

Conditions Environnementales pour les équipements FTI des avions d'essai Airbus Commercial

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Pourquoi a t-on besoin de tester les équipements en conditions environnementales ?

Les équipements embarqués dans un aéronef (système de communication, instruments de vol, équipements de sécurité, calculateurs, éclairages, système de divertissement, ...) doivent être capables de fonctionner de façon sûre et fiable quelques soient les environnements climatiques mécaniques, conditions atmosphériques, ... pour lesquels ils ont été conçus et auxquels ils seront exposés.

Exemples de phénomènes et de situations critiques:



Windmilling



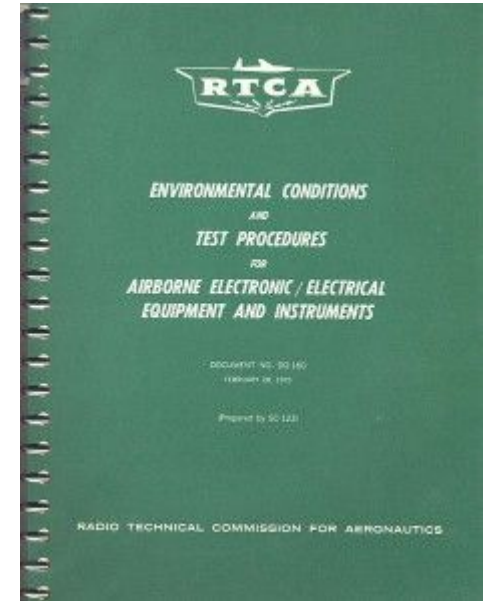
Lightning

Normes et règles de qualifications des systèmes avion

Depuis 1975, les procédures de tests et les conditions environnementales pour les hardware des systèmes avioniques sont décrits et spécifiés dans la norme **DO160**.

Tous les fabricants de systèmes aéronautiques doivent couvrir toutes les exigences de ce standard pour assurer que l'équipement sera opéré correctement dans l'avion:

- Temperature and Altitude
- Temperature Variation
- Humidity
- Operational Shocks and Crash Safety
- Vibration
- Explosive Atmosphere
- Waterproofness
- Fluids Susceptibility
- Sand and Dust
- Fungus Resistance
- Salt Fog
- Magnetic Effect
- Power Input
- Voltage Spike
- Audio Frequency Conducted Susceptibility - Power Inputs
- Induced Signal Susceptibility
- Radio Frequency Susceptibility (Radiated and Conducted)
- Emission of Radio Frequency Energy
- Lightning Induced Transient Susceptibility
- Lightning Direct Effects
- Icing
- Electrostatic Discharge (ESD)
- Fire, Flammability



Normes et règles de qualifications des avions AIRBUS

Basé sur la DO160, AIRBUS a rédigé des directives spécifiques [ABD0100](#) décrivant les conditions environnementales et les exigences d'essais pour les avions AIRBUS.

Il existe principalement 2 sous normes:

- ABD0100 1.2 Environmental Conditions and Tests Requirements Associated to Qualification
- ABD0100 1.8 Caractéristiques électriques des systems AC et DC

AIRBUS - A350
Equipment - Design - General
Requirements For Suppliers
ABD0100.1.8.1
PART 1 - PRODUCT
CHAP 8 - ELECTRIC - INSTALL

**Electrical Characteristics of A350
AC and DC Systems**

SCOPE:
This directive provides:
• the requirements related to AC and DC aircraft electrical networks with regard to the quality of the electrical power that is made available at the line contactors of the electrical power sources.

AIRBUS
Equipment - Design - General
Requirements For Suppliers
ABD0100.1.2
PART 1 - PRODUCT
CHAP 2 - ENVIRONMENT

**Environmental Conditions and Tests
Requirements Associated to
Qualification**

SCOPE:
This directive:
• defines all the general environmental conditions that the item of equipment is likely to encounter,
• defines the particular test conditions associated to the verification of the unit's performance within its specified environment.
This document shall be used as a complement to the Purchaser Technical Specifications (PTS), High Level Purchaser Technical Specifications (HLPTS) and Delta Purchaser Technical Specifications (Delta-PTS) to define the system environmental qualification requirements.

