

<b>Title</b>	<b>Demonstrate knowledge of, operate, and monitor an advanced steam generation process</b>		
<b>Level</b>	<b>5</b>	<b>Credits</b>	<b>20</b>

<b>Purpose</b>	<p>This unit standard is intended for experienced people working as boiler operators in a steam generation plant.</p> <p>People credited with this unit standard are able to: demonstrate knowledge of an advanced steam generation process, describe air systems and fuel types used in an advanced steam generation process; describe scientific principles relating to steam generation, and demonstrate knowledge of an advanced steam generation process in an energy and chemical plant. They are also able to: operate an advanced steam generation process; and monitor and control an advanced steam generation process, in an energy and chemical plant.</p>
----------------	--

<b>Classification</b>	Energy and Chemical Plant > Operation of Energy and Chemical Plant
-----------------------	--

<b>Available grade</b>	Achieved
------------------------	----------

## Guidance Information

1 Legislation relevant to this unit standard includes but is not limited to:

- Health and Safety at Work Act 2015;
  - Hazardous Substances and New Organisms Act 1996;
  - Resource Management Act 1991;
- and any subsequent amendments.

2 Definitions

*Advanced steam generation process* – steam generation process that due to its size, complexity, classification, or mode of operation, is deemed by the Controller, Inspection Body, and manufacturer to require advanced competencies for its operation.

*Code* – the current *Approved Code of Practice for the Design, Safe Operation, Maintenance and Servicing of Boilers*, Occupational Safety and Health Service, and other relevant associated code, <https://worksafe.govt.nz/dmsdocument/1571-acop-the-design-safe-operation-maintenance-and-service-of-boilers>.

*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.

*Organisational requirements* – documented policies and procedures. These may include: equipment manufacturers' procedures; plant procedures; suppliers'

instructions; site signage; codes of practice; company health and safety plans; on site briefings; and supervisor's instructions. This includes all regulatory and legislative obligations that apply to the plant.

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

3 For the purposes of assessment:

- evidence for the practical components of this unit standard must be supplied from the workplace.

---

## Outcomes and performance criteria

### Outcome 1

Demonstrate knowledge of an advanced steam generation process.

#### Performance criteria

1.1 Identify and describe types of advanced steam generation processes in terms of use, and compare in relation to principles of operation, operating and capital cost, and fitness for purpose.

Range types include but are not limited to – water tube, heat recovery.

1.2 Describe components of an advanced steam generation process in terms of purpose and design.

Range components include but are not limited to – superheater, economiser, air preheater, steam drum, furnace, tubes, headers, desuperheater, reheater, expansion protection, expansion support, gauge glass, sootblowers.

1.3 Describe materials used for the construction of an advanced steam generation process in terms of operating conditions and product compatibility.

1.4 Describe internal steam drum components in terms of purpose and design.

Range components include but are not limited to – steam separators, scrubbers, cyclones, feed distributors, chemical distributors, blowdown piping.

1.5 Describe safety valves are described in terms of their design, application, and function.

Range safety valves include but are not limited to – torsion bars, spring, springless, electrically assisted, high-lift and full-bore, silencers.

1.6 Describe auxiliary systems in terms of purpose and operating concepts.

Range auxiliary systems include but are not limited to – boiler feedwater, chemical treatment, blowdown system, combustion air, furnace, purge system, fuel systems, safety systems, control systems.

## Outcome 2

Describe air systems and fuel types used in an advanced steam generation process.

### Performance criteria

2.1 Describe air systems for fired pressure equipment in terms of purpose, use, and impact on fire box pressure.

Range air systems include but are not limited to – natural draught, forced draught, balanced draught, induced draught.

2.2 Identify and describe fuels used in fired pressure equipment in terms of the chemical composition and chemical reaction for complete combustion.

Range fuels include but are not limited to – gas, liquid, solid.

2.3 Describe solid fuel systems in terms of design and operation.

Range systems include but are not limited to – chain grate, sprinkler stoker, ram stoker, pulveriser mills;  
operations include but are not limited to – start-up, shut-down, control of fuel.

2.4 Describe liquid fuel systems in terms of design and operation.

Range systems include but are not limited to – pumping and heating systems, fuel atomising systems, liquid fuel burners;  
operations include but are not limited to – start-up, shut-down, control of fuel.

2.5 Describe gas fuel systems in terms of design and operation.

Range systems include but are not limited to – de-pressurisation control, gas pre-heating, gas leak detection;  
operations include but are not limited to – start-up, shut-down, control of fuel.

## Outcome 3

Describe scientific principles relating to steam generation.

