LMUK Ampthill Foreign Object Damage Prevention Doc. No: 1QA734-D01

Acceptable Means of Compliance

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1. Associated Documents

LM Corporate Documents	
Number	**Title**
None	-
Missiles & Fire Control Documents	
Number	**Title**
1-2-329	Foreign Object Elimination
LMUK Ampthill Process Maps	
Number	**Title**
1QA102	Handle a Non Conforming Product
1QA398	Manage an Escape
5MAN195	Return parts from Production to Stores
5MAN587	Use and Return a Tool or item
LMUK Ampthill Documents	
Number	**Title**
1QA099-D01	Control Disposition and Reporting of Non-Conformances
1QA398-D01	Handle and manage an escape
5MAN195-D01	Return of Parts to Stores from Production
5MAN376-D01	Manage Controlled Tools and Tool Boxes within Manufacturing
ECC6-044	Non Conformance Reporting and Quality Notifications

2. Standards

Standard	Title
AS9100D	Quality Management System Requirements for Aviation Space and Defense Organizations: 8.1 Operational Planning and Control 8.5.1 Control of Production and Service Provision
ISO 9001:2015	Quality Management System -- Requirements

3. Forms

Once completed a form shall be retained as documented information, to be retained in accordance with Legislation, Contract, project lifespan, or 7 years.

Number	Title	Retention Period
F0228	Lost or Damaged Tool Report	7 Years
F0431	Housekeeping Checklist	7 Years
MFC-0403	Sponge Count - Control Entry Log	7 Years
Form Instruction	Sponge Count – Control Entry Log Form Instruction	n/a
MFC-0252	Work Area Qualification Plan (WAQP)	

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4. Abbreviations / Definitions

Table 1

Idiom	Definition
BCAB	Business Corrective Action Board
CAR	Corrective Action Report.
Chemicals	Sealants and solvents, adhesives, glue, cleaners, and primers.
Clean As You Go (CAYG)	Cleaning immediate work area on the product when Foreign Objects have the potential to migrate out of sight or to an inaccessible area and become Foreign Object Debris.
Consumables	Items/tools that are used-up or can be re-used to the point of being unserviceable or disposed of as part of the build process.
Expendables	Items consumed in use or not reusable (e.g. wipes, rags, sandpaper, brushes, applicators, plastic scrapers).
Fabrication	Areas where raw materials are used to produce/manufacture/modify sub-assemblies or parts.
FOD Awareness Area(s)	An area with a minimal potential for FOD entrapment or migration; however, control is required to eliminate risk. Personal attire and personal item restrictions may apply. Restrictions on food, drink shall be documented on the WAQP.
FOD Control Area(s)	An area with a moderate risk of FOD entrapment and migration to the next assemblies and/or final product. Tools/items and equipment regularly used in the area shall be Company approved and assigned to the area. Personal attire and personal item restrictions may apply. Food, drink and use of tobacco products shall not be allowed in these areas.
FOD Critical Area(s)	An area, where there is the highest risk of a potential FOD incident. Exposure to FOD in these areas would potentially cause system or product failures due to deterioration, malfunction or damage. These areas shall have controlled entry points. Tools/items and equipment regularly used in the area shall be company provided and assigned to the area. Personal attire and personal item restrictions shall apply. Food, drink and use of tobacco products shall not be allowed in these areas. When assemblies/hardware are not present, FOD Critical requirements are waived only to allow temporary tooling or maintenance tasks.
FOD Prevention Devices/Barriers	Caps/plugs, dust covers, pads, etc. for open tubing, ducting, electrical connectors, protection of surfaces/edges.
FOD Prevention Walk	An organised check of a specific area to physically search for and remove any Foreign Objects preventing potential damage to the product.
Foreign Object (FO)	A substance or article alien to a product or system that may or may not cause Foreign Object Damage (FOD) if not removed or controlled and allowed to migrate onto the product, system, or introduced into an operational environment.

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Foreign Object (FO) Incident	The discovery of a foreign object that could have, or has, potentially caused damage to the product had it not been found. This is reported as a Quality Notification (see 1QA099-D01 Control Disposition and Reporting of Non-Conformances).
Foreign Object Damage (FOD)	Any damage attributed to a foreign object that may be expressed in physical or economic terms, which may or may not degrade the product's required safety and/or performance characteristics.
Foreign Object Debris (FOd)	A substance, debris or article alien to a product or system which would potentially cause damage.
FPA	FOD Prevention Area.
General Housekeeping Area(s)	Production, non-production, test, or development area(s) in which application of housekeeping will ensure that foreign objects will not migrate to additional areas, contaminate the product, or affect testing or development.
Hardware	Small parts (e.g. nuts, rivets, washers, screws, bolts, spacers, wire terminals, wire splices).
Housekeeping	A process for sweeping, vacuuming, applying 6S Methodology/Lean Manufacturing, and cleanliness to ensure all work areas are kept clean, orderly, and free of potential foreign objects.
Items	Hardware, consumables, expendables, shop and production aids, and personal items.
LTI	Lost Tools / Items.
MFC	Missiles & Fire Control.
Miscellaneous Small Parts (MSP)	General hardware such as rivets, washers, fasteners, and other hardware.
Miscellaneous Support Equipment (MSE)	Hand carried items or equipment that facilitates production or modification by providing these resources (compressed air, electrical power/lighting, ergonomic devices, access, housekeeping, data); examples may include: air hoses, vacuum cleaners, extension cords, gel pads, cushions, chair/stools, step stands, work table, notebooks, work instructions.
PCA	Physical Configuration Audit
Perishable Tools	Standard tools which are consumed or readily damaged/ruined during the production process (e.g. drill bits, reamers).
Personal Items	Property owned by or distributed to employees for personal use (e.g. keys, wallets, cell phones, eyeglasses, jewellery, safety glasses, personal protective equipment, tool sheets, stamps, food, drinks).
Personal Packs	A company issued carrying bag, which is worn to hold personal items and display badges.
POC	Point of Contact
Product	Components, Sub-Assemblies, Assemblies that are in the process of manufacturing, modification or maintenance in progression towards customer acceptance.

