



FOD is not just an airplane problem!

Tailoring FOE programs for
manufacturing

Lockheed Martin Missiles and Fire Control FOD elimination model

What's driving FOE programs in the aerospace industry?



AS 91000B:2004

- 7.5.1) ...The organization shall plan and carry out production and service provision under controlled conditions. Controlled conditions shall include, as applicable...i) provision for the prevention, detection, and removal of foreign objects ...
- 7.5.5)...Preservation shall also include to the constituent parts of a product... b) prevention, detection and removal of foreign objects....

What does this include?



- Aircraft and aircraft engines
- Hardware and fasteners
- Machined parts
- Electronic assemblies
- Sheet metal assemblies
- Optical assemblies
- Electronic components
- Chemicals, sealants and adhesives
- Even software!

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How do we establish a FOE program considering the different products?



By Creating A Set Of Tailored Controls

- Appropriate to the type of foreign objects
- Creating at least one countermeasure for each type of potential foreign object
- Backed by a set of minimum requirements
- Defined, implemented and sustained by Production, Quality and Engineering in the area

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What should typical FOE control plans consider?



- **The types of potential foreign objects**
- **The appropriate controls for each type**
 - 1) People controls
 - 2) Tool controls
 - 3) Parts controls
 - 4) Special controls
 - 5) Area controls

1) People Controls



- Personal attire
- Organizer Belt Pouches
- Training requirements
- Visitor requirements

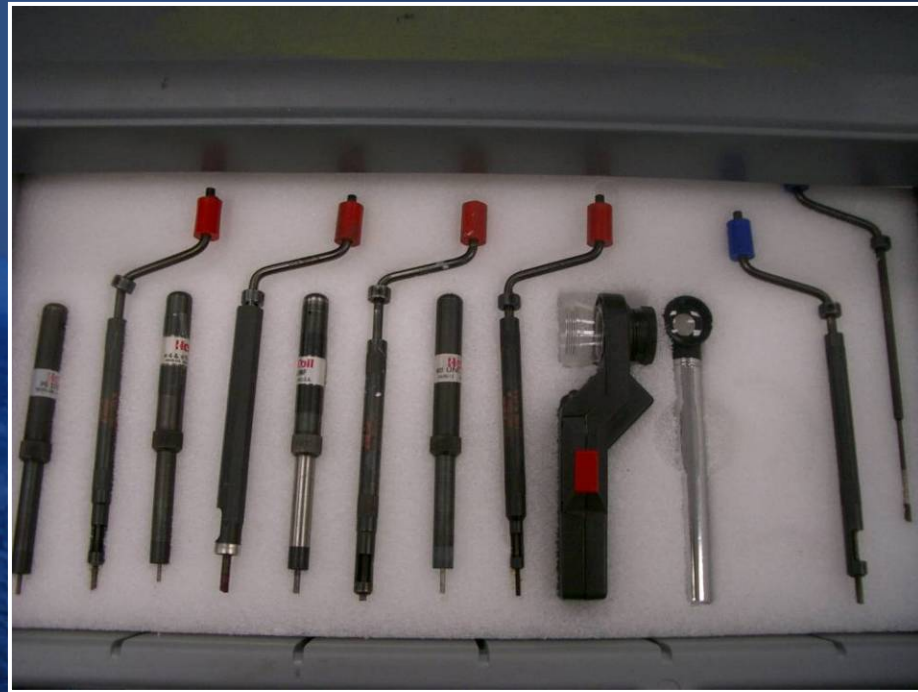


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2) Tool Controls



- Tool accountability
- Tethered tools
- Shadowbox
- Chits



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3) Part Controls



- Special packaging and/or handling
- Shadowbox
- Sponge count
- Kitted parts
- Special marking



