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FOREIGN OBJECT DAMAGE PREVENTION PROGRAM (FOD)

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FOREWORD

Foreign object damage (FOD) is a major concern in the aviation, space and defense industries.

This document defines FOD prevention program requirements for organizations that design, develop and supply aviation, space and defense products and services, as well as for organizations that provide post-delivery support, including maintenance, spare parts or materials for their own products and services.

It is emphasized that the requirements specified in this document are complementary to (and not alternative to) customer, applicable legal and regulatory requirements.

This presentation is intended to provide complementary and illustrated information to EN9146 on the requirements of the Foreign Object Damage (FOD) prevention program. This guidance document should therefore be used in conjunction with the standard.





Terms and definitions

Foreign object (FO)

Foreign substance or item (e.g. tools, consumables, equipment, product protection devices, personal items, product process debris, operation debris and environmental debris) that may enter and migrate into/onto the product or system becoming FOd and possibly cause FOD, if not removed and controlled.

Foreign body debris (FOd)

Any foreign matter that has entered and migrated into/on the product or system can potentially cause FOD if not removed and controlled.

Foreign object damage (FOD)

Any damage attributed to foreign bodies that can be expressed in physical or economic terms is likely to degrade the required safety and performance characteristics of the product or system.



FO/FOd/FOD Examples

Foreign object (FO)

Foreign substance or item (e.g. tools, consumables, equipment, product protection devices, personal items, product process debris, operational debris, environmental debris) that could potentially enter and migrate into/on the product or system to become FOd and potentially cause FOD, if not removed and controlled.



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FO example

Machining chips form during machining processes and must be carefully cleaned and removed from workpieces.

Fod example

Machining chips had become embedded in the cavity and had not been properly cleaned from the component.

Had it not been detected and removed, this FOd could have caused an FOD.



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Fod example

This part was returned by a customer due to FOd contamination. Had it not been detected and eliminated, this FOd could have caused FOD.





FOD example

The product leaked during acceptance testing.

- The leak was caused by an optical fiber preventing seal integrity at a manifold interface
- Laboratory analysis revealed that the optical fiber was a nylon fiber
- The source of the nylon fiber was determined to be a type of garment.

This FOD condition could have caused further damage to other components or systems had it not been detected and eliminated.

Note: Although the part itself has not been directly damaged, the leak is qualified as "damage that can be expressed in physical terms, which could potentially degrade the required safety and performance characteristics of the product or system", thus qualifying it as a FOD condition.





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PROGRAMME DE PRÉVENTION DES FOD

An FOD prevention program takes into account the following elements:

- Operations
- Zone designation
- Personnel training and access
- Product protection
- Maintenance and cleaning Consumables, equipment, personal items Responsibility and control
- Responsibility and control of tools.





OPERATIONS:

The organization shall establish, implement and maintain FOd/FOD prevention processes for operations.

FOd/FOD prevention processes establish requirements for :

- identification of products/features (e.g. openings, compartments, cavities) requiring FOd/FOd protection;
- Assess the capabilities of FOd/FOd protection, cleaning and inspection/detection processes;
- Inspection/detection methods at appropriate stages or intervals to prevent contamination, damage and deterioration.





DESIGNATION OF THE ZONE

The organization must determine zone designation on the basis of an assessment of FOD risks linked to product characteristics and operations.

For each designated area, establish, implement and maintain the appropriate level of control taking into account the following elements:

- operations performed
- staff training and access product protection
- maintenance and cleaning of premises
- responsibility for and control of consumables, equipment and personal items
- responsibility for and control of tools

Zones are identified by a logo:







TRAINING

The organization must :

establish, implement and maintain an FOD prevention training program in line with the results of the FOD risk assessment.

- Determine the appropriate criteria and content of initial training.
- Identify internal and external staff training needs.
- Establish training methods (e.g. classroom, electronic).
- Establish criteria, content and intervals for periodic training.
- Evaluate training effectiveness (e.g., by measuring employee skills, FOD/FOd non-compliances).
 Keep documented records of training program compliance.