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SAP Quality Notification (QN)	QNs are raised in the SAP tool with a separate Item created within the QN per defect. Multiple defects related to the same Material Master can be listed on the same QN. All incidents of finding Foreign Objects during inspection shall be reported as a Q3 type QN in SAP with an Item raised per defect. For example: two Foreign Objects found within one part shall have two QN Items raised.
Shadow of the product	The actual footprint of the product.
SLT	Senior Leadership Team.
WAQP	Work Area Qualification Plan

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Table 2

Examples of Foreign Objects at LMUKAmpthill	
Category	**Examples**
People (recorded as Personal Items in SAP)	Food Drink Pass/Lanyard Glasses/Personal Protective Equipment (PPE) Phone Mud (shoes etc transfer) Belts/Buckles Coins/wallets Tissues Keys Lypsyl/Lipstick/Make-up Jewellery
Environment (recorded as Natures FOD in SAP)	Dust Wind debris such as Leaves Insects Animals
Hardware (recorded as Manufacturing Hardware and Material in SAP)	Miscellaneous Small Parts (MSP) Glue/Paste Paint flakes Packaging Materials
Process (recorded as Business Items in SAP)	Tools Swarf Torque pen Consumables Expendables Perishable tools
Procedures (recorded as Business Items in SAP)	Paperwork Tablet Camera
Test (recorded as Business Items in SAP)	Leads Laptop Communication equipment

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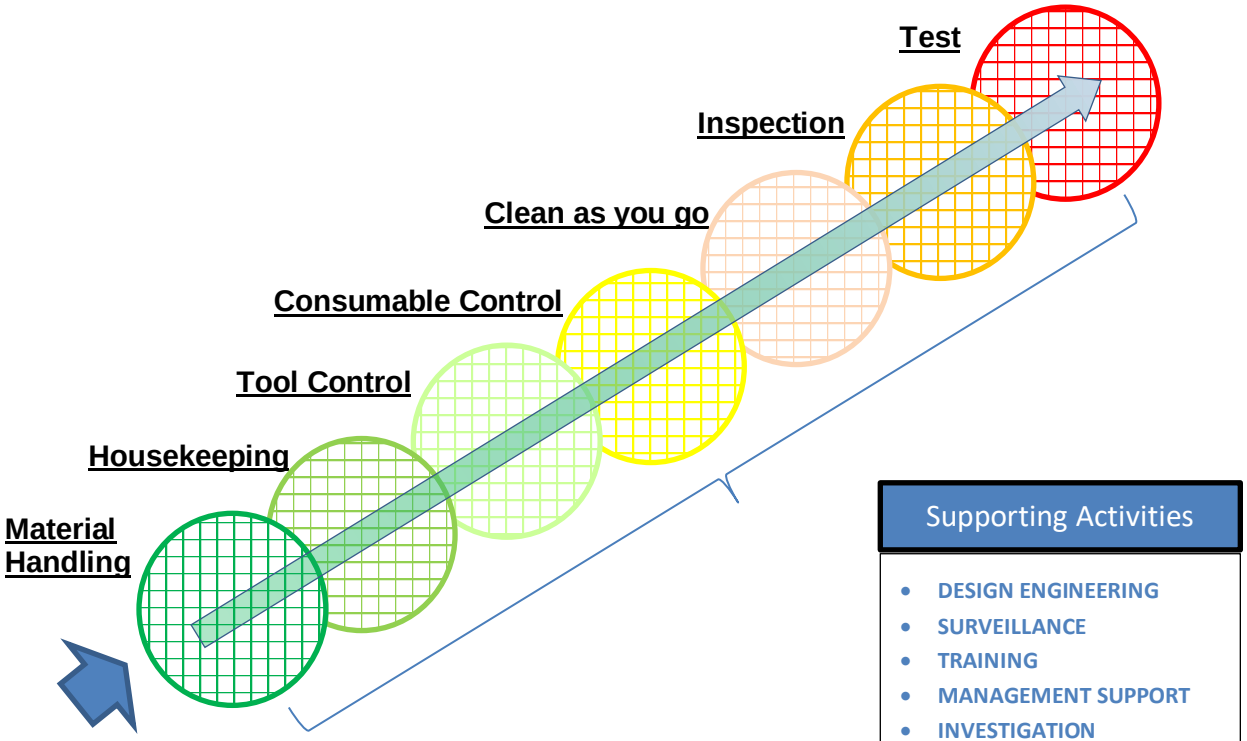
5. Scope & Applicability

5.1 This document provides information on the prevention of Foreign Object Damage (FOD).

5.2 The scope of this document is all products, assemblies, sub-assemblies and parts on site at LMUK Ampthill, or under the control of LMUK Ampthill staff at customer or supplier premises.

5.3 This document is a detailed breakout of the requirements for preventing FOD during fabrication, manufacturing, modification and test. Successful FOD prevention in this environment relies on the proper assessment of FOD risk combined with the appropriate controls to mitigate the risk.

As no single process is expected to be 100% effective at eliminating the risk of FOD, LMUK Ampthill employs a layered approach designed to progressively reduce the presence of Foreign Objects (FO)/Foreign Object Debris (FOd) to mitigate the risk of FOD as below:



Foreign Objects (FO)

CONSISTS OF:
- DEBRIS
- TOOLS
- CONSUMABLES
- MISCELLANEOUS SMALL PARTS (MSP)
- ENVIRONMENTAL FO

Supporting Activities

- DESIGN ENGINEERING
- SURVEILLANCE
- TRAINING
- MANAGEMENT SUPPORT
- INVESTIGATION
- COMMUNICATION
- POLICY
- AREA ASSESSMENT
- CORRECTIVE ACTION
- PREVENTATIVE ACTION
- ADMINISTRATION

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5.4 This document is applicable but not limited to the following functions:

- Quality;
- Production Operations
- Engineering;
- Global Supply Chain Operations (A);
- Together with any staff/individual visiting a FOD designated area, including internal support staff.

