

Title	Demonstrate knowledge of scientific principles, energy costs and fluid mechanics related to pulp or paper manufacturing		
Level	4	Credits	10

Purpose	<p>People credited with this unit standard are able to, in pulp or paper manufacturing, demonstrate knowledge of: the physical principles of the states of matter; the principles of work and energy; the principles of heat; the types of forces; fluid mechanics; and the types of simple machines.</p> <p>They are also able to explain energy costs in pulp or paper manufacturing.</p>
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Classification	Wood Fibre Manufacturing > Pulp and Paper Technology
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Available grade	Achieved
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Guidance Information

1 Definition

Worksite documentation refers to organisation policies and procedures that are documented in memo, electronic, or manual format and available in the workplace, and are consistent with manufacturer's requirements. They may include but are not limited to – standard operating procedures, site specific procedures, site safety procedures, equipment operating procedures, quality assurance procedures, product quality specifications, references, approved codes of practice, housekeeping standards, environmental considerations, sustainability, on-site briefings, supervisor's instructions, and procedures to comply with legislative and local body requirements relevant to the pulp and paper industry.

2 Assessment information

Evidence presented for assessment against this unit standard must be consistent with safe working practices and be in accordance with applicable service information, worksite documentation and legislative requirements. This includes the knowledge and use of suitable tools and equipment.

Outcomes and performance criteria

Outcome 1

Demonstrate knowledge of the physical principles of the states of matter in pulp or paper manufacturing.

Performance criteria

- 1.1 Properties of each state of matter are defined in terms of shape, volume, and compression.
- 1.2 Principles of vapour pressure and its relationship to boiling are explained.
- 1.3 Use of steam to transfer energy, and the principles of the steam cycle and latent heat, are explained related to pulp or paper manufacturing.
- 1.4 Charles' and Boyle's law is explained in relation to volume, temperature, and pressure related to pulp or paper manufacturing.

Outcome 2

Demonstrate knowledge of the principles of work and energy in pulp or paper manufacturing.

Performance criteria

- 2.1 Energy, work, and power are defined.
- 2.2 Types of energy including potential, kinetic, thermal, nuclear, internal, and chemical are defined; sources and applications for each type are related to pulp or paper manufacturing.
- 2.3 The first law of thermodynamics (conservation of energy) is explained and the methodology for an energy balance is described for a selected pulp or paper manufacturing operation.
- 2.4 Principles of entropy are explained related to pulp or paper manufacturing.

Outcome 3

Demonstrate knowledge of the principles of heat in pulp or paper manufacturing.

Performance criteria

- 3.1 The terms 'heat' and 'temperature' are defined and the difference between them is explained.
- 3.2 Specific heat capacity is defined related to pulp or paper manufacturing.
- 3.3 Changes that occur with the application of heat are explained in terms of latent sensible and super heat, expansion, and changes of state.
- 3.4 Types of heat transfer are explained using pulp or paper manufacturing examples.

Range types of heat transfer – conduction, convection, and radiation.

Outcome 4

Demonstrate knowledge of the types of forces in pulp or paper manufacturing.

Performance criteria

- 4.1 Principles of force, equilibrium, gravity, mass, weight, centrifugal and centripetal force are defined related to pulp or paper manufacturing.
- 4.2 Calculations involving the application of force are carried out to measure variables related to pulp or paper manufacturing.

Outcome 5

Demonstrate knowledge of fluid mechanics in pulp or paper manufacturing.

Performance criteria

- 5.1 Principles of flow in terms of their effect on pipework are described.
- Range flow includes but is not limited to – turbulent flow, streamline flow, Bernoulli's principle.
- 5.2 Factors affecting flow in terms of their effect on pipework are described.
- Range factors may include but are not limited to – temperature, density, pressure head, cross-sectional area of pipe, pipe material, bends, fittings, viscosity of fluid; evidence of four factors affecting flow is required.
- 5.3 The impact of factors affecting flow on a pulp or paper manufacturing process is explained.
- 5.4 Properties of Newtonian and non-Newtonian fluids are compared related to pulp or paper manufacturing.

Outcome 6

Demonstrate knowledge of the types of simple machines in pulp or paper manufacturing.

Performance criteria

- 6.1 Principles and applications of levers, gears, pulleys, and inclined planes are described in terms of pulp or paper manufacturing.
- 6.2 Calculations involving mechanical advantage and velocity ratio are carried out to measure variables in a pulp or paper manufacturing specific situation.

Outcome 7

Explain energy costs in pulp or paper manufacturing.

Performance criteria

- 7.1 The significance of energy costs in a pulp or paper manufacturing site is explained.
- Range purchased fuel consumption, purchased energy costs, average purchased energy costs.
- 7.2 Methods to minimise energy costs at a pulp or paper manufacturing site are explained.
- Range modification of process and equipment, recovery and reuse of energy, thermodynamic loss control, utilisation of all energy resources available, cogeneration.

Replacement information	This unit standard replaced unit standard 28812.
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Planned review date	31 December 2028
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Status information and last date for assessment for superseded versions

Process	Version	Date	Last Date for Assessment
Registration	1	30 November 2023	N/A

Consent and Moderation Requirements (CMR) reference	0173
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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 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.