Spira FOD Prevention Program

Rev 2/11/2021

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1 Scope

As a manufacturer of OEM and customer-defined products installed in aerospace and other mission-critical applications, it is essential that Spira design, develop, and implement a Foreign Object Damage (FOD) program. Effective FOD programs begin at the door with excellent housekeeping and continue through all aspects of manufacturing, including customer support after the parts have left the plant.

This document's requirements are based on AS9146. In the event of a conflict with operational practices, consult the AS document's current revision for information. This document works in conjunction with Spira's AS9100 quality system and should be implemented in all manufacturing processes.

2 Applicable Documents

The following documents should be considered for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document, including any amendments, applies.

- 9100 Quality Management Systems – Requirements for Aviation, Space, and Defense Organizations
- IAQG Supply Chain Management Handbook (SCMH) – Foreign Object Prevention Program Guidance Material (http://www.sae.org/iaqg/)
- ISO 9000:2015 Quality management systems – Fundamentals and vocabulary
- Spira Manufacturing Quality Manual (Current Revision)

3 Terms and Definitions

Spira's FOD prevention program uses the terms and definitions defined in AS9146 to maintain continuity.

Clean-As-You-Go: Practice of cleaning the immediate work area of the product at appropriate intervals to eliminate the accumulation or migration of Foreign Objects (FOs) that may potentially become entrapped within the product [i.e., Foreign Object Debris (FOd)] or cause damage (i.e., FOD).

Consumables: Supplies, materials, and miscellaneous items required for product and operations processes that are expected to be consumed during work performed or discarded after useful function.

Foreign Object (FO):   An alien substance or article (e.g., tools, consumables, hardware, product protective devices, personal items, product process debris, operations debris, environmental debris) that could potentially enter and/or migrate into/on the product or system becoming FOd and potentially cause FOD, if not removed and controlled.

Foreign Object Damage (FOD):   Any damage attributed to FOd that can be expressed in physical or economic terms, which could potentially degrade the product or system's required safety and/or performance characteristics.

Foreign Object Debris (FOd):   Any FO that has entered and/or migrated into/on the product or system, and could potentially cause FOD, if not removed and controlled.

Hardware:	Bill of Materials (BOM) parts used in operations (e.g., standards, fasteners, nuts, rivets, washers, screws, bolts, spacers, cotter keys, wire terminals, wire terminal connectors).
Housekeeping:	A process to maintain general cleanliness and ensure all work areas are orderly and free of potential FOs at appropriate intervals.
Operations:	Product related activities and services through all stages of production, maintenance, and service execution (e.g., design and development, manufacturing, assembly, test, packaging, shipping).
Personal Items:	Items owned by individuals or distributed by the organization for personal use (e.g., badge, stamps, keys, cell phones, wallets, personal protective equipment, food, drink, tobacco products).

4 Foreign Object Damage Prevention Plan

4.1 Progam Management

4.1.1 Spira Manufacturing's top management shall demonstrate leadership and commitment to the FOD prevention program

4.1.2 Spira Manufacturing shall designate a "FOD Prevention Representative" with the responsibility and authority to establish, implement, and maintain the program. See Spira job descriptions for the designated representative.

4.1.3 Spira Manufacturing shall establish, implement, and maintain documented information of a FOD Prevention Program. The documented program shall be made available to customers upon request.

4.1.4 FOD non-conformities shall be recorded and tracked to aid in the evaluation of the current processes.

4.1.5 FOD non-conformities shall be recorded and processed in a manner consistent with AS9100 nonconformance handling. This process includes the NCR, containment, root cause investigation, corrective action implementation, and verification.

4.1.6 Spira Manufacturing shall evaluate Spira's FOD Prevention Program's effectiveness based on internal, customer, statutory, and regulatory requirements pertaining to Spira products.

4.1.7 The annual evaluation of Spira's FOD Prevention Program shall be made available to customers upon request. Evaluation data consists of the number of non-conformities based on the total count of orders shipped.

