



FMEA for Maintenance Engineers

Simplified Failure Modes & Effects Analysis workbook with worked examples.

Failure Modes & Effects Analysis (FMEA) is a structured approach to identify potential failure modes, their causes and effects, and to prioritize actions that reduce risk. This simplified workbook provides maintenance engineers with practical guidance, scoring tables, and worked examples to quickly apply FMEA in daily work.

1. FMEA Basics

- Failure Mode: How an asset or component can fail (e.g., bearing seizure).
- Failure Effect: The impact of the failure on the system (e.g., pump stops delivering flow).
- Failure Cause: The underlying reason (e.g., poor lubrication).
- Risk Priority Number (RPN): Calculated as $\text{Severity} \times \text{Occurrence} \times \text{Detection}$.

2. Scoring Tables

Severity, Occurrence, and Detection are scored 1-10. Higher values indicate greater risk.

Factor	Score 1	Score 5	Score 10
Severity	No effect	System downtime < 1h	Catastrophic failure, safety impact
Occurrence	Failure unlikely (<0.01%)	Occasional (1-5% chance)	Frequent (>20% chance)
Detection	Almost certain to detect	May not detect	Impossible to detect before failure

3. Worked Example

Example asset: Centrifugal Pump

Failure Mode	Effect	Cause	Severity (1-10)	Occurrence (1-10)	Detection (1-10)	RPN
Bearing Seizure	Pump stops, loss of flow	Poor lubrication	8	6	5	240
Seal Leak	Fluid leak, environmental hazard	Seal wear	7	5	6	210
Impeller Damage	Reduced flow/efficiency	Cavitation	6	4	7	168

Interpretation:

The highest RPN (240) is for Bearing Seizure. Maintenance focus should prioritize improved lubrication practices, condition monitoring, and spare bearing availability.

4. Implementation Steps

- 1. Select asset or system with known issues or high criticality.
- 2. Identify potential failure modes, effects, and causes.
- 3. Score Severity, Occurrence, and Detection using standard tables.
- 4. Calculate $RPN = \text{Severity} \times \text{Occurrence} \times \text{Detection}$.
- 5. Prioritize actions on highest RPN items.
- 6. Review and update FMEA periodically based on actual failures.

5. FMEA Checklist

- ✓ Asset selected and scope defined.
- ✓ Failure modes identified with effects and causes.
- ✓ Scoring completed for Severity, Occurrence, and Detection.
- ✓ RPN calculated for each failure mode.
- ✓ Mitigation actions identified for high RPN items.
- ✓ FMEA reviewed and updated regularly.

AssetStage helps maintenance teams perform quick FMEAs by providing templates, scoring guides, and integration with CMMS data.