

# **CAREER GUIDE FOR ELECTRICAL ENGINEERS**

SOC Code: 17-2071

Pay Bands: 5 and 6 ([Salary Structure](#))

**Standard Occupational Description:** Design, develop, test, or supervise the manufacturing and installation of electrical equipment, components, or systems for commercial, industrial, military, or scientific use.

**Electrical Engineer positions in the Commonwealth are assigned to the following Roles in the [Architecture and Engineering Career Group](#):**

[Engineer I](#)

[Engineer II](#)

While Electrical Engineers within the Commonwealth are all located within the Architecture and Engineering Career Group, individuals may want to pursue other managerial opportunities within the Commonwealth depending upon individual training, education, knowledge, skills, abilities, and interests.

Other Career Group(s) that may be of interest are:

[General Administration](#)

[Program Administration](#)

[Engineering Technology](#)

[Electronics](#)

[Information Technology](#)

[Building Trades](#)

## **SKILLS, KNOWLEDGE, ABILITIES AND TASKS**

(Technical and Functional Expertise)

### **Skills**

**Note:** *The technical and functional skills listed below are based on general occupational qualifications for Electrical Engineers commonly recognized by most employers. Typically, you will not be required to have all of the skills listed to be a successful performer. Recruitment and selection standards for an individual state job must be based on the specific knowledge, skills, and abilities for that job as indicated in the job announcement and job description in the Employee Work Profile.*

### **Skills**

1. Giving full attention to what other people are saying, taking time to understand the points being made, asking questions as appropriate, and not interrupting at inappropriate times.
2. Determining causes of operating errors and deciding what to do about it.
3. Using logic and reasoning to identify the strengths and weaknesses of alternative solutions, conclusions or approaches to problems.
4. Understanding written sentences and paragraphs in work related documents.

5. Generating or adapting equipment and technology to serve user needs.
6. Identifying complex problems and reviewing related information to develop and evaluate options and implement solutions.
7. Understanding the implications of new information for both current and future problem-solving and decision-making.
8. Determining how a system should work and how changes in conditions, operations, and the environment will affect outcomes.
9. Considering the relative costs and benefits of potential actions to choose the most appropriate one.
10. Managing one's own time and the time of others.

## **Knowledge**

**Note:** *The technical and functional knowledge statements listed below are based on general occupational qualifications for Electrical Engineers commonly recognized by most employers. Typically, you will not be required to have all of the knowledge listed to be a successful performer. Recruitment and selection standards for an individual state job must be based on the specific knowledge, skills, and abilities for that job as indicated in the job announcement and job description in the Employee Work Profile.*

### **The Knowledge of:**

1. Practical application of engineering science and technology. This includes applying principles, techniques, procedures, and equipment to the design and production of various goods and services.
2. Circuit boards, processors, chips, electronic equipment, and computer hardware and software, including applications and programming.
3. Arithmetic, algebra, geometry, calculus, statistics, and their applications.
4. Structure and content of the English language including the meaning and spelling of words, rules of composition, and grammar
5. Design techniques, tools, and principles involved in production of precision technical plans, blueprints, drawings, and models
6. And prediction of physical principles, laws, their interrelationships, and applications to understanding fluid, material, and atmospheric dynamics, and mechanical, electrical, atomic and sub- atomic structures and processes.
7. Transmission, broadcasting, switching, control, and operation of telecommunications systems.
8. Raw materials, production processes, quality control, costs, and other techniques for maximizing the effective manufacture and distribution of goods.

## **Abilities**

**Note:** *The technical and functional abilities listed below are based on general occupational qualifications for Electrical Engineers commonly recognized by most employers. Typically, you will not be required to have all of the abilities listed to be a successful performer. Recruitment and selection standards for an individual state job must be based on the specific knowledge, skills, and abilities for that job as indicated in the job announcement and job description in the Employee Work Profile.*

### **The Ability to:**

1. Apply general rules to specific problems to produce answers that make sense.
2. See details at close range (within a few feet of the observer).
3. Tell when something is wrong or is likely to go wrong. It does not involve solving the problem, only recognizing there is a problem.

4. Arrange things or actions in a certain order or pattern according to a specific rule or set of rules (e.g., patterns of numbers, letters, words, pictures, mathematical operations).
5. Choose the right mathematical methods or formulas to solve a problem.
6. Communicate information and ideas in speaking so others will understand.
7. Imagine how something will look after it is moved around or when its parts are moved or rearranged.
8. Listen to and understand information and ideas presented through spoken words and sentences.
9. Speak clearly so others can understand you.
10. Read and understand information and ideas presented in writing.