4.1.8 Spira manufacturing shall maintain documented information of a FOD risk assessment for procured product and flow down FOD prevention requirements commensurate with that risk.

4.2 Operations

4.2.1 FOD Prevention Process controls

Spira Manufacturing shall establish, implement, and maintain FOd/FOD prevention processes for operations.

4.2.2a Product Designs

Spira manufacturing shall design all COTS parts with consideration to prevent the possibility of FO. An example of poor FO design would be: parts with limited lengths of adhesion area. Such designs may allow the gasket to debond from the frame and become FOd. Designs of products should be reviewed for the possibility of creating FO within the application. The design of parts and applicable quality systems should clearly state the limits of acceptability to aid in FO's inspection process (see SWS-9000).

Customer-driven designs are modifications of basic product sets and may push the boundaries of acceptability. Largy all the details of the customer systems are not known to Spira Manufacturing and can not be evaluated for FOD acceptability at the part level. These designs are driven by the design of the customer and are subject to their FOD prevention programs.

4.2.2b Protective Devices and Measures

Spira Manufacturing may implement articles of FOD protection on the products it produces. Examples of articles that may prevent FOD are; resealable packaging, heat-sealed bagging, adhesive barriers on specific areas of parts, boxing, or lids on containers. Additional articles may be evaluated and added to production systems at the decision of the MRB.

4.2.2c Sequence Operations to Reduce Risk

The job sequence of the production of parts, controlled by the job traveler, shall be formatted to limit FO exposure. Defining potential FO exposure and processes that create can enable the planning for cleaning or inspection operations. When products finish these operations, they should be clearly defined inspection steps for eliminating any further contamination of the parts in further processing.

4.2.2d Identify characteristics requiring FO protection

MRB evaluates and specifies any features of products that require specific care or treatment to reduce the risk of FO inclusion. Such features may be blind cavities or areas that would present problems trying to remove the FO later in the production process.

4.2.2e Capabilities for cleaning and detection of FO/FOd

Spira manufacturing utilizes various methods for the detection and removal of FO in the production process. Such methods consist of but are not limited to manual compressed air cleaning, visual inspection, and audible inspection criteria. Spira Manufacturing may implement alternate processes and inspection methods or cleaning, as deemed necessary by the MRB.

4.2.2f Inspection steps at appropriate intervals

FO inspections shall be conducted routinely and often to provide reasonable assurance that the issues are being mitigated. Products in which the processes generate more significant FO potential should be inspected more than processes with less potential contamination. Increased controls may be evident in the frequency of inspection checkpoints and/or the products' sampling rate in the checkpoints.

4.3 Area Designation

4.3.1 Site Map

Spira Manufacturing has established a site map that marks the locations of FOD controlled areas. See the map in Appendix A for details. Uncontrolled areas are marked with high visibility black and yellow striped floor marking.

4.3.2 Area Controls

Each of the following areas requires defined topics of control. These protocols are enacted to mitigate FO's risk within the parts based on the specific aspects foreseen within the topic. Levels of control vary by topic and may be altered at any time as deemed necessary by the MRB.

4.3.2a Operations and Training ~ See Section 4.4

4.3.2b Training and personnel Access ~ See Section 4.5

4.3.2c Product Protection ~ See Section 4.6

4.3.2d Housekeeping and Clean-as-you-go ~ See Section 4.7

4.3.2e Non-registerable item control ~ See Section 4.8

4.3.2f Tool accountability and control ~ See Section 4.9

4.3.3 Visual Designation

All-access points into the facility's production area must have signage notifying the personnel of the critical effort in the area. Applicable signs should be mounted on all access points and be evident without effort to notice. FOD signs should be brightly colored & floor marking tape shall be yellow and black to signify a controlled area.