Awareness sticker



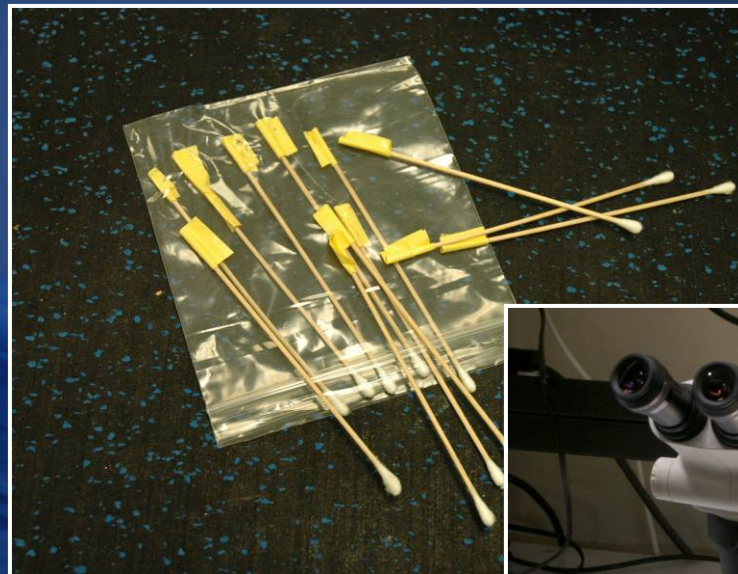
Shadowboxed hardware

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4) Special Controls



- Detection methods and processes
- Special inspection methods
- Packaging
- Bore scopes
- Microscopes
- X-ray
- Roll fixtures

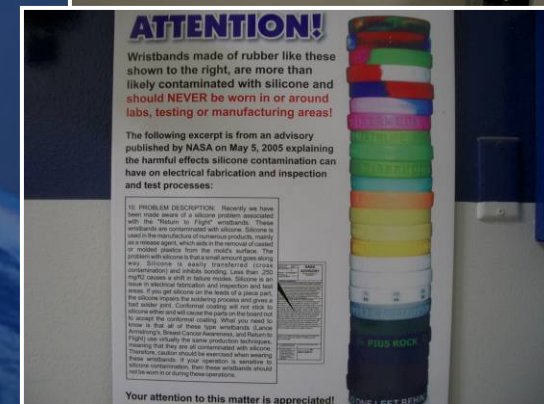


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5) Area Controls



- Designated containers for trash, rags, and used solvents
- Visitor control
- FOD control entry logs
- Entry item holding containers
- Consumable factory supplies
- FOD collectors
- Clean-As-You-Go
- 6S
- Posters and **signs**



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5) Area Controls – Cont'd



FOD Control Designation



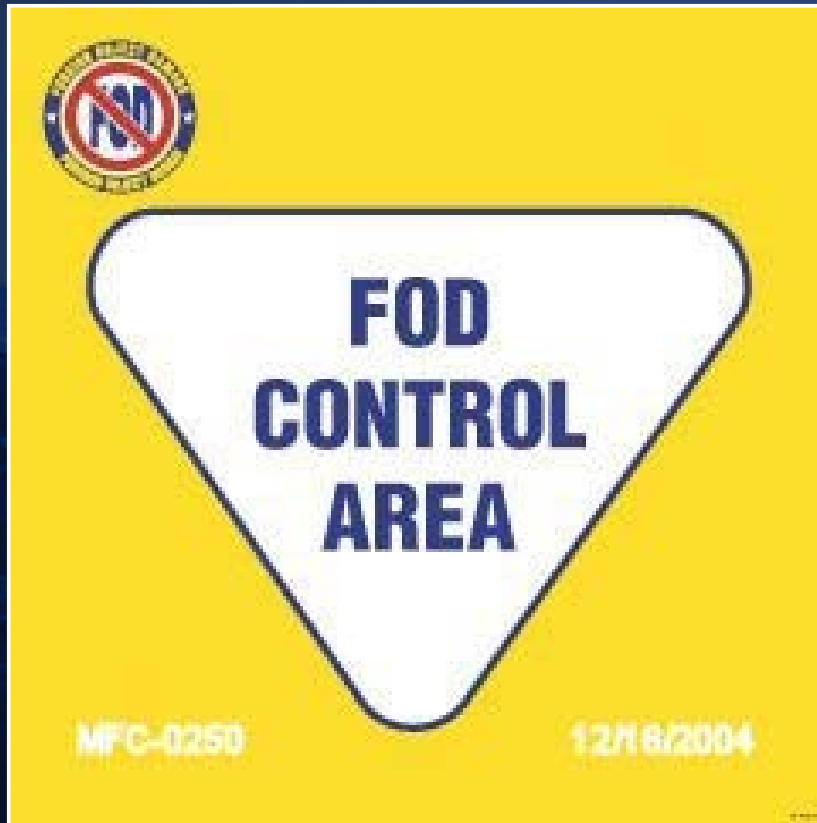
- Controls are desired to minimize risk
- Personal attire and personal item restrictions may apply
- Restrictions on food, drink and use of tobacco products may apply if stated in the area control plan