## **Tasks**

1. Confer with engineers, customers, and others to discuss existing or potential engineering projects and products.
2. Design, implement, maintain, and improve electrical instruments, equipment, facilities, components, products, and systems for commercial, industrial, and domestic purposes.
3. Operate computer-assisted engineering and design software and equipment to perform engineering tasks.
4. Direct and coordinate manufacturing, construction, installation, maintenance, support, documentation, and testing activities to ensure compliance with specifications, codes, and customer requirements.
5. Perform detailed calculations to compute and establish manufacturing, construction, and installation standards and specifications.
6. Inspect completed installations and observe operations, to ensure conformance to design and equipment specifications and compliance with operational and safety standards.
7. Plan and implement research methodology and procedures to apply principles of electrical theory to engineering projects.
8. Prepare specifications for purchase of materials and equipment.
9. Supervise and train project team members as necessary.
10. Investigate and test vendors' and competitors' products.

## **INTERESTED?**

Like people, occupations have traits or characteristics. These characteristics give important clues about the nature of the work and work environment, and give you an opportunity to match your own personal interests to a specific occupation. When you choose a job in an occupation that matches your own interests you have taken an important step in planning a successful and rewarding career.

The electrical engineer occupation has the following characteristics:

**Investigative** — Investigative occupations frequently involve working with ideas, and require an extensive amount of thinking. These occupations can involve searching for facts and figuring out problems mentally.

**Realistic** — Realistic occupations frequently involve work activities that include practical, hands-on problems and solutions. They often deal with plants, animals, and real-world materials like wood, tools, and machinery. Many of the occupations require working outside, and do not involve a lot of paperwork or working closely with others.

## **LICENSURE, REGISTRATION, OR CERTIFICATION REQUIREMENTS**

Generally licensure is required for engineers or a licensed professional engineer must supervise unlicensed electrical engineer positions in state government.

Licensing information for professional engineers can be found on the Department of Professional & Occupational Regulations' web site at <http://www.dpor.virginia.gov/>

All 50 States and the District of Columbia require licensure for engineers who offer their services directly to the public. Engineers who are licensed are called Professional Engineers (PE). Recent graduates can start the licensing process by taking the examination in two stages. The initial Fundamentals of Engineering (FE) examination can be taken upon graduation. Engineers who pass this examination commonly are called Engineers in Training (EIT) or Engineer Interns (EI). After acquiring suitable work experience, EITs can take the second examination, the Principles and Practice of Engineering exam. Several States have imposed mandatory continuing education requirements for licensure.

Licensure and certification enhances professional development and career progression.

## **EDUCATIONAL, TRAINING, AND LEARNING OPPORTUNITIES**

The Department of Labor provides the following information:

Electrical and electronics engineers design, develop, test, and supervise the manufacture of electrical and electronic equipment. Some of this equipment includes broadcast and communications systems; electric motors, machinery controls, lighting, and wiring in buildings, automobiles, aircraft, and radar and navigation systems; and power generating, controlling, and transmission devices used by electric utilities. Many electrical and electronics engineers also work in areas closely related to computers.

Electrical and electronics engineers design new products, write performance requirements, and develop maintenance schedules. They also test equipment, solve operating problems, and estimate the time and cost of engineering projects.

A bachelor's in engineering is needed for almost all entry-level engineering jobs. College grads with a degree in a science or mathematics may get some jobs.

Getting into engineering school requires a strong report card in math and science, and courses in English, social studies, and computers.

In a typical college, the first 2 years are for studying math, science, engineering basics, the arts, and social sciences. In the last 2 years, most courses are in engineering, mostly in a single branch.

Engineers should be creative, curious, analytical, and detail-oriented. They should be able to work as part of a team. People skills are important. This is because engineers often work with people in a wide range of fields.

Engineers have a base of knowledge and training that can be applied in many fields. Electronics engineers, for example, work in the medical, computer, communications, and missile guidance fields. Because there are many separate problems to solve in a large engineering project, engineers in one field often work closely with specialists in other scientific, engineering, and business occupations.

The State Council of Higher Education (SCHEV) lists many Virginia educational institutions offering programs in engineering on their web site:  
<http://research.schev.edu/degreeinventory/inventory>

## **COMMONWEALTH COMPETENCIES**

Competencies are a set of identified behaviors, knowledge, skills, and abilities that directly and positively impact the success of employees and the organization. Competencies can be observed and measured. When consistently demonstrated, competencies make employees particularly effective in their work. Competencies help lay out a road map to career success. You can use the Commonwealth Competencies to help improve your individual performance by adopting behaviors that make high performing employees successful in their jobs. In this way, you can use the Commonwealth Competencies for your further professional development.

