

Title	Demonstrate knowledge of and operate fired pressure equipment in an energy and chemical plant		
Level	4	Credits	10

Purpose	<p>This unit standard is intended for people working as boiler operators and energy and chemical process operators in an energy and chemical plant.</p> <p>People credited with this unit standard are able to: demonstrate knowledge of fired pressure equipment used in the energy and chemical industry, and fired pressure equipment used in an energy and chemical plant; locate fired pressure equipment and control systems, and operate fired pressure equipment; and monitor and control fired pressure equipment, in an energy and chemical plant.</p>
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Classification	Energy and Chemical Plant > Operation of Energy and Chemical Plant
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Available grade	Achieved
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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

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 codes, <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.

Fired pressure equipment – equipment that is operated under pressure and is directly fired.

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 fired pressure equipment used in the energy and chemical industry.

Performance criteria

- 1.1 Identify and describe the differences in fired pressure equipment in terms of the use of each type.
- Range types include but are not limited to – water and fire tube boilers, fired heaters, incinerators.
- 1.2 Describe materials used for the construction of fired pressure equipment in terms of process conditions.
- Range materials include but are not limited to – alloy steels, ceramics, fire bricks, other refractory materials.
- 1.3 Describe corrosion, erosion, expansion, and thermal stress in terms of causes and effects on fired pressure equipment.
- 1.4 Describe auxiliary equipment and systems in terms of purpose and use for each type of fired pressure equipment.
- Range equipment includes but is not limited to – burner, igniter, samper, analyser, soot blower, air pre-heater, explosion door; systems include but are not limited to – fuel system, furnace purge system, safety system, blow-down system, control system.
- 1.5 Describe air systems for fired pressure equipment in terms of purpose and use.
- Range air systems include but are not limited to – natural draught, forced draught, balanced draught, induced draught; evidence of an example of each air system that demonstrates the impact of the air system type on fire box pressure is required.
- 1.6 Identify and describe specific 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.

- 1.7 Describe the design of basic fired pressure equipment in terms of safety and the requirements of the Code.
- Range equipment includes but is not limited to – fire tube, water tube, reformer, fired heater, incinerator, flare.
- 1.8 Describe the theory of heat transfer in terms of the operation of pressure fired equipment.
- Range heat transfer includes but is not limited to – convection, radiation, conduction.
- 1.9 Describe burner design set-ups in terms of the different types of fuels used in fired pressure equipment.
- Range fuels include but are not limited to – hydrocarbon gas, hydrocarbon liquids, pulverised coal.
- 1.10 Describe solid fuel systems in terms of design and operation.
- Range systems include but are not limited to – chain grate, sprinkler stoker, ram stoker;
operations include but are not limited to – start-up, shut-down, control of fuel.
- 1.11 Describe long, medium, and short-term storage methods for fired pressure equipment in terms of use.
- Range methods include but are not limited to – nitrogen capping, water wedging, dry storage, chemical storage.

Outcome 2

Demonstrate knowledge of fired pressure equipment used in an energy and chemical plant.

Performance criteria

- 2.1 Describe a heat balance for specified fired pressure equipment in terms of the percentage efficiency and any key factors that would cause variance.
- 2.2 Describe operations and tuning used to optimise fired pressure equipment efficiency in terms of operational factors.
- Range operational factors include but are not limited to – excess air, furnace heat release, stack temperatures, stack gas composition, tube fouling, flue fouling.

- 2.3 Describe causes and effects of potential operational problems in terms of steps and techniques required to correct them.
- Range problems include but are not limited to – incorrect purging, positive pressure, air starvation, unburnt fuel build-up, insufficient process flow level, flame out, unstable flame, overheating, flame impingement, liquid in gas fuels, incorrect lighting.
- 2.4 Describe fired pressure equipment plant protection systems in terms of purpose, operating concepts and the protection provided.
- Range systems include but are not limited to – trip, purge, flame sensor, overpressure relief, under pressure relief, burner management.
- 2.5 Identify and describe deviations from normal operating parameters that can occur in fired pressure equipment in terms of operational steps and techniques used to respond to each deviation.
- Range evidence of at least three deviations from normal operating parameters is required.
- 2.6 Identify and describe fired pressure equipment emergencies in terms of procedures to respond to them.
- Range evidence of furnace explosion and one other emergency is required.

Outcome 3

Locate fired pressure equipment and control systems, and operate fired pressure equipment in an energy and chemical plant.

Performance criteria

- 3.1 Identify the location of fired pressure equipment in accordance with the site-specific identification coding system, organisational requirements and the Code.
- 3.2 Identify control systems for all fired pressure equipment and auxiliary systems in accordance with organisational requirements and the Code.
- Range control systems may include but are not limited to – flow, pressure, temperature, level, air, oxygen; evidence of at least four is required.
- 3.3 Operate fired pressure equipment using safe work practices in accordance with organisational requirements and the Code.
- 3.4 Carry out checks on fired pressure equipment in accordance with organisational requirements and the Code.
- 3.5 Complete all plant documentation related to the process and equipment operation in accordance with organisational requirements and the Code.

Outcome 4

Monitor and control fired pressure equipment in an energy and chemical plant.

Performance criteria

- 4.1 Identify and describe any deviations from normal operating parameters in terms of the impact on plant operations in accordance with organisational requirements and the Code.
- Range evidence of three deviations is required.
- 4.2 Take and record corrective actions to return to normal operating parameters in accordance with organisational requirements and the Code.
- 4.3 Interpret and adjust flue gas analysers to maintain optimum safe performance in accordance with organisational requirements and the Code.
- 4.4 Carry out routine procedures and functional testing of equipment systems in accordance with organisational requirements and the Code.

Planned review date	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	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

Consent and Moderation Requirements (CMR) reference	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 if you wish to suggest changes to the content of this unit standard.