.2.2.1 Modifications must be classified as either major or minor, using the criteria of regulation 21.093. Modifications may be further classified as substantial, significant or not significant.

5.3 Assessment of a modification for major/minor classification

5.3.1 Regulation 21.093 provides the criteria for the classification of design changes as minor or major. A minor change is one that has no appreciable effect on the weight, balance, structural strength, reliability, operational characteristics, or other characteristics affecting the airworthiness of an aircraft, aircraft engine or propeller. All other changes are major changes.

5.3.2 This section is intended to provide guidance for classification of a modification, particularly in relation to the terms ‘appreciable effect’ and ‘affecting the airworthiness’ from regulation 21.093, where ‘airworthiness’ is interpreted in the context of an aircraft or aeronautical product in conformity with its approved design and in a condition for safe operation.

5.3.3 Guidance for major/minor classification of modifications

5.3.3.1 A change to the approved design is judged to have an ‘appreciable effect on other characteristics affecting the airworthiness of the product’ and therefore should be classified 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 (such as special condition, equivalent safety finding, elect to comply, earlier certification specification (reversion), later certification specification)
b. where the applicant proposes a new interpretation of the certification specifications used for the type type-certification basis, that has not been published as an acceptable means of compliance or otherwise agreed with CASA

c. where the demonstration of compliance uses methods that have not been previously accepted as appropriate for the nature of the change to the product or for similar changes to other products designed by the applicant
d. where the extent of new substantiation data necessary to comply with the applicable certification specifications and the degree to which the original substantiation data has to be re-assessed and re-evaluated is considerable
e. the change alters the airworthiness limitations or the operating limitations
f. the change is made mandatory by an airworthiness directive or the change is the terminating action of an airworthiness directive (see note)
g. where the change introduces or affects functions where the failure effect is classified catastrophic or hazardous.

Note: A design change previously classified minor and approved prior to the publication of the airworthiness directive needs no re-classification. However, CASA may review the change and re-classify/re-approve if necessary.

5.3.3.2 Appendix E provides examples of major changes for various engineering disciplines that illustrate how to apply the above conditions.

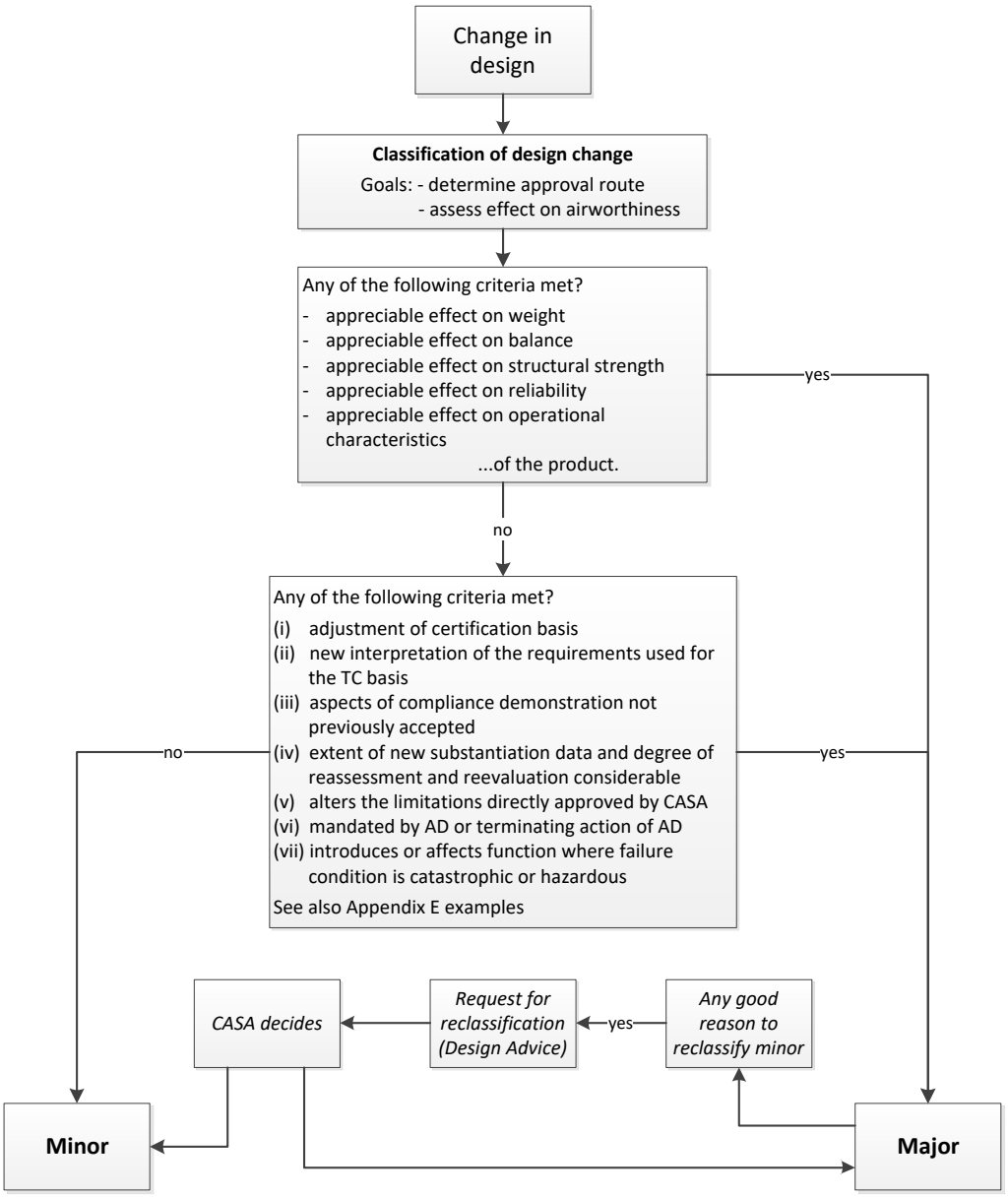

Figure 1: Decision chart for major/minor classification of modifications

5.4 Assessment of a major modification for substantial, significant or not significant classification

5.4.1 Substantial changes

5.4.1.1 A substantial change is a change which is so extensive that a substantially complete investigation of compliance is required, and consequently a new TC.

5.4.2 Significant changes

5.4.2.1 A significant change is a change significant to the extent that it changes at the product level one or more of the following: general configuration, principles of construction or the assumptions used for certification, but not to the extent to be considered a substantial change. The significance of the change is considered in the context of all

previous relevant design changes and all related revisions to the applicable regulations. Not all product level changes are significant.

5.4.3 Not significant changes

5.4.3.1 A not significant change is a change that is not a significant change or a substantial change, i.e. those changes where there is no change to the general configuration, no change to the principle of construction and the assumptions used for certification are still valid.

5.4.4 Examples of substantial, significant or not significant changes

5.4.4.1 Appendix A contains examples of typical type design changes for small aeroplanes, large aeroplanes, rotorcraft, engines, and propellers which are categorised by CASA into individual tables according to the classifications to the level of design change – substantial, significant, and not significant.

5.5 Approval of major modifications

5.5.1 As a general rule, substantial changes will require a new TC and significant changes will require an STC (or an amended TC if the applicant is the TC holder).

5.5.2 Not significant changes may require an STC or, in certain circumstances, may be approved under Subpart 21.M. One of the criteria used to determine the approval method will be the number of aircraft or aeronautical products that are expected to be modified.

5.5.3 AC 21-8 provides general guidance with regards to approval of modifications and repairs under Subpart 21.M. AC 21-8, section 5.8, provides further information and assessment criteria that will be applied by CASA when determining whether a major modification may be approved under Subpart 21.M or if an STC approval is required.

