

<b>Title</b>	<b>Demonstrate knowledge of basic thermodynamics relevant to the energy and chemical industry</b>		
<b>Level</b>	<b>3</b>	<b>Credits</b>	<b>5</b>

<b>Purpose</b>	<p>This unit standard is intended for people working as boiler operators and process operators in an energy and chemical plant.</p> <p>People credited with this unit standard are able to demonstrate knowledge of: basic thermodynamics; the basics of energy; and the basics of heat, relevant to the energy and chemical industry.</p>
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<b>Classification</b>	Energy and Chemical Plant > Operation of Energy and Chemical Plant
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<b>Available grade</b>	Achieved
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### Guidance Information

- 1 Legislation and regulations relevant to this unit standard include but are not limited to:
  - Health and Safety at Work Act 2015;
  - Health and Safety at Work (Hazardous Substances) regulations 2017 (HSWA);
  - Resource Management Act 1991; and any subsequent amendments.
  
- 2 Definitions
 

*Energy and chemical plant* may be in – petrochemical, agri-nutrient, power generation, dairy processing, meat processing, and wood fibre manufacturing, or other plants that operate with a combination of high temperatures, pressures, steam and/or chemicals in gas, liquid or solid form.

*Plant* – the operational unit, equipment and/or workplace at which the person is working.

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### Outcomes and performance criteria

#### Outcome 1

Demonstrate knowledge of basic thermodynamics relevant to the energy and chemical industry.

**Performance criteria**

- 1.1 Describe thermodynamics in terms of the basic principles.
- Range principles include but are not limited to – energy, heat, specific heat capacity, temperature, work, pressure, flow, power, force.
- 1.2 Describe the relationship between pressure, temperature, and volume in terms of the equation for each gas law.
- Range gas laws include but are not limited to – Boyle’s Law, Charles’ Law, Gay-Lussac’s Law, Combined Gas Law.
- 1.3 Describe the relationship between temperature and pressure in terms of saturation temperature and changes of state.
- 1.4 Describe absolute and gauge pressure in terms of their relationship to the energy and chemical industry.
- 1.5 Describe a thermodynamic cycle in terms of its relationship to the energy and chemical industry.

**Outcome 2**

Demonstrate knowledge of the basics of energy relevant to the energy and chemical industry.

**Performance criteria**

- 2.1 Describe laws that govern the behaviour of energy in terms of the laws of thermodynamics.
- Range laws of thermodynamics include but are not limited to – zeroth, first, second, third.
- 2.2 Describe common forms of energy in terms of their uses.
- Range common forms of energy include but are not limited to – potential, kinetic, internal, chemical, nuclear.
- 2.3 Describe the effect of energy on a substance using thermodynamic terms.
- Range thermodynamic terms include but are not limited to – temperature, coefficient of linear expansion, change of state, specific heat capacity.

**Outcome 3**

Demonstrate knowledge of the basics of heat relevant to the energy and chemical industry.

**Performance criteria**

3.1 Describe heat in terms of types.

Range types include but are not limited to – sensible, latent, super.

3.2 Describe the transfer of energy from one body to another in terms of the process.

Range transfer includes but is not limited to – temperature, differential, coefficient of heat transfer, conduction, convection, radiation.

3.3 Interpret steam tables in terms of determining energy contents of steam and the boiling point of steam at different pressures.

<b>Planned review date</b>	31 December 2024
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**Status information and last date for assessment for superseded versions**

Process	Version	Date	Last Date for Assessment
Registration	1	27 June 2005	31 December 2014
Rollover and Revision	2	25 July 2006	31 December 2014
Review	3	22 May 2009	31 December 2016
Review	4	24 October 2014	31 December 2022
Review	5	27 February 2020	N/A

<b>Consent and Moderation Requirements (CMR) reference</b>	0079
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This CMR can be accessed at <http://www.nzqa.govt.nz/framework/search/index.do>.

**Comments on this unit standard**

Please contact the Primary Industry Training Organisation [standards@primaryito.ac.nz](mailto:standards@primaryito.ac.nz) if you wish to suggest changes to the content of this unit standard.