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Date : 10 December 2008
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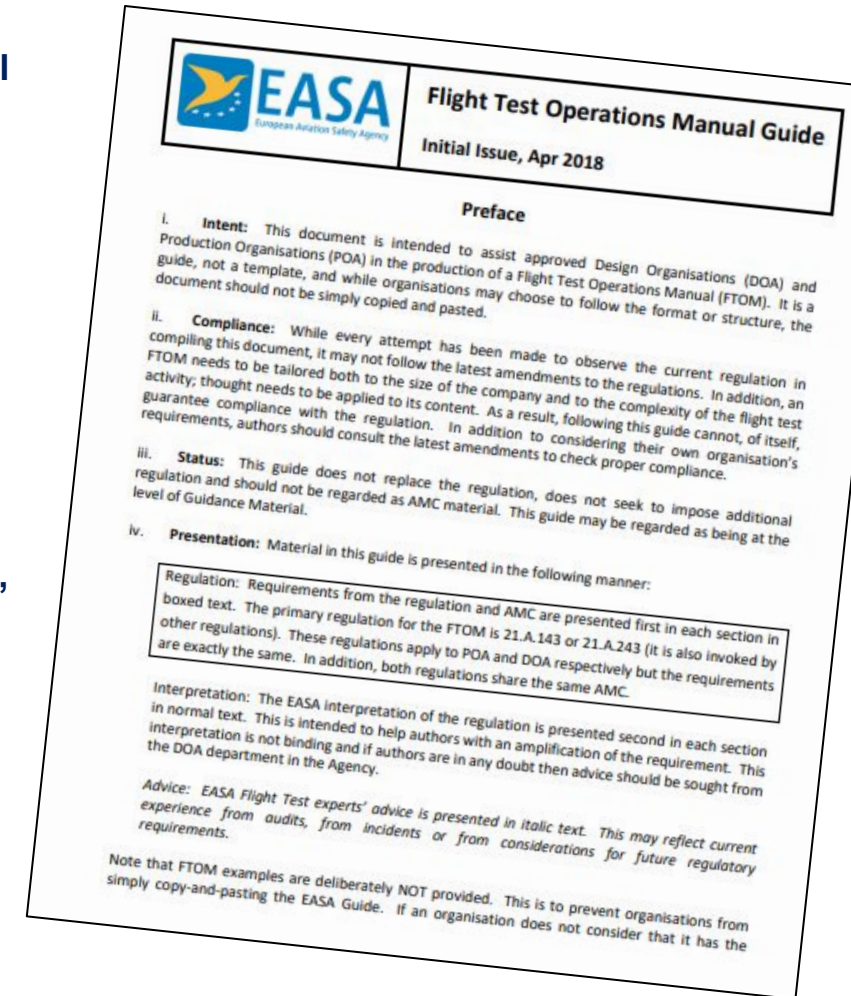
Réglementation liée aux équipements d'une installation d'essai

La réglementation EASA pour le “Permit to Fly” est intégrée dans le FTOM (Flight Test Operational Manual).

La réglementation adresse 2 catégories distinctes d'instruments et équipements utilisés pour les activités d'essai en vol :

- Equipements “Safety”
- Equipements de l'installation d'essai “Flight Test Instrumentation”

Chaque organisation décrit dans son FTOM la liste minimum des “Aircraft Safety Equipment”



Exigences de qualification des équipements FTI "Non Safety" au Centre d'essai AIRBUS Commercial

Dans notre organisation, les équipements FTI ne sont pas utilisés pour assurer la sécurité du vol (**Safety of Flight**).

Les tests de qualifications sont réalisés :

- pour assurer que les équipements et l'installation ne mettent pas en danger l'équipage et l'avion (**MANDATORY**).
- Pour valider que l'équipement fonctionne comme attendu et durant son profil de vie



Tests de Qualification environnementale pour les composants FTI / ou les équipements installés en zone FFLZ

- | | | | |
|-------------------------------------|-------------------------|-------------------------------------|---------------------------------|
| <input type="checkbox"/> | Temperature | <input type="checkbox"/> | Flammability / Toxicity |
| <input type="checkbox"/> | Pressure & Humidity | <input type="checkbox"/> | Hail |
| <input checked="" type="checkbox"/> | Shocks | <input type="checkbox"/> | Electrical Requirements |
| <input checked="" type="checkbox"/> | Vibrations | <input type="checkbox"/> | Lightning |
| <input checked="" type="checkbox"/> | Explosion Hazard | <input type="checkbox"/> | Radio Frequency Susceptibility |
| <input type="checkbox"/> | Icing | <input type="checkbox"/> | HIRF |
| <input checked="" type="checkbox"/> | Fire | <input checked="" type="checkbox"/> | Radio Frequency Emission |

