FLUKE® Reliability

C&W SERVICES

Reliability Centered Maintenance

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Safety

LOTOTO

Lockout Device (definition): Any device that uses positive means, such as a lock, blank flanges and bolted slip blinds, to hold an energy-isolating device in a safe position, thereby preventing the energizing of machinery or equipment.
Examples:

- **Personal Locks**
- **Warning Tags**
- **Multiple Lock Hasps**
- **Equipment Isolation Lock**
- **Proprietary Group Lock**
- **Satellite Lock**

Polling question

What percentage use a work authorization permit?

THE LOTOTO CARDINAL RULE:

- ALWAYS FOLLOW LOTO REQUIREMENTS WHEN WORKING ON EQUIPMENT
- NEVWER BEGIN WORK WITH OUT FIRST ISOLATING/CONTROLING ALL ENERGY

What is the Work Authorization Permit (WAP)?

WAP IS USED IN CASES WHERE LOTO IS NEEDED, BUT NO ECP IS AVAILABLE

Work Authorization Permit (WAP) Process

- WAP is a task-specific, not equipment-specific, control document
- WAP identifies the source(s) of energy and the means for control
  - Equipment to be serviced
  - Types and unique sources of energy
  - Methods for safe work
  - Verification
- WAP is used to document and authorize the performance of a specific task
- WAP must be used when an ECP is not available
- WAP may be used if existing ECP will not be followed as written
  - ECP's typically ensure LOTO of ALL (multiple) energy sources
  - In some cases, work may not require control or removal of ALL energy sources
  - In such cases, instead of drafting a new ECP, the WAP may be used
  - The WAP thereby documents a Task-Specific ECP, if/when needed
- Performance of WAP is functionally equivalent to an ECP

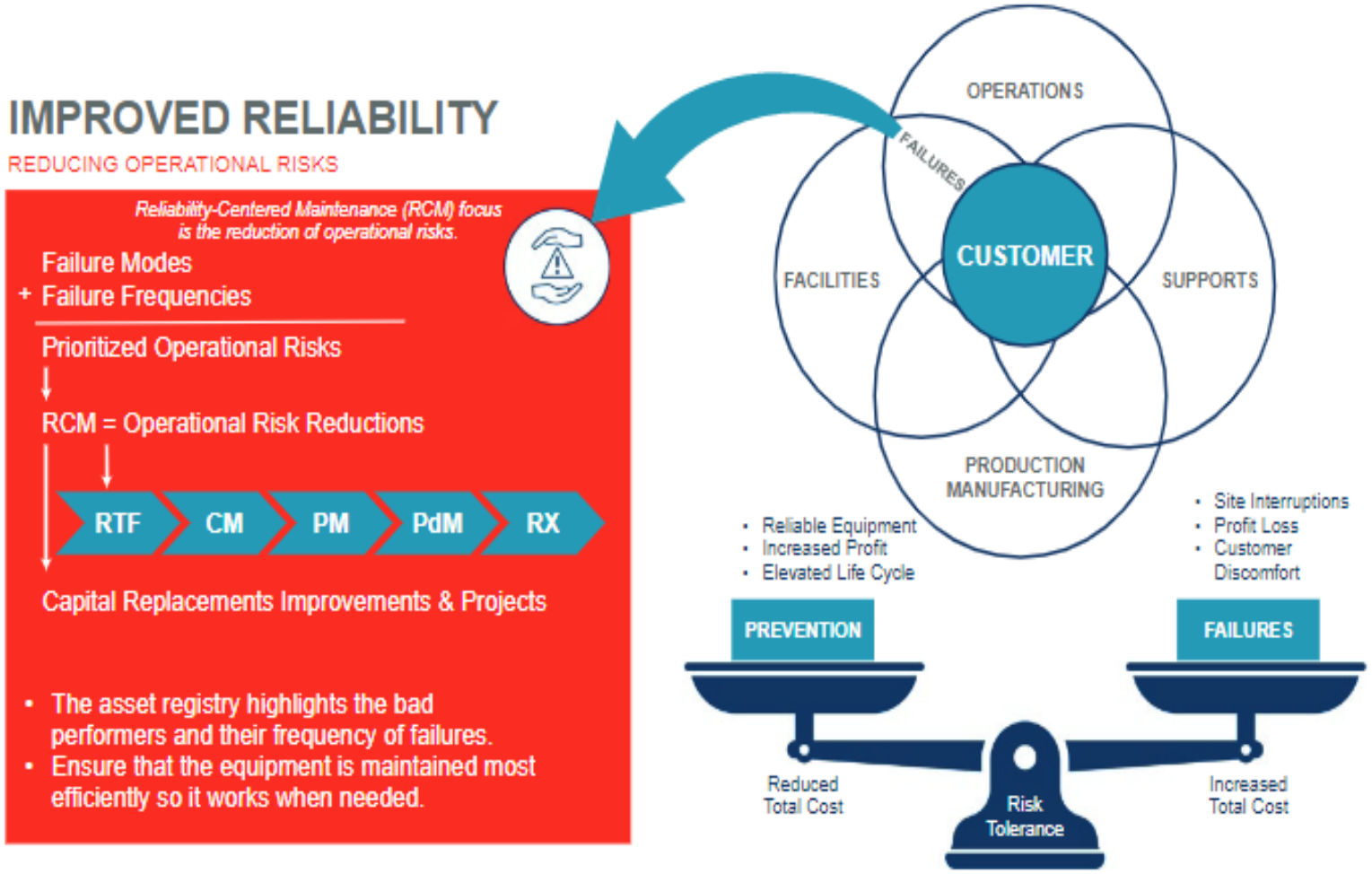
***EXAMPLE ONLY* WORK AUTHORIZATION PERMIT (WAP)**

