ENGINEERS AUSTRALIA | National Engineering Register

Areas of Practice Descriptions

Applicants applying for registration on the NER should refer to the Application Guidelines at www.engineersaustralia.org.au/ner

The areas of practice descriptions are designed to help you choose your area of practice for registration on the NER and to identify the specific skills and experience you should focus on in your work experience statement.

You should write your work experience statement in such a way as to show that the area of practice in which you are seeking registration is a significant part of your professional employment or practice.

Note: The following areas of practice have specific requirements in addition to the information in the areas of practice descriptions:

- Aerospace Engineering
- Amusement Rides and Devices In-Service Inspection
- Building Services Engineering
- Fire Safety Engineering
- Heritage and Conservation Engineering
- Information, Telecommunications and Electronics Engineering (ITEE)
- Leadership and Management
- Naval Architecture
- Oil & Gas Pipeline Engineering
- Petroleum Engineering
- Pressure Equipment Design Verifier
- Subdivision Geotechnics

Aerospace Engineering

Aerospace Engineering is multidisciplinary in nature. By definition, it is 'the practice of the art and science of engineering for the purpose of achieving optimal integrated aerospace systems including military and civil air and space vehicle systems'.

Broadly speaking, the areas of practice embraced by Aerospace Engineering, in the context of the aerospace environment, involve, inter alia:

- Aerodynamics and performance
- Aircraft stores
- Airports and ground systems
- Airways systems
- Cabin environment
- Cockpit ergonomics
- Communications systems
- Computer systems and avionics
- Crashworthiness
- Electrical systems
- Electronic warfare
- Environmental effects
- Fire safety and control
- Flight management systems
- Flight simulators
- Flight test recording
- Fuels and lubricants
- Hydraulic systems
- Maintenance
- Materials and manufacturing
- Navigation systems
- Noise and acoustic effects

- Propulsion systems
- Radar systems
- Risk management
- Satellite systems
- Software
- Structural integrity
- Test flight control
- Tracking systems
- Vehicle dynamics
- Vehicle launch and recovery

The scope of activities by individuals or organisations practising in Aerospace Engineering includes, but is not necessarily limited to:

- Air safety Investigation
- Certification
- Design and documentation
- Education and training
- Installation
- Manufacture and supply
- Operation and maintenance
- Quality assurance
- Research and development
- Risk management
- Test and evaluation
- User and regulatory requirements.

Applicants who are corporate members of the Royal Aeronautical Society (RAeS) and registered as a Chartered Engineer (CEng MRAes) are eligible to apply for registration on the NER without further assessment.

More detailed information is available in the Aerospace Area of Practice Guidelines.

Biomedical Engineering

Biomedical Engineering is concerned with the research, design, development, evaluation, manufacture, installation, operation, maintenance, management and control of biomedical devices, facilities and equipment designed to support and enhance human life and help individuals to overcome physical disabilities, the planning and assessment of medical procedures and the development of related data handling facilities.

Applicants must have significant training in the life sciences, typically 80 hours of formal education or equivalent, and hold or have held a position of professional responsibility in biomedical engineering.

Chemical Engineering

Chemical Engineering is concerned with research, teaching, design, development, economics, manufacture, installation, operation, sales, maintenance and management of commercial scale chemical plants and process systems, industrial processing and fabrication of products undergoing chemical and/or physical changes being applied to materials for construction, process systems and equipment for instrumentation and control, and protection of the environment.

Applicants must have experience in the safety aspects of design and/or operations. In addition they must have experience in two of the following functions involving process systems and equipment: design, evaluation, operation, materials selection and fabrication.

Civil Engineering

Civil Engineering is concerned with materials such as steel, concrete, timber, earth and rock, and with their application in the research, design, development, manufacture, construction, operation, maintenance and management of hydraulic, structural, environmental and systems aspects of infrastructure works and services such as water,

sewerage, transport, urban development and municipal services, and with building and construction for other infrastructure industries**.**

Electrical Engineering

Electrical Engineering is concerned with research, design, development, manufacture, installation, operation, maintenance and management of equipment, plant and systems within the electrical, electronic, communication and computer systems areas, being applied to electrical power generation, transmission, distribution and utilisation, manufacture, instrumentation and control in industry, communications networks, electronic plant and equipment, integration and control of computer systems.