PRODUCT PROTECTION

The organization shall identify methods and materials to protect product characteristics against FO/FOd, as defined by a FOD risk assessment. Establish, implement and maintain a product protection process at all stages of operations.

- Protection against contamination (plastic materials, caps, lids, trays, tubs, plugs, etc.)
- Methods for receiving, applying and removing product protection devices must be defined in work instructions.

Key points to consider for product protection methods :

- How are product protection devices delivered to the process? (In kits? On the product as received? In bins?)
- How, when and where are they applied (bolted on? stretched over the product? glued onto the product? inserted, etc.)?
- What happens once the operation is complete? (Are they left in place or removed?)
- What happens to them after removal? (Are they thrown away, put back in stock, sent back to the supplier?)





PRODUCT PROTECTION (continued)

- Product storage, handling and transportation (cleanliness of carts, containers, trays, etc.);
- Protection against physical and functional damage (separation of parts, obstruction of passages, damage to connectors, etc.);
- Protection against debris from the manufacturing process which may affect product characteristics (machining chips, oil, silicone residues, sealing resin, silk pieces from electronic components, shot blasting, metallurgical powder, coatings, paint, etc.).





CLEANING AS YOU GO

The organization must :

 Establish, implement and maintain housekeeping and cleaning processes in all work areas and infrastructure.

NOTE: Infrastructure includes buildings, warehouse, workspace, public areas and process equipment...

- Mitigate FO/FOd/FOD risks associated with the accumulation of debris and waste in all work areas at appropriate intervals.
 Example of cleaning interval: Cleaning of the general work area at the end of the work or at the end of the work period.
- Mitigate FO/FOd/FOD risks in the product's immediate working area at intervals appropriate for production, maintenance and servicing processes (commonly known as "Clean-As-You-Go"). Examples of cleaning intervals :
 - Cleaning of operation debris on the product when there is a risk of accumulation or migration of organic contaminants;
 - Cleaning of operation debris at the end of each operation and before the start of another operation.





CONSUMABLES, EQUIPMENT, PERSONAL ITEMS | RESPONSIBILITY AND CONTROL

The organization must:

- Establish, implement and maintain processes for accounting for and controlling consumables, equipment and personal items to mitigate the risk of FOD to the product;
- Maintain documented information on a process for reporting lost consumables, equipment and personal items to mitigate FOD risk to the product. Personal items: items belonging to individuals or distributed by the organization for personal use.

Note: Personal items include, but are not limited to, the following examples:

- Personal items belonging to individuals: keys, cell phones, wallets/pocket books, food products, beverages, tobacco products, lighters, jewelry, coins, electronic devices, pens, pencils, etc.
- Personal items belonging to the organization: company badge, inspection stamps, personal protective equipment, toolbox, pens, pencils, etc.



RESPONSIBILITY AND CONTROL OF TOOLS

The organization must establish, implement and maintain a process for accounting for and controlling company-owned and privately-owned tools to reduce the risk of FOD. Tool accountability and control includes:

- storage and preservation,
- identification and inventory,
- tool location and management (e.g. knowing where tools are at all times), maintenance, serviceability and condition (e.g. cleanliness, absence of broken parts, missing parts),
- design considerations to avoid generating or trapping foreign bodies, and to enable their detection and removal.

Define and maintain documented information on a process for reporting tool-related problems to mitigate the risk of FOD to the product (e.g. lost tool, missing/broken tool part or detail).





1900 family

Cavity burrs







Surface treatment chipping on SIM products | EN4165



Loss of nut on ASR product at customer site









Burrs, excess of material (plastic or silicone) → potential electrical problem







Metal chips after assembly of a metal insert in a SIM|EN4165 board



Metallic scrap after silk cutting



Metal debris in plastic housing



Incorrect assembly of a stop ring resulting in loss of parts







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