WORK AUTHORIZATION PERMIT (WAP)					
Location Description: *Client ABC, Building #1, HVAC Room*				**Task Description:** *Replace a section of faulty heat exchange fan*	
Description of Machine/Equipment/System: *Air Handling Union - Equipment ID #: Carrier ABCD1234*				**Date Permit Prepared:** 01/01/18 **Time Permit Prepared:** 16:30 **Permit #:** 01-01-18 – 16:30	
List of Authorized Employee(s): *John Smith - Electrician*		**List of Affected Employees(s):** *Bobby – Warehouse Workers*		**Permit Preparer's Name:** *John Smith*	
Type & Magnitude of Energy	**Hazards of Energy**	**Energy Isolation Device**	**Location of Isolation Device**	**Control Method**	**Verification**
Electrical ☐ 110VAC ☒ 220VAC ☐ 480VAC ☐ Other _____	☒ Shock ☐ Fire ☐ Explosion ☐ Other _____	Electrical disconnect switch	Isolation point below union	Move electrical disconnect switch to off position, apply padlock, apply tag	Depress the green on button at the control panel
Mechanical ☐ Slight ☐ Moderate ☐ High ☐ Other _____	☐ Caught in/on/ between ☐ Pinch Points ☐ Striking by/against ☐ Other _____				
Hydraulic ☐ Slight ☒ Moderate ☐ High ☐ Other _____	☐ Caught in/on/between ☐ Pinch Points ☒ Striking by/against ☐ Other _____	Refrigerant inlet valve	Isolation point on the inlet refrigerant pipe	1. Turn valve clockwise until full stop, apply gate valve lockout device, apply tag 2. Open outlet valve to accumulator	Check the pressure valve for system verified it reads zero
Pneumatic ☐ Slight ☐ Moderate ☐ High ☐ Other _____	☐ Caught in/on/between ☐ Pinch Points ☐ Striking by/against ☐ Other _____				
Chemical ☐ Slight ☐ Moderate ☐ High ☐ Other _____	☐ Inhalation ☐ Skin Contact ☐ Absorption ☐ Other _____				
Thermal ☐ Slight ☒ Moderate ☐ High ☐ Other _____	☒ Skin Contact ☐ Heat Stress ☒ Cold Stress ☐ Other _____	Refrigerant inlet valve	Isolation point on the inlet refrigerant pipe	Turn valve clockwise until full stop, apply gate valve lockout device, and apply tag. Open outlet valve to accumulator	Check temperature of unit on control panel, verify
Other Energy:					
WAP Approval – I, hereby approve this LOTO Work Permit and attest the equipment has been de-energized. The service/maintenance task(s) may now proceed. This permit is valid for the time required to perform the task, or 1 work-shift, or 8 hours from the time of signature (whichever is less). **Name**:_____ **Signature**:_____ **Title**:_____		After service/ maintenance work is completed, proceed to Release the LOTO, as specified in the LOTO General ECP, then close-out the WAP and obtain the required		**WAP Closure** – I, hereby attest that I have: ☐ Verified all LOTO devices have been removed. ☐ Verified all equipment has been returned to normal operating conditions. ☐ Notified all affected personnel that system is back in service. ☐ Ensured work is completed and accepted. ☐ **Alternative Option**: Client responsible for Energy Restoration **Name**:_____ **Signature**:_____ **Title**:_____	

Reliability Centered maintenance

What is reliability centered maintenance?

