

EASA	NOTIFICATION OF A PROPOSAL TO ISSUE A CERTIFICATION MEMORANDUM
	<p>EASA Proposed CM No.: EASA Proposed CM - ES – 001 Issue: 01 Issue Date: 13th of October 2011 Issued by: Electrical Systems section Approved by: Head of Certification Experts Department Regulatory Requirement(s): CS 25.601, CS 25.869 (a), CS 25.1301, CS 25.1309, CS 25.1351(a)(1), CS 25.1353(a), CS 25.1357(a)(c), CS 25.1360(a), CS 25.1431, CS 25.1529, and CS-25 Subpart H.</p>

In accordance with the EASA Certification Memorandum procedural guideline, the Agency proposes to issue an EASA Certification Memorandum (CM) on the subject identified below.

All interested persons may send their comments, referencing the EASA Proposed CM Number above, to the e-mail address specified in the "Remarks" section, prior to the indicated closing date for consultation.

EASA Certification Memoranda clarify the Agency's general course of action on specific certification items. They are intended to provide guidance on a particular subject and, as non-binding material, may provide complementary information and guidance for compliance demonstration with current standards. Certification Memoranda are provided for information purposes only and must not be misconstrued as formally adopted Acceptable Means of Compliance (AMC) or as Guidance Material (GM). Certification Memoranda are not intended to introduce new certification requirements or to modify existing certification requirements and do not constitute any legal obligation.

EASA Certification Memoranda are living documents into which either additional criteria or additional issues can be incorporated as soon as a need is identified by EASA.

Subject

**Certification of Power Supply Systems for Portable
Electronic Devices**

Log of Issues

Issue	Issue date	Change description
01	13.10.2011	First issue.

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1. INTRODUCTION

1.1. PURPOSE AND SCOPE

The purpose of **this** Certification Memorandum is to provide specific guidance for the certification of Power Supply Systems (PSS) which connect aeroplane electrical power to Portable Electronic Devices (PED) for CS-25 large aeroplanes.

This Certification Memorandum is applicable to PSS intended for use with PED and is independent of the PSS outlet location (e.g. seat, wall or cabinet mounted) and the purpose of the system (In-Seat Power Supply System, Executive Power System, Medical Equipment Supply System). It applies only to the electrical aspects of PSS for PED.

This Certification Memorandum does not cover the approval of the use of portable electronic devices or any interconnecting means (adapters, cords, etc.) used to power such equipment on board an aeroplane. This Certification Memorandum covers low voltage (e.g. 15 V DC) and high voltage (e.g. 110 V AC 60Hz AC; 230 V AC 50Hz) systems. Nominal output voltages differing from the typical voltage values specified above may also be considered using this approach.

Note: for consistency with EU-OPS 1.110 the term PED stands for Portable Electronic Device. However, in the context of this Certification Memorandum, a PED is meant to be any portable electrical device, such as laptops, hair dryers or any other electrical equipment to be connected to the PSS in the aeroplane.

1.2. REGULATORY REFERENCES & REQUIREMENTS

It is intended that the following reference materials be used in conjunction with this Certification Memorandum:

Reference	Title	Code	Issue	Date
25.601	General	CS-25	5 and up	05/09/2008
25.869 (a)	Fire protection: systems - Electrical system components	CS-25	5 and up	05/09/2008
25.1301	Function and installation	CS-25	5 and up	05/09/2008
25.1309	Equipment, systems and installations	CS-25	5 and up	05/09/2008
25.1351(a)(1)	General – Electrical system capability	CS-25	5 and up	05/09/2008
25.1353(a)	Electrical equipment and installations	CS-25	5 and up	05/09/2008
25.1357(a)(c)	Circuit protective devices	CS-25	5 and up	05/09/2008
25.1360(a)	Precautions against injury - shock	CS-25	5 and up	05/09/2008
25.1431	Electronic equipment	CS-25	5 and up	05/09/2008
25.1529	Instructions for continued airworthiness	CS-25	5 and up	05/09/2008

Reference	Title	Code	Issue	Date
Subpart H	Electrical wiring interconnection system	CS-25	5 and up	05/09/2008
EUROCAE ED-14/RTCA DO-160	Environmental conditions and test procedures for airborne equipment	ED-14/DO-160	Latest issue	---
EN 61008-1	Residual current operated circuit-breakers without integral overcurrent protection for household and similar uses (RCCBs)	EN 61008-1:2006	---	24/05/2006

The applicable requirements listed above are relative to the electrical aspects of the PSS for PED based on the up-to-date CS-25 standards. Different standards and amendments may apply (notably for EWIS) depending on retained Type Certification Basis (i.e. previous JAR-25). These lay out the regulatory basis for the approval and installation of PSS for PED.

