

MARSH

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Equipment Safety

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Semiconductor Equipment Safety Continuum (Best Case Scenario)

1. Equipment is designed to SEMI and other regulatory standards
2. 3rd party evaluation to ensure design meets standards
3. Device manufacturer evaluates equipment validates standards and company specific requirements were met
4. Device manufacturer installs and test equipment prior to start-up
 - Safety level sign-off
5. Equipment supplier provides customers safety updates if concern is realized
6. Equipment is maintained on tight schedules to prevent potential safety events

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Potential Faults and Areas of Increased Risks

- Supplier missed calculated or did not provide adequate control
- Standards did not exist when equipment was designed
- Inaccurate risk ranking during 3rd party evaluation
- Potential risk was never realized or considered a true hazard
 - (Space shuttle heating tiles)
- Equipment received is not representative of the equipment tested
- Equipment is used and/or has been modified previously
- Equipment has undergone retrofits
- Equipment is installed improperly
- Equipment operated and maintained improperly
- Component failure that was not supposed to fail

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Ensuring Safety Integrity of Equipment

- Safety engineers aware of standards and product safety practices
 - Evaluate equipment entering facility
 - Communicate expectations of new equipment and components
 - Request appropriate testing (S2, S2, EMI, etc.)
- Equipment, process, and facilities engineers are trained on equipment safety requirements
 - Recognize the importance of ensuring components and equipment that are chosen allow for safe operation of equipment

Note: Selecting the proper equipment and components can significantly reduce errors in quality, equipment downtime, redesign, and prevent incidents.

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Equipment Safety – S2/S8

- SEMI S2 - Safety
 - Design guideline to be used by engineers when designing equipment
 - Excellent source for technical information on safety and IH
 - Assessed by 3rd parties to ensure compliance to design standards
 - 3rd part reports is a great source for information on the equipment
 - Facility requirements
 - Tool configuration
 - Safety Features
- SEMI S8 - Ergonomics
 - Good source for ergonomics information
 - Not fully understood or accurately assessed by 3rd parties

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Equipment Safety – What to Look For

- Interlocks
 - Hardware **NOT** software (mechanical relays rather than software signals)
 - Place equipment in safe state and remove the hazard it is protecting against
 - Must require manual reset
 - Components must be NRTL certified
 - If hazard is not interlocked, access should require a tool and have a label explaining the hazard

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Equipment Safety – What to Look For

- Emergency Off Buttons
 - Red with yellow background
 - Labeled Emergency Off
 - Located every 3ft. And within reach of maintenance areas
 - Eliminates power to equipment
 - Components that take time for hazard to be reduced (e.g. turbo pumps) or those are not hooked up to EMO circuit need to be clearly labeled.

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Equipment Safety – What to Look For

- Electrical
 - Switch gear located in non-combustible enclosure
 - A main circuit breaker with lock out tag out capability
 - NRTL rated components
 - Detailed labeling
 - “Hot” components must be finger safe
 - Isolated from flammable areas
 - Enclosure grounded and bonded

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Equipment Safety – What to Look For

- Mechanical

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 - This is a sample of a second-level bullet
 - This is a sample of a third-level bullet
 - This is a sample of a fourth-level bullet

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Step 2

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