

RA 5865 – Repairs (MRP Part 21 Subpart M)

Rationale

During the design and development of Air Systems, consideration will be given to the possible need for Repairs. It is important that only approved organizations undertake the design of such Repairs. Failure to correctly control the Repair process may result in unforeseen outcomes. Design Organizations (DO) whose terms of Approval covers the classification or the design of Repairs are subject to certain obligations relating to those Approvals.

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Regulation 5865(1)

Scope (MRP Part 21.A.431A)

5865(1) The term “Repair” **shall** be understood to mean the elimination of damage and / or restoration to an airworthy condition and approved configuration.

The elimination of damage by replacement of Parts or Appliances without the necessity for design activity **shall** be considered as a Maintenance task and therefore require no approval under this Regulation.

Acceptable Means of Compliance 5865(1)

Scope (MRP Part 21.A.431A)

1. Standard Repairs that follow design data published in the Instructions for Sustaining Type Airworthiness (ISTA)¹, containing acceptable methods, techniques and practices for carrying out and identifying standard Repairs, **should** require no additional approval under this Regulation.

Guidance Material 5865(1)

Scope (MRP Part 21.A.431A)

2. Nil.

Regulation 5865(2)

Demonstration of Capability (MRP Part 21.A.432B)

5865(2) The Type Airworthiness Authority (TAA) or Commodity Chief Engineer (CE) **shall** ensure that the DO holds an extant approval from the MAA under the Design Approved Organization Scheme (DAOS) covering the relevant scope of activities².

¹ Refer to RA 5815 – Instructions for Sustaining Type Airworthiness.

² Refer to RA 5850 – Military Design Approved Organization (MRP Part 21 Subpart J).

Acceptable Means of Compliance 5865(2)

Demonstration of Capability (MRP Part 21.A.432B)

3. For Civilian-Owned / Civilian Operated Air Systems the Air System Sponsor has the opportunity to split Type Airworthiness (TAW) responsibility, with regards to Repairs, between the TAA and a Type Airworthiness Manager (TAM), the TAA ►will◀ provide advice to the Sponsor on the most appropriate split of TAW Repair Responsibilities³, noting that a TAM **should not** authorize major Repairs.
4. The TAA or Commodity CE **should** enable a direct interface between the Product, Part, Appliance, Airborne Equipment and Air Launched Weapons DO and the DO designing the Repair for the availability of appropriate Design Records and the timely provision of Design advice when requested by the DO designing the Repair.
5. The DO **should** have the appropriate Design Records and staff to Design and conduct airworthy Repair schemes.

Guidance Material 5865(2)

Demonstration of Capability (MRP Part 21.A.432B)

6. Nil.

Regulation 5865(3)

Classification of Repairs (MRP Part 21.A.435)

- 5865(3) A Repair **shall** be classified major or minor either by the TAA or by a privileged DO ►within its scope as recorded in its terms of Approval◀⁴.

Acceptable Means of Compliance 5865(3)

Classification of Repairs (MRP Part 21.A.435)

7. A new repair **should** be classified as major if the result on the approved Type 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.
8. A Repair **should** be 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 (ie unusual material selection, heat treatment, material processes, jiggling diagrams, etc).
9. Repairs that require a re-assessment and re-evaluation of the original certification substantiation data to ensure that the Air System still complies with all the relevant requirements **should** be considered major Repairs.
10. ►DOs without privileges◀ **should** provide a recommended classification, with supporting justification, to the TAA for all ►◀ Repairs.
11. For major Repairs, the TAA **should** consider if a Change to the Type Design⁵ is a better solution than repairing the Air System.

Guidance Material 5865(3)

Classification of Repairs (MRP Part 21.A.435)

Clarification of the term's major / minor

12. It is understood that not all the Certification substantiation data will be available to those persons / organizations 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.

³ Where the Air System is not UK MOD-owned, Type Airworthiness (TAW) management regulatory responsibility by either the TAA or TAM needs to be agreed within the Sponsor's approved model; refer to RA 1162 – Air Safety Governance Arrangements for Civilian Operated (Development) and (In-Service) Air Systems, or refer to RA 1163 – Air Safety Governance Arrangements for Special Case Flying Air Systems. Dependant on the agreed delegation of TAW responsibilities TAM may be read in place of TAA as appropriate throughout this RA.

⁴ ►For the scope of DO privileges, and the invoking of privileges refer to◀ RA 5850 – Military Design Approved Organization (MRP Part 21 Subpart J).

⁵ Refer to RA 5820 – Changes in Type Design.

