SAFETY BY DESIGN

HARD GUARDING

BOSCH REXROTH

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Safety by Design – Hard Guarding

- Agenda
  - Why Guard?
  - Guarding Process
  - Question
Why Guard?

- Adhere to laws
  - OSHA 1910.212 (a)(3)(iii)
  - The point of operation of machines whose operation exposes an employee to injury, shall be guarded.
Why Guard?
Why Guard?

▶ Questions to ask yourself

▶ Would you be comfortable working on this equipment?

▶ What if someone I cared about was working on this machine?

▶ Typical Excuses

▶ “Someone would have to be stupid to stick their hand in there!”
Guarding Process

- Risk Assessment
- Design
- Fabricate
- Install
- Risk Assessment
Risk Assessment - Design - Fabricate - Install - Risk Assessment

- Identify Hazards
  - Identify every hazard on the machine

- Hard Guards
  - Visible Hazards
    - Cutting
    - Pressing
    - Crushing
    - Shearing
    - Flying Objects

- ANSI Standards
  - Specific to type of machine
Risk Assessment - Design - Fabricate - Install - Risk Assessment

- Assign a risk level

  - High Risk
    - High Probability
    - High Cost
      - Redundant (hard and soft guarding)
      - Redundant controls
      - Constant monitoring

  - Low Risk
    - Less Likely
    - Not as tragic
      - Single Solution
      - Cost Effective Solution
Fixed Point guards

Machine guards (4’x4’ panels & smaller), removable panels, doors - 30x30

Larger guards (panels larger than 4’x4’), freestanding guards, guard/frame combinations - 45x45 & larger

Perimeter guards - EcoSafe or 45x45 & larger
Fixed Point/Machine guards

- Permanent part of the machine
- Not dependent upon moving parts to perform its intended function
- Constructed of sheet metal, screen, wire cloth, bars plastic or other substantial material
- Usually preferable to all other types because of its relative simplicity and permanence
Fixed Point/Machine guards
- On the machine
- Integrated into the process
- Stand alone automation

Types
- Very small to very large
- Barriers from Mesh to Glass

Require Access
- For Production
- For Maintenance

Space and Function
Fixed Point/Machine guards

- How do I design a guard?

- Focus on framing solution
Connector - Connection Screw
- M12x30, M8x25, M6x16 - self tapping
- M12x30 standard screw
- M16x100 standard screw

Advantages
- Does not obscure the t-slot. No need to trim panels to fit around connector.
- Inexpensive (especially self tapping versions)
- Torx head version available

Disadvantage
- Machining required
- Not easy to reconfigure
Risk Assessment - Design - Fabricate - Install - Risk Assessment
Guards with Panels - Connector

- Connector - Inside to Inside/Outside Gussets
  - For 8mm and 10mm t-slots

- Advantages
  - Does not obscure the t-slot. No need to trim panels to fit around connector.
  - No machining required
  - Easy to reconfigure

- Disadvantages
  - Not as strong as the connection screw
Panel Support Inserts - Hold panels in position in t-slot.
- For 6mm, 8mm, 10mm t-slots

Advantages
- Accommodate a variety of panel widths
- Prevent “panel rattle”
- Heavy duty panel support available for 6mm (nominal 1/4”) panels

Disadvantages
- Disassembly required to change panels
Risk Assessment - Design - Fabricate - Install - Risk Assessment
Guards with Panels - Inserts

- Removable Panel Support Inserts
  - Hold panels in position.
    - For 8mm and 10mm t-slots

- Advantages
  - Accommodate a variety of panel widths
  - Prevent “panel rattle”
  - Panels may be removed without disassembly
  - Panels may be installed after frame/guard assembly is complete

- Disadvantages
  - Glazing strip splits after repeated removal
Risk Assessment - Design - Fabricate - Install - Risk Assessment
Guards with Panels - Inserts

- Flush Mount Removable Panel Support Inserts - Hold panels in position.
  - For 8mm and 10mm t-slots

