

Advisory Circular

APPROVAL REQUIREMENTS FOR MODIFICATIONS AND REPAIRS

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1. **GENERAL.** Pursuant to paragraph 88B of the Air Navigation Order, the Director General of the Civil Aviation Authority of Singapore (DGCA) may, from time to time, issue advisory circulars (ACs) on any aspect of safety in civil aviation. This AC contains information about standards, practices and procedures acceptable to CAAS. The revision number of the AC is indicated in parenthesis in the suffix of the AC number.
2. **PURPOSE.** This AC is issued to provide additional guidance and explanation to comply with the Singapore Airworthiness Requirements Part-21 (SAR-21) pertaining to:
 - Approval requirement of Major and Minor modifications
 - Approval requirement of Major and Minor repairs
 - Classification of Major and Minor with respect to modifications and repairs
3. **APPLICABILITY.** This AC applies to Singapore Air Operators and CAAS approved SAR-21 Design Organisations, CAAS approved SAR Part-145 Approved Maintenance Organisations and applicants intending to hold CAAS approvals.
4. **CANCELLATION.** This AC supersedes AC 21-1(2) dated 17 August 2016.
5. **EFFECTIVE DATE.** This AC is effective from 16 January 2018.
6. **REFERENCES.**
 - Air Navigation Order (ANO); and
 - Singapore Airworthiness Requirements (SAR) Part-21.
7. **BACKGROUND.**
 - 7.1 The SAR-21 contains the regulatory requirements for the approval of design and production organisations and the certification requirements for a new, a design change or a repair on aircraft, aircraft component or aircraft material. The requirements for approval of modifications (design change) and repairs to a product or article are contained under different subparts of SAR-21 as follows:
 - (a) SAR-21 Subpart C, Supplemental Type Certificates, contains the requirements for the modification approval of a product;

- (b) SAR-21 Subpart E, Singapore Technical Standard Order (STSO) Certificate of Approval, contains the requirements for the approval of a STSO article;
- (c) SAR -21 Subpart F, Repairs, contains the requirements for repair approval of a product or an article.

8. ACCEPTABLE DATA FOR MAJOR AND MINOR MODIFICATIONS/ REPAIRS.

8.1 Subparts C and F of the SAR-21 provides requirements for obtaining CAAS' approval for the use of data for modifications and repairs respectively. Within these subparts, it also states that CAAS' approval is not required if the data are acceptable under SAR Part-21.117.

8.2 Under SAR Part-21.117, a person may use data, in support of a design change or repair on a product or article, regardless of major or minor classification, if such data meets one of the following criteria below: -

- (a) Approved by the Federal Aviation Administration (FAA) under the scope of an agreement between CAAS and FAA; or
- (b) Approved by the European Aviation Safety Agency (EASA) under the scope of an arrangement between CAAS and EASA; or
- (c) Issued by a holder of a FAA's type certificate and CAAS' letter of type acceptance; or
- (d) Approved by a holder of an EASA's type certificate and CAAS' letter of type acceptance.

8.3 The following are examples of acceptable data under SAR-21.117:

For modifications (design changes)

- (a) Data for a design change¹ (i.e. Service Bulletin, Modification Instruction, etc) approved by a holder of a:
 - i. EASA or FAA type certificate who is also holding a CAAS letter of type acceptance, except in the case where the design change leads to the re-issuance of the type certificate (in the case of a variant of a product) and is to be reviewed under Subpart B of the SAR-21; or
 - ii. FAA or EASA Supplemental Type Certificate that is validated by CAAS, except in the case where there is a significant/major design change that resulted in an amended Supplemental Type Certificate and may require approval under Subpart C of the SAR-21.
- (b) Data for a design change approved by EASA where EASA is the Competent Authority representing the State of Design of the product (i.e. EASA approval on modifications for Airbus aircraft or Rolls-Royce engines), except in the case of a supplement type certificate;

For repairs

- (c) Data for a repair issued by:-
 - i. A holder of a FAA type certificate who is also holding a CAAS letter of type acceptance (i.e. Boeing or Pratt & Whitney);
 - ii. A holder of a FAA Supplemental Type Certificate that is validated by CAAS;
 - iii. A holder of a FAA Technical Standard Order Authorisation that is validated by CAAS;

¹ Although the data are acceptable, CAAS may request to witness conformity and compliance demonstrations during the installation on a Singapore registered aircraft and, in the case of a major change on cabin interior, CAAS may request a cabin interior inspection report. In addition, CAAS may request for demonstration compliance against any specific certification requirements applicable under Singapore legislation.

- iv. A holder of a FAA Organisation Designation Authorisation; and
- v. A FAA Designated Engineering Representative.

For all major repairs, the FAA approved design data must be supported with applicable FAA approval forms such as the FAA 8110-3, 8100-9, or Form 337 (block 3).

