

An international comparison study

A supplementary report to accompany the Sector Review of Qualifications and the Qualifications System in Construction and the Built Environment



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Introduction

As part of the Sector Review of qualifications in the Construction and the Built Environment, we have conducted a small scale international comparison. We have used a case study approach to review the routes offered in different countries to qualifications in carpentry and joinery and plumbing and domestic heating. The review included online research of publicly available material on the qualifications and the education systems as well as email exchanges with experts from qualification regulators and similar bodies in the four countries. The countries reviewed are Germany¹, Australia, Canada (Province of Alberta) and New Zealand.

The rationale for the selection of countries was based on similarities and suspected comparability of the qualifications systems in Australia and New Zealand with the system in the UK (qualification level approach), the good reputation of the vocational education system in Germany and the aim to include an additional example from a different English speaking country to add variety to the sample. In addition, the selection was based on availability of information in online sources.

The rationale for the selection of qualifications/trades for the case studies was based on the high uptake of qualifications in these trades by learners in Wales. The qualifications reviewed in each country have been chosen to represent a level that allows a learner to enter into the workforce upon completion of the qualification.

Summary of findings

The routes to achieving comparable qualifications to become a carpenter or plumber in Germany, Canada and New Zealand are similar and follow an apprenticeship model including technical or theoretical school based training. In Australia, these qualifications can be achieved through registered training organisations as well as work-based learning/apprenticeships.

Apprenticeships in Canada and New Zealand are designed to last four years, in Germany they typically last three to three and a half years.

In Canada and Germany, both employers and employees are involved in the development of qualifications and assessments, while recent reforms in Australia aim particularly at improving employer involvement in the development of qualifications.

Assessment methodologies differ between the countries and range from multiple choice tests to written exams and practical assessments, either in a simulated environment or through visits to the work place.

Carpentry qualifications in the countries reviewed appear to cover very similar areas of competency. In plumbing and domestic heating, there is much similarity in curricula, but several countries offer specialisations in water, sanitary, gas, or, in the case of Germany, in renewable energy and environmental technology.

¹ For the German cases, online resources and email responses from experts in Germany have been translated by Gitte Sparding.

1. Germany

- Vocational qualifications are based on occupations and are largely taught and assessed through apprenticeships.
- Carpentry is based on three-year apprenticeship.
- Assessment is both theoretical (written) and practical, which takes place at the end of year two and three. Practical exams may be based on the construction of a roof structure or staircase; written exam includes subject economic and social studies.

1.1 General features of the education and qualifications system

General secondary education policy in Germany is devolved to the federal states. National co-ordination takes place between the states to ensure and enhance comparability between general qualifications. General qualifications are awarded by schools. The state's ministries of education are responsible for the regulation of schools. In many states this task is delegated to regional or local authorities. In most states, centralised final exams take place at the end of either 9/10 or 12/13 years and form part of the final grade on the school leaving certificate.

Vocational education policy is coordinated at the federal level with framework curricula being set for 328 officially recognised occupations² (constituting a qualification) by the federal ministries. The majority of vocational education takes place in the so-called “dual system” consisting of work-based learning in the form of apprenticeships within a company supported by school-based learning in vocational schools run by the federal states. Regional chambers of crafts and trade are responsible for the regulation of qualifications and award of certificates.

Learners are assessed by examination panels which are created for each occupation in the relevant chamber district and consist of representatives of employers and employees as well as teachers from vocational schools. These examination panels are appointed by the state government and function as independent examiners. In general, it is the responsibility of the examination panel to design the assessments for their occupation. While all assessments have to cover a specific curriculum, the content of exam papers may therefore vary between chamber districts. However, in many occupations, there are uniform exams which are developed by organisations commissioned for this purpose by the relevant chambers. These assessments are developed and quality assured by panels of voluntary experts within each occupation (these may be members of existing examination panels), again including representative from employers, employees and vocational schools. The organisation is responsible for distributing exam papers across Germany each year.

