AEROSPACE RECOMMENDED PRACTICE

ARP6448™	REV. A
Issued 2012-06 Revised 2021-10 Superseding ARP6448	

(R) Gaining Approval for Seats with Integrated Electronics in Accordance with AC 21-49 Section 7.b

RATIONALE

The FAA issued AC 21-49, which provides guidance on methods for approving passenger seats with integrated electronics. The seat industry required a recognized means of documenting the processes required to enact the business changes required by this AC. This SAE Aerospace Recommended Practice (ARP) captures an acceptable means by which data can be exchanged between all parties when following Section 7.b of AC 21-49.

Revision A is a general update/reorganization of ARP6448 and its appendices for clarity and to improve accuracy; the procedures and agreements used for data exchange between the seat suppliers, TC/ATC/STC applicant/holder, electronics manufacturers, and the customers have not changed. This revision provides more succinct instructions on implementation of TSO holder—electronics manufacturer data exchange agreements and change approval delegation. Appendix A, which defines key characteristics of change types, is updated with improved direction for assessing change impact with respect to the TSO attributes listed in Table 1 of AC 21-49. Appendix B is updated to include Figure B6, which is a flowchart for design change submittal and approval process using the EMNOC form. Appendix C is updated to clarify the process for delegation from the seat supplier to the electronics manufacturer. Appendix D is added to provide an example of a working together agreement (WTA). References to Section 9 of AC 21-49 are added where appropriate to ensure that the effects of changes to electronic components are evaluated at the aircraft installation level in addition to ensuring TSO MPS are not affected by the change.

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https://www.sae.org/standards/content/ARP6448A

1. SCOPE

This SAE Aerospace Recommended Practice (ARP) provides a framework for establishing methods and stakeholder responsibilities to ensure that seats with integrated electronic components (e.g., actuation system, reading light, inflatable restraint, inflight entertainment equipment, etc.) meet the seat TSO minimum performance standard. These agreements will allow seat suppliers to build and ship TSO-approved seats with integrated electronic components. The document presents the roles and accountabilities of the electronics manufacturer (EM), the seat supplier, and the TC/ATC/STC applicant/holder in the context of AC 21-49 Section 7.b ("Type Certification Using TSO-Approved Seat with Electronic Components Defined in TSO Design"). This document applies to all FAA seat TSOs C39( ), C127( ), etc.

The document defines the roles and responsibilities of each party involved in the procurement of electronics, their integration on a TSO-approved seat, and the seat's installation on an aircraft. Requirements for design and quality control and the methods for communicating design and change data between electronics manufacturers (EM) and seat suppliers are defined such that standardization is possible across the industry to ensure continued airworthiness of TSO-approved seats with integrated electronic components. This document primarily focuses on correspondence between the seat supplier and the electronics manufacturer.

Appendix A: Presents key characteristics of electronic components and guidance on how changes are classified per the requirements of Table 1 of AC 21-49.

Appendix B: Provides an outline of a typical data approval process and the change management process between electronics manufactures and seat suppliers.

Appendix C: While the responsibility rests solely with the seat supplier to ensure all TSO attributes identified in Table 1 of AC 21-49 are acceptable, Appendix C has been included to outline the process for delegating EMs authorization to assess the impact of changes on their equipment with respect to seat TSO attributes. This authorization will allow the classification of the change and the appropriate administration of the change by the electronics manufacturer via seat supplier delegation.

Appendix D: Given the mix of business arrangements that can exist in the seat, in-flight, and aircraft procurement lifecycle (buyer furnished equipment, supplier furnished equipment, customer furnished equipment), there is discussion on the potential need for separate agreements between the EMs and seat suppliers to ensure binding flow down of design and quality control requirements. As such, a working together agreement (WTA) template is provided as Appendix D.

1.1 Regulatory and Business Model

It is important to recognize that industry and the FAA have different needs when it comes to getting a seat with electronic components approved for use in an aircraft. The FAA looks at certification strictly from a regulatory point of view and to whom they issue the various approvals. The FAA makes the approval holder responsible for ensuring all aspects under that approval are met, regardless of how industry establishes the business arrangements.

For seats covered under TSOA, there are two approvals: the seat TSOA and the installation approval (TC/STC/ATC). The TSOA holder will continue to review and approve changes as long as the seats with integrated electronic components are in the field. The installation approval holder may close their installation project after the last aircraft delivers and cannot review any proposed changes under that closed project. In these cases, a third party TC/STC/ATC holder/applicant may be contracted to review and approve changes to electronic components for the aspects of the change that affect AC 21-49 Section 9 requirements.

For industry, regulatory obligations under each approval have to be met while having some flexibility for establishing business agreements and delegations such that said obligations can be achieved efficiently. This document defines the responsibilities from both a regulatory perspective and a business perspective.

1.1.1 Overview on Responsibilities (Post-AC 21-49 Business Practice)

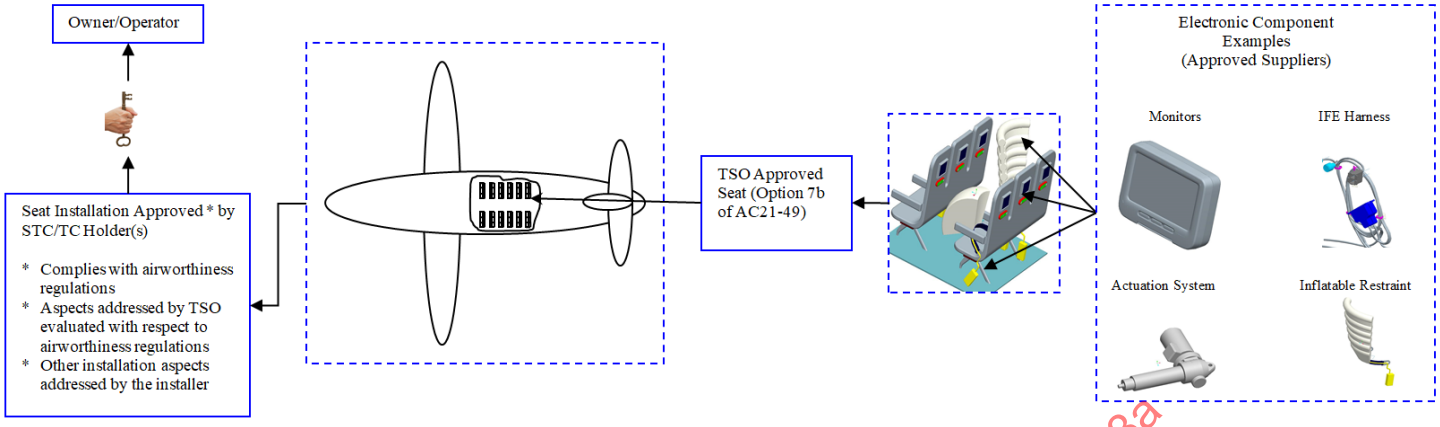

Figure 1

2. REFERENCES

2.1 Applicable Documents

The following publications form a part of this document to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order. In the event of conflict between the text of this document and references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific examption has been obtained.

2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

ARP5526	Aircraft Seat Design Guidance and Clarifications
AS8049	Performance Standard for Seats in Civil Rotorcraft, Transport Aircraft, and General Aviation Aircraft
AS9100	Quality Management Systems - Requirements for Aviation, Space, and Defense Organizations
AS9116	Aerospace Series - Notice of Change (NOC) Requirements

2.1.2 FAA Publications

Available from Federal Aviation Administration, 800 Independence Avenue, SW, Washington, DC 20591, Tel: 866-835-5322, www.faa.gov.

AC 21-46	Technical Standard Order Program
AC 21-49	Gaining Approval of Seats with Integrated Electronic Components
AC 21-50	Installation of TSOA Articles and LODA Appliances
AC 25.562-1B_CHG1	FAA Advisory Circular - Dynamic Evaluation of Seat Restraint Systems and Occupant Protection on Transport Airplanes
AC 25.853-1	FAA Advisory Circular - Flammability Requirements for Aircraft Seat Cushions
AC 25.785-1B	FAA Advisory Circular - Flight Attendant Seat and Torso Restraint System Installations

PS-AIR-21-130-03-01 Clarification for Non-TSO Functions in Seats

TSO-C39( ) 9g Transport Airplane Seats Certified by Static Testing

TSO-C127( ) Rotorcraft, Transport Airplane, and Small Airplane Seating Syst (Includes Dynamic Test Requirements)

2.1.3 Code of Federal Regulations (CFR) Publications

Available from the United States Government Printing Office, 732 North Capitol Street, NW, Washington, DC 20401, Tel: 202-512-1800, www.gpo.gov.

14 CFR Part 21 Certification Procedures for Products and Parts

14 CFR Part 23 Airworthiness Standards: Normal, Utility, Acrobatic, and Commuter Category Airplanes.

14 CFR Part 25 Airworthiness Standards: Transport Category Airplanes

14 CFR Part 27 Airworthiness Standards: Normal Category Rotorcraft

14 CFR Part 29 Airworthiness Standards: Transport Category Rotorcraft

3. DEFINITIONS

ARP6448 QUALIFIED ELECTRONICS MANUFACTURER: An EM with this delegation has demonstrated an understanding of AC 21-49 and this ARP. The EM is an approved supplier to the seat supplier and there is a working together agreement (WTA) or equivalent, in place between the EM and the seat supplier. See Appendices C and D for details.

ARP6448 DELEGATED ELECTRONICS MANUFACTURER: An EM with this delegation has met the requirements of an ARP6448 qualified electronics manufacturer, as discussed above. In addition, they must have written delegation from a specific seat supplier of the authorization to make Class 1 versus Class 2 change classifications on behalf of the seat supplier. See Appendix C for details. A delegated EM may have delegation from one seat suppler, but not another. This delegation does not relieve the TSO holder of the responsibility for managing changes according to regulatory requirements and their local authority.

CLASS 1 CHANGE: A design change to electronic components, or their attachment to the seat, with potential impact to the attributes in Table 1 of AC 21-49 (utilizing the guidance in Table A1). While this class level has been used to associate the impact level of change to the TSO MPS, Class 1 changes may also be significant to the TC/ATC/STC applicant/holder. Class 1 changes require prior approval by the seat supplier.

CLASS 2 CHANGE: A design change to electronic components, or their attachment to the seat, with no potential impact to the attributes in Table 1 of AC 21-49. While this class level has been used to associate the impact level of change to the TSO seat, Class 2 changes may also be significant to the TC/ATC/STC applicant/holder. Class 2 changes do not require approval by the seat supplier prior to implementation when the EM has written delegation from the seat supplier to make the change class determination. EMs that do not have written delegation from the affected seat suppliers must submit Class 2 changes to the seat supplier for approval prior to implementation.