Environmental Engineering

Environmental engineering is a very broad field in which there are new applications and adaptations of all the traditional disciplines of engineering. Many applicants seeking recognition as environmental engineers may have academic qualifications and professional experience in civil, mechanical or chemical engineering and not environmental engineering specifically.

Applicants will need to show that they have developed specialist skills within their practice area in environmental engineering, and that they have developed expertise in the general field of environmental engineering particularly, in the principles and applications of sustainable development. They will also need to describe the ongoing training that is specific to environmental engineering. It will not be sufficient to have maintained expertise within a traditional area of practice such as civil, mechanical or chemical engineering.

In addition to their qualifications and experience, applicants will need to demonstrate:

- that environmental engineering is a significant part of their professional employment or practice;
- that they have a high level of awareness of the scope of environmental engineering, the principles and practice of ecological sustainability, of best practice environmental management and implementation, and of local and global environmental issues generally; and
- that they practise independently or under general direction, in the provision of environmental services related to at least one of the **areas of practice** listed below.
- Water and waste water treatment and management, including engineering application of re-use, recycling, etc.
- Waste management, including eco-efficiency, cleaner production concepts, life cycle assessment, repurposing etc.
- Surface and groundwater system environmental management, including water quality and quantity management
- Contaminated land assessment and remediation
- Natural resource management
- Environment protection, management and pollution control

- Environmental management system design, including environmental management planning, auditing, etc.
- Environmental impact assessment and environmental management planning
- Environmental information systems
- Natural system accounting, including economic evaluation
- Social impact analysis, community consultation, dispute resolution, etc.
- Sustainable energy planning and design, greenhouse gas mitigation and management
- Environmental risk assessment and management
- Environmental policy formulation
- Sustainable infrastructure.

Information, Telecommunications and Electronics Engineering (ITEE)

Information, Telecommunications and Electronics Engineering (ITEE) is multi-disciplinary in nature. By definition, it is the practice of the art and science of engineering for the purpose of achieving, inter alia, communication between individuals and societies for social and commercial interchange of information, the provision of equipment to facilitate daily living and the practice of commerce, business and industry, space exploration, resources exploration, etc.

Applicants seeking registration the general area of practice of ITEE are required to demonstrate their professional involvement in one or more of the following major areas of practice:

- Information engineering
- Communications engineering
- Computer systems engineering
- Electronics engineering
- Software engineering.

The scope of activities in Information, Telecommunications and Electronics Engineering include, but are not necessarily limited to:

- Teaching and training
- Research and development
- Design and documentation
- Manufacture and supply
- Quality assurance
- Installation, testing and commissioning
- Operation and maintenance.

For more detailed information about each of the major areas of practice refer to the ITEE Areas of Practice Guidelines.

Mechanical Engineering

Mechanical Engineering is concerned with design, development, research, evaluation, manufacture, installation, testing, operation, maintenance and management of machines, mechanical and mechatronic systems automated systems and robotic devices, thermodynamic and combustion systems, fluid and thermal energy systems, materials and manufacturing equipment and process plant and materials handling systems. This is applied to manufacturing, land, sea and air transportation, electricity generation, mining, minerals and metals processing, food, agricultural and forest products processing, thermal and environmental control systems in buildings and industry, refrigeration and air conditioning systems.

Applicants must have experience in the safety aspects of design and/or operation of machines, plant, systems or processes and with noise, airborne and water borne emission controls to reduce environmental impact.

Structural Engineering

Structural Engineering is concerned with research, planning, design, construction, inspection, monitoring, maintenance, rehabilitation and demolition of permanent and temporary structures and structural systems and their components and with associated technical, economic, environmental, aesthetic and social aspects. Structures might include buildings, bridges, in-ground structures, footings, frameworks and space frames, including those for motor vehicles, space vehicles, ships, aeroplanes and cranes, composed of any structural material including composites and novel materials.