**Guidance
Material
5865(3)**

Airworthiness concerns for major / minor classification

13. The following ►need◄ to be considered for the significance of their effect when classifying Repairs. If the effect is considered to be significant then the Repair ►will◄ be classified major. The Repair may be classified as minor where the effect is known to be without appreciable consequence. Considerations for classifying Repairs major / minor are not limited to those listed below:

- a. **Structural performance.** Structural performance of the product includes static strength, fatigue, damage tolerance, flutter and stiffness characteristics. Repairs to any element of the structure ►need◄ to be assessed for their effect upon the structural performance.
- b. **Weight and Moment.** The weight of the Repair may have a greater effect upon smaller Air Systems as opposed to larger Air System's. The effects to be considered are related to overall Centre of Gravity (CofG) and 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.
- c. **Systems.** Repairs to any elements of a System ►need◄ to 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 are also to be considered as above, (for example: airframe Repair in the area of a static port).
- d. **Operational characteristics** Changes may include:
 - (1) Stall characteristics.
 - (2) Handling.
 - (3) Performance and drag.
 - (4) Vibration.
- e. **Other characteristics**
 - (1) Changes to load path and load sharing.
 - (2) Change to noise and emissions.
 - (3) Fire protection / resistance.

14. Examples of major Repairs:

- a. A Repair that requires a permanent additional inspection to the approved Maintenance schedule, necessary to ensure the TAw of the product.
- b. A Repair to life limited or critical parts.
- c. A Repair that introduces a change to the Aircraft Flight Manual⁶.

Note:

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 TAw do not cause classification as major of the associated Repair.

**Regulation
5865(4)**

Repair Design (MRP Part 21.A.433)

5865(4) The applicant for approval of a Repair Design shall demonstrate its compliance with the Type Certification Basis (TCB) plus any amendments to the TCB.

⁶ The Aircraft Flight Manual contains the limitations within which the Air System ►will◄ be considered airworthy, and instructions and information necessary to the flight crew for the safe operation of the Air System ie the Aircrew Manual in military terms.

**Acceptable
Means of
Compliance
5865(4)****Repair Design (MRP Part 21.A.433)**

15. A Repair to a (European) Technical Standard Order ((E)TSO)⁷ article **should** be treated as a change to the (E)TSO design and ►will◄ be processed in accordance with (iaw) the issuing authority procedures.

16. The applicant for approval of a Repair design **should** submit all necessary substantiation data (eg analysis, calculations or tests) to the TAA⁸.

17. The TAA **should** consider the implications of a Repair scheme embodied that does not restore static strength, stiffness, fatigue life, functionality and Airworthiness to the original design levels, in order that consideration can be given to the need for an amendment to the Air System Release To Service (RTS).

18. Any Repair not meeting design limitations **should** be recorded and agreed with the TAA.

Repair schemes

19. The DO **should** respect any extant design limits and comply with the following requirements:

a. The DO **should** notify the TAA where an RTS limitation may be necessary following the incorporation of an approved Repair scheme.

b. Where there is a Repair, any limitations prescribed by the Air System DO or TAA for structure, aerodynamics, weight, CofG, and Systems (including software) **should** be respected. Designs **should not** transgress such limitations without the written technical agreement of the Air System DO for the Air System concerned.

c. Arrangements **should** exist for all Repair schemes, where technical advice or written technical agreement is required, as defined by paragraph 19b above, to be passed to the Air System DO. The Air System DO **should** provide advice as to whether or not the proposed Repair transgresses the prescribed design limitations.

d. The DO **should** seek the written approval of the TAA to design any Repair where the Air System DO advise that prescribed design limitations will be transgressed.

20. In designing Air System Repairs the DO **should** comply with the following requirements:

a. The Air System DO **should** be consulted by the DO designing the Repair when there is no valid precedent, principle, DO Repair Instruction or sufficient evidence to prove restoration with the TCB.

b. A complete list of all Repair schemes, and consequently changes to the Air System build standard, **should** be forwarded to the TAA for the Air System affected, for configuration management purposes and Maintenance of any Design Records.

c. Consideration **should** be given to whether the approved Repair scheme has a sufficiently wide application to be included in the ISTA¹.

21. Repair schemes **should** individually identify the designing DO.

Repair Design substantiation data

22. Relevant substantiation data associated with the design of a new major Repair and record keeping **should** include:

a. Damage identification and reporting source.

b. Major Repair design approval sheet identifying applicable specifications and references of justifications.

c. Repair drawing and / or instructions and scheme identifier.