NOTE: Class 1 and Class 2 relate to AC 21-49 Table 1 attributes which indicate a potential impact on the seat TSOA. All changes, regardless of TSO classification, require separate evaluation by the TC/STC/ATC applicant and/or holder as discussed in Section 9 of AC 21-49.

CONFIGURATION MANAGEMENT: Configuration management is the systematic process that establishes and maintains the consistency of a product (or article) and its functional and physical attributes with its requirements, design, and operational information throughout its life cycle. The goal of configuration management is to ensure that a certified baseline product (or article) definition is established and maintained throughout the product's (or article's) life cycle. This is accomplished through the establishment of clear configuration and quality management processes throughout the supply chain with appropriate agreements between parties that ensure changes are clearly communicated in advance of their incorporation and both quality as well as the certified baseline of the product (or article) definition is maintained. It is understood that changes deemed non-significant by one party may have a significant certification and configuration control impact on the part of another. Processes and agreements must be established between parties to ensure that configuration control requirements are met.

DESIGN DEFINITION: Design definition involves the establishment and implementation of documented procedures to define and control the design of a product (or article) in order to ensure that specified requirements are met.

ELECTRONICS MANUFACTURER (EM): A party that designs and manufactures electronic components to be used in the installation and collaborates with both the seat supplier and the TC/ATC/STC applicant/holder. The electronics manufacturer may be a production approval holder.

ELECTRONICS MANUFACTURER COMPONENT DATA (EMCD) FORM: Form used by the electronics manufacturer to communicate the initial data needed to satisfy Table 1 attributes of AC 21-49 and by the seat supplier to return disposition of the data to the electronics manufacturer.

ELECTRONICS MANUFACTURER NOTICE OF CHANGE (EMNOC) FORM: Form used by the electronics manufacturer to communicate design changes that effect Table 1 attributes of AC 21-49 and by the seat supplier to return disposition of the change to the electronics manufacturer.

CUSTOMER FURNISHED EQUIPMENT (CFE): Typically, IFE components—e.g., PC power, video systems, and phones—are purchased by the airline and provided direct to the seat supplier at no cost and are referred to as CFE.

NON-CUSTOMER FURNISHED EQUIPMENT (NON-CFE): Typical NON-CFE electronic components include reading lights, inflatable restraints, and seat actuation systems. These are specified and purchased by the seat supplier.

INTEGRATED SEAT: An airplane seat approved under a seat TSOA/LODA that includes electronic components. The electronic components may include IFE, in-seat power systems, reading lights, inflatable restraints, and electrically actuated seat features.

LETTER OF DESIGN APPROVAL (LODA): A LODA is a finding by the FAA that a foreign manufacturer's article design meets a specific TSO.

OPERATOR: Entity operating the aircraft (airline).

TC/ATC/STC APPLICANT/HOLDER: An entity that attains regulatory approval (TC/STC/ATC) for the installation of a TSO-approved seat onto a commercial passenger aircraft is referred to as the TC/ATC/STC applicant/holder. In certain instances, a separate TC/ATC/STC applicant/holder will be responsible for the electrical activation of the electronic components installed in the TSO seat. In this case, there will be two TC/ATC/STC applicants/holders: one that installs the seats and one that is responsible for the attributes of the electronic components described in Section 9 of AC 21-49.

SUPPLIER: Vendors supplying parts and/or services.

NOTE: Regulatory guidance on supplier and manufacturer responsibilities may be found in FAA AC 21-46, paragraph 2.2.1.

WORKING TOGETHER AGREEMENT (MULTI-PARTY): A binding agreement or a combination of agreements between a seat supplier and an electronics manufacturer that defines and assigns responsibilities to the parties to ensure that the TSO-approval holders have design and quality control over the electronic components integrated into the TSO-approved seat. These agreements are also known as working together agreements (WTA) and often apply when design and quality control is not flowed down from the TSO holder to the EM by way of a commercially binding purchase order/contract, such as CFE scenarios. Similar agreements may be in place between the TC/ATC/STC applicant/holder and the EMs.

TYPE CERTIFICATE/SUPPLEMENTAL TYPE CERTIFICATE/AMENDED TYPE CERTIFICATE (TC/STC/ATC) APPLICANT: Person who fills out FAA form 8110-12, application for type certificate, production certificate, or supplement or amended type certificate. In the context of this ARP, the TC/STC/ATC applicant will be referred to as “TC/ATC/STC applicant/holder.”

TSO APPLICANT/HOLDER OR SEAT SUPPLIER: A TSO applicant/holder is a person or organization who applies for and obtains a technical standard order authorization or letter of TSO design approval (LODA) under 14 CFR Part 21, Subpart O.

A seat supplier is a company that attains a TSO-approval for a seat which has integrated electronic components. These components can include in-flight entertainment equipment (IFE) modules, actuation, lighting, in-seat power, inflatable restraints, passenger control units, and all the associated harnesses.

In the context of this ARP, a seat supplier is a TSO applicant/holder.

TSOA: A TSOA is a finding by the FAA that a manufacturer’s article meets a specific TSO and the manufacturer’s production system can manufacturer articles conforming to the approved design. A TSOA is a design and production approval.

NOTE: Some OEMs have acronyms for electronic components that are installed on their aircraft, e.g., buyer-furnished equipment (BFE), customer-selected equipment (CSE), and seller-furnished equipment (SFE). These acronyms are not meaningful in context of this ARP.

4. ACRONYMS

AC	Advisory Circular
AC O	Aircraft Certification Office
ADCN	Advance Document/Drawing Change Notice
AECN	Advance Engineering Change Notice
ARP	Aerospace Recommended Practice
AS	Aerospace Standard
ATC	Amended Type Certificate
BFE	Buyer Furnished Equipment
CAA	Civil Aviation Authority
CFE	Customer Furnished Equipment
CG	Center of Gravity
CM	Configuration Management
DCN	Design Change Notice
EASA	European Aviation Safety Agency
EM	Electronics Manufacturer
EMCD	Electronics Manufacturer Component Data
EMNOC	Electronics Manufacturer Notice of Change
ECN	Engineering Change Notice

ETSO	European Technical Standard Order
FAA	Federal Aviation Administration
FAI	First Article Inspection
HIC	Head Injury Criterion
IFE	In-Flight Entertainment
ITCM	Initial Technical Coordination Meeting
LODA	Letter of Design Approval
MPS	Minimum Performance Standards
PAH	Production Approval Holder
PMA	Parts Manufacturer Approval
PC	Production Certificate
STC	Supplemental Type Certificate
TTL	Taxi, Take-off, and Landing
TC	Type Certificate
TSO	Technical Standard Order
TSOA	Technical Standard Order Authorization
WTA	Working Together Agreement

5. ELECTRONICS MANUFACTURER (EM) RESPONSIBILITIES

5.1 Overview

The electronics manufacturer will communicate with the operator, the TC/ATC/STC applicant/holder, and the seat supplier to address the following: technical issues, ensure that the equipment meets owner/operator requirements, ensure that the electronic components meets seat supplier and TC/ATC/STC applicant/holder requirements, and ensure that appropriate configuration and quality management agreements are adhered to.

In addition, the electronics manufacturer will coordinate with TC/ATC/STC applicant/holder and seat supplier for all installation, analysis, testing requirements, and data associated with the integration of electronic components into the TSO-approved seats and aircraft installation, respectively.

5.2 Design Definition

The electronics manufacturer will communicate to the seat supplier design data relating to the configuration of the electronic components with respect to the Table 1 attributes of AC 21-49; see B.4.1 for the data required by the TSOA holder. The electronics manufacturer will communicate with the TC/ATC/STC applicant/holder for the data to meet the requirements of AC 21-49 Section 9.

Data requirements for TC/STC/ATC production approvals are discussed in Section 9 of AC 21-49 and in 5.3.2, but are not addressed in this ARP.

5.3 Configuration Management

5.3.1 EM Coordination with the Seat Supplier

The EM will implement a configuration control process for releasing initial design data and subsequent revisions to the seat supplier(s). The EMCD and EMNOC forms (see Appendix B) and instructions for their use as described herein will be used exclusively. CM procedures will be in place with all involved entities that align bilateral processes with the CM requirements of this ARP.

EMs will manage their CM process recognizing that change approval must be obtained from seat suppliers and TC/ATC/STC applicant/holders that hold design and production approvals for the electronic components that are being changed.

5.3.2 EM Coordination with the Seat TC/ATC/STC Applicant/Holder

In addition to approval from the TSOA holder, changes to electrical components that are installed on seats must also be approved for aircraft installation per Section 9.a of AC 21-49: “TSO-C39 and C127 performance criteria are not adequate to address installation of seat mounted electronic components into an aircraft. We [the FAA] can’t approve items not listed in Table 1 for the electronic components under the TSO-approval. Those items must be approved for the aircraft using the type certification process (TC, ATC or STC).”

This ARP focuses on the interaction between the EM and the seat supplier so the electronic components can be covered under the seat TSOA per option 7.b of AC 21-49. All changes must be reviewed by the TC/ATC/STC applicant/holder per Section 9 of AC 21-49.

5.3.3 Electronics Manufacturer Component Data (EMCD) Form

The EMCD (see Appendix B) will be completed by the EM and supports submittal of top-level design data to the seat supplier. This data shall be sufficient for the seat supplier to assess the component’s effect on the AC 21-49 Table 1 attributes of the seat’s TSO MPS. This data also establishes the baseline configuration on which future receipt of the component into the seat supplier production system will be based. The EMCD must be approved by the seat supplier and returned to the EM before related EMNOCs can be processed.

5.3.4 Electronics Manufacturer Notice of Change (EMNOC) Form

The EMNOC (see Appendix B) will be completed by the EM to support submittal of change data to the seat supplier.

5.3.5 EMCD and EMNOC Administration

Record retention practices shall be in accordance with the seat supplier(s) requirements and verified in AS9100 audits.

5.4 Quality Control

The electronics manufacturer is responsible for providing electronic components for integration into the TSO-approved seat that conform to electronics manufacturer type design. The electronics manufacturer is required to coordinate changes related to their quality system with the seat supplier and the TC/ATC/STC applicant/holder.

The EM will provide adequate quality controls in the form of audits and training verification to ensure any change classification and change approvals that are delegated to them are performed per the criteria set forth in this ARP and any WTA that may be in effect.

5.5 Continued Airworthiness

The electronics manufacturer will ensure proper configuration management of the electronic components and software they manufacture and will coordinate changes with both the seat supplier and the TC/ATC/STC applicant/holder according to this ARP and any WTA that may be in effect to ensure that changes will not affect the seat TSO or the aircraft’s certification.