² https://www.bibb.de/dokumente/pdf/Verzeichnis_anerkannter_AB_2015.pdf

1.2 Qualification description: Carpentry and Joinery

To become a carpenter in Germany, an apprentice must complete 3 years of apprenticeship (including work-based and school-based training). At the end of the apprenticeship the apprentice should know:

- rights and responsibilities in the work place/during the apprenticeship;
- the business structure of the firm employing the apprentice;
- the tools and machines available in the trade and how to use them;
- what to take into account when reading or drafting plans;
- the materials used for construction;
- what insulation material to use for damp, heat, cold, sound and fire protection;
- relevant information about environmental protection;
- the techniques applied to use different construction components;
- how to calculate building material needs;
- how to produce roof- wall- and ceiling constructions using panelling;
- what to consider when erecting simple roof, turret or dormer constructions;
- how to erect scaffolding and other support systems; and
- how to treat construction woods.

Additional training received in vocational schools provides more specific knowledge, e.g. on how to construct wooden spiral staircases as well as general knowledge in the subjects German, maths and economic and social studies.

1.2.1 Assessment of Carpentry and Joinery qualifications

The apprentice has to complete both written and work-based assessments at the end of year 2 and 3 of the apprenticeship. Work-based tasks are assessed by the chamber of crafts' examination panel for this occupation. The assessment normally takes place in the chamber's own workshops. In some circumstances the work-based task can relate to a real-life scenario and will then take place in the firm employing the apprentice. In this case, the person training the apprentice in the firm will submit a proposal for the task to the examination panel which must approve it. The task will then still be assessed by the examination panel. Examples of work-based tasks are:

- erecting a roof construction with angle rafters, valley rafter and jack rafters;
- constructing a dormer window; and
- constructing a staircase.

Written exams are designed and assessed by the carpentry examination panel and are held for the following subjects:

- Wooden constructions;
- Construction components; and
- Economic and social studies.

1.3 Qualification description: Plumbing and Domestic Heating³

Since 2003, plumbing and domestic heating has been part of a reformed occupation/qualification called “systems mechanic for sanitary, heating and air-conditioning technology”. The apprenticeship for this qualification normally takes 3.5 years to complete. Upon successful completion, a journeyman certificate is awarded (equivalent to Level 4 of the German and European Qualifications Framework, Level 3 of the CQFW).

Apprentices are trained in at least one of these four areas of operations/specialisations:

- sanitary technology;
- heating technology;
- air-conditioning technology; and
- renewable energy and environmental technology.

The core knowledge, competencies and skills that an apprentice must obtain during the apprenticeship include:

- Testing and measuring building systems;
- Conducting building systems maintenance;
- Building systems management;
- Operating and controlling/testing sustainable building systems and (waste) disposal systems;
- Fitting sanitary facilities;
- Installing electric components;
- Mounting/assembling plumbing and drains/sewers;
- Conducting hygienic measures; and
- Customer service and order management.

1.3.1 Assessment of Plumbing and Domestic Heating qualifications⁴

Assessment in this qualification takes place in two parts: the first assessment takes place at the end of year two in the field of building services engineering. It consists of a work-based practical task and a technical discussion as well as written examination of questions relating to the practical task.

At the end of the apprenticeship examination takes place in the following subjects:

- Customer order (practical task and technical discussion);
- Work scheduling (written exam);
- System analysis and maintenance (written exam); and
- Economics and social studies (written exam).

Work-based tasks are assessed by the chamber of crafts' examination panel for this occupation. The assessment normally takes place in the chamber's own workshops. In some circumstances the work-based task can relate to a real-life scenario and will then take place in the firm employing the apprentice. In this case, the person training the apprentice in the firm will submit a proposal for the task to the examination panel which must approve it. The task will then still be assessed by the examination panel.

³ <https://berufenet.arbeitsagentur.de/berufenet/faces/index?path=null/kurzbeschreibung&dkz=15164>

⁴ <https://berufenet.arbeitsagentur.de/berufenet/faces/index?path=null/kurzbeschreibung/ausbildungsdauerabschluss&dkz=15164>

2. Australia

- Recent reforms in vocational education and training aim to improve employer involvement in designing qualifications through Industry Reference Committees.
- Guidelines for assessments set out minimum qualification requirements for assessors, but Registered Training Organisations are free to design the assessments of learners. Guidelines advise for assessments to take place in the work place where possible.
- Apprenticeships typically take four years.
- Elective units of competency include managing small business finances and investigating micro-business opportunities.

