Proposed Policy

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Subject: ACTION: Policy Guidance for Certification of In-seat Power Supply Systems on Title 14 Code of Federal Regulations, Part 25 Aircraft
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The policy contained in this memorandum has been harmonized between the FAA and a Joint Aviation Authority (JAA) and industry harmonization working group. It should be applied to all transport airplane programs for an acceptable method of compliance with 14 CFR part 25 for in-seat power supply systems (ISPSS) installations.

INTRODUCTION

The following describes conditions that should be met for the approval of ISPSS which connect aircraft electrical power to passenger provided carry-on devices. This policy does not cover the approval of the use of such portable electrical devices (PED's) or any interconnecting means (adapters, cords etc.) used to power such equipment onboard an aircraft. This guidance covers the approval of low voltage (nominal 15V DC) and high voltage (nominal 110V AC, 60 Hz) systems. Nominal output voltages differing from the typical voltage values specified above may also be considered for approval using the guidelines specified in this policy. For guidance on additional criteria to be met for the approval of the high voltage ISPSS, refer to Paragraphs l), m), and n) of this policy.

This policy is based on the FAA memorandum on the same subject, dated June 24, 1997, issued by the Transport Airplane Directorate. This policy was modified from that in a JAA and FAA study group (DFSG#103) and agreed to on October 5, 1999. Differences from the Draft JAA policy include: references to FAA, CFR, AC (Advisory Circular) etc., rather than JAA, JAR (Joint Aviation Requirements), AMJ (Advisory Material Joint), etc.; the use of American English terminology and some minor clarification and editorial modifications.

ISPSS APPROVAL CONDITIONS

a. The ISPSS should be designed to provide circuit protection against system overloads, smoke and fire hazards resulting from intentional or unintentional system shorts, faults, etc., (e.g., including spilling liquids in the sockets and children inserting thin metal objects into the sockets. Ref. 14 CFR, Sections 25.869, 25.1353, 25.1357).

Output power should not be present at the ISPSS socket until the portable electrical device (PED) connector is correctly mated with the ISPSS socket.

The design of the ISPSS socket installation should be such as to prevent the ingress of fluid into the power sockets.

The hazard to the aircraft occupants of tripping over the PED lead wire should be addressed in the design of the ISPSS connector and installation.

If an automatic overheat protection feature is employed by the ISPSS, then this feature should not be able to be reset in flight.

The ISPSS should be powered from a non-essential power supply (bus) of the aircraft.

In addition, appropriate quantitative and/or qualitative failure analyses of each installed ISPSS should be conducted such that any likely failure condition would not reduce aircraft safety nor endanger the occupants. The analysis should consider the effects of the environment in which any ISPSS equipment is installed, the cooling arrangements and the safety features employed to prevent a fire or overheat condition from being inadvertently created.

b. The ISPSS should be designed so that it may be de-powered at any time. A clearly labeled and conspicuous means (on/off switch) of de-powering the ISPSS should be provided as a minimum for the cabin crew. Cabin configurations may allow for the provision of more than one switch in the cabin. If multiple switches are used, the design should be such as to prevent cabin crew confusion when de-powering the ISPSS.

An additional switch may also be provided in the flight deck. This de-powering feature should allow for the immediate removal of power to all seat outlets (because circuit breakers are not to be used as switches, their use for this purpose is not acceptable). The ISPSS should be deactivated during critical phases of flight such as take-off and landing.

If flight deck indication of ISPSS status (system "on" or "off") is deemed necessary, then the indication should be consistent with the airplane manufacturer's design philosophy with regard to system status indication.

The overall control of the system should be with the flight and/or cabin crew. If the control is by a cabin switch only, then airplane flight manual, operations manual and/or cabin crew operating procedures should be provided. The ISPSS operating procedures should not conflict nor cause confusion with any aspect of the normal and non-normal/emergency airplane operating procedures, such as isolation of fire and smoke from unknown origins.

Operational procedures should be in place in the operations manual which should include, as a minimum but not restricted to, the following:

1) Description of the system; 3

2) Activation and deactivation of the ISPSS, system control switches and passenger controls;

3) Restrictions on use for each phase of flight;

4) Use of compatible adapters and use of compatible equipment;

5) Monitoring passenger use of system by Cabin Crew;

6) Flight deck and cabin crew communication;

7) Hazards, e.g., trip hazards, overheating of passenger devices because of being covered by pillows, blankets, etc.;

8) Information to passengers, such as, safety precautions and warning that in-seat power may be disconnected at any time if necessary without notice;

9) Malfunction of system and individual units and corrective action.

Consideration should be given to automatic deactivation of the ISPSS in the event of a rapid decompression of the aircraft cabin.

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

d. Instructions for continued Airworthiness (ICAW) should be prepared in accordance with the requirements of 14 CFR Section 25.1529. The ICAW should include all necessary maintenance actions required to maintain the ISPSS system so that the continued airworthiness of the airplane is maintained. The ICAW should include maintenance actions necessary to ensure the continuing effectiveness of ISPSS system features that prevent electrical shock hazards to passengers (reference paragraph c) and the features that prevent any radiated or conducted electromagnetic interference (EMI) to critical or essential aircraft systems (ref. paragraph g).

e. To provide for a power connection from the aircraft ISPSS to a PED, a special adapter should be required for all connected PED's to operate. The special adapter will have the following characteristic: it should have a mating connector that will plug into an ISPSS outlet on the aircraft side that cannot be mistaken for, and is not compatible with, a conventional alternating current (AC) outlet. The intent of this paragraph is, in part, to control the PED's that are connected to the power supply by the selection of a particular connector type if the control of the PED's cannot be effected otherwise (e.g., by equipment features or cabin crew procedures). Automotive sockets (cigarette lighter style) would not be acceptable.

f. ISPSS Power Limitations - Applicants for installation approval should submit substantiation of proposed maximum power as being non-hazardous to passengers. Regardless of the level of substantiation, the maximum power available at each seat outlet should be limited to 100 watts.