6. SEAT SUPPLIER RESPONSIBILITY

6.1 Overview

The seat supplier obtains a TSO-approval and is responsible for showing compliance to the minimum performance standards of the applicable TSO for seats with integrated electronics. The seat supplier must also adhere to all configuration and quality management agreements with the TC/ATC/STC applicant/holder to ensure that type design is maintained. The seat supplier is responsible for preparing compliance documentation for TSO requirements as required by the FAA and other seat design requirements as specified by the TC/ATC/STC applicant/holder.

6.2 Design Definition

The seat supplier will review all electronic component integration requirements provided by the TC/ATC/STC applicant/holder and electronics manufacturer and develop a design that meets both the TSO and aircraft level certification requirements. The seat supplier must also provide the FAA the data necessary to demonstrate that the seat continues to meet the TSO MPS after integration of the electronic components and wiring.

When the electronic components are manufactured by the seat supplier (e.g., actuation components, harnesses, etc.), the seat supplier is responsible (as if it were an EM) for providing the design definition to the TC/ATC/STC applicant/holder and for administrating a configuration control process; see Figure B2.

6.3 Configuration Management

The seat supplier is responsible for coordinating with the TC/ATC/STC applicant/holder to ensure the TC/ATC/STC applicant/holder's TC/STC/ATC configuration management requirements with respect to design change are met while the program is active.

Once a program is complete, the seat supplier can make minor changes if the change can be evaluated with respect to that TSO's minimum performance standard per Table 1 of AC 21-49. Changes to electronic components must also be evaluated by the TC/ATC/STC applicant/holder per Section 9.a of AC 21-49 as discussed in 5.3.2 before the EM incorporates the change into production articles.

The seat supplier is responsible for the review and approval of changes communicated to them by the electronics manufacturer to ensure the TSO-approval is maintained. The seat supplier is also responsible for maintaining quality control and configuration management system that includes electronic components whether or not component(s) are CFE or non-CFE.

Seat suppliers shall develop a supplier control relationship, which may be a WTA, with EMs just as they do with suppliers of any other purchased commodity and be able to demonstrate that design and production quality controls are in place. Seat suppliers may implement configuration control delegation to the extent the EM has the core competency to act on the seat supplier's behalf. Delegation terms will be defined in the WTA (see Appendix D for an example WTA) and follow the guidelines of Appendix C for delegation.

An AS9100 audit does not evaluate an EM's understanding of AC 21-49 and ARP6448. The seat supplier must assess the EM's capability to classify changes with respect to the performance standards of the TSO per this ARP and in compliance with AC 21-49 (see Appendix A).

6.4 Quality Control

The seat supplier is responsible for providing TSO-approved seats with integrated electronic components that conform to the seat design approved under the TSOA (or LODA) and meet the TC/ATC/STC applicant/holder's requirements. The seat supplier is also required to ensure the electronic components integrated in TSO-approved seats meet and will continue to meet Table 1 attributes of AC 21-49.

6.5 Continued Airworthiness

TSO-applicants follow the regulatory requirements for maintaining continuing airworthiness.

TSOA holder will continue to evaluate change requests from the electronics manufacturer as long as the seat incorporating the electrical components remains in service.

7. TC/ATC/STC APPLICANT/HOLDER RESPONSIBILITY

7.1 Overview

TC/ATC/STC applicant/holder will obtain the applicable certification (TC/STC/ATC) for the seat installation and electronic component activation in the aircraft and are responsible for showing compliance to the applicable airworthiness regulations for the aircraft, which includes the TSO-approved seat with integrated electronics. TC/ATC/STC applicant/holders will communicate with seat suppliers and electronics manufacturers applicable technical issues regarding aircraft design, installation, configuration control, and quality requirements along with regulatory requirements for certifying the seat installation in the aircraft.

7.2 Design Definition

Communicate all TC/ATC/STC applicant/holder and TC/STC/ATC regulatory requirements relating to the TSO-approved seat and all integrated seat-related electronic components to both the seat supplier and the electronics manufacturer. Review design data provided by the seat supplier and the electronics manufacturer to ensure aircraft installation requirements are met.

7.3 Configuration Management

The certified installation establishes a baseline for configuration management. The TC/ATC/STC applicant/holder is responsible for maintaining the installed configuration of the seat through the delivery phase of the program. Changes to seat electronic components must be approved by the TC/ATC/STC applicant/holder as there may be impact outside the TSO requirements. This approval process is in parallel to EMNOC process defined herein.

When the TC/ATC/STC applicant/holder is purchasing electronics on behalf of the airline customer they are responsible for ensuring the EM understands and comply with data transmittal requirements. This includes the FAI documents and applicable certificates required by the seat supplier to confirm part configuration on receipt of parts which may route through a third-party logistics operation.

7.4 Quality Control

The TC/ATC/STC applicant/holder must ensure TSO-approved seats with integrated electronic components conform to the approved aircraft type design.

7.5 Continued Airworthiness

TC/ATC/STC applicant/holder follow the applicable regulatory requirement for maintaining continuing airworthiness. As discussed in 1.1, TC/ATC/STC applicant/holders may close their TC/STC/ATC project after the last aircraft delivers and will not continue to evaluate design changes to electronic components. In these cases, a third party TC/STC/ATC holder/applicant may be contracted to review and approve changes to electronic components for the aspects of the change that affect AC 21-49 Section 9 requirements.

8. CONCLUSION

This document provides guidance on how to meet AC 21-49, Section 7.b (“Type Certification Using TSO-Approved Seat with Electronic Components Defined in TSO Design”).

The responsibilities, areas of authority, and accountability of each party—as well as the communication protocols defined herein—are intended to ensure that compliant configuration management, design control, and quality control process are developed and implemented to ensure the requirements of AC 21-49 are met.

9. PMA

Seat suppliers shall not issue PMA assist letter for electronic components because the seat supplier's approval (TSOA) only covers electronic components for the attributes listed in Table 1 of AC 21-49.

10. NOTES

10.1 Revision Indicator

A change bar (I) located in the left margin is for the convenience of the user in locating areas where technical revisions, not editorial changes, have been made to the previous issue of this document. An (R) symbol to the left of the document title indicates a complete revision of the document, including technical revisions. Change bars and (R) are not used in original publications, nor in documents that contain editorial changes only.

PREPARED BY SAE AIRCRAFT SEAT COMMITTEE

APPENDIX A - CHARACTERISTICS OF CLASS 1 AND CLASS 2 DESIGN CHANGES

A.1 PURPOSE

The purpose of Table A1 and Figures A1 and A2 is to provide examples of typical changes to electronic components and to explain how the changes should be categorized as Class 1 or Class 2; see Section 3. Guidance regarding categorization of changes is presented in Table A1, based on the approach from AS9116.

The guidance in Table A1 may act as a tool to establish a uniform interpretation of AC 21-49 Table 1 among all local FAA-AC Os and other non-FAA civil aviation regulators.

A.2 CLASS 1 VERSUS CLASS 2 DESIGN CHANGE CLASSIFICATION

Each change must be evaluated to determine if it presents a potential effect on any of the six seat TSO attributes listed in Table A1 of this ARP; if it does, it is a Class 1 change. Otherwise, it is a Class 2 change.

NOTE: Each change requires an additional approval to address installation of seat mounted electronic components into an aircraft as discussed in 5.3.2.

Table A1, Figure A1, and Figure A2 are guidance to electronics manufacturers for categorizing their design changes as Class 1 or Class 2. Any change that cannot be categorized as Class 2, based on the guidance below, should be presented to the seat manufacturer for evaluation as a Class 1 change.

Table A2 links Table A1 of this ARP to Table 1 of AC 21-49 and associates the TSO attributes with the appropriate seat TSO. Software was added to Table A1 and A2 because software can be used to establish the seat back upright angle as well as other safety related features and so can affect a TSO function.

NOTE: Table A1, Figure A1, and Figure A2 provide guidance and do not address all electrical components that may affect the Table 1 attributes listed in AC 21-49. EM must contact the seat supplier if there are any questions.

Table A1 - Characteristics of Class 1 and Class 2 changes

Attribute	Class 1 Characteristics	Class 2 Characteristics
Method of Attachment AC 21-49 Table 1: ▪ Strength of attachment of electronic components to seat	Number and/or location and/or size. Type (threaded to shanked). Rivets (squeeze versus pop). Material changes. Fasteners incorporated into plastic or composite structures using proprietary processes or specifications. Attachment type changes: ▪ Clamped versus threaded. ▪ Clamped surface area. Note: Changes that affect an electrical component's ability to hold together or an electrical component's method of attachment (retention) to the seat are Class 1.	Hardware length changes provided equivalent thread or grip engagement is shown. Fastener variations in finish. Changes to harnesses or cables. Changes to electrical components that weigh less than 1/3 pound (0.15 kg).
Mass and Center of Gravity AC 21-49 Table 1: ▪ Mass, location, and center of gravity (CG) of electronic components on seat under static loading ▪ Mass, location, and CG of electronic components on seat under dynamic loading	Any change in mass or center of gravity is a Class 1 design change.	No design changes that affect mass or center of gravity can be Class 2. Note: CG changes are not applicable to cables and harnesses.

<table>
<tr><th>Attribute</th><th>Class 1 Characteristics</th><th>Class 2 Characteristics</th></tr>
<tr>
<td>Flammability

AC 21-49 Table 1:
▪ Flammability</td>
<td>Material changes, including changes to formulation, are Class 1—except for “small parts.”</td>
<td>Definition of small part (from ARP5526E, 3.24.2.1):

“A small part may not have a volume greater than 8 in^3 (131 cm^3) and the largest single (one side) projected surface may not exceed 9 in^2 (58 cm^2). For example, the projected surface area of a cylinder is its diameter multiplied its length. Manipulation of the part to force it within these limits is not permitted.

“Table 8 is a list of items that have been established as small parts (size and volume limits still apply).”

Table 8 - Typical small parts
<table>
<tr><th>Part</th><th>Comment</th></tr>
<tr><td>Knobs</td><td></td></tr>
<tr><td>Handles</td><td></td></tr>
<tr><td>Rollers</td><td></td></tr>
<tr><td>Fasteners, nuts, washers</td><td></td></tr>
<tr><td>Clips</td><td></td></tr>
<tr><td>Grommets</td><td></td></tr>
<tr><td>Rub strips</td><td></td></tr>
<tr><td>Pulleys</td><td></td></tr>
<tr><td>Small electrical parts</td><td>Capacitors, resistors, etc.</td></tr>
<tr><td>Placards</td><td></td></tr>
<tr><td>Tie wraps</td><td></td></tr>
<tr><td>Cable ties</td><td>Including cable tie mounts</td></tr>
<tr><td>Bushings</td><td></td></tr>
<tr><td>Spacers</td><td></td></tr>
<tr><td>Hooks</td><td></td></tr>
<tr><td>Switches</td><td></td></tr>
<tr><td>Electrical tape</td><td>Wrapped in a small area</td></tr>
<tr><td>Thread</td><td></td></tr>
</table>
Note: This small part definition does not apply to parts that must meet Federal Regulations regarding the self-extinguishing properties of insulation on electrical wire and electrical cable (e.g., 14 CFR 25.869, amendment 25-113).