2.1 General features of the education and qualifications system⁵

Secondary education policy is devolved to the Australian states. National co-ordination takes place between the states to ensure and enhance comparability between qualifications.

General secondary education takes place at comprehensive high schools for 4-6 years. Each state has a statutory body awarding the Senior Secondary Certificate of Education upon completion of high school as well as separate qualifications that allow entry into university. The statutory bodies are accountable to the Minister of Education of the individual state.

The operation and regulation of technical and further education institutions in Australia is also devolved to the states. However, vocational qualifications are registered nationally (in a joint operation of the federal and state and territorial governments) to ensure portability. Traineeships and apprenticeships can be undertaken in different industries. Technical and further education institutes offer vocational education and training and private Registered Training Organisations (RTOs) regulated by state authorities (in each state) also deliver government accredited vocational qualifications.

Following a reform in 2015⁶, Industry Reference Committees supported by Sector Skills Organisations have taken on responsibility for developing training packages for different sectors. These training packages consist of an industry endorsed list of relevant sector qualifications at different levels of the Australian Qualifications Framework. The qualifications are expressed through units of competency that demonstrate the knowledge and skills required in the workplace. The training packages also include a set of standards regarding issues such as entry requirements, skills and assessment⁷.

The Sector Skills Organisation responsible for developing the training packages for the construction and property industries is called Artibus Innovation⁸. They regularly develop and refine qualifications starting with a research phase looking at regulatory, environmental and technology drivers nationally and internationally. This is supported by an ongoing monitoring process and annual update of their research resources. After the research phase a review phase follows in which feedback on the qualification is considered as well as reviewing the content and structure of the qualification. The output of this initial review is then further discussed by an external technical advisory group consisting of representatives from industry, regulators and training organisations and any issues or necessary updates are discussed⁹.

⁵ <http://www.aqf.edu.au/wp-content/uploads/2013/02/Australian-education-system.pdf>
<https://www.education.gov.au/school-education> <http://www.acaca.org.au/go/about-acaca>

⁶ <https://www.education.gov.au/AISC>

⁷ https://training.gov.au/TrainingComponentFiles/CPC08/CPC08_R9.3.pdf

⁸ <http://www.artibus.com.au/>

⁹ Information via email from Artibus

2.2 Qualification description: Carpentry and Joinery

The Certificate III in Carpentry and Joinery qualification¹⁰ is included in the construction, plumbing and services training package¹¹.

The qualification requires a number of core and elective units of competency to be assessed in order to demonstrate common and specialist skills for the construction industry. The qualification specification summarises several employability skills addressed in this qualification: communication, teamwork, problem solving, initiative and enterprise, planning and organising, self-management, learning and technology. To achieve this qualification, the candidate must demonstrate competency in: 30 units of competency (22 core units and 8 elective units).

The core units for this qualification include:

- Use carpentry tools and equipment;
- Handle carpentry materials;
- Carry out general demolition of minor building structures;
- Install and replace windows and doors;
- Install lining, panelling and moulding;
- Install exterior cladding;
- Work effectively and sustainably in the construction industry;
- Conduct workplace communication;
- Use explosive power tools; and
- Apply OHS requirements, policies and procedures in the construction industry.

Further core units are taken in the two specialist areas

- Construction and erection of frames, trusses, eaves and roofs field of work
For example:
 - Install flooring systems
 - Construct wall frames.
- Joinery - machining and component manufacture and assembly field of work
For example:
 - Install flooring systems
 - Construct wall frames.

In addition to the core units, there are specialist elective units such as

- Frame and fit wet area fixtures; and
- Design and set out stairs.

As well as general elective units such as:

- Investigate micro business opportunities; and
- Manage small business finances.

