

Title	Explain principles of pulp and paper sheet formation, pressing, drying and reeling		
Level	4	Credits	10

Purpose	People credited with this unit standard are able to explain: the processes used in paper making approach and forming systems; factors involved in sheet formation; the function and operation of the press section; the operation of, and the processes involved in, the sheet drying section; the steam and condensate systems for cylinder drying pulp and paper webs; the process of vapour removal from the sheet drying section; the effect of the drying process on paper qualities; the fundamentals of paper calendering; and the fundamentals of paper reeling.
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Classification	Wood Fibre Manufacturing > Pulp and Paper Technology
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Available grade	Achieved
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Explanatory notes

All evidence requirements must be demonstrated and assessed in accordance with the reference text: *Explain principles of pulp and paper sheet formation, pressing and drying* and *Explain fundamentals of paper finishing* published by Competenz and available from Competenz at <http://www.competenz.org.nz/>, or Competenz, PO Box 9005, Newmarket, Auckland 1149.

Outcomes and evidence requirements

Outcome 1

Explain the processes used in paper making approach and forming systems.

Evidence requirements

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

Range components – 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 are identified and their function is explained.

Range components – 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 – flowbox, drainage elements, rolls, couch, showers, fabrics, wires, tension and guiding systems.

Outcome 2

Explain factors involved in sheet formation.

Evidence requirements

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 – pressure formation, velocity formation, gap formers.

2.3 Components of the drainage process are identified and explained.

Range components – drainage, oriented shear, turbulence.

2.4 Causes of inconsistent basis weight are identified.

Range vacuum pulsations, flowbox pressures.

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

Range 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

Explain the function and operation of the press section.

Evidence requirements

- 3.1 Types of presses are identified and the operating characteristics of each are explained.
- Range types – 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 – furnish, machine speed, nip pressure, felt condition, sheet temperature.
- 3.5 Sheet defects originating in the press section are identified and explained.
- Range defects – felt marks, crushing, blowing, wet streaks, cockle, shadow marks, two sidedness, creasing.

Outcome 4

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

Evidence requirements

- 4.1 Arrangement of the cylinders for multi-cylinder drying is described and their functions are explained.
- 4.2 Components of the yankee and machine glazing cylinder systems are described and their operations are explained.
- Range components – hood, cylinder, air pipes, doctor blades, rolls, felts.
- 4.3 Principles of infra-red drying are explained.
- 4.4 Principles of air drying are explained.

Outcome 5

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

Evidence requirements

- 5.1 Phases of paper web cylinder drying are detailed 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 drying cylinders is described and the process is explained.
- Range equipment – fixed syphons, rotating syphons, ribs, spoilers, grooves.

Outcome 6

Explain the process of vapour removal from the sheet drying section.

Evidence requirements

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

Explain the effect of the drying process on paper qualities.

Evidence requirements

- 7.1 Effects of sheet shrinkage on sheet strength are explained.
- 7.2 Paper defects resulting from poor drying are identified.
- Range may include but is not limited to – brittleness, wrinkles, poor finish, moisture streaks, moisture variation cross direction, roping, cockle, de-lamination.

Outcome 8

Explain the fundamentals of paper calendering.

Evidence requirements

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 – drive roll, swimming roll, doctors, spreader roll, loading cylinder, water boxes.

Outcome 9

Explain the fundamentals of paper reeling.

Evidence requirements

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

Range components – 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 – blackening, thickness variations, cuts, stamps, creases, corrugations, barring, soft edges, soft centres, level, holes, starring.

Planned review date	31 December 2019
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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 2000	N/A
Review	2	18 December 2006	N/A
Review	3	24 October 2014	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>.

Please note

Providers must be granted consent to assess against standards (accredited) by NZQA, before they can report credits from assessment against unit standards or deliver courses of study leading to that assessment.

Industry Training Organisations must be granted consent to assess against standards by NZQA before they can register credits from assessment against unit standards.

Providers and Industry Training Organisations, which have been granted consent and which are assessing against unit standards must engage with the moderation system that applies to those standards.

Requirements for consent to assess and an outline of the moderation system that applies to this standard are outlined in the Consent and Moderation Requirements (CMR). The CMR also includes useful information about special requirements for organisations wishing to develop education and training programmes, such as minimum qualifications for tutors and assessors, and special resource requirements.

Comments on this unit standard

Please contact Competenz qualifications@competenz.org.nz if you wish to suggest changes to the content of this unit standard.