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5) Area Controls – Cont'd



FOD Control Designation



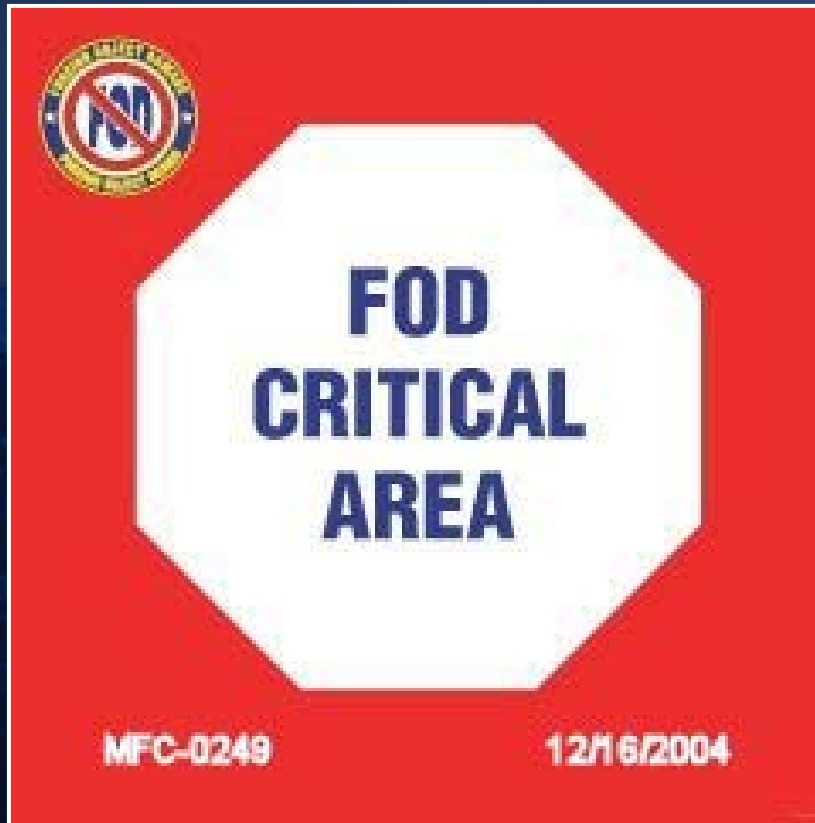
- Tools/items and equipment regularly used are Company-approved / assigned to the area
- Personal attire and personal item restrictions may apply
- Food, drink and use of tobacco products are not allowed

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5) Area Controls – Cont'd



FOD Control Designation



- Controlled entry points
- Tools/items and equipment company-provided and assigned to the area
- Personal attire/item restrictions apply
- Food, drink and use of tobacco products prohibited

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FOD Area Control Plan




Area Designation

General Area Info

Potential Risks

Controls and Risk Mitigation Plans

Signatures & Dates



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Form No. MFC-0252

FOD WORK AREA QUALIFICATION PLAN

Work Area	Location	Revision
Process	Product	N/C

Potential Risk

Controls and Risk Mitigation Plan

People	Parts	Area
▶	▶	▶
▶	▶	▶
▶	▶	▶
▶	▶	▶
▶	▶	▶
Tools	Special Controls	▶
▶	▶	▶
▶	▶	▶

Signatures & Dates					
Supervisor	Date	Quality Engineer	Date	Engineer / Production Engineer	Date

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Identify area, product, process, Plan Rev, etc.

