

Title	Explain and apply laws of thermodynamics to mechanical engineering		
Level	5	Credits	15

Purpose	People credited with this unit standard are able to explain and apply the first and second laws of thermodynamics to mechanical engineering.
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Classification	Mechanical Engineering > Applied Principles of Mechanical Engineering
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Available grade	Achieved
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Explanatory notes

- 1 References
Health and Safety at Work Act 2015 and supporting Regulations.
- 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.
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 thermodynamics 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

Explain and apply the first law of thermodynamics to mechanical engineering.

Evidence requirements

- 1.1 The first law of thermodynamics is explained in terms of the conservation of energy and the flow energy equation.

- 1.2 The first law of thermodynamics is applied to the solution of flow and non-flow processes.
- Range evidence of a minimum of two is required.
- 1.3 The production of energy from natural and renewable sources is explained in terms of mechanical engineering concepts and the factors influencing energy production.
- 1.4 Energetics of work are explained in terms of the way energy is exchanged and its influence on the states of matter.
- 1.5 Calculations are made of heat transference via conduction, convection, and radiation.
- Range evidence of a minimum of two calculations for each is required.
- 1.6 Heat and heat capacity are explained in terms of the effects of heat energy moving between bodies of different temperatures.
- 1.7 Calculations involving heat capacity are made to determine the amount of heat required to raise and lower the temperature of a substance by 1 degree K.
- Range evidence of a minimum of two calculations is required.
- 1.8 Changes of state are explained in terms of internal energy, enthalpy and the changes in heat, work, temperature, and pressure.
- 1.9 Calculations are made of the change in volume of a solid or liquid if the pressure or temperature is increased.
- Range evidence of a minimum of two calculations for each is required.
- 1.10 Calculations are made of the change in volume of a gas if the pressure or temperature is increased.
- Range evidence of a minimum of two calculations is required.
- 1.11 Phase changes are explained in terms of their consumption or liberation of energy.
- Range may include one or more of the following – fusion (melting), freezing, vaporization, condensation, sublimation.
- 1.12 Calculations are made of the amount of flow and/or energy required to achieve a change in an energy phase.
- Range evidence of a minimum of two calculations is required.

Outcome 2

Explain and apply the second law of thermodynamics to mechanical engineering.

Evidence requirements

- 2.1 The second law of thermodynamics is explained in terms of reversibility, entropy, and the relationship between changes in volume and energy.
- 2.2 A model heat cycle is explained in terms of expansion and compression.
- 2.3 The efficiency of a heat engine is calculated.

Replacement information	This unit standard and unit standard 21782 replaced unit standard 11387.
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Planned review date	31 December 2021
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Status information and last date for assessment for superseded versions

Process	Version	Date	Last Date for Assessment
Registration	1	27 October 2005	31 December 2016
Rollover and Revision	2	19 March 2010	31 December 2021
Review	3	20 October 2016	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 (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.