¹⁰ <https://training.gov.au/Training/Details/CPC32011#>

¹¹ https://training.gov.au/TrainingComponentFiles/CPC08/CPC08_R9.3.pdf

2.3 Qualification description: Plumbing and Domestic Heating

The Certificate III in Plumbing qualification is included in the construction, plumbing and services training package¹².

The qualification requires a number of core and elective units of competency to be assessed in order to demonstrate common and specialist skills for the plumbing industry in four out of six different streams:

- i) Stream 1 Water;
- ii) Stream 2 Sanitary;
- iii) Stream 3 Drainage;
- iv) Stream 4 Mechanical services;
- v) Stream 5 Roofing; and
- vi) Stream 6 Gas services.

Core units include:

- Installing water and drainage systems;
- Install disposal systems;
- Installing heating systems;
- Selecting and installing roof sheeting and wall cladding;
- Installing gas systems and control equipment; and
- Workplace health and safety requirements.

Elective units include:

- Installing acoustic and thermal environmental protection systems;
- Cutting and joining sheet metal; and
- Installing portable fire equipment.

¹² https://training.gov.au/TrainingComponentFiles/CPC08/CPC08_R9.3.pdf

2.4 Assessment methodologies

Assessments for these qualifications and their component units must satisfy the endorsed Assessment Guidelines of the Construction, Plumbing and Services Training Package which refer further to the Standards for NVR Registered Training Organisations that the Australian Qualifications Authority has published and which serve as essential conditions and standards for registration.

The construction industry strongly affirms that training and assessment take place in a real or very closely simulated workplace environment and these qualifications require all units of competency to be delivered in this context.

Assessors are required to have:

- formal recognition of competency at least to the level being assessed;
- relevant industry experience, that is, workplace experience within the last two years in the competency area being delivered; and
- relevant occupational registration or licensing in areas where this is a regulatory requirement to practise in the jurisdiction where the qualification is being assessed¹³

At higher levels of qualifications (Certificate 4, Diplomas etc.) assessors are required to have current professional experience, evidenced for example by registration on relevant registers. Relevant professional recognition is also required in some instances and can be evidenced by membership in relevant professional bodies.

¹³ <https://training.gov.au/Training/Details/CPC08>

3. Canada: Province of Alberta

- Carpentry is a registered trade achieved through a 4-year apprenticeship including 1.560 hours of on-the-job training and 8 weeks of school-based technical training per year culminating in a journeyman certificate.
- Assessment is based on multiple choice tests at the end of each year as well as practical exams of between 6 and 26 hours.
- Interprovincial examination for the “Red Seal”¹⁴ interprovincial standards allows portability of the qualification.

3.1 General features of the education and qualifications system

Canada does not have a federally integrated system of education and each province or territory is responsible for the organisation, delivery and assessment of general, vocational and university education. The province of Alberta, used as an example in this case study, shares the main features of the education system with 10 of the 13 jurisdictions within Canada, so is regarded here as a representative example.

Secondary education in Alberta takes 4 years and finishes with graduation from high school. The average graduation rate (in Canada) was 74% in 2003. After high school, learners may continue to university, college, apprenticeships or other forms of vocational and technical education. High school education is largely general education (final examinations are held in English, maths, social sciences and science) but there are also opportunities for vocational education in so called “knowledge and employability occupational courses”¹⁵ in which learners can earn credit towards a high school achievement certificate or high school diploma.

Qualification in one of the 50 registered trades in Alberta is achieved through an apprenticeship. Entry requirements for apprenticeships consist of certain high school attainments in maths, English and science or the successful completion of an entry examination. Apprentices need to find an employer who will take them on (they will work with a qualified journeyman at their side). They can then register with Alberta Apprenticeship and Industry Training, a body created to support partnerships between industry (employers and employees), government and training providers. Apprenticeship registrations have increased steadily over the years with the largest increases seen in the building construction trades.

Apprentices are paid by their employer with wages increasing from 60% to 90% of a journeyman’s wages over the course of the apprenticeship. Technical training is subsidized through the public post-secondary education system. Base tuition fees are approximately £511 for eight weeks of training and materials.