6. Acceptable Means of Compliance

6.1 Executive Commitment

The Head of Quality is the owner of the FOD Prevention Programme at LMUK Ampthill and establishes / communicates the vision and direction.

They are responsible for:

- Defining the FOD Prevention Programme processes;
- Setting expectations for the FOD Prevention Programme and establish periodic performance thresholds based on performance data;
- Reviewing Site and Programme level FO Incident Metrics for process compliance;
- Engaging Programme Leadership when metrics are not at the acceptable performance level;
- Being aware of FO Incident related Corrective Action Plans.

The Head of Production Operations is accountable for the compliance and implementation of the FOD Prevention Programme. They will support improvements in FOD Prevention and communications.

The individual Programme Quality Managers (PQMs) are responsible for ensuring consistent / standardised application of FOD Prevention practices on their Programme, including training of their team members.

The individual Programme Production Managers are responsible for ensuring consistent / standardised implementation of FOD practices on their Programme, including training of their team members.

6.2 Responsibilities

Quality shall:

- Generate FO Incident metrics for presentation at the Business level Corrective Action Board (BCAB) and Programme level Corrective Action Boards (PCAB).
- Audit for compliance to the FOD Prevention procedures and raise Non-Conformances where the procedures are not being followed.
- Designate a point of contact (POC) for each area to interface with the team on FO issues.

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- Inspect the product in accordance with this procedure and any additional Programme level directives. Raise a SAP Quality Notification (QN) with a separate Item per FO incident.
- Generate an Inspection Instruction document for each Inspection Operation. This will instruct the Inspector what to inspect against within the Operation.
- Support the resolution of FOD related non-conformances in accordance with 1QA099-D01.

Production Engineer shall:

- Ensure Inspection Operations are added to the routing for preventing FO at key stages in the build of the product.
- Sequence operations to preclude disassembly.
- Write clear work instructions that identify FO concerns and prevention methods.
- Clearly identify FO prevention areas and controls.
- Standardise FO prevention materials and practices such as signage.
- Identify/design suitable FO prevention packaging for equipment/materials.

Engineering shall:

- Design the product to be resistant to introduction or accumulation of FO and is protected from potential damages that may be caused by them. Examples of this are to design the product with minimal fasteners, limiting entrapment areas and to design for inspection and cleaning of any cavities.
- Highlight on the drawing where special processes must be utilised during manufacturing or transportation to prevent FOD.

Manufacturing shall:

- Maintain FO prevention areas and controls.
- Ensure good housekeeping and clean as you go is upheld.
- Following all instructions relevant to the FOD designation (Awareness/Control/Critical).
- Ensure timely reporting of potential FO, lost tools or items using the Lost Tools/Items process (LTI).

Global Supply Chain Operations (A) shall:

- Liaise with suppliers to ensure they understand the definitions and implications of FO in their deliverables.
- Ensure our suppliers have clear requirements for the prevention of FO in their products, including the materials/packaging used for delivery.

Stores and the Ministry Stores Controller shall:

- Protect products from FO invasions by using protective materials during storage and transportation. (e.g. dust caps, sleeving, anti-static bags).

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- Inspect and/or clean product containers before each use to ensure they are free of FOs.
- Avoid storing/transporting FO sensitive items directly inside of materials that can flake, fray, or produce particles (e.g., wood, cardboard).
- Ensure packaging materials (e.g., foam, peanuts) will not migrate into recesses of product.
- Identify FO risks when defining move/handling procedures.

6.3 Metrics

Metrics on FO Incidents are collected by quality on a monthly basis and reported up to the BCAB.

Programme Level metrics on FO are to be decided by the individual Programme taking into account the nature of the work performed and risk of FO.

6.4 Surveillance

Regular surveillance audits will be undertaken at programme level to ensure compliance to this process. These surveillance audits will be the responsibility of Production Operations management who will also undertake them.

An annual audit (as a minimum) will be assigned in the company audit schedule per programme with a manufacturing phase. These audits will be undertaken by Quality.

A company level audit shall also be planned on an annual basis to ensure compliance to the process on collection and reporting of data and any subsequent corrective actions. These audits will be undertaken by Quality.

6.5 Delivered FO

Any FOs found by the customer on a delivered product, or during customer inspection of the product at Ampthill premises, shall constitute an External Escape and thus be reported via a customer Corrective Action Report (CAR). The CAR is then handled using 1QA398-D01 Handle and manage an escape process. This will be raised in SAP as a Q1 type QN.

6.6 FO Incident reporting

Inspection (Detection)

If FOs are detected during inspection, they must be reported and documented in SAP as a non-conformance so that appropriate corrective/preventive action can be taken to avoid recurrence, for example a new Inspection Operation to check for FOs. Audits/Process reviews validate that detection measures are appropriate and effective.

Use visual inspection to detect FOs in all areas of the product at appropriate intervals and prior to product closure. This is the final step in preventing the risk of FOD and may require multiple layers depending on the effectiveness of prevention and retrieval processes.

When visual inspection cannot be accomplished with minimal manipulation of the product, the following detection techniques can be used: use of mirrors, flashlights, magnification, shake and listen, borescope inspection and potentially compressed air if that won't cause debris to be blown into other areas of the product.

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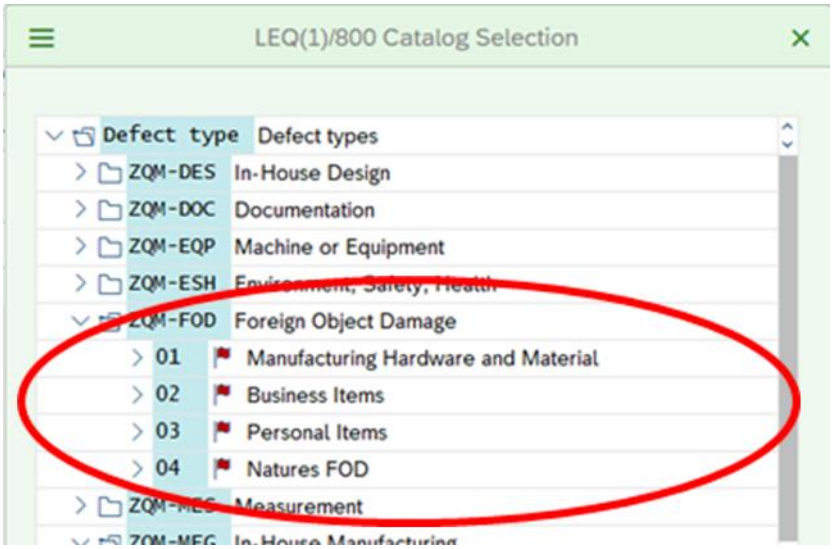
Documentation - raising a QN Item with Foreign Objects Item

When FOs are found in the product, a non-conformance must be raised to record the event. Non-conformances are managed using the 1QA099-D01 process.