NER Special Areas of Practice available only to Chartered Members of Engineers Australia and to applicants who have successfully completed a Stage 2 Competency Assessment.

Amusement Rides and Devices In-Service Inspection

Amusement rides and devices are used by members of the public who have a high expectation that they will be able to do so safely. In Australia, State and Territory Governments are responsible for the regulation of occupational health and safety, which includes fairground and amusement equipment. Regulations vary considerably between jurisdictions, however, the law generally holds ride owners responsible for the safety of people on amusement rides and devices.

Ride owners and operators relocate, assemble, check and operate their equipment in accordance with manufacturers' instructions and procedures recommended by AS3533. However, the technical expertise of the engineering profession is essential to in-service inspection and safety certification. Registration on the NER as a Professional Engineer or an Engineering Technologist in the specific area of Amusement Rides and Devices In-service Inspection requires specific competencies to carry out inspections.

For details of the specific requirements to be met for this area of practice refer to the Amusement Rides and Devices In-Service Inspection Area of Practice Guidelines.

Building Services Engineering

Building Services Engineering is multidisciplinary in nature. By definition, it is the practice of the art and science of engineering for the purpose of achieving optimal integrated building systems incorporating environmental control and safety provisions for the comfort and wellbeing of the occupants of the built environment.

Broadly speaking, the areas of practice embraced by Building Services Engineering, in the context of the built environment, involve:

- Air conditioning and mechanical ventilation
- Electrical light and power
- Fire services
- Fire safety engineering
- Water and waste services
- Data and communications
- Security and access control
- Vertical transportation
- Acoustics in buildings
- Energy management

The scope of activities by individuals or organisations practising in Building Services Engineering includes, but is not necessarily limited to:

- Teaching and training
- Research and development
- Design and documentation
- Manufacture and supply
- Quality assurance
- Installation testing and commissioning
- Operation and maintenance

Applicants seeking recognition as building services engineers may have academic qualifications and professional experience in fields other than those obtained through Engineers Australia accredited or recognised building services engineering degree courses offered in Australia and overseas. Such applicants will need to show that they have received adequate training and practised independently, or under general direction, as building services engineers.

For more information refer to the detailed Building Services Engineering Area of Practice Guidelines.

Fire Safety Engineering

Fire safety engineering is multidisciplinary in nature, having substantial relationships with building services, mechanical, electrical, electronics, chemical, structural and civil engineering and embraces an understanding of human behaviour.

It is the application of engineering principles, rules and expert judgement based on a scientific appreciation of the fire phenomenon, of the effects of fire and of the reaction and behaviour of people in order to:

- save life, protect property and preserve the environment and heritage from destructive fire.
- quantify the hazards and risk of fire and its effects.
- mitigate fire damage by proper design, construction, arrangement and use of buildings, materials, structures, industrial processes and transportation systems.
- evaluate analytically the optimum protective and preventive measures, including design, installation and maintenance of active and passive fire and life safety systems, necessary to limit, within prescribed levels, the consequences of fire.

There are currently few structured courses providing training in fire safety engineering. Most applicants seeking recognition as fire safety engineers will have academic qualifications and professional training in other engineering or related fields. Applicants will need to show that they have received adequate training within the area of fire safety engineering in which they practise and wish to be registered.

The criteria for registration in this area of practice align with the building legislation in each jurisdiction in Australia, implementing registration in the Class of Fire Safety Engineering.

For details of the specific requirements to be met for this area of practice refer to the Fire Safety Engineering Area of Practice Guidelines.

Heritage and Conservation Engineering

Engineering works have, since the beginning of the 19th century, been at the forefront of improvements to public health and quality of life. The engineering of roads, railways, telecommunications, power, sewerage and water supply etc. has produced substantial benefits for mankind. In fact, much architectural progress has depended on significant engineering input. As such, the conservation of our engineering and industrial heritage provides continuity with the past and with the Nation’s growth, demonstrates the development of ideas and technology and celebrates the genius of our engineering forebears. The conservation of this national heritage asset is substantially dependant on heritage engineers.