1.3. ABBREVIATIONS

The following abbreviations are used in this Certification Memorandum:

Abbreviation	Meaning
CS	C ertification S pecification
CRI	C ertification R eview I tem
EASA	E uropean A viation S afety A gency
ELA	E lectrical L oad A nalysis
EMC	E lectromagnetic C ompatibility
EMI	E lectromagnetic I nterference
EPS	E xecutive P ower S ystem
ETSO	E uropean T echnical S tandard O der
EWIS	E lectrical W iring I nterconnection S ystem
FAA	F ederal A viation A dministration
Hz	H ertz
ICA	I nstructions for C ontinued A irworthiness
ISPSS	I n- S eat P ower S upply S ystems
JAA	J oint A viation A uthorities
JAR	J oint A viation R equirements

Abbreviation	Meaning
kHz	K ilohertz
mA	M illiamp
MHz	M egahertz
msec	M illisecond
OEM	O riginal E quipment M anufacturer
PED	P ortable E lectronic D evice
PSS	P ower S upply S ystem
RF	R adio F requency
RTCA	R adio T echnical C ommission for A eronautics
STC	S upplemental T ype C ertificate
SWPM	S tandard W iring P ractices M anual
TC	T ype C ertificate
TGM	T emporary G uidance M aterial
V AC	V olt(s) of A lternating C urrent
V DC	V olt(s) of D irect C urrent

1.4. DEFINITIONS

The following definitions are used in this Certification Memorandum:

Definition	Meaning
EWIS	See CS 25.1701

2. BACKGROUND

This Certification Memorandum is issued to harmonise and compile into one document previous guidance material applicable to ISPSS and EPS, and make it applicable to any PSS for PED installation in an aeroplane, independently of the system electrical outlets location.

The content of this Certification Memorandum is based on:

- JAA TGM/25/10: Temporary Guidance Material regarding the Installation of In-Seat Power Supply Systems (ISPSS) for Portable Electrical Devices (PED) dated 01/06/2001.
- Generic EASA CRI on Executive Power System, which contained guidance and minimum requirements for the installation of power outlets and power sources for PED.
- FAA memorandum: Policy Statement on Certification of Power Supply Systems for Portable Electronic Devices on Part 25 Airplanes dated 18/03/2005.

The standards clearly establish that operation of any one unit or system of units of the PSS for PED must not adversely affect the operation of other electrical units or systems essential to safe aeroplane operation, nor create a hazard that would endanger the occupants.

3. EASA CERTIFICATION POLICY

3.1. EASA POLICY

3.1.1. Certification of Power Supply Systems for Portable Electronic Devices

3.1.1.1. Circuit protection and hazards to occupants (Ref. CS 25.601, CS 25.1357, CS 25.1360)

The PSS for PED should be designed to provide circuit protection against system overloads, smoke and fire hazards resulting from intentional or unintentional systems shorts, faults, etc. These types of faults may be caused by spilled liquids or insertion of conductive objects into the outlets.

Therefore, the design of the PSS for PED socket installation should be such as to prevent the ingress of fluid into the power socket as far as is practically possible.

The design should also minimize the possibility that conductive objects could be inserted into the power sockets. An applicant should show that a design means is in place to mitigate the resultant hazard. Means of mitigation could include installation of outlets with a child lock or a design where output power is present at the output socket only when the PED connector is correctly mated with the socket.

Occupants should be protected against the hazards of electrical shock. Applicants should submit substantiation of non-hazards to passengers for all proposed voltages. Substantiation should include system requirements which eliminate the risk of shock.

3.1.1.2. Electrical Power Source (Ref. CS 25.1353(a))

PSS for PED should be powered from a non-essential supply (bus bar) of the aeroplane, i.e. an electrical bus that does not supply power to aeroplane systems necessary for continued safe flight and landing. The utility, galley, and ground service busses are examples of the types of electrical busses that should be utilized to provide power to the PSS for PED. This would ensure the level of safety intended by the certification requirements is provided and that failure or malfunction of the PSS for PED will not affect the operation of systems essential to the safe operation of the aeroplane.

3.1.1.3. Electrical Load Analysis (Ref. CS 25.1351(a)(1), CS 25.1729)

An aeroplane Electrical Load Analysis (ELA) should be undertaken, taking into account the maximum loading that may be utilized from the PSS for PED to substantiate that the aeroplane's electrical power generating system has sufficient capacity to safely provide the maximum amount of power required by the PSS for PED to operate properly.

