

Title	Demonstrate and apply knowledge of maintenance plans for mechanical equipment and plant		
Level	5	Credits	8

Purpose	<p>This unit standard is for people who carry out maintenance on mechanical equipment and plant.</p> <p>People credited with this unit standard are able to: explain the principles of mechanical equipment and plant maintenance; demonstrate knowledge of maintenance procedures and documentation; prepare to carry out maintenance activities; carry out maintenance activities; and complete maintenance activities.</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

Legislation relevant to this unit standard includes but is not limited to the: Health and Safety in Employment Act 1992; Resource Management Act 1991; Hazardous Substances and New Organisms Act 1996 and any subsequent amendments.

Ramesh Gulati, Ricky Smith. *Maintenance and Reliability Best Practices*. New York: Industrial Press Inc., 2009.

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

John Moubray. *Reliability-centered Maintenance* (Second Edition). New York: Industrial Press Inc., 1997. ISBN 0-8311-3146-2.

2 Definitions

Standard industry practice – standard and proven industry practices accepted by the mechanical engineering industry.

Worksite procedures – documented procedures used by the organisation carrying out the work and applicable to the tasks being carried out. They may include but are not limited to – standard operating procedures, site safety procedures, equipment operating procedures, codes of practice, quality assurance procedures, housekeeping standards, procedures to comply with legislative and local body requirements.

Maintenance plan – a structured and documented schedule of activities designed to keep equipment and plant operating to its intended performance specifications.

PPM – planned preventative maintenance.
OCM – on condition maintenance.
CBM – condition based maintenance.
RCFA – root cause failure analysis.
MTBF – mean time between failures.
CMMS – computerised maintenance management system.
PLC – programmable logic controller.

Outcomes and evidence requirements

Outcome 1

Explain the principles of mechanical equipment and plant maintenance.

Evidence requirements

- 1.1 Maintenance terms and abbreviations are explained in accordance with standard industry practices and reference texts.
- Range uptime, downtime, lockout tagout, PPM, OCM, CBM, RCFA, MTBF, CMMS.
- 1.2 Maintenance types are described in terms of their characteristics in accordance with standard industry practice and reference texts.
- Range condition based maintenance, planned maintenance, unplanned maintenance, opportunity maintenance.
- 1.3 Maintenance periods are described in accordance with standard industry practices and reference texts.
- Range calendar based, operating time based, operating cycle based.
- 1.4 The effects of maintenance are explained in terms of the impact on plant and equipment operation, production output, and costs.
- Range planned verses unplanned maintenance, loss of production, consequences of lack of maintenance, effect on life of equipment, effect on output quality, environmental and safety costs.
- 1.5 The effects of different operating contexts on equipment and maintenance requirements are explained.
- Range load, operating time, operating cycle length, number of cycles, thermal cycling, continuous verses intermittent operation, operating conditions and environments.
- 1.6 The principles of computerised maintenance management systems are described in accordance with standard industry practice and reference texts.

Outcome 2

Demonstrate knowledge of maintenance procedures and documentation.

Evidence requirements

- 2.1 Shut down and start-up procedures are described in accordance with standard industry practice.
- Range safety requirements, legislative requirements, communication requirements, worksite procedures, lockout tagout procedures and signage, isolating procedures, stored energy, zero energy state.
- 2.2 Maintenance documents are described in terms of their purpose and content.
- Range maintenance plans, maintenance records, work orders, equipment manufacturer's publications, in-house publications and documents, warranty documents.
- 2.3 Permits to work are described in terms of their legislative requirements, and application in maintenance activities.

Outcome 3

Prepare to carry out maintenance activities.

Evidence requirements

- 3.1 Maintenance activities are established from the maintenance plan.
- 3.2 Impending maintenance activities are communicated to affected personnel in accordance with worksite procedures.
- 3.3 Equipment to be maintained is identified and matches the maintenance plan.
- 3.4 Resources are obtained and checked for serviceability or status in accordance with workplace procedures.
- Range tooling, materials, equipment, publications and documents.
- 3.5 Equipment to be maintained is shut down in accordance with worksite procedures.
- Range power removed, lockout tagout procedures complied with, systems isolated, zero energy state confirmed.
- 3.6 Work area is prepared for maintenance activity in accordance with worksite procedures.
- Range may include but is not limited to – signage, fences, barriers, security, hazards identified and notified, lighting, work stands, access equipment, permit to work requirements.

Outcome 4

Carry out maintenance activities.

Evidence requirements

4.1 Maintenance activities are carried out in accordance with the maintenance plan, standard industry practices, and worksite procedures.

Range activities may include but not limited to – disassembly, cleaning, inspection, measurements, troubleshooting, use of PLC systems and displays, lubrication, repair, replacement of parts, assembly, testing.

4.2 Maintenance publications and documents applicable to the worksite and maintenance activities are interpreted and complied with.

Range may include but not limited to – work orders, work instructions, manufacturer's publications, drawings, specifications, circuit diagrams, troubleshooting charts, bills of materials, site equipment and infrastructure information.

Outcome 5

Complete maintenance activities.

Evidence requirements

5.1 Tools, maintenance equipment, and materials are accounted for and returned to storage in accordance with worksite procedures.

5.2 Waste materials and left over parts are disposed of or processed in accordance with worksite procedures.

5.3 Plant and/or equipment are made ready for the application of power and return to operation in accordance with standard industry practices and worksite procedures.

Range may include but not limited to – lockout tagout procedures complied with, equipment positions and settings, notification to other staff.

5.4 Plant and/or equipment is powered up and checked for operation in accordance with standard industry practices and worksite procedures.

5.5 Work area is returned to its required operational state in accordance with worksite procedures.

5.6 Operational state of plant and/or equipment is communicated to affected personnel in accordance with worksite procedures.

5.7 Documentation is completed in accordance with worksite procedures.

Range may include but not limited to – work orders, maintenance records, reports, warranty claims, suggestions for changes to documents or procedures.

5.8 Documents are distributed and/or filed in accordance with worksite procedures.

Planned review date	31 December 2018
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Status information and last date for assessment for superseded versions

Process	Version	Date	Last Date for Assessment
Registration	1	12 December 2013	N/A

Consent and Moderation Requirements (CMR) reference	0013
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This CMR 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, 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.

Requirements for consent to assess and an outline of the moderation system that applies to this standard are outlined in the Consent and Moderation Requirements (CMR). The CMR 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 at qualifications@competenz.org.nz if you wish to suggest changes to the content of this unit standard.