5.5.4 The following flow chart provides a simplified depiction of the approval methods for major modifications.

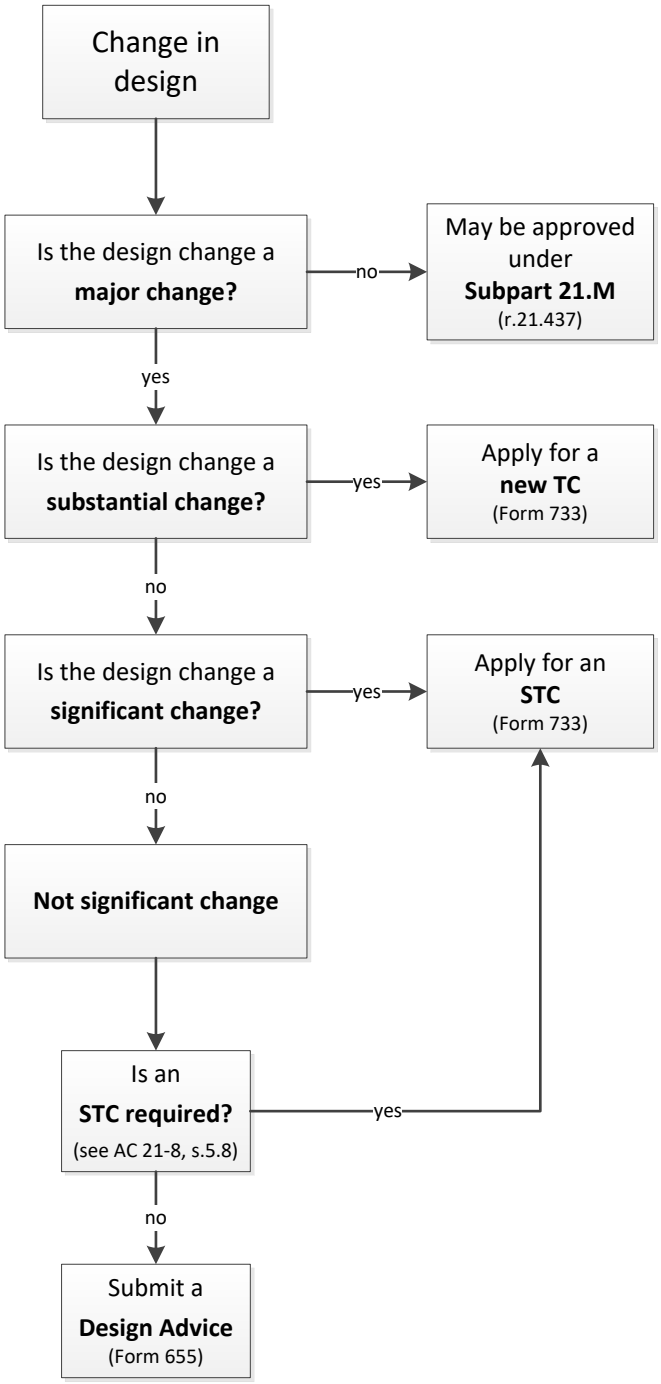

Figure 2: Approval methods for major modifications

6 Establishment of the type-certification basis of changed aeronautical products

Reserved for future use.

7 Reclassifying changes

7.1.1 It is understood that in some cases not all the certification substantiation data will be available to those persons/organisations classifying design changes. A qualitative judgement of the effects of the change will therefore be acceptable for the initial classification. The subsequent review of the design change may lead to it being re-classified, owing to early judgements being no longer valid.

7.1.2 A request to reclassify an initial design change classification may be submitted to CASA via a Design Advice. The Design Advice application should include the reasons why the classification should be changed and data to substantiate the request, for example, flight test data that shows the impact on aircraft performance.

Appendix A

Classification of changes

The following examples of substantial, significant and not significant changes are adopted by CASA, the FAA, European Aviation Safety Agency (EASA) and Transport Canada Civil Aviation (TCCA) through an international collaboration. The classification may change due to cumulative effects and/or combinations of individual changes. The “NA” in the substantial example tables indicates that the automatic classification criteria in the heading are “Not Applicable” at the “21.019 Substantial Evaluation” phase.

Table 1: Examples of Changes for Small Aeroplanes (Part 23)

The following examples are for **SUBSTANTIAL** changes for **Small Aeroplanes (Part 23)**:

Description of change	Is there a change to the general configuration?	Is there a change to the principles of construction?	Have the assumptions used for certification been invalidated?	Notes
Change in wing location (tandem, forward, canard, high/low)	N/A	N/A	N/A	Proposed change in design is so extensive that a substantially complete investigation of compliance with the applicable certification specifications is required.
Fixed wing to tilt wing	N/A	N/A	N/A	Proposed change in design is so extensive that a substantially complete investigation of compliance with the applicable certification specifications is required.
Increase or decrease in the number of engines	N/A	N/A	N/A	Proposed change in design is so extensive that a substantially complete investigation of compliance with the applicable certification specifications is required.

Description of change	Is there a change to the general configuration?	Is there a change to the principles of construction?	Have the assumptions used for certification been invalidated?	Notes
Replacement of piston or turbo-prop engines with turbojet or turbofan engines	N/A	N/A	N/A	Proposed change in design is so extensive that a substantially complete investigation of compliance with the applicable certification specifications is required.
Change in engine configuration (tractor to pusher)	N/A	N/A	N/A	Proposed change in design is so extensive that a substantially complete investigation of compliance with the applicable certification specifications is required.
Increase from subsonic to supersonic flight regime	N/A	N/A	N/A	Proposed change in design is so extensive that a substantially complete investigation of compliance with the applicable certification specifications is required.
Change from an all metal aeroplane to all composite primary structure (fuselage, wing, empennage)	N/A	N/A	N/A	Proposed change in design is so extensive that a substantially complete investigation of compliance with the applicable certification specifications is required.

The following examples are for **SIGNIFICANT** changes for **Small Aeroplanes (Part 23)**:

Description of change	Is there a change to the general configuration?	Is there a change to the principles of construction?	Have the assumptions used for certification been invalidated?	Notes
Conventional tail to T-tail or Y-tail, or vice versa	Yes	No	Yes	Change in general configuration. Requires extensive structural, flying qualities and performance re-investigation. Requires a new AFM to address performance and flight characteristics.
Changes in wing configuration such as change in dihedral, changes in wing span, flap or aileron span, addition of winglets, or increase of more than 10% of the original wing sweep at the quarter chord	Yes	No	Yes	Change in general configuration. Likely requires extensive changes to wing structure. Requires a new AFM to address performance and flight characteristics. Note: Small changes to wingtip are not significant changes. See table for not significant changes.
Changes to tail configuration such as the addition of tail strakes or angle of incidence of the tail	Yes	No	Yes	Change in general configuration. Likely requires extensive changes to tail structure. Requires a new AFM to address performance and flight characteristics. Note: Small changes to tail are not significant changes.
Tricycle / tail wheel undercarriage change or addition of floats	Yes	No	No	Change in general configuration. Principles of construction and certification assumptions remain valid.
Passenger to	Yes	No	Yes	Change in general

Description of change	Is there a change to the general configuration?	Is there a change to the principles of construction?	Have the assumptions used for certification been invalidated?	Notes
freighter configuration conversion which involves the introduction of a cargo door or an increase in floor loading of more than 20%, or provision for carriage of passengers and freight together				configuration affecting load paths, aeroelastic characteristics, aircraft related systems, etc. Change in design assumptions.
Replace reciprocating engines with the same number of turbo-propeller engines where the operating envelope is expanded	No	No	Yes	Invalidates certification assumptions. Requires a new AFM to address performance and flight characteristics.
Addition of a turbo-charger that changes the power envelope, operating range, or limitations	No	No	Yes	Invalidates certification assumptions due to changes in operating envelope and limitations. Requires a new AFM to address performance and flight characteristics.
The replacement of an engine of higher rated power or increase thrust would be considered significant if it would invalidate the existing substantiation, or would change the primary structure, aerodynamics, or operating envelope sufficiently to invalidate the assumptions of certification	No	Yes	Yes	Invalidates certification assumptions. Requires a new AFM to address performance and flight characteristics. Likely changes to primary structure. Requires extensive construction re-investigation.

Description of change	Is there a change to the general configuration?	Is there a change to the principles of construction?	Have the assumptions used for certification been invalidated?	Notes
A change in the type of material, such as composites in place of metal (or one composite fiber material system with another (e.g., carbon for fiberglass), for primary structure would normally be assessed as a significant change	No	Yes	Yes	Change in principles of construction and design from conventional practices. Likely change in design/certification assumptions.
Change involving appreciable increase in design speeds Vd, Vmo, Vc, or Va	No	No	Yes	Certification assumptions invalidated. Requires a new AFM to address performance and flight characteristics.
Short Take-Off and Landing (STOL) kit	No	No	Yes	Certification assumptions invalidated. Requires a new AFM to address performance and flight characteristics.
A change in the rated power or thrust is likely to be regarded as significant if the design speeds are thereby changed so that compliance needs to be re-justified with a majority of certification specifications	No	No	Yes	Certification assumptions invalidated. Requires a new AFM to address performance and flight characteristics.
Fuel state: such as compressed gaseous fuels, or fuel cells. This could completely alter the fuel storage and handling systems and possibly affect the aeroplane	No	No	Yes	Changes in design/certification assumptions. Extensive alteration of fuel storage and handling systems.

Description of change	Is there a change to the general configuration?	Is there a change to the principles of construction?	Have the assumptions used for certification been invalidated?	Notes
structure				
A design change that alters the aircraft flight characteristics or performance from the type design would normally be significant if it appreciably changes the kinematics or dynamics of the aeroplane	No	No	Yes	Certification assumptions invalidated. Requires a new AFM to address performance and flight characteristics.
A change in the flight control concept for an aircraft, for example to fly by wire (FBW) and side-stick control, or a change from hydraulic to electronically actuated flight controls, would in isolation normally be regarded as a significant change	No	No	Yes	Changes in design and certification assumptions. Requires extensive systems architecture and integration re-investigation. Requires a new AFM.
Change to aeroplane's cabin operating altitude, or operating pressure	No	No	Yes	An increase greater than 10 % in maximum cabin pressure differential invalidates certification assumptions and the fundamental approach used in decompression, structural strength, and fatigue.
Addition of cabin pressurisation system	No	Yes	Yes	Extensive airframe changes affecting load paths, fatigue evaluation, aero elastic characteristics, etc. Invalidates design assumptions.

