



NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

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NEW ZEALAND CERTIFICATE IN ENGINEERING – PRODUCTION

WORK EXPERIENCE GUIDELINES

Aim of Work Experience

The aim of the work experience component for the New Zealand Certificate in Engineering is to supplement and integrate the academic learning with practical knowledge and experience, and hence to develop further competence in technician engineering through actual on-job experience.

Sources of Suitable Experience

The emphasis in work experience for NZCE (Production) is on the production of articles by the application of mechanical engineering methods and not production in any other sense. Experience is to be gained in producing articles made from a variety of materials as from a secondary industry to provide components for industrial, commercial and domestic machine assembly or static products. Typical materials are metals, plastics, ceramics, textiles, wood and leather. As well as a good working knowledge of the range of experience provided for the NZCE (Mechanical), candidates require specialised knowledge of production machines and the tools required to work materials, as well as experience in production planning, economics of productivity and producing articles of suitable quality.

Opportunities for employment in production engineering occur largely in the private sector.

Advising the Employer

The candidate's employer should be advised by the candidate of the requirements of these guidelines, preferably prior to the candidate commencing employment but in any event as early as possible in the work experience, in order to ensure that the employer is aware of the type of experience required and can make the appropriate arrangements to provide it. Mentoring services are available through organisations such as the Institution of Professional Engineers New Zealand (IPENZ) if the employer is unable to assist.

Core Expectations

Basic Academic Knowledge

The basic academic knowledge will be acquired through a course of full or part time study generally at a polytechnic. Often this study is completed prior to commencing work experience. The requirements are specified in the Qualifications Authority's Advanced Vocational Awards Handbook.

Breadth

A broad range of experience is desirable including exposure to investigation, design or development, supervision, management, testing, operating, installing, commissioning and servicing. The work undertaken towards NZCE should have a variety of activities that require thought as to method, reliability, cost, and commercial as well as engineering factors. An exposure to real situations and equipment is advisable, as this will give an appreciation of what is feasible and practical in the design and operation of systems. A candidate should also be able to appreciate projects as a whole from specification through to completion, even if involved in only a small part.

Level of Accomplishment

On completion of academic and work experience the candidate should be capable of self-directed work, particularly in systems design, installation and commissioning, leading small teams, making judgements covered by defined methods or procedures, and then deciding, using readily available information, which procedure, system or component to use.

Work Experience Credit for Related Qualifications

Between six months and eighteen months work experience may be credited from a completed apprenticeship, a Trade Certificate, an Advanced Trade Certificate or a National Certificate at level 3 or above in any relevant area from the following:

- toolmaking
- fitting and turning
- fabrication engineering
- maintenance and diagnostics
- pattern making.

The time credited will be determined according to the details recorded in the Work Experience Record Book. Candidates should submit a certified copy of the certificate of completion of apprenticeship, Trade Certificate, Advanced Trade Certificate or National Certificate (a certified copy is one which is signed by a legally authorised person such as a justice of the peace, a solicitor, or a notary public as an authentic copy of the original).

It may be possible that time can be credited from qualifications other than those above. Advice should be sought from the Qualifications Authority.

Fundamental Practical Knowledge

Candidates should be able to demonstrate by the type of work undertaken during their work experience that they understand the capabilities, limitations and important requirements governing the use of the particular processes, devices or equipment. The work must include sufficient practical experience, either hands-on or by direct observation, to enable candidates to have a general understanding of most of the following:

- using tools, engineering machinery and protective equipment
- developing safe practices for work environments and working within statutory or industry standards for safety.

NZCE Work Experience Relevant to Production Engineering

Candidates should gain experience in general engineering practice, product design and evaluation, production machines and tooling, production planning, and quality control and quality assurance. Further experience may be gained in production management role.

Note that the items in the following lists are not to be regarded as having equal weighting; it is important that the candidate completes a wide range of activities in the fields listed in the previous paragraph. The process of approving Work Experience Record Books will be assisted by cross-referencing activities entered in the book to these activities.

1 General Engineering Practice

- 1.1 Selecting materials and applying properties of common workshop materials.
- 1.2 Machining various tool insert profiles to the correct specifications.
- 1.3 Heat-treating metals.
- 1.4 Using all types of metal fasteners.
- 1.5 Using lathes, boring bars, surface grinders, cam grinders (automotive only), milling machines, valve and seat refacing equipment.
- 1.6 Undertaking static and dynamic balancing.
- 1.7 Soldering, brazing, oxy-acetylene welding using electric, MIG and TIG welding techniques.
- 1.8 Moulding, casting and fabricating components. Identifying limitations and factors governing choice of process.
- 1.9 Modifying equipment.
- 1.10 Fitting, welding, and working with hydraulic and pneumatic equipment.

- 1.11 Using engineering instruments, vernier, micrometer, telescopic gauges etc.
- 1.12 Working with bearings and seals and their applications to differing duties, their correct fitting and adjustment.
- 1.13 Applying principles of preventative maintenance, condition based monitoring and other modern maintenance methods.
- 1.14 Working with services generation and reticulation, eg steam, water and compressed air.