¹⁴ http://www.jobbank.gc.ca/content_pieces-eng.do?cid=24&lang=eng#R

¹⁵ <https://education.alberta.ca/knowledge-and-employability/senior-high-ke-courses/everyone/senior-high-ke-courses/>

Employers and employees are involved in the development of training and assessment through a number of local and provincial industry committees providing advice to the Apprenticeship and Industry Training Board. Industry committee members are also involved in design criteria for practical exams, while those same people or contracted workers assist with marking. Practical exams take place in controlled environments, either at a training institute or at the worksite, depending on the trade. The Apprenticeship and Industry Training Board is responsible for organising these assessments.

The “Red Seal” is a registered trademark symbol based on interprovincially shared standards which allows portability of trade qualifications between the different territories of Canada. Apprentices can take an interprovincial exam in their final year to earn the right to practice their trade in other territories of the country.

3.2 Qualification description: Carpentry and Joinery

Carpenter is a regulated trade in Alberta, Canada¹⁶ and is achieved by completing an apprenticeship. The apprenticeship takes four years with each year consisting of at least 1,560 hours of on the job training as well as 8 weeks of technical training (240 hours), followed by two theoretical exams and one practical exam.

After successfully completing their apprenticeship, the apprentice should be able to:

- responsibly do all work tasks expected of a journeyperson;
- supervise, train and coach apprentices;
- understand the principles of sound and safe construction;
- know the characteristics and proper use of all building construction materials;
- read drawings, do layout work and calculate quantities of materials;
- build various types of concrete forms;
- build all types of wood framed buildings and apply exterior and interior finish components;
- be proficient in the safe use and maintenance of hand and power tools;
- be familiar with the work of other tradespeople in the building industry;
- comply with all safety regulations of the construction industry; and
- perform assigned tasks in accordance with quality and production standards required by industry¹⁷

Training centres also offer pre-employment courses in carpentry for learners who do not yet have any knowledge of a trade and have not started an apprenticeship. The course covers the same material as the technical training of Year 1 of the apprenticeship with additional practical skills and safety training provided. After completing this course, candidates are eligible to take the end of Year 1 exam for apprentices.¹⁸

¹⁶ <http://tradesecrets.alberta.ca/trades-occupations/profiles/002/>

¹⁷ http://tradesecrets.alberta.ca/SOURCES/PDFS/course_outlines/002_outline.pdf

¹⁸ <http://www.sait.ca/programs-and-courses/apprenticeships-and-trades/pre-employment-programs>

3.2.1 Assessment of Carpentry and Joinery qualifications¹⁹

Theoretical exams are taken in each year of the 4-year apprenticeship. They are 3-hour multiple choice exams with a total of 100 questions in four to five categories. The categories are:

Year 1:

- Safety and building materials;
- Tools;
- Site preparation, building layout, foundations and floor frame systems; and
- Residential estimating and drawing interpretation.

Year 2:

- Frame Structures;
- Wood frame roofs;
- Interior and exterior finishes;
- Wood stairs; and
- Light commercial estimating and drawing interpretation.

Year 3:

- Concrete and building layout;
- Commercial form works;
- Commercial interiors and exteriors; and
- Commercial estimating and drawing interpretation.

Year 4:

- Workplace organisation and interior finishes;
- Advanced roof framing and stairs;
- Renovations, building design, energy efficiency and building science; and
- Industrial estimating and drawing.

In the practical exams at the end of each year, the apprentice is given 6 hours to complete a task. Points can be earned for dimension, construction and finish. In Year 4, there is an additional practical exam for which 26 hours are allocated. Points can be earned for:

- Base framing;
- Partition framing;
- Rafters;
- Frame;
- Base finish; and
- Stairs.