An aircraft electrical load analysis should also be conducted that substantiates the maximum loading that may be utilized from the ISPSS (ref. 14 CFR Section 25.1351(a) (1)).

g. Each ISPSS should be designed to prevent any radiated or conducted EMI to critical or essential aircraft systems. If filters are used to accomplish this, then the effect of static discharge should also be addressed.

The applicant for installation approval should also ensure isolation of all aircraft electrical system buses and electrical systems from any unacceptable conducted EMI produced by connected PED's (ref. 14 CFR, Sections 25.1353, 25.1431).

h. An electromagnetic compatibility (EMC) evaluation of the ISPSS should be accomplished for all foreseeable EMC worst case conditions.

It is recommended that simulated complex loads be used to check the conducted and radiated EMI from the ISPSS itself, under the worst load conditions.

In the absence of a more rational analysis, the following cases should be considered:

- One load: minimum, maximum power;

- Several loads connected;

- All loads connected: minimum, maximum power.

This should be followed by tests with the intended PED's connected to check the conducted interference from the PED's (30-100 MHz). Known worst case loads at worst case locations should be tested. Additional testing, using computer modeling techniques can also be used.

i. System testing should be accomplished in accordance with appropriate chapters of RTCA DO-160D/EUROCAE ED-14D/ISO7137, and should include, as a minimum, sections 4 through 9, 11, and 15 through 22. Testing for conducted emissions should include 150 kHz to at least 30 MHz as depicted in section 21 of document DO-160D. Additionally, the conducted emissions portion of the testing should be continued up to 100 MHz (levels as specified in section 21 of DO-160D) to ensure no radio frequency (RF) coupling paths exist that may channel signals upstream of the ISPSS.

j. To guard against damage to ISPSS cable assemblies installed in the seat itself, seat mounted wiring should have appropriate protection means, such as protective conduits. ISPSS wiring and wire bundles should be appropriately routed and secured and should be physically separated from other aircraft wiring and wire bundles.

k. Indication should be provided to enable the cabin crew to detect which outlets are in use.

ADDITIONAL CRITERIA FOR THE INSTALLATION OF 110V, 60 HZ AC SYSTEMS

The following criteria in this appendix should be considered in addition to the material presented in the main body of this policy for approval of 110 volt 60 Hz AC ISPSS:

l. The power outlets should be labeled with the output voltage and frequency (110V AC, 60 Hz) and suitable safety instructions should be provided for the passenger detailing the PED's permitted to be used. These instructions should also include the use of the system, its limitations, hazards, and the control of airline supplied equipment.

m. Suitable means of protection, such as differential protection and/or galvanic isolation (isolation transformer), should be provided to minimize the risk of passenger shock. This is to guard against inadvertent contact with live parts of the system.

If differential protection is utilized, it should have the following characteristics:

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 30 mSec. 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 feature should not be permitted.

n. The ISPSS should be automatically deactivated in the event of a rapid decompression of the aircraft

NOTES

Note 1: It is not expected that the PED's perform to the category 'H' level of radiated emissions (ref. DO-160D Section 21). However, the power supply system should filter undesirable conducted emissions generated by the PED's or by the ISPSS itself and prevent the propagation of any unwanted RF into other aircraft systems. (see paragraph g. above).

Note 2: The burden of establishing the suitability of use of PED's on a particular aircraft model will remain with the aircraft operator as provided for by 14 CFR Section 91.21, Portable electronic devices.

Note 3: The use of PED's should be prohibited during critical flight phases such as take-off and landing, as described for the ISPSS under paragraph b above.

Note 4: If the ISPSS system includes seat-mounted equipment, the applicant is accountable for the certification of the entire ISPSS system, including the seat mounted equipment. As a reminder, in general, the seat TSO's (Technical Standard Orders) do not contain electrical requirements. Therefore, electrical aspects of the ISPSS components are not addressed under the TSO. In addition, many TSO holders disclaim the basic production and certification of the ISPSS parts. Therefore, it should not be assumed that electrical components have been addressed, in any way, under the TSO. Further information regarding seat mounted ISPSS equipment can be found in the AIR-100 policy memorandum Policy and Guidance on the Approval of Electrical Components on Aircraft Seating Systems, dated October 27, 1998, or later revisions.

Note 5: Operators should provide suitable safety instructions for the passengers detailing the PED's permitted to be used. These instructions should also include the use of the system, its limitations, hazards and the operation of airline supplied equipment.

The general policy stated in this document is not intended to establish a binding norm; it does not constitute a new regulation and the FAA would not apply or rely upon it as a regulation. Although the FAA retains the discretion not to follow the policy in this document, an Aircraft Certification Office proposing a deviation from this policy should only do so with the concurrence of the Transport

Standards Staff, ANM-113. Applicants should expect that the certificating officials will consider this information when making finding of compliance relevant to new certificate actions. Also, as with all advisory material, this statement of policy identifies one means, but not the only means, of compliance.

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