Description of change	Is there a change to the general configuration?	Is there a change to the principles of construction?	Have the assumptions used for certification been invalidated?	Notes
Changes in types and number of emergency exits or an increase in maximum certificated passenger capacity	Yes	No	Yes	Emergency egress certification specifications exceed those previously substantiated. Invalidates assumptions of certification.
A change in the required number of flight crew, which necessitates a complete cockpit re-arrangement, and/or an increase in pilot workload would be a significant change	No	No	Yes	Extensive changes to avionics and aircraft systems. Invalidates certification assumptions. Requires a new AFM.
Expansion of an aircraft's operating envelope	No	No	Yes	An appreciable expansion of operating capability would normally be a significant change (e.g., an increase in maximum altitude limitation, approval for flight in known icing conditions, or an increase in airspeed limitations). Merely operating a product to an expanded envelope for which it was originally designed is generally not a significant change. In this case, the assumptions used for certification of the basic product remain valid and the results can be applied to cover the changed product with predictable effects or can be demonstrated without significant changes to the product.

Description of change	Is there a change to the general configuration?	Is there a change to the principles of construction?	Have the assumptions used for certification been invalidated?	Notes
Replacement of an aviation gasoline engine with an engine of approximately the same horsepower utilising diesel fuel	No	No	Yes	A major change to the aeroplane. The general configuration and principles of construction will usually remain valid; however, the assumptions for certification are invalidated.
Comprehensive flight deck upgrade, such as conversion from entirely federated, independent electro-mechanical flight instruments to highly integrated and combined electronic display systems with extensive use of software and/or complex electronic hardware	No	No	Yes	Affects avionics and electrical systems integration and architecture concepts, or philosophies.
Introduction of autoland	No	No	Yes	Invalidates original design assumptions.
Airframe life extension	No	No	Yes	This modification pertains to fuselage and/or wing limits, and ageing aeroplane concerns. An increase from the original life limit which constitutes a re-evaluation of certification design assumptions.
Extensive structural airframe modification, such as a large opening in fuselage	Yes	No	No	Requires extensive changes to fuselage structure, affects aircraft systems, and requires a new AFM to address performance and flight characteristics.
Fuselage stretch or	Yes	No	Yes	Cabin interior

Description of change	Is there a change to the general configuration?	Is there a change to the principles of construction?	Have the assumptions used for certification been invalidated?	Notes
shortening in the cabin or pressure vessel				changes are related changes since occupant safety considerations are impacted by a cabin length change. Even if a new cabin interior is not included in the product level change, the functional effect of the fuselage plug has implications on occupant safety (e.g., the dynamic environment in an emergency landing, emergency evacuation, etc.), and thus the existing cabin interior becomes an affected area.
Conversion from normal category to commuter category aeroplane	Yes	No	Yes	In many cases this change could be considered a substantial change to the type design. Therefore, a proposed change of this nature would be subject to CASA determination under regulation 21.019.

The following examples are for **NOT SIGNIFICANT** changes for **Small Aeroplanes (Part 23)**:

Description of change	Is there a change to the general configuration?	Is there a change to the principles of construction?	Have the assumptions used for certification been invalidated?	Notes
Addition of wingtip modifications (not winglets)	No	No	No	Although a major change to the aeroplane, likely the original general configuration, principles of construction and certification assumptions remain valid.
Installation of skis or wheel skis	No	No	No	Although a major change to the aeroplane, likely the original general configuration, principles of construction and certification assumptions remain valid.
FLIR or surveillance camera installation	No	No	No	Additional flight or structural evaluation may be necessary but the change does not alter basic aeroplane certification.
Litter, berth and cargo tie down device installation	No	No	No	
Increased tire size, including tundra tires	No	No	No	
Replacement of one propeller type with another (irrespective of increase in number of blades)	No	No	No	Although a major change to the aeroplane, likely the original general configuration, principles of construction and certification assumptions remain valid.
Addition of a turbo-charger that does not change the power envelope,	No	No	No	

Description of change	Is there a change to the general configuration?	Is there a change to the principles of construction?	Have the assumptions used for certification been invalidated?	Notes
operating range, or limitations (e.g., a turbo—normalised engine, where the additional power is used to enhance high altitude or hot day performance)				
Substitution of one method of bonding for another (e.g., change in type of adhesive)	No	No	No	
Substitution of one type of metal for another	No	No	No	
Any change in construction or fastening not involving primary structure	No	No	No	
A new fabric type for fabric skinned aircraft	No	No	No	
Increase in flap speed or undercarriage limit speed	No	No	No	Although a major change to the aeroplane, likely the original general configuration, principles of construction and certification assumptions remain valid.
Structural strength increases	No	No	No	Although a major change to the aeroplane, likely the original general configuration, principles of construction and certification assumptions remain valid.
Instrument Flight Rules (IFR)	No	No	No	

Description of change	Is there a change to the general configuration?	Is there a change to the principles of construction?	Have the assumptions used for certification been invalidated?	Notes
upgrades involving installation of components (where the original certification does not indicate that the aeroplane is not suitable as an IFR platform, e.g., special handling concerns)				
Fuel lines, where engine horsepower is increased but fuel flow is not increased beyond the certified maximum amount	No	No	No	
Fuel tanks, where fuel is changed from gasoline to diesel fuel and tank support loads are small enough that an extrapolation from the previous analysis would be valid. Chemical compatibility would have to be substantiated	No	No	No	
Limited changes in a pressurisation system, e.g., number of outflow valves, type of controller, or size of pressurised compartment, but the system must be re-substantiated if the original test data is invalidated	No	No	No	Although a major change to the aeroplane, likely the original general configuration, principles of construction and certification assumptions remain valid.
Install a quieter exhaust system	No	No	No	
Changes in engine cooling or cowling	No	No	No	
Changing fuels of substantially the	No	No	No	Although a major change to the

Description of change	Is there a change to the general configuration?	Is there a change to the principles of construction?	Have the assumptions used for certification been invalidated?	Notes
same type: Such as AvGas to AutoGas, AvGas (80/87) to AvGas (100LL), Ethanol to Isopropyl Alcohol, Jet B to Jet A (although Jet A to Jet B may be considered significant due to the fact that Jet B is considered potentially more explosive)				aeroplane, likely the original general configuration, principles of construction and certification assumptions remain valid.
Fuels that specify different levels of 'conventional' fuel additives that do not change the primary fuel type. Different additives (MTBE, ETBE, ethanol, amines, etc.) in AvGas would not be considered a significant change	No	No	No	Although a major change to the aeroplane, likely the original general configuration, principles of construction and certification assumptions remain valid.
A change to the maximum take-off weight of less than 5 % unless assumptions made in justification of the design are thereby invalidated	No	No	No	Although a major change to the aeroplane, likely the original general configuration, principles of construction and certification assumptions remain valid. (Unless this weight increase would result in a shift to commuter category.)
An additional aileron tab (e.g. on the other wing)	No	No	No	Although a major change to the aeroplane, likely the original general configuration, principles of construction and certification assumptions remain valid.

Description of change	Is there a change to the general configuration?	Is there a change to the principles of construction?	Have the assumptions used for certification been invalidated?	Notes
Larger diameter flight control cables with no change in routing, or other system design	No	No	No	
Autopilot installation (for Instrument Flight Rules (IFR) use, where the original certification does not indicate that the aeroplane is not suitable as an IFR platform)	No	No	No	Although a major change to the aeroplane, likely the original general configuration, principles of construction and certification assumptions remain valid.
Increased battery capacity or relocate battery	No	No	No	
Replace generator with alternator	No	No	No	
Additional lighting (e.g., navigation lights, strobes)	No	No	No	
Higher capacity brake assemblies	No	No	No	
Increase in fuel tank capacity	No	No	No	Not a product level change, unless it is tied with an increase in gross weight.
Addition of an oxygen system	No	No	No	
Relocation of a galley	No	No	No	
Passenger to freight (only) conversion with no change to basic fuselage structure	No	No	No	Although a major change to the aeroplane, likely the original general configuration, principles of construction and certification assumptions remain valid.