En rouge, Test Obligatoire “Safety of Flight” :

Les Tests sont validés par le point focal SAFETY FTI

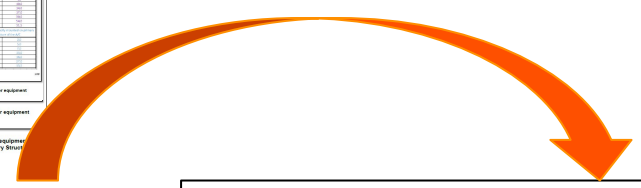
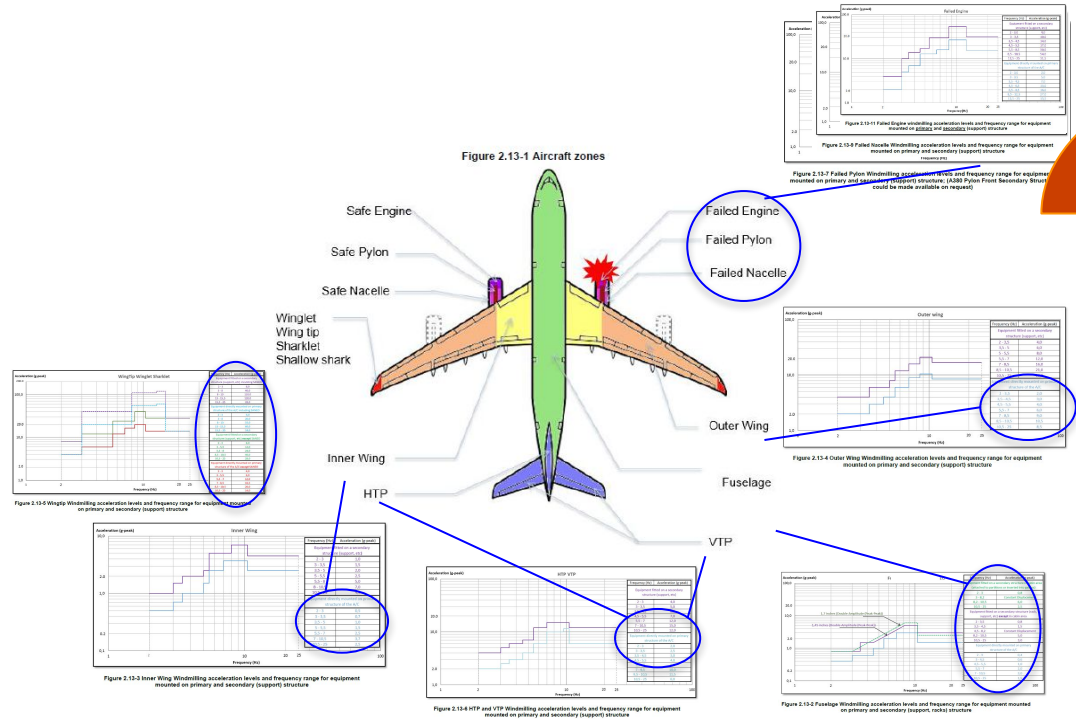
Règles de qualification pour les équipements FTI

Chapitres Applicables

Les exigences de qualifications FTI sont issues de l'ABD0100 / DO160 et déclinées par zone.