When FOs are found in the product, a QN is to be raised in SAP of type Q3 (shop floor defect). See ECC6-044 for how to raise a QN.

Within the QN an Item shall be recorded per incident of FO as below: (see Table 2 on page 7 for examples of each type of item)



The Item shall record the location of the Item and as much detail as possible to aid with root cause analysis and corrective action.

6.7 FOD Prevention training

FOD Prevention Training is provided during initial job orientation and recurring as appropriate.

Table 3

FOD Prevention Training Matrix			
Course	**Attended by**	**Frequency**	**Instruction method**
MFC Foreign Object Damage Course # 101927WPL00	All staff regularly entering or working in a FOD controlled area	Annual Compliance	Atlas Training
FOD overview discussion	All new starters	On starting	As part of new starter induction process
Project specific FOD overview	All staff (including contractors and unescorted visitors) regularly entering or working in a FOD controlled area on that project	On starting on project and at appropriate intervals as required by the project.	As part of the project induction process

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6.8 Foreign Object Prevention Awareness and Communications

There are four main communications objectives for the LMUK Ampthill FO Prevention Programme:

1. Develop the awareness of how important FOs prevention is to the site;
2. Understanding what FOs are;
3. Support and encourage the development of an ethos / culture of zero External Escapes and issues during customer onsite inspections, for example during Physical Configuration Audit (PCA);
4. Grow the ethos that FO elimination is everybody's responsibility across site.

The communications is led by the Quality function and will involve the Communications team for advice and guidance as required. Primarily communications will be via the Ampthill insideLM page.

Develop Foreign Objects awareness:

- Provide the reason why FO prevention is so important.
- Provide up-to-date information about FO on site.
- Provide continuous communications to keep FO at the front of people's minds.
- Demonstrate complete buy-in from senior leaders.
- Receive feedback and adjust messaging accordingly.
- Bring awareness to the site strategy on FO prevention.

Understanding what Foreign Objects are:

- Increase understanding of FO what the different categories are and definitions.
- Develop understanding of the site strategy for FO prevention.
- Develop continuous understanding and training for all functions.
- Develop Frequently Asked Questions.
- Develop a feedback mechanism.

Development of the culture of zero External Escapes:

- Demonstrate why zero External Escapes are so important.
- Develop the adoption of why FO prevention is so important.
- Develop the "What's In It For Me" aspect.
- Develop the understanding of the impact to the company, country, and ourselves if a FO External Escape turned to damage.
- Engage in feedback.
- Be part of the solution.

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Development of the whole site responsibility for Foreign Objects Prevention:

- Opportunity to provide a more detailed and innovative solution for different functions.
- Develop what the impacts are to suppliers and customers.
- Increased customer satisfaction.
- Increased supplier satisfaction.
- Increase pride with the work we do.

Target Audience (key stakeholders):

- LMUK Ampthill employees.
- LMUK Ampthill SLT.
- LMUK employees.
- MFC.
- Suppliers.
- Customers.

6.9 FOD Prevention meetings

Recurring FOD Prevention Meetings require cross-functional participation promoting the importance of FOD Prevention within all areas of the organisation.

The Head of Quality will hold regular meetings to raise FOD Prevention awareness addressing the following:

- Review the FOD Prevention Programme, identify opportunities for improvement, share lessons learned, and make recommendations for problem areas.
- Review results of FO Incident defects & formal CARs root cause/corrective actions.
- Review data trend analysis and results for quantity, types, and location of FOd found including how they were found.
- Assist with periodic reviews of FOD Prevention Programme procedures and recommend necessary revisions.
- Attendees with be representatives from Production Operations, Quality, Engineering and Global Supply Chain as a minimum.

6.10 FOD Prevention Area Designation

Requirements for FOD Prevention and tool/item management shall be progressively more stringent based on the risk level defined. Based on this categorisation, varying levels of cleaning, inventory management, work processes, and incident reporting are required for risk mitigation.

The FOD Prevention Area designation process establishes the appropriate controls based on level of risk for each area. FOD Awareness, FOD Control and FOD Critical will be the standard nomenclature for describing levels of risk associated to Products.