Description of change	Is there a change to the general configuration?	Is there a change to the principles of construction?	Have the assumptions used for certification been invalidated?	Notes
				Requires certification substantiation applicable to freighter certification specifications.
New cabin interior with no fuselage length change	No	No	No	
Installation of new seat belt or shoulder harness	No	No	No	
A small increase in CG range	No	No	No	At product level, no change in general configuration, principles of construction & certification assumptions.
APU Installation that is not flight essential	No	No	No	Although a major change to the aeroplane level, likely the original general configuration, principles of construction and certification assumptions remain valid.
An alternative autopilot	No	No	No	
Addition of Class B Terrain Awareness and Warning Systems (TAWS)	No	No	No	

Table 2: Examples of Changes for Transport Aeroplanes (Part 25)

The following examples are for **SUBSTANTIAL** changes for **Transport Aeroplanes (Part 25)**:

Description of change	Is there a change to the general configuration?	Is there a change to the principles of construction?	Have the assumptions used for certification been invalidated?	Notes
Change in the number or location of engines, e.g., four to two wing-mounted engines or two wing-mounted to two body-mounted engines	N/A	N/A	N/A	Proposed change in design is so extensive that a substantially complete investigation of compliance with the applicable certification specifications is required.
Change from a high wing to low wing configuration	N/A	N/A	N/A	Proposed change in design is so extensive that a substantially complete investigation of compliance with the applicable certification specifications is required.
Change from an all metal aeroplane to all composite primary structure (fuselage, wing, empennage)	N/A	N/A	N/A	Proposed change in design is so extensive that a substantially complete investigation of compliance with the applicable certification specifications is required.
Change of empennage configuration for larger aeroplanes (cruciform vs. ‘T’ or ‘V’ tail)	N/A	N/A	N/A	Proposed change in design is so extensive that a substantially complete investigation of compliance with the applicable certification specifications is required.
Increase from	N/A	N/A	N/A	Proposed change in

Description of change	Is there a change to the general configuration?	Is there a change to the principles of construction?	Have the assumptions used for certification been invalidated?	Notes
subsonic to supersonic flight regime				design is so extensive that a substantially complete investigation of compliance with the applicable certification specifications is required.

The following examples are for **SIGNIFICANT** changes for **Transport Aeroplanes (Part 25)**:

Description of change	Is there a change to the general configuration?	Is there a change to the principles of construction?	Have the assumptions used for certification been invalidated?	Notes
Reduction in the number of flight crew (In conjunction with flight deck update)	Yes	No	Yes	Extensive changes to avionics and aircraft systems. Impact to crew workload and human factors, pilot type rating.
Modify an aeroplane for flight in known icing conditions by adding systems for ice detection and elimination	Yes	No	Yes	New aircraft operating envelop. Requires major new systems installation and aircraft evaluation. Operating envelope changed.
Conversion – passenger or combination freighter/passenger to all freighter including cargo door, redesign floor structure and 9g net or rigid barrier	Yes	No	Yes	Extensive airframe changes affecting load paths, aeroelastic characteristics, aircraft related systems for fire protection, etc. Design assumptions changed from passenger to freighter.
Increase in cabin pressurisation	No	No	Yes	Typically, a change greater than 10 % in operational cabin pressure differential.

Description of change	Is there a change to the general configuration?	Is there a change to the principles of construction?	Have the assumptions used for certification been invalidated?	Notes
				May require extensive airframe changes affecting load paths, fatigue evaluation, aeroelastic characteristics, etc. Invalidates design assumptions.
Addition of leading edge slats	Yes	No	No	Requires extensive changes to wing structure, adds aircraft level systems, and requires a new AFM to address performance and flight characteristics.
Fuselage stretch or shortening in the cabin or pressure vessel	Yes	No	Yes	Cabin interior changes are related changes since occupant safety considerations are impacted by a cabin length change. Even if a new cabin interior is not included in the product level change, the functional effect of the fuselage plug has implications on occupant safety (e.g., the dynamic environment in an emergency landing, emergency evacuation, etc.), and thus the cabin interior becomes an affected area.
Extensive structural airframe modification, such as installation of a large telescope with large opening in fuselage	Yes	No	No	Requires extensive changes to fuselage structure, affects aircraft level systems, and requires a new aeroplane flight

Description of change	Is there a change to the general configuration?	Is there a change to the principles of construction?	Have the assumptions used for certification been invalidated?	Notes
				manual to address performance and flight characteristics.
Changing the number of axles or number of landing gear done in context with a product level change which involves changing the aeroplane gross weight	Yes	No	No	Requires extensive changes to aircraft structure, affects aircraft l systems and requires AFM changes.
Primary structure changes from metallic material to composite material	No	Yes	No	Change in principles of construction and design from conventional practices.
Airframe life extension	No	No	Yes	This modification pertains to fuselage and/or wing limits, and ageing aeroplane concerns. An increase from the original life limit which constitutes a re-evaluation of certification design assumptions.
Typically, an increase in design weight of more than 10%	No	No	Yes	Requires extensive re-substantiation of aircraft structure, aircraft performance and flying qualities and associated systems.
Installation of winglets	Yes	No	Yes	
Wing changes in span, sweep, and tip designs or wing chord	Yes	No	Yes	When it requires extensive changes to wing structure, adds aircraft level systems, and requires a new AFM to address performance and flight characteristics.

Description of change	Is there a change to the general configuration?	Is there a change to the principles of construction?	Have the assumptions used for certification been invalidated?	Notes
				Note: Potentially substantial if it is a change from a high wing to a low wing, or a new wing.
Change in type or number of emergency exits or an increase in the maximum certificated number of passengers demonstrated	Yes	No	Yes	The new emergency egress certification specifications exceed those previously substantiated.
Comprehensive flight deck upgrade, such as conversion from entirely federated, independent electro-mechanical flight instruments to highly integrated and combined electronic display systems with extensive use of software and possibly complex hardware	No	No	Yes	Affects avionics and electrical systems integration and architecture concepts and philosophies.
Change in primary flight controls to fly by wire (FBW) system. (Some aeroplanes have some degree of FBW. Achieving full FBW may be a not significant change on some aeroplanes.)	No	No	Yes	When the degree of change is so extensive that it affects basic aircraft systems integration and architecture concepts and philosophies. This drives a complete re-assessment of flight crew workload, handling qualities, and performance evaluation, which are different from the original design assumptions.
Replace reciprocating with turbo-propeller engines	Yes	No	No	Requires extensive changes to airframe structure, adds aircraft level

Description of change	Is there a change to the general configuration?	Is there a change to the principles of construction?	Have the assumptions used for certification been invalidated?	Notes
				systems, and requires a new AFM to address performance and flight characteristics.
Typically a thrust increase of more than 10%	No	No	Yes	Requires extensive re-substantiation of powerplant installation, and has a marked effect on aircraft performance and flying qualities.
Initial installation of an autoland system	No	No	Yes	Baseline aeroplane not designed for autoland operation, potential crew work load and systems compatibility issues
Installation of a new fuel tank (horizontal stabiliser tank or auxiliary fuel tank in the fuselage outside the wing in conjunction with increased maximum take-off weight and take-off thrust)	No	No	Yes	Requires changes to airframe, systems and AFM. Results in performance changes.
Main deck cargo door installation	Yes	No	No	Redistribution of internal loads, change in aeroelastic characteristics, system changes.
Expansion of an aircraft's operating envelope	No	No	Yes	An expansion of operating capability would normally be a significant change (e.g. an increase in maximum altitude limitation, approval for flight in known icing conditions, or an increase in airspeed limitations). Merely operating a product to an

Description of change	Is there a change to the general configuration?	Is there a change to the principles of construction?	Have the assumptions used for certification been invalidated?	Notes
				expanded envelope for which it was originally designed is generally not a significant change. In this case, the assumptions used for certification of the basic product remain valid and the results can be applied to cover the changed product with predictable effects or can be demonstrated without significant physical changes to the product.
Conversion from a passenger floor to a cargo floor and installation of a cargo handling system	No	No	Yes	Completely new floor loading and design. Redistribution of internal loads, change in cabin safety certification specifications, system changes.
Initial installation of an APU essential for aircraft flight operation	No	No	Yes	Changes emergency electrical power certification specifications, change in AFM and operating characteristics.
Conversion from hydraulically actuated brakes to electrically actuated brakes	No	No	Yes	Assumptions of certification for aeroplane performance are changed.
Change to aeroplane's cabin operating altitude, or operating pressure	No	No	Yes	An increase greater than 10 % in maximum cabin pressure differential invalidates certification assumptions and the fundamental approach used in decompression.

