

Title	Demonstrate knowledge of hydraulic systems principles and operation		
Level	3	Credits	20

Purpose	<p>This unit standard is intended for people training in mechanical engineering trades.</p> <p>People credited with this unit standard are able to: describe energy in machine applications; demonstrate knowledge of the principles, terminology, and formulas of hydraulic systems; describe hydraulic components and symbology; demonstrate knowledge of hydraulic systems operation and applications; describe hydraulic power system contamination and mitigation; and describe hazards associated with hydraulic systems and their prevention or mitigation.</p>
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Classification	Mechanical Engineering > Fluid Power - Hydraulics
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Available grade	Achieved
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Guidance Information

- 1 Legislation and references
Legislation, regulations and/or industry standards relevant to this unit standard include but are not limited to the:
Health and Safety at Work Act 2015 and supporting regulations;
The International System of Units (SI), 9th edition (France: Bureau International des Poids et Mesures, 2006) available at
<https://www.bipm.org/documents/20126/41483022/SI-Brochure-9-EN.pdf>.

Any new, amended or replacement Acts, regulations, standards, codes of practice, guidelines, or authority requirements or conditions affecting this unit standard will take precedence for assessment purposes, pending review of this unit standard.

- 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.
Hazard refers to “a person’s behaviour where that behaviour has the potential to cause death, injury, or illness to a person (whether or not that behaviour results from physical or mental fatigue, drugs, alcohol, traumatic shock, or another temporary condition that affects a person’s behaviour)”.

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

Examples and/or evidence given must be within the context of fluid power or mechanical engineering and must meet applicable workplace procedures and accepted industry practice.

Outcomes and performance criteria

Outcome 1

Describe energy in machine applications.

Performance criteria

1.1 Energy transmission and basic physics as it applies to machines are described.

Range force, resistance, motion, forms of energy (thermal, mechanical, chemical, etc), law of conservation of energy, energy form changes, changes of state.

Outcome 2

Demonstrate knowledge of the principles, terminology, and formulas of hydraulic systems.

Performance criteria

2.1 The purpose and advantages of hydraulic systems compared to mechanical and pneumatic systems are described.

2.2 Terminologies in the context of a hydraulic system are explained.

Range pressure, flow, fluid velocity (including in laminar, transition and turbulent states), pressure drops, force, torque, holding pressure, revolutions per minute (RPM), linear movement, power, load, lift, power beyond.

2.3 Atmospheric, gauge, and absolute pressures are compared and their uses in hydraulic systems are explained.

2.4 Pascal's law is described in terms of how its principles apply to hydraulic systems.

2.5 Bernoulli's principle is described in terms of how it applies to fluid movement and conservation of energy in hydraulic systems.

2.6 Formulas, charts, and nomographs are used to calculate the performance of hydraulic systems.

Range pressure, power, force, with transposition of variables; examples of variables are – pump and motor displacement, hose diameter and flow rate and fluid velocities, cylinder volume (both rod & cap side, motor volumes, actuator speed (both directions) for both linear and rotary. units – international standard.

Outcome 3

Describe hydraulic components and symbology.

Performance criteria

3.1 Hydraulic systems components are described.

Range components – coolers, reservoir, gauge, filter, control valves including series and parallel types; pumps must include gear, vane and piston; motor, cylinders including single, double, displacement, telescopic & tandem types; rotary actuator, accumulator; conductors must include pipe, tube and hose. fluids (viscosity(s), biofluids, fire resistant types, lubricity, additives, mineral, synthetic & semi-synthetic).

3.2 Hydraulic system controls are described.

Range load sensing, pressure compensation, temperature compensated, directional control valves including manual, pilot pressure and electrical solenoid.

3.3 Hydraulic system symbology is described.

Range hydraulic circuits; must include reservoir, gauge, filter, control valves, pump, motor, cylinder, accumulator.

Outcome 4

Demonstrate knowledge of hydraulic systems operation and applications.

Performance criteria

4.1 Hydraulic system operation is described.

Range purpose and function of components, fluids, pressure and flow control; components – reservoir, gauge, filter, control valves, pump, actuator, accumulator, fluid conductors.

4.2 Two hydraulic system applications are identified and their component functions are explained.

Range examples – earth movers, lifting equipment, transport applications, industrial.

Outcome 5

Describe hydraulic power system contamination and mitigation.

Performance criteria

5.1 Types of hydraulic power system contamination are described.

5.2 The effects of contamination on the safe and efficient performance of a hydraulic system are described.

5.3 The identification of contaminants within a hydraulic system and how to mitigate these are described.

Outcome 6

Describe hazards associated with hydraulic systems and their prevention or mitigation.

Performance criteria

6.1 The hazard risk of pressure in hydraulic systems and its prevention or mitigation is described.

Range accumulators, induced load, cylinders, pump running, pump stopped, stored energy.

6.2 Potential personal injury hazards and their prevention or mitigation are described.

Range crushing and pinch points, burns from hot oil at high pressure, fire from oil leaks, flailing hydraulic lines, injection of oil into the skin and eyes, oil leaks on floor, exposure to oils, hydrocarbons, workshop chemicals.
component catastrophic failure hazards – examples may include projectile, cartridge loads, suspended loads, “dieseling” in hydraulic cylinders.

Planned review date	31 December 2027
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Status information and last date for assessment for superseded versions

Process	Version	Date	Last Date for Assessment
Registration	1	26 October 2023	N/A

Consent and Moderation Requirements (CMR) reference

0014

This CMR can be accessed at <http://www.nzqa.govt.nz/framework/search/index.do>.

Comments on this unit standard

Please contact Hanga-Aro-Rau Manufacturing, Engineering and Logistics Workforce Development Council qualifications@hangaarorau.nz if you wish to suggest changes to the content of this unit standard.