Heritage and conservation engineering is an area of practice which requires applications and adaptations of all the traditional disciplines of engineering, together with an understanding of the elementary scientific principles involved which might not be directly referenced in current practice procedures.

Practitioners will need to be aware of all the phases involved in conservation and the role of other professions, such as historians, archaeologists and architects.

Applicants seeking recognition as heritage and conservation engineers may have academic qualifications and professional experience in civil, structural, mechanical or electrical

engineering, and not in heritage and conservation engineering. In such cases, applicants will need to show that they have developed specialist skills within their practice area in heritage and conservation engineering, and that they have expertise in the general field of heritage and conservation engineering. They will also need to describe the continuing professional development they have undertaken which has been specific to heritage and conservation engineering and how this has established their expertise in that field.

The following areas of practice are a normal part of the heritage and conservation engineering discipline, with specialties dependent upon the basic discipline of the practitioner:

- conservation of heritage places, works, materials, structures, services and objects;
- assessment of heritage significance of the above;
- preparation of heritage impact studies;
- preparation of conservation management plans for places, works and objects;
- preparation of heritage interpretation plans.

For details of the specific requirements to be met for this area of practice refer to the Heritage and Conservation Engineering Area of Practice Guidelines.

Leadership & Management

The Leadership & Management special area of practice is for professional engineers, engineering technologists and engineering associates who hold management and administrative positions, where the majority of their day-to-day activities do not always involve technical considerations. If management forms a substantial and separate function, engineering practitioners may seek registration on the NER in Leadership & Management. However, registration in Leadership & Management is not warranted where managerial functions are only incidental to practice in a discipline.

Registration in Leadership & Management is available to engineering practitioners who, in addition to satisfying the above requirements, can show that they are engaged in professional activities which call on their engineering qualifications and experience either directly or indirectly and which place demands on acquired management skills, knowledge and judgement comparable to those required for an engineering area of practice.

In addition to their engineering qualifications and experience, applicants will need to demonstrate that:

- they have gained management qualifications or acquired acceptable management knowledge and skills in other ways
- they have moved into the management or administrative position as a progression of their professional career.
- They have specialised in certain multidisciplinary areas of practice specifically covered by the College of Leadership and Management

Applicants must show that their practice includes management, leadership, or consultancy in one or more of the following:

- General management
- Project management
- Human resources
- Finance

- Marketing
- Quality assurance or management
- Education or training in management
- Contract arbitration
- Policy analysis or development
- Other (detailed description required)

Multidisciplinary Areas in CLM

- Asset management
- Cost engineering
- Risk engineering
- Systems engineering
- Project management

Eng Exec members of Engineers Australia are eligible to apply for registration on the NER without further assessment.

Naval Architecture

A Naval Architect is a professional engineer who is responsible for the safe design and specification of ships, boats, and marine structures, both civil and military, including merchant ships (cargo and passenger), warships, submarines & underwater vehicles, offshore structures (fixed & floating), high speed craft, workboats and pleasure craft. The Naval Architect can also be involved in, or manage, the construction, repair / refit or operation of such ships / marine structures.

Bachelor of Engineering courses in Naval Architecture are offered at UNSW and the Australian Maritime College (AMC) with full accreditation by Engineers Australia and the Royal Institute of Naval Architects (RINA).

Certificate-level courses for Naval Architecture Technologists have also been accredited.

The basic competency of a Naval Architect is the ability to assemble and apply the relevant elements of science and technology into the safe design and construction of a ship.

Some of the required competencies are held to a greater or lesser extent by those in other branches of engineering. It is the Naval Architect who has the competency and responsibility to bring all of these elements together to form a ship/marine structure capable of meeting its operational criteria in the marine environment within the design limitation imposed by the force of weather such as wind, waves and tidal action.

It should be noted that Naval Architecture is essentially related to the form, arrangement, stability, structure and integration of the ship/marine structure. Naval Architecture is distinguished from Marine Engineering, which covers the design, construction and operation of engineering systems on-board the ship or marine structure.

The scope of organisations in which Naval Architects practice can include, but is not limited to: education & training, research & development, design & documentation, project management, construction & repair, operation & maintenance, risk management & quality assurance, regulation & legislation, consulting & surveying, marketing & sales.

