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

Purpose	This unit standard is intended for people working as boiler operators and energy and chemical process operators in an energy and chemical plant.
	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.

Classification	Energy and Chemical Plant > Operation of Energy and Chemical Plant

Available grade	Achieved	201

### **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, <u>https://worksafe.govt.nz/dmsdocument/1571-acop-</u> 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 sitespecific 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.

Replacement information	This unit standard was replaced by skill standard 40450.
-	X.O.

# This unit standard is expiring. Assessment against the standard must take place by the last date for assessment set out below.

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	31 December 2026
Review	11	24 April 2025	31 December 2026

### Status information and last date for assessment for superseded versions

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