Attachment of small parts (from ARP5526E, 3.24.2.2):

“A small part may be bonded, or mechanically attached, to a larger part without losing its designation as a small part. FAA policy memo PS-ANM-25.853-01-R2 provides more details on acceptable methods of compliance.”</td>
</tr>
</table>

Attribute	Class 1 Characteristics	Class 2 Characteristics
HIC/Delethalization AC 21-49 Table 1: ▪ Sharp edges (delethalization) ▪ Effect on head injury criteria (HIC) for electronic components mounted in seat backs or arm rests	Most changes to electrical components that are installed inside the head strike zone (see Figure A1) are Class 1—except as discussed in the adjacent Class 2 column. Changes that affect the stiffness of components in the head strike zone are Class 1. Examples of common back mounted electrical components include video monitors, passenger control units, phones, power outlets, USB connectors, etc. The following are examples of Class 1 changes. (see Figure A2): 4A. Change to protective film. 4B. Change to glass. 4C. Bezel: Change to material, geometry/configuration or method of construction. 4D. Circuit boards: Material layups and process specifications. Change that affects stiffness. 4E. Frame: Change to material, geometry/configuration or method of construction. 4F. Fasteners: Changes that affect strength of the fastener, internal joint, or external method of attachment. 4G. Video Brackets: Change to material, geometry/configuration or method of construction.	An electrical component must be assumed to be inside the head strike zone (see Figure A1), unless the EM is certain that it is not. Examples of electrical components that are typically not in the head strike zone include: harnesses, cables, and under seat boxes. Changes to components that are not inside the head strike zone are considered Class 2. A change to the color of materials is Class 2. Changes to electrical components that are inside the head strike zone that only modify circuit board components, wire routing, and placement (addressing small electrical parts such as diodes, capacitors, transistors, resistors wiring, etc.) are Class 2 as long as the distance between adjacent internal components is not affected.
Lumbar Loads AC 21-49 Table 1: ▪ Effect on lumbar loads for electronic components mounted under the seat	A change that affects an electrical component that is located under a passenger place and changes the component's external size, mass, CG, or attachment location points is Class 1. A change that makes the electronic component more likely or less likely to be contacted during a lumbar test is Class 1.	Changes to electronic components that are not located under a passenger place are Class 2. (If the EM is not certain that the component is not located under a passenger place, then they must assume that it is.) A change that does not make an electrical component that is located under a passenger place more likely or less likely to be contacted by the bottom diaphragm of the seat during a vertical test is Class 2. These are changes that do not affect the component's external size, mass, CG, or attachment location.
Software that Affect TSO function	Software changes that affect a TSO function are Class 1, e.g., seat actuation systems that affect seat position, actuation speed, movement, force/torque safety limits, passenger control interface, inflatable restraints, and pre-tensioners.	Small changes and bug fixes for actuation systems that do not affect seat position, actuation speed and movement, force/torque safety limits, or passenger control interface are Class 2. Note that all service documents must be routed through the seat supplier and not sent from the electronics manufacturer directly to the operator.