Identify possible FO

Identify appropriate countermeasures for each identified risk

Coordinate with area Supervisor, OE, ME

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Creating an Area Control Plan for a “Helicoil Installation Area”



Situation.....

Three workers and one inspector work in an enclosed area separated from the adjacent machine and sheet metal shops.

Workers in this area deburr, clean, and install Helicoil's in castings. Circuit card assemblies and other electro mechanical components are installed in these castings at other locations.

Enter General Information



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FOD WORK AREA QUALIFICATION PLAN

Work Area	Location	Revision N/C
Process	Product	
Potential Risk		

People

▶	▶	▶
▶	▶	▶
▶	▶	▶
▶	▶	▶

Tools

▶	▶	▶
▶	▶	▶

Signatures & Dates

Supervisor	Date	Quality Engineer	Date	Engineer / Production Engineer	Date
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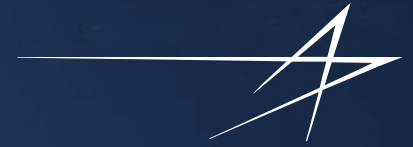
FOD WORK AREA QUALIFICATION PLAN

Work Area Helicoil assembly	Location Building 1000	Revision N/C
Process Assembly	Product All programs	
Potential Risk		

- Building or other location
- Process type
- Product

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Identify “Potential Risks”



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FOD WORK AREA QUALIFICATION PLAN

Work Area	Location	Revision
		N/C

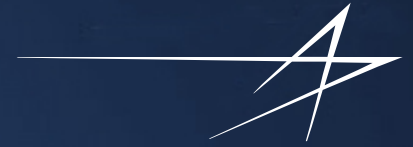
Potential Risk

▶	▶	▶			
▶	▶	▶			
Tools	Special Controls	▶			
▶	▶	▶			
▶	▶	▶			
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Identify “Potential Risks”



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FOD WORK AREA QUALIFICATION PLAN

Work Area	Location	Revision
		N/C

Potential Risk

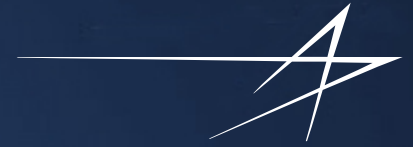
Potential risk is associated with small tangs not captured from the helicoil inserts that may remain in small holes undetected. Loose hanging burrs, potential FOD if burr becomes detached from hardware.

▶	▶	▶			
▶	▶	▶			
Tools	Special Controls	▶			
▶	▶	▶			
▶	▶	▶			
Signatures & Dates					
Supervisor	Date	Quality Engineer	Date	Engineer / Production Engineer	Date

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Define “People” Controls



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FOD WORK AREA QUALIFICATION

Work Area	Location	
Process	Product	
Potential Risk		
Controls and Risk Mitigation		
People	Parts	
▶	▶	
▶	▶	
▶	▶	
▶	▶	
▶	▶	
Tools	Special Controls	
▶	▶	
▶	▶	
Supervisor	Date	Signatures & Date Quality Engineer

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People	
▶	
▶	
▶	
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▶	
▶	

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Define “People” Controls



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FOD WORK AREA QUALIFICATION

Work Area	Location	
Process	Product	
Potential Risk		
Controls and Risk Mitigation		
People	Parts	
▶	▶	
▶	▶	
▶	▶	
▶	▶	
▶	▶	
Tools	Special Controls	
▶	▶	
▶	▶	
Supervisor	Date	Signatures & Date Quality Engineer

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People	
▶	All employees complete FOD awareness certification
▶	Only personnel authorized by management will be allowed in this FOD control area
▶	Personnel Performing installation of Helicoil inserts will be trained to ST 396, ST 397 and MP-FO13-22
▶	White lab coats will be worn during helicoil installation and tang recovery only
▶	Visitors: While work is in progress visitors are allowed only when escorted by trained personnel.