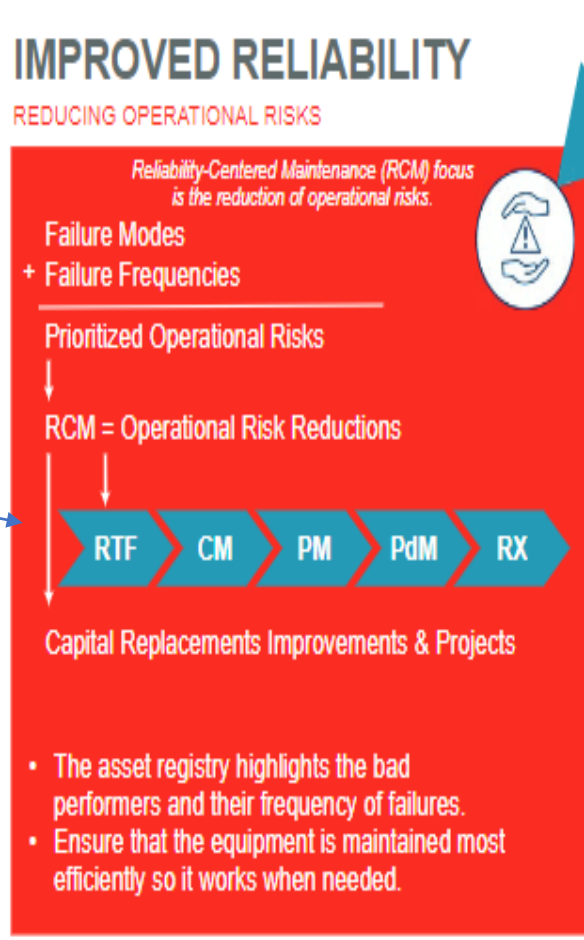
RCM is an ongoing, systematic process of matching assets with maintenance strategies. The primary objective of RCM is to identify failure modes and preserve system functions. By concentrating on the reliability journey, RCM will reduce operational risks, producing consistent and dependable equipment.