Règles de qualification FTI

Exigences de qualification FTI : Document de spécification basé sur l'ABD0100 et DO160



Section	Requirement Designation	Objective of the requirement	for Functional of A/C, Integrity, Safety, etc. not Damaged	Test for	ATEX measurement	Non-Fatigue and Static PFLZ tests	Electronic test	Coupler	Cabin Pressurized and controlled temperature press. with FTI Engineer	Cargo Depressurized and controlled temperature press. without FTI Engineer	Body/Fatigue	Externally mounted equipment	Ving (HTP/VTP Loading/Other Externally mounted)
Shock	Crash safety EUDOR 67.3	Check that equipment receives no damage during or after the crash - except for: - equipment which could detach and damage equipment during or after the crash. - Fuel/Choc. or a. d. - Vibration on equipment to be functional during or after crash. - equipment measurement check.	S	J	Crash Safety test - 3g - 6 duration: 20 sec	Crash Safety test - 3g - 6 duration: 20 sec	Crash Safety test - 3g - 6 duration: 20 sec	Crash Safety test - 3g - 6 duration: 20 sec	Crash Safety test - 3g - 6 duration: 20 sec	Crash Safety test - 3g - 6 duration: 20 sec	Crash Safety test - 3g - 6 duration: 20 sec	Crash Safety test - 3g - 6 duration: 20 sec	Crash Safety test - 3g - 6 duration: 20 sec
Vibration	Vibration due to engine fan blade (Vibration) AB0100 pt 1.2.12.10 CSO 13 CSO 13 CSO 13	Check that equipment is able to cope with engine vibration. CSO 13 CSO 13 CSO 13	F	J	Mtor FTI check detach and damage eng equipment during or after the crash. Mtor FTI check detach and damage eng equipment during or after the crash. Mtor FTI check detach and damage eng equipment during or after the crash. Mtor FTI check detach and damage eng equipment during or after the crash. Mtor FTI check detach and damage eng equipment during or after the crash.	Mtor FTI check detach and damage eng equipment during or after the crash. Mtor FTI check detach and damage eng equipment during or after the crash. Mtor FTI check detach and damage eng equipment during or after the crash. Mtor FTI check detach and damage eng equipment during or after the crash. Mtor FTI check detach and damage eng equipment during or after the crash.	Mtor FTI check detach and damage eng equipment during or after the crash. Mtor FTI check detach and damage eng equipment during or after the crash. Mtor FTI check detach and damage eng equipment during or after the crash. Mtor FTI check detach and damage eng equipment during or after the crash. Mtor FTI check detach and damage eng equipment during or after the crash.	Mtor FTI check detach and damage eng equipment during or after the crash. Mtor FTI check detach and damage eng equipment during or after the crash. Mtor FTI check detach and damage eng equipment during or after the crash. Mtor FTI check detach and damage eng equipment during or after the crash. Mtor FTI check detach and damage eng equipment during or after the crash.	Mtor FTI check detach and damage eng equipment during or after the crash. Mtor FTI check detach and damage eng equipment during or after the crash. Mtor FTI check detach and damage eng equipment during or after the crash. Mtor FTI check detach and damage eng equipment during or after the crash. Mtor FTI check detach and damage eng equipment during or after the crash.	Mtor FTI check detach and damage eng equipment during or after the crash. Mtor FTI check detach and damage eng equipment during or after the crash. Mtor FTI check detach and damage eng equipment during or after the crash. Mtor FTI check detach and damage eng equipment during or after the crash. Mtor FTI check detach and damage eng equipment during or after the crash.	Mtor FTI check detach and damage eng equipment during or after the crash. Mtor FTI check detach and damage eng equipment during or after the crash. Mtor FTI check detach and damage eng equipment during or after the crash. Mtor FTI check detach and damage eng equipment during or after the crash. Mtor FTI check detach and damage eng equipment during or after the crash.	Mtor FTI check detach and damage eng equipment during or after the crash. Mtor FTI check detach and damage eng equipment during or after the crash. Mtor FTI check detach and damage eng equipment during or after the crash. Mtor FTI check detach and damage eng equipment during or after the crash. Mtor FTI check detach and damage eng equipment during or after the crash.	Mtor FTI check detach and damage eng equipment during or after the crash. Mtor FTI check detach and damage eng equipment during or after the crash. Mtor FTI check detach and damage eng equipment during or after the crash. Mtor FTI check detach and damage eng equipment during or after the crash. Mtor FTI check detach and damage eng equipment during or after the crash.
Explosion Hazard	Explosion Protection Safety and PFLZ per ATEX cat. 1 AB0100 pt 1.2.12.16.3	Check that equipment is not able to ignite the surrounding atmosphere. T also assess ambient air. If ambient atmosphere which might occur over the aft ATEX device shall be compared with AB0100 pt 1.2.12.16.3 and	S	T	ATEX certification	ATEX certification	ATEX certification	ATEX certification	ATEX certification	ATEX certification	ATEX certification	ATEX certification	ATEX certification
Explosion Hazard	Fuel Tank Safety Safety - ECSS-11.10.01 for engine AB0100 pt 1.2.12.14.3 TCSS - TDDO - SDP30	One system follow ECSS-11.10.01 for engine AB0100 pt 1.2.12.14.3 TCSS - TDDO - SDP30	S	J	Mtor FTI check detach and damage eng equipment during or after the crash. Mtor FTI check detach and damage eng equipment during or after the crash.	Mtor FTI check detach and damage eng equipment during or after the crash. Mtor FTI check detach and damage eng equipment during or after the crash.	Mtor FTI check detach and damage eng equipment during or after the crash. Mtor FTI check detach and damage eng equipment during or after the crash.	Mtor FTI check detach and damage eng equipment during or after the crash. Mtor FTI check detach and damage eng equipment during or after the crash.	Mtor FTI check detach and damage eng equipment during or after the crash. Mtor FTI check detach and damage eng equipment during or after the crash.	Mtor FTI check detach and damage eng equipment during or after the crash. Mtor FTI check detach and damage eng equipment during or after the crash.	Mtor FTI check detach and damage eng equipment during or after the crash. Mtor FTI check detach and damage eng equipment during or after the crash.	Mtor FTI check detach and damage eng equipment during or after the crash. Mtor FTI check detach and damage eng equipment during or after the crash.	Mtor FTI check detach and damage eng equipment during or after the crash. Mtor FTI check detach and damage eng equipment during or after the crash.
Explosion Hazard	Fuel Tank Safety Safety AB0100 pt 1.2.12.14.1 EUDOR 69	Check that equipment is not able to ignite the surrounding atmosphere.	S	J	Mtor FTI Safety evaluation	Mtor FTI Safety evaluation	Mtor FTI Safety evaluation	Mtor FTI Safety evaluation	Mtor FTI Safety evaluation	Mtor FTI Safety evaluation	Mtor FTI Safety evaluation	Mtor FTI Safety evaluation	Mtor FTI Safety evaluation