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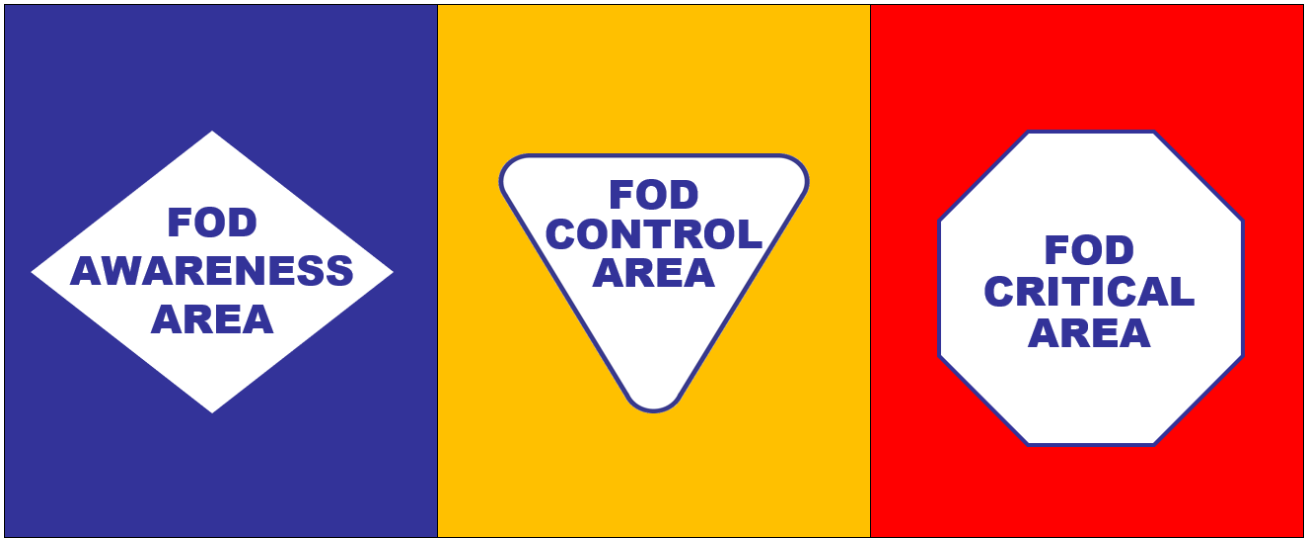
Requirements for FOD Prevention and tool/item management shall be progressively more stringent based on the risk level defined. Based on this categorisation, varying levels of cleaning, inventory management, work processes, and incident reporting are required for risk mitigation.

Typical signs for each area are as follows. Note the actual signs may be slightly different based on the risk in each project area and the information to be communicated.



6.11 Designation of FOD areas

FOD Prevention requirements within a designated area shall be based on the potential risk of FO migration, entrapment, and damage. To determine the risk level and appropriate requirements for each level use attachment 1 of the MFC policy 1-2-329 Foreign Object Elimination. This explains how to undertake the risk assessment and complete the Work Area Qualification Plan (WAPQ).

When undertaking the risk assessment consider the following:

- Location/type of work area and working conditions to prevent FO migration.
- Activities/processes performed in support of product assembly, manufacture, and fabrication.
- Stage of Manufacturing Process.
- Likelihood of process/part/product to create FO.
- Likelihood of part/product contamination or damage from FOd and the potential consequences of contamination or damage.
- Types/sizes of tools used during each stage of the tasks performed.
- Size and complexity of Product.
- Past performance of FO Incident escapes and metric trends.

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6.12 Risk Controls

FOD Prevention Area (FPA) designations signify the control methods required to protect the Product. General Housekeeping, FOD Awareness, FOD Control and FOD Critical are the standard nomenclature as shown below.

The Head of Quality has the final authority to designate the FOD Prevention Area.

Drinks must be in closable containers while in the working environment such as benches and worktables, but shall remain outside of the shadow of the Product.

Table 4

FPA Designations			
FPA Designation	**Work Performed in/or Supported by Area**	**Work Area Requirements**	**Example areas**
General Housekeeping	– Fabrication Areas, Laboratories, Warehouses, & Offices – Fabrication Paint Areas – Facilities Maintenance Areas – Tool/Equipment Support Areas (for tools used in General Housekeeping Areas)	– Housekeeping and Area Organisation – Clean As You Go	- UL7 Office
FOD Awareness	– Production of assemblies, sub-assemblies, and components – Product Disassembly for Modification – Component Storage/Staging Areas in production environment – NDI (X-ray) area – Tool/Equipment Support Areas (for tools used in FOD Awareness, Control, Critical Areas)	– Housekeeping and Shop Organisation – Clean As You Go – Basic Tool Control/Item Control – Lost Tool/Item Process (LTI)	- Spall area - Basket area - General Stores - UL9 Stores - Goods-in Inspection
FOD Control	– Final Assembly – Systems Installation and Testing – Modification Reassembly	– Housekeeping and Shop Organisation – Clean As You Go – Basic & Intermediate Tool Control/Item Control – Lost Tool/Item Process (LTI) – Dress Code – Consumable Control – Personal Item Control	– UL8/9 production area – Rework areas – 3S Build area
FOD Critical	– Finished product areas – Final Testing areas – Customer inspection areas – Specialist Assembly Areas	– Housekeeping and Shop Organisation – Clean As You Go – Basic & Intermediate & Advanced Tool Control/Item Control	– PFAT area – Physical Configuration Audit (PCA) area

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FPA Designations			
FPA Designation	**Work Performed in/or Supported by Area**	**Work Area Requirements**	**Example areas**
		– Lost Tool/Item Process (LTI) – Dress Code – Consumable Control – Personal Item Control – Assigned Equipment Accountability – Applicable Record Keeping/Logging	– Delivery areas – Clean room

6.13 Dress Code

Personnel must remain outside of the FOD Control or Critical FPA at all times if not compliant with FOD Prevention Dress Code. Dress Code Requirements for Visitors are the same as LM employees. The LM sponsor is responsible for ensuring compliance. Clothing with ornamental accessories (detachable or sewn on) presenting a FO hazard is not allowed. Company issued mobile phones, pagers, 2-way radios, are allowable and must be secured to the user or stored in Personal Pack.

Personal items must be controlled in FOD Control/Critical FPAs. Empty all pockets. Store personal items in box, locker, desk or company provided Personal Pack. Wallets are allowable in a pocket below the waist fully enclosed within the pocket. Personnel can secure badge by attached clip, badge lanyard (without ornamental accessories) or company provided arm band badge holder. Logging such items is not required in the FOD Critical area.

When using a company provided Personal Pack, display badge and keep zipper closed except during times of access. Personal Pack shall not be accessed while inside or on top of the product. It is allowable to remove and set aside Personal Packs while performing assigned task.

Personnel may wear additional work required devices that are company provided, Headlamps, headsets/ear defenders will be marked for traceability. Wear shoe covers when stepping on surfaces unless mats or temporary panels protect the surface. Do not wear shoe covers inside the product. Inspect shoe bottoms for FO prior to entering product.

Remove employee badges, Personal Packs, arm band badge holders, badge lanyards, and all electronic devices that do not violate Environmental Safety & Health (ESH)/Security requirements prior to entering confined spaces.