- Advantages
  - Suitable for clean room applications
  - Accommodate a variety of panel widths
  - Prevent “panel rattle”
  - Removed without disassembly
  - Installed after frame/guard assembly completed

- Disadvantages
  - For 45 & 90 Series
Glazing Strip - Hold panels in position.
  - For 6mm, 8mm and 10mm t-slots

Advantages
  - Easy installation
  - Prevents panel rattle
  - Inexpensive

Disadvantages
  - None
Variofix Panel Mounting Fasteners
- For 8mm and 10mm t-slots

Advantages
- Accommodate a variety of panel widths
- Prevent “panel rattle”
- Panels may be removed without disassembly
- Panels may be installed after frame/guard assembly is complete
- Available in version without plastic clips
- Extremely fast installation
- Nut provided for OSHA “compliance”

Disadvantage
- Leaves gap around panel
Wire Mesh Frame and Corner Connectors
  - For 10mm t-slot
  - May be mounted to the side of 6mm and 8mm t-slots

Advantages
  - Deep serrated slot holds wire mesh even when panels are large
  - Inside and Outside Corners accommodate odd panel shapes
  - May be used for removable panels

Disadvantage
  - None
Clamp Bushing
- For 8mm or 10mm t-slots

Advantages
- Use only number necessary for application
- Can install after frame/guard assembly
- Inexpensive
- Independent of wire mesh gage
Risk Assessment - Design - Fabricate - Install - Risk Assessment
Guard Access - Swinging Doors

- **Hinges**
  - For 6mm, 8mm, and 10mm (20 series, 30series, 40 series, 45 series, 50 series, and 60 series profiles)

- **Advantage**
  - All hinges have alignment tabs (for 8mm and 10mm t-slots, tab orientation is done by the customer)
  - Packaged in pairs with appropriate hardware
  - Hinge hasp sized to profile
Clean Room Hinges
- For 6mm, 8mm, and 10mm (20 series, 30 series, 40 series, 45 series, 50 series, and 60 series profiles)

Advantages
- Hinges have alignment tabs
- Packaged in pairs with appropriate hardware
Lift-Off Hinges
- For 8mm, and 10mm (30 series, 45 series, and 60 series profiles)

Advantages
- All hinges have alignment tabs
- Packaged in pairs with appropriate hardware
- Can be reconfigured for 4 hinge mounting options

Disadvantages
- Not available for 40/50 Series
Risk Assessment - Design - Fabricate - Install - Risk Assessment
Guard Access - Swinging Doors, EcoSafe

- Hinge, Lift-Off
  - For 45x45 profiles used with EcoSafe profiles

- Advantages
  - Adjustability
  - High strength, T-Block mounting

- Disadvantages
  - Mounts with T blocks
Guard Access - Sliding Doors

- **Aluminum Sliding Door Guide Profile**
  - Available for 8mm and 10mm t-slots (aluminum for 10mm only)

- **Advantages**
  - Available in either aluminum structural version or polypropylene snap-in version
  - Lift out door possible with insert
  - Panel spacer available to eliminate rattle
  - End Stops and End Caps available

- **Disadvantages**
  - Aluminum version must be milled to make a butt joint
Risk Assessment - Design - Fabricate - Install - Risk Assessment
Guard Access - Guillotine Doors

- Counterbalance
  - Designed for use with 45x45 profile

- Advantages
  - No springs
  - Simple, robust mechanics

- Disadvantage
  - Counterweight not supplied
Risk Assessment - Design - Fabricate - Install - Risk Assessment
Guard Access - Folding Doors

- Folding Door Kit
  - For 8mm and 10mm t-slots

- Advantages
  - Guide pin position selectable on assembly
  - 50k cycle lifetime
  - Use on 30, 40, and 45 Series
Risk Assessment - Design - Fabricate - Install - Risk Assessment
Guarding Accessories - Folding Doors

- Universal Ball Detent Latch
  - For 10mm t-slots
  - Mounts to 40, 45, and 50 series profiles

