Title	**Demonstrate knowledge of the principles of pulp and paper sheet formation, pressing, drying and reeling**		
Level	**4**	**Credits**	**15**

Purpose	People credited with this unit standard are able to demonstrate knowledge of: the processes used in paper making approach and forming systems; the factors involved in sheet formation; the function and operation of the press section; the process of vapour removal from the sheet drying section; the effect of the drying process on paper qualities; paper calendering; and paper reeling. People credited with this unit standard are also able to explain: the operation of, and the processes involved in, the sheet drying section; and the steam and condensate systems for cylinder drying pulp and paper webs

Classification	Wood Fibre Manufacturing > Pulp and Paper Technology

Available grade	Achieved

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 processes used in paper making approach and forming systems.

Performance criteria

1.1 Components of a tapered flow spreader (headbox) are identified and their functions are explained.

Range components may include but are not limited to – header, recirculation, inlet pipes, adjustable throat, rectifier roll.

1.2 Relationships between the flowbox, stock valve, and fan pump are identified and their functions are explained.

1.3 Components of a conventional air padded flowbox and their functions are explained.

Range components may include but are not limited to – rectifier rolls, spray, slice, pressure.

1.4 Control of the flowbox slice and the effects of the efflux ratio are explained in terms of the operation of the evener roll, hinge, adjusting screws, slice, and headbox pressure.

1.5 Paper machine components are identified and their functions are explained.

Range components may include but are not limited to – flowbox, drainage elements, rolls, couch, showers, fabrics, wires, tension and guiding systems.

Outcome 2

Demonstrate knowledge of the factors involved in sheet formation.

Performance criteria

2.1 Stages of the formation process are explained in terms of fibre dispersion and water removal.

2.2 Types of stock delivery are named and explained.

Range types may include but are not limited to – pressure formation, velocity formation, gap formers.

2.3 Components of the drainage process are identified and explained.

Range components may include but are not limited to – drainage, oriented shear, turbulence.

2.4 Causes of inconsistent basis weight are identified.

Range causes may include but are not limited to – vacuum pulsations, flowbox pressures.

2.5 Paper defects that originate at the forming section are explained.

Range defects may include but are not limited to – barring, basis weight variation, thickness variation, couch mark, feathered edges, foam holes, seam mark, crushing, fish eyes, checking, creasing, holes.

2.6 Jet to wire speed ratio is defined and paper properties affected are explained.

Range formation, strength, shrinkage.

Outcome 3

Demonstrate knowledge of the function and operation of the press section.

Performance criteria

3.1 Types of presses are identified and the operating characteristics of each are explained.

Range types may include but are not limited to – plain, suction, grooved, three roll, fabric, extending nip press.

3.2 Press roll camber is described and its significance in relation to sheet properties is explained.

Range sheet properties – profiles.

3.3 Press felts, and their functions in terms of support and protection, are explained.

3.4 Machine variables that influence press performance are identified and their functions are explained.

Range machine variables may include but are not limited to – furnish, machine speed, nip pressure, felt preparation condition, sheet temperature.

3.5 Sheet defects originating in the press section are identified and explained.

Range defects may include but are not limited to – felt marks, crushing, blowing, wet streaks, cockle, shadow marks, two sidedness, creasing.

Outcome 4

Explain the operation, and the processes involved in, the sheet drying section.

Performance criteria

4.1 Arrangement of the cylinders in the multi-cylinder sheet drying process is described and their functions are explained.

4.2 Principles of air drying are explained.

Outcome 5

Explain the steam and condensate systems for cylinder drying pulp or paper webs.

Performance criteria

5.1 Phases of paper web cylinder drying are explained in terms of their characteristics.

Range sheet contact, heat transfer, felt separation, evaporation.

5.2 Stages of water evaporation in sheet drying are explained in terms of warming up, constant rate, and falling rate.

5.3 Heat transfer and mass transfer processes in sheet drying are explained.

5.4 Use of thermo-compressor and cascade steam distribution systems in dryer sections is explained.

5.5 Condensate extraction equipment used in the cylinder drying process is explained.

Range equipment may include but is not limited to – fixed syphons, rotating syphons, ribs, spoilers, grooves.

Outcome 6

Demonstrate knowledge of the process of vapour removal from the sheet drying section.

Performance criteria

6.1 Components of a ventilation system are described and the purpose of the system is explained.

Range components may include but are not limited to – pocket, blowbox.

6.2 The importance of the vapour pressure of water in dry air to the moisture transfer is explained.

6.3 Dryer felt design is described and its effect on ventilation is explained.

6.4 Components of an air dryer are described and the mechanism for air drying pulp and paper sheets is explained.

Outcome 7

Demonstrate knowledge of the effect of the drying process on paper qualities.

Performance criteria

7.1 Effects of sheet shrinkage on sheet strength are explained.

7.2 Paper defects resulting from poor drying are identified.

Range paper defects may include but are not limited to – brittleness, wrinkles, poor finish, moisture streaks, moisture variation cross direction, roping, cockle, de-lamination.

Outcome 8

Demonstrate knowledge of paper calendering.

Performance criteria

8.1 Calendering's purpose is explained in terms of required finish, consistency of thickness, and consistency of density.

8.2 Calendering equipment is identified by type.

Range typical calender, board calender, dual roll, supercalender.

8.3 Calender components are identified and their functions are explained.

Range components may include but are not limited to – drive roll, swimming roll, soft roll, doctors, spreader roll, loading cylinder.

Outcome 9

Demonstrate knowledge of paper reeling.

Performance criteria

9.1 Components of the machine paper reeler are identified and their purpose is explained.

Range components may include but are not limited to – drum, primary arm, secondary arm, reel, reel brake, reel stop.

9.2 Paper defects appearing after calendering and reeling are identified and the remedies are explained.

Range paper defects may include but are not limited to – blackening, thickness variations, cuts, stamps, creases, corrugations, barring, soft edges, soft centres, level, holes, starring.

Planned review date	31 December 2028

Status information and last date for assessment for superseded versions

Process	Version	Date	Last Date for Assessment
Registration	1	30 November 2000	31 December 2024
Review	2	18 December 2006	31 December 2024
Review	3	24 October 2014	31 December 2025
Review	4	30 November 2023	N/A

Consent and Moderation Requirements (CMR) reference	0173

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.