6.14 Area Marking

Identify FOD Awareness/Control/Critical FPAs clearly by a method that will be understood by all employees (e.g. signage with specific colours, high visibility coloured tape, and high visibility floor decals).

6.15 Changing Area Designations

There will be instances where area designations need to be permanently or temporarily changed or modified. This must be agreed using the WAQP process and clearly communicated out to impacted employees. Area marking signs must be clear at all times.

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6.16 FO Migration

Prevention

The emphasis shall be on prevention over all other elements in order to provide the highest degree of risk mitigation. A fully capable FO Prevention system would leave no foreign object debris at retrieval or detection steps. If full prevention is not possible or practical, additional steps must be included in the process to adequately mitigate risk. Prevention measures commensurate with the defined area risk mitigation level include:

- Locate workstations to isolate operations that could generate cross contamination.
- Do not unpack components on or in the product.
- Practice good housekeeping (Chapter 6.18).
- Control consumables/items as defined in Management of Consumables, Expendables, and Hardware (Chapter 6.19).
- Control tools as defined in (Chapter 6.20).
- Control materials as defined in Material Handling and Packaging (Chapter 6.24).
- Place receptacles in strategic locations to contain potential FO. Empty receptacles at regular intervals to prevent overfilling.
- Ensure production tooling (e.g. jigs, fixtures, and handling equipment) is clean, undamaged, and free of FO prior to use.

Retrieval / Cleaning

Production processes shall include measures to effectively clean debris from all areas of the product at established intervals unless prevention provides 100% process control. Tools/Methods for control of materials include but are not limited to.

- Practice Clean as You Go (Chapter 6.17).
- Vacuuming, sweeping, magnets, flushing, washing, and absorbent material.
- Avoid wherever possible the use of compressed air to remove debris; vacuuming is the preferred method of FO retrieval. If compressed air is determined to be the only effective method of FO retrieval, then appropriate measures must be taken to prevent migration as well as personnel from the risk of injury.
- Remove residual adhesives that can attract/contain debris through the use of approved solvents.

6.17 Clean As You Go (CAYG)

Product FO is an inherent risk in production and modification. CAYG is the process of cleaning the immediate work area on the product when FO has the potential to migrate out of sight or to an inaccessible area and become FOd.

Production, manufacturing, fabrication and modification processes will include measures to effectively clean debris from immediate areas of the product to prevent the risk of FOD.

The immediate area (including 45cm of the surrounding area subject to FO migration) shall be free of FO/FOd at the time it is presented for customer (internal/external) acceptance. FO

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discovered during customer acceptance/inspection shall be removed and documented in SAP as a Q1 type QN.

CAYG is an ongoing process that includes at a minimum:

- Cleaning immediate work area when FO has the potential to migrate out of sight or to an inaccessible area and become FOd.
- Cleaning immediate area of the product when work cannot continue.
- Cleaning immediate area of the product after work is completed and prior to inspection.
- Picking up dropped items inside of the product.

6.18 Housekeeping

The purpose of this process is to establish cleanliness standards off product to prevent FO migration. Good housekeeping is essential to establishing a FOD Prevention culture. Based on each area's work schedule, perform the following Housekeeping duties daily (end of shift as a minimum) and record on the F0431 Housekeeping Checklist:

- Clean test equipment before and after use;
- Keep workstations and work areas clean and neatly organised;
- Dispose of rubbish in proper receptacles;
- Rubbish bins shall be emptied when full;
- Proper rubbish receptacles shall be provided/used;
- End of shift clean-up includes the work environment and surrounding area;
- All work generated debris, dirt and spills are thoroughly cleaned;
- Return all equipment not in use to its designated location;
- Clean work benches, tables and workshop areas;
- Clean all floors, decks, stands, tooling fixtures and jigs;
- Periodic cleaning of infrequently used areas;
- Keep company vehicles free of debris (e.g. cranes, trolleys).

6.19 Management of Consumables, Expendables and Hardware Control

This process is to establish practices for the accountability, storage, use/consumption, and disposal of consumables, expendables, and hardware for effective control within the product areas to prevent the risk of leaving these items within the product as FO.

User shall verify item is not broken/unserviceable prior to use. If item breaks or becomes unserviceable in the course of usage, do not return it to point of issue location. Retrieve broken pieces and dispose of item properly using the Return of Parts to Stores from Production 5MAN195-D01. If unable to retrieve pieces, contact supervisor to initiate LTI process as required.

Basic Control - FOD Awareness

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- Maintain organisation and cleanliness for storage within the production areas using the housekeeping processes.
- Take only the minimum amount of items required to complete the individual task into the immediate work area.
- Keep consumables, expendables, and hardware contained to prevent spillage.
- Do not place items directly on the outer skin of the product. Use protective mats/covers/devices as required.
- Items will be removed from the product at breaks, lunch/dinner, reassignment of task, or end of shift.
- Items in use may remain within the shadow of the product until work is completed or end of shift.
- Properly segregate container contents to prevent co-mingling.
- Properly identify and use appropriate containers for liquids and solvents.
- Periodically remove and properly dispose of consumed/used items to maintain cleanliness (minimum at the end of shift).
- When removing parts from the product during disassembly or re-work, containerise all removed consumables, expendables, hardware, that will be reused in a properly labelled container for protection and containment; properly dispose of items that will not be reused.
- Ensure proper containment and return of excess issued items not used during operations.
- If an item is lost, contact supervisor to initiate the LTI process as required.

Intermediate Control - FOD Control

In addition to Basic Controls, Intermediate Control processes include:

- Transport consumables, expendables, and hardware in an appropriate container as determined by the environment and type of item/tool to be transported.
- Examples: Closable Container, Bags, and Self-Closing Snap lid tray.
- Keep consumables, expendables, and hardware, secured in a closable container when working on the product.
- If an item is dropped into the product it must be retrieved. If not immediately retrievable, notify area supervisor to expand retrieval efforts.