¹⁹ <http://tradesecrets.alberta.ca/trades-occupations/profiles/002/exams/>

The interprovincial Red Seal exams are also theoretical and multiple choice exams consisting of 100 questions. The areas covered are²⁰

- Common occupational skills
 - Uses and maintains tools and equipment;
 - Performs safety related activities;
 - Uses building materials; and
 - Builds and uses temporary access structures.
- Planning and Layout
 - Interprets documentation;
 - Organizes work; and
 - Performs layout.
- Concrete
 - Constructs formwork; and
 - Installs concrete, cement-based and epoxy products.
- Framing
 - Constructs floor systems;
 - Constructs deck systems;
 - Constructs wall systems; and
 - Constructs roof and ceiling systems.
- Exterior finish
 - Installs exterior doors and windows;
 - Installs roofing; and
 - Installs exterior finishes.
- Interior finish
 - Applies wall and ceiling finishes;
 - Installs flooring;
 - Installs interior doors and windows; and
 - Constructs and installs finish components and stairs.
- Renovations
 - Performs renovation-specific support activities; and
 - Performs renovation-specific construction activities.

3.4 Qualification description: Plumbing and Domestic Heating

Plumbing is a regulated trade in Alberta, Canada²¹ and is achieved by completing an apprenticeship. For an apprentice who is already a certified gasfitter, the apprentice programme will include both the plumber and a gasfitter trade²². The apprenticeship takes four years with each year consisting of at least 1,500 hours of on the job training as well as 8 weeks of technical training (240 hours), followed by an exam.

The apprenticeship training in work as well as in school is designed to equip an apprentice to be able to:

- install and maintain all plumbing systems, including hot liquid heating, water supply, water treatment, related hospital systems and compressed air and vacuum systems;
- fabricate and install any of the pipe systems used for various purposes in buildings, using any type of pipe: steel, cast iron, copper, plastic, etc;
- provide safe and efficient systems which function well in conjunction with other systems;
- know the rules and codes governing installations;
- read and interpret plans and specifications and prepare layouts and working drawings;

²⁰ http://tradesecrets.alberta.ca/SOURCES/PDFS/exams/002_exams/002_exam_eq_ip_qual_t1.pdf

²¹ <https://occinfo.alis.alberta.ca/occinfopreview/info/browse-occupations/occupation-profile.html?id=71003098>

²² <http://tradesecrets.alberta.ca/trades-occupations/profiles/006/>

- be proficient with the safe use of hand tools, powered machines and equipment
- calculate material quantities;
- detail components and fixtures according to specifications and assume responsibility for the end product;
- relate to job situations and other trades that precede or follow; and
- perform assigned tasks in accordance with quality and production standards required by industry²³

Training centres also offer pre-employment courses in plumbing for learners who do not yet have any knowledge of a trade and have not started an apprenticeship. The course covers the same material as the technical training of Year 1 of the apprenticeship with additional practical skills and safety training provided. After completing this course, candidates are eligible to take the end of Year 1 exam for apprentices²⁴.

3.4.1 Assessment of Qualifications in Plumbing and Heating

Theoretical exams are taken in each year of the 4-year apprenticeship. They are multiple choice exams with around 125 questions in four to five categories. Plumbing theory is a common category of years 1-3 while maths, science and blueprint reading are part of all four exams. Other categories are:²⁵

- Year 1: Heating and gas theory;
- Year 2: Hydronic heating, gas fitting, pipefitting and welding;
- Year 3: Hydronic radiant heating, gas fitting and lab; and
- Year 4: Private water supply and water treatment, special applications, drain waste and venting.

The interprovincial exams are also theoretical and multiple choice exams consisting of 125 questions. The areas covered are:²⁶

- Occupational skills, e.g. health and safety, work organisation;
- Piping preparation and assembly, e.g. joining and fitting tubes and pipes;
- Drainage, waste, vents and sewage treatment systems, e.g. installing sewage treatment systems;
- Water service and distribution, installing water and pressure systems;
- Fixtures, appliances and water treatment systems, e.g. installing plumbing fixtures;
- Low pressure steam and hydronic heating and cooling systems, e.g. installing hydronic system controls and transfer units;
- Specialized systems, e.g. installing process piping systems; and
- Maintenance and repairs, e.g. troubleshooting systems and components.

