

TECHNICAL GUIDANCE MATERIAL FOR CLASSIFICATION OF DESIGN CHANGES

SUBJECT: TECHNICAL GUIDANCE MATERIAL FOR CLASSIFICATION OF DESIGN CHANGES

EFFECTIVE DATE: 28 September 2021

APPLICABILITY

This Technical Guidance Material(TGM) applies to SACAA Airworthiness Engineering (AED) personnel and Approved Design Organisations (ADOs). This TGM is intended to provide guidance for classification of design changes to type certificated Aircraft, Engines or Propellers.

PURPOSE

The purpose of this technical guidance material (TGM) is to provide procedural guidelines 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.

REQUIREMENTS

Part 21 of the South African Civil Aviation Regulations provides the regulatory framework for the) for approval of major design changes to class 1 aeronautical products. This TGM therefore, provides guidance procedures for classification of design changes as “minor” or “major” when showing compliance to regulatory requirements and applicable airworthiness design standards when carrying out modification or repair projects.

Classification of design changes or repair design changes can be carried out by either the approved design organisation or the SACAA.

1. REFERENCE

It is intended that the following reference material be used in conjunction with this TGM:

- i. Part 21 of the South African Civil Aviation Regulations (CAR's) Certification Procedures for Products and Parts .
- ii. SA-CATS 21, South African Civil Aviation Technical Standards, Airworthiness Requirements.
- iii. Part 148 of the South African Civil Aviation Regulations (CAR's) Manufacturing Organisations.
- iv. SA-CATS 148, South African Civil Aviation Technical Standards, Manufacturing Organisations
- v. CAR Part 43 of the of the South African Civil Aviation Regulations CAR's
- vi. Part 147 of the CAR's, Design Organisations for Products, Parts and Appliances.
- vii. SA-CATS 147, South African Civil Aviation Technical Standards, Design Organisations;
- viii. Part 187 of the CAR's, Fees.
- ix. Part 23 of the Federal Aviation Regulations (FAR), Normal, Utility, Acrobatic and Commuter category Aeroplanes;
- x. Part 25 of the FAR, Transport Category Aeroplanes;
- xi. Part 27 of the FAR, Normal category Rotorcraft.
- xii. Part 29 of the FAR, Transport Category Rotorcraft.
- xiii. Part 33 of the FAR, Aircraft Engines.
- xiv. Part 35 of the FAR, Propellers.
- xv. Part 34 of the South African Civil Aviation Regulations (CAR's) , Aircraft Engine Emissions.

2. TERMS AND ABBREVIATIONS

TERM	DEFINITION
Aircraft	means an aircraft as defined in the CARs, including its engines, propellers, rotor, components, parts, equipment, instruments, accessories and materials
Airworthiness Standard	detailed and comprehensive airworthiness code applicable to the aircraft, aircraft engine or propeller as detailed in CAR Part 21.
State of Design	means the State which has authority over the organisation responsible for the type design of the Class I product.
Class I Product	means a complete aircraft, aircraft engine or propeller, that has been type certificated in accordance with the appropriate airworthiness requirements and for which the necessary type certificate or equivalent have been issued.
Class II product	A major component of a Class I product or an unapproved Class I product the failure of which would jeopardise the safety of a Class I product.
Class III product	A part or component which is not a class I or class II product.
Design Change	A change in the approved design of an aircraft, aircraft engine or propeller.
Major Design Change	A change that has an appreciable effect on the weight, balance, structural strength, reliability, operational characteristics, or other characteristics affecting the airworthiness of an aircraft, aircraft engine or propeller.
Minor Design Change	A change that is not a major change.
Applicant	means the applicant who is the legal entity i.e., design organization approval holder on whose behalf the application was made. This will normally be the entity to which the Classifications of design changes is issued when the certification activity is completed.

ABBREVIATION	DESCRIPTION
AD	Airworthiness Directive
AED	Airworthiness Engineering Department
AFM	Aircraft Flight Manual
CAR	Civil Aviation Regulations
C of A	Certificate of Airworthiness
DCA	Director of Civil Aviation
DOA	Design Organisation Approval
GA	General Aviation
ICA	Instructions for Continued Airworthiness
OEM	Original Equipment Manufacturer
SACAR	South African Civil Aircraft Register
SA-CATS	South African Civil Aviation Technical Standards
STC	Classifications of design changes
TC	Type Certificate

3. BACKGROUND

3.1 Introduction

- 3.1.1 SACAR Part 21 and Part 43 details the requirements for approval of design changes or repairs . Changes must be classified as either major or minor. Classification of design changes or repairs is necessary to determine the appropriate approval process and the relevance of the existing type certification basis for the approval of the change.
- 3.1.2 Changes to the data forming part of the approved type design of the aeronautical product, is considered a design change. A design change includes both modifications and repairs. It may be one or a combination of a changes that affects weight, configuration, operating envelope, performance, operating characteristics, limitations, or ICA. Design change may be a single change or a collection of changes.
- 3.1.3 A request to reclassify an initial design change may be submitted to SACAA. The request should include the reasons why the classification should be changed and data to substantiate the request.