4.3.4 Protection of environment

In the event of non-product related activities are being performed (maintenance, equipment repairs, construction, etc.), all product MUST be moved out of the immediate vicinity. The requirement for products at a minimum of 6 feet away. If the process creates excessive amounts of dust, then the product should be moved further away. Whenever possible, cover non-involved machinery and products with protective coverings.

4.4 Training and Personnel Access

All employees and contract workers receive FOD training and information during their orientation (See Appendix A). Signatures of completion of the training are required of the individual and the supervisor after reviewing the FOD handout. Company-wide training is conducted annually to maintain awareness and vigilance. Annual training may consist of general FOD practices or focus on specific policies within the manual to ensure they are followed. Training forms regarding FOD are signed by the employees in attendance and stored in the appropriate electronic format.

Any personnel entering the facility who have not had FOD training must be accompanied to ensure Spira's FOD Prevention Program guidelines are being followed.

4.5 Product Protection

To ensure FOD is not absorbed into the product during production, specific policies may be enacted to mitigate risk. Containment and packaging control is implemented to ensure that the materials used to protect the parts are not the cause for damage. Articles used to restrain the parts can become FOd if they are incorporated incorrectly. For example, the ties to hold Enduro-shield bundles together may cause issues if a stray article is wrapped in the bundle.

Housekeeping of storage facilities and utensils must be routine to prevent contamination. Carts should be maintained and free from debris so that parts moving from one area to another do not absorb the material. Storage racks should be cleaned routinely so that the dust does not impinge on the material. Also, the material on the storage racks should not contact other products that could have adverse effects. Whenever non-production related events are happening, the inventory and storage areas should be covered or relocated to reduce contamination.

4.6 Housekeeping and Clean-as-you-go

Spira employees are trained in keeping work areas organized, clean, and with items adequately stored. These areas include, but are not limited to, aisles, jigs, tooling, fixtures, workbenches, decks, work stands, tool boxes, tool/tote trays, floors, tables, outside areas, and fabrication. It is everyone's responsibility to keep work areas clean and orderly. Items not in use and not adequately stored shall be addressed as a violation of the housekeeping standard. Each employee is allotted time daily to clean workstations and practice housekeeping.

The process for production shall be broken down into sections to allow for "Clean-as-you-go" processing. "Clean-as-you-go" methodology is the fundamental of breaking down the production schedule into sections so that debris from one process can be cleaned before moving to the next. Isolating processes and cleaning immediately after they conclude reduces the contaminant's chances of being spread or drug into the parts being processed or parts in standby.

4.7 Non-registerable item control

Efforts are taken within Spira Manufacturing's production system to reduce the risk of accidentally including components out of the production system. For example, if an employee trims an initial sample from the winding machine, the sample should be discarded not to get mixed in loosely with the spooled product. For example, specified bags are used for scrap collection, so it is not accumulating with the potential to get enveloped with the product. Non-registerable item control is a significant portion of the program and one of the more challenging aspects because the materials in question are not countable items and primarily arise outside of the production process. Additional items for consideration and their mitigation methods are as follows:

Artifact Type	Examples	Mitigation Method
Dirt	Dust from ventilation systems Machine Grime buildup	Daily Housekeeping practices
Personal artifacts	Jewelry Buttons	Prohibition of personal jewelry The requirement of cover garments
Process Scrap	Scraps created by scissor trimming HF drilling debris	Housekeeping practices Designated scrap bins
Rouge hardware	HF testing bolts HF assembly fasteners HF assembly inserts	Housekeeping practices Proper storage Issuing and counting control
Consumables	Glove Fibers Buffing wheel fibers	Visual inspection Cleaning with compressed air Restriction of materials in use

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4.8 Tool accountability and control

Spira production work centers are controlled via specified manufacturing equipment. Each station incorporates dividers with tool storage to remove tools not involved in the specific process being conducted. Daily the tools are inspected to ensure they are in proper working order. This effort is critical in ensuring that damaged tools do not leave behind parts that can become FO and become enveloped into the parts.