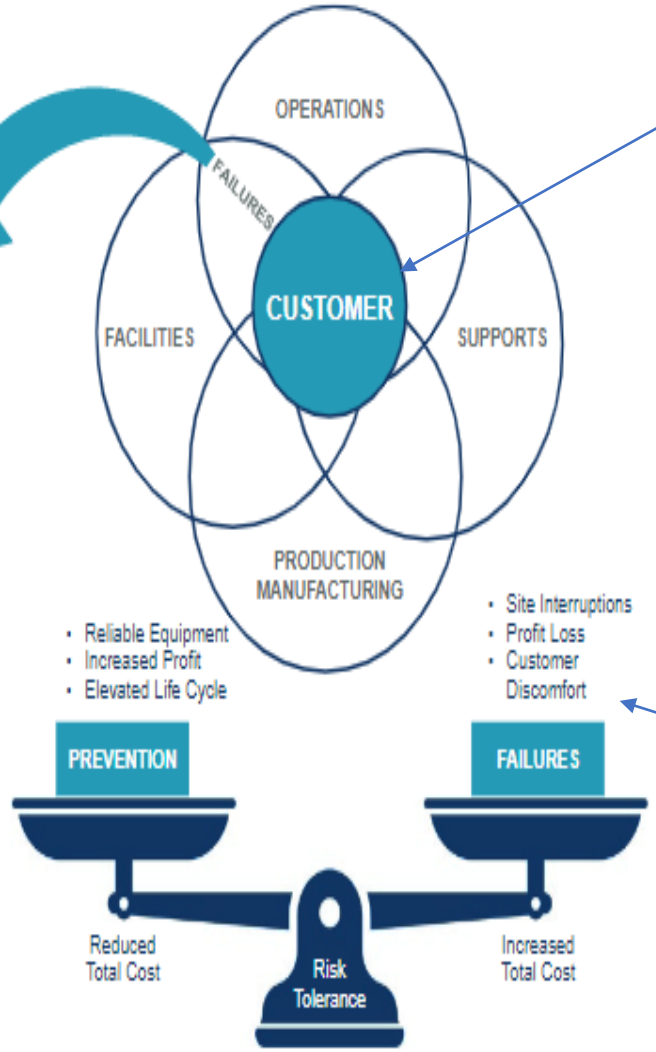


What is reliability centered maintenance?

RCM will reduce operational risks by producing consistent and dependable equipment.

RCM is matching assets with maintenance strategies.





Reliability Centered Maintenance(RCM) identify failure modes and preserve system functions.

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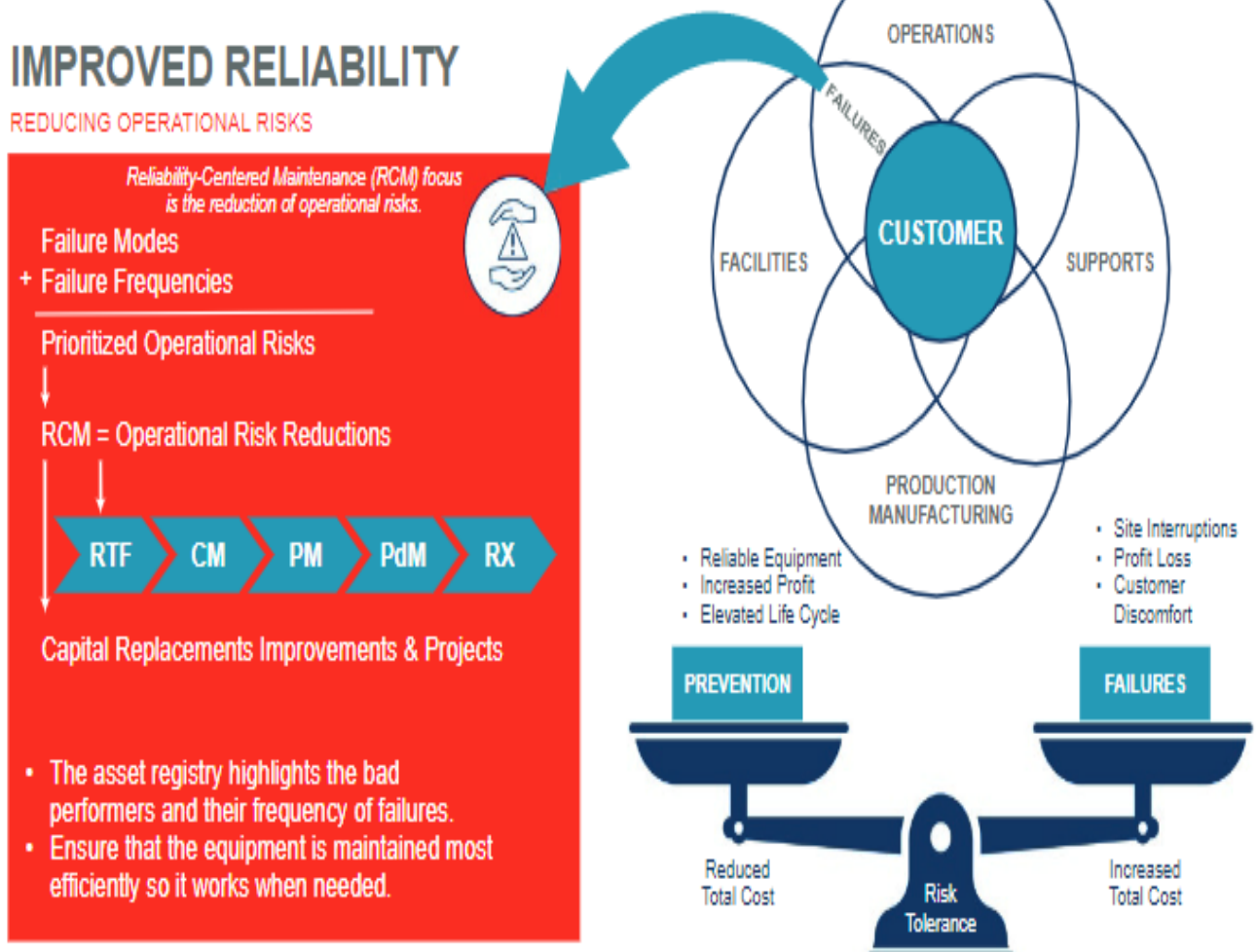
RCM is matching assets with maintenance strategies.



