



NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

Final date for issue of award is 31 December 2008

NEW ZEALAND CERTIFICATE IN ENGINEERING - POWER AND PLANT

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

Work Experience for NZCE (Power and Plant) may be gained in a wide variety of enterprises relating to fixed and/or mobile plant. These plants may range from those producing power (eg electric generating stations, industrial type installations or services or similar) to mobile plant such as earthmoving machinery and mobile power plants. The academic study overlaps several engineering disciplines; mechanical, electrical, automotive, electronic, industrial measurement and control overlap with power production, its planning, the conditions of use and controls available for the economic running of plant.

Examples of environments in which suitable work experience may be obtained are: industrial manufacturing plants, power producers as in steel manufacture, pulp and paper, cement manufacture, electricity generation plants of various kinds and industrial refrigeration plants.

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.

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 and plant. 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
- electrical wiring
- industrial instrumentation.

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 Power and Plant Engineering

Candidates should gain experience in design, installation, commissioning and operation records of plant, control system operation for plant and machinery, operation of plant and machinery, and maintenance of plant and machinery. 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 candidates complete 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 Design, Installation, Commissioning and Operational Records of Plant

- 1.1 Designing plant layouts, foundations, provisions for vibration. Installing, levelling and commissioning plant, and providing for safety ancillary services.
- 1.2 Designing control systems.
- 1.3 Installing fuel systems (eg solid, granulated, gaseous and liquid fuel under pressure) and fuel-feed systems (eg gravity and conveyor).
- 1.4 Advising and using proper jointing techniques for all types of components and materials used with the plant.
- 1.5 Keeping plant records, maintenance schedules, stores of stock replacement parts and developing a knowledge of plant replacement policy.'
- 1.6 Recording of expenditure on plant operation and maintenance.

2 Control System Operation for Plant and Machinery

- 2.1 Working with control systems for power units using manual, automotive, and open and closed loop systems.
- 2.2 Working with elements of plant controls, including sensing, measuring and transmitting.
- 2.3 Comparing control systems for deviation, application and control action.

2.4 Servicing and replacing components of control systems.

- 2.5 Servicing (simple servicing) to signal amplifiers, electrical, electronic and pneumatic. Identifying the location of problems and reporting faults.
- 2.6 Comparing mediums in electrical, electronic, hydraulic, pneumatic and fluidic control systems.
- 2.7 Working with microprocessor applications.
- 2.8 Tuning controllers, involving gain, proportional band, offset and overshoot.

3 Operation of Plant and Machinery

- 3.1 Determining flow characteristics of automatic control valves with poppet, linear and percentage plus features, and determining the effect of system resistance.
- 3.2 Observing the elements of materials and structure to design prime movers subject to dynamically induced stresses or stress reversals. Investigating the failure of components of whole plant, or prime movers subject to dynamically induced stresses or stress reversals.
- 3.3 Testing for static and dynamic balance and implementing procedures to correct or minimise these.
- 3.4 Determining types, causes and effects of vibration, and overcoming problems associated with particular cases.
- 3.5 Investigating the efficiency of various fuels for particular applications, including multiple fuel systems. Determining the efficiency of combustion, heat uptake or pressure effectiveness. Analysing exhaust gases.
- 3.6 Working with steam plant operation for heat and power generation involving different fuel-type boilers.
- 3.7 Determining factors affecting boiler action (eg contamination, chemical action).
- 3.8 Working with steam turbines. Determining blading, heat exchanger and condenser efficiencies and axial thrust developed in the power take off.
- 3.9 Working with heat pumps.
- 3.10 Testing pipe networks for pressure/flow characteristics and/or pressure drops and their causes.

- 3.11 Testing pump power required for efficient plant operation.
- 3.12 Operating and maintaining accumulators and intensifiers, and hydraulic and hydro-pneumatic systems.
- 3.13 Maintaining suitably efficient power transmissions involving chains, gears, friction drives, clutches, couplings, cams, brakes and allied mechanisms.

4 Maintenance of Plant and Machinery

- 4.1 Maintaining mechanical or electrical machinery involving the use of lubricants, oils, greases graphites.
- 4.2 Renewing various types of bearings and re-selecting.
- 4.3 Stripping down, overhauling, re-assembling and re-commissioning internal combustion engines.
- 4.4 Maintaining electrical machines, generators and motors involving testing of circuits.
- 4.5 Determining performance characteristics of plant and machines.
- 4.6 Measuring wear of machine components. Checking, assessing and adjusting tolerances.
- 4.7 Determining causes of breakdowns of prime movers, whether mechanical or because of lack of maintenance.

Additional Relevant Activities

Involvement in the following activities also provides relevant work experience.

- Assisting with management planning 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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