²³ https://tradesecrets.alberta.ca/SOURCES/PDFS/course_outlines/006_outline.pdf

²⁴ <http://www.sait.ca/programs-and-courses/apprenticeships-and-trades/pre-employment-programs>

²⁵ <http://tradesecrets.alberta.ca/trades-occupations/profiles/006/exams/>

²⁶ http://tradesecrets.alberta.ca/SOURCES/PDFS/exams/006_exams/0060_exam_eq_ip_qual_t1.pdf

4. New Zealand

- Work as a professional plumber or carpenter/joiner requires registration with professional bodies, and the requirements of this registration are incorporated into the design of vocational qualifications.
- New Zealand Certificates at Level 4 of the New Zealand Qualifications Framework are designed to be delivered to learners with apprenticeship agreements, and elements of assessment will take place ‘on the job’
- Tertiary Education Organisations (TEOs) act as both learning providers and awarding bodies, working to specifications that are provided by the New Zealand Qualifications Authority (NZQA) but with scope to vary their provision.

4.1 General features of the education and qualifications system

Schooling in New Zealand is compulsory from ages six to 16. 85% of learners attend state maintained schools. 82% of learners in New Zealand remain in school-based education until the year of their 17th birthday. All publicly funded qualifications in New Zealand are incorporated into the New Zealand Qualifications Framework (NZQF). The original framework, developed in 1989, was the first such framework in the world. The framework represents a high-level ambition to create parity between general and vocational qualifications, and is described as competence-based. Flexibility in delivery and assessment settings is one of the four principles of the NZQF.

At the end of compulsory schooling at age 16, learners are expected to attain Levels 1-3 of the NZQF, either through New Zealand Certificate of Educational Attainment (NCEA) or through Certificates. Some learners will access elements of vocational education pre-16 through school-based programmes allowing learners to combine work placements with study towards relevant subjects at NCEA levels 1-3. Vocational and technical education can be delivered through both Certificates and, beyond Level 3, Diplomas. Certificates and Diplomas are designed to demonstrate competences and “proven skills in a particular area of work.” (Careers New Zealand, n.d.). Both Certificates and Diplomas at Level 3 and above can be studied towards ‘on the job’ through industry training or apprenticeships. Vocational education post-16 is delivered through Tertiary Education Organisations (TEOs). These bodies devise programmes based on the specifications set out by the New Zealand Qualifications Authority (NZQA), and also assess and award qualifications.

4.2 Qualifications description: Carpentry and Joinery

Whilst there are no qualification requirements for working as a carpenter or joiner, the Certificates offered at different levels of the NZQF come with guidance as to how their learning outcomes relate to the requirements of work in the industry, with suggestions as to the types and levels of work that graduates might be able to do. Certain types of work are classified as 'Restricted Building Work', mainly for primary structure work on residential houses and apartments. Undertaking 'Restricted Building Work' requires becoming a Licensed Building Practitioner. The Licence is competence-based, and requires a New Zealand Certificate Level 4 qualification.

New Zealand Certificate in Carpentry Level 4 is awarded by Tertiary Education Organisations (TEO), who also act as learning centres providing teaching to candidates. The qualification, like many Level 4 vocational Certificates, is designed to be undertaken through an apprenticeship. Candidates are expected to source placements with employers, and the Building and Construction Training Organisation, a sector body, will subsequently coordinate study within a TEO. Gaining the Level 4 qualification typically takes 3-4 years.

The work-based learning component is a requirement for becoming a Licensed Building Practitioner. Holders of this qualification will be able to:

- work effectively as a carpenter on a construction site;
- apply working knowledge of legislation and regulations relevant to the construction industry;
- understand the construction process, and consent and planning requirements for construction projects including site services, and health and safety management;
- demonstrate safe work practices, including workplace first aid, and safely use equipment and tools on construction sites;
- read and interpret plans, working drawings and specifications;
- perform a broad range of calculations and measurements used in construction including working out and costing material quantities;
- apply technical knowledge of materials and methods used in construction;
- demonstrate a broad range of practical skills in various aspects of construction to a commercially competitive level;
- utilise interpersonal communication and time management skills to work effectively within the construction industry; and
- undertake further study for qualifications relating to leading hand, supervisor or construction management roles and/or related trades within the construction industry.