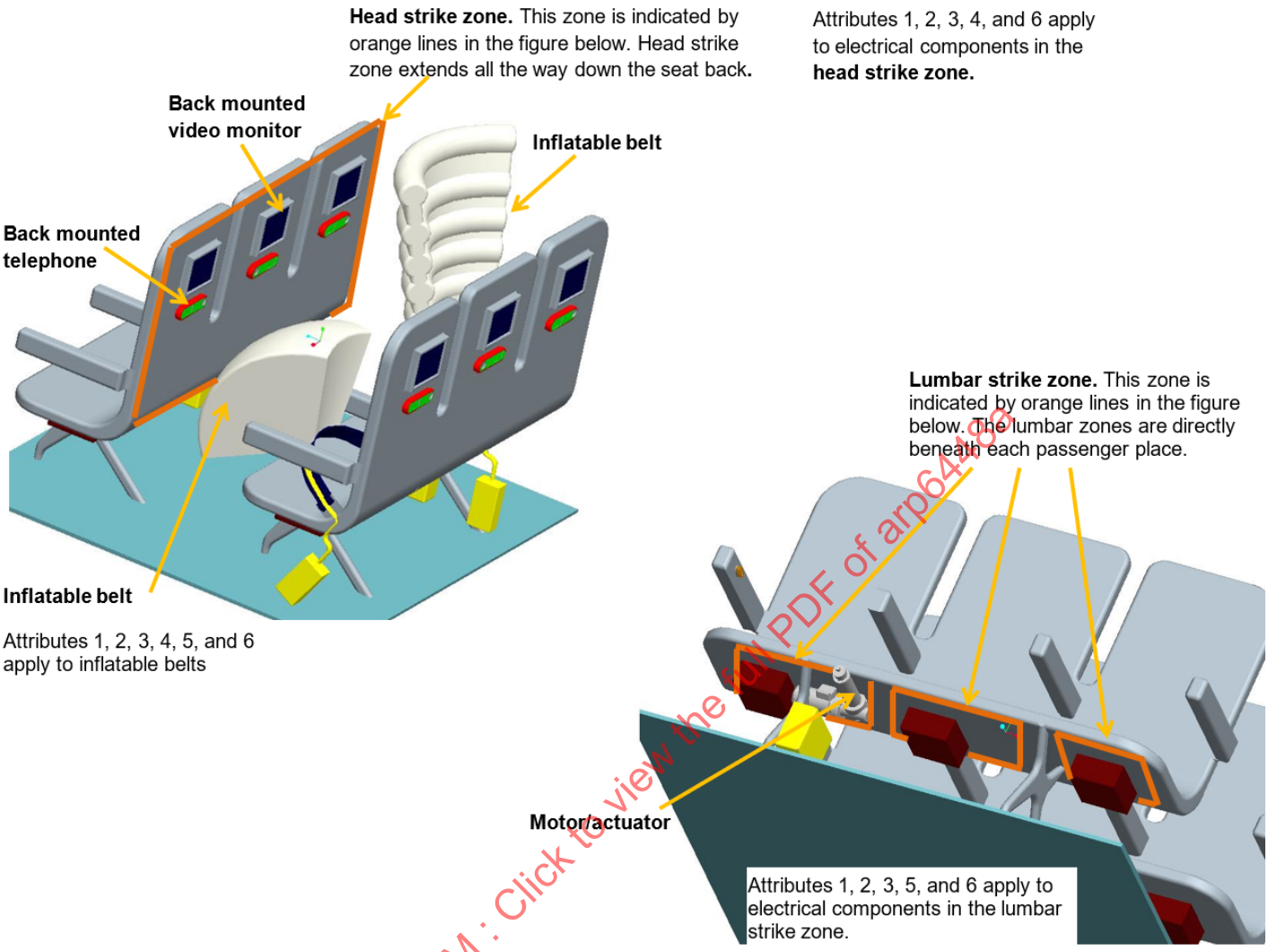

Figure A1 - Typical integration of electrical components onto aircraft seat

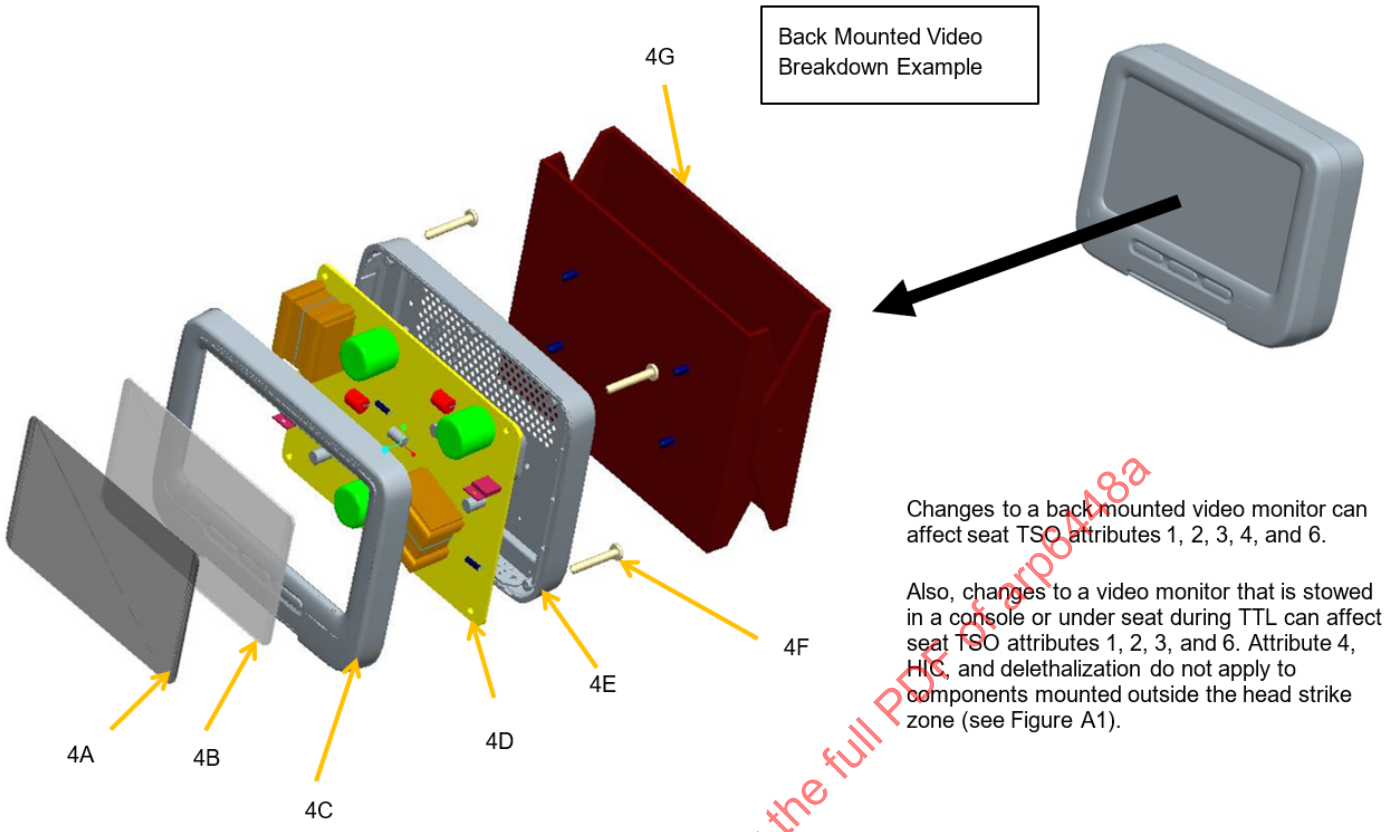

Figure A2 - Video monitor assembly

Table A2 - AC 21-49 Table 1 attribute to ARP6448 Table A1 cross-reference

AC 21-49 Table 1 Attribute	ARP6448 Table A1 Attribute	TSO-C39	TSO-C127
Strength of attachment of electronic components to seat	1. Method of attachment	Yes	Yes
Mass, location, and center of gravity (CG) of electronic components on seat under static loading	2. Mass and center of gravity	Yes	Yes
Sharp edges (delethalization)	4. HIC/delethalization	Yes	Yes
Flammability requirements as applicable to each TSO	3. Flammability	Yes	Yes
Mass, location, and CG of electronic components on seat under dynamic loading	2. Mass and center of gravity	N/A	Yes
Effect on head injury criteria (HIC) for electronic components mounted in seat backs or arm rests	4. HIC/delethalization	N/A	Yes
Effect on lumbar loads for electronic components mounted under the seat	5. Lumbar loads	N/A	Yes
N/A(1)	6. Software that affect TSO function	Yes	Yes

(1) Though software is not listed in AC 21-49 Table 1, it can affect TSO function and is addressed in Tables A1 and A2 of this ARP.

APPENDIX B - DATA APPROVAL AND CHANGE MANAGEMENT PROCESS

B.1 PURPOSE

The purpose of this appendix is to define a data approval and change management process by establishing proper and timely communication between seat supplier and electronics manufacturer. This communication will ensure that proper design and quality control as required by AC 21-49 Section 7.b is initiated and maintained. The electronics manufacturer must be approved as a vendor to the seat supplier according to the seat supplier's quality system.

Gaining approval of aircraft seats with integrated electronic components following AC 21-49 Section 7.b involves two separate approvals:

- Seat supplier obtains seat TSOA per Section 7.b of AC 21-49.
- TC/ATC/STC applicant/holder obtains (TC, ATC, or STC) per Section 9 of AC 21-49.

When the electronic components are CFE—e.g., equipment that is purchased by the end customer (operator) and provided at no charge to the seat suppler—the electronics manufacturer coordinates with (see Figure B1):

- Seat supplier to support TSO data approval and change management requirements per Section 7.b of AC 21-49.
- TC/ATC/STC applicant/holder to support (TC, ATC, or STC) data approval and change management requirements per Section 9 of AC 21-49.

When the electronic components are not CFE—e.g., equipment that is specified and purchased by seat supplier—the electronics manufacturer coordinates with (see Figure B2):

- Seat supplier to support:
  - TSO data approval and change management requirements per Section 7.b of AC 21-49.
  - Type certification data to support (TC, ATC, or STC) data approval and change management requirements per Section 9 of AC 21-49. Seat supplier coordinates with the TC/ATC/STC applicant/holder.

For components that are non-CFE, the electronics manufacturer does not communicate directly with the TC/ATC/STC applicant/holder or the operator.

This appendix focuses on the data exchange between the seat supplier and the electronics manufacturer using the EMCD and EMNOC as discussed in Sections B.4 and B.5 of this ARP.

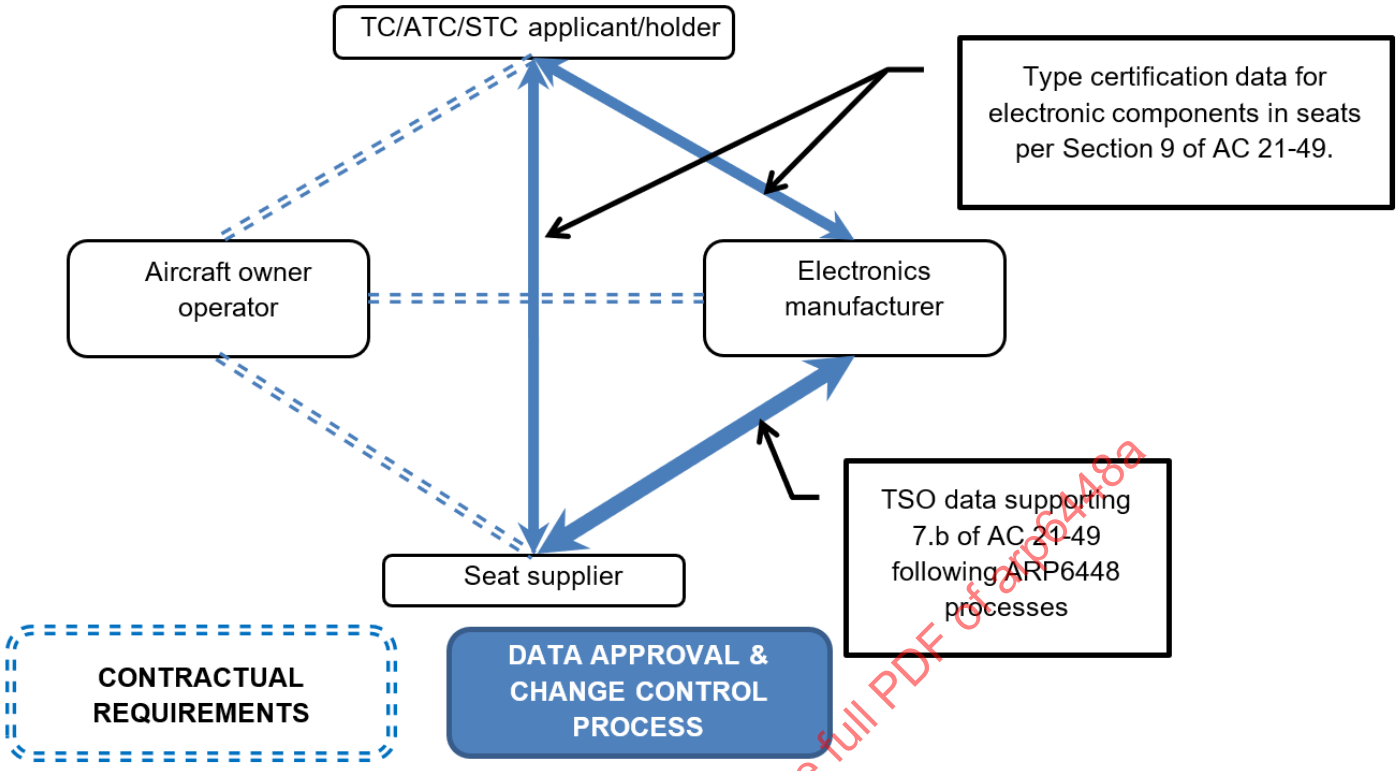

Figure B1 - Coordination of data approval and change control process between stakeholders

B.2 SCOPE

This appendix establishes the original data approval and change management process for electrical components that are approved under a seat TSOA per AC 21-49 Section 7.b.

Seat suppliers require data submittals, as defined in this appendix, for new electronic equipment and for all changes to electronic components. This supports proper data approval and change management for all electronic components integrated on TSO-approved seats per AC 21-49 Section 7.b. So, a change management system must be established between the electronics manufacturer and the seat supplier.

Electrical manufacturers will make data submittals that seat suppliers will receive and review for the entire life of the electronic component—even if it is no longer included on new production TSOA seats—to ensure changes to electrical components are minor with respect to TSO MPS.

The data submittals are prepared by the electronics manufacturer and are submitted to the seat supplier using one of the following forms that are defined in this appendix:

- EMCD (electronics manufacturer component data form): This form is for electrical components that are new to a seat supplier. It transmits data that the seat supplier needs to demonstrate that the electronic components comply with the Table 1 attributes of AC 21-49; e.g., flammability data, mass, CG, method of attachment, etc. Once accepted by the seat supplier and the electrical component is released in the seat supplier's engineering data management system, it can be integrated into an aircraft seat.

- EMNOC (electronics manufacturer notice of change form): This form supports the change management requirements of Section 7.b of AC 21-49. Electronics manufacturers use the EMNOC to inform the seat supplier of a change to an electrical component that may be approved as part of a seat TSO-approval.

The acronyms EMCD and EMNOC will be used in the remainder of this appendix when referring to these data submittals.

NOTE: In addition to approval from the TSOA holder, changes to electrical components that are installed on seats must also be approved for aircraft installation (see 5.3.2).

B.3 DATA SUBMITTALS AND APPROVAL OF NEW ELECTRONIC EQUIPMENT

The following section describes the steps required to gain approval of electronic component data that supports TSO-approval of seats with integrated electronic components. A flowchart describing the steps is shown in Figure B2.

1. Coordination:

   Seat supplier must identify and communicate to the electronics manufacturer which electronic components will be integrated on a TSO-approved seat to initiate the data and review and approval process. The integration of all electronic components under the seat TSOA should be discussed at the initial technical coordination meeting (ITCM). This review is especially critical when new electronics manufacturers are involved so they can become familiar with the requirements of AC 21-49 and their responsibilities under ARP6448.

2. Planning:

   Seat supplier and electronics manufacturer will agree on the required data submittals, approvals, and the schedule.

3. Data submittal process:

   All technical data required per B.4.1 will be supplied to the seat supplier. All documents submitted must be controlled and released according to the electronics manufacturer's approved document control system.

   All data packages will be transmitted by the electronics manufacturer to the seat supplier by an agreed upon means. A working together agreement (WTA) (see Appendix D) should be established between electronics manufacturer and seat supplier.

   Data submittals are required when electronic components are being integrated for the first time on TSO-approved seats.

   Electronic component(s) listed on a rejected EMCD are not acceptable for integration on TSO-approved seats. Rejected data items must be rectified by whatever means is acceptable to all affected parties.

4. Initial electronics manufacturer data approval:

   Seat supplier must perform a review of all supplied data and verify that sufficient data has been provided to show that the attributes listed in Table 1 of AC 21-49 are met. EMCD forms will be approved and returned to the electronics manufacturer.

   Seat suppliers may re-use the same data for common electronic components integrated on any TSO seat part number provided it continues to satisfy all attributes listed in Table 1 of AC 21-49 after integration on these TSO seats.

5. Data review and approval:

   Seat supplier completes review, approves data, and notifies the electronics manufacturer.