If a tool is ever misplaced or found to be missing a part, a supervisor must be notified. Records of lost tools or missing parts of tools should be recorded to enable the components' search and reconciliation.

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Appendix A

Employee FOD Maintenance Program

What is FOD?

- When an item that shouldn't have been there or what is referred to as a foreign object causes aircraft or support equipment damage, it is classified as "FOD," Foreign object is a term that includes just about anything that doesn't belong, like tools, test equipment, scraps of safety wire, extra washers, or personal items like pocket change and even trash that gets left behind during the performance of a job FOD can easily damage jet engines, jam critical control mechanisms or short circuit electrical components.

¿Qué es FOD?

- Cuando un artículo que no debería haber estado allí o lo que se conoce como un objeto extraño causa daños a la aeronave o al equipo de apoyo, se clasifica como FOD ", objetos extraños es un término que incluye casi cualquier cosa que no pertenezca, como herramientas, equipo de prueba, restos de cable de seguridad, arandelas adicionales o elementos personales como cambio de bolsillo e incluso basura que se quedan atrás durante el desempeño de un trabajo. FOD puede dañar fácilmente los motores a reacción, atascar los mecanismos críticos de control o cortocircuitar los componentes eléctricos.

Designated Food Area

- When bringing food inside or out of the building, you must stay inside the designated food area within the yellow and black lines. No food is permitted outside these lines.

Área de comida designada

- Cuando traiga comida dentro o fuera del edificio, debe permanecer dentro del área de comida designada dentro de las líneas amarilla y negra, no se permite comida fuera de las líneas.
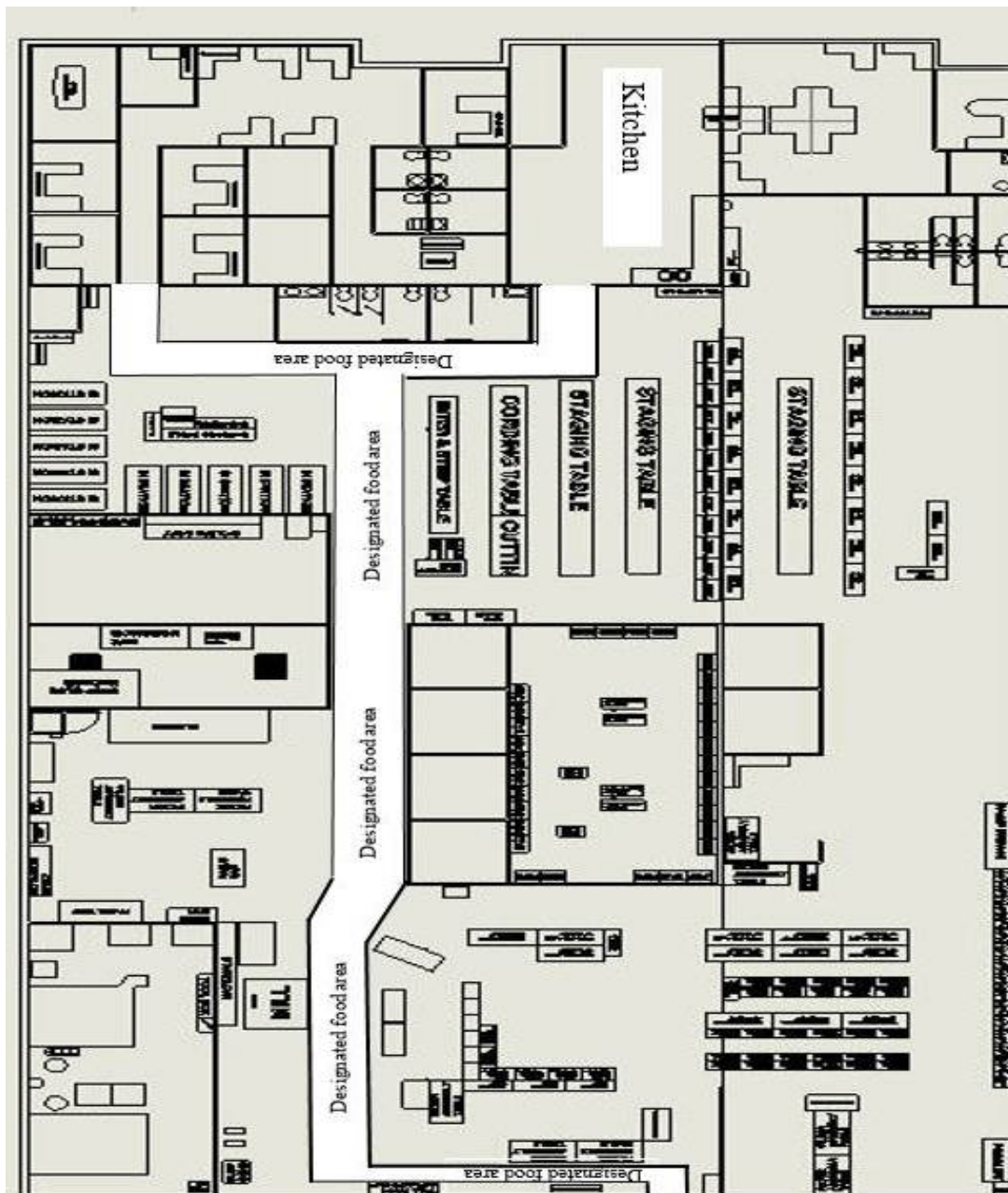
- Drinks should only be water or coffee in spill-proof mugs or plastic (non-breakable) bottles with a" secure" cap or lid. No canned beverages, paper/plastic cups, glass, or open containers are allowed.