Aside from professional engineer Naval Architects, engineering technologists and engineering associates working in the industry are essential to the Naval Architecture design teams. Specifically, draft persons also have to be skilled in the art of ship/marine structure construction and knowledgeable in the safety and structural regulations.

Unlike any land-based structure, ships/marine structures have to be designed to operate safely on a moving surface, namely the sea or another body of water. Unlike any land-based engineering designed tasks, this requires the Naval Architect to have the skill to design the structure for a wide range of dynamic forces, and to understand how persons on board respond to a moving environment. Ships at sea are often operated outside of the jurisdiction of any country and therefore knowledge of the internationally agreed safety and environmental protection regulations are essential. These specialist skills are embodied in Naval Architects.

For details of the specific requirements to be met for this area of practice refer to the Naval Architecture Area of Practice Guidelines.

Oil & Gas Pipeline Engineering

Pipeline engineering is multidisciplinary in nature, drawing on a broad range of general disciplines (such as civil, structural, mechanical, environmental, chemical electrical and materials engineering) and applying them to the specific area of practice of engineering of pipelines.

Registration of Pipeline Engineers is important to the industry and Australian society because petroleum pipelines are an extremely efficient, safe and environmentally sustainable method of transporting hydrocarbons from supply sources to centres of consumption when designed, constructed, operated and maintained according to sound engineering principles and practice. However, because of the hazardous nature of petroleum, poor engineering can result in catastrophic results. Ensuring clear recognition of competent pipeline engineers is an important ingredient in ensuring the safety of petroleum pipelines.

This area of practice relates only to petroleum and energy transmission and related fluid pipelines.

Applicants must be eligible for registration on the NER in a general area of practice, typically mechanical, civil, chemical or electrical engineering, (through satisfying the requirements of the Australian Engineering Competency Standards Stage 2 for Professional Engineers) and must provide evidence of their standing in the area of practice of pipeline engineering. As such they must hold an accredited or recognised Bachelor's degree in the relevant discipline or have participated in an upgrade program for a technical trade or other non-degree technical qualification.

In particular, to achieve registration a pipeline engineer must have a sound knowledge, understanding and experience of pipeline engineering and have demonstrated expertise and professionalism that can be relied upon by employers, clients, regulators and their peers. This will involve having a sound breadth of understanding and depth of knowledge, experience and expertise.

The competency standards for pipeline engineers and the processes of the Australian Pipeline & Gas Association are used as the basis for assessment for registration in the area of practice of Oil and Gas Pipeline Engineering (http://www.apga.org.au/training/pipeline-engineer-training-project/).

Applicants should provide the following accompanying documentation with their application:

- A completed APGA Pipeline Engineering Competency Portfolio (found on the APIA website at www.apga.org.au/training/pipeline-engineer-training-project/tools). This comprises the following:
    - Standard information about the applicant
    - Information about current registration/CPEng status
    - Qualifications
    - Summary of Competencies achieved and the name of verifier (or statutory declaration)
    - Course history summary
    - Non-course knowledge acquisition summary
    - Career history and experience report
    - Individual Competency Evidence Reports (CompER). For the GE001, GE003-GE011 these may be aggregated in to a single CompER
    - Appendix of copies of evidentiary supporting documents
    - Statutory declarations as verification of CompERs
    - Verifier professional background including information about CPEng, NER, RPEQ or other professional membership and contact details.

For details of the specific requirements to be met for this area of practice refer to the Oil & Gas Pipeline Engineering Area of Practice Guidelines.

Petroleum Engineering

Petroleum Engineering is the engineering science focused on achieving optimal integrated exploration, technical assessment, production and development of oil, gas and geothermal resources and reserves upstream of processing plants, refineries and power stations. Petroleum Engineers may evaluate oil and gas wells and potential reservoirs, design and oversee drilling, completion, intervention and stimulation activities, select and implement improved reservoir recovery schemes, and design and optimise well production and surface collection and treatment facilities. Petroleum Engineers fall within four main sub-disciplines of Reservoir, Drilling, Production and Formation Evaluation Engineering as described in Section 3.