- Advantages
  - Clean design
  - Ease of installation
Detent Latch
- For 6, 8, and 10mm t-slots
- Mounts directly to door material

Advantages
- Clean design
- Ease of installation
- Clean room suitable
- Magnetic Latch
  - For 6, 8, and 10mm t-slots
  - Mounts directly to door material

- Advantages
  - Clean design
  - Ease of installation
  - 20 & 40N versions available
  - Clean room suitable
Door Accessories - Locks

- Locks for Swinging or Sliding Doors
  - For 30 series and 45 series profiles

- Advantages
  - One lock for either sliding or swinging doors
  - Left and right hand locks available

- Disadvantages
  - Single key for multiple units not possible
Risk Assessment - Design - Fabricate - Install - Risk Assessment
Door Accessories - Locks

- Compact Lock
  - For 40 series and 45 series profiles

- Advantages
  - One lock for either sliding or swinging doors
  - Left and right hand locks available
  - Heavy steel construction
  - Low profile
  - Universal key version available

- Disadvantages
Locks for Heavy Swinging Doors
  - For 45x45 profile

Advantages
  - Esthetically pleasing
  - Mechanism reversible for left or right hand doors

Disadvantages
  - Milling required to install
  - Lock barrel not supplied
  - Relatively expensive
Risk Assessment - Design - Fabricate - Install - Risk Assessment

Guard Access - Removable Panels

- Removable Frame Brackets
  - For 8mm or 10mm t-slots

- Advantages
  - Locks panel in position with screws for OSHA compliance
  - Panel remains hanging when screws are removed
Risk Assessment - Design - Fabricate - Install - Risk Assessment
Guards - Floor to Guard Elements

- Base Plates
- Foot Plates
- Leveling Feet

Floor Guard Foot
Anchor Bolts
Foundation Brackets
Risk Assessment - **Design** - Fabricate - Install - Risk Assessment

Door Accessories - Other

- **Handles**
  - For 6mm, 8mm, and 10mm t-slots
  - Strap and Bar types available

- **Stops**
  - For 8mm and 10mm t-slots

- **Latches**
  - For 6mm, 8mm, 10mm t-slots

- **Handle Adapter, EcoSafe**
Risk Assessment - **Design** - Fabricate - Install - Risk Assessment

Perimeter Guarding

- Automated Process
- Stand Alone – not mounted to machine
- Limited Access during production
- Large in Size
- Integrated
Risk Assessment - Design - Fabricate - Install - Risk Assessment

Perimeter Guarding - Ecosafe Guarding System

The especially economical protective barrier system
- only a few items to order
- standard and custom sizes immediately deliverable
- pre-constructed assemblies
- quick installation
- accessories for sliding doors
- rigid wire mesh attachment easily reconfigured
- universal fastening t-slot
- attractive design

EcoSafe panels EcoSafe suspension bracket EcoSafe door frame

EcoSafe profiles Footplate Door locks Hinges Wire mesh handle adapter
PRECISION ENGINEERED

Strength
• Maximum engagement of extrusion profile
• Publish technical data

Appearance
• Clean smooth aluminum finish
• Rugged and industrial

| TECHNICAL DATA for Frames with Galvanized Mesh |
|-----------------|--------|--------|--------|
| Part Number     | Height | Width  | Force  |
| 3 842 522 467   | 1800mm | 750mm  | 1100 N |
| 3 842 522 468   | 1800mm | 1000mm | 730 N  |
| 3 842 522 469   | 1800mm | 1500mm | 550 N  |

Force needed to push woven wire out of grill profile as tested statically in the center of panel with a 200mm dia. steel plate.
Pre-Assembled Support Posts
- 2000mm or custom 350mm to 2300mm
- Available in 45x45 or 45x90 support
EASY INSTALLATION

- Easy to align and pre-install posts
  - Installs ON SITE in less than 1/2 the time
  - Easy to re-configure & modify

Assembly Note

Use the lateral alignment mark in the footplate to achieve precise spacing for EcoSafe support posts.
Risk Assessment - Design - Fabricate - Install - Risk Assessment