o Las bebidas solo deben ser agua o café en tazas a prueba de derrames o botellas de plástico (que no se rompan) con una tapa o tapa "segura". No se permiten bebidas enlatadas, vasos de papel / plástico, vidrio o recipientes abiertos

Personal Items and Work Areas

- Please remove all jewelry before commencing work.

o Por favor, quitese todas las joyas antes de comenzar a trabajar

- **All personal items** belong in your locker.

o **Todos los artículos** personales pertenecen a su casillero.

- **All items** on work station should be assigned or approved by management.

o **Todos los artículos** en la estación de trabajo deben ser asignado o aprobados por la gerencia.

- **All electronics** must be approved by management.

o **Todos los productos electrónicos** deberán ser aprobados por la gerencia.

Housekeeping

- Definition: — Housekeeping is the practice of keeping work areas organized, clean, with items adequately stored. These areas include, but are not limited to, aisles, jigs, tooling, fixtures, workbenches, decks, work stands, tool boxes, tool/tote trays, floors, tables, outside areas, and fabrication. It is everyone's responsibility to keep work areas clean and orderly. Items not in use and not properly stored shall be addressed as a violation of the housekeeping standard.

Limpieza

o Definición: - La limpieza es la práctica de mantener las áreas de trabajo organizadas, limpias, con los elementos correctamente almacenados. Estas áreas incluyen, pero no están limitadas a; pasillos, plantillas, herramientas, accesorios, bancos de trabajo, plataformas, soportes de trabajo, cajas de herramientas, bandejas de herramientas / contenedores, pisos, mesas, áreas exteriores y fabricación. Es responsabilidad de todos mantener las áreas de trabajo limpias y ordenadas. Los artículos que no estén en uso y que no se hayan almacenado correctamente se tratarán como una violación del estándar de limpieza.

- Everyone in the warehouse has the last five minutes of their working schedule to focus on housekeeping.

○ Todos en la bodega tendrán los últimos cinco minutos de su horario de trabajo para enfocarse en la limpieza.

YES

NO