Title	**Demonstrate and apply knowledge of maintenance planning for mechanical engineering**		
Level	**6**	**Credits**	**15**

Purpose	This unit standard is intended primarily for use in diploma programmes in mechanical engineering. It covers knowledge of maintenance planning and its application to scenarios or simulations of industrial maintenance situations. People credited with this unit standard are able to: demonstrate knowledge of mechanical engineering maintenance philosophies, maintenance techniques, and maintenance planning; and develop maintenance plans for mechanical engineering equipment.

Classification	Mechanical Engineering > Applied Principles of Mechanical Engineering

Available grade	Achieved

Explanatory notes

1 References
Building Act 2004.
Hazardous Substances and New Organisms Act 1996
Health and Safety at Work Act 2015 and supporting Regulations.
Resource Management Act 1991.

2 Definitions
Accepted industry practice refers to approved codes of practice and standardised procedures accepted by the wider mechanical engineering industry sectors as examples of best practice.
Critical Path Analysis (CPA) or the Critical Path Method (CPM) is a project management tool that identifies tasks which must be completed on time for the whole project to be completed on time.
Gantt chart is a project management tool showing graphically the duration and progress of project tasks against time.
Maintenance refers to activities which may include but are not limited to – inspection, recording, testing, measuring, cleaning, lubrication, adjustment, replacement of parts.
Program Evaluation Review Technique (PERT) is a project management tool for analysing the tasks within a project. A PERT chart shows the interdependence of tasks within the project.
Workplace procedures refer to 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, safety procedures, equipment operating

procedures, codes of practice, quality management practices and standards, procedures to comply with legislative and local body requirements.

3 Assessment information
Numerous reference texts and training manuals on maintenance planning are available and may be used; however, no one textbook or source of information is envisaged. All activities must comply with applicable workplace procedures and must be consistent with accepted industry practice.

Outcomes and evidence requirements

Outcome 1

Demonstrate knowledge of mechanical engineering maintenance philosophies.

Evidence requirements

1.1 The objectives and limitations of planned and unplanned maintenance philosophies are explained.

1.2 The relative costs of maintenance and down-time are compared for planned and unplanned maintenance for typical industrial processes.

1.3 Preventative and predictive maintenance philosophies are explained with reference to machine monitoring and operational availability.

Outcome 2

Demonstrate knowledge of mechanical engineering maintenance techniques.

Evidence requirements

2.1 Maintenance inspections of plant or equipment required by legislation or regulations are identified.

Range may include but is not limited to – boilers, lifts, hoists, cranes, pressure vessels, air-receivers, radiation sources, dust extraction plant, breathing apparatus, resuscitators, fire alarms.

2.2 Maintenance techniques designed to prolong serviceability of plant or equipment are explained with reference to purpose and method.

Range includes but is not limited to – visual inspection; measurement of wear, balance, mis-alignment, power consumption, and other physical parameters; regular lubrication; vibration analysis; thermal imaging; lubricant particle analysis.

2.3 Failure mechanisms of machine components are explained with reference to cause, effect, and how to minimise failures.

Outcome 3

Demonstrate knowledge of mechanical engineering maintenance planning.

Evidence requirements

3.1 The need to schedule maintenance is explained in terms of the ability to meet operational availability and the predicted limits of time, cost, and personnel.

3.2 CPA and Gantt or PERT charts are explained in terms of the benefits of their use in maintenance planning.

3.3 Elements of a maintenance plan are explained with reference to frequency of activities, standard of activities, and resources required.

Range frequency of activities may include but is not limited to – maintenance activities, recording requirements, reporting requirements, contingency actions, review requirements; standard of activities may include but is not limited to – requirements of manufacturer, designer, operator; resources may include but are not limited to – personnel, materials, sources of supply, availability, cost.

3.4 The role of contingency planning in maintenance planning is explained.

3.5 Phases in the maintenance planning cycle are explained in terms of their function and application.

Range phases – determining requirements, developing plan, implementing plan, monitoring activities, reviewing plan.

Outcome 4

Develop maintenance plans for mechanical engineering equipment.

Range equipment – any plant or machinery used in real production or manufacturing processes, and which requires regular maintenance;
evidence is required for three items.

Evidence requirements

4.1 The maintenance philosophy adopted is outlined in the plans.

4.2 Personnel responsible for maintenance activities are identified in the plans.

4.3 Data provided by equipment manuals, production schedules, and, where available, historical maintenance data are analysed to establish details, timing, and frequency of planned maintenance activities, and the instrumentation and materials required.

4.4 Relevant legislation and regulations are analysed to identify additional maintenance requirements and/or certifications.

4.5 Alternatives are considered to minimise waste of materials and labour.

4.6 Gantt charts of scheduled maintenance activities are included in the plans.

4.7 Schedules of materials, with costs, sources of supply, and date required are included in the plans.

4.8 Recoding and communication methods for results of the maintenance activities are detailed in the plans.

Planned review date	31 December 2021

Status information and last date for assessment for superseded versions

Process	Version	Date	Last Date for Assessment
Registration	1	26 November 2007	31 December 2016
Rollover	2	19 March 2010	31 December 2021
Review	3	20 October 2016	N/A

Consent and Moderation Requirements (CMR) reference	0013

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 (CMRs). 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 qualifications@competenz.org.nz if you wish to suggest changes to the content of this unit standard.