Description of change	Is there a change to the general configuration?	Is there a change to the principles of construction?	Have the assumptions used for certification been invalidated?	Notes
				structural strength, and fatigue analysis.
Installation of engine thrust reversers	Yes	No	Yes	

The following examples are for **NOT SIGNIFICANT** changes for **Transport Aeroplanes (Part 25)**:

Description of change	Is there a change to the general configuration?	Is there a change to the principles of construction?	Have the assumptions used for certification been invalidated?	Notes
Alternate engine installation or hush kit at same position	No	No	No	Typically it is not significant so long as there is not more than a 10% increase in thrust or a change in the principles of propulsion.
A small change in fuselage length due to re-fairing the aft body or radome	No	No	No	For cruise performance reasons, where such changes do not require extensive structural, systems, aerodynamic or AFM changes.
Re-fairing of wing tip caps (for lights, fuel dump pipes) and addition of splitter plates to the trailing edge thickness of the cruise airfoil	No	No	No	Does not require extensive structural, AFM, or systems changes.
Additional power used to enhance high altitude or hot day performance	No	No	No	Usually no change in basic operating envelope. Existing cert. data can be extrapolated. Could be significant product change if the additional power is provided by installation of a rocket motor or additional, on

Description of change	Is there a change to the general configuration?	Is there a change to the principles of construction?	Have the assumptions used for certification been invalidated?	Notes
				demand engine due to changes in certification assumptions.
Initial installation of an autopilot system	No	No	See note	It may be possible that the modification is adaptive in nature, with no change to original certification assumptions. However, in certain cases the installation of an auto-pilot may include extensive changes and design features which change the assumptions for certification (i.e. installation of the auto-pilot may introduce a number of additional mechanical and electronic failure modes and change the hazard classification of given aircraft level failures).
Change from assembled primary structure to monolithic or integrally machined structure	No	No	No	Method of construction must be well understood.
Modification to ice protection systems	No	No	No	Re-certification required, but type-certification basis is adequate.
Brakes: design or material change, e.g., steel to carbon	No	No	No	Re-certification required, but type-certification basis is adequate.
Redesign floor structure	No	No	No	By itself, this is not a significant product change. It is significant if part of a

Description of change	Is there a change to the general configuration?	Is there a change to the principles of construction?	Have the assumptions used for certification been invalidated?	Notes
				cargo conversion of a passenger aeroplane.
New cabin interior with no fuselage length change	No	No	No	A new cabin interior includes new ceiling and sidewall panels, stowage, galleys, lavatories, and seats. New and novel features in the cabin interior may require special conditions. Many interior related certification specifications are incorporated in operational rules. Even though the design approval holder may not be required to comply with these certification specifications, the operator may be required to comply.
A re-arrangement of an interior (e.g. seats, galleys, lavatories, closets, etc.)	No	No	No	Re-arrangement requires the use of the existing floor mounting structure.
Novel or unusual method of construction of a component	No	No	No	Special conditions could be required if there are no existing certification specifications that adequately address these features. The component change does not rise to the product level change.
Initial installation of a non-essential APU	No	No	No	A stand-alone initial APU installation on an aeroplane originally designed to use ground/airport

Description of change	Is there a change to the general configuration?	Is there a change to the principles of construction?	Have the assumptions used for certification been invalidated?	Notes
				supplied electricity, and air-conditioning. In this case, the APU would be an option to be independent of airport power.

Table 3: Examples of Changes for Rotorcraft (Parts 27 and 29)

The following examples are for **SUBSTANTIAL** changes for **Rotorcraft (Parts 27 and 29)**:

Description of change	Is there a change to the general configuration?	Is there a change to the principles of construction?	Have the assumptions used for certification been invalidated?	Notes
Change from the number and/or configuration of rotors (e.g. main & tail rotor system to two main rotors	N/A	N/A	N/A	Proposed change in design is so extensive that a substantially complete investigation of compliance with the applicable certification specifications is required.
Change from an all-metal rotorcraft to all composite rotorcraft	N/A	N/A	N/A	Proposed change in design is so extensive that a substantially complete investigation of compliance with the applicable certification specifications is required

The following examples are for **SIGNIFICANT** changes for **Rotorcraft (Parts 27 and 29)**:

Description of change	Is there a change to the general configuration?	Is there a change to the principles of construction?	Have the assumptions used for certification been invalidated?	Notes
Comprehensive flight deck upgrade, such as conversion from entirely federated, independent electro-mechanical flight instruments to highly integrated and combined electronic display systems with extensive use of software and/or complex electronic hardware	No	No	Yes	Affects avionics and electrical systems integration and architecture concepts and philosophies.
Certification for flight into known icing conditions	No	No	Yes	
(Fixed) flying controls from mechanical to fly by wire	No	No	Yes	This drives a complete re-assessment of the rotorcraft controllability and flight control failure.
Addition of an engine; e.g., from single to twin or reduction of the number of engines; e.g., from twin to single	Yes	Yes	Yes	May be a substantial change depending upon project details.
A change of rotor drive system primary gearbox splash type lubrication system to a pressure lubricated system due to an increase in horsepower of an engine or changing a piston engine to a turbine engine	No	Yes	Yes	
A fuselage or tail boom modification that changes the primary structure, aerodynamics, and operating envelope	Yes	No	Yes	

Description of change	Is there a change to the general configuration?	Is there a change to the principles of construction?	Have the assumptions used for certification been invalidated?	Notes
sufficiently to invalidate the certification assumptions				
Application of an approved primary structure to a different approved model (e.g., installation on a former model of the main rotor approved on a new model that results in increase performance	No	Yes	Yes	
Extensive primary structure changes from metallic material to composite material.	No	Yes	Yes	Change in principles of construction and assumptions used for certification for the product level change. Changes of a few individual elements from metal to composite are not typically considered a significant change .
Emergency Medical Service (EMS) configuration with primary structural changes sufficient to invalidate the certification assumptions	No	No	Yes	Many EMS configurations will not be classified as significant. Modifications made for EMS are typically internal, and the general external configuration is normally not affected. These changes should not automatically be classified as significant.
Skid landing gear to wheel landing gear or wheel landing to skid	Yes	No	Yes	
Change of the number of rotor blades	Yes	No	Yes	

Description of change	Is there a change to the general configuration?	Is there a change to the principles of construction?	Have the assumptions used for certification been invalidated?	Notes
Change tail anti-torque device (e.g., tail rotor, ducted fan or other technology)	Yes	Yes	No	
Passenger configured helicopter to a fire fighting equipment configured helicopter	Yes	No	Yes	Depends on the fire fighting configuration.
Passenger configured helicopter to an agricultural configured helicopter	Yes	No	Yes	Depends on the agricultural configuration.
A new Category A certification approval to an existing configuration	No	No	Yes	
Instrument Flight Rules (IFR) upgrades involving installation of upgraded components for new IFR configuration	No	No	Yes	
Human External Cargo (HEC) certification approval	No	No	Yes	Must comply with the latest HEC certification specifications in order to obtain operational approval. HEC include fatigue, Quick Release Systems, High Intensity Radio Frequency (HIRF), One Engine Inoperative (OEI) performance and OEI procedures.
Reducing the number of pilots for IFR from 2 to 1	No	No	Yes	

The following examples are for **NOT SIGNIFICANT** changes for **Rotorcraft (Parts 27 and 29)**:

Description of change	Is there a change to the general configuration?	Is there a change to the principles of construction?	Have the assumptions used for certification been invalidated?	Notes
Emergency floats	No	No	No	Must comply with the specific applicable certification specifications for emergency floats. This installation, in itself, does not change the rotorcraft configuration, overall performance, or operational capability. Expanding an operating envelope (such as operating altitude and temperature) and mission profile (such as passenger carrying operations to external load operations, or flight over water, or operations in snow conditions) are not by themselves so different that the original certification assumptions are no longer valid at the type-certificated product level.
FLIR or surveillance camera installation	No	No	No	Additional flight or structural evaluation may be necessary but the change does not alter the basic rotorcraft certification.
Helicopter Terrain Awareness Warning System (HTAWS) for operational credit	No	No	No	Certified per rotorcraft HTAWS AC guidance material and ETSO-C194.

Description of change	Is there a change to the general configuration?	Is there a change to the principles of construction?	Have the assumptions used for certification been invalidated?	Notes
Health Usage Monitoring System (HUMS) for Maintenance Credit	No	No	No	Certified per rotorcraft HUMS AC guidance material.
Expanded limitations with minimal or no design changes, following further tests/justifications or different mix of limitations (CG limits, oil temperatures, altitude, minimum/maximum weight, minimum/max external temperatures, speed, ratings structure)	No	No	No	Expanding an operating envelope (such as operating altitude and temperature) and mission profile (such as passenger carrying operations to external load operations, or flight over water, or operations in snow conditions) are not by themselves so different that the original certification assumptions are no longer valid at the type-certificated product level.
Installation of a new engine type, equivalent to the former one; leaving a/c installation and limitations substantially unchanged	No	No	No	Refer to AC 27-1 or AC 29-2 for guidance
Windscreen installation	No	No	No	Does not change the rotorcraft overall product configuration
Snow skis, ‘Bear Paws’	No	No	No	Must comply with specific certification specifications associated with the change. Expanding an operating envelope (such as operating altitude and temperature) and mission profile (such as passenger carrying operations

Description of change	Is there a change to the general configuration?	Is there a change to the principles of construction?	Have the assumptions used for certification been invalidated?	Notes
				to external load operations, or flight over water, or operations in snow conditions) are not by themselves so different that the original certification assumptions are no longer valid at the type-certificated product level.
External Cargo Hoist	No	No	No	Must comply with the specific applicable certification specifications for external loads. This installation, in itself, does not change the rotorcraft configuration, overall performance, or operational capability. Expanding an operating envelope (such as operating altitude and temperature) and mission profile (such as passenger carrying operations to external load operations, or flight over water, or operations in snow conditions) are not by themselves so different that the original certification assumptions are no longer valid at the type-certificated product level.
Instrument Flight Rules (IFR) upgrades involving installation of upgraded	No	No	No	Not a rotorcraft level change.