⁷ The (E)TSO abbreviation **should** be taken to mean a TSO from the USA or a European TSO.

⁸ Note not applicable for minor Repairs approved under privilege.

Acceptable Means of Compliance 5865(4)

- d. Correspondence with the TAA, DO or (E)TSO approval holder, if its advice on the design has been sought.
 - e. Structural justification (static strength, fatigue, damage tolerance, flutter etc) or references to this data.
 - f. Effect on the Air System, engines and / or Systems (performance, flight handling, etc as appropriate).
 - g. Effect on the Maintenance schedule.
 - h. Effect on Airworthiness limitations, the Flight Manual and the Operating Manual.
 - i. Weight and balance change.
 - j. Special test requirements.
23. Relevant minor Repair documentation **should** include paragraphs 22a and 22c. Other points of paragraph 22 **should** be included where necessary. If the Repair is outside the approved Type Design, justification for classification **should** be provided.

Guidance Material 5865(4)

Repair Design (MRP Part 21.A.433)

24. The term 'Repair scheme' will be taken to include 'Repair instructions'.
25. When manuals and other instructions for TAw are as approved, they may be used by operators without further approval to cope with anticipated In-Service problems arising from normal usage provided that they are used strictly for the purpose for which they have been developed.

Repair schemes

26. Repair schemes which restore the original structural designer's intent inherently meet the full load spectrum of the Air System design. A Repair scheme is not a Modification and therefore a full Safety Assessment (SA), iaw Defence Standard (Def Stan) 00-056⁹, is not required in order to substantiate the Repair's Structural Integrity (SI) and Airworthiness.
27. A list of DO approved Repair schemes which have not been included in the ISTA will be retained in a master list forming part of the Design Records.

Regulation 5865(5)

Issue of a Repair Design Approval (MRP Part 21.A.435)

- 5865(5) The TAA **shall** ensure that the Repair design complies with the applicable TCB prior to approval.

Acceptable Means of Compliance 5865(5)

Issue of a Repair Design Approval (MRP Part 21.A.435)

28. The approval for major Repair designs **should** be issued only:
- a. By the TAA.
 - b. For minor Repairs by the TAA or by an appropriately privileged DO.
29. In order for the TAA to approve Repair designs the following **should** be applicable:
- a. The TCB for the Product, Part or Appliance to be repaired has been identified together with all other relevant requirements.
 - b. All records and substantiation data including documents showing compliance with all relevant Certification Specifications are held for review by the MAA.
30. All major Repairs **should** be accompanied with a Certificate of Design (CofD) and installation instructions¹⁰.

⁹ Refer to Def Stan 00 – 056 – Safety Management Requirements for Defence Systems.

¹⁰ Note: A minor Repair has no appreciable effect on Airworthiness as it is returning the item to the approved certification basis, a CofD will not be required for a minor Repair.

**Acceptable
Means of
Compliance
5865(5)**

31. A summary list of all Repair approvals **should** be provided to the TAA on a regular basis as agreed.

Air Systems Type Certified by the MAA

32. The TAA **should** seek MAA approval in cases of major Repairs proposed by DO approval holders, if the major Repair is:
- Related to new interpretation of the Certification Specifications as used for Type Certification.
 - Related to different means of compliance from that used for Type Certification.
 - Related to the application of Certification Specifications different from that used for Type Certification.

**Guidance
Material
5865(5)**

Issue of a Repair Design Approval (MRP Part 21.A.435)

33. **Approval by DO.** Approval of Repairs through the use of privileges invoked by the TAA¹, means an approval issued by the DO without requiring TAA involvement. The MAA will monitor application of this procedure within the surveillance plan for the relevant organization. When the organization exercises this privilege, the Repair release documentation ►will◀ clearly state that the privilege has been identified under their DAOS approval.

34. **Previously approved data for other applications.** When it is intended to use previously approved data for other applications, it is expected that applicability and effectiveness would be checked with an appropriately approved DO. After damage identification, if a Repair solution exists in the available approved data, and if the application of this solution to the identified damage remains justified by the previous approved Repair design, (structural justifications still valid, possible Airworthiness limitations unchanged), the solution can be considered approved and can be used again.

35. **Temporary Repairs.** These are Repairs that are life limited, to be removed and replaced by a permanent Repair after a limited service period. These Repairs ►will◀ be classified under RA 5865(3) and the service period defined at the approval of the Repair and recorded in the Technical Log.

36. **Fatigue and damage tolerance.** When the repaired Product is released into service before the fatigue and damage tolerance evaluation has been completed, the release ►will◀ be for a limited period, defined at the issue of the Repair.

