



NEW ZEALAND QUALIFICATIONS AUTHORITY  
MANA TOHU MĀTAURANGA O AOTEAROA

**Final date for issue of award is 31 December 2008**

## **NEW ZEALAND CERTIFICATE IN ENGINEERING - HEATING, VENTILATION AND AIR-CONDITIONING**

### **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 on-job experience.

#### **Sources of Suitable Experience**

Heating, ventilation and air conditioning systems are installed in buildings to regulate temperature and humidity to maintain human comfort levels and uniform conditions for efficient operation of equipment.

Work in heating, ventilating and air conditioning is carried out both in the public and private sectors. Heating, ventilating and air conditioning systems installed can include air intake with cleaning and humidity equipment, heating and/or cooling units, duct or pipework to distribute the medium and opportunity for discharge or recirculation.

#### **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, installation and 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, 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:

- sheet metal engineering
- fitting and turning
- fabrication, maintenance and diagnostics
- refrigeration
- electrical wiring.

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 and protective equipment
- working with (producing and/or reading) technical drawings
- using test equipment
- developing safe practices for work environments and working within statutory or industry standards for safety.

## **NZCE Work Experience Relevant to Heating, Ventilation and Air-Conditioning**

The work experience must include sufficient practical experience, either hands-on or by direct observation, to enable the candidate to have a general understanding of most of the processes, systems or equipment below. 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, systems or equipment.

It is expected that experience will be gained under **each** of the nine categories listed below. In each category, appropriate activities from which relevant experience might be gained are given. The process of approving Work Experience Record Books will be assisted by cross-referencing activities entered in the book to these activities.

### **1 Design - Investigation**

- 1.1 Taking design brief and either working in with planners or evaluating proposals for installation in existing premises.
- 1.2 Designing preliminary layout of systems, and drawing up and evaluating various proposals, including cost effectiveness, energy efficiency and life cycle costs of alternatives.

### **2 Design of Systems**

- 2.1 Designing units of warm/cool air fuelled by electricity, combustible fuels or coolants for direct or indirect heating/cooling giving consideration to materials of the building and its orientation.
- 2.2 Designing ventilation by natural means or by fan assistance (with or without ducting) using plenum and/or exhaust systems.
- 2.3 Designing combined heating and ventilation systems.
- 2.4 Designing air conditioning as single space units or as part of an overall system.
- 2.5 Designing units of a combined nature.

- 2.6 Designing units for cold storage for industrial plants and refrigerated freight transport.
- 2.7 Designing heating systems using hot water and steam from a boiler supply fuelled by gas, coal or oil.
- 2.8 Designing piping layout in three dimensions, including pipe sizing and balancing the systems
- 2.9 Designing ducting layout and ducting sizing for proper balancing of flow and discharge.
- 2.10 Designing control equipment for all sizes of units used in heating, ventilation and air conditioning systems (automatic and/or electronic).
- 2.11 Calculating boiler sizing, electric motor rating, fan capacities and auxiliary equipment sizing or rating.

### **3 Design, Draughting, Specifying and Evaluating**

Draughting should include familiarity with the use of computer aided draughting techniques.

- 3.1 Draughting complete schemes for installation, unit equipment and details of systems to current New Zealand standards (which should be stated).
- 3.2 Draughting mechanical units according to current New Zealand standards (which should be stated).
- 3.3 Draughting control equipment design and location.
- 3.4 Checking designs against draughting interpretations and checking sets of drawings against one another. Making corrections for “as built” records.
- 3.5 Scheduling installation work programmes.
- 3.6 Specifying work to be done, standards of materials and quality of work for installation of heating, ventilation and air conditioning systems.
- 3.7 Overseeing evaluation of design, drawing and specification for economy of capital expenditure and running costs.

### **4 Scheduling Quantities and Costing**

- 4.1 Making up schedules of quantities of approved designs, applying labour rates, material and prime costs, and other charges to provide estimates and costings of installations including estimation of life cycle costs.
- 4.2 Making up schedules of materials and equipment requirements to match schedules of job programmes.
- 4.3 Preparing contract documents and evaluation of tenders
- 4.4 Assessing for progress payments.

## **5 *Field Work and Site Measurement***

- 5.1 Inspecting sites for installing in new buildings and/or in existing structures. Locating routes of piping and ducting, support for appliances or units of the heating, ventilation and air conditioning system to be installed.
- 5.2 Reading plans and interpreting specifications of work to be done.
- 5.3 Checking site work against plans (and, in the case of existing structures, feasibility). Supplying details for "as built" records.

## **6 *Fabrication***

- 6.1 Marking out materials for making up as ducts or piping systems.
- 6.2 Carrying out sheet metalwork and pipe cutting, and preparing joints.
- 6.3 Making up transition pieces, providing for grille attachment at inlets and outlets.
- 6.4 Providing for junctions with heating, ventilation and air conditioning mechanical and control units.
- 6.5 Making up special size grilles.

## **7 *Installation and Commissioning***

- 7.1 Installing heating, ventilation and air conditioning schemes as work in new or existing buildings. Reassembling pre-fabricated work, installing of units related to heating, fans, filters, water supply, fuel liners, electrical supply, control equipment etc.
- 7.2 Testing installations and making adjustments or corrections for installation of the completed work as designed.

- 7.3 Calibrating and adjusting controls.
- 7.4 Obtaining and supplying "as built" information for plan records.
- 7.5 Trouble-shooting.
- 7.6 Evaluating the performance of automatic controls.
- 7.7 Undertaking hydraulic balancing of piping systems.

## **8 Maintenance**

- 8.1 Designing maintenance schedules for periodic inspection and/or replacement of items normally expected to require servicing.
- 8.2 Carrying out maintenance on operating units for heating, cooling (for refrigeration), ventilation and air conditioning.

## **9 Management**

- 9.1 Planning and controlling materials, work flow, output, scheduling and quality.
- 9.2 Participating in public and/or industrial relations management.
- 9.3 Developing and implementing safety and accident prevention policies and procedures.

### **Additional Relevant Activities**

Involvement in the following activities also provides relevant work experience.

- Total Quality Management, including problem solving techniques.
- Total Productive Maintenance.
- Techniques for cost benefit analysis of expenditure.
- 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.
- An understanding of 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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