Description of change	Is there a change to the general configuration?	Is there a change to the principles of construction?	Have the assumptions used for certification been invalidated?	Notes
components to replace existing components				

Table 4: Examples of Changes for Engines (Part 33)

The following are examples of **SUBSTANTIAL** changes for **Engines (Part 33):**

Description of change	Is there a change to the general configuration?	Is there a change to the principles of construction?	Have the assumptions used for certification been invalidated?	Notes
Turbine Engines				
Traditional turbofan to geared-fan engine	N/A	N/A	N/A	Proposed change in design is so extensive that a substantially complete investigation of compliance with the applicable certification specifications is required. Note: There may be certain circumstances where this change would be significant.
Low bypass ratio engine to high bypass ratio engine with an increased inlet area	N/A	N/A	N/A	Proposed change in design is so extensive that a substantially complete investigation of compliance with the applicable certification specifications is required. Note: There may be certain circumstances where this change would be significant.

Description of change	Is there a change to the general configuration?	Is there a change to the principles of construction?	Have the assumptions used for certification been invalidated?	Notes
Turbojet to Turbofan	N/A	N/A	N/A	Proposed change in design is so extensive that a substantially complete investigation of compliance with the applicable certification specifications is required. Note: There may be certain circumstances where this change would be significant.
Turbo-shaft to turbo-propeller	N/A	N/A	N/A	Proposed change in design is so extensive that a substantially complete investigation of compliance with the applicable certification specifications is required. Note: There may be certain circumstances where this change would be significant.
Conventional ducted fan to unducted fan	N/A	N/A	N/A	Proposed change in design is so extensive that a substantially complete investigation of compliance with the applicable certification specifications is required. Note: There may be certain circumstances where this change would be significant.

Description of change	Is there a change to the general configuration?	Is there a change to the principles of construction?	Have the assumptions used for certification been invalidated?	Notes
Turbine engine for subsonic operation to afterburning engine for supersonic operation	N/A	N/A	N/A	Proposed change in design is so extensive that a substantially complete investigation of compliance with the applicable certification specifications is required.
Increase/decrease in the number of compressor/turbine stages with resultant change in approved limitations* (* excludes life limits)	Yes	No	Yes	Change is associated with other changes to the ratings and operating limitations; engine dynamic behaviour in terms of backbone bending, torque spike effects on casing, surge and stall characteristics, etc.
New design fan blade and fan hub, or a bladed fan disk to a blisk or a fan diameter change that could not be retrofitted	Yes	No	Yes	Change is associated with other changes to the engine thrust, ratings and operating limitations; engine dynamic behaviour in terms of backbone bending, torque spike effects on casing, foreign object ingestion behaviour, burst model protection for the aircraft. If there is a diameter change, installation will be also affected.
Hydro-Mechanical control to FADEC/EEC without hydro-mechanical backup	Yes	No	No	Change in engine control configuration. Not interchangeable. Likely fundamental

Description of change	Is there a change to the general configuration?	Is there a change to the principles of construction?	Have the assumptions used for certification been invalidated?	Notes
				change to engine operation.
A change in the containment case from hard-wall to composite construction or vice-versa, that could not be retrofitted without additional major changes to the engine or restrictions in the initial limitations in the installation manual	No	Yes	No	Change in methods of construction that have affected inherent strength, backbone bending, blade to case clearance retention, containment wave effect on installation, effect on burst model, torque spike effects.
Replace gas generator (core, turbine/compressor /combustor) with a different one that is associated with changes in approved limitations* * excludes life limits	No	No	Yes	Change is associated with other changes that would affect engine thrust/power and may affect the dynamic behaviour of the engine. Assumptions used for certification may no longer be valid.
Piston Engines				
Convert from mechanical to electronic control system	Yes	Yes	No	Change in engine configuration: Installation interface of engine changed. Changes to principles of construction: Digital controllers and sensors require new construction techniques and environmental testing.
Add turbocharger that increases performance and changes in overall	Yes	No	Yes	Change in general configuration: Installation interface of engine changed

Description of change	Is there a change to the general configuration?	Is there a change to the principles of construction?	Have the assumptions used for certification been invalidated?	Notes
product				(exhaust system). Certification assumptions invalidated: Change in operating envelope and performance.
Convert from air-cooled cylinders to liquid cooled cylinders	Yes	No	Yes	Change in general configuration: Installation interface of engine changed (cooling lines from radiator, change to cooling baffles). Certification assumptions invalidated: • Change in operating envelope and engine temperature specifications.
Convert from spark-ignition to compression-ignition	Yes	No	Yes	Change in general configuration: Installation interface of engine changed (no mixture lever). Certification assumptions invalidated: Change in operating envelope and performance.

The following are examples of **SIGNIFICANT** changes for **Engines (Part 33)**:

Description of change	Is there a change to the general configuration?	Is there a change to the principles of construction?	Have the assumptions used for certification been invalidated?	Notes
Turbine Engines				
Increase/decrease in the number of compressor/turbine stages with resultant change in approved limitations*. (* excludes life limits)	Yes	No	Yes	Change is associated with other changes to the ratings and operating limitations; engine dynamic behaviour in terms of backbone bending, torque spike effects on casing, surge and stall characteristics, etc.
New design fan blade and fan hub, or a bladed fan disk to a blisk or a fan diameter change that could not be retrofitted	Yes	No	Yes	Change is associated with other changes to the engine thrust, ratings and operating limitations; engine dynamic behaviour in terms of backbone bending, torque spike effects on casing, foreign object ingestion behaviour, burst model protection for the aircraft. If there is a diameter change, installation will be also affected.
Hydro-Mechanical control to FADEC/EEC without hydro-mechanical backup	Yes	No	No	Change in engine control configuration. Not interchangeable. Likely fundamental change to engine operation.
A change in the containment case from hard-wall to composite construction or vice-	No	Yes	No	Change in methods of construction that have affected inherent strength, backbone bending,

Description of change	Is there a change to the general configuration?	Is there a change to the principles of construction?	Have the assumptions used for certification been invalidated?	Notes
versa, that could not be retrofitted without additional major changes to the engine or restrictions in the initial limitations in the installation manual				blade to case clearance retention, containment wave effect on installation, effect on burst model, torque spike effects.
Replace gas generator (core, turbine/compressor/ combustor) with a different one that is associated with changes in approved limitations* * excludes life limits	No	No	Yes	Change is associated with other changes that would affect engine thrust/power and may affect the dynamic behaviour of the engine. Assumptions used for certification may no longer be valid
Piston Engines				
Convert from mechanical to electronic control system	Yes	Yes	No	Change in engine configuration: Installation interface of engine changed. Changes to principles of construction: Digital controllers and sensors require new construction techniques and environmental testing.
Add turbocharger that increases performance and changes in overall product	Yes	No	Yes	Change in general configuration: Installation interface of engine changed (exhaust system). Certification assumptions invalidated: Change in operating envelope and performance.

Description of change	Is there a change to the general configuration?	Is there a change to the principles of construction?	Have the assumptions used for certification been invalidated?	Notes
Convert from air-cooled cylinders to liquid cooled cylinders.	Yes	No	Yes	Change in general configuration: Installation interface of engine changed (cooling lines from radiator, change to cooling baffles). Certification assumptions invalidated: • Change in operating envelope and engine temperature specifications.
Convert from spark-ignition to compression-ignition	Yes	No	Yes	Change in general configuration: Installation interface of engine changed (no mixture lever). Certification assumptions invalidated: Change in operating envelope and performance.