Define “Tool” Controls



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FOD WORK AREA QUALITY CONTROL

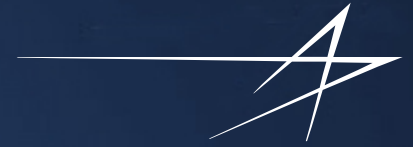
Work Area	Location				
Process	Product				
Potential Risk					
Controls and Risk Management					
People	Parts				
▶	▶				
▶	▶				
▶	▶				
▶	▶				
▶	▶				
Tools	Special Controls				
▶	▶				
▶	▶				
Signatures & Dates					
Supervisor	Date	Quality Engineer	Date	Engineer / Production Engineer	Date

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Tools	
▶	▶
▶	▶
▶	▶
▶	▶
▶	▶

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Define “Parts” Controls



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FOD WORK AREA Q

Work Area	Location	
Process	Product	
Potential Risk		
Controls and Ris		
People		
▶	▶	
▶	▶	
▶	▶	
▶	▶	
▶	▶	
Tools		
Specia		
▶	▶	
▶	▶	
Supervisor	Date	Signature
		Quality Engineer

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Parts	
▶	
▶	
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▶	
▶	
▶	

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Define “Parts” Controls



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FOD WORK AREA Q

Work Area	Location
Process	Product
Potential Risk	
Controls and Ris	
People	
▶	▶
▶	▶
▶	▶
▶	▶
Tools	
▶	▶
▶	▶
Supervisor	Date
Signature Quality Engineer	

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Parts	
▶	Parts will be Inspected for FOD prior to packaging or removal from the area.
▶	Sponge count : A count of helicoil inserts will be taken as they enter the cell; The count will be entered into the area logbook
▶	Incoming and outgoing parts are covered and stored in designated containers and in designated areas.
▶	The tang from each helicoil insert will be accounted for on the work order when the hardware leaves the area
▶	

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Define “Special” Controls



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FOD WORK AREA QUALIFICATION

Work Area	Location				
Process	Product				
Potential Risk					
Controls and Risk Mitigation					
People	Parts	Area			
▶	▶	▶			
▶	▶	▶			
▶	▶	▶			
▶	▶	▶			
▶	▶	▶			
Tools	Special Controls				
▶	▶				
▶	▶				
▶	▶				
Signatures & Dates					
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Special Controls

▶	
▶	

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Define “Special” Controls



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FOD WORK AREA QUALIFICATION

Work Area	Location
Process	Product
Potential Risk	
Controls and Risk Mitigation	

People	Parts	Area
▶	▶	▶
▶	▶	▶
▶	▶	▶
▶	▶	▶
▶	▶	▶
▶	▶	▶

Tools	Special Controls
▶	▶
▶	▶
▶	▶

Signatures & Dates

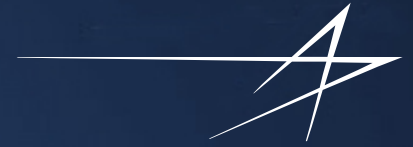
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Special Controls

- ▶ Parts leaving area will be sealed and will display FOD free packing labels
- ▶ A Bore Scope will be used for detection in small holes

Define “Area” Controls



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FOD WORK AREA QUALITY CONTROL

Work Area	Location
Process	Product
Potential Risk	
Controls and Risk Mitigation	
People	Parts
▶	▶
▶	▶
▶	▶
▶	▶
▶	▶
▶	▶
Tools	Special Co
▶	▶
▶	▶

Area

▶

▶

▶

▶

▶

Signatures & Dates

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Define “Area” Controls



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FOD WORK AREA QUALITY CONTROL

Work Area	Location				
Process	Product				
Potential Risk					
Controls and Risk Management					
People	Parts				
▶	▶				
▶	▶				
▶	▶				
▶	▶				
▶	▶				
▶	▶				
Tools	Special Co				
▶	▶				
▶	▶				
Signatures & Dates					
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Area

- ▶ Clean as you go
- ▶ Area signs:
▶ FOD CONTROL AREA
- ▶ No food / Beverages or use of tobacco products in the area
- ▶ General area is enclosed and isolated

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Define the FOD “Area Type”



CHOOSE FOD AREA TYPE

Potential Risk

Controls and Risk Mitigation Plan					
People		Parts		Area	
▶		▶		▶	
▶		▶		▶	
▶		▶		▶	
▶		▶		▶	
▶		▶		▶	
Tools		Special Controls			
▶		▶		▶	
▶		▶		▶	
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•FOD Awareness