The applicant should base the PSS for PED ELA on an ELA that accurately reflects the aeroplane's current pre-modified electrical loads. If this is not available the applicant should make measurements of the aeroplane's pre-modified condition and use these measurements for the PSS for PED ELA.

3.1.1.4. Means of deactivation (Ref. CS 25.1353(a))

To ensure that PSS for PED systems will not adversely affect the operation of a system essential to the safe operation of the aeroplane, the PSS for PED should be designed such that it may be deactivated at any time by a crew member.

A clearly labelled and conspicuous means (on/off switch) for deactivating the PSS for PED should be provided as a minimum for the cabin crew. Cabin configurations may require the provision of more than one switch in the cabin. An additional switch may also be provided in the flight deck.

The use of a circuit breaker as a means of de-powering a function is not acceptable since the repeated use of circuit breakers as switches can degrade their performance and prevent them from actuating at the rated current trip point.

The removal of power should occur as close to the source of power as practical.

Such deactivation means should allow for the immediate disconnection of all outlets. Regardless of the number of installed cut-off switches, at least one of these should act as a master power switch that allows for the immediate removal of power to the entire PSS for PED. The master power switch should be clearly labelled to prevent crew confusion and unintentional reactivation of the system by crew members.

If multiple switches are used, the design should prevent crew confusion and they should be in a serial configuration with the master power switch to prevent reactivation of the system by crew members unaware of a hazardous or potentially hazardous condition of the system.

Procedures for the use of such switches should be documented in the appropriate crew operating/training manuals.

The PSS for PED should be deactivated during critical phases of flight: i.e. take-off and landing.

3.1.1.5. System Status Indication (Ref. CS 25.1301)

A means of indication should be provided to enable the cabin crew to identify which outlets are in use. If multiple de-powering switches are used in the design, consideration should be given to including a system status indicator at each switch location. This feature would allow cabin crew members to determine if problems associated with an individual passenger outlet are related to the localized components (e.g. seat mounted components) or the system as a whole and provide the ability to address any potential safety issues quickly.

If a flight deck indication of PSS for PED status (e.g. system "on" or "off") is installed, then it should be consistent with the aeroplane manufacturer's design philosophy with regard to system status indication.

3.1.1.6. Radiated and Conducted Emissions (Ref. CS 25.1353(a), CS 25.1431(d))

The levels of conducted and radiated interference generated by the PSS for PED equipment via power supply feeders or other system components should not cause an unacceptable degradation of performance of other aeroplane systems.

If filters are used to accomplish this, then the effect of electrostatic discharge damage to the filters should also be addressed. In addition, periodic maintenance should be undertaken to establish the effectiveness of the filters in service.

Performing tests per EUROCAE ED-14/RTCA DO-160 at its latest issue (see Sections 4 through 9, 11, and 15 through 22, as applicable to a particular design) is an acceptable means of demonstrating compliance. Testing for conducted emissions should include 150 kHz to at least 30 MHz as depicted in Section 21 of document EUROCAE ED-14/RTCA DO-160. Additionally, the conducted emissions portion of the testing should be continued up to 100 MHz (levels as specified in Section 21 of EUROCAE ED-14/RTCA DO-160) to ensure no radio frequency (RF) coupling paths exist which may channel signals upstream of the PSS.

Electromagnetic compatibility (EMC) evaluation of the PSS for PED should be accomplished for all foreseeable operating and standby conditions. Representative PED loads should be used to check the conducted and radiated electromagnetic interference (EMI) from the PSS whilst under load conditions.

As a minimum, the following cases should be considered:

- No load;
- One load: minimum, maximum power delivered by the PSS for PED;
- Several loads connected;
- All loads connected: minimum, maximum power delivered by the PSS for PED

This should be followed by tests with the intended PEDs connected to the PSS for PED to check the conducted interference from the PED in the range of 30-100 MHz. To check for conducted interference known worst case loads at worst case locations should be tested. Additional testing using validated modelling techniques can also be used.

Note 1: It is not expected that the PED perform to the category 'H' level of radiated emissions (reference EUROCAE ED-14/RTCA DO-160 Section 21). However, the PSS should filter undesirable conducted emissions generated by the PED or by the PSS for PED itself and prevent the propagation of any unwanted RF into other aeroplane systems.