2 Product Design and Evaluation

- 2.1 Investigating, from an initial concept, the major aspects of product functionality to assist selection of materials and production methods.
- 2.2 Draughting to current standards design proposals for a product concept, and producing details of design, including specification and material selection.
- 2.3 Identifying critically stressed items, and using techniques for physical testing e.g. strain gauges and techniques for analysis such as FEA, fatigue life analysis.
- 2.4 Applying principles the man-machine interface with reference to the design process.
- 2.5 Taking off schedules of quantities from drawings
- 2.6 Calculating labour requirements, applying rates and material costs to calculate basic costs.
- 2.7 Designing jigs and tools.
- 2.8 Checking prototypes against design.
- 2.9 Testing and evaluating prototypes under normal and extreme conditions over a specified time.
- 2.10 Making modifications following evaluation.
- 2.11 Using computers for design, stress analysis, tool path generation and cutting profiles.

3 Production, Machines and Tooling

- 3.1 Determining machine accuracy, alignment work holding and tool holding removal capacity, including accuracy in measuring components.
- 3.2 Applying the principles inherent in accuracy limitations in possible machine tool choices.
- 3.3 Determining machine accuracy, alignment, work holding and tool holding, removal capacity, and applying the principles of accuracy and limitations of measuring instruments.
- 3.4 Manufacturing plastic products in a plastics engineering workshop, and applying plastics production techniques such as injection molding, thermo forming, blow molding, stretch blow.
- 3.5 Costing machine and fabrication steps.
- 3.6 Determining production rates (eg $W/m^3/min$ tests), accuracy, cutting times, grinding times and metal deposition.
- 3.7 Working with hydraulic and pneumatic machinery such as clamps, presses, jigs.
- 3.8 Working within safety requirements of compressors, hydraulic pumps, accumulators, intensifiers as production machinery.
- 3.9 Maintaining hydraulic and pneumatic machines.
- 3.10 Working with electrotechnology for production processes (eg AC and DC circuits, electric motors of various kinds, three phase and single or relevant switchgear, fuses and starting devices).
- 3.11 Programming complex control systems as applied to production equipment, eg. CNC
- 3.12 Producing components by roll forming, pressing, stamping and extruding materials.
- 3.13 Using control system devices (eg electric, pneumatic or hydraulic).
- 3.14 Using various types of actuators (eg piston, diaphragm, electrical, electric-hydraulic, solenoid and servo).

4 Production Planning

- 4.1 Undertaking cost reduction by improving methods and using controls to identify and highlight problem areas, improving productivity by efficient utilization of resources for goods and services in different situations.

- 4.2 Planning work schedules and/or production organizational structure.
- 4.3 Participating in work studies, determining labour input and production output.
- 4.4 Acting as workshop supervisor or production controller.
- 4.5 Designing target charts, networks and cost production plans.
- 4.6 Constructing networks for material supplies and integrating various sources. Using, where appropriate, CPM network diagrams and Gantt charts.
- 4.7 Recording motion economy by filming.
- 4.8 Determining labour requirements.
- 4.9 Laying out work areas; determining factory flow, physical requirements for efficient work operations and safety.
- 4.10 Attending to statutory requirements of factory working conditions.
- 4.11 Organising material storage and warehouse stacking (including vertical placement).
- 4.12 Setting up material and product handling means (eg conveyors, monorails and forklifts), and examining the economics of handling time and placing.
- 4.13 Reporting results of production operations stressing purpose, reasons, objectives and limitations, results and proposed follow-up actions where deviations from plan exist.
- 4.14 Training staff and operatives, assessing success and making best use of employees for jobs in production.
- 4.15 Checking against ISO and NZ standards of product material and product itself.
- 4.16 Devising and evaluating production studies, setting objectives, procedures, advantages and limitations.
- 4.17 Participating in analytical estimating.
- 4.18 Developing standards in work place as an aid in planning, costing, budgeting, payment etc.

- 4.19 Undertaking work distribution analysis and analyzing results of feed back studies.
- 4.20 Applying production controls from management (costs, machines, labour, materials, production techniques and quality controls).
- 4.21 Controlling efficient use of raw materials and minimizing waste; recycling waste.

5 Quality Control and Quality Assurance

- 5.1 Implementing quality control of production machinery and materials flow.

- 5.2 Applying techniques of quality control.
- 5.3 Using ISO, NZS, TELARC standards for quality control in relation to limits, tolerances, fits, connections, surface finish, and component drawing evaluation.
- 5.4 Carrying out inspection work and product inspection procedures.
- 5.5 Ensuring absolute machine tool alignment in all planes of reference and using accurate tools for checking, including dial gauges and optical tooling.
- 5.6 Conducting laboratory tests of material specifications and products.
- 5.7 Organising work methods for quality assurance in order to optimise sales.
- 5.8 Evaluating quality assurance against warranty costs.
- 5.9 Establishing quality standards with national certifying and testing agencies.
- 5.10 Establishing and using systems to assess customer satisfaction both with sellers of the product and consumers.
- 5.11 Creating a satisfactory inspection and random testing scheme.
- 5.12 Aligning customer specification with process capability and establishing a sound reliability testing method.

Additional Relevant Activities

Involvement in the following activities also provides relevant work experience.

- Assisting with management planning and production in the above.
- Practising good industrial relations at all levels.
- Taking records and assisting with the preparation of productivity reports for management.
- Team work related skills, e.g. conflict resolution, running meetings etc.
- Project management.
- Budgeting, reporting, and classification of expenditure, i.e. difference between R& M and capital expenditure and cost benefit analysis.
- Working with specific legislation affecting the work place such as:
 - Health and Safety in Employment Act, 1992
 - The Resource Management Act, 1991
 - The Building Act, 1991.

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