•FOD Control



•FOD Critical



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Define the FOD "Area Type"



FOD CONTROL AREA

Potential Risk					
Controls and Risk Mitigation Plan					
People		Parts		Area	
▶		▶		▶	
▶		▶		▶	
▶		▶		▶	
▶		▶		▶	
▶		▶		▶	
Tools		Special Controls			
▶		▶			
▶		▶			
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• FOD Awareness



• FOD Control



• FOD Critical



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Approval Signatures



L Missiles and Fire Control Form No. MFC-0252 FOD CONTROL AREA					
FOD WORK AREA QUALIFICATION PLAN					
Work Area Helicoil assembly	Location Building 1000	Revision N/C			
Process Assembly	Product all programs				
Potential Risk Potential risk is associated with small tangs not captured from the Helicoil inserts that may remain in small holes undetected. Loose hanging burrs are potential FOD if burr becomes detached from the hardware					
Controls and Risk Mitigation Plan					
People	Parts	Area			
<ul style="list-style-type: none"> All employees working in the area will complete FOD awareness certification Only Personnel Designated by management allowed in this FOD control area Personnel Performing installation of inserts shall be trained to ST 96 or ST 397 and MP-FO13-022 White lab coats shall be worn during helicoil installation and tang recovery only Visitors: While work is in progress visitors are allowed only when escorted by trained personnel. 	<ul style="list-style-type: none"> Inspect all parts for FOD prior to packaging Sponge count : A count of helicoil inserts will be taken as they enter the cell.the count will be entered into the area logbook Incoming and outgoing are covered and stored in designated in designated areas The tang from each helicoil insert will be accounted for on the work order when the hardware leaves the area 	<ul style="list-style-type: none"> Clean as you go Area signs: FOD CONTROL AREA NO food / Beverages or use of tobacco products in the area General area is enclosed and isolated 			
Tools	Special Controls				
<ul style="list-style-type: none"> All to and 	Signatures & Dates				
Supervisor	Date	Quality Engineer	Date	Engineer / Production Engineer	Date
Superv					

Area Supervision,
Quality engineering
and engineering sign
the control plan

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FOD CONTROL AREA

FOD WORK AREA QUALIFICATION PLAN

Work Area Helicoil assembly	Location Building 1000	Revision N/C
Process Assembly	Product all programs	

Potential Risk
 Potential risk is associated with small tangs not captured from the helicoil inserts that may remain in small holes undetected. Loose hanging burrs, potential FOD if burr becomes detached from hardware

Controls and Risk Mitigation Plan

People	Parts	Area
▶ All employees complete FOD awareness certification	▶ Parts will be Inspected for FOD prior to packaging or removal from the area.	▶ Clean as you go
▶ Only personnel authorized by management will be allowed in this FOD control area	▶ Sponge count : A count of helicoil inserts will be taken as they enter the cell; The count will be entered into the area logbook	▶ Area signs: ▶ FOD CONTROL AREA
▶ Personnel Performing installation of Helicoil inserts will be trained to ST 96 or ST 397 and MP-FO13-022	▶ Incoming and outgoing parts are covered and stored in designated containers and in designated areas	▶ No food / Beverages or use of tobacco products in the area
▶ White lab coats will be worn during helicoil installation and tang recovery only	▶ The tang from each helicoil insert will be accounted for on the work order when the hardware leaves the area	▶ General area is enclosed and isolated
▶ Visitors: While work is in progress visitors are allowed only when escorted by trained personnel.	▶	▶
Tools	Special Controls	▶
▶ All tools used for helicoil insertion and removal are company issued .	▶ Parts leaving area will be sealed and will display FOD free packing labels	▶
▶	▶ A Bore Scope will be used for detection in small holes	▶

Signatures & Dates

Supervisor	Date	Quality Engineer	Date	Engineer / Production Engineer	Date
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Area Control Plans



Key Factors

- Determine the potential FO and its possible impact
- Determine the appropriate countermeasures
- Collaborate!

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Questions?

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