3.2 Classifications of design changes

- 3.2.1 Design changes should be classified as either major or minor. 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.
- 3.2.2 Major modifications may be classified as not significant, significant, or substantial.
- 3.2.3 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.
- 3.2.4 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.
- 3.2.5 A substantial change is a change which is so extensive that a substantially complete investigation of compliance is required, and consequently a new TC.

3.3. Elements for major/minor classification of modifications

- 3.3.1 A change to the approved design that has an 'appreciable effect on characteristics affecting the airworthiness of the product 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, 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 SACAA

- 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
- g. where the change introduces or affects functions where the failure effect is classified catastrophic or hazardous

4. Classification of repairs design

- 4.1.1 A repair design is classified as 'major' if it has an appreciable effect on structural performance, weight, balance, systems, operational characteristics or other characteristics affecting the airworthiness of the product, part or appliance.
- 4.1.2 A repair design is classified as 'major' if it requires extensive static loads, fatigue and damage tolerance, strength justification and/or testing in its own right, or if the design methods, techniques or practices are unusual (i.e., unusual material selection, heat treatment, material processes, jiggling diagrams, etc.)
- 4.1.3 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.
- 4.1.4 Repairs whose effects are minimal or require no assessment of the original certification basis, are to be considered 'minor'.
- 4.1.5 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.

4.2 Elements to consider for major/minor repair classification

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

4.2.1 Structural performance

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.

4.2.2 Weight and balance

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.

4.2.3 Systems

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).

4.2.4 **Operational characteristics**

Changes may include:

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

4.2.5 **Other characteristics**

Changes may include:

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

5. Appendix A details examples of typical type design changes for small aeroplanes, large aeroplanes, rotorcraft, engines, and propellers, individual tabled according to the classification level of design change – substantial, significant, and not significant.

Appendix A

The classification may change due to cumulative effects and/or combinations of individual changes.

Table 1. Examples of Changes

SUBSTANTIAL 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
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.
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.
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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 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.

SIGNIFICANT CHANGES:

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.
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
Passenger to 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	Yes	No	Yes	Change in general 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.
A change in the type of material, such as	No	Yes	Yes	Change in principles of construction and

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				design from conventional practices. Likely change in design/certification assumptions.
Change involving appreciable increase in design speeds V_d , V_{mo} , V_c , or V_a	No	No	Yes	Certification assumptions invalidated. 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
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 structure	No	No	Yes	Changes in design/certification assumptions. Extensive alteration of fuel storage and handling systems.
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	No	No	Yes	Changes in design and

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				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.

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 cabin pressurisation system	No	Yes	Yes	Extensive airframe changes affecting load paths, fatigue evaluation, aero elastic characteristics, etc. Invalidates design assumptions.
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	No	No	Yes	An appreciable

aircraft's operating envelope				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.
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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 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

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
				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 CAA determination

NOT SIGNIFICANT CHANGES

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	

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 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	No	No	No	

envelope, 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.
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
Instrument Flight Rules (IFR) upgrades involving installation of components (where the original certification does not indicate that the aeroplane is not suitable as an IFR)	No	No	No	

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 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)	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
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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.
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	
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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
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. 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	

SUBSTANTIAL CHANGES: Transport Aeroplanes

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 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

SIGNIFICANT CHANGES: Transport Aeroplanes

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. 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 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 I 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	Yes	No	Yes	When it requires extensive changes to

or wing chord				wing structure, adds aircraft level systems, and requires a new AFM to address performance and flight characteristics. 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 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 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
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				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. structural strength, and fatigue analysis.
Installation of engine thrust reversers	Yes	No	Yes	

NOT SIGNIFICANT CHANGES: Transport Aeroplanes

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 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 autopilot may include extensive changes and design features which change the assumptions for certification (i.e. installation of the autopilot 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.
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
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 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 supplied electricity, and air-conditioning. In this case, the APU would be an option to be independent of airport

SUBSTANTIAL CHANGES: Rotorcraft

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

SIGNIFICANT CHANGES: Rotorcraft

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	Yes	Yes	Yes	May be a substantial change depending

or reduction of the number of engines; e.g., from twin to single				upon project details.
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 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 sufficiently to invalidate the certification assumptions	Yes	No	Yes	
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	
Change tail anti-torque device (e.g., tail rotor, ducted fan or other technology)	Yes	Yes	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
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	

NOT SIGNIFICANT CHANGES :Rotorcraft

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.
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

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
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 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 components to replace existing components	No	No	No	Not a rotorcraft level change.

SIGNIFICANT CHANGES: Engines

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-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

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
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.
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.

NOT SIGNIFICANT CHANGES: Engines

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 resultant change in performance envelope	No	No	No	No change in performance. Assumptions are still 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. Retrofittable. Assumptions used for certification are still valid. Possible changes in principles of construction are insignificant.
Software changes	No	No	No	
Sub-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	No	No	No	

with similar material that can be retrofitted				
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	
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	

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
Piston Engines				
A change in principal physical properties and mechanics of load	No	No	No	

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				
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	

SUBSTANTIAL CHANGES : Propellers

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.

SIGNIFICANT CHANGES : Propellers

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	Notes



			been invalidated?	
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 method of mounting the propeller to the engine such as a spline to a flange mount	Yes	Yes	No	Requires extensive 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.


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 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 certification and other aspects. The propeller will require special conditions under 21.016.
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NOT SIGNIFICANT CHANGES: Propellers

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.

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