RCM will reduce operational risks by producing consistent and dependable equipment.

Reliability Centered Maintenance(RCM) identify failure modes and preserve system functions.

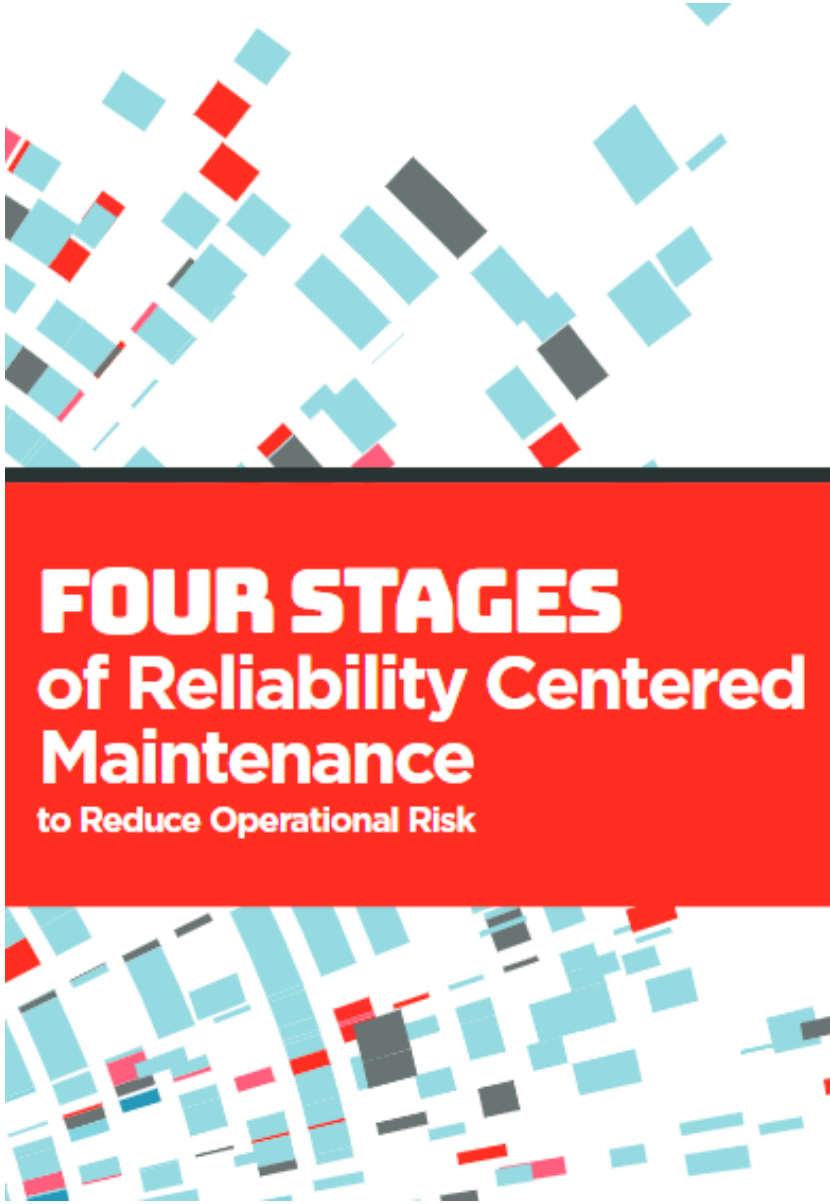
Four Stages of Reliability Centered Maintenance