Perimeter Guarding - Ecosafe Guarding System

- Hook -n- Hang brackets
  - Hook -n- hang concept
    - Easy installation
    - Easy removal
    - Multi-angle
Risk Assessment - **Design** - Fabricate - Install - Risk Assessment
Perimeter Guarding – Ecosafe Guarding System

▶ FLEXIBILITY

▶ Works for all types of configurations
  – Straight runs
  – Angled corners

▶ Custom panel options available
  – Lexan
  – Other
Risk Assessment - Design - Fabricate - Install - Risk Assessment
Perimeter Guarding – EcoSafe Guarding System

- Sliding Door Kit with Overhead Trolley
  - Available in 1000mm & 1500mm widths
  - No trip hazard at bottom of door
  - Mounts on standard Support Posts
  - Easy sliding Delrin® bearings
  - V-block stop
Sliding Door Kit with Lower Roller Guide
- Available in 1000mm & 1500mm widths
- No overhead guide to obstruct fork trucks
- No trip hazard at bottom of door
- Mounts on standard Support Posts
- Easy sliding Delrin® bearings
- V-block stop
ECOSAFE GUARDING
Risk Assessment - **Design** - Fabricate - Install - Risk Assessment

- **Design (Hard Guarding)**
  - Internal Capabilities
    - Evaluate Competence
    - Evaluate Resources
    - Determine Costs
  - External Resources at CMA/Flodyne/Hydradyne
Risk Assessment - Design - Fabricate - Install - Risk Assessment

- External Resources: CMA/ Flodyne/Hydradyne

- Design
  - Dedicated Engineering
    - Turnkey solutions
      » From Drawings
      » On-site measurements
      » CAD Capabilities

- Integrated Solutions
  - Hard and Soft Guarding Solutions
Fabrication (Hard Guarding)

Frame Material
- Aluminum Profile

Fabrication Required
- Cut
- Machine

Equipment Required
- Saw
- Machining Center (drill, tap, mill etc.)
Risk Assessment - Design - Fabricate - Install - Risk Assessment

- Fabrication (Hard Guarding)
  - Barrier Material
    - Wire Mesh
    - Plexiglass or Equivalent
      - Clear, Smoked
    - Aluminum and sheet metal
    - Glass
  - Fabrication Required
    - Cut
    - Machine holes
  - Equipment Required
    - Panel Saw and Shear
    - Drill
Risk Assessment - Design - **Fabricate** - Install - Risk Assessment

▶ Fabrication (Hard Guarding)

▶ Internal Capabilities
  • Evaluate Competence
  • Evaluate Equipment
  • Determine Costs

▶ External Resources at CMA/Flodyne/Hydradyne
Risk Assessment - Design - **Fabricate** - Install - Risk Assessment

- **External Resources:** CMA/ Flodyne/Hydradyne

- **Fabrication**
  - Dedicated Assembly Team
  - Framing Machining Fabrication
    - Cutting
    - Drilling
    - Tapping
  - Barrier Fabrication
    - Shearing Mesh
    - Panel Saw for Plexiglass

- **Integrated Solutions**
  - Hard and Soft Guarding Solutions
Installation (Hard Guarding)

- Internal Capabilities
  - Evaluate Competence
  - Evaluate Equipment
  - Determine Costs

- External Resources at CMA/Flodyne/Hydradyne
Risk Assessment - Design - Fabricate - **Install** - Risk Assessment

- **External Resources:** CMA/ Flodyne/ Hydradyne

  - **Installation**
    - Dedicated Installation Team
    - Multiple levels of service
      - Raw Material
      - Kits
      - Turnkey solutions
    - On-site Installation

  - **Integrated Solutions**
    - Hard and Soft Guarding Solutions
Did you eliminate the identified hazards?
- Evaluate the new guarding
- Document Completion

Identify New Hazards
- Were new hazards created?
- Repeat process as necessary
## APPLICATIONS