**Performance criteria**

- 3.1 Describe types of steam and thermodynamic principles in terms of their effect on steam generation operations and in accordance with organisational requirements and the Code.
- Range types of steam include but are not limited to – wet, dry, saturated, superheated;  
thermodynamic principles include but are not limited to – thermosyphonic action, enthalpy, entropy, critical pressure.
- 3.2 Describe the theory of heat transfer in terms of the operation of pressure fired equipment and in accordance with organisational requirements and the Code.
- Range heat transfer includes but is not limited to – convection, radiation, conduction.
- 3.3 Describe problems related to an advanced steam generation process in terms of cause and effect and in accordance with organisational requirements and the Code.
- Range problems include but are not limited to – corrosion, erosion, creep, expansion, thermal stress.
- 3.4 Describe storage methods for an advanced steam generation process in terms of long, medium, and short-term methods and in accordance with organisational requirements and the Code.
- Range methods include but are not limited to – nitrogen capping, water wedging, dry storage, chemical storage.

**Outcome 4**

Demonstrate knowledge of an advanced steam generation process in an energy and chemical plant.

**Performance criteria**

- 4.1 Describe process controls and protection systems for an advanced steam generation process in terms of their purpose and operation and in accordance with organisational requirements and the Code.
- 4.2 Describe operations and tuning used to optimise fired pressure equipment efficiency in terms of operational factors and in accordance with organisational requirements and the Code.
- Range operational factors include but are not limited to – excess air, furnace heat release, stack temperatures, stack gas composition, tube fouling, flue fouling, atmospheric conditions, plant capability, auxiliary energy use, resource consents;  
evidence of three factors is required.

- 4.3 Describe the causes and effects of potential operational problems in terms of the steps and techniques required to correct them in accordance with organisational requirements and the Code.
- Range problems include but are not limited to – trip, incorrect purging, positive pressure, air starvation, unburnt fuel build-up, flame out, unstable flame, overheating, flame impingement, drum level, low and/or high steam temperatures
- 4.4 Identify and describe deviations from normal operating parameters that can occur in an advanced steam generation process in terms of the operational steps and techniques used to respond to each deviation and in accordance with organisational requirements and the Code.
- Range deviations include but are not limited to – water hammer, priming, carry over, tube failure.
- 4.5 Describe emergency shutdown procedures in accordance with organisational requirements and the Code.

## Outcome 5

Operate an advanced steam generation process in an energy and chemical plant.

### Performance criteria

- 5.1 Identify advanced steam generation process equipment in accordance with the plant specific identification coding systems, organisational requirements and the Code.
- 5.2 Operate an advanced steam generation process using safe work practices in accordance with organisational requirements and the Code.
- 5.3 Determine current status of an advanced steam generation process and interconnected systems in accordance with plant specific indication and control systems, organisational requirements and the Code.
- Range systems may include but are not limited to – Human Machine Interface (HMI), Programme Logic Controller (PLC), Burner Management System, remote and local control systems.
- 5.4 Complete all plant documentation related to the steam generation process operation in accordance with organisational requirements and the Code.

## Outcome 6

Monitor and control an advanced steam generation process in an energy and chemical plant.

**Performance criteria**

- 6.1 Carry out routine procedures for functional testing and plant checks in accordance with organisational requirements and the Code.
- 6.2 Identify and record deviations from normal operating parameters in accordance with organisational requirements and the Code.
- 6.3 Take and record corrective actions to return to normal operating parameters in accordance with organisational requirements and the Code.
- Range evidence of three corrective actions is required.
- 6.4 Identify and log equipment malfunctions in accordance with organisational requirements and the Code.
- 6.5 Take and log corrective actions to return the equipment to standard condition in accordance with organisational requirements and the Code.
- Range evidence of three corrective actions is required.

<b>Planned review date</b>	31 December 2024
----------------------------	------------------

**Status information and last date for assessment for superseded versions**

Process	Version	Date	Last Date for Assessment
Registration	1	8 November 1995	31 December 2014
Revision	2	15 December 1998	31 December 2014
Review	3	29 May 2000	31 December 2014
Revision	4	24 July 2002	31 December 2014
Revision	5	14 March 2003	31 December 2014
Review	6	27 June 2005	31 December 2014
Rollover and Revision	7	25 July 2006	31 December 2014
Review	8	22 May 2009	31 December 2016
Review	9	24 October 2014	31 December 2022
Review	10	27 February 2020	N/A

<b>Consent and Moderation Requirements (CMR) reference</b>	0079
--	------

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.