Teaching is delivered by TEOs, which are run as private businesses. Fees are charged directly to students, although government funding schemes are available. Teaching on apprenticeships is organised into between 10-13 week-long blocks.

4.3 Assessment of qualifications in Carpentry and Joinery

Learners must undertake practical assessments for each unit throughout their period of study. Assessment is competency based, and TEOs that award Level 4 New Zealand Certificates can assess learners' practical skills either in controlled assessments or 'on-site' through visits to employers. Controlled assessments take place in TEO settings with assessment completed by either an education provider or a registered workplace assessor from an industry training organisation. Registered assessors also undertake work-based assessments by observing work and can discuss work with supervisors involved in the learners work placement to gain attestation of their practical skills. Employers and supervisors may be consulted on how assessments take place, but they have no role in the design of assessments.

Learners may also be asked to submit documentation relevant to the unit that they are undertaking, such as plans or construction specifications, work records or photographs, as well as being monitored against performance criteria for particular skills and competences.

4.4 Qualifications description: Plumbing and Domestic Heating

New Zealand Certificate in Plumbing Level 4 is awarded by Tertiary Education Organisations (TEO), who also act as learning centres providing teaching to candidates. The qualification, like many Level 4 vocational Certificates, is designed to be undertaken through an apprenticeship. Candidates are expected to source placements with employers, and the Building and Construction Training Organisation will subsequently coordinate study within a TEO. Gaining the Level 4 qualification typically takes 3-4 years.

Holders of this qualification can work as professional plumbers, after becoming registered with the New Zealand Plumbers, Drainlayers and Gasfitters Board. The common assessment on the Level 4 Certificate is designed to match the requirements of the Board's registration examination. The Board is actively involved in reviewing the suitability of the qualification for the needs of the industry through engagement with NZQA and through on-site visits of TEOs and work placements and reviews of learners' assessment materials.

As with many other Level 4 construction Certificates in New Zealand, the qualification is designed for learners on apprenticeship placements. Some of the unit standards on this qualification are also shared by Certificates in Drainlaying and Gasfitting, and learners completing the New Zealand Certificate in Plumbing often complete the Certificate in Gasfitting and vice versa. Holders of them are able to:

- Install, maintain and repair plumbing systems in accordance with the legal requirements for a licensed plumber, including the following systems:
 - Water supply including backflow;
 - Domestic fire sprinkler;
 - Sanitary plumbing of appliances and fixtures;
 - Foulwater;
 - Hot water supply;
 - Solar water heating;
 - Rainwater handling;
 - Ventilation and ducting; and
 - Pumps.

- Interpret plumbing drawings and specifications;
- Understand and apply the legislative responsibilities of a licensed plumber;
- Make, install and repair flashings and penetrations and repair external envelope claddings that are associated with plumbing systems;
- Install, maintain and repair solid fuel space heaters;
- Install, maintain and repair profiled metal roofing and wall cladding;
- Work with consideration of other construction trades and related services on site and practice ethically;
- Apply material science and selection, trade physics, and environmentally sustainable considerations for plumbing systems; and
- Apply safe working procedures and practices; identify and control hazards in a working environment; and
- Isolate and test for safety and explain the limitations on plumbers carrying out electrical work.

4.5 Assessment of qualifications in Plumbing and Domestic Heating

Learners must undertake practical assessments for each unit throughout their period of study. Assessment is competency based, and TEOs that award Level 4 New Zealand Certificates can assess learners' practical skills either in controlled assessments or 'on-site' through visits to employers. Controlled assessments take place in TEO settings with assessment completed by either an education provider or a registered workplace assessor from an industry training organisation. Registered assessors also undertake work-based assessments by observing work and can discuss work with supervisors involved in the learners work placement to gain attestation of their practical skills. Employers and supervisors may be consulted on how assessments take place, but they have no role in the design of assessments.

Learners may also be asked to submit documentation relevant to the unit that they are undertaking, such as plans or construction specifications, work records or photographs, as well as being monitored against performance criteria for particular skills and competences.



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