3.1.1.7. Overheat Protection (Ref. CS 25.601, CS 25.1309)

The system components should include an overheat protection. This feature should provide automatic shutdown of the system if an overheat situation is detected and lower the possibility that it will be the source of smoke or fire. However, if this feature is included, it should not be automatically resettable. Resetting of the system after an automatic shutdown because of an overheat situation should only be accomplished manually by the cabin crew or flight crew after assessment and in accordance with operating procedures established by the operator.

3.1.1.8. Flammability Requirements (Ref. CS 25.869)

All components associated with the PSS for PED should meet the applicable flammability requirements.

3.1.1.9. Power limitation (Ref. CS 25.1301, CS 25.1360(a))

The intended function of the PSS for PED is to supply the power needed to enable the PED to operate while connected to the power supply outlet. As such, the PSS for PED should not supply more power than the normally expected uses would demand. Limiting the power available at the outlets prevents the use of these outlets for purposes outside of the intended function.

Maximum power available at PSS for PED outlets should be limited to 200 watts.

In specific cases where higher power levels are necessary, such as those for medical or other special use equipment or special use aeroplanes, the applicant should submit a proposal to the EASA for the increased power capability of the PSS. The proposal should include

rationale as to the need for the increased power requirements and the additional design features that will minimize the possibility of adverse effects on systems essential to the safe operation of the aeroplane and the shock hazards to persons.

3.1.1.10. Safety Assessment (Ref. CS 25.1309, CS 25.1709)

Appropriate qualitative and/or quantitative failure analyses of each installed power supply system for PED should be conducted such that any likely failure condition would not reduce aeroplane safety nor endanger the occupants. The analysis should consider the effects of the environment in which the PSS for PED equipment is installed, EWIS installation and separation, cooling arrangements, and the safety features employed to prevent a fire, overheat, or shock hazard from being inadvertently created within, or by, the PSS for PED.

3.1.1.11. Installation of PSS for PED (Ref. Requirements relative to EWIS contained in CS-25 Subpart H)

The installation of the EWIS related to the PSS for PED should be in accordance with the requirements contained in CS-25 Subpart H. In order to meet these requirements the following guidelines should be followed:

- Wiring Installation should be in accordance with the Standard Wiring Practices Manual (SWPM) of the aeroplane.
- Standard OEM wiring or compatible types should be used.
- Installation drawings should be provided in accordance with Annex Part 21A.31 to Commission Regulation (EC) No 1702/2003.
- In the absence of more specific guidelines from the SWPM of the aeroplane, 230V AC voltage power supplies wires should not be routed within standard aeroplane wiring looms, where PSS for PED EWIS is routed with standard aeroplane wiring looms, spacers or equivalent separation should be used to keep a minimum distance in accordance with the SWPM of the aeroplane.

As EWIS related to PSS for PED is present throughout the cabin (exposed in some cases), the potential for system faults is increased by the wide exposure to varying hazards (e.g. EWIS chafing in the seat tracks, passengers stepping on or kicking the seat electronic box, spilled liquid, etc.). Since these systems are exposed to hazards, the potential to adversely affect other systems necessary for safe operation significantly increases, as well as the possibility of shock hazards to people. Special consideration should be given to guard against damage to PSS for PED EWIS components installed in the seat itself, they should have appropriate protection means so that passengers cannot damage it with their feet or access it with their hands. Engineering data that control the installation of PSS for PED EWIS and equipment should contain specific, unambiguous requirements for the routing, supporting, and protection of all PSS for PED EWIS and equipment, and should identify all parts necessary to accomplish those installations.

Care should be taken to ensure that any electrical PSS for PED equipment installed in aeroplane seat assemblies does not invalidate the seat approval (e.g. applicable ETSO). In addition, it should further be noted that any ETSO approval for a seat does not on its own address the electrical equipment installation aspects for PSS.

3.1.1.12. Instructions for Continued Airworthiness (ICA) (Ref. CS 25.1529, CS 25.1729)

Although these PSS for PED are non-essential electrical systems, this does not preclude them from the requirements to prepare and submit ICA. The ICA should include all necessary maintenance actions required to maintain the PSS for PED so that the continued airworthiness of the aeroplane is maintained.

3.1.2. Additional Criteria for Installation of High Voltage Alternating Current (AC) Systems

The following criteria should be considered in addition to the material presented in the previous sections of this policy for high voltage AC PSS for PED (e.g. 110 V AC 60 Hz, 230 V AC 50 Hz) due to the increased risk to the aeroplane and occupants.