Advanced Control - FOD Critical

In addition to Basic and Intermediate, Advanced Control processes include:

- Identify exact quantities of consumables, expendables, and hardware with minimal overage brought to the product.

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- Open Consumable bins / Point of Use shall not be stored or pre-positioned in the FOD Critical area.
- Immediate processing of used items to include packaging or protective coverings (e.g. disposal, return to source, storage).
- Give special consideration to containment methods for capturing and disposing of consumable, expendable, and hardware fragments to prevent debris migration.

Logging Process:

- Consumables, expendables, and hardware shall be accounted for on the appropriate log.
- All personnel entering information on a logging form are responsible for legibility and accuracy.
- Supervisors or designees are responsible to ensure all personnel comply with the logging procedure.
- Designate a centralised location for logging forms.
- All logged consumables, expendables, and hardware will remain in the area until all items are removed or used in process and logged out.
- Log items not contained or kitted by quantity.
- Log items that are kitted or contained in a self-closing spill proof container as 1 container.

6.20 Tool Control

Tool Control encompasses inventory management and user responsibilities from the time the tool is issued/selected, through usage on the product, and until the tool is returned to the point of issue. Tools control is to be undertaken using process 5MAN376-D01 Manage Controlled Tools and Tool Boxes within Manufacturing.

Do not place tools directly on the product. Use protective mats/covers/devices to protect product.

Personal Tools are not to be used in FOD Awareness/Control/Critical areas to support product build and/or rework processes.

Basic Tool Control - FOD Awareness Area:

- Take only tools necessary to accomplish the task and properly contained before entering the work area and onto the product.
- Tools shall be removed from the product at breaks, lunch/dinner, reassignment of task, or end of shift.
- Tools in use may remain within the shadow of the product until work is completed or end of shift. Exception: Difficult set-ups (example: test equipment, tooling, work lights, etc.) may be left on the product beyond the end of an employee's work shift with supervisor approval.
- If an item is lost, contact supervisor to initiate the LTI process as required.

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Intermediate Tool Control - FOD Control Area

In addition to Basic, Intermediate Tool Control includes the following techniques:

- Tools shall be transported to and from the product in an appropriate container determined by the environment and type of tools to be transported.
- Tools shall remain contained when placed on the product and not in use to prevent damage.

Advanced Tool Control - FOD Critical Area

In addition to Basic and Intermediate, Advanced Tool Control includes the following techniques:

- Tool design considerations. Use tools designed to mitigate FO; tools made of materials that bend rather than fracture when placed under stress; design tools with minimal parts and/or parts that are not easily removed; tools with details (parts) that are loose or designed to be removed shall be encapsulated or tethered to the tool.
- Tool logging using Sponge Count - Control Entry Log MFC-0403:
    - Supervisors or designees are responsible to ensure all personnel comply with procedures for logging.
    - All Personnel entering information on any logs are responsible for following the form instructions.
    - Areas, positions, departments will have a designated centralised location for completing logs.
    - All Tools/Items logged on forms into the FOD Critical Areas remain in the area until accounted for and logged out as removed or used in process.

6.21 Lost Tools/Items (LTI) Process

When a tool/ item is reported lost by the employee, immediate notification to supervision is essential to establish risk to the product. LTI reporting is non-punitive when notification to area supervision is immediate upon discovery.

NOTE: Missing items from desks, chairs, worktables, toolboxes, lockers, facility fixtures, etc. within the FOD Prevention Area but not used directly on the product/ will not require an LTI.

Production Operations and Quality shall jointly assess risk to the product of the lost tool/item and stop work in accordance with the risk.

NOTE: If the lost tool/item is confined to a specific area of the product the work stoppage should only apply to that area.

As per process map 5MAN587, a full sweep of the area shall be made to locate the missing tool. Production Operations and Quality will select personnel and begin search of all potential areas for the lost tool/item. If the tool cannot be found then form F0228 Lost or Damaged Tools Report shall be completed and presented to the manager for action.

If the search is not completed due to shift change, then status will be communicated and responsibility will be transferred to next shift supervision for completion of the LTI documentation.

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Affected products shall not be released for test or to the customer until the search process has concluded.

The test team and/or customer shall be briefed on all incidents of lost tools/items that may still be on the product.

When all search efforts have been exhausted, Production Operations and Quality will release affected product zone and resume normal operations (if applicable).

6.22 Miscellaneous Support Equipment (MSE) Control

MSE used by build departments, or modification/maintenance teams; require visual serviceability checks to ensure completeness and no FOD/Safety hazards exist prior to each use.

Return MSE to storage locations when use is complete.

Do not use unserviceable MSE.

Within FOD Critical Area, MSE presenting potential FOD risk due to removable pieces/items shall have those areas affixed in a way to prevent accidental removal or loosening. Organise cabinets used to store MSE, parts or other items.

MSE does not require Logging into the FOD Critical Area.

6.23 FOD Prevention and Tool Control Requirements for non-LM staff on site

Contractors working in a FOD Awareness, Control or Critical FPA but **not on the product**:

- Whenever feasible, Awareness/Control/Critical FPA designations should be temporarily declassified during contractor work. Contact the FOD Prevention Program Site Lead or designee to temporarily declassify a FOD designation.
- If the FPA designation is not declassified, the LM Ampthill representative overseeing contractors is responsible to ensure compliance with the terms of the contract, purchase order or other authorizing documents relevant to FOD Prevention procedures and will coordinate with the FOD Prevention Program Site Lead to ensure all elements of the FOD Prevention and Tool Control Plan are approved prior to working in a FOD Awareness, Control, or Critical area. A FOD Prevention and Tool Control Plan must include the following elements:
    - Identify a contractor POC for all FOD Prevention control issues.
    - Describe the housekeeping methods to be used for FO migration control.
    - Describe the types of FOD Prevention devices/barriers to be used for FO migration control.
    - Describe process to ensure no tools are left in area after work in complete.
- If scope of work changes after the FOD Prevention and Tool Control Plan approval, submit a new plan for approval before “new” work can start.

Contractors working **on product** in a FOD Awareness, Control or Critical FPA.