- (d) Data for a repair approved by:
 - i. EASA where EASA is the Competent Authority representing the State of Design of the product (i.e. EASA approval on repairs for Airbus aircraft or Rolls-Royce engines);
 - ii. A holder of an EASA type certificate for a product where such type certificate was accepted by CAAS under a letter of type acceptance (i.e. data for repair issued by Airbus for a repair on an Airbus aircraft; or data for a repair issued by Rolls-Royce for a Rolls-Royce engine, etc); or
 - iii. A holder of an EASA Supplemental Type Certificate (STC), and that STC is validated by CAAS.
- (e) Data for a minor repair that is :
 - i. approved by the original equipment manufacturer (OEM) holding a design organisation approval issued by EASA for repair on an article that was included as part of the EASA type certification, and that such type certificate was accepted by CAAS under a letter of type acceptance; or
 - ii. issued by the OEM holding a design approval issued by the FAA for a repair on an article that were included as part of the FAA type certification, and that such type certificate was accepted by CAAS under a letter of type acceptance.

8.4 For the use of data not fulfilling the criteria of SAR-21.117, CAAS approval is required under SAR-21 Subpart C or Subpart F.

9. APPROVAL REQUIREMENT FOR MAJOR AND MINOR MODIFICATIONS OR REPAIRS

Modifications to products

- 9.1 Unless the data is acceptable under SAR-21.117, the data for a:
- (a) major change to a product is to be approved under Subpart C (Supplemental Type Certificates) of the SAR-21;
 - (b) minor change to a product is to be approved by the CAAS or a holder of a SAR-21 Design Organisation Approval with the appropriate scope of approval.

Modifications to be carried out to a Singapore Technical Standard Order (STSO) article approved under Subpart E of the SAR-21

- 9.3 Design change which is classified as major that requires a complete investigation to determine its compliance with a STSO will require a new approval from CAAS under Subpart E of the SAR-21.
- 9.4 Design change which is classified as minor after STSO certificate of approval has been granted does not require a new application for approval but the STSO approval holder must notify CAAS within 6 months after making the minor change and preferably before shipment of the article.

Repairs to products or articles

- 9.5 Unless the data is acceptable under SAR-21.117, the data for a:
- (a) major repair to a product or article is to be approved under Subpart F of the SAR-21;
 - (b) minor repair to a product or article is to be approved by CAAS, or a holder of a SAR-21 Design Organisation Approval with the appropriate scope of approval.

Repairs to be carried out to a Singapore Technical Standard Order (STSO) article approved under Subpart E of SAR-21

- 9.6 An article that is produced under a STSO Certificate of approval is subject to specific requirements under Subpart E of the SAR-21. A repair to such an article should be carried out in accordance with that Subpart. Notwithstanding the aforementioned, a person may carry out a repair to an aircraft that may affect a STSO article in accordance to Subpart F of the SAR-21. In this case the repair is identified as a repair to an aircraft and not a repair to a STSO article.

Classification of major or minor modification/repair

- 9.7 For the purpose of approving a minor design change and repair within its scope of approval, a holder of a SAR-21 Design Organisation Approval is to establish procedures and processes to determine whether the change and repair is major or minor. Further guidance can be found in **Appendix A** and **Appendix B** of this AC.

APPENDIX A

CRITERIA FOR THE CLASSIFICATION OF MAJOR AND MINOR MODIFICATIONS

The following criteria can be used to determine whether a modification is major or minor. For each issue, it must be determined whether or not the proposed change will appreciably affect the aircraft. The questions require a "yes" or "no" responses. An affirmative answer to any individual question indicates that the changes should be classified as major.

Organisations are encouraged to develop their own internal checklist to determine the major and minor classifications in view of its scope of approval. When there is a doubt to the classification of change, CAAS should be consulted for clarification via their CAAS' point of contact.

Criteria for the classification of major and minor modifications			
Instruction: Insert a tick () if the criteria is Yes or No. If the criteria is not applicable, fill in "NA".			
No	Criteria	Yes	No
1	General		
	a) Is the change being accomplished as an alternative means of compliance with an airworthiness directive or equivalent?		
	b) Does the change affect type approval status?		
2	Mass and balance		
	a) Does the change involve a revision in the approved mass limitations or centre of gravity range limits?		
	b) Does the change require the installation of ballast or use of other methods to maintain the centre of gravity within the approved limits?		
3	Performance and flight characteristics		
	Does the change involve alterations to the configuration of the aircraft which may:		
	a) increase drag;		
	b) alter the thrust or power;		
	c) affect stability or controllability;		
	d) induce flutter or vibration; or		
	e) alter the stalling characteristics to an extent which necessitates analysis or test?		
4	Structural strength		
	a) Does the change involve a principal component of the aircraft structure such as a frame, stringer, rib, spar or stressed skin?		
	b) Does the change involve a structural element which is addressed as part of a damage tolerance or fatigue/failsafe evaluation?		
	c) Is a pressure vessel penetration or change involved?		
	d) Does the change involve the installation of an item of mass necessitating structural re-evaluation?		
	e) Does the change involve the installation or alteration of a containment or restraint system intended for the stowage of items of significant mass?		
	f) Does the change involve modifications to the load-bearing structure of seats, harnesses or their means of attachment or any other occupant restraint equipment?		
	g) Does the change involve the substitution of materials?		
5	Engine operation		
	a) Does the change significantly affect the engine or propeller or their accessories?		
6	Other qualities affecting airworthiness		
	a) Does the change involve equipment for which there is no performance standard which has been approved or accepted by the airworthiness authority?		