**Regulation
5865(6)**

Production of Repair Parts (MRP Part 21.A.439)

- 5865(6) Parts and Appliances to be used for the Repair **shall** be manufactured iaw production data based upon all the necessary Design data as provided by the DO:
- By an appropriately recognized¹¹ Production Organization (PO); or
 - By an Approved Maintenance Organization (AMO)¹², or a Military Maintenance Organization (MMO)¹³.

**Acceptable
Means of
Compliance
5865(6)**

Production of Repair Parts (MRP Part 21.A.439)

37. Parts or Appliances used for the Repair **should** be appropriately marked¹⁴.

¹¹ Refer to RA 5835 – Production Organizations (MRP Part 21 Subpart G).

¹² Refer to RA 4800 to RA 4821 (MRP Part 145).

¹³ Refer to RA 4809 – Acceptance of Components (MRP 145.A.42).

¹⁴ Refer to RA 5885 – Identification of Products, Parts and Appliances (MRP Part 21 Subpart Q).

**Guidance
Material
5865(6)**

Production of Repair Parts (MRP Part 21.A.439)

38. Nil.

**Regulation
5865(7)**

Repair Embodiment (MRP Part 21.A.441)

5865(7) The embodiment of a Repair **shall** be made:

- a. By an appropriately recognized¹¹ PO; or
- b. By an AMO¹⁵ or MMO using the necessary installation instructions issued by the TAA or a privileged DO¹⁶.

**Acceptable
Means of
Compliance
5865(7)**

Repair Embodiment (MRP Part 21.A.441)

39. The TAA or a privileged DO **should** transmit to the organization performing the Repair all the necessary installation instructions.

**Guidance
Material
5865(7)**

Repair Embodiment (MRP Part 21.A.441)

40. Nil.

**Regulation
5865(8)**

Limitations (MRP Part 21.A.443)

5865(8) The instructions and any limitations for a Repair design **shall** be submitted by the Repair design approval holder to the TAA.

**Acceptable
Means of
Compliance
5865(8)**

Limitations (MRP Part 21.A.443)

41. Any limitations associated with major Repairs **should** be identified in the CofD¹⁷.

**Guidance
Material
5865(8)**

Limitations (MRP Part 21.A.443)

42. Nil.

**Regulation
5865(9)**

Unrepaired Damage (MRP Part 21.A.445)

5865(9) When a damaged Product, Part or Appliance is left unrepaired and is not covered by previously approved data, the TAA or a privileged DO **shall** approve its continued use.

**Acceptable
Means of
Compliance
5865(9)**

Unrepaired Damage (MRP Part 21.A.445)

43. When the DO evaluates the unrepaired damage for its Airworthiness consequences, they **should** inform the TAA.

44. When the organization evaluating the unrepaired damage is neither the TAA nor the DO, this organization **should** justify that the information on which the evaluation is based is adequate either from its own resources or through an arrangement with the original DO.

45. The TAA **should** evaluate the unrepaired damage for Airworthiness consequences. ►If the TAA is◄ in any doubt, ►they◄ **should** consult with the DO.

¹⁵ Appropriately approved iaw RA 4800 – RA 4821 (MRP Part 145).

¹⁶ Where there is a Continuing Airworthiness Management Organization, these instructions ►need◄ to be transmitted through them to the AMO or MMO.

¹⁷ Refer to RA 5103 – Certificate of Design.

**Guidance
Material
5865(9)****Unrepaired Damage (MRP Part 21.A.445)**

46. This is not intended to supersede the normal Maintenance practices defined by the DO, (eg blending out corrosion and re-protection, stop drilling cracks, etc), but addresses specific cases not covered in the ISTA.

47. A damaged Product, Part or Appliance that is left unrepaired can be approved for its continued use by a TAA.

**Regulation
5865(10)****Record Keeping (MRP Part 21.A.447)**

5865(10) For each Repair, all relevant design information, drawings, test reports, instructions and limitations issued iaw RA 5865, justification for classification and evidence of the Repair design approval, **shall**:

a. Be held by the Repair design approval holder at the disposal of the TAA.

b. Be retained by the Repair design approval holder in order to provide the information necessary to ensure the TAA of the repaired Products, Parts or Appliances.

**Acceptable
Means of
Compliance
5865(10)****Record Keeping (MRP Part 21.A.447)**

48. Nil.

**Guidance
Material
5865(10)****Record Keeping (MRP Part 21.A.447)**

49. Nil.