

Title	Demonstrate and apply knowledge of maintenance and reliability of mechanical engineering plant		
Level	5	Credits	10

Purpose	<p>This unit standard is for use in the training of mechanical engineering maintenance personnel in manufacturing and processing plants. It covers principles and techniques of maintenance and reliability, and their practical application.</p> <p>People credited with this unit standard are able to demonstrate knowledge of maintenance and reliability principles, equipment failure mechanisms, and condition monitoring; and apply and document maintenance and reliability techniques.</p>
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Classification	Mechanical Engineering > Maintenance and Diagnostics in Mechanical Engineering
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Available grade	Achieved
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Explanatory notes

1 References

IEC 60812:2006, *Analysis techniques for system reliability – Procedure for failure mode and effects analysis (FMEA)*.

IEC 61882:2001, *Hazard and operability studies (HAZOP studies) - Application guide*.

SAE JA 1011:2009, *Evaluation Criteria for Reliability-Centered Maintenance (RCM) Processes*.

SAE JA 1012:2002, *A Guide to the Reliability-Centered Maintenance (RCM) Standard*.

Idhammar, C, Idhammar, T, et al. *Preventive Maintenance/ Essential Care and Condition Monitoring*. Raleigh NC: IDCON Inc., 1999. Available from <http://www.idcon.com>.

2 Definitions

Recognised methodology refers to a methodology for maintenance processes and techniques in accordance with the reference texts listed in explanatory note 1, or similar published methodologies, or similar in-house enterprise methodologies for which guidelines or precedents exist.

FMECA – Failure Mode Effects and Criticality Analysis.

HAZOPS – Hazard and Operability Study. A structured and systematic examination of a process or operation in order to identify and evaluate problems that may represent risks to personnel or equipment, or prevent efficient operation.

NDT – Non-destructive Testing.

P-F Interval – a plot of plant condition versus time. This is the interval between the point at which potential failure (P) becomes detectable and the point at which it degrades into a functional failure (F).

RCFA – Root Cause Failure Analysis.

RCM – Reliability Centred Maintenance. A systematic and structured process to develop an efficient and effective maintenance plan for an asset. The process aims to minimize the probability of failures, ensure safety, and meet operational objectives.

Outcomes and evidence requirements

Outcome 1

Demonstrate knowledge of maintenance and reliability principles.

Evidence requirements

- 1.1 The concepts of maintainability and reliability of plant assets, and their significance to the successful operation of an enterprise, are explained.
- 1.2 The key steps in the RCM process are explained in accordance with a recognised methodology.
- Range key steps – FMECA, structured decision making, maintenance task analysis.
- 1.3 The purpose and benefits of RCFA and HAZOPS are explained in the context of a continuous maintenance improvement programme.
- 1.4 Key performance indicators used to measure plant reliability are identified and their use explained.
- Range evidence of at least three performance indicators is required.

Outcome 2

Demonstrate knowledge of equipment failure mechanisms.

Evidence requirements

- 2.1 Failure patterns are described with the aid of sketches of probability of failure versus time which are sketched by the candidate.
- Range patterns – bathtub, age-related, random.
- 2.2 Wear processes are described with reference to the cause of wear and where it may typically occur.
- Range wear processes include but are not limited to – adhesion, abrasion, fretting, erosion, corrosion, surface fatigue.

- 2.3 The P-F Interval is defined with the aid of a sketch of plant condition versus time which are sketched by the candidate, and its significance to condition monitoring is explained.

Outcome 3

Demonstrate knowledge of condition monitoring.

Evidence requirements

- 3.1 The purpose and benefits of conditioning monitoring of plant assets are outlined in the context of reliability and costs.
- 3.2 Condition monitoring techniques are selected for given scenarios of components and environment.

Range techniques include but are not limited to – vibration analysis, shaft alignment monitoring, thermography, temperature indicators, visual examination, measurement, NDT, particle discharge monitoring, oil analysis, relay injection, audible or sound techniques.
Evidence of at least 6 different techniques is required.

Outcome 4

Apply and document maintenance and reliability techniques.

Evidence requirements

- 4.1 RCM techniques are applied and documented for the maintenance of a plant asset in accordance with a recognised methodology.
- Range techniques – FMECA, structured decision making, maintenance task analysis.
- 4.2 An RCFA is performed and documented to identify the real cause of failure of a process plant component in accordance with a recognised methodology.
- 4.3 A HAZOPS is performed and documented for a process plant component in order to identify and evaluate potential risks to personnel, equipment, or efficient operation in accordance with a recognised methodology.

Planned review date	31 December 2015
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Status information and last date for assessment for superseded versions

Process	Version	Date	Last Date for Assessment
Registration	1	19 November 2010	N/A

Accreditation and Moderation Action Plan (AMAP) reference	0013
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This AMAP can be accessed at <http://www.nzqa.govt.nz/framework/search/index.do>.

Please note

Providers must be granted consent to assess against standards (accredited) by NZQA, or an inter-institutional body with delegated authority for quality assurance, before they can report credits from assessment against unit standards or deliver courses of study leading to that assessment.

Industry Training Organisations must be granted consent to assess against standards by NZQA before they can register credits from assessment against unit standards.

Providers and Industry Training Organisations, which have been granted consent and which are assessing against unit standards must engage with the moderation system that applies to those standards.

Consent requirements and an outline of the moderation system that applies to this standard are outlined in the Accreditation and Moderation Action Plan (AMAP). The AMAP also includes useful information about special requirements for organisations wishing to develop education and training programmes, such as minimum qualifications for tutors and assessors, and special resource requirements.

Comments on this unit standard

Please contact Competenz info@competenz.org.nz if you wish to suggest changes to the content of this unit standard.