01 Evaluation

02 Design and Determination Stage

03 Quality and Value Stage

04 Implementation and Validation Stage



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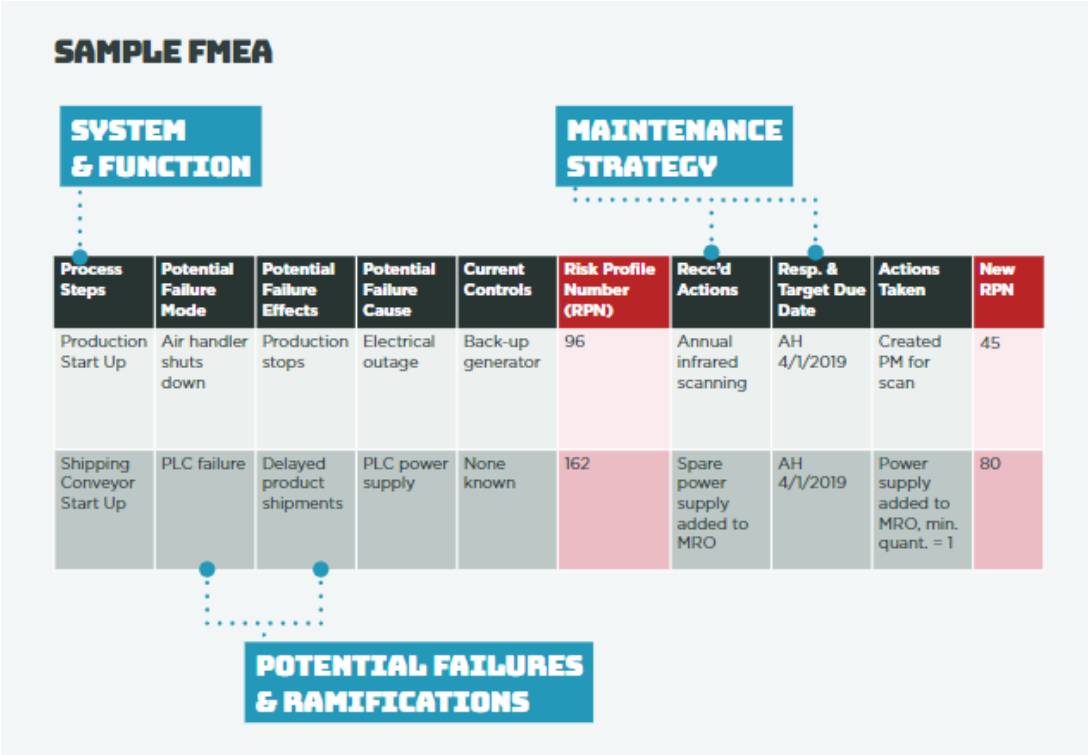
01 Evaluation

- How do you evaluate your assets?
- The common tool used is Failure mode and Effects Analysis (FMEA) it is a risk management tool which identifies and quantifies potential failures. FMEA can highlight failure cause, frequency, impact and probability of failure.
- What is an asset?
- Property owned by the company that has been identified as having value
- What is an asset management system?
- It is a tool that follows a process to manage a company's assets.



Process Steps	Potential Failure Mode	Potential Failure Effects	Potential Failure Cause	Current Controls	Risk Profile Number (RPN)	Recc'd Actions	Resp. & Target Due Date	Actions Taken	New RPN
Production Start Up	Air handler shuts down	Production stops	Electrical outage	Back-up generator	96	Annual infrared scanning	AH 4/1/2019	Created PM for scan	45
Shipping Conveyor Start Up	PLC failure	Delayed product shipments	PLC power supply	None known	162	Spare power supply added to MRO	AH 4/1/2019	Power supply added to MRO, min. quant. = 1	80

01 Evaluation

Detection	Likelihood of DETECTION by Design Control	Ranking
Absolute Uncertainty	Design control **cannot** detect potential cause/mechanism and subsequent failure mode	10
Very Remote	**Very remote** chance the design control will detect potential cause/mechanism and subsequent failure mode	9
Remote	**Remote** chance the design control will detect potential cause/mechanism and subsequent failure mode	8
Very Low	**Very low** chance the design control will detect potential cause/mechanism and subsequent failure mode	7
Low	**Low** chance the design control will detect potential cause/mechanism and subsequent failure mode	6
Moderate	**Moderate** chance the design control will detect potential cause/mechanism and subsequent failure mode	5
Moderately High	**Moderately High** chance the design control will detect potential cause/mechanism and subsequent failure mode	4
High	**High** chance the design control will detect potential cause/mechanism and subsequent failure mode	3
Very High	**Very high** chance the design control will detect potential cause/mechanism and subsequent failure mode	2
Almost Certain	Design control **will** detect potential cause/mechanism and subsequent failure mode	1

The following FMEA questions should be considered:

1. What is the system?
2. How does it function?
3. What are the potential failures of the equipment?
4. What is the impact and ramifications for each failure point?
5. What is the maintenance strategy that will be implemented?