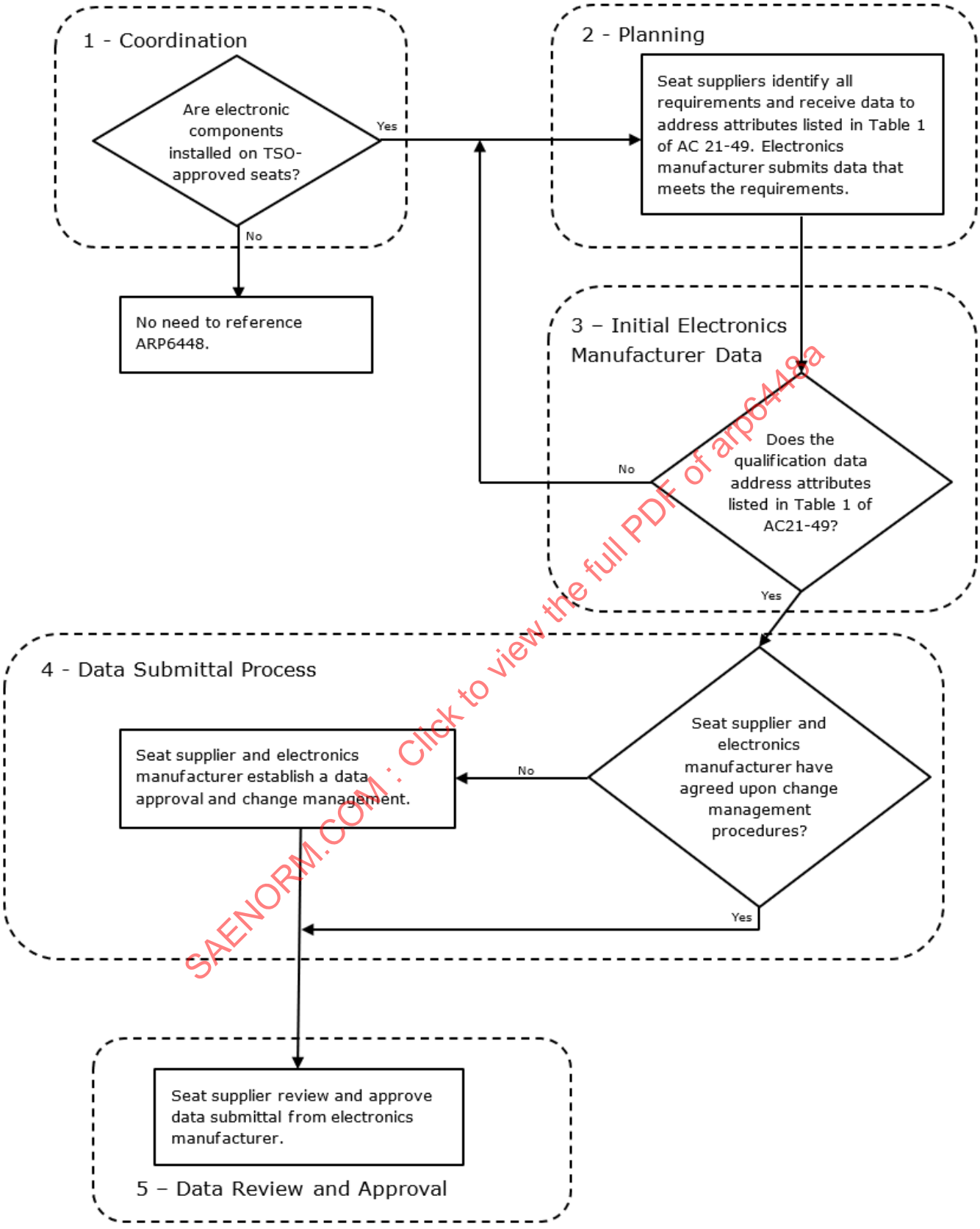

Figure B2 - Data submittals and approval of new electronic equipment

B.4 EMCD - ELECTRONICS MANUFACTURER COMPONENT DATA (FORM)

B.4.1 Basic Elements of a Design Data Package

When the electronics manufacturer supplies a new design data package to the seat supplier, the electronics manufacturer must ensure that the required information is provided. The basic elements addressing the attributes listed in Table 1 of AC 21-49 must be communicated to the seat supplier in the form of outline drawings, specifications, flammability data, process specifications, etc.

Typical data submittals are as follows, but not necessarily limited to:

1. Electronic component definition:
    a. Controlled outline drawing(s), containing the following at a minimum:
        i. Part number.
        ii. Part revision level (if applicable).
        iii. Part drawing number.
        iv. Part drawing revision level.
    b. Envelope dimensions.
    c. Mass.
    d. CG location (except for harnesses and cables).
    e. Method of attachment to the seat: location, number, and type of fasteners.
    f. Software part number and software revision level (if the software affects a TSO function).
2. Test data and/or rational analysis to demonstrate compliance to the applicable flammability requirements.

B.4.2 EMCD - Electronics Manufacturer

Sections I, II, III, IV, and will be completed by the electronics manufacturer.

B.4.2.1 Section I: General Information

Table B1

No.	Description	Instructions
1	Seat Supplier Name	Enter the company name of the seat supplier that will receive the EMCD.
2	EMCD Tracking Number	Enter a unique tracking number generated by the electronics manufacturer.
3	Revision	(Optional) Enter the revision level of the EMCD.
4	Transmittal Date	Enter the date that the data package is transmitted to the seat supplier.

B.4.2.2 Section II: Part Information

Table B2

No.	Description	Instructions
1	Part Number	Enter the part number of the component for which data is being submitted current as of the date of the submittal to the seat supplier.
2	Part Revision (if applicable)	Enter the revision of the part.
3	Nomenclature	Enter the name/nomenclature of the part.
4	Electronics Manufacturer	Enter the company name and address of the electronics manufacturer of the part.
5	Part Description	Enter a brief description of the part.

B.4.2.3 Section III: Program Applicability (Optional)

Completion of this section is optional. If completed, this section is to contain a table of the programs utilizing the part number identified in Section II for the seat supplier identified in Section I at the time that the form is completed.

Table B3

No.	Description	Instructions
1	Program Identifier	Enter the electronics manufacturer's program number or identifier, if applicable.
2	Operator	Enter the aircraft owner and/or operator name, as applicable.
3	Aircraft Type	Enter the type of aircraft. Major model should be entered at minimum; major and minor model may be entered as appropriate.
4	Effectivity/Tail/MSN	Enter the aircraft identifier (tail number, MSN number, etc.) as appropriate.

B.4.2.4 Section IV: Electronics Manufacturer Data Items

This section is to contain a table of the data items included in the data package. One data item should be entered per line. No data items can be included in the data package without being listed here. At least one line will be present for each requirement type.

Table B4

No.	Description	Instructions
1	No.	Enter the sequential number of the data item, beginning with 1.
2	Requirement Type	Enter the requirement that the data item fulfills, e.g., fire properties, outline drawing, etc.
3	Drawing/Document	Enter the drawing or document number of the data item.
4	Revision	Enter the revision level of the drawing/document.
5	Chg Doc	If the drawing or document includes change notices, such as a DCN, ECN, ADCN, AECN, etc., enter the type and identifying number. If the drawing or document does not include any drawing change notices, enter "N/A."
6	Additional Information/Comments	EM may enter any comments specific to the listed data item which the seat supplier may find helpful with the review and disposition the data package.

B.4.2.5 Section V: Electronics Manufacturer Comments

Enter any comments which the seat supplier may need in order to review and disposition the data package. For example, if one or more of the listed data items had been transmitted to the seat supplier previously, a reference to the prior transmittal date could be entered here.

B.4.3 EMCD - Seat Supplier

Section VI will be completed by the seat supplier.

B.4.3.1 Section VI: Seat Supplier Data Package Disposition

Table B5

No.	Description	Instructions
1	Disposition	Check either “accept” or “reject” as appropriate. “Accept” must only be selected if all data items listed in Section IV are found to be acceptable. If “reject” is selected, reason(s) for rejection must be identified to the electronics manufacturer.
2	Disposition Comments	Enter any relevant comments to be communicated back to the electronics manufacturer. If there is not enough space available on the form, enter “see attached” and attach a separate sheet containing the comments.
3	Representative Name	Enter the name of the authorized representative or agent of the seat supplier who is dispositioning the data package.
4	Representative Title	Enter the title of the authorized representative or agent of the seat supplier who is dispositioning the data package.
5	Representative Signature	The authorized representative or agent of the seat supplier who is dispositioning the data package will sign in this block.
6	Date	The person that dispositioned the data package should enter the date that they signed the EMCD.