The following are examples of **NOT SIGNIFICANT** changes for **Engines (Part 33)**:

Description of change	Is there a change to the general configuration?	Is there a change to the principles of construction?	Have the assumptions used for certification been invalidated?	Notes
Turbine Engines				
Change in the material from one type of metal to another type of metal of a compressor drum	No	No	No	No change in performance. Assumptions are still valid.
Increase/decrease in the number of compressor/turbine stages without	No	No	No	No change in performance. Assumptions are still

Description of change	Is there a change to the general configuration?	Is there a change to the principles of construction?	Have the assumptions used for certification been invalidated?	Notes
resultant change in performance envelope				valid.
New components internal to the FADEC/EEC the introduction of which does not change the function of the system	No	No	No	No change in configuration. Retrofitable. Assumptions used for certification are still valid. Possible changes in principles of construction are insignificant.
Software changes	No	No	No	
Rub-strip design changes	No	No	No	
A new combustor that does not change the approved limitations, or dynamic behaviour* (* excludes life limits)	No	No	No	
Bearing changes	No	No	No	
New blade designs with similar material that can be retrofitted	No	No	No	
Fan blade re-design that can be retrofitted	No	No	No	
Oil tank re-design	No	No	No	
Change from one hydro-mechanical control to another hydro-mechanical control	No	No	No	
Change to limits on life limited components	No	No	No	

Description of change	Is there a change to the general configuration?	Is there a change to the principles of construction?	Have the assumptions used for certification been invalidated?	Notes
Changes to limits on exhaust gas temperature	No	No	No	
Changes in certification maintenance requirements (CMR) with no configuration changes	No	No	No	
Bump ratings within the product's physical capabilities that may be enhanced with gas path changes such as blade re-stagger, cooling hole patterns, blade coating changes, etc.	No	No	No	
A change in principal physical properties and mechanics of load transfer of a material of primary structure or highly loaded components. For example, change from traditional metal to either an exotic alloy or a composite material on a highly loaded component	No	No	No	
Piston Engines				
A change in principal physical properties and mechanics of load transfer of a material of primary structure or highly loaded components. For example, change from traditional metal to either an exotic alloy or a composite material on a highly	No	No	No	

Description of change	Is there a change to the general configuration?	Is there a change to the principles of construction?	Have the assumptions used for certification been invalidated?	Notes
loaded component				
New or redesigned cylinder head, or valves or pistons	No	No	No	
Changes in crankshaft	No	No	No	
Changes in crankcase	No	No	No	
Changes in carburettor	No	No	No	
Changes in mechanical fuel injection system	No	No	No	
Changes in mechanical fuel injection pump	No	No	No	
Engine model change to accommodate new aeroplane installation. No change in principles of operation of major subsystems; no significant expansion in power or operating envelopes or in limitations	No	No	No	
No change in basic principles of operation, or a simple mechanical change. For example, change from dual magneto to two single magnetos on a model.	No	No	No	
Subsystem change produces no changes in base engine input parameters, and previous analysis	No	No	No	

Description of change	Is there a change to the general configuration?	Is there a change to the principles of construction?	Have the assumptions used for certification been invalidated?	Notes
can be reliably extended. For example, a change in turbocharger where induction system inlet conditions remain unchanged, or if changed, the effects can be reliably extrapolated.				
Change in material of secondary structure or not highly loaded component. For example, a change from metal to composite material in a non-highly loaded component, such as an oil pan that is not used as a mount pad.	No	No	No	
Change in material that retains the physical properties and mechanics of load transfer. For example, a change in trace elements in a metal casting for ease of pouring or to update to a newer or more readily available alloy with similar mechanical properties.	No	No	No	

Table 4: Examples of Changes for Propellers (Part 35)

The following are examples of **SUBSTANTIAL** changes for **Propellers (Part 35)**:

Description of change	Is there a change to the general configuration?	Is there a change to the principles of construction?	Have the assumptions used for certification been invalidated?	Notes
Change in the number of blades	N/A	N/A	N/A	Proposed change in design is so extensive that a substantially complete investigation of compliance with the applicable certification specifications is required.

The following are examples of **SIGNIFICANT** changes for **Propellers (Part 35)**:

Description of change	Is there a change to the general configuration?	Is there a change to the principles of construction?	Have the assumptions used for certification been invalidated?	Notes
Principle of pitch change such as a change from single acting to dual acting	Yes	Yes	Yes	Requires extensive modification of the pitch change system with the introduction of back-up systems. The inherent control system requires re-evaluation.
Introduction of a different principle of blade retention such as a single row to a dual row bearing	Yes	Yes	No	Requires extensive modification of the propeller hub and blade structure. The inherent strength requires re-evaluation.
A hub configuration change such as a split hub to a one-piece hub	Yes	Yes	No	Requires extensive modification of the propeller hub structure. The inherent strength requires re-evaluation.
Changing the	Yes	Yes	No	Requires extensive

Description of change	Is there a change to the general configuration?	Is there a change to the principles of construction?	Have the assumptions used for certification been invalidated?	Notes
method of mounting the propeller to the engine such as a spline to a flange mount				modification of the propeller hub structure. Note: Such a change could be considered not significant if implemented without a change in general configuration or principals of construction.
Change in hub material from steel to aluminium	Yes	Yes	No	Requires extensive modification of the propeller hub structure and change to method of blade retention. The inherent strength requires re-evaluation.
Change in blade material from metal to composite	Yes	Yes	Yes	Requires extensive modification of the propeller blade structure and change to method of blade retention. Composite construction methods required. The inherent strength requires re-evaluation.
Change from hydro-mechanical to electronic control	Yes	Yes	Yes	Electronic manufacturing and design methods required. Assumptions used for certification are no longer valid or were not addressed in the original certification, i.e., high intensity radio frequency (HIRF) and lightning protection, fault tolerance, software

Description of change	Is there a change to the general configuration?	Is there a change to the principles of construction?	Have the assumptions used for certification been invalidated?	Notes
				certification and other aspects. The propeller will require special conditions under 21.016.

The following are examples of **NOT SIGNIFICANT** changes for **Propellers (Part 35)**:

Description of change	Is there a change to the general configuration?	Is there a change to the principles of construction?	Have the assumptions used for certification been invalidated?	Notes
Change in the material of a blade bearing	No	No	No	
Change to a component in the control system	No	No	No	
Change to a de-icer boot	No	No	No	
Changes to the operational design envelope such as an increase in power.	No	No	No	Propeller's operating characteristics and inherent strength require re-evaluation.
Change to the intended usage such as normal to aerobatic category	No	No	No	Propeller's operating characteristics and inherent strength require re-evaluation.

Appendix B

Reserved for future use

Appendix C

Reserved for future use

Appendix D

Reserved for future use

Appendix E

Examples of major modifications

E.1 Examples of major modifications per discipline

E.1.1 The information below is intended to provide some examples of major changes per discipline. It is not intended to present a comprehensive list of all major changes. Examples are categorised by discipline and are applicable to all aircraft, engines and propellers. However, a particular change may involve more than one discipline, for example a change to engine controls may be covered in engines and systems (software).

E.1.2 Those involved with classification should always be aware of the interaction between disciplines and the consequences this will have when assessing the effects of a change (e.g. operations and structures, systems and structures, systems and systems).

E.1.3 Where in this list of examples the words ‘has effect’ or ‘affect(s)’ are used, they are to be understood as being the opposite of ‘no appreciable effect’ as in the definition of minor change in regulation 21.093. The words ‘has appreciable effect’ and ‘appreciably affect(s)’ have been used to improve readability.

E.1.4 Structure

E.1.4.1 Changes such as a cargo door cut-out, fuselage plugs, change of dihedral, addition of floats.

E.1.4.2 Changes to materials, processes or methods of manufacture of primary structural elements, such as spars, frames and critical parts.

E.1.4.3 Changes that adversely affect fatigue or damage tolerance or life limit characteristics.

E.1.4.4 Changes that adversely affect aeroelastic characteristics.

E.1.5 Cabin Safety

E.1.5.1 Changes which introduce a new cabin layout of sufficient change to require a re-assessment of emergency evacuation capability or which adversely affect other aspects of passenger or crew safety. Items to consider include, but are not limited to:

a. changes to or introduction of dynamically tested seats
b. change to the pitch between seat rows
c. change of distance between seat and adjacent obstacle like a divider
d. changes to cabin lay outs that affect evacuation path or access to exits
e. installation of new galleys, toilets, wardrobes, etc.
f. installation of new type of electrically powered galley insert
g. changes to the pressurisation control system which adversely affect previously approved limitations.

E.1.6 Flight

E.1.6.1 Changes which adversely affect the approved performance, such as high altitude operation, brake changes that affect braking performance.

E.1.6.2 Changes which adversely affect the flight envelope.

E.1.6.3 Changes which adversely affect the handling qualities of the product including changes to the flight controls function (gains adjustments, functional modification to software) or changes to the flight protection or warning system.

E.1.7 Systems

E.1.7.1 For systems assessed under FAR or CS 25.1309, the classification process is based on the functional aspects of the change and its potential effects on safety.

E.1.7.2 Where failure effect is 'Catastrophic' or 'Hazardous', the change should be classified as major.

E.1.7.3 Where failure effect is 'major', the change should be classified as major if:

a. aspects of the compliance demonstration use means that have not been previously accepted for the nature of the change to the system
b. the change affects the pilot/system interface (displays, controls, approved procedures), or
c. the change introduces new types of functions/systems such as GPS primary, TCAS, Predictive windshear, HUD.

E.1.7.4 The assessment of the criteria for software changes to systems also needs to be performed.

E.1.7.5 When software is involved, account should be taken also of the following guidelines:

a. Where a change is made to software produced in accordance with the guidelines of the latest edition of EASA AMC 20-115 (or equivalent, see EASA AMC-20 document) the change should be classified as major if any of the following apply, and the failure effect is Catastrophic, Hazardous or Major:
    i. the executable code for software, determined to be Level A or Level B in accordance with the guidelines, is changed unless that change involves only a variation of a parameter value within a range already verified for the previous certification standard
    ii. the software is upgraded to or downgraded from Level A, Level B or Level C, or
    iii. the executable code, determined to be level C, is deeply changed, e.g. after a software re-engineering process accompanying a change of processor.

