

FMECA



Reliability Centered Maintenance

FMECA – What is it?

- Broad application across many disciplines
- FMEA – Failure Modes and Effect Analysis whose prime aim is to determine the effects of each failure mode
- FMECA – Failure Modes and Effects Criticality Analysis extends the analysis to focus on the severity of the consequences of each probable failure mode
- Level of detail of the FMEA/FMECA application depends upon the objectives of the analysis
 - Higher Functional Level – focus on high level system architecture
 - Lower Functional Level – greater focus on discrete components especially for safety critical elements

FMECA – What does it do?

- FEMCA requires time and investment
- It identifies failures that produce unwanted effects
- Determines the seriousness of each failure.
- Identifies safety hazards and non compliance.
- Assists the design of Built-in-Test and failure indications.

FMECA – Benefits

- Proof that care has been taken will meet requirements
- Improves knowledge and understanding
- Can assist production, design, development, maintenance procedures

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- **Function:** What the component must do.
- Function statement should consist of a **VERB**, an **OBJECT** and a desired **STANDARD OF PERFORMANCE**
 - The verb relates to the function – what has to be done
 - The object relates to the asset
 - The standard of performance sets the minimum specification for system functionality to meet the user requirements
- E.g. The pump must deliver oil at 100 litres per minute

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- Initial Capability (what the system can do)
- Lifetime Desired Capability (what the system is required to do)
- Forms of Performance Standards:
 - Multiple Performance Standards
 - Quantitative Performance Standards
 - Qualitative Performance Standards
 - Absolute Performance Standards
 - Variable Performance Standards
 - Variable Capacity - Upper and Lower Limits

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Influence on functional requirements

- Operating natural environment
- Quality standards environment
- Work place environment – location, facilities, people & practices
- Safety environment
- Supply chain
- Presence of system redundancy
- Market demand

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Failure Mode: Defined as the inability of a system to fulfil a function to its standard of performance which is acceptable to the user

- Broad classifications of failure:
 - Total
 - Partial
 - Evident
 - Hidden

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- **Failure mode:** What could possibly go wrong – regardless of probability (within reason)
- **Failure cause:** why it went wrong
- **Failure effect:** the consequence of the failure mode, when it occurs
- **Occurrence:** the probability of a particular cause occurring
 - Scale of 1-10: 1 = very remote; 10; almost certain
 - Do not use relative rate.

FMECA – What is in it?

- **Criticality:** severity of consequences
 - Scale of 1 – 10: 1 = very minor; 10 = catastrophic
 - In aviation 9 or 10 usually indicates fatalities; generally uncommon and some corrective action should be taken.
- **Detection:** How likely could the faults be detected before the effect.
 - Scale of 1 – 10: 1 = very likely; 10 = not likely at all

FMECA – What is in it?

- **RPN:** (Risk Priority Number) Its magnitude indicates the priority for corrective action.
 - $RPN = \text{occurrence} \times \text{severity} \times \text{detection}$
 - Higher the score – higher the priority
 - Action may be taken if a solution is low cost and easily corrected on a low scoring RPN

FMECA – What is it?

- **Recommended Actions:** Actions that would best reduce the failure severity or probability, increase the chance of early detection.
- **Actions Taken:** Actions that have been taken to reduce the failure severity or probability, increase the chance of early detection. This is dependant on cost effectiveness and severity.
- **Improved RPN:** Same calculation as RPN, with new figures based on 'Actions Taken'.