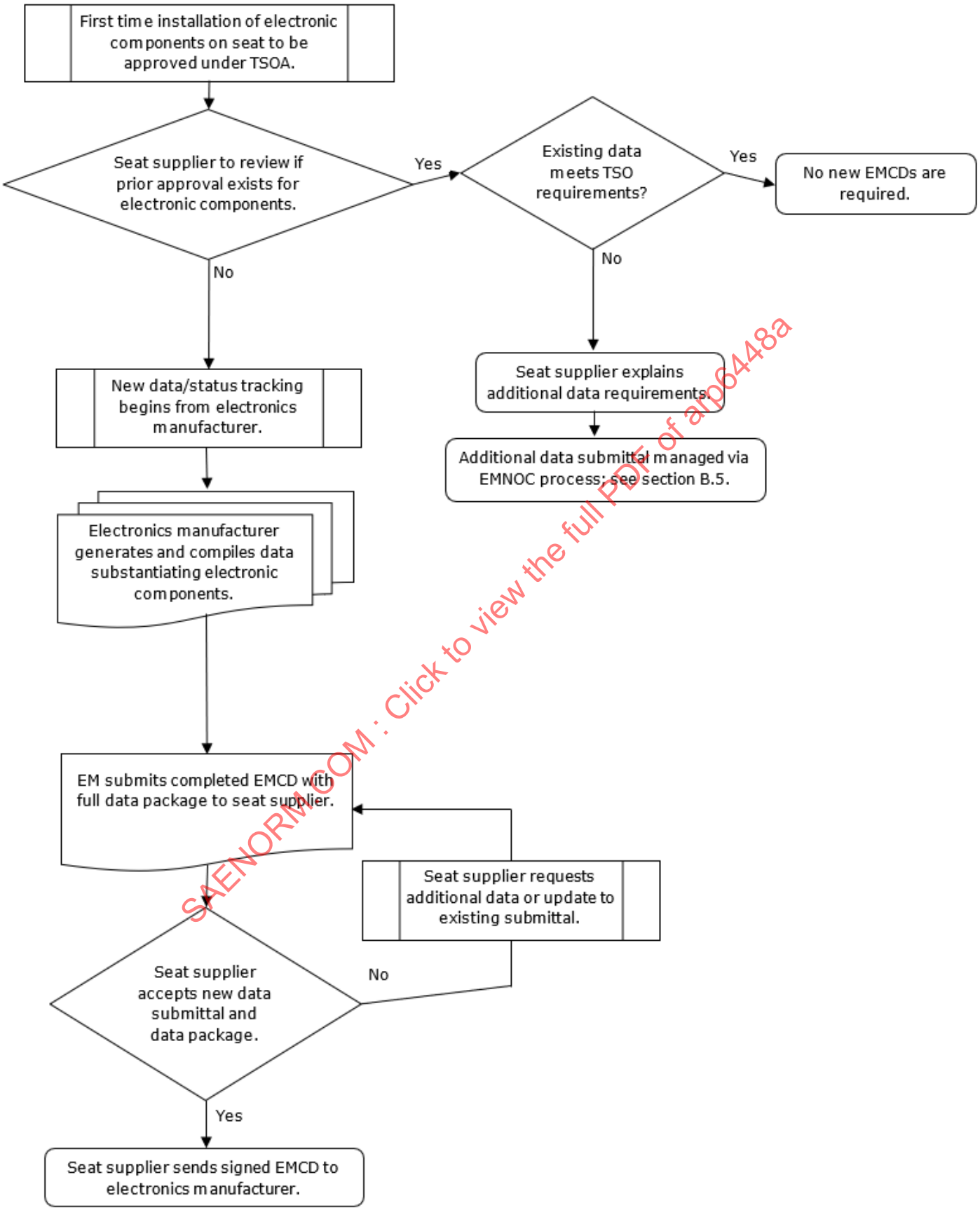

Figure B3 - New data submittal and approval process using the EMCD form

ELECTRONICS MANUFACTURER COMPONENT DATA			
I. General Information			
1. Seat Supplier Name:	**2. EMCD Tracking Number:**	**3. EMCD Revision:**	**4. Transmittal Date:**
II. Part Information			
1. Part Number:	**2. Part Revision:**	**4. Electronics Manufacturer:**	
3. Nomenclature:			
5. Part Description:			
III. Program Applicability (Optional)			
Program Identifier:	**Operator:**	**Aircraft Type:**	**Effectivity/Tail/MSN:**

IV. Electronics Manufacturer Data Items					
No.	**Requirement Type**	**Drawing/Document**	**Rev**	**Chg Doc**	**Additional Information/Comments**

V. Electronics Manufacturer Comments

VI. Seat Supplier Data Package Disposition
1. Disposition: On behalf of the seat supplier named above, I hereby ☐ **Accept*** ☐ **Reject**** this data package. * Accept indicates that the seat supplier has reviewed all data listed in Section IV and finds it acceptable. ** If reject is checked, specific reasons for Rejection and identification of the rejected data item(s) must be provided in Section IV above, the space provided below or in a separate attachment.
2. Disposition Comments:

3. Representative Name (Please Print):	**4. Representative Title:**	**5. Representative Signature:**	**6. Date:**

Figure B4 - EMCD form

B.5 EMNOC - ELECTRONICS MANUFACTURER NOTICE OF CHANGE (FORM)

When the electronics manufacturer revises seat supplier approved design data, an electronics manufacturer notification of change (EMNOC) may be required to document the change.

The EMNOC form will be sent to the seat supplier along with any applicable data used to show compliance to the attributes listed in Table 1 of AC 21-49. The basic elements of the data package have been detailed in B.4.1.

B.5.1 Basic Elements a Design Change Package

EMNOCs categorize the effects of a change, provides the reason for the change and a description of the change. EMNOCs list the affected data items and transmit revised drawings and test data from the electronics manufacturer to the seat supplier. The seat supplier uses the EMNOC to accept or reject a proposed change.

B.5.2 EMNOC - Electronics Manufacturer

Sections I, II, III, IV, V, VI, and VII will be completed by the electronics manufacturer.

One EMNOC form should be completed per change. All part numbers listed in Section II are intended to propose or implement the same change for all the listed part numbers.

B.5.2.1 Section I: General Information

Table B6

No.	Description	Instructions
1	EMNOC Number	Enter a unique tracking number generated by the electronics manufacturer.
2	EMNOC Revision (Revision control for EMCDs is optional)	Enter the revision level of the EMNOC. The first submittal should be revision “new”; second submittal should be revision “A,” etc.
3	Submittal Date	Enter the date that the EMNOC is submitted to the seat supplier.
4	Priority of Change	Check the priority of the EMNOC, either “line stopper” or “routine,” to indicate to the seat supplier(s) the amount of time in which review results are needed. Please note that only one priority may be checked. Turn times are typically defined in WTAs.
5	Change Impact	Check: □ Class 1: Response required. □ Class 2: Notification only, for delegated EM.* Please note that only one notification type may be checked.
6	Electronics Manufacturer	Enter the name of the electronics manufacturer submitting the EMNOC.
7	Technical Contact	Enter the name, email address and/or telephone number of the technical contact at the electronics manufacturer. This will be the person to whom any technical question about the EMCD that the seat supplier(s) should contact.

* Delegated electronics manufacturer (EM) must have a working together agreement (WTA) in place with the seat supplier and the seat supplier must have provided written delegation to the EM allowing them to make Class 1 versus Class 2 determinations on their behalf. EMs without a WTA and delegation must gain pre-approval from the seat supplier before implementing all changes regardless of change classification. See Appendix C.

B.5.2.2 Section II: Affected Part Number(s)

This section is to contain a table of the part numbers to which the EMNOC applies. One part number should be entered per line. All part numbers listed are intended to propose or implement the same change.

Table B7

No.	Description	Instructions
1	No.	Enter the sequential number of the part number(s) to which this EMNOC applies, beginning with 1.
2	Part Number	Enter the part number.
3	Nomenclature	Enter the name/nomenclature of the part.
4	New Rev/Mod	Enter the new revision* level of the part, if it is changing. If the mod/rev level of the part is not being changed as part of this EMNOC, enter the current revision* of the part.
5	Affected S/Ns/or Manufacture Dates	Enter the affected serial number(s) of the specified part number. This may be a cut-in point, such as “123 and on,” or a list of specific serial numbers/dates. If the parts are not serialized or dated, or if there is not a specifically identified cut-in point, this field should be left blank.

* EMs may track changes to electrical components using revision level, amendment level, or some other nomenclature that identifies the configuration of the electronic component. That information needs to be entered in this field.

B.5.2.3 Section III: Change Affects

For blocks 1 through 7, check all that may apply.

If none of blocks 1 through 7 apply, check block 8, “Other,” and provide a description or explanation in the space provided.

B.5.2.4 Section IV: Reason for Change

Enter a brief description of the reason for the change.

B.5.2.5 Section V: Description of Change

Enter a description of the change, including all information necessary to fully define the change. This will typically include a description of the before and after states. Additional pages may be attached if more space is required.

B.5.2.6 Section VI: Affected Data Items

This section is to contain a table of the electronics manufacturer’s data items that the EMNOC affects or that are needed to fully define or substantiate the EMNOC. One data item should be entered per line. All listed data items will accompany the completed EMNOC form to comprise the full EMNOC submittal package transmitted to the seat supplier(s). The full EMNOC submittal package must not contain any data items that are not listed in this section.

Table B8

No.	Description	Instructions
1	No.	Enter the sequential number of the data item, beginning with 1.
2	Data Type	Enter the type of data, e.g., fire properties, outline drawing, reference data, etc.
3	Drawing/Document	Enter the drawing or document number of the data item.
4	Rev	Enter the revision level of the drawing or document
5	Chg Doc	If the drawing or document includes change notices, such as a DCN, ECN, ADCN, AECN, etc., enter the type and identifying number. If the drawing or document does not include any change notices, enter “N/A.”
6	Reviewer Comments	The electronics manufacturer will leave this field blank. This field is reserved for the seat supplier.

B.5.2.7 Section VII: Electronics Manufacturer Authorization

Table B9

No.	Description	Instructions
1	Prepared By (Please Print)	Enter the name of the person that prepared the EMNOC.
2	Title	Enter the title of the person that prepared the EMNOC.
3	Signature	The person that prepared the EMNOC should sign in this block.
4	Date	The person that prepared the EMNOC must enter the date that they signed the EMNOC.
5	Approved By (Please Print)	Enter the name of the person that approves the EMNOC for submittal to the seat supplier.
6	Title	Enter the title of the person that approved the EMNOC for submittal.
7	Signature	The person that approved the EMNOC for submittal should sign in this block.
8	Date	The person that approved the EMNOC for submittal will enter the date that they applied their signature in block 7.

B.5.3 EMNOC - Seat Supplier

Sections VIII will be completed by the seat supplier.

B.5.3.1 Section VIII: Seat Supplier Disposition

Table B10

No.	Description	Instructions
1	Disposition Comments	Enter any relevant comments to be communicated back to the electronics manufacturer. If there is not enough space available on the form, enter “see attached” and attach a separate sheet containing the relevant comments.
2	Disposition	Check either “accept” or “reject” as appropriate. Please note that if “reject” is selected, there must be a reason for rejection identified to the electronics manufacturer.
3	Company Name	Enter the seat supplier’s company name.
4	Date	Enter the date that the disposition was recorded.
5	Representative Name (Please Print)	Enter the name of the authorized representative or agent of the seat supplier who is dispositioning the EMNOC.
6	Title	Enter the title of the authorized representative or agent of the seat supplier who is dispositioning the EMNOC
7	Signature	The authorized representative or agent of the seat supplier who is dispositioning the EMNOC shall sign in this block.

