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DICTIONARY OF OCCUPATIONAL TITLES (4th Ed., Rev. 1991) -- OCCUPATIONAL GROUP ARRANGEMENT

TITLE PAGE
HOW TO READ PARTS OF AN OCCUPATIONAL TITLE

0/1 PROFESSIONAL, TECHNICAL, AND MANAGERIAL OCCUPATIONS
001.061-010 to 024.364-010

This category includes occupations concerned with the theoretical or practical aspects of such fields of human endeavor as art, science, engineering, education, medicine, law, business relations, and administrative, managerial, and technical work. Most of these occupations require substantial educational preparation (usually at the university, junior college, or technical institute level).

00/01 OCCUPATIONS IN ARCHITECTURE, ENGINEERING, AND SURVEYING

This division includes occupations concerned with the practical application of physical laws and principles of engineering or architecture for the development and utilization of machines, materials, instruments, structures, processes, and services. Typical specializations are research, design, construction, testing, procurement, production, operations, and sales. Also includes preparation of drawings, specifications, and cost estimates, and participation in verification tests.

001 ARCHITECTURAL OCCUPATIONS

This group includes occupations concerned with the design and construction of buildings and related structures, or landscaping, and floating structures, according to aesthetic and functional factors.

001.061-010 ARCHITECT (profess. & kin.)

Researches, plans, designs, and administers building projects for clients, applying knowledge of design, construction procedures, zoning and building codes, and building materials: Consults with client to determine functional and spatial requirements of new structure or renovation, and prepares information regarding design, specifications, materials, color, equipment, estimated costs, and construction time. Plans layout of project and integrates engineering elements into unified design for client review and approval. Prepares scale drawings and contract documents for building contractors. Represents client in obtaining bids and awarding construction contracts. Administers construction contracts and conducts periodic on-site observation of work during construction to monitor compliance with plans. May prepare operating and maintenance manuals, studies, and reports. May use computer-assisted design software and equipment to prepare project designs and plans. May direct activities of workers engaged in preparing drawings and specification documents.
GOE: 05.01.07 STRENGTH: L GED: R6 M6 L6 SVP: 8 DLU: 81

001.061-014 ARCHITECT, MARINE (profess. & kin.) alternate titles: architect, naval; naval designer

Designs and oversees construction and repair of marine craft and floating structures, such as ships, barges, tugs, dredges, submarines, torpedoes, floats, and buoys: Studies design proposals and specifications to establish basic characteristics of craft, such as size, weight, speed, propulsion, armament, cargo, displacement, draft, crew and passenger complements, and fresh or salt water service. Oversees construction and testing of prototype in model basin and develops sectional and waterline curves of hull to establish center of gravity, ideal hull form, and buoyancy and stability data. Designs complete hull and superstructure according to specifications and test data, in conformity with standards of safety, efficiency, and economy. Designs layout of craft interior including cargo space, passenger compartments, ladder wells, and elevators. Confers with MARINE ENGINEERS (profess. & kin.) to establish arrangement of boiler room equipment and propulsion machinery, heating and ventilating systems, refrigeration equipment, piping, and other functional equipment. Evaluates performance of craft during dock and sea trials to determine design changes and conformance with national and international standards.
GOE: 05.01.07 STRENGTH: L GED: R6 M6 L6 SVP: 9 DLU: 77

001.061-018 LANDSCAPE ARCHITECT (profess. & kin.) alternate titles: community planner; environmental planner; land planner; site planner

Plans and designs development of land areas for projects, such as parks and other recreational facilities, airports, highways, and parkways, hospitals, schools, land subdivisions, and commercial, industrial, and residential sites: Confers with clients, engineering personnel, and ARCHITECTS (profess. & kin.) on overall program. Compiles and analyzes data on such site conditions as geographic location; soil, vegetation, and rock features; drainage; and location of structures for preparation of environmental impact report and development of landscaping plans. Prepares site plans, working drawings, specifications, and cost estimates for land development, showing ground contours, vegetation, locations of structures, and such facilities as roads, walks, parking areas, fences, walls, and utilities, coordinating arrangement of existing and proposed land features and structures. Inspects construction work in progress to ensure compliance with landscape specifications, to approve quality of materials and work, and to advise client and construction personnel on landscape features. May be designated according to project as Highway-Landscape Architect (profess. & kin.); Park-Landscape Architect (profess. & kin.).
GOE: 05.01.07 STRENGTH: L GED: R5 M5 L5 SVP: 8 DLU: 77

001.167-010 SCHOOL-PLANT CONSULTANT (education)

Formulates and enforces standards for construction and alteration of public school facilities throughout state: Develops legislation relative to school building sites and school design and construction. Guides school districts in development of long range comprehensive master plans, including such factors as site selection and expected population growth and mobility, and school finance and specifications. Coordinates activities, jurisdictions, and responsibilities of adjacent school districts and evaluates entire systems of schools. Provides technical information and advice to local school authorities considering construction or renovation of school plant. Inspects proposed sites and schools under construction or undergoing alteration to enforce applicable standards. Prepares suggested classroom plans and layouts, taking into consideration such factors as climate, construction costs, availability of materials, and accepted principles of institutional construction. Reviews plans for construction and renovation of school buildings and approves or disapproves plans in accordance with standards and policies of department. Confers with representatives of school boards, educators, and architects to explain and reach agreement on design concepts and construction standards. Arbitrates difficult and unusual construction disputes. Conducts special research studies concerned with lighting, heating, ventilation, air-conditioning, and acoustics. Prepares reports for state education department and state legislature.
GOE: 05.01.08 STRENGTH: S GED: R5 M5 L5 SVP: 6 DLU: 77

001.261-010 DRAFTER, ARCHITECTURAL (profess. & kin.)

Prepares detailed drawings of architectural designs and plans for buildings, according to specifications, sketches, and rough drafts provided by ARCHITECT (profess. & kin.) 001.061-010: Draws rough and detailed sketches, drawings, and plans to scale [DRAFTER (profess. & kin.) Master Title].
GOE: 05.03.02 STRENGTH: S GED: R4 M4 L4 SVP: 7 DLU: 81

001.261-014 DRAFTER, LANDSCAPE (profess. & kin.)

Prepares detailed scale drawings and tracings from rough sketches or other data provided by LANDSCAPE ARCHITECT (profess. & kin.), performing duties described under DRAFTER (profess. & kin.) Master Title. May prepare separate detailed site plan, grading and drainage plan, lighting plan, paving plan, irrigation plan, planting plan, and drawings and detail of garden structures. May build models of proposed landscape construction and prepare colored drawings for presentation to client.
GOE: 05.03.02 STRENGTH: S GED: R4 M4 L3 SVP: 7 DLU: 77

002 AERONAUTICAL ENGINEERING OCCUPATIONS

This group includes occupations concerned with design and development of aircraft, space vehicles, surface effect vehicles, missiles, weapons, and related systems. Accessory techniques needed are those found in electronic and electrical engineering, mechanical and electromechanical engineering, metallurgy, propulsion systems design, ordnance engineering, and human factors and test engineering.

002.061-010 AERODYNAMICIST (aircraft mfg.) alternate titles: aerodynamics engineer; aerophysics engineer

Plans and conducts analysis of aerodynamic, thermodynamic, aerothermodynamic, and aerophysics concepts, systems, and designs to resolve problems and determine suitability and application to aircraft and aerospace products: Establishes computational methods and computer input data for analyzing problems. Analyzes designs and develops configurations to ensure satisfactory static and dynamic stability and control characteristics for completed vehicle. Initiates and assists in formulating and evaluating laboratory, flight, and wind tunnel test programs, and prepares reports and conclusions for other engineering and design personnel. Coordinates activities of model design group and model shop to assure required configuration of wind tunnel models. Prepares air load data on vehicle to conform to aerodynamic requirements. May prepare reports on results of analyses, such as flight performance validation, aircraft configuration, trade studies, and aircraft certification. May confer with customer on performance problems during operational life of vehicle. May specialize in analysis of thermodynamic effects and be designated Thermodynamics Engineer (aircraft mfg.).
GOE: 05.01.01 STRENGTH: L GED: R6 M6 L6 SVP: 8 DLU: 88

002.061-014 AERONAUTICAL ENGINEER (aircraft mfg.)

Designs, develops, and tests aircraft, space vehicles, surface effect vehicles, missiles, and related component systems, applying engineering principles and techniques: Designs and develops commercial, military, executive, general aviation, or special purpose aircraft, space vehicles, satellites, missiles, or related hardware or systems. Tests models, prototypes, subassemblies, or production vehicles to study and evaluate operational characteristics and effects of stress imposed during actual or simulated flight conditions. May specialize in design and development of structural components, such as wings, fuselage, rib assemblies, landing gear, or operational control systems. May specialize in analytical programs concerned with ground or flight testing, or development of acoustic, thermodynamic, or propulsion systems. May assist in planning technical phases of air transportation systems or other aspects of flight operations, maintenance, or logistics.
GOE: 05.01.07 STRENGTH: L GED: R6 M6 L6 SVP: 8 DLU: 86

002.061-018 AERONAUTICAL TEST ENGINEER (aircraft mfg.)

Conducts testing activities on aerospace and aircraft products, performing duties as described under TEST ENGINEER (profess. & kin.) Master Title.
GOE: 05.01.04 STRENGTH: L GED: R5 M5 L5 SVP: 8 DLU: 88

002.061-022 AERONAUTICAL-DESIGN ENGINEER (aircraft mfg.)

Develops basic design concepts used in design, development, and production of aeronautical and aerospace products and systems, performing duties as described under DESIGN ENGINEER, PRODUCTS (profess. & kin.) Master Title.
GOE: 05.01.07 STRENGTH: S GED: R5 M5 L5 SVP: 8 DLU: 88

002.061-026 AERONAUTICAL-RESEARCH ENGINEER (aircraft mfg.)

Conducts research in field of aeronautics, performing duties as described under RESEARCH ENGINEER (profess. & kin.) Master Title.
GOE: 05.01.01 STRENGTH: L GED: R6 M6 L6 SVP: 8 DLU: 88

002.061-030 STRESS ANALYST (aircraft mfg.)

Conducts stress analyses on designs of experimental, prototype, or production aircraft, space vehicles, surface effect vehicles, missiles, and related components to evaluate ability to withstand stresses imposed during flight or ground operations: Analyzes ability of structural components to withstand stresses imposed by static, dynamic, or thermal loads, due to operational or test conditions. Studies preliminary specifications and design requirements to determine strength and bending characteristics of parts, assemblies, and total airframe. Consults with design personnel regarding results of analyses and need for additional analysis, testing, or design modifications. Formulates $T3mathematical model$T1 of stress problem or devises other methods of computer analysis or simulation to assist in stress analysis.
GOE: 05.01.04 STRENGTH: S GED: R5 M5 L5 SVP: 8 DLU: 88

002.151-010 SALES ENGINEER, AERONAUTICAL PRODUCTS (aircraft mfg.)

Sells aeronautical products and provides customers with technical engineering services as described under SALES ENGINEER (profess. & kin.) Master Title.
GOE: 05.01.05 STRENGTH: L GED: R5 M5 L5 SVP: 8 DLU: 89

002.167-010 VALUE ENGINEER (aircraft mfg.) alternate titles: cost development engineer; design specialist, producibility, cost and component technology

Plans and coordinates engineering activities to develop and apply standardized design criteria and production requirements for parts and equipment used in aircraft and aerospace vehicles: Establishes and maintains liaison between engineering and other departments to formulate and apply design criteria and production requirements for proposed products. Analyzes product design data to determine conformance to established design selection criteria, use of standardized parts and equipment, and design-to-cost ratio. Approves initial design or recommends modifications based on producibility, cost, and component technology factors. Coordinates testing of new parts and equipment, evaluates test results, and approves or rejects usage of parts and equipment based on test results. Evaluates and approves selection of vendors. Initiates and provides technical direction for research and development programs to enhance production methods, improve parts and equipment technology, and reduce costs. Develops methods and programs to predict, track, and report production costs during design development.
GOE: 05.01.06 STRENGTH: S GED: R6 M5 L6 SVP: 8 DLU: 89

002.167-014 FIELD-SERVICE ENGINEER (aircraft mfg.)

Plans and coordinates activities concerned with investigating and resolving customer reports of technical problems with aircraft or aerospace vehicles and eliminating future operational or service difficulties: Reviews performance reports and documentation from customers and field representatives, and inspects malfunctioning or damaged product to determine nature and scope of problem. Analyzes review and inspection findings to determine source of problem, and recommends repair, replacement, or other corrective action. Coordinates problem resolution with engineering, customer service, and other personnel to expedite repairs. Maintains records of performance reports. Analyzes reports of technical problems to determine trends affecting future design, production, service, and maintenance processes, and recommends modifications to eliminate future problems. May prepare service handbooks and bulletins based on field investigations, engineering changes, and overall knowledge of product. May provide on-site technical assistance to oversee repairs.
GOE: 05.01.04 STRENGTH: L GED: R5 M5 L5 SVP: 8 DLU: 89

002.167-018 AERONAUTICAL PROJECT ENGINEER (aircraft mfg.) alternate titles: aerospace project engineer

Directs and coordinates activities of personnel engaged in designing mechanisms, structures, systems, and equipment for aeronautical or aerospace products, applying knowledge of engineering theory and technology: Reviews and evaluates product request from customer, and formulates conceptual design to meet customer requirements. Analyzes project proposal to determine feasibility, producibility, cost, and production time, and discusses proposal with customer representatives, engineers, and other personnel. Assigns project personnel to specific aspects or phases of project, such as analysis, development, or design. Evaluates product design for conformance to engineering principles, customer requirements, quality standards, and specifications. Evaluates and approves design changes and drawing releases. Coordinates design, production, testing, and related activities. Consults with project personnel and others to provide technical assistance and information.
GOE: 05.01.08 STRENGTH: L GED: R6 M6 L6 SVP: 9 DLU: 88

002.261-010 DRAFTER, AERONAUTICAL (aircraft mfg.)

Drafts engineering drawings of developmental or production airplanes, missiles, and component and ancillary equipment, including launch mechanisms and scale models of prototype aircraft, as planned by AERONAUTICAL ENGINEER (aircraft mfg.) 002.061-014. Performs other duties as described under DRAFTER (profess. & kin.) Master Title.
GOE: 05.03.02 STRENGTH: S GED: R5 M5 L4 SVP: 7 DLU: 87

002.261-014 RESEARCH MECHANIC (aircraft mfg.) alternate titles: laboratory test mechanic

Lays out, fabricates, assembles, and tests mechanical, electromechanical, structural, hydraulic, and pneumatic aircraft parts, assemblies, and mechanisms to assist engineers in determining faulty design or fabrication procedures: Lays out, fabricates, and assembles parts, assemblies, and mechanisms to be tested, according to blueprints, specifications, sketches, templates, or verbal instructions. Installs test specimens, such as rib assemblies, struts, landing gears, valves, ducts, fuselage sections, and control surfaces, in test equipment, and connects wiring, tubing, couplings, and power sources, using handtools and power tools. Operates test equipment to gather data on performance of parts, assemblies, and mechanisms under simulated flight and operational conditions. Measures induced variations from normal, using precision instruments, such as micrometers, verniers, calipers, pressure gauges, flowmeters, strain gauges, and dynamometers. Records and interprets test data. Confers with engineering personnel regarding test procedures and test results. Fabricates and assembles test equipment, tooling, shop aids, or other devices for experimental test projects.
GOE: 05.01.04 STRENGTH: M GED: R4 M4 L4 SVP: 7 DLU: 87

002.262-010 FLIGHT-TEST DATA ACQUISITION TECHNICIAN (aircraft mfg.) alternate titles: data acquisition laboratory technician; technical aide, flight test data

Sets up, operates, monitors, modifies, calibrates, and maintains computer systems and devices for acquisition and analysis of flight test data, utilizing knowledge of electronic theory and operation of computer systems: Reviews engineering notification of flight test to determine data required for post-flight analysis. Plans method and sequence of operations to acquire data, and sets up required electronic data acquisition, test, and measurement equipment and accessories. Inputs flight test data and program information into computer console for specific test requested. Enters commands to modify program to accommodate additional or revised test requirements. Calculates calibration values used as model for comparison and measurement of test data. Monitors lights, displays, and other operating features of computer equipment, such as console, receivers, and printers, to detect malfunctions and ensure integrity of processed data. Diagnoses cause of equipment malfunctioning, and adjusts, repairs, or replaces faulty components. Enters information to update flight test data base and to maintain records, such as electronic parts inventory and manuals for equipment maintenance and calibrations. Discusses flight test requirements and results with engineers and other personnel.
GOE: 05.03.05 STRENGTH: L GED: R5 M4 L4 SVP: 7 DLU: 89

003 ELECTRICAL/ELECTRONICS ENGINEERING OCCUPATIONS

This group includes occupations concerned with the application of the laws of electrical energy and the principles of engineering for the generation, transmission, and use of electricity. Also includes the design and development of machinery and equipment for production and utilization of electric power. Accessory techniques needed are those used in mechanical and process engineering. Typical specializations are electrical power generation, transmission, and distribution, atomic power generation, electrical and electronic components, equipment, and systems manufacturing, radio and television broadcasting, telephone, telegraph, and electronic computer engineering, and bioengineering.

003.061-010 ELECTRICAL ENGINEER (profess. & kin.)

Researches, develops, designs, and tests electrical components, equipment, and systems, applying principles and techniques of electrical engineering: Designs electrical equipment, facilities, components, products, and systems for commercial, industrial, and domestic purposes [DESIGN ENGINEER, FACILITIES (profess. & kin.) Master Title; DESIGN ENGINEER, PRODUCTS (profess. & kin.) Master Title]. Designs and directs engineering personnel in fabrication of test control apparatus and equipment, and determines methods, procedures, and conditions for testing products [TEST ENGINEER (profess. & kin.) Master Title]. Develops applications of controls, instruments, and systems for new commercial, domestic, and industrial uses. Directs activities to ensure that manufacturing, construction, installation, and operational testing conform to functional specifications and customer requirements. May direct and coordinate operation, maintenance, and repair of equipment and systems in field installations. May specialize in specific area of discipline, such as electrical energy generation, transmission, and distribution systems; products, such as appliances, generators, transformers, control devices, and relays; or area of work, such as manufacturing, applications, or installation. May use computer-assisted engineering and design software and equipment to perform engineering tasks.
GOE: 05.01.08 STRENGTH: L GED: R5 M5 L5 SVP: 8 DLU: 88

003.061-014 ELECTRICAL TEST ENGINEER (profess. & kin.)

Conducts tests on electrical equipment and systems, performing duties as described under TEST ENGINEER (profess. & kin.) Master Title.
GOE: 05.01.04 STRENGTH: L GED: R5 M5 L5 SVP: 8 DLU: 77

003.061-018 ELECTRICAL-DESIGN ENGINEER (profess. & kin.)

Designs electrical equipment and products, performing duties as described under DESIGN ENGINEER, FACILITIES (profess. & kin.) Master Title; DESIGN ENGINEER, PRODUCTS (profess. & kin.) Master Title.

GOE: 05.01.07 STRENGTH: L GED: R5 M5 L5 SVP: 8 DLU: 77

003.061-022 ELECTRICAL-PROSPECTING ENGINEER (profess. & kin.) alternate titles: electrical engineer, geophysical prospecting

Designs and develops electrical and electronic instruments and equipment used in petroleum prospecting with the seismograph, magnetometer, or other instruments which detect and measure various physical properties of the earth's crust.
GOE: 05.01.07 STRENGTH: S GED: R6 M6 L6 SVP: 8 DLU: 77

003.061-026 ELECTRICAL-RESEARCH ENGINEER (profess. & kin.)

Conducts research in various fields of electrical phenomena performing duties as described under RESEARCH ENGINEER (profess. & kin.) Master Title.
GOE: 05.01.01 STRENGTH: L GED: R5 M5 L5 SVP: 8 DLU: 77

003.061-030 ELECTRONICS ENGINEER (profess. & kin.)

Researches, develops, designs, and tests electronic components, products, and systems for commercial, industrial, medical, military, and scientific applications, applying principles and techniques of electronic engineering: Designs electronic circuits, components and integrated systems, utilizing ferroelectric, nonlinear, dielectric, phosphorescent, photo-conductive, and thermoelectric properties of materials [DESIGN ENGINEER, PRODUCTS (profess. & kin.) Master Title]. Designs test control apparatus and equipment, determines procedures for testing products [TEST ENGINEER (profess. & kin.) Master Title], and directs engineering personnel in fabrication of test control apparatus and equipment. Develops new applications of conductive properties of metallic and nonmetallic materials used in components, and in application of components to products or systems. May direct field operations and maintenance of electronic installations. May evaluate operational systems and recommend design modifications to eliminate causes of malfunctions or changes in system requirements. May specialize in development of electronic principles and technology in fields, such as telecommunications, telemetry, aerospace guidance, missile propulsion control, counter-measures, acoustics, nucleonic instrumentation, industrial controls and measurements, high-frequency heating, computers, radiation detection, encephalography, electron optics, and biomedical research. May use computer-assisted engineering and design software and equipment to perform engineering tasks.
GOE: 05.01.08 STRENGTH: L GED: R5 M5 L5 SVP: 8 DLU: 88

003.061-034 ELECTRONICS-DESIGN ENGINEER (profess. & kin.)

Designs and develops electronic components, equipment, systems, and products, applying knowledge and principles of electronic theory, design, and engineering. Performs duties as described under DESIGN ENGINEER, PRODUCTS (profess. & kin.) Master Title. May use computer-assisted engineering and design software and equipment to formulate and test electronic designs.
GOE: 05.01.07 STRENGTH: L GED: R5 M5 L5 SVP: 8 DLU: 89

003.061-038 ELECTRONICS-RESEARCH ENGINEER (profess. & kin.)

Conducts research on electronic phenomena, performing duties as described under RESEARCH ENGINEER (profess. & kin.) Master Title.
GOE: 05.01.01 STRENGTH: L GED: R5 M5 L5 SVP: 8 DLU: 77

003.061-042 ELECTRONICS-TEST ENGINEER (profess. & kin.)

Plans, develops, and conducts tests on electronic components, products, and systems, applying knowledge and principles of electronic theory, testing methodology and procedures, and electronic engineering. Performs duties described under TEST ENGINEER (profess. & kin.) Master Title. May develop or use computer software and hardware to conduct tests on electronic products and systems.
GOE: 05.01.04 STRENGTH: L GED: R5 M5 L5 SVP: 8 DLU: 87

003.061-046 ILLUMINATING ENGINEER (profess. & kin.)

Designs and directs installation of illuminating equipment and systems for buildings, plants, streets, stadia, tunnels, and outdoor displays: Studies lighting requirements of client to determine lighting equipment and arrangement of lamps that will provide optimum illumination with economy of installation and operation. Designs lamps of required light intensity and output, light control reflectors and lenses, and lamp arrangement required to meet illuminating standards. Plans and prepares drawings for installation of lighting system in accordance with client's specifications and municipal codes. Directs installation of system to ensure conformance with engineering specifications and compliance with electrical codes. May be designated according to type or location of illumination system designed and installed as Building-Illuminating Engineer (profess. & kin.); Industrial-Illuminating Engineer (profess. & kin.); Outdoor-Illuminating Engineer (profess. & kin.).
GOE: 05.01.03 STRENGTH: S GED: R5 M5 L5 SVP: 8 DLU: 77

003.061-050 PLANNING ENGINEER, CENTRAL OFFICE FACILITIES (tel. & tel.)

Conducts studies to develop data required for planning central office switching facilities, and prepares plans and schedules for acquisition and installation of equipment to meet long term and current relief requirements: Conducts studies to accumulate information on current services, equipment capacities, current traffic data and estimated acquisition and installation costs. Analyzes data and forecasts on subscriber demands and projected traffic to determine type, size, and quantity of switching equipment required. Plans and schedules equipment acquisition, and installation, considering such factors as availability, current and future costs, and other economic projections. Reviews implementation schedules on continuing basis to ensure switching facilities have capacity within objective limits for subscriber demands. Prepares modifications on implementation schedules for acquisition and installation of switching equipment due to unforeseen increase or decrease of demands for services.
GOE: 05.01.03 STRENGTH: S GED: R6 M6 L6 SVP: 8 DLU: 77

003.131-010 SUPERVISOR, DRAFTING AND PRINTED CIRCUIT DESIGN (profess. & kin.)

Supervises and coordinates activities of workers engaged in drafting and designing layouts of printed circuit boards (PCB's) for use in manufacture of electronic equipment: Confers with PCB vendors to resolve problems encountered with board design. Reviews cost quotations for equipment and attends demonstrations to select equipment for purchase. Requisitions supplies, such as film positives. May design or change design of layout for PCB's [DRAFTER (profess. & kin.) Master Title]. Performs duties as described under SUPERVISOR (any industry) Master Title.
GOE: 05.03.02 STRENGTH: S GED: R4 M4 L4 SVP: 8 DLU: 86

003.151-010 SALES-ENGINEER, ELECTRICAL PRODUCTS (profess. & kin.)

Sells electrical products, power, and systems and provides technical services to clients, performing duties as described under SALES ENGINEER (profess. & kin.) Master Title.
GOE: 05.01.05 STRENGTH: L GED: R5 M5 L5 SVP: 8 DLU: 77

003.151-014 SALES-ENGINEER, ELECTRONICS PRODUCTS AND SYSTEMS (profess. & kin.)

Sells electronic products and systems and provides technical services to clients, performing duties as described under SALES ENGINEER (profess. & kin.) Master Title.
GOE: 05.01.05 STRENGTH: L GED: R5 M5 L5 SVP: 8 DLU: 77

003.161-010 ELECTRICAL TECHNICIAN (profess. & kin.) alternate titles: electrical-laboratory technician

Applies electrical theory and related knowledge to test and modify developmental or operational electrical machinery and electrical control equipment and circuitry in industrial or commercial plants and laboratories: Assembles and tests experimental motor-control devices, switch panels, transformers, generator windings, solenoids, and other electrical equipment and components according to engineering data and knowledge of electrical principles. Modifies electrical prototypes to correct functional deviations under direction of ELECTRICAL ENGINEER (profess. & kin.). Diagnoses cause of electrical or mechanical malfunction or failure of operational equipment and performs preventative and corrective maintenance. Develops wiring diagrams, layout drawings, and engineering specifications for system or equipment modifications or expansion, and directs personnel performing routine installation and maintenance duties. Plans, directs, and records periodic electrical testing, and recommends or initiates modification or replacement of equipment which fails to meet acceptable operating standards.
GOE: 05.01.01 STRENGTH: L GED: R4 M4 L4 SVP: 7 DLU: 77

003.161-014 ELECTRONICS TECHNICIAN (profess. & kin.)

Lays out, builds, tests, troubleshoots, repairs and modifies developmental and production electronic components, parts, equipment, and systems, such as computer equipment, missile control instrumentation, electron tubes, test equipment, and machine tool numerical controls, applying principles and theories of electronics, electrical circuitry, engineering mathematics, electronic and electrical testing, and physics: Discusses layout and assembly procedures and problems with ELECTRONICS ENGINEER (profess. & kin.) 003.061-030 and draws sketches to clarify design details and functional criteria of electronic units. Assembles experimental circuitry (breadboard) or complete prototype model according to engineering instructions, technical manuals, and knowledge of electronic systems and components. Recommends changes in circuitry or installation specifications to simplify assembly and maintenance. Sets up standard test apparatus or devises test equipment and circuitry to conduct functional, operational, environmental, and life tests to evaluate performance and reliability of prototype or production model. Analyzes and interprets test data. Adjusts, calibrates, aligns, and modifies circuitry and components and records effects on unit performance. Writes technical reports and develops charts, graphs, and schematics to describe and illustrate system's operating characteristics, malfunctions, deviations from design specifications, and functional limitations for consideration by engineers in broader determinations affecting system design and laboratory procedures. May operate bench lathes, drills, or other machine tools to fabricate parts, such as coils, terminal boards, and chassis. May check functioning of newly installed equipment in aircraft, ships, and structures to evaluate system performance under actual operating conditions. May instruct and supervise other technical personnel. May be designated according to specialization in electronic applications as Computer-Laboratory Technician (profess. & kin.); Development-Instrumentation Technician (profess. & kin.); Electronic-Communications Technician (profess. & kin); Electronics Technician, Nuclear Reactor (profess. & kin); Experimental Electronics Developer (aircraft mfg.); Systems-Testing-Laboratory Technician (profess. & kin.).
GOE: 05.01.01 STRENGTH: L GED: R5 M5 L4 SVP: 7 DLU: 88

003.161-018 TECHNICIAN, SEMICONDUCTOR DEVELOPMENT (profess. & kin.)

Tests developmental semiconductor devices or sample production units, and evaluates test equipment to develop data for engineering evaluation of new designs or special production yield study, applying knowledge of electronic theory and test equipment operating principles: Designs basic circuitry and prepares rough sketches for design documentation as directed by engineers, using drafting instruments and computer-assisted design/drafting equipment. Evaluates, calibrates, and tests new equipment circuits and fixtures, using testing equipment, such as oscilloscopes, logic and test probes, and calibrators. Builds and modifies electronic components, using handtools and power tools. Assists engineers in development of testing techniques and laboratory equipment. Assists with equipment maintenance. Liaises between test project sites to ensure orderly flow of information and materials. May supervise other technicians in unit.
GOE: 05.01.01 STRENGTH: L GED: R5 M5 L4 SVP: 8 DLU: 86

003.167-010 CABLE ENGINEER, OUTSIDE PLANT (tel. & tel.)

Plans, directs, and coordinates activities concerned with laying and repairing submarine telecommunication cables: Devises plans for laying cable lines, taking into consideration ocean currents and ocean depths. Determines where and how cables should be laid and decides such matters as where to place buoys, where to cut cable, what grapnel to use, what length of rope to use for a given depth, what type of cable to use, and what route to follow. Keeps charts and records to show depth and location of all cables laid. Analyzes test figures made when cable fault occurs to determine exact location of cable break. Oversees work of locating and repairing damaged cables.
GOE: 05.01.03 STRENGTH: L GED: R5 M5 L5 SVP: 8 DLU: 77

003.167-014 DISTRIBUTION-FIELD ENGINEER (utilities) alternate titles: line inspector

Plans and outlines changes in power distribution facilities to overcome unsatisfactory conditions, such as overloaded or underloaded circuits, and to provide for new or anticipated load increases: Reviews complaints and reports of load requirements for area under question to determine nature of adjustment to be made. Makes field surveys or studies maps showing relays, line intersections, overhead and underground connections, feeder lines, and other component elements of power system area under observation to ascertain where changes can be made. Makes calculations, following standardized procedures, to determine amount and type of replacing, switching, or other system revisions necessary to improve service. Recommends installation of additional facilities if changes within existing system cannot meet increased load. Makes notes and sketches of proposed changes and refers sketch to DRAFTER, CARTOGRAPHIC (profess. & kin.) for detailed work drawings. May investigate low voltage complaints by visiting area and determining if excessive load or power leakage causes defect.
GOE: 05.01.03 STRENGTH: L GED: R5 M5 L5 SVP: 8 DLU: 77

003.167-018 ELECTRICAL ENGINEER, POWER SYSTEM (utilities) alternate titles: power engineer

Designs power system facilities and equipment and coordinates construction, operation, and maintenance of electric power generating, receiving, and distribution stations, transmission lines, and distribution systems and equipment: Designs and plans layout of generating plants, transmission and distribution lines, and receiving and distribution stations. Directs preparation of, or prepares drawings and specific type of equipment and materials to be used, in construction and equipment installation. Estimates labor, material, construction, and equipment costs. Inspects completed installations for conformance with design and equipment specifications and safety standards. Observes operation of installation for conformance with operational standards. Coordinates operation and maintenance activities to ensure optimum utilization of power system facilities and meet customer demands for electrical energy. May compile power rates and direct others in evaluating properties and developing utilities in new territories. May be designated according to type of engineering functions as Engineer, Design-And-Construction (utilities); Engineer, Operations-And-Maintenance (utilities).
GOE: 05.01.03 STRENGTH: L GED: R6 M6 L6 SVP: 8 DLU: 77

003.167-022 ELECTROLYSIS-AND-CORROSION-CONTROL ENGINEER (profess. & kin.) alternate titles: corrosion-control specialist; corrosion engineer; electrolysis engineer; electrolysis investigator

Investigates causes and devises means to combat or eliminate electrolysis of water, gas, and oil mains and pipelines resulting from stray electric currents flowing in earth: Determines existence and locates sources of stray electric currents creating electrolytic conditions, using voltmeters, ammeters, and other electrical testing apparatus. Recommends preventive and corrective measures for protection of pipe and underground structures, such as use of insulating and corrosion resisting materials. Confers with power company personnel and power consumers and suggests methods to eliminate sources of power leakage. Studies destructive properties of soil, corrosive actions, and other problems of deterioration, and suggests methods of preventing or mitigating trouble. Writes reports of studies and investigations conducted.

May design and direct installation of cathodic protection stations to minimize and control electrolysis. May design and construct apparatus for use in testing materials or determining location of stray electric currents.
GOE: 05.01.03 STRENGTH: L GED: R5 M5 L5 SVP: 8 DLU: 77

003.167-026 ENGINEER OF SYSTEM DEVELOPMENT (utilities) alternate titles: development-and-planning engineer; planning engineer; system-planning engineer

Plans and coordinates activities to provide for orderly development and improve operating efficiency of electric power system: Coordinates scheduling, conducting, and analysis of special studies, such as commercial and residential developments in surrounding territory, population estimates, and advantages of and facilities for interconnections with other power systems. Coordinates collection and analysis of operational data, such as system-load demands and generating capacity. Evaluates analyses and recommends additional facilities to meet requirements of new, increased, or future loads, or to improve system.
GOE: 05.01.03 STRENGTH: S GED: R5 M5 L5 SVP: 8 DLU: 77

003.167-030 ENGINEER-IN-CHARGE, STUDIO OPERATIONS (radio-tv broad.) alternate titles: chief engineer; chief engineer, broadcasting operations; transmission engineer

Directs and coordinates radio or television station activities concerned with acquisition, installation, and maintenance, or with modification of studio broadcasting equipment: Evaluates studio needs for new broadcasting equipment to determine if acquisition would be justified considering such factors as cost, availability, and improvement gain in technical performance, and authorizes acquisition according to evaluation. Directs activities concerned with layout and design of electrical circuitry for acquired equipment to ensure conformance with codes and safety regulations. Establishes procedures for operation and maintenance of studio, remote control, and microwave transmission equipment. Inspects, and directs testing and maintenance of studio, remote, and airborne broadcasting equipment to ensure operational performance meets company standards and rules and regulations of Federal Communications Commission. Develops modification plans for existing broadcasting equipment to improve technical performance. Directs modification and testing of equipment to ensure operational performance meets specified standards. Prepares repair and maintenance schedules for studio, remote, and airborne broadcasting equipment to prevent interruption of broadcasts. Contacts telephone company personnel to ensure leased landlines or microwave facilities are operative and available for network broadcasting [COMMERCIAL ENGINEER (radio-tv broad.) 003.187-014]. Prepares annual budget for engineering department and controls expenditures within budget limitations. May direct and coordinate activities of transmitter personnel [ENGINEER-IN-CHARGE, TRANSMITTER (radio-tv broad.) 003.167-034]. May operate and maintain transmitter equipment to broadcast radio and television programs [TRANSMITTER OPERATOR (radio-tv broad.) 193.262-038]. May inspect and direct repair and maintenance of unmanned stations. Must hold First Class Radiotelephone License issued by FCC.
GOE: 05.01.03 STRENGTH: L GED: R5 M5 L5 SVP: 8 DLU: 89

003.167-034 ENGINEER-IN-CHARGE, TRANSMITTER (radio-tv broad.) alternate titles: director of engineering; engineer, chief; transmitter engineer

Directs and coordinates operation and maintenance activities of radio, television broadcasting, or satellite uplink transmitter station in accordance with rules and regulations of Federal Communications Commission: Establishes procedures and standards for operation and maintenance of transmitter equipment. Trains workers to interpret readings and indicator lights on control console and picture on video monitor, and to determine operating adjustments required to obtain uniform audio sound level and video picture of specified clarity and color. Tunes or directs worker to tune transmitter to ensure signal emissions and radiation do not infringe on frequencies or broadcast area of other stations, and to obtain optimum operational performance of transmitting equipment. Trains workers in diagnosing causes of transmitter malfunctions, using test equipment, and in repairing or jury-rigging equipment (making temporary hookup) to return transmitter to operational status. Establishes procedures for testing of transmitter equipment, performance of preventative maintenance activities, and operation of equipment during test of Emergency Broadcast System. Develops, plans, and prepares schematic drawings designed to modify and improve existing transmitter equipment, and directs and coordinates equipment modification activities to prevent interruptions in transmitting operations. Prepares work schedules for TRANSMITTER OPERATORS (radio-tv broad.) 193.262-038. May remove and repair, or assist workers to remove and repair equipment, using handtools, such as screwdrivers, wrenches, and pliers. Must hold first class radiotelephone license issued by Federal Communications Commission.
GOE: 05.01.03 STRENGTH: M GED: R5 M5 L5 SVP: 8 DLU: 89

003.167-038 INDUCTION-COORDINATION POWER ENGINEER (utilities)

Investigates and eliminates inductive interference by power transmission systems in telephones and radio receivers: Conducts technical investigations relating to inductive-coordination problems, including joint field investigations with engineers of communications and railroad companies. Checks proposed parallels between power and communications circuits and recommends installation of facilities to eliminate or reduce inductive interference. Consults with transmission and distribution line engineers on design of lines for prevention or reduction of radio interference. Conducts research in detection and elimination of the causes of radio noises in transmission systems. Assists municipalities on problems related to control equipment for alarm systems.
GOE: 05.01.03 STRENGTH: L GED: R5 M5 L5 SVP: 8 DLU: 77

003.167-042 OUTSIDE-PLANT ENGINEER (tel. & tel.)

Plans and prepares drawings for construction of new, and removal or rearrangement of existing, overhead or underground lines, cables, and conduits to obtain optimum and economical utilization of communications facilities: Analyzes traffic loads, available and existing lines, and estimates or forecasts of projected traffic to determine new construction or rearrangements and removals required. Selects routing of lines and equipment required for work projects. Prepares detailed construction and installation drawings, estimates equipment, labor, and material costs. Initiates work authorization request and submits request with substantiating drawings and documents to management for approval. Orders materials and equipment required and directs work activities to ensure conformance with engineering specifications and work authorization.
GOE: 05.01.03 STRENGTH: L GED: R5 M5 L5 SVP: 8 DLU: 77

003.167-046 POWER-DISTRIBUTION ENGINEER (utilities) alternate titles: electric-distribution engineer

Plans construction and coordinates operation of facilities for transmitting power from distribution points to consumers: Lays out substations and overhead and underground lines in urban and rural areas. Prepares specifications and estimates costs. Makes complex electrical computations to determine type and arrangement of circuits and size, type and number of pieces of equipment, such as transformers, circuit breakers, switches, and lightning arresters. Computes sag and stress for specifications on wire and cable. Plans layout of pole lines and underground cable and solves problems, such as determining height, location, spacing, guying, and insulating of poles. May be designated according to specialization as Overhead-Distribution Engineer (utilities); Rural-Service Engineer (utilities); Substation Engineer (utilities); Underground-Distribution Engineer (utilities).
GOE: 05.01.03 STRENGTH: S GED: R5 M5 L5 SVP: 8 DLU: 77

003.167-050 POWER-TRANSMISSION ENGINEER (utilities) alternate titles: electrical-transmission engineer; transmission-and-coordination engineer; transmission-line engineer

Lays out plans and estimates costs for constructing transmission lines (high-tension facilities for carrying power from source to distributing points): Visits proposed construction site and selects best and shortest route to avoid interference with telephone or other lines. Submits data on proposed route to right-of-way department for obtaining necessary easements. Arranges for aerial, topographical, and other surveys to be made to obtain pertinent data for planning lines. Devises steel and wood supporting structures for cables and draws sketch showing their location. Performs detailed engineering calculations to draw up construction specifications, such as cable sag, pole strength, and necessary grounding. Estimates labor, material, and construction costs, and draws up specifications for purchase of materials and equipment. Keeps informed on new developments in electric power transmission. Assists various departments of power company on problems involving transmission-line operation

and maintenance. Inspects completed installation. Does not usually plan facilities for distributing power to consumers [POWER-DISTRIBUTION ENGINEER (utilities)].
GOE: 05.01.03 STRENGTH: L GED: R5 M5 L5 SVP: 8 DLU: 77

003.167-054 PROTECTION ENGINEER (utilities)

Plans layout and oversees maintenance of protection equipment of an electric power distribution system to minimize interruption to service and danger to lives and equipment from abnormalities, such as overload, no load, and short circuits: Studies drawings of power system and makes complex calculations to determine type, number, location, and correlation of protectors, such as relays, circuit breakers, fuses, and grounding devices. Plans adjustments and additions to protective system necessitated by increased demands in development of new residential areas and unusual requirements of heavy industry. Coordinates testing, repair, and installation of equipment. Studies new developments to determine suitability of their application to protection system. May program and direct computer analyses of system operating characteristics, such as power flow under normal and short-circuit conditions, system stability, and voltage and load limitations to obtain data used for such purposes as timing major system changes and additions, and analyzing interconnecting system problems. May be designated according to specialization as Grounding Engineer (utilities); Relay Engineer (utilities).
GOE: 05.01.03 STRENGTH: S GED: R5 M5 L5 SVP: 8 DLU: 77

003.167-058 SUPERVISOR, MICROWAVE (radio-tv broad.)

Plans relocation, installation, repair, and maintenance of microwave transmitters and receivers for cable-television broadcasting and gives technical advice and direction to laboratory and field staff regarding microwave transmission and reception: Plans installation or relocation of microwave transmitters and receivers for improved cable-television reception, new channels, or on-site live-broadcast transmission, using knowledge of microwave and electronic theory and electronic measuring and testing instruments. Directs laboratory and field supervisors and technicians in technical aspects of relocating, installing, repairing, and maintaining microwave transmitters and receivers. Monitors field and laboratory technicians to see that F.C.C. regulations regarding microwave equipment are observed. Advises field and laboratory staff on technical problems of microwave equipment, commercial-FM radios used in company trucks, and portable radios used by field staff.
GOE: 05.01.03 STRENGTH: S GED: R5 M5 L5 SVP: 8 DLU: 77

003.167-066 TRANSMISSION-AND-PROTECTION ENGINEER (tel. & tel.) alternate titles: transmission engineer

Plans and lays out telephone transmitting facilities from engineering sketches: Advises and assists operation forces on application of transmission methods, devices, and standards affecting telephone equipment. Provides engineering services for protection of telephone service and facilities from noise, cross-talk, electrolysis, lightning, and other adverse electrical effects. Investigates causes of personal injury resulting from contact with high voltage communication equipment.
GOE: 05.01.03 STRENGTH: L GED: R5 M5 L5 SVP: 8 DLU: 77

003.167-070 ENGINEERING MANAGER, ELECTRONICS (profess. & kin.)

Directs and coordinates activities of engineering department to design, manufacture, and test electronic components, products, and systems: Directs department activities, through subordinates, to design new products, modify existing designs, improve production techniques, and develop test procedures. Analyzes technology trends, human resource needs, and market demand to plan projects. Confers with management, production, and marketing staff to determine engineering feasibility, cost effectiveness, and customer demand for new and existing products. Forecasts operating costs of department and directs preparation of budget requests. Directs personnel activities of department, such as recruitment, hiring, performance evaluations, and salary adjustments. May direct field testing of products and systems performed by field staff.
GOE: 05.01.08 STRENGTH: S GED: R6 M6 L5 SVP: 9 DLU: 88

003.187-010 CENTRAL-OFFICE EQUIPMENT ENGINEER (tel. & tel.)

Directs implementation of planning schedule for installation of central office toll or local switching facilities, or interoffice transmission facilities equipment, such as radio, TV, camera, and repeaters: Reviews planning schedule or equipment request and data on projected traffic to determine quantities of specific types of equipment required. Plans arrangement of equipment, prepares cost estimates for equipment and installation, and submits data to management for authorization approval. Prepares drawings and equipment specifications for installation. Monitors installation activities to solve any problems concerning arrangement or specifications. Assigns equipment and installation expenditures to specific program or project accounts. Closes out installation authorization when equipment has been tested and put in service.
GOE: 05.01.03 STRENGTH: S GED: R6 M6 L6 SVP: 8 DLU: 77

003.187-014 COMMERCIAL ENGINEER (radio-tv broad.) alternate titles: traffic engineer

Plans use of wire facilities connecting stations comprising a network to cover changing conditions and requirements: Evaluates technical capabilities of wire facilities, according to availability and range, to obtain most effective method of transmission. Reviews network program schedule to be linked to network stations, and projects use of wire facilities. Subdivides wire facilities linking network stations for simultaneous broadcasting of different programs to stations. Tests facilities prior to broadcast time to determine readiness of transmission line. May prepare engineering estimates of equipment installations or modification of existing equipment.
GOE: 05.01.03 STRENGTH: S GED: R5 M5 L5 SVP: 7 DLU: 77

003.187-018 CUSTOMER-EQUIPMENT ENGINEER (tel. & tel.) alternate titles: services engineer

Directs activities concerned with selection and installation of telephone facilities and special equipment on customer's premises to meet customer's communication requirements: Reviews sales order to ascertain extent of telephone facilities and equipment required. Inspects customer premises to ascertain space available for installation of equipment and to determine type and quantity of designated equipment that can be installed to provide specific communication facilities. Prepares floor plan of equipment arrangement for customer or architect approval. Prepares cost estimate for equipment and installation and submits data to management for authorization to proceed with job. Orders equipment, prepares installation specifications, and monitors progress of installation to ensure facilities are ready on specified date. Prepares all job-related paper work and closes out work authorization when equipment is in service.
GOE: 05.01.08 STRENGTH: L GED: R5 M5 L5 SVP: 8 DLU: 77

003.261-010 INSTRUMENTATION TECHNICIAN (profess. & kin.)

Devises, selects, sets up, and operates electronic instrumentation and related electromechanical or electrohydraulic apparatus used for operational and environmental testing of mechanical, structural, or electrical equipment, and translates test data for engineering personnel to formulate engineering design and evaluation decisions: Selects, installs, calibrates, and checks sensing, telemetering, and recording instrumentation and circuitry, and develops specifications for nonstandard apparatus according to engineering data, characteristics of equipment under test, and capabilities of procurable test apparatus. Sketches and builds or modifies jigs, fixtures, and instruments and related apparatus, and verifies dimensional and functional acceptability of devices fabricated by craft or technical personnel. Performs preventive and corrective maintenance of test apparatus and peripheral equipment. Installs or directs technical personnel in installation of unit in test chamber or other test facility. Operates test apparatus during test cycle to produce, regulate, and record effects of actual or simulated conditions, such as vibration, stress, temperature, humidity, pressure, altitude, and acceleration. Analyzes and converts test data to usable form, using mathematical formulas, and prepares graphs and written reports to translate test results. May plan test program. May use computerized equipment and software to perform testing functions and produce graphs. May be designated according to equipment tested as Rocket-Control Technician (profess. & kin.); or according to nature of test as Environmental-Research Test Technician (profess. & kin.); Vibration Technician (profess. & kin.).
GOE: 05.01.01 STRENGTH: L GED: R5 M5 L4 SVP: 7 DLU: 90

003.261-014 CONTROLS DESIGNER (profess. & kin.) alternate titles: controls project engineer

Designs and drafts systems of electrical, hydraulic, and pneumatic controls for machines and equipment, such as arc welders, robots, conveyors, and $T3programmable controllers,$T1 applying knowledge of electricity, electronics, hydraulics, and pneumatics: Discusses project with SUPERVISOR (any industry) Master Title and APPLICATIONS ENGINEER, MANUFACTURING (profess. & kin.) 007.061-038 to review functions of machines and equipment. Designs and drafts arrangement of linkage of conductors, relays, and other components of electrical, electronic, hydraulic, pneumatic, and lubrication devices, using drafting tools, and applying knowledge of electrical engineering and drafting [DRAFTER (profess. & kin.) Master Title]. Diagrams logic system for functions such as sequence and timing control. Designs and drafts diagrams of cable connection for robots, robot end-of-arm tool, $T3robot controller,$T1 and other machines. Illustrates and describes installation and maintenance details, such as where bearings should be lubricated, types of lubrication, and which parts are lubricated automatically and manually. Confers with ASSEMBLER AND WIRER, INDUSTRIAL EQUIPMENT (elec. equip.; machinery mfg.) 826.361-010 to resolve problems regarding building of controls systems. Reviews schematics with customer's representatives to answer questions during installation of robot systems. Observes gauges during trial run of programmed machine and equipment operation to verify that electrical signals in system conform to specifications. May design controls for energy conversion or other industrial plant monitoring systems. May use computer and software programs to produce design drawings and be designated Controls Designer, Computer-Assisted (profess. & kin.).
GOE: 05.03.02 STRENGTH: S GED: R5 M4 L4 SVP: 8 DLU: 86

003.261-018 INTEGRATED CIRCUIT LAYOUT DESIGNER (profess. & kin.) alternate titles: mask designer

Designs layout for integrated circuits (IC), according to engineering specifications, using computer-assisted design (CAD) equipment and software, and utilizing knowledge of electronics, drafting, and IC design rules (standard IC manufacturing process requirements): Reviews and analyzes engineering design schematics and supporting documents, such as logic diagrams and design rules to plan layout of IC. Confers with engineering staff to resolve design details or problems. Enters engineering specifications into computer memory of CAD equipment and composes configurations on equipment display screen of IC logic elements (basic components of integrated circuit, such as resistors and transistors) for all IC layers, using keyboard, digitizing work aids (light pen or digitizing tablet), and engineering design schematics, and applying knowledge of design rules, programmed CAD functions, and electronics. Compares logic element configuration on equipment display screen with engineering schematics and redesigns or modifies logic elements, as needed, using digitizing work aids (light pen or digitizing tablet), keyboard, and programmed CAD functions. Lays out, redesigns, and modifies arrangement and interconnections of logic elements for each layer of integrated circuit, using digitizing work aids (light pen or digitizing tablet), keyboard and programmed CAD functions listed on display screen. Keys in specified commands, using CAD equipment keyboard, to test final IC layout for errors in design rules, using design rule software package. May generate copy of logic element design, using plotter to verify that logic element design copy meets design requirements and for use in laying out IC layer design for Very Large Scale (VLS) integrated circuits. May generate tape of final layout design for use in producing photo masks for each layer of IC, using CAD equipment. May program CAD equipment to change CAD functions listed on display screen, using keyboard. May be designated according to complexity of IC designed as IC Designer, Custom (profess. & kin.); IC Designer, Gate Arrays (profess. & kin.); IC Designer, Standard Cells (profess. & kin.).
GOE: 05.03.02 STRENGTH: S GED: R4 M4 L4 SVP: 8 DLU: 86

003.261-022 PRINTED CIRCUIT DESIGNER (profess. & kin.)

Designs and drafts layout for printed circuit boards (PCB's) according to engineering specifications, utilizing knowledge of electronics, drafting, and PCB design: Reviews and analyzes engineering design schematics and supporting documents to plan layout of PCB components and printed circuitry. Confers with engineering staff to resolve design details and problems. Drafts detailed drawings [DRAFTER (profess. & kin.) Master Title] and composes master layout of design components and circuitry. Examines and verifies master layout for electrical and mechanical accuracy. May verify accuracy of film reproductions of master layout. May prepare copies of drawings for use in PCB fabrication, using blueprint or diazo print machine. May generate computer tape for use in photo plotting design onto film, using digitizing equipment.
GOE: 05.03.02 STRENGTH: S GED: R4 M4 L4 SVP: 7 DLU: 88

003.281-010 DRAFTER, ELECTRICAL (profess. & kin.)

Drafts electrical equipment working drawings and wiring diagrams used by construction crews and repairers who erect, install, and repair electrical equipment and wiring in communications centers, power plants, industrial establishments, commercial or domestic buildings, or electrical distribution systems, performing duties as described under DRAFTER (profess. & kin.) Master Title. May use computer-assisted drafting (CAD) equipment and software and be designated Drafter (CAD), Electrical (profess. & kin.). May prepare detail cable layout and diagrams for cable installation and be designated Electric-Cable Diagrammer (elec. equip.).
GOE: 05.03.02 STRENGTH: S GED: R5 M5 L4 SVP: 7 DLU: 86

003.281-014 DRAFTER, ELECTRONIC (profess. & kin.) alternate titles: drafter, electromechanical

Drafts detailed drawings, such as wiring diagrams, layout drawings, mechanical detail drawings, and drawings of intermediate and final assemblies, used in manufacture, assembly, installation, and repair of electronic components, printed circuit boards, and equipment. Examines electronic schematics and supporting documents received from design engineering department to develop, compute, and verify specifications drafting data, such as configuration of parts, dimensions, and tolerances. Performs duties as described under DRAFTER (profess. & kin.) Master Title. May use computer-assisted drafting (CAD) equipment and software and be designated Drafter (CAD), Electronic (profess. & kin.).
GOE: 05.03.02 STRENGTH: S GED: R5 M5 L4 SVP: 7 DLU: 89

003.362-010 DESIGN TECHNICIAN, COMPUTER-AIDED (electron. comp.) alternate titles: digitizer

Operates computer-aided design (CAD) system and peripheral equipment to resize or modify integrated circuit designs (artwork) and to generate computer tape of artwork for use in producing mask plates used in manufacturing integrated circuits: Reviews work order and procedural manuals to determine critical dimensions of design. Calculates figures to convert design dimensions to resizing dimensions specified for subsequent production processes, using conversion chart and calculator. Locates file relating to specified design projection data base library and loads program into computer. Enters specified commands into computer, using keyboard, to retrieve design information from file and display design on CAD equipment display screen. Types commands on keyboard to enter resizing specifications into computer. Confers with engineering and design staff to determine design modifications and enters editing information into computer. Keys in specified information, using keyboard connected to on-line or off-line peripheral equipment (plotter), to produce graphic representation (hard copy) of design for review and approval by engineering and design staff. Enters specified information into computer, using keyboard, to generate computer tape of approved design.
GOE: 05.03.02 STRENGTH: L GED: R3 M3 L3 SVP: 5 DLU: 86

005 CIVIL ENGINEERING OCCUPATIONS

This group includes occupations concerned with the planning, design, and construction of structures and facilities, such as buildings, bridges, roads, harbors, airfields, dams, tunnels, and water supply and sewage systems. Also included are occupations concerned with the engineering aspects of environmental health systems and urban planning or renewal. Frequently requires a knowledge of industrial trends, population growth, zoning laws, and state and local building codes and ordinances. Accessory techniques needed are those used in agricultural, ceramic, chemical, electrical, geological, mechanical, metallurgical, and mining engineering. Typical specializations are structures, hydraulics, transportation systems, sanitation, water utility systems, airports, city planning, environmental protection, construction, engineering mechanics, irrigation and drainage, power, soil mechanics and foundations, pipeline engineering, and waterways and harbors.

005.061-010 AIRPORT ENGINEER (profess. & kin.)

Plans and lays out airports and landing fields and directs construction work involved in leveling fields, laying out and surfacing runways, and providing drainage: Designs runways based on weight and size of aircraft and prepares material and construction specifications. Directs or participates in surveying to lay out installations and establish

reference points, grades, and elevations to guide construction. Estimates costs to provide basis for payments to contractor. Observes progress of construction to ensure work is in conformity with specifications and advises SUPERINTENDENT, CONSTRUCTION (construction) regarding necessary corrections. May serve as agent or employee of contractor and study plans and specifications to recommend special equipment or procedures to reduce time and cost of construction. May schedule delivery of materials, analyze costs, and provide technical advice in solution of construction problems.
GOE: 05.01.07 STRENGTH: L GED: R5 M5 L5 SVP: 8 DLU: 77

005.061-014 CIVIL ENGINEER (profess. & kin.)

Plans, designs, and directs civil engineering projects, such as roads, railroads, airports, bridges, harbors, channels, dams, irrigation systems, pipelines, and powerplants: Analyzes reports, maps, drawings, blueprints, tests, and aerial photographs on soil composition, terrain, hydrological characteristics, and other topographical and geologic data to plan and design project. Calculates cost and determines feasibility of project based on analysis of collected data, applying knowledge and techniques of engineering, and advanced mathematics. Prepares or directs preparation and modification of reports, specifications, plans, construction schedules, environmental impact studies, and designs for project. Inspects construction site to monitor progress and ensure conformance to engineering plans, specifications, and construction and safety standards. May direct construction and maintenance activities at project site. May use computer-assisted engineering and design software and equipment to prepare engineering and design documents. May be designated according to specialty or product.
GOE: 05.01.07 STRENGTH: L GED: R5 M5 L5 SVP: 8 DLU: 81

005.061-018 HYDRAULIC ENGINEER (profess. & kin.) alternate titles: hydrologic engineer

Designs and directs construction of power and other hydraulic engineering projects for control and use of water: Computes and estimates rates of waterflow. Specifies type and size of equipment, such as conduits, pumps, turbines, pressure valves, and surge tanks, used in transporting water and converting water power into electricity. Directs, through subordinate supervisors, activities of workers engaged in dredging, digging cutoffs, placing jetties, and constructing levees to stabilize streams or open water ways. Designs and coordinates construction of artificial canals, conduits, and mains to transport and distribute water; and plans reservoirs, pressure valves, and booster stations to obtain proper water pressure at all levels. Frequently builds laboratory models to study construction and flow problems.
GOE: 05.01.03 STRENGTH: L GED: R5 M5 L5 SVP: 7 DLU: 77

005.061-022 IRRIGATION ENGINEER (profess. & kin.)

Plans, designs, and oversees construction of irrigation projects for transporting and distributing water to agricultural lands: Plans and designs irrigation fixtures and installation of fixtures to requirements and specifications. Directs, through subordinate supervisors, construction of such irrigation systems as dams, canals, and ditches, according to type of soil, climatic characteristics, water supply, return flow, and other factors affecting irrigation requirements. Conducts research on problems of soil drainage and conservation, applying knowledge of civil engineering [RESEARCH ENGINEER (profess. & kin.)].
GOE: 05.01.03 STRENGTH: L GED: R5 M5 L4 SVP: 8 DLU: 77

005.061-026 RAILROAD ENGINEER (profess. & kin.)

Designs railroad and street railway tracks, terminals, yards, and other facilities and directs and coordinates construction and relocation of facilities: Plans roadbed, rail size, and curves to meet train speed and load requirements. Directs, through subordinate supervisors, construction of bridges, culverts, buildings, and other structures. Directs track and roadway maintenance. Surveys traffic problems related to street railway system and recommends grade revisions, additional trackage, use of heavier power, and other changes to relieve congestion and reduce hazards.
GOE: 05.01.07 STRENGTH: L GED: R5 M5 L5 SVP: 8 DLU: 77

005.061-030 SANITARY ENGINEER (profess. & kin.) alternate titles: public-health engineer

Designs and directs construction and operation of hygienic projects such as waterworks, sewage, garbage and trash disposal plants, drainage systems, and insect and rodent control projects: Plans development of watersheds and directs building of aqueducts, filtration plants, and storage and distribution systems for water supply. Directs swamp drainage, insect spraying, and design of insect-proof buildings. Plans and directs workers in building and operation of sewage-disposal plants. Designs and controls operation of incinerators, sanitary fills, and garbage-reduction plants to dispose of garbage and other refuse. Advises industrial plants in disposal of obnoxious gases, oils, greases, and other chemicals. Inspects and regulates sanitary condition of public places, such as markets, parks, and camps. May plan and direct operation of water treatment plant to soften and purify water for human consumption or industrial use and be known as Water-Treatment-Plant Engineer (profess. & kin.).
GOE: 05.01.03 STRENGTH: L GED: R5 M5 L5 SVP: 8 DLU: 77

005.061-034 STRUCTURAL ENGINEER (construction)

Directs or participates in planning, designing, or reviewing plans for erection of structures requiring stress analysis: Designs structure to meet estimated load requirements, computing size, shape, strength, and type of structural members, or performs structural analysis of plans and structures prepared by private engineers. May inspect existing projects and recommend repair and replacement of defective members or rebuilding of entire structure.
GOE: 05.01.08 STRENGTH: L GED: R5 M5 L5 SVP: 8 DLU: 77

005.061-038 TRANSPORTATION ENGINEER (profess. & kin.)

Develops plans for surface transportation projects according to established engineering standards and state or federal construction policy: Prepares plans, estimates, and specifications to design transportation facilities. Plans alterations and modifications of existing streets, highways, and freeways to improve traffic flow. Prepares deeds, property descriptions, and right-of-way maps. Performs field engineering calculations to compensate for change orders and contract estimates. May prepare and present public reports of environmental analysis statements and other transportation information. May specialize in particular phase of work, such as making surveys, improving signs or lighting, preparing plans, or directing and coordinating construction or maintenance activities. May be designated Highway Engineer (government ser.). May specialize in studying vehicular and pedestrian traffic conditions and be designated Traffic Engineer (government ser.). May plan, organize, and direct work in transportation studies to plan surface systems and be designated Transportation Planning Engineer (government ser.).
GOE: 05.01.08 STRENGTH: L GED: R5 M5 L5 SVP: 8 DLU: 77

005.061-042 WASTE-MANAGEMENT ENGINEER, RADIOACTIVE MATERIALS (profess. & kin.)

Designs, implements, and tests systems and procedures to reduce volume and dispose of nuclear waste materials and contaminated objects: Identifies objects contaminated by exposure to radiation, such as trash, workers' clothing, and discarded tools and equipment. Analyzes samples of sludge and liquid effluents resulting from operation of nuclear reactors to determine level of radioactivity in substances and potential for retention of radioactivity, using radioactivity counters and chemical and electronic analyzers. Refers to state and federal regulations and technical manuals to determine disposal method recommended for prevention of leakage or absorption of radioactive waste. Compares costs of transporting waste to designated nuclear waste disposal sites and reducing volume of waste and storing waste on plant site. Confers with equipment manufacturers' representatives and plant technical and management personnel to discuss alternatives and to choose most suitable plan on basis of safety, efficiency, and cost-effectiveness. Designs and draws plans for systems to reduce volume of waste by solidification, compaction, or incineration. Oversees construction, testing, and implementation of waste disposal systems, and resolves operational problems. Develops plans for modification of operating procedures to reduce volume and radioactive level of effluents, and writes manuals to instruct workers in changes in work procedures. Advises management on selection of lands suitable for use as nuclear waste disposal sites and on establishment of effective safety, operating, and closure procedures.
GOE: 05.01.03 STRENGTH: L GED: R5 M5 L5 SVP: 8 DLU: 86

005.167-010 CHIEF ENGINEER, WATERWORKS (waterworks)

Plans and directs activities concerned with water utility systems installation, operation, maintenance, and service: Directs activities of engineers engaged in preparing designs and plans to construct, enlarge, and modify such facilities as water treatment plants, watersheds, and dams, hydroelectric stations, pumping stations, and to install water mains, and other appurtenances. Provides engineering and technical direction for planning and design of water utility projects. Reviews plans and specifications prior to instituting project to determine whether they meet organizational requirements. Analyzes and compiles data received from engineers to prepare budget estimates. Directs and coordinates engineers in conducting studies, such as economics of systems operation, water distribution, and water treatment plants or relative equipment performance to determine most feasible approach to meeting organizational and technical problems. Confers with municipal authorities concerning budget requirements, changes in organizational policy, regulation of water rates, and plumbing requirements, or other problems affecting community.
GOE: 05.01.03 STRENGTH: L GED: R5 M5 L5 SVP: 9 DLU: 77

005.167-014 DRAINAGE-DESIGN COORDINATOR (waterworks)

Plans, designs, and coordinates construction of drainage systems in irrigation district, based on knowledge of soils, slope of land, and availability and economic use of existing drainage canals: Requests engineering surveys and soil tests to determine surface profile, types of soil, and characteristics such as salinity, water table, and areas of subnormal crop growth. Studies data and sketches scale drawing of tile and open ditch drains for area, using triangles, scales, dividers, and other drawing instruments. Indicates depth, spacing, and size of tiling for crop area leading to district drainage canals. Considers drainage cost to improve fertility, at least cost to farmer and district. Recommends deepening of drainage canals when field elevation prevents gravity flow, or provides for installation of sumps and electric pumps to drain low areas. Arranges for sale to farmers of district approved drainage materials, such as concrete wells and pipes. Determines need for securing easements and right-of-way deeds for district drainage structures. Inspects completed systems to determine that installation conforms to plan.
GOE: 05.01.03 STRENGTH: S GED: R5 M5 L4 SVP: 8 DLU: 77

005.167-018 FOREST ENGINEER (forestry; logging)

Lays out and directs construction, installation, and use of structures, equipment, and road or rail systems, and performs other engineering duties concerned with removal of logs from timber area: Surveys timber land and draws maps to show topographical features of area. Determines locations of loading points and storage areas and selects methods and equipment for handling logs. Lays out and directs construction of roads or rail network used to transport logs from cutting areas to loading sites and storage areas. Plans and directs construction of campsites, loading docks, bridges and culverts, equipment shelters, and water and sewage systems to maintain efficient and safe removal of logs from constantly shifting cutting areas.
GOE: 05.01.06 STRENGTH: L GED: R5 M5 L5 SVP: 7 DLU: 77

005.167-022 HIGHWAY-ADMINISTRATIVE ENGINEER (government ser.) alternate titles: director, traffic and planning

Administers statewide highway planning, design, construction, and maintenance programs: Coordinates activities of state highway engineering agencies. Reviews highway and bridge plans, location, contracts, and cost estimates for technical and legal accuracy, and approves acceptable proposals or makes corrective recommendations. Directs workers in research activities related to highway planning and engineering, and formulates highway engineering policies and procedures. Directs preparation of state agency budgets. Directs workers in preparation of reports to state and federal government officials and represents state highway commissioner at hearings with public officials, contractors, and engineering personnel. Speaks before civic groups and public gatherings to disseminate highway planning information and to solicit public support.
GOE: 11.05.03 STRENGTH: S GED: R6 M5 L6 SVP: 9 DLU: 77

005.167-026 PRODUCTION ENGINEER, TRACK (r.r. trans.)

Plans, directs, and coordinates, through supervisory personnel, activities of track maintenance crews of railway system: Analyzes engineering data and inspects repair site to determine priority of proposed track repair and maintenance projects. Coordinates scheduling of track maintenance and activities within designated region. Determines frequency of track use and project costs, utilizing computerized data and knowledge of railroad operations and maintenance expense to formulate recommendations for revising established project priorities. Reviews production reports and confers with engineering personnel to identify causes of low productivity of repair crews. Visits work sites to observe work crews and to inspect repairs. Directs engineering supervisors to correct substandard repairs.
GOE: 05.01.06 STRENGTH: L GED: R5 M3 L4 SVP: 9 DLU: 86

005.261-014 CIVIL ENGINEERING TECHNICIAN (profess. & kin.)

Assists CIVIL ENGINEER (profess. & kin.) 005.061-014 in application of principles, methods, and techniques of civil engineering technology: Reviews project specifications and confers with CIVIL ENGINEER (profess. & kin.) concerning assistance required, such as plan preparation, acceptance testing, evaluation of field conditions, design changes, and reports. Conducts materials testing and analysis, using tools and equipment and applying engineering knowledge necessary to conduct tests. Prepares reports detailing tests conducted and results. Surveys project sites to obtain and analyze topographical details of sites, using maps and surveying equipment. Drafts detailed dimensional drawings, such as those needed for highway plans, structural steel fabrication, and water control projects, performing duties as described under DRAFTER (profess. & kin.) Master Title. Calculates dimensions, profile specifications, and quantities of materials such as steel, concrete, and asphalt, using calculator. Inspects construction site to determine conformance of site to design specifications. May assist engineers to ensure that construction and repair of water and wastewater treatment systems meet pollution control requirements.
GOE: 05.03.02 STRENGTH: L GED: R4 M4 L4 SVP: 7 DLU: 86

005.281-010 DRAFTER, CIVIL (profess. & kin.) alternate titles: drafter, civil engineering; drafter, construction; drafter, engineering

Drafts detailed construction drawings, topographical profiles, and related maps and specifications used in planning and construction of civil engineering projects, such as highways, river and harbor improvements, flood control, and drainage: Reviews rough sketches, drawings, specifications, and other engineering data received from CIVIL ENGINEER (profess. & kin.) 005.061-014. Plots maps and charts showing profiles and cross-sections, indicating relation of topographical contours and elevations to buildings, retaining walls, tunnels, overhead power lines, and other structures. Drafts detailed drawings of structures and installations, such as roads, culverts, fresh water supply, sewage disposal systems, dikes, wharfs, and breakwaters. Computes volume of tonnage of excavations and fills and prepares graphs and hauling diagrams used in earthmoving operations. Performs other duties as described under DRAFTER (profess. & kin.) Master Title. May accompany survey crew in field to locate grading markers or to collect data required for revision of construction drawings. May specialize in drafting and modifying topographical maps from surveying notes and aerial photographs and be designated Drafter, Topographical (profess. & kin.). May use computer-assisted drafting (CAD) equipment and software and be designated Drafter, Civil (CAD) (profess. & kin.).
GOE: 05.03.02 STRENGTH: S GED: R4 M4 L4 SVP: 7 DLU: 81

005.281-014 DRAFTER, STRUCTURAL (profess. & kin.)

Performs duties of DRAFTER (profess. & kin.) Master Title by drawing plans and details for structures employing structural reinforcing steel, concrete, masonry, wood, and other structural materials. Produces plans and details of foundations, building frame, floor and roof framing, and other structural elements.
GOE: 05.03.02 STRENGTH: S GED: R5 M5 L4 SVP: 7 DLU: 77

006 CERAMIC ENGINEERING OCCUPATIONS

This group includes occupations concerned with the design, manufacture, and application of products made from nonmetallic minerals and rocks; and the design, construction, and control of necessary equipment and tools for the manufacture of such products. Accessory techniques include those used in chemical, mechanical, and electrical engineering, and physics and mineralogy. Typical specializations are structural materials, abrasives, cements, glass, whiteware, and refractories. Occupations which are involved in only one phase of engineering, such as research, design, testing, sales, or project control, are found in Group 019.

006.061-010 CERAMIC DESIGN ENGINEER (profess. & kin.)

Designs ceramics manufacturing equipment and products, performing duties as described under DESIGN ENGINEER, FACILITIES (profess. & kin.) Master Title; DESIGN ENGINEER, PRODUCTS (profess. & kin.) Master Title.
GOE: 05.01.07 STRENGTH: L GED: R5 M5 L5 SVP: 8 DLU: 77

006.061-014 CERAMIC ENGINEER (profess. & kin.)

Conducts research, designs machinery, develops processing techniques, and directs technical work concerned with manufacture of ceramic products: Directs testing of physical, chemical, and heat-resisting properties of materials, such as clays and silicas. Analyzes results of test to determine combinations of materials which will improve quality of products. Conducts research into methods of processing, forming, and firing of clays to develop new ceramic products, such as ceramic machine tools, refractories for space vehicles, and for use in glass and steel furnaces. Designs equipment and apparatus for forming, firing, and handling products. Coordinates testing activities of finished products for characteristics, such as texture, color, durability, glazing, and refractory properties. May specialize in one branch of ceramic production, such as brick, glass, crockery, tile, pipe, or refractories. May specialize in developing heat-resistant and corrosion-resistant materials for use in aerospace, electronics, and nuclear energy fields.
GOE: 05.01.07 STRENGTH: L GED: R6 M6 L6 SVP: 8 DLU: 77

006.061-018 CERAMIC RESEARCH ENGINEER (profess. & kin.)

Conducts research to develop new ceramic products performing duties as described under RESEARCH ENGINEER (profess. & kin.) Master Title.
GOE: 05.01.01 STRENGTH: L GED: R5 M5 L5 SVP: 8 DLU: 77

006.061-022 CERAMICS TEST ENGINEER (profess. & kin.)

Conducts tests on ceramic products performing duties as described under TEST ENGINEER (profess. & kin.) Master Title.
GOE: 05.01.04 STRENGTH: L GED: R5 M5 L5 SVP: 8 DLU: 77

006.151-010 SALES ENGINEER, CERAMIC PRODUCTS (profess. & kin.)

Sells ceramic products and provides technical services for client performing duties as described under SALES ENGINEER (profess. & kin.) Master Title.
GOE: 05.01.05 STRENGTH: L GED: R5 M5 L5 SVP: 8 DLU: 77

006.261-010 SCIENTIFIC GLASS BLOWER (glass products) alternate titles: glass technician; glass technologist

Fabricates, modifies, and repairs experimental and laboratory glass products, using variety of machines and tools, and provides technical advice to scientific and engineering staff on function, properties, and proposed design of products, applying knowledge of glass technology: Confers with scientific or engineering personnel to exchange information and suggest design modifications regarding proposed glass apparatus, such as distillation and high-vacuum systems. Cuts glass tubing of specified type, using cutting tools, such as glass saw and hot-wire cutter. Heats glass tubing until pliable, using gas torch, and blows, bends, and shapes tubing to specified form, using blowhose, handtools, and manual pressure. Performs finishing operations to fabricate glass product or section, using machines and equipment, such as $T3lapping$T1 and polishing wheels, spot-welding and sandblasting machines, internal-plating equipment, and drill press. Measures products to verify dimensions, using $T3optical scanner,$T1 micrometers, and calipers, and examines glass coloration for degree of internal stress, using polariscope, to determine annealing requirements. Anneals products, using annealing oven. Joins and seals subassemblies to assemble finished product, using gas torch, handtools, and vacuum pump. May operate special equipment, such as radio-frequency-fusing machine, to bond glass to metal, quartz, and ceramic materials. May identify glass of unknown composition by heating with gas torch and evaluating curvature, bondability, and color characteristics. May direct and train GLASS BLOWERS, LABORATORY APPARATUS (glass products; inst. & app.). May design fixtures for use in production of prototype glass products and prepare sketches for machine-shop personnel. May prepare cost estimates for prototype glass products. May requisition or recommend purchase of materials, tools, and equipment. May specialize in specific types of glass scientific apparatus and have knowledge of effects of special environments on glass, such as radioactivity, vacuums, gases, chemicals, and electricity.
GOE: 05.05.11 STRENGTH: L GED: R4 M4 L4 SVP: 8 DLU: 77

007 MECHANICAL ENGINEERING OCCUPATIONS

This group includes occupations concerned with application of principles of physics and engineering for the generation, transmission, and utilization of heat and mechanical power; and the design, production, installation, and maintenance of fabricated products, tools, machines, machinery, and associated or auxiliary systems. Accessory techniques needed may be those used in electrical, metallurgical, nuclear, and civil engineering. Typical specializations are steam and mechanical power generation, transmission, and utilization; hydraulics; instrumentation; controls; automotive engineering; tooling; heating and ventilating; air-conditioning and refrigeration; bioengineering; pollution control; systems engineering; research; design; testing; sales; and project control.

007.061-010 AUTOMOTIVE ENGINEER (auto. mfg.)

Develops improved or new designs for automotive structural members, engines, transmissions, and associated automotive equipment or modifies existing equipment on production vehicles, and directs building, modification, and testing of vehicle, using computerized work aids: Conducts experiments and tests on existing designs and equipment to obtain data on function of and performance of equipment. Analyzes data to develop new designs for motors, chassis, and other related mechanical, hydraulic, and electromechanical components and systems in automotive equipment. Designs components and systems to provide maximum customer value and vehicle function, including improved economy and safety of operation, control of emissions, and operational performance, at optimum costs. Directs and coordinates building, or modification of, automotive equipment or vehicle to ensure conformance with engineering design. Directs testing activities on components and equipment under designated conditions to ensure operational performance meets design specifications. Alters or modifies design to obtain specified functional and operational performance. May assist DRAFTER, AUTOMOTIVE DESIGN (auto. mfg.) 017.261-042 in developing structural design for auto body. May conduct research studies to develop new concepts in automotive engineering field.
GOE: 05.01.08 STRENGTH: L GED: R5 M5 L5 SVP: 8 DLU: 90

007.061-014 MECHANICAL ENGINEER (profess. & kin.)

Researches, plans, and designs mechanical and electromechanical products and systems, and directs and coordinates activities involved in fabrication, operation, application, installation, and repair of mechanical or electromechanical products and systems: Researches and analyzes data, such as customer design proposal, specifications, and manuals to determine feasibility of design or application. Designs products or systems, such as instruments, controls, robots, engines, machines, and mechanical, thermal, hydraulic, or heat transfer systems, applying knowledge of engineering principles [DESIGN ENGINEER, PRODUCTS (profess. & kin.) Master Title]. Plans and directs engineering personnel in fabrication of test control apparatus and equipment, and development of methods and procedures for testing products or

systems [TEST ENGINEER (profess. & kin.) Master Title]. Directs and coordinates fabrication and installation activities to ensure products and systems conform to engineering design and customer specifications. Coordinates operation, maintenance, and repair activities to obtain optimum utilization of machines and equipment. May design products and systems to interface machines, hardware, and software. May evaluate field installations and recommend design modifications to eliminate machine or system malfunctions. May specialize in specific field of mechanical engineering, such as heat transfer, hydraulics, electromechanics, controls and instrumentation, robotics, nuclear systems, tooling, air-conditioning and refrigeration; or in type of product, such as propulsion systems or machinery and mechanical equipment; or in type of work, such as steam or gas generation and distribution, steam plant engineering, or system planning.
GOE: 05.01.08 STRENGTH: L GED: R5 M5 L5 SVP: 8 DLU: 88

007.061-018 MECHANICAL-DESIGN ENGINEER, FACILITIES (profess. & kin.)

Designs and directs installation of plant systems or product lines performing duties as described under DESIGN ENGINEER, FACILITIES (profess. & kin.) Master Title.
GOE: 05.01.07 STRENGTH: S GED: R5 M5 L5 SVP: 8 DLU: 77

007.061-022 MECHANICAL-DESIGN ENGINEER, PRODUCTS (profess. & kin.)

Designs mechanical or electromechanical products or systems performing duties as described under DESIGN ENGINEER, PRODUCTS (profess. & kin.) Master Title.
GOE: 05.01.07 STRENGTH: S GED: R5 M5 L5 SVP: 8 DLU: 77

007.061-026 TOOL DESIGNER (profess. & kin.)

Designs single- or multiple-edged machine cutting tools, such as broaches, milling-machine cutters, and drills, and related jigs, dies, and fixtures: Studies specifications, engineering blueprints, tool orders, and shop data and confers with engineering and shop personnel to resolve design problems related to material characteristics, dimensional tolerances, service requirements, manufacturing procedures, and cost. Applies algebraic and geometric formulas and standard tool engineering data to develop tool configuration. Selects standard items, such as bushings and tool bits, to incorporate into tool design. Draws preliminary sketches and prepares layout and detail drawings, using standard drafting tools and equipment or computer-assisted design/drafting equipment and software. Modifies tool designs according to trial or production service data to improve tool life or performance.
GOE: 05.01.07 STRENGTH: L GED: R5 M5 L5 SVP: 8 DLU: 88

007.061-030 TOOL-DESIGNER APPRENTICE (profess. & kin.)

Performs duties as described under APPRENTICE (any industry) Master Title.
GOE: 05.01.07 STRENGTH: L GED: R5 M5 L5 SVP: 8 DLU: 77

007.061-034 UTILIZATION ENGINEER (utilities)

Solves engineering problems concerned with industrial utilization of gas as source of power: Studies industrial processes to determine where and how application of gas fuel-consuming equipment can be made. Designs equipment to meet process requirements. Examines gas-powered equipment after installation to ensure proper functioning. Investigates equipment failures and difficulties and diagnoses faulty operation. Corrects or makes recommendations to maintenance crew to correct faults. Conducts safety, breakdown, and other engineering tests on gas fuel-consuming equipment to ascertain efficiency and safety of design and construction. May solve problems concerned with other gas-consuming equipment, such as air-conditioning and heating.
GOE: 05.01.06 STRENGTH: S GED: R5 M5 L5 SVP: 8 DLU: 77

007.061-038 APPLICATIONS ENGINEER, MANUFACTURING (profess. & kin.)

Plans, designs, and coordinates integration of machinery and equipment into manufacturing process of industrial establishment, applying knowledge of engineering and programming, and using computer, precision-measuring instruments, and drafting tools: Develops and writes equipment specifications, performance requirements, cost analysis, and proposal for integrating machinery and equipment, such as robots, $T3robot controllers,$T1 and $T3programmable controllers$T1 into manufacturing process, applying knowledge of mechanics, hydraulics, pneumatics, electrical wiring, electronics, programming, and manufacturing requirements, and using computer and calculator. Selects or designs robot end-of-arm tools to meet specifications, using robot manuals and either drafting tools or computer and software programs. Writes operating programs, using existing computer program, or writes own computer programs, applying knowledge of programming language and computer. Oversees installation to ensure machines and equipment are installed and functioning according to specifications. Tests ability of machines, such as robot, to perform tasks, using $T3teach pendant$T1 and precision measuring instruments and following specifications. Confers with establishment personnel to implement operating procedures and resolve system malfunctions. Determines parts supply, maintenance tasks, safety procedures, and service schedule required to maintain machines and equipment in prescribed condition. Develops models of alternate processing methods to test feasibility of new applications of system components, and recommends implementation of improved procedures. Participates in meetings, seminars, and training sessions to stay apprised of new developments in field. Confers with workers in other departments, such as marketing, legal, and engineering, to provide technical information. May develop and conduct robot and related equipment training programs and demonstrate skills to trainees, using teach pendant, handtools, precision-measuring instruments, and following schematics, plant drawings, and manufacturer's specifications.
GOE: 05.01.08 STRENGTH: L GED: R5 M5 L5 SVP: 8 DLU: 86

007.061-042 STRESS ANALYST (profess. & kin.)

Conducts stress analyses on engineering designs for electronic components, systems, and products, using mathematical formulas and computer-aided engineering (CAE) systems: Analyzes engineering designs, schematics, and customer specifications to determine stress requirements on product. Formulates $T3mathematical model$T1 or three-dimensional computer graphic model of product, using calculator or CAE system. Analyzes ability of product to withstand stress imposed by conditions such as temperature, loads, motion, and vibration, using mathematical formulas and computer simulation. Builds product model of wood or other material, performs physical stress tests on model, and evaluates test results. Consults with ELECTRONICS-DESIGN ENGINEER (profess. & kin.) 003.061-034 to recommend design modifications of product based on results of stress analysis. Prepares stress analysis reports.
GOE: 05.01.04 STRENGTH: S GED: R6 M6 L5 SVP: 8 DLU: 86

007.151-010 SALES ENGINEER, MECHANICAL EQUIPMENT (utilities)

Sells mechanical equipment and provides technical-services to clients as described under SALES ENGINEER (profess. & kin.) Master Title.
GOE: 05.01.05 STRENGTH: L GED: R5 M5 L5 SVP: 8 DLU: 77

007.161-010 DIE DESIGNER (machine shop) alternate titles: design leader; die design drafter; die developer

Develops plans for single stage or progressive stage dies for stamping, forming, forging, or extrusion presses, according to blueprints of product and knowledge of press characteristics and process limitations: Drafts drawings of dies necessary to form complete forging, stamping, or other part. Determines sequence and number of die stages in which single or progressive cutting, punching, and forming will be accomplished, and type of die sets required to produce complete part, based on knowledge of dies, forming processes, and machines. Drafts scale drawings of each die set, delineating contours and dimensions for manufacture of die. Compares part drawings with wood patterns of cast dies to determine correctness of pattern dimensions and form. May observe setup and tryout of newly developed die set in production machine to

determine need for redesign or readiness for production use.
GOE: 05.03.02 STRENGTH: S GED: R4 M4 L4 SVP: 7 DLU: 77

007.161-014 DIE-DESIGNER APPRENTICE (machine shop)

Performs duties as described under APPRENTICE (any industry) Master Title.
GOE: 05.03.02 STRENGTH: S GED: R4 M4 L4 SVP: 7 DLU: 77

007.161-018 ENGINEERING ASSISTANT, MECHANICAL EQUIPMENT (profess. & kin.) alternate titles: mechanical design technician

Develops detailed design drawings and related specifications of mechanical equipment, according to engineering sketches and design proposal specifications: Analyzes engineering sketches, specifications, and related data and drawings to determine design factors, such as size, shape, and arrangement of parts. Sketches rough layout of machine and computes angles, weights, surface areas, dimensions, radii, clearances, tolerances, leverages, and location of holes. Computes magnitude, direction, and point of application of tension, compression, and bending forces, and develops geometric shape of machine parts to accommodate operating loads. Drafts detailed multiview drawings of machine and subassemblies, including specifications for gear ratios, bearing loads, and direction of moving parts, using engineering data and standard references. Compiles and analyzes test data to determine effect of machine design on various factors, such as temperature, pressures, speed, horsepower, and fuel consumption. Modifies machine design to correct operating deficiencies or to reduce production problems. May measure machine and parts during production to ensure compliance with design specifications, using precision measuring instruments. May specialize in specific type of machine, such as air-cooled internal combustion engines, diesel engines, or machine tools. May use computer-assisted design/drafting equipment and software to develop designs.
GOE: 05.03.02 STRENGTH: S GED: R5 M5 L5 SVP: 7 DLU: 88

007.161-022 MECHANICAL RESEARCH ENGINEER (profess. & kin.)

Conducts research to develop mechanical equipment and machinery, performing duties as described under RESEARCH ENGINEER (profess. & kin.) Master Title.
GOE: 05.01.01 STRENGTH: L GED: R5 M5 L5 SVP: 8 DLU: 77

007.161-026 MECHANICAL-ENGINEERING TECHNICIAN (profess. & kin.) alternate titles: engineering technician; experimental technician; laboratory-development technician; mechanical technician

Develops and tests machinery and equipment, applying knowledge of mechanical engineering technology, under direction of engineering and scientific staff: Reviews project instructions and blueprints to ascertain test specifications, procedures, objectives, test equipment, nature of technical problem, and possible solutions, such as part redesign, substitution of material or parts, or rearrangement of parts or subassemblies. Drafts detail drawing or sketch for drafting room completion or to request parts fabrication by machine, sheet metal or wood shops. Devises, fabricates, and assembles new or modified mechanical components or assemblies for products, such as industrial equipment and machinery, power equipment, servosystems, machine tools, and measuring instruments. Sets up and conducts tests of complete units and components under operational conditions to investigate design proposals for improving equipment performance or other factors, or to obtain data for development, standardization, and quality control. Analyzes indicated and calculated test results in relation to design or rated specifications and test objectives, and modifies or adjusts equipment to meet specifications. Records test procedures and results, numerical and graphical data, and recommendations for changes in product or test method.
GOE: 05.01.01 STRENGTH: L GED: R5 M4 L4 SVP: 7 DLU: 77

007.161-030 OPTOMECHANICAL TECHNICIAN (optical goods; photo. appar.)

Applies engineering theory and practical knowledge, under direction of engineering staff, to build and test prototype optomechanical devices to be used in such equipment as aerial cameras, gun sights, and telescopes: Reviews project instructions, and preliminary specifications to identify and plan requirements for parts fabrication, purchase, assembly, and test. Prepares sketches and writes work orders and purchase requests for items to be furnished by others, and follows up delivery. Designs, builds, or modifies fixtures used to assemble parts. Lays out cutting lines for machining, using drafting tools. Assembles and adjusts parts and related electrical units of prototype to prepare for test. Sets up prototype and test apparatus, such as control console, collimator, recording equipment, and cables in accordance with specifications. Operates controls of test apparatus and prototype to observe and record test results. Computes test data on laboratory forms for engineers. Confers in technical meetings, recommending design and material changes to reduce cost and lead time. May be assigned as group leader to coordinate work of technicians, model makers, and others assigned to assist.
GOE: 05.01.01 STRENGTH: L GED: R5 M4 L4 SVP: 8 DLU: 77

007.161-034 TEST ENGINEER, MECHANICAL EQUIPMENT (profess. & kin.)

Conducts tests on mechanical equipment performing duties as described under TEST ENGINEER (profess. & kin.) Master Title.
GOE: 05.01.04 STRENGTH: S GED: R5 M5 L5 SVP: 8 DLU: 77

007.161-038 SOLAR-ENERGY-SYSTEMS DESIGNER (profess. & kin.)

Designs solar domestic hot water and space heating systems for new and existing structures, applying knowledge of energy requirements of structure, local climatological conditions, solar technology, and thermodynamics: Estimates energy requirements of new or existing structures, based on analysis of utility bills of structure, calculations of thermal efficiency of structure, and prevailing climatological conditions. Determines type of solar system, such as water, glycol, or silicone, which functions most efficiently under prevailing climatological conditions. Calculates on-site heat generating capacity of different solar panels to determine optimum size and type of panels which meet structure's energy requirements. Arranges location of solar system components, such as panel, pumps, and storage tanks, to minimize length and number of direction changes in pipes and reconstruction of existing structures. Studies engineering tables to determine size of pipes and pumps required to maintain specified flow rate through solar panels. Specifies types of electrical controls, such as differential thermostat, temperature sensors, and solenoid valves, compatible with other system components, using knowledge of control systems. Completes parts list, specifying components of system. Draws wiring, piping, and other diagrams, using drafting tools. May inspect structures to compile data used in solar system design, such as structure's angle of alignment with sun and temperature of incoming cold water. May inspect construction of system to ensure adherence to design specifications.
GOE: 05.03.07 STRENGTH: L GED: R5 M4 L4 SVP: 5 DLU: 86

007.167-010 DIE-DRAWING CHECKER (profess. & kin.)

Examines die design drawings prepared by DIE DESIGNER (machine shop) for accuracy of design detail and to assure production feasibility of die sets: Computes dimensions of drawings to check accuracy of figures and proper placement of layout. Ascertains that production parts can be fabricated with dies as designed by applying thorough knowledge of machine capacities. Returns erroneous drawings to original designer for correction, indicating orally, or in writing, changes to be made.
GOE: 05.03.02 STRENGTH: S GED: R5 M5 L4 SVP: 7 DLU: 77

007.167-014 PLANT ENGINEER (profess. & kin.) alternate titles: factory engineer; superintendent, mechanical

Plans, directs, and coordinates activities concerned with design, construction, modification, and maintenance of equipment and machinery in industrial plant: Establishes standards and policies for pollution control, installation, modification, quality control, testing, operating procedure, inspection, and maintenance of equipment, according to engineering principles and safety regulations. Directs maintenance of plant buildings and coordinates requirements for new designs, surveys, and maintenance schedules

for equipment and machinery. Prepares bid sheets and contracts for construction and facilities acquisition. Tests newly installed machines and equipment to ensure fulfillment of contract specifications.
GOE: 05.01.08 STRENGTH: L GED: R5 M5 L5 SVP: 8 DLU: 87

007.167-018 TOOL PROGRAMMER, NUMERICAL CONTROL (any industry) alternate titles: computer-programmer, numerical control; programmer, numerical control; tool programmer

Plans numerical control program to control contour-path machining of metal parts on automatic machine tools: Analyzes drawings, sketches, and design data of part to determine dimension and configuration of cuts, selection of cutting tools, and machine speeds and feed rates, according to knowledge of machine shop processes, part specifications, and machine capabilities. Determines reference points and direction of machine cutting paths. Computes angular and linear dimensions, radii, and curvatures, and outlines sequence of operations required to machine part. Prepares geometric layout on graph paper or using computer-assisted drafting software to show location of reference points and direction of cutting paths, using drafting instruments or computer. Writes instruction sheets and cutter lists to guide setup and operation of machine. Writes program of machine instructions in symbolic language to encode numerical control tape or direct numerical control data base to regulate movement of machine along cutting path. Compares encoded tape or computer printout with original program sheet to assure accuracy of machine instructions. Revises program to eliminate instruction errors or omissions. Observes operation of machine on trial run to prove taped or programmed instructions.
GOE: 05.01.06 STRENGTH: S GED: R5 M4 L4 SVP: 7 DLU: 87

007.181-010 HEAT-TRANSFER TECHNICIAN (profess. & kin.)

Plans requirements for fabricating, installing, testing, and servicing climate control and heat transfer assemblies and systems to assist engineering personnel, utilizing knowledge of heat transfer technology and engineering methods: Calculates required capacities for equipment units of proposed system to obtain specified performance and submits data to engineering personnel for approval. Studies supplier catalogs and technical data to recommend equipment unit selections for system. Prepares unit design layouts and detail drawings for fabricating parts and assembling system. Estimates cost factors, such as labor and material for purchased and fabricated parts, and costs for assembling, testing and installing in customer's premises. Fabricates nonstandard parts for system, using metalworking machinery and assembles system, using handtools and power tools. Installs test fixtures, apparatus, and controls and conducts operational tests under specified conditions. Analyzes test data and prepares report for evaluation by engineering personnel. Installs system in customer premises and tests operational performance for compliance with contract specifications and applicable codes. Diagnoses special service problems of systems under service contract and writes instructions for service or repair personnel. May be designated according to specialty as Air-Conditioning Technician (profess. & kin.); Heating Technician (profess. & kin.); Refrigerating Technician (profess. & kin.).
GOE: 05.03.07 STRENGTH: L GED: R5 M5 L5 SVP: 7 DLU: 77

007.261-010 CHIEF DRAFTER (profess. & kin.) alternate titles: layer-out; lay-out drafter

Draws rough layout and sketches, and assigns work to and directs subordinate drafting workers: Sketches layout according to design proposal and standard specifications and practices. Assigns drafting of detail drawings to subordinate personnel and verifies accuracy and completeness of finished drawings. May perform duties described under DRAFTER (profess. & kin.) Master Title.
GOE: 05.03.02 STRENGTH: S GED: R5 M5 L5 SVP: 7 DLU: 77

007.261-014 DRAFTER, CASTINGS (profess. & kin.)

Drafts detailed drawings for castings which require special knowledge and attention to shrinkage allowances and such factors as minimum radii of fillets and rounds. Performs other duties as described under DRAFTER (profess. & kin.) Master Title.
GOE: 05.03.02 STRENGTH: S GED: R4 M4 L4 SVP: 7 DLU: 77

007.261-018 DRAFTER, PATENT (profess. & kin.)

Drafts clear and accurate drawings of varied sorts of mechanical devices for use of LAWYER, PATENT (profess. & kin.) in obtaining patent rights. Performs other duties as described under DRAFTER (profess. & kin.) Master Title.

GOE: 05.03.02 STRENGTH: S GED: R5 M5 L5 SVP: 7 DLU: 77

007.261-022 DRAFTER, TOOL DESIGN (profess. & kin.)

Drafts detailed drawing plans for manufacture of tools, usually following designs and specifications indicated by TOOL DESIGNER (profess. & kin.). Performs other duties as described under DRAFTER (profess. & kin.) Master Title.
GOE: 05.03.02 STRENGTH: S GED: R5 M5 L5 SVP: 7 DLU: 77

007.267-010 DRAWINGS CHECKER, ENGINEERING (profess. & kin.) alternate titles: standards analyst

Examines engineering drawings of military and commercial parts, assemblies, and installations to detect errors in design documents: Compares figures and lines on production drawing or diagram with production layout, examining angles, dimensions, bend allowances, and tolerances for accuracy. Determines practicality of design, material selection, available tooling, and fabrication process, applying knowledge of drafting and manufacturing methods. Confers with design personnel to resolve drawing and design discrepancies. May specialize in checking specific types of designs, such as mechanical assemblies, microelectronic circuitry, or fluid-flow systems. May operate copier equipment to make duplicates of designs.
GOE: 05.03.02 STRENGTH: S GED: R4 M4 L4 SVP: 6 DLU: 88

007.267-014 TOOL DESIGN CHECKER (aircraft mfg.) alternate titles: tool drawing checker

Examines tool drawings prepared by TOOL DESIGNER (profess. & kin.) 007.061-026 for inaccuracies of detail and evaluates overall tool design for fit, form, and function, utilizing knowledge of engineering principles, tool design methods, and manufacturing processes: Measures drawing dimensions, and compares figures with dimensions on original layout, specifications, or sample part to verify measurements conform to scale. Marks verified or out-of-scale dimensions on drawings. Inspects lines and figures on drawings for clarity. Evaluates overall tool design for functionality, conformance to drawing standards and design specifications, and manufacturing feasibility. Reviews material requirements for standardization and conformance to industry specification manuals. Discusses design, manufacturing, and related issues with engineering, production, or other personnel. Approves or rejects design. May operate computer to examine and evaluate computer-generated tool designs.
GOE: 05.01.07 STRENGTH: S GED: R5 M5 L5 SVP: 8 DLU: 88

007.281-010 DRAFTER, MECHANICAL (profess. & kin.) alternate titles: drafter, engineering

Drafts detailed drawings of machinery and mechanical devices, indicating dimensions and tolerances, fasteners and joining requirements, and other engineering data: Reviews rough sketches and engineering specifications received from engineer or architect. Drafts multiple-view assembly, subassembly, and layout drawings as required for manufacture and repair of machines and equipment. Performs other duties as described under DRAFTER (profess. & kin.) Master Title.
GOE: 05.03.02 STRENGTH: S GED: R5 M5 L5 SVP: 7 DLU: 87

007.362-010 NESTING OPERATOR, NUMERICAL CONTROL (aircraft mfg.) alternate titles: computer-numerical-control nesting operator; pattern data operator

Operates computer to lay out graphic display of parts to be machined in optimum arrangement (nest) and generate control media for numerical-control drilling, routing, and cutting machines: Reviews shop orders to determine job specifications and nesting requirements. Sorts shop orders into groups according to compatibility factors, such as quantity and shape of parts, and type, size, alloy, and gauge of material to be machined to produce nest that maximizes material utilization and minimizes machine setup and operation. Enters computer commands to retrieve stored parts data and graphic displays, such as simulated patterns or templates, and displays and manipulates part images on computer screen into optimum arrangement. Calculates and codes machine controlling criteria, such as table movement, type and size of cutting and drilling tools, spindle location, and machining start point, feed rate, and speed, utilizing knowledge of numerical-control machine operation. Enters commands to title and store nest layouts in computer memory and to build and maintain source files. Keys in commands to transfer nest data, listings, or layouts to other media, such as hardcopy, tape, or floppy disk, or to route nest data by direct link to direct-numerical-control machines. Loads and unloads disk packs, tapes, or floppy disks. May operate digitizing equipment to produce patterns. May discuss nesting or machining problems with machine operators or other personnel.
GOE: 05.03.02 STRENGTH: L GED: R4 M3 L3 SVP: 6 DLU: 89

008 CHEMICAL ENGINEERING OCCUPATIONS

This group includes occupations concerned with the application of chemistry and other sciences, such as physics and mathematics, and of engineering principles to manufacturing operations which involve chemical processes. Also includes the design, construction, and operation of industrial plants carrying out chemical processes. Typical specializations are heat transfer and energy conversion, food and pharmaceutical products, forest products, petrochemicals and fuels, and materials handling.

008.061-010 ABSORPTION-AND-ADSORPTION ENGINEER (profess. & kin.) alternate titles: adsorption-and-absorption engineer

Designs equipment and devises chemical processes to remove and separate components of gas mixture or liquid solutions by absorption and adsorption, using knowledge of chemistry and engineering: Devises processes and directs workers, using equipment, such as crushers, grinders, kilns, screens, pumps, compressors, pipelines, valves, tanks, and separators. Directs workers controlling flow of liquid or gas through an adsorbent, such as fuller's earth, clays, carbons, charcoal, and bone char in granular form (percolation method); or mixing adsorbent with liquid or gas and removing adsorbent by filtration, settling, or combination of both (contact filtration method). Directs workers, using absorption method to remove soluble constituent of gas or vapor by dissolving it in a liquid, using packed columns or towers into which liquid is sprayed.
GOE: 05.01.08 STRENGTH: S GED: R6 M6 L6 SVP: 8 DLU: 77

008.061-014 CHEMICAL DESIGN ENGINEER, PROCESSES (profess. & kin.)

Designs equipment and processes to produce chemical changes in elements and compounds, performing duties as described under DESIGN ENGINEER, FACILITIES (profess. & kin.) Master Title.
GOE: 05.01.07 STRENGTH: S GED: R5 M5 L5 SVP: 8 DLU: 77

008.061-018 CHEMICAL ENGINEER (profess. & kin.)

Designs equipment and develops processes for manufacturing chemicals and related products utilizing principles and technology of chemistry, physics, mathematics, engineering and related physical and natural sciences: Conducts research to develop new and improved chemical manufacturing processes. Designs, plans layout, and oversees workers engaged in constructing, controlling, and improving equipment to carry out chemical processes on commercial scale. Analyzes operating procedures and equipment and machinery functions to reduce processing time and cost. Designs equipment to control movement, storage, and packaging of solids, liquids, and gases. Designs and plans measurement and control systems for chemical plants based on data collected in laboratory experiments and pilot plant operations. Determines most effective arrangement of unit operations such as mixing, grinding, crushing, heat transfer, size reduction, hydrogenation, distillation, purification, oxidation, polymerization, evaporation, and fermentation, exercising judgment to compromise between process requirements, economic evaluation, operator effectiveness, and physical and health hazards. Directs activities of workers who operate and control such equipment as condensers, absorption and evaporation towers, kilns, pumps, stills, valves, tanks, boilers, compressors, grinders, pipelines, electro-magnets, and centrifuges to effect required chemical or physical change. Performs tests and takes measurements throughout stages of production to determine degree of control over variables such as temperature, density, specific gravity, and pressure. May apply principles of chemical engineering to solve environmental problems. May apply principles of chemical engineering to solve bio-medical problems. May develop electro-chemical processes to generate electric currents, using controlled chemical reactions or to produce chemical changes, using electric currents. May specialize in heat transfer and energy conversion, petrochemicals and fuels, materials handling, pharmaceuticals, foods, forest products, or products such as plastics, detergents, rubber, or synthetic textiles. May be designated according to area of specialization.
GOE: 05.01.07 STRENGTH: L GED: R6 M6 L6 SVP: 8 DLU: 77

008.061-022 CHEMICAL RESEARCH ENGINEER (profess. & kin.)

Conducts research on chemical processes and equipment, performing duties as described under RESEARCH ENGINEER (profess. & kin.) Master Title.
GOE: 05.01.01 STRENGTH: L GED: R5 M5 L5 SVP: 8 DLU: 77

008.061-026 CHEMICAL-TEST ENGINEER (profess. & kin.)

Conducts tests on chemicals, fuels, and processes, performing duties as described under TEST ENGINEER (profess. & kin.) Master Title.
GOE: 05.01.04 STRENGTH: L GED: R5 M5 L5 SVP: 8 DLU: 77

008.151-010 CHEMICAL-EQUIPMENT SALES ENGINEER (profess. & kin.)

Sells chemical processing equipment and provides technical services to clients, performing duties as described under SALES ENGINEER (profess. & kin.) Master Title.
GOE: 05.01.05 STRENGTH: L GED: R5 M5 L5 SVP: 8 DLU: 77

008.167-010 TECHNICAL DIRECTOR, CHEMICAL PLANT (profess. & kin.) alternate titles: technical manager, chemical plant

Plans and coordinates technical activities in chemical plant, pilot-plant, or chemical-engineering department: Directs activities of engineering personnel engaged in preparing plans, designs, cost estimates, and specifications for experimental, maintenance, or modernization programs to determine most feasible approach to technical problems. Directs activities of engineers and technicians setting up prototype units designed to perform experimental operations. Coordinates activities of workers engaged in testing and metering unit operations, and collecting and interpreting processing records. Evaluates performance records of chemical processes and physical operations and submits report of findings to management. May prepare reports on cost of plant operation.
GOE: 05.01.08 STRENGTH: L GED: R6 M6 L5 SVP: 8 DLU: 77

008.261-010 CHEMICAL-ENGINEERING TECHNICIAN (profess. & kin.)

Applies chemical engineering principles and technical skills to assist CHEMICAL ENGINEER (profess. & kin.) in developing, improving, and testing chemical-plant processes, products, and equipment: Prepares charts, sketches, diagrams, flow charts, and compiles and records engineering data to clarify design details or functional

criteria of chemical processing and physical operation units. Participates in fabricating, installing, and modifying equipment to ensure that critical standards are met. Tests developmental equipment and formulates standard operating procedures. Tests processing equipment and instruments to observe and record operating characteristics and performance of specified design or process. Observes chemical or physical operation processes and recommends modification or change. Observes and confers with equipment operators to ensure specified techniques are used. Writes technical reports and submits finding to CHEMICAL ENGINEER (profess. & kin.). Performs preventive and corrective maintenance of chemical processing equipment. May prepare chemical solutions for use in processing materials, such as synthetic textiles, detergents, and fertilizers following formula. May set up test apparatus. May instruct or direct activities of technical personnel. May assist in developing and testing prototype processing systems and be designated Chemical-Engineering Technician, Prototype-Development (profess. & kin.). May assist in development of pilot-plant units and be designated Pilot-Plant Research-Technician (petrol. refin.).
GOE: 05.01.08 STRENGTH: L GED: R5 M5 L5 SVP: 8 DLU: 77

010 MINING AND PETROLEUM ENGINEERING OCCUPATIONS

This group includes occupations concerned with the extraction of minerals from the earth, including planning the development of the mine. Accessory techniques include those used in geology and in civil, mechanical, electrical, metallurgical, and chemical engineering. Typical specializations are according to activities involved, such as exploration, extraction, mine layout, oil well development, safety, research, and supervision and management; or according to type of substance involved, such as metals, nonmetallic minerals, coal, or petroleum and natural gas.

010.061-010 DESIGN ENGINEER, MINING-AND-OIL-FIELD EQUIPMENT (profess. & kin.)

Designs mining and oil field machinery, performing duties as described under DESIGN ENGINEER, PRODUCTS (profess. & kin.) Master Title.
GOE: 05.01.07 STRENGTH: L GED: R5 M5 L5 SVP: 8 DLU: 77

010.061-014 MINING ENGINEER (mine & quarry)

Conducts research to determine location and methods of extracting minerals, such as metallic ores and nonmetallic substances, such as coal, stone, and gravel: Conducts or collaborates in geological exploration, and reviews maps and drilling logs to determine location, size, accessibility, and estimated value of mineral deposit. Determines methods to extract minerals, considering factors such as safety, operational costs, deposit characteristics, overburden depth, and surrounding strata. Plans, recommends, and coordinates mining process, type and capacity of haulage equipment, such as power shovels and trucks, and labor utilization. Lays out and directs mine construction operations, such as location and development of shafts, tunnels, chambers, position of excavation benches (levels), and access roads. Designs, implements, and monitors facility projects, such as water and power supply, ventilation system, rock-dust and radon gas control, drainage, rail and conveyor systems, and material cleaning, grading, and reduction systems. May devise methods and locations to store and replace excavated soil to reclaim mine sites. May analyze labor requirements, equipment needs, and operational costs to compute and prepare annual budget reports. May apply knowledge of mining engineering to solve problems concerned with environment.
GOE: 05.01.06 STRENGTH: L GED: R5 M5 L5 SVP: 7 DLU: 80

010.061-018 PETROLEUM ENGINEER (petrol. & gas)

Analyzes technical and cost factors to plan methods to recover maximum oil and gas in oil-field operations, utilizing knowledge of petroleum engineering and related technologies: Examines map of subsurface oil and gas reservoir locations to recommend placement of wells to maximize economical production from reservoir. Evaluates probable well production rate during natural or stimulated-flow production phases. Recommends supplementary processes to enhance recovery involving stimulation of flow by use of processes, such as pressurizing or heating in subsurface regions. Analyzes recommendations of reservoir engineering specialist for placement of well in oil field. Develops well drilling plan for management approval, specifying factors including drilling time, number of special operations, such as directional drilling, and testing, and material requirements and costs including well casing and drilling muds. Provides technical consultation during drilling operations to resolve problems such as bore directional change, unsatisfactory drilling rate or invasion of subsurface water in well bore. Advises substitution of drilling mud compounds or tool bits to improve drilling conditions. Inspects well to determine that final casing and tubing installations are completed. Plans oil and gas field recovery containers, piping, and treatment vessels to receive, remove contaminants, and separate oil and gas products flowing from well. Monitors production rate of gas or oil from established wells and plans rework process to correct well production, such as repacking of well bore and additional perforation of subsurface sands adjacent to well bottom. May apply knowledge of petroleum engineering to solve problems concerned with environment [ENVIRONMENTAL ENGINEER (profess. & kin.)]. May be designated according to specialty as Development Engineer, Geothermal Operations (profess. & kin.); Drilling Engineer (petrol. & gas); Production Engineer (petrol. & gas); Reservoir Engineer (petrol. & gas).
GOE: 05.01.08 STRENGTH: L GED: R5 M5 L5 SVP: 8 DLU: 77

010.061-022 RESEARCH ENGINEER, MINING-AND-OIL-WELL EQUIPMENT (mine & quarry; petrol. & gas)

Conducts research to develop improved mining and oil well equipment, performing duties as described under RESEARCH ENGINEER (profess. & kin.) Master Title.
GOE: 05.01.01 STRENGTH: L GED: R5 M5 L5 SVP: 8 DLU: 77

010.061-026 SAFETY ENGINEER, MINES (mine & quarry) alternate titles: director, safety

Inspects underground or open-pit mining areas and trains mine personnel to ensure compliance with state and federal laws and accepted mining practices designed to prevent mine accidents: Inspects mine workings to detect unsafe timbers, cribbing, roof bolts, electric wiring, elevators, explosives storage, equipment, and working conditions. Examines walls and roof surfaces for evidence of strata faults indicating cave-in or rock slide hazards. Tests air to detect concentrations of toxic gases and explosive dusts, using safety lamp, methane detector, carbon monoxide register, and anemometer. Recommends alteration or installation of ventilation shafts, partitions, or equipment to remedy inadequate air circulation of air-conditioning. Applies principles of mining engineering and human engineering to design protective equipment and safety devices for mine machinery. Gives instructions to mine personnel in safe working practices and first aid, and strives to promote and maintain safety-mindedness of workers. Investigates explosions, fires, and accidents and reports causes and recommendations for remedial action to insurance companies, mine management, and state authorities. May lead rescue activities during emergencies and maintain rescue equipment.
GOE: 05.01.02 STRENGTH: L GED: R5 M5 L5 SVP: 8 DLU: 80

010.061-030 TEST ENGINEER, MINING-AND-OIL-FIELD EQUIPMENT (mine & quarry; petrol. & gas)

Conducts tests on mining and oil field machinery and equipment, performing duties as described under TEST ENGINEER (profess. & kin.) Master Title.
GOE: 05.01.04 STRENGTH: L GED: R5 M5 L5 SVP: 8 DLU: 77

010.131-010 WELL-LOGGING CAPTAIN, MUD ANALYSIS (petrol. & gas) alternate titles: mud-analysis-well-logging captain

Supervises and coordinates activities of workers engaged in analysis of oil well drilling mud and well cuttings during drilling operations to detect presence of oil or gas and identify productive strata: Coordinates work of WELL-LOGGING OPERATORS, MUD ANALYSIS (petrol. & gas) engaged in continuous sampling and analysis of mud circulating through wells being drilled and preparation of mud analysis logs. Reviews analysis made by workers of cores cut from wells to determine nature of earth formations penetrated. Summarizes log data and core analysis records for engineering personnel. Initiates or recommends personnel actions, such as pay increase, transfer or discipline.
GOE: 02.04.01 STRENGTH: L GED: R5 M5 L4 SVP: 7 DLU: 77

010.151-010 SALES ENGINEER, MINING-AND-OIL-WELL EQUIPMENT AND SERVICES (mine & quarry; petrol. & gas)

Sells mining and oilwell equipment and provides technical services to clients, performing duties as described under SALES ENGINEER (profess. & kin.) Master Title.
GOE: 05.01.05 STRENGTH: L GED: R5 M5 L5 SVP: 8 DLU: 77

010.161-010 CHIEF ENGINEER, RESEARCH (petrol. & gas)

Coordinates research activities to develop new and improved methods of drilling wells and producing oil or gas: Directs, through subordinate engineering personnel, planning and progress of experimental projects in drilling and production operations, such as projects investigating composition of drilling mud, recovery of natural gasoline from crude oil and gas solutions, or dehydration of crude petroleum. Assists CHIEF PETROLEUM ENGINEER (petrol. & gas) in solution of technical operating problems. May direct research activities in geochemical or other petroleum prospecting methods.
GOE: 05.01.01 STRENGTH: S GED: R6 M6 L6 SVP: 8 DLU: 77

010.161-014 CHIEF PETROLEUM ENGINEER (petrol. & gas)

Plans and directs engineering activities of a petroleum company to develop oil fields and produce oil and gas: Formulates programs for developing oil fields, planning schedules for drilling wells and for constructing pumping units, crude-oil treating units, and other production facilities. Coordinates projected activities with civil, electrical, and other engineering departments. Directs, through subordinate workers, selection, installation, use, and repair of oil field equipment. Directs PETROLEUM ENGINEERS (petrol. & gas) in engineering work concerned with drilling new wells and producing flow of oil or gas from wells, in maintaining well logs, and in other engineering activities. Directs laboratory and field research to develop new or to improve old methods and equipment for recovery of oil and gas. Keeps abreast of new developments in petroleum engineering. Selects, trains, and promotes engineering personnel. May direct mechanical, civil, electrical, and other engineering activities. May direct engineering and drilling activities in developing geothermal field and be designated Director, Geothermal Operations (petrol. & gas).
GOE: 05.01.08 STRENGTH: S GED: R6 M6 L6 SVP: 9 DLU: 77

010.161-018 OBSERVER, SEISMIC PROSPECTING (petrol. & gas) alternate titles: field seismologist; geophysical operator; section-plotter operator

Plans and directs activities of field party engaged in collecting seismic data used in prospecting for oil or gas: Designates location of shot holes and placement of seismometers and connecting cables over blast area according to plot drawn by SURVEYOR, GEOPHYSICAL PROSPECTING (petrol. & gas). Plans and directs activities of workers engaged in laying out seismographic measuring apparatus over test area. Surveys area to verify that equipment is in position specified and tests electrical circuits for continuity. Directs SHOOTER, SEISMOGRAPH (petrol. & gas) to detonate charges placed in shot holes, using short wave radio. Observes reaction of recording instruments to detect irregularity. Develops picture of seismic wave pattern in photographic developing solution. Examines wave pattern on subterranean strata for evidence of distortion caused by electronic crossfeed, short circuit, or loose connection. Orders redrilling of shot holes and equipment layout to repeat shot. Directs repair or repairs instruments or equipment, using manufacturers' manuals and handtools.
GOE: 05.03.04 STRENGTH: L GED: R4 M4 L4 SVP: 7 DLU: 77

010.167-010 CHIEF ENGINEER (petrol. & gas; pipe lines)

Directs activities of