E.1.7.6 For software developed to guidelines other than the latest edition of EASA AMC 20-115 (or equivalent), the applicant should assess changes in accordance with the foregoing principles.

E.1.7.7 For other codes the principles noted above may be used. However, due consideration should be given to specific certification specifications/interpretations.

E.1.7.8 A change to a system should be classified as minor where the failure effect would have no adverse safety implications of any flight operation.

E.1.7.9 For more information see FAA AC 23.1309-1, FAA AC 25.1309-1 and EASA CS-25 AMC 25.1309.

E.1.8 Propellers

E.1.8.1 Changes to:

a. diameter
b. airfoil
c. planform
d. material
e. blade retention system, etc.

E.1.9 Engines

E.1.9.1 Changes:

a. that adversely affect operating speeds, temperatures, and other limitations
b. that affect or introduce parts identified by CS E-510 or FAR 33.75 where the failure effect has been shown to be hazardous
c. that affect or introduce engine critical parts or their life limits
d. to a structural part which requires a re-substantiation of the fatigue and static load determination used during certification
e. to any part of the engine which adversely affects the existing containment capability of the structure
f. that adversely affect the fuel, oil and air systems, which alter the method of operation, or require reinvestigation against the type-certification basis
g. that introduce new materials or processes, particularly on critical components.

E.1.10 Rotors and drive systems

E.1.10.1 Changes that:

a. adversely affect fatigue evaluation unless the service life or inspection interval are unchanged. This includes changes to materials, processes or methods of manufacture of parts, such as:
    i. rotor blades
    ii. rotor hubs including dampers and controls
    iii. gears
    iv. drive shafts
    v. couplings
b. affect systems the failure of which may have hazardous or catastrophic effects. The design assessment will include:
    i. cooling system
    ii. lubrication system
    iii. rotor controls
c. adversely affect the results of the rotor drive system endurance test, the rotor drive system being defined in CS or FAR 27/29.917
d. adversely affect the results of the shafting critical speed analysis required by CS or FAR 27/29.931.

E.1.11 Environment

E.1.11.1 Where a change is made to an aircraft or aircraft engine, the effect of the change on the product's environmental characteristics should be taken into account. Examples of changes that might have an appreciable effect on the product's environmental characteristics, and might therefore be classified as a major change, are listed below. The examples are not exhaustive and will not, in every case, result in an appreciable change to the product's environmental characteristics, and therefore, will not per-se and in every case result in a major change classification.

E.1.11.2 An appreciable effect is considered to be one which exceeds the ICAO criteria for a no-acoustical change or a no-emissions change. For the definition of a no-acoustical change refer to the section of the ICAO Environmental Technical Manual, Volume I (ICAO Doc 9501, Volume I – Procedures for the Noise Certification of Aircraft) concerning changes to aircraft type designs involving no-acoustical changes (see also the definitions of a 'derived version' in ICAO Annex 16, Volume I). For the definition of a no-emissions change refer to the section of the ICAO Environmental Technical Manual, Volume II (ICAO Doc 9501, Volume II – Procedures for the Emissions Certification of Aircraft Engines) concerning no-emissions changes.

Notes:

1. Noise and emissions certification, or lack of such certification, does not directly affect a design approval under Part 21 of CASR. However, if an individual aircraft does not meet the relevant Australian requirements, then it is illegal for that aircraft to operate in Australian territory, even though the aircraft may have a valid certificate of airworthiness. If a design change would affect the existing noise or emissions certification, then recertification will be required.
2. Aircraft noise is regulated by Airservices Australia under the Air Navigation (Aircraft Noise) Regulations 1984. Aircraft emissions are regulated by the Department of Infrastructure and Transport under the Air Navigation (Aircraft Engine Emissions) Regulations. Further information regarding noise and emissions certification is available on the Airservices Australia and Department of Infrastructure and Transport websites.
3. The following examples should be considered, particularly in relation to designs intended for use in foreign countries under international agreements.

Noise

E.1.11.3 A change that introduces either:

a. an increase in the noise certification level(s), or
b. a reduction in the noise certification level(s) for which the applicant wishes to take credit.

E.1.11.4 Examples of noise-related changes that might lead to a major change classification are:

a. For jet and heavy (maximum take-off mass greater than 8618 kg) propeller-driven aeroplanes:
    i. A change that might affect the aircraft's take-off performance including:
        A. a change to the maximum take-off mass
        B. a change to V2 ('take-off safety speed'), or
        C. a change to the lift augmentation devices, including their configuration under normal take-off operating conditions.
    ii. A change that might affect the aircraft's landing performance including:
        A. a change to the maximum landing mass

B. a change to VREF (reference landing speed), or
C. a change to the lift augmentation devices, including their deployment under normal landing operating conditions.

iii. A change to the Centre of Gravity (CG) limits
iv. A change that increases the aircraft's drag
v. A change that alters the external profile of the aircraft, including the installation or change of shape or size of any item on the external surface of the aircraft that might protrude into the airflow such as winglets and vortex generators; generally the installation of small antennas does not represent an acoustical change
vi. A change that introduces an open-ended hollow cavity at more or less right angles to the airflow (e.g. hollow pins in undercarriage assemblies)
vii. A change of engine or, if fitted, propeller type
viii. A change in engine thrust rating
ix. A change to the engine rotating parts or stators, such as geometry, blade profile or blade number
x. A change to the aerodynamic flow lines through the engine
xi. A change that affects the engine thermodynamic cycle, including a change to the engine's bypass ratio
xii. A change to the engine nacelle, including a change to the acoustic liners
xiii. A change to the engine exhaust
xiv. A change to the engine bleed valves, including bleed valve scheduling
xv. A change in the operation of engine power off-takes (e.g. the operation of the Environmental Control System (ECS) during a normal take-off or approach)
xvi. A change to the Auxiliary Power Unit (APU), including associated operating limitations (e.g. a change that allows the APU to be operated during a normal approach when previously it was not allowed)
xvii. A change to the propeller pitch and/or propeller speed during a normal take-off or approach
xviii. A change that causes a change to the angle at which air flows into the propeller.

b. For light (maximum take-off mass 8618 kg or less) propeller-driven aeroplanes:
i. A change that might affect the aircraft's take-off performance including:
A. a change to the maximum take-off mass
B. a change to the take-off distance
C. a change to the rate of climb, or
D. a change to Vy (best rate of climb speed).
ii. A change that increases the aircraft's drag (e.g. the installation of external cargo pods, external fuel tanks, larger tyres to a fixed undercarriage, floats etc.)
iii. A change of engine or propeller type
iv. A change in take-off power including a change in engine speed (tachometer 'red line') or, for piston engines, a change to the manifold pressure limitations

v. A change to the highest power in the normal operating range (‘top of green arc’)
vi. In the case of an aircraft where take-off power/engine speed is time limited, a change in the period over which take-off power/engine speed may be applied
vii. A change to the engine inlet or exhaust including, if fitted, the inlet or exhaust muffler
viii. A change in propeller diameter, tip shape, blade thickness or the number of blades
ix. The installation of a variable or adjustable pitch propeller in place of a fixed pitch propeller and vice versa
x. A change that causes a change to the angle at which air flows into the propeller.

c. For helicopters:
i. A change that might affect the take-off and/or landing performance, including a change in take-off mass and VY (best rate of climb speed)
ii. A change to VNE (never-exceed airspeed) or to VH (airspeed in level flight obtained using the torque corresponding to minimum engine installed, maximum continuous power available for sea level pressure, 25°C ambient conditions at the relevant maximum certificated mass)
iii. A change to the maximum take-off engine power or maximum continuous power
iv. A change to the gearbox torque limits
v. A change of engine type
vi. A change to the engine intake or exhaust
vii. A change to the maximum normal operating rpm of the main or tail rotors
viii. A change to the main or tail rotors, including a change in diameter, blade thickness or blade tip profile.

Emissions

E.1.11.5 A change that introduces an increase or decrease in the emissions certification levels. Examples of smoke and gaseous engine emission-related changes that might lead to a major change classification are:

a. a change in engine thrust rating
b. a change to the aerodynamic flow lines through the engine
c. a change that affects the engine thermodynamic cycle, specifically relevant engine cycle parameters (e.g. combustor pressure P3, combustor entry temperature T3, Air Fuel Ratio (AFR))
d. a change to the compressor that might influence the combustor inlet conditions and engine overall pressure ratio
e. a change to the combustor design (geometry)
f. a change to the cooling of the combustor
g. a change to the air mass flow through the combustor
h. a change that affects the fuel spray characteristics.

E.1.12 Power plant Installation

E.1.12.1 Changes which include:

a. control system changes which affect the engine/propeller/airframe interface
b. new instrumentation displaying operating limits
c. modifications to the fuel system and tanks (number, size and configuration)
d. change of engine/propeller type.