	b) Does the change affect the probability of failure conditions that could impair or preclude continued safe flight or landing?		
	c) Does the change affect the pilot's visibility or impair the pilot's capability to control the aircraft?		
	d) Does the change involve alterations to the interior arrangement or cabin materials?		
	e) Does the change involve systems for cabin pressurization or the provision of breathing oxygen?		
	f) Does the change involve flight controls or autopilot functions of the aircraft?		
	g) Does the change involve critical- or essential components of the electrical system such as generators, alternators, inverters, batteries, distribution buses, or bus protection and control devices?		
	h) Does the change affect instruments or indicators or their subsystems that provide navigation information?		
	i) Does the change affect instruments, indicators or their subsystems that provide essential or critical information concerning the aircraft status?		
	j) Does the change affect a regulated placard?		
	k) Does the change affect any approved information contained in the flight manual or relevant document?		
	l) Does the change alters the airworthiness limitations or the operating limitations?		
	m) Does the change requires an adjustment of the type-certification basis (such as special condition, equivalent safety finding, earlier certification specification, etc)?		
	n) Is the demonstration of compliance using methods that have not been previously accepted as appropriate for the nature of the change to the product or for similar changes to other product designed?		
	o) Do the change introduces or affects functions where the failure effect is classified catastrophic or hazardous		
7	Other qualities affecting environmental characteristics		
	a) Does the change alter the aircraft noise or emission characteristics?		
8	Non-standard practices		
	a) Does the change involve practices or techniques which are novel or unproven in the proposed application?		
9	Software criticality		
	a) Does the change have a significant impact on flight operation?		

Note: Criteria stated above should vary according to the scope of approval. The considerations should not be limited to those stated above but it must cover the areas as defined in the major modification's definition.

APPENDIX B

CRITERIA FOR THE CLASSIFICATION OF MAJOR AND MINOR REPAIRS

The following criteria can be used to determine whether a repair is major or minor. For the repair proposed, considerations must also be taken whether or not the repair will appreciably affect the other systems. The questions require a "yes" or "no" responses. An affirmative answer to any individual question indicates that the repair should be classified as major.

Organisations are encouraged to develop their own internal checklist to determine the major and minor classifications in view of its scope of approval. When there is a doubt to the classification of change, CAAS should be consulted for clarification via their CAAS' point of contact.

Criteria for the classification of major and minor repairs			
Instruction: Insert a tick () if the criteria is Yes or No. If the criteria is not applicable, fill in "NA".			
No	Criteria	Yes	No
1	General		
	a) Does the repair requires a re-assessment and re-evaluation of the original certification substantiation data to ensure that the aircraft still complies with all the relevant requirements?		
2	Mass and balance		
	a) Does the repair involve a revision in the approved mass limitations or centre of gravity range limits?		
3	Performance and flight characteristics		
	a) Will the repair affect the configuration of the aircraft in terms of stall characteristics, handling qualities, vibrations, aircraft performance and drag?		
4	Structural strength		
	a) Does the repair requires a re-work of the principal component of the aircraft structure (i.e. frame, stinger, rib, spar or stress skin) that necessitates a re-evaluation of the damage tolerance and fatigue analysis and/or testing or it needs methods, techniques or practices that are unusual?		
	b) Does the repair affect a life limited or critical part?		
	c) Does the repair requires a re-work of the load-bearing structure of seats, harness or their means of attachment or any other occupant restraint equipment?		
	d) Will the repair change the load path and/or load sharing?		
5	Other qualities affecting airworthiness or environmental characteristics		
	a) Does the repair have an impact on the operation of the aircraft or other associated systems, including the effect on system redundancy?		
	b) Does the repair significantly affect the engine or propeller or their accessories?		
	c) Does the repair requires a re-work or re-routing of the critical or essential components of the electrical system?		
	d) Does the repair has a change to noise and emissions of the aircraft?		
	e) Does the repair change the fire protection or resistance?		

Note: Criteria stated above should vary according to the scope of approval. The considerations should not be limited to those stated above but it must cover the areas as defined in the major repair's definition.