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- If performing operations on product, the LM Ampthill representative overseeing contractors is responsible to ensure compliance with the terms of the contract, purchase order or other authorizing documents relevant to FOD Prevention procedures and will coordinate with the FOD Prevention Program Site Lead to ensure all elements of the FOD Prevention and Tool Control Plan are approved prior to commencing work. A FOD Prevention and Tool Control Plan must include the following elements:
    - Identify a contractor POC for all FOD Prevention control issues.
    - Describe the CAYG and Housekeeping methods to be used for FO migration control.
    - Describe the types of FOD Prevention devices/barriers to be used for FO migration control.
    - Describe process to ensure tool control processes equivalent to or better than Lockheed approved procedures.
- If scope of work changes after the FOD Prevention and Tool Control Plan approval, submit a new plan for approval before “new” work can start.

6.24 Material Handling and Packaging

FOD Prevention control measures built into material handling and packaging processes will help prevent potential migration to the product.

Specific control measures shall be in place for adequate storage, handling, transportation of materials, and components used in manufacturing, fabrication, assembly and testing processes. Control measures shall provide protection against contamination or physical/functional damage throughout the product/process cycle. Employee training ensuring cognizance of packaging, handling, shipping, and storage control measures within the work environment is required.

FPA designation shall be considered to appropriately sequence control measures for packaging, handling, shipping, and storage.

6.25 FOD Prevention Devices/Barriers

FOD Prevention devices/barriers shall be used consistently to the maximum extent to protect the product from FOs, protect sealing surfaces, or retain fluids without leakage as necessary.

Manufactured FOD Prevention devices/barriers are the preferred method. Acceptable alternatives to the preferred method are: plastic bags, clean rags, approved tape or form fitting foam wrap to protect product or components until part or component installation. In any application FOD Prevention devices/barriers must be properly secured to prevent contamination/migration into the product and lead to FO/FOd or FOD.

All parts/components removed or awaiting installation shall be protected from damage /contamination and properly stored.

6.26 Food and Beverages

Products shall be protected from food and beverages contamination. Specific requirements shall be implemented based on area designation referenced in Section 6.11 (e.g. open containers,

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cans, cups are not allowed on the product). Food consumption shall be restricted to designated areas.

6.27 Material Handling Control

Basic Control - FOD Awareness

Control measures shall be applied where products are fabricated, machined, inspected, assembled, or tested, and debris-producing processes are still in use such as machining, coating, shot-peen, or grit-blast. Ensure FO detection and inspection does not allow debris to migrate into more critical areas. Basic Material Handling Control measures shall include but are not limited to:

- Properly protecting critical product openings with approved closures.
- Open lines, tubing, connectors etc. must have protective caps/plugs/ or type of approved barrier installed to prevent FOd contamination.
- Caps/Plugs can be temporarily secured using approved tape making sure that tape cannot become FO. Any tape used must not leave a residue on the product.
- Electrical connectors, which are a part of large harnesses, can be gathered and protected in an approved bag adequately secured (excluding rubber bands).
- FOD Prevention devices/barriers shall be highly visible, properly secured, and of size, colour, and shape that would preclude assembly into product.
- Product cavities shall not be used for temporary placement of documents or other materials during manufacturing, assembly or transit.
- Closures shall be constructed to withstand the normal strains, jars, vibrations, and other conditions incident to shipping, storage and handling.
- When installed, all closures shall be capable of protecting and, when applicable, sealing the threaded, beaded, and tapered surfaces. Climatic conditions should not affect the performance of the closure.
- Closures will be constructed so that when installed they will prevent assembly with the mating part for that opening.
- Closures installed in recessed or hidden openings shall have a visible "flag" attached to alert technicians to its presence.
- FOD Prevention devices/barriers are to remain installed on the equipment until inspection, maintenance or testing is complete or until work is done.
- FOD Prevention devices/barriers will be removed for as required component installation, maintenance, and inspection or testing per direction of work instructions and reinstalled after activity completion.
- Planning/work instructions used to control the type, quantity, and application of FOD Prevention devices/barriers is preferred.

Intermediate Control - FOD Control

Control measures shall be applied where products may be sensitive to contamination. Ensure FO detection and inspection is capable of identifying FO, and removal may require work

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instructions or disassembly. In addition to the Basic, Intermediate Material Handling Control measures shall include the following parts protection and material handling techniques:

- Protection of exposed threads and fittings.
- Unapproved FOD Prevention devices/barriers (e.g. cloth, gloves, wipes) shall not be inserted into product, used to prevent fluid spills, or for the containment of product. Fluids shall be drained into suitable containers.

Advanced Control - FOD Critical

Control measures shall be applied to any area where product is sensitive to the smallest levels of contamination. In addition to the Basic and Intermediate, Advanced Material Handling Control measures shall be applied to include the following:

- Detailed parts protection and material handling.
- Parts and assemblies packaged to prevent FO contamination.
- Logging FOD Prevention devices/barriers is not required in a FOD Critical area when planning/work instructions are used to control the type, quantity, and application.
- If not controlled by planning/work instructions, log devices/barriers

6.28 Product and Process Design Considerations

The elimination of foreign object hazards and damage potential begins with the product design process and continues through manufacturing sequencing. To the maximum extent practical, products should be designed to resist damage, minimise debris during production and provide access to detect and remove debris. Processes should be logically sequenced with attention given to preventing FO migration and contain detailed guidance for prevention and cleaning activity. Personnel involved in the design or procurement of tooling, products, or processes shall be appropriately trained in FOD Prevention.

6.29 Test Environment

FO can pose a risk to product during testing of components including hydraulic, pneumatic, mechanical and electrical. Care shall be taken when designing test procedures to FOD Prevention including proper pre-inspections of equipment, products, and due care for material handling.

Test is the last step in the layered approach to FOD elimination/prevention process. The Test step should include the technician's checking the system prior to being handed over to inspection. Inspection must thoroughly check the system for FOD prior to any customer inspection such as PCA.

7. Document Revision History

Details of Revision	Revision Date
Initial Release	20/07/2021

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