Accredited or recognised Petroleum Engineering degree courses are offered in Australia and overseas. However, some applicants seeking registration as Petroleum Engineers may have academic qualifications and professional experience in other engineering or industry fields. In such cases, applicants must show that they have received adequate education, training and experience, demonstrate appropriate knowledge in at least one of the main sub-disciplines of Petroleum Engineering, and have practised independently or under general direction as a Petroleum Engineer.

For details of the specific requirements to be met for this area of practice refer to the Petroleum Engineering Area of Practice Guidelines.

Pressure Equipment Design Verification

Pressure equipment design verification is the process which assures the integrity of the equipment for the stated design and operating conditions. As a minimum, this must ensure compliance with

the relevant equipment Standards as well as any additional requirements deemed necessary to ensure the equipment integrity. Design verification is not concerned with functionality but is concerned with the equipment safety.

The design verifier then issues a certificate of design verification which includes a brief description of the equipment, its relevant design and operating conditions, principal design parameters such as maximum pressure and temperature, safe working loads, limiting wind and seismic conditions and the fluid to be contained.

The certificate lists the document numbers of calculations, drawings and applicable design code(s), and includes a declaration that the verifier believes the equipment complies with the design specification and standards for the stated conditions, subject to any required modifications or observations.

Certification as a pressure equipment design verifier requires that applicants:

- have an acceptable qualification and sufficient experience **either** to satisfy the Australian Engineering Competency Standards for Professional Engineers at Stage 2 **or** to satisfy the Australian Engineering Competency Standards for Engineering Technologists at Stage 2 in the area of pressure equipment design and/or design verification
- practise as a pressure equipment design verifiers as a significant component of their professional employment or practice
- can show they have capability in the mandatory areas of competence and a satisfactory range of optional design verification competencies.

All applicants must show they have practised competently as design verifiers. They must demonstrate competencies consistent with AS/NZS 4481:1997 and other relevant standards. They can claim competency as a design verifier in respect of one or more of the following broad categories of pressure equipment:

a) Pressure vessels
b) Boilers
c) Pressure piping
d) Gas cylinders.

Subdivisional Geotechnics

The area of practice of Subdivisional Geotechnics applies specifically to work covered by AS 2870 Residential slabs and footings – construction and AS 3798 Guidelines on earthworks for commercial and residential development

This area of practice is for civil engineers whose practice includes geotechnical aspects of subdivisions and the foundations of buildings up to three storeys.

The area of practice applies to practitioners with experience in the design, specification and construction of foundations, earthworks, earth retaining structures and pavements relevant to subdivisions and low rise buildings.

Civil engineers applying for recognition in the area of practice of Subdivisional Geotechnics are also expected to possess an awareness of the effects and limitations of:

- land instability, mine subsidence, earthquakes, contamination and ground / structure interactions
- appropriate investigation and design methods that can be utilised
- influences of heavy and / or extensive loadings

- local geotechnical factors peculiar to the geological setting of an area or region
- risk / hazard classification
- cost implications of design solutions.

Recognition in the area of practice of Subdivisional Geotechnics **does not** imply the competence to work with:

- major geotechnical projects
- footings for high rise buildings
- excavations for mines and deep basements, heavy pile design and dewatering
- water retaining structures, rock slope engineering and embankment stability
- contaminated site investigation and rehabilitation
- stabilisation techniques and heavy duty pavements (e.g. runways)
- underground construction

Applicants are expected to be familiar with site investigation techniques, relevant codes of practice and Australian Standards and good construction practices and to demonstrate they have practised competently in the areas described in below.

Site Investigations

- Planning and undertaking appropriate site investigation
- Correctly interpreting test results
- Developing geotechnical models and design parameters

Design

- Taking account of design loadings, earth and water pressures
- Analysing stability, bearing capacity and displacements
- Specifying appropriate standards of compaction, batter slopes, erosion control measures and control of ground water effects

Construction

- Developing inspection and testing programs including audit of test results
- Verifying design assumptions during construction
- Responding appropriately to construction practices.