### **The Commonwealth Competencies are:**

1. Technical and Functional Expertise
2. Understanding the Business
3. Achieving Results
4. Serving the Customer
5. Teamwork
6. Interpersonal and Communication Skills
7. Leadership and Personal Effectiveness

The above competencies may be applied to employees throughout the Commonwealth of Virginia. They can be rank-ordered by agencies and hiring managers to represent the needs of a specific job. The rank ordering will change depending upon the occupation, an organization's priorities, the actual job requirements, and the supervisor's preferences.

Career success is both about what you do (applying your technical knowledge, skills, and ability) and how you do it (the consistent behaviors you demonstrate and choose to use) while interacting and communicating with others. Hopefully, by studying the Commonwealth competencies, identifying your developmental opportunities, and working to refine your own competence, you can take charge of your career!

For additional information about the **Commonwealth Competencies** go to:  
[http://jobs.state.va.us/cc\\_planningctr.htm](http://jobs.state.va.us/cc_planningctr.htm). For the competencies, we first list the competencies and then define each. Finally, we list competency indicators; to describe what successful performance looks like.

## **COMMONWEALTH CAREER PATH**

Career opportunities in the Commonwealth are not limited to moving “up” to the next highest role and pay band, changing positions, or to becoming a supervisor. That’s because most roles

describe a broad group of occupationally related positions that perform a range of work that requires increased knowledge and skills. For that reason, Commonwealth roles describe the career paths within the same or higher-level role for the same or different Career Group. The broad salary range and the Commonwealth's pay practices provide flexibility in recognizing career development and advancement. (Salary Structure)

For example:

Pay Band	Practitioner Role
5	Engineer I
6	Engineer II

Pay Band	Manager Role
5	Engineer Manager I
6	Engineer Manager II
7	Engineer Manager III
8	Engineer Manager IV

### Sample Career Path

#### Engineer I

The Engineer I role provides career tracks for electrical engineers whose expertise levels range from trainee to advanced level. Responsibilities include applying engineering principles and practices to projects of varying complexity in specialty areas.

#### Engineer II

The Engineer II role provides career tracks for electrical engineers that serve as an expert or first line supervisor. Duties include evaluating the plans and specifications for projects prepared by other engineers; or for applying related engineering principles and practices to complex, extensive and diversified engineering projects in specialty areas.

#### Engineering Manager I

The Engineering Manager I role provides career tracks for managers who manage various administrative, budgetary, planning, scheduling and technical activities related to multiple complex engineering projects or programs and the staff performing related functions. These functions draw upon knowledge of specialty engineering; capital outlay or other construction projects, transportation, water and wastewater projects or programs and health and safety related operations.

#### Engineering Manager II

The Engineering Manager II role provides career tracks for managers who manage, coordinate, and direct the activities of one or more specialized engineering program operations in their assigned geographic or divisional area. This includes budgetary, planning, scheduling, public relations, human resource functions, and technical activities related to a broad range of engineering, administrative and other projects or programs.

#### Engineering Manager III

The Engineering Manager III role provides career tracks for managers who direct the engineering, maintenance, administrative and other operations and programs of a defined geographic district. This role provides career tracks for managers who manage an agency's design and construction projects that involve multiple facilities with special requirements, such as security provisions and long-term development and evaluation of programs.

### **Engineering Manager IV**

The Engineering Manager IV role provides a career track for the executive manager who serves as the agency's chief engineer responsible for planning and directing large-scale, multi-division engineering operations with statewide scope. Directs areas such as structure and bridge, right of way and utilities, materials and construction. Interfaces with state and federal officials and executives on agency issues.

### **ADDITIONAL OCCUPATIONAL INFORMATION CAN BE FOUND AT:**

O\*NET (Occupational Information Network)

<http://online.onetcenter.org/>

Virginia Employment Commission

<http://www.alex.vec.state.va.us/>

Department of Professional & Occupation Regulation

<http://www.dpor.virginia.gov>

Career One Stop

<http://www.careeronestop.org/>

Virginia Career Resource Network

<http://www.vacrn.net/>

Institute of Electrical and Electronics Engineers

<http://www.ieee.org>

[Accreditation Board for Engineering and Technology, Inc.](http://www.abet.org)

[/help/exit?u=http%3A/www.abet.org/&t=Accreditation%20Board%20for%20Engineering%20and%20Technology%2C%20Inc.external site,](http://www.abet.org)

[American Society for Engineering Education](http://www.asee.org)

[/help/exit?u=http%3A/www.asee.org/&t=American%20Society%20for%20Engineering%20Educationexternal site,](http://www.asee.org)

[National Council of Examiners for Engineers and Surveying](http://www.ncees.org)

[/help/exit?u=http%3A/www.ncees.org/&t=National%20Council%20of%20Examiners%20for%20Engineers%20and%20Surveyingexternal site.](http://www.ncees.org)

[National Society of Professional Engineers](http://www.nspe.org)

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