PROBABILITY of Failure	Failure Prob	Ranking
Very High: Failure is almost inevitable	>1 in 2	10
	1 in 3	9
High: Repeated failures	1 in 8	8
	1 in 20	7
Moderate: Occasional failures	1 in 80	6
	1 in 400	5
	1 in 2,000	4
Low: Relatively few failures	1 in 15,000	3
	1 in 150,000	2
Remote: Failure is unlikely	<1 in 1,500,000	1

Effect	SEVERITY of Effect	Ranking
Hazardous without warning	Very high severity ranking when a potential failure mode affects safe system operation without warning	10
Hazardous with warning	Very high severity ranking when a potential failure mode affects safe system operation with warning	9
Very High	System inoperable with destructive failure without compromising safety	8
High	System inoperable with equipment damage	7
Moderate	System inoperable with minor damage	6
Low	System inoperable without damage	5
Very Low	System operable with significant degradation of performance	4
Minor	System operable with some degradation of performance	3
Very Minor	System operable with minimal interference	2
None	No effect	1

02 Design and Determination Stage

The function and criticality of the system must be defined at this point.

You should identify if the asset fails what will be affected, the whole site or one building.

Manufacturing usability requirements, safety, regulatory compliance, and non-fictional requirements are only a few of the elements that influence criticality in this stage.

https://www.linkedin.com/pulse/understanding-regulatory-compliance-risk-5-key-steps-ross-hamilton

03 Quality and Value Stage

It’s important to have a high-quality program that follows an identifiable and repeatable procedure approved by management. The RCM process adds value by ensuring the equipment and systems’ integrity by:

» Extending the life of the equipment

» Reducing spontaneous failures

» Diminishing maintenance cost

» Achieving regulatory compliance

» Providing systems available when needed

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04 Implementation and Validation Stage

The implementation stage is sometimes disregarded because it appears to be simple. This could not be further from the truth. For the technician executing the work, it's critical to get the data entry correct. A single incorrect keystroke might have a negative impact on a company's bottom line.

- Each new task and maintenance technique suggested should be examined.
- The FMEA and root cause analysis should be reviewed for alignment while validating the new mitigation task and procedure.
- The new job plans should reduce or eliminate the FMEA-identified failure point and should fall into one of these asset RCM program schemes for consideration:

Run to Fail (RTF)
Maintenance is only performed when equipment has failed.
Corrective Maintenance (CM)
A task performed to restore a non- or under-performing asset to an optimum or operational condition.
Preventive Maintenance (PM)
A strategy that is regularly and routinely performed on physical assets to reduce the chances of equipment failure and unplanned machine downtime
Predictive Maintenance (PdM)
Uses condition-monitoring tools and techniques to monitor the performance of a structure or a piece of equipment during operation.
Prescriptive Maintenance (RX)
A strategy that uses machine learning to adjust operating conditions for desired outcomes, as well as intelligently schedule and plan asset maintenance.

ISO 55000 ASSET MANAGEMANT

The factors which influence the type of assets that an organization requires to achieve its objectives, and how the assets are managed, include the following:

- the nature and purpose of the organization;
- its operating context;
- its financial constraints and regulatory requirements;
- the needs and expectations of the organization and its stakeholders.

These influencing factors need to be considered when establishing, implementing, maintaining and continually improving asset management.

Effective control and governance of assets by organizations is essential to realize value through managing risk and opportunity, in order to achieve the desired balance of cost, risk and performance. The regulatory and legislative environment in which organizations operate is increasingly challenging and the inherent risks that many assets present are constantly evolving.

The fundamentals of asset management and the supporting asset management system introduced in this international standard, when integrated into the broader governance and risk framework of an organization, can contribute tangible benefits and leverage opportunities.

Asset management translates the organization’s objectives into asset-related decisions, plans and activities, using a risk-based approach.

International Standard link →

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Thank you!

For More Information & Dashboard Access, Please Contact:

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