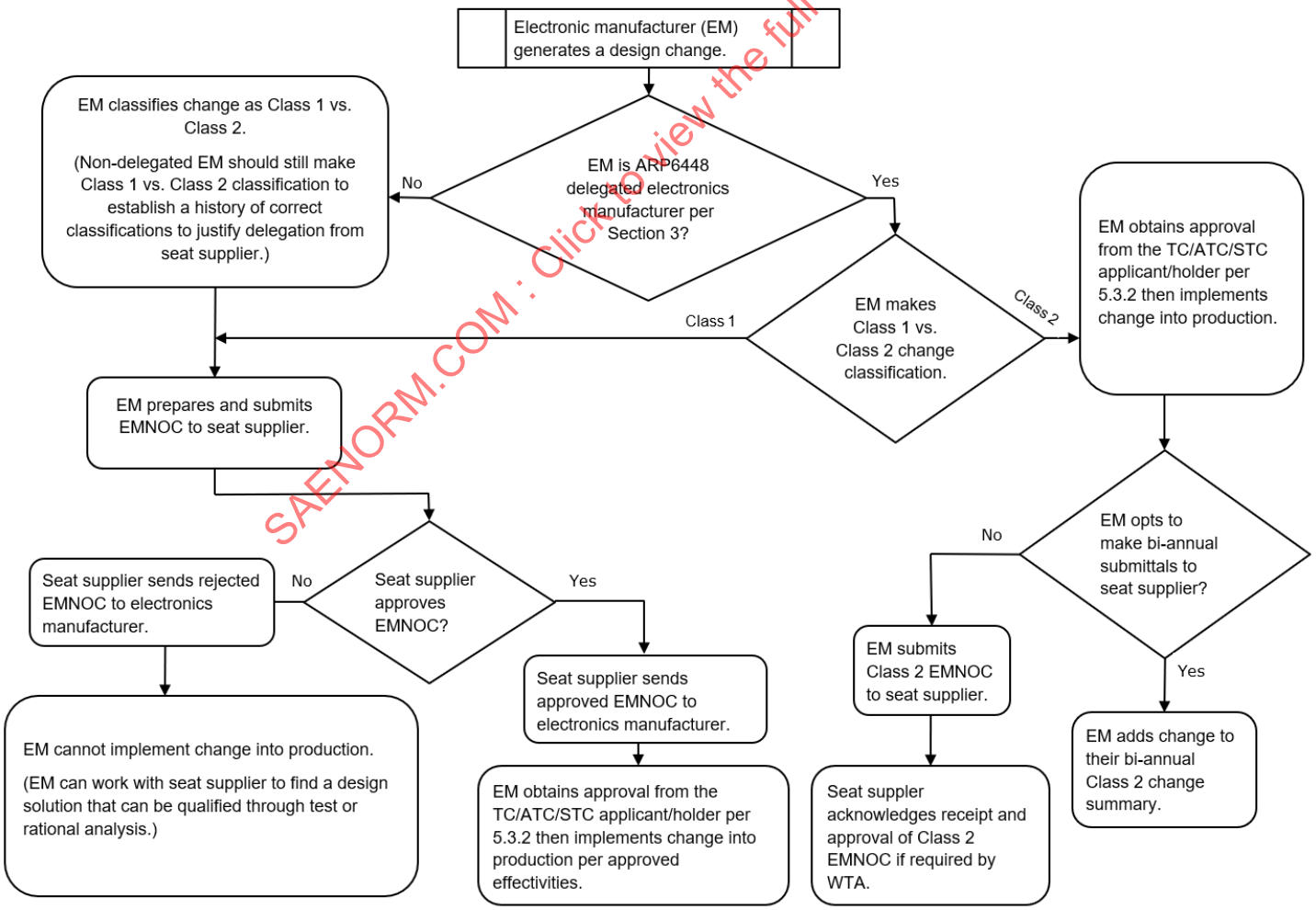

Figure B5 - Design change submittal and approval process using the EMNOC form

ELECTRONICS MANUFACTURER NOTIFICATION OF CHANGE				
I. General Information				
1. EMNOC Number:	**2. EMNOC Revision:**	**3. Submittal Date:**	**4. Priority of Change:** ☐ Line Stopper ☐ Routine	**5. Change Impact:** ☐ Class 1 ☐ Class 2
6. Electronics Manufacturer:		**7. Technical Contact:**		

II. Affected Part Number(s)				
No.	**Part Number**	**Nomenclature**	**New Rev/Mod**	**Affected S/Ns/or Manufacture Dates**

III. Change Affects		
☐1. Method of Attachment	☐4. HIC/Delethalization	☐7. Type Design Documentation Only
☐2. Mass/Center of Gravity	☐5. Lumbar Loads	☐8. Other (define):
☐3. Fire Properties	☐6. Software Covered (if the software affects a TSO function)	

IV. Reason for Change

V. Description of Change

VI. Affected Data Items					
No.	**Data Type**	**Drawing/Document**	**Rev**	**Chg Doc**	**Reviewer Comments**

VII. Electronics Manufacturer Authorization			
1. Prepared By (Please Print):	**2. Title:**	**3. Signature:**	**4. Date:**
5. Approved By (Please Print):	**6. Title:**	**7. Signature:**	**8. Date:**

VIII. Seat Supplier Disposition		
1. Disposition Comments:		
2. Disposition: ☐ **Accept** ☐ **Reject**	**3. Company Name:**	**4. Date:**
5. Representative Name (Please Print):	**6. Title:**	**7. Signature:**

Figure B6 - EMNOC form

APPENDIX C - DELEGATION FOR CLASS DETERMINATION AND APPROVAL

It is desirable for the electronics manufacturer to evaluate changes to their products with respect to whether the changes affect any of the TSO attributes defined in Table 1 of AC 21-49. The electronics manufacturer would then be able to classify their changes as Class 1 or Class 2.

C.1 SEAT SUPPLIERS AND EMS COLLABORATION ON AUDITS

To reduce the cost and logistics burden of auditing, seat suppliers and EMs can collaborate on audits to become an ARP6448 delegated or qualified EM. When a seat supplier conducts an audit of an EM, they should agree to allow the EM to share the audit findings with other seats suppliers who may accept the audit.

C.2 TYPES OF DELEGATION

EMs making Class 1 versus Class 2 determinations are either “ARP6448 qualified electronics manufacturer” or “ARP6448 delegated electronics manufacturer” per Section 3. The scopes of these delegations are as follows:

- An ARP6448 qualified electronics manufacturer (see Section 3) must:
  - Follow the processes specified in this ARP.
  - Submit EMNOCs to the seat supplier for all changes.
  - Have approval from the seat supplier prior to implementation of all changes into their production. (Approval from the TC/ATC/STC applicant/holder for the effects of the change on AC 21-49 Section 9 requirements is also required before implementation of all changes into EM production.)
- An ARP6448 delegated electronics manufacturer (see Section 3) must:
  - Meet the requirements of a qualified electronics manufacturer per Section 3.
  - Submit EMNOCs to the seat supplier for Class 1 changes and must have approval from the seat supplier prior to implementation of Class 1 changes.

ARP6448 delegated electronics manufacturer may implement changes that they categorize as Class 2 without pre-approval from the seat supplier once they have approval from the installer/activator or from a third party TC/ATC/STC applicant/holder for the effects of the change on AC 21-49 Section 9 requirements.

For electronic components that are NON-CFE, an ARP6448 delegated electronics manufacturer must submit all changes to the seat supplier, including Class 2 changes. For Class 2 changes, the AC 21-49 Section 7.b requirements have been satisfied but effects of the change on AC 21-49 Section 9 requirements must be evaluated. The seat supplier will coordinate approval from the TC/ATC/STC applicant/holder or from a third party TC/STC/ATC holder/applicant for the effects of the change on AC 21-49 Section 9 requirements. See Section 5.

An ARP6448 delegated electronics manufacturer may send Class 2 EMNOCs to seat suppliers or they may opt to submit bi-annual change summary to the seat supplier if their WTA allows it. Scope of delegation is seat supplier dependent and should be a function of the EM’s demonstrated ability to act on the seat supplier’s behalf. See Appendix A for guidance on making Class 1 versus Class 2 change determinations.

C.2.1 ARP6448 Qualified Electronics Manufacturer

To gain delegation of authorization to act as an ARP6448 qualified electronics manufacturer, follow the steps in Tables C1 and C2:

Table C1 - General quality audit (standard audit for all suppliers to the seat supplier)

Approved (Y/N)	Item	Audit Requirement
	1	Electronics manufacturer will have been audited by the quality department of the seat supplier and be listed on the seat supplier's approved supplier list (ASL).
	2	The electronics manufacturer must have a quality management system in place that meets the requirements of AS9100 and the requirements of the seat supplier's qualify system.

Table C2 - ARP6448-specific audit for an ARP6448 qualified electronics manufacturer

Approved (Y/N)	Item	Audit Requirement
	1	Electronics manufacturer must have a written Class 1 versus Class 2 determination procedure describing the change screening activity with respect to the attributes listed in Table 1 of AC 21-49. This procedure will be approved by the seat supplier.
	2	The electronics manufacturer must have an engineering organization in place that has the capability to categorize changes as Class 1 or Class 2 as described in this ARP. The EM's engineering organization will have passed ARP6448 audit by the seat supplier.
	3	The EM will define qualification requirements for personnel classifying changes. These qualification requirements will be approved by the seat supplier and be incorporated in the Class 1 versus Class 2 determination procedure described in item 1.
	4	Evaluations must be performed by EM personnel with appropriate credentials/knowledge such that all changes are properly classified and routed to seat supplier in accordance with AC 21-49 and ARP6448. Seat supplier audit will verify that the EM has ARP6448 training materials and evidence of training for personnel using the Class 1 versus Class 2 Determination procedure discussed in item 2.
	5	The EM will have a working together agreement (WTA) (see Appendix D) in place with the seat supplier.

The electronics manufacturer must make a request to the seat supplier in writing for delegation to act as an ARP6448 qualified electronics manufacturer.

The requesting document should provide evidence of compliance with items 1 and 2 of Table C1 and items 1 through 5 of Table C2.

The seat supplier will grant the delegate in writing to perform change impact analyses to the electronics manufacturer if it finds the request for delegation acceptable. Note that a qualified electronics manufacturer must submit changes to the seat supplier and the TC/ATC/STC applicant/holder per C.2.

When these items have been completed, the electronics manufacturer may begin submitting change data to the seat supplier as an ARP6448 qualified electronics manufacturer according to the requirements of this ARP and the WTA. The electronics manufacturer must notify the seat supplier of any changes in its organization that affect the items contained in C.2.1.

C.2.2 ARP6448 Delegated Electronics Manufacturer

The EM must be an ARP6448 qualified electronics manufacturer before requesting delegation to make Class 1 versus Class 2 change determinations as an ARP6448 delegated electronics manufacturer.

The electronics manufacturer must make a request to the seat supplier in writing authorization for delegation to perform change impact analyses as described above and act as an ARP6448 delegated electronics manufacturer.

The seat supplier will grant the authorization in writing to perform change impact analyses to the electronics manufacturer if it finds the request for authorization acceptable based on experience with EM and their performance as an ARP6448 qualified electronics manufacturer.

When the EM has written delegation to act as an ARP6448 delegated electronics manufacturer, the EM may begin change making Class 1 versus Class 2 change determinations according to the guidance in Appendix A of this ARP. The electronics manufacturer must notify the seat supplier of any changes in its organization that affect the items contained in C.2.1.