3.1.2.1. Outlet Labelling (Ref. CS 25.1301(a)(2), CS 25.1360(a))

Due to the increased risk of personal injury from high power PSS for PED, the output voltage and frequency should be labelled on power outlets (e.g., 110 V AC 60 Hz). Such labelling would also reduce the likelihood of users connecting incompatible devices to the high voltage source. Given the variety of outlet and connector types used for various power sources and the variety of plug adapters that are available, outlet type alone is not considered to be sufficient.

Power outlets for use of high power equipment (i.e. output power above 200 watts) should also be labelled with the maximum outlet power.

3.1.2.2. Fault Protection (Ref. CS 25.1360(a))

To prevent personnel injury, suitable means of protection such as differential protection and/or galvanic isolation (isolation transformer) should be provided to minimise the risk of passenger or crew members shock. This is to guard against inadvertent contact with live parts of the system.

If differential protection is used, it should have the following characteristics (or equivalent):

- Maximum fault current should be limited to 30 mA.
- Activation time in the event of a differential fault should be less than or equal to 100 msec according to EN 61008-1.

In the event of differential protection circuit failure, output power should be automatically shut down at the outlet.

The fault protection system should include features for monitoring the health of the fault detection circuits. If a fault is detected the power to the outlet should be automatically removed. Any automatic reset facility should not be permitted.

Note: Fault current is defined as a current that flows from one conductor to ground or to another conductor owing to an abnormal connection (including an arc) between the two. Differential protection is a technique for protection from short circuits.

3.1.2.3. Cabin Decompression (Ref. CS 25.1309)

Because of the possibility of cabin decompression and the resulting arcing that could occur, a means for the automatic deactivation of the PSS for PED in the event of a rapid decompression of the aeroplane cabin should be provided, to remove power from all components containing high voltage circuits, unless they have been shown to be free of arcing during the rapid decompression environmental tests specified in EUROCAE ED-14/RTCA DO-160.

3.1.3. Additional Criteria for Installation of PSS for PED power outlets into areas where sources of water are present

If PSS for PED power outlets are installed into rooms or areas where sources of water (e.g. faucets) or shower (bathroom) are present, the following requirements should be fulfilled:

- The distance between a faucet and the outlets should be not less than 0,6m.
- If the distance from the outlet to the source of water is between 0,3m and 0,6m, outlets should be covered with a lid or be installed so that the front side of the outlet shows straight downward.

- The shower cubicle should be closed up to the ceiling.
- No outlets are allowed inside the shower cubicle.
- The power outlets should not be placed within the encompassing radius of 0,6m at the shower cubicle door.

3.1.4. Operational Considerations

The responsibility of establishing the suitability of use of a Portable Electronic Device on an aeroplane model remains with the aeroplane operator as required by the currently applicable EU.OPS 1.110 Portable Electronic Devices.

When crew actions are needed to implement a chosen method of compliance, they should be included in the appropriate operations/training manuals, together with at least the following minimum technical data and operational information, necessary to enable such actions:

- a) Description of the system;
- b) Instructions for the activation/deactivation of the PSS, e.g. system control switches and passenger controls;
- c) Identification of the restrictions on use for each phase of flight (the PSS for PED should be deactivated during critical phases of flight: i.e. take-off and landing.);
- d) Monitoring passenger use of system by cabin crew;

In addition, it is recommended that the following operation factors be considered and reviewed with the appropriate personnel. This list should include, but it is not limited to, the following:

- e) Flight deck and cabin crew communication/coordination; if applicable;
- f) Hazards e.g. trip hazards, overheating of passenger devices because of being covered by pillows, blankets, etc;
- g) Information to passengers, such as, safety precautions and warning that power may be disconnected at any time if necessary without notice;
- h) Identification of malfunction of system and/or individual units and corrective action.

3.2. WHO THIS CERTIFICATION MEMORANDUM AFFECTS

All TC and STC applicants who intend to install Power Supply Systems (PSS) which connect aeroplane electrical power to Portable Electronic Devices (PED) in CS-25 large aeroplanes, independently of the system electrical outlets location.

4. REMARKS

1. This EASA Proposed Certification Memorandum will be closed for public consultation on 25th of November 2011. Comments received after the indicated closing date for consultation might not be taken into account.
2. Comments regarding this EASA Proposed Certification Memorandum should be referred to the Certification Policy and Planning Department, Certification Directorate, EASA. E-mail CM@easa.europa.eu or fax +49 (0)221 89990 4459.
3. For any question concerning the technical content of this EASA Proposed Certification Memorandum, please contact:

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