Si un équipement est utilisé dans différentes zones, on applique le cas pire.

Les exigences de qualifications FTI sont issues de l'ABD0100 / DO160 et déclinées par zone.

Règles de qualification FTI

Exigences de qualification FTI : Document de spécification basé sur

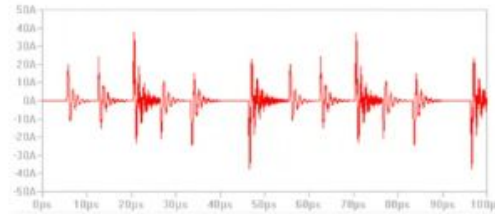


<p>Mandatory request (Safety of Flight) Bold : Mandatory (Safety or FTI) <=> SHALL <i>Italic : recommendation <=> SHOULD</i> Black or empty : System Maturity or Nice to have <=> MAY Depend on the Location of the equipment</p>													
Section	Requirement Designation	Objective of the requirement	for Functional or A/C Integrity / Safety / or not Damaged	Test or Justification by Design	ATEX In tank measurement	FFLZ Near Tank and inside FFLZ areas	Electronic bag	Cockpit	Cabin Pressurized and controlled temperature areas, with FT Engineer	Cargo Unpressurized and uncontrolled temperature areas, without FT Engineer	Belly Fairing	Externally mounted RF antenna/sensor	Ving /HTP / VTP S19 Landing Gear Externally mounted

Batteries Lithium: DO227-DO311

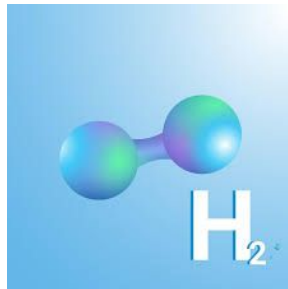
Introduction de technologies PWM HVDC: Immunité à de nouvelles contraintes EMI

Common mode current:
Repetitive pulses, source of
ElectroMagnetic Interferences (EMI)



2

ATEX / Hydrogène



Equipements optiques, Lasers & LIDARs:



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Règles de qualification FTI

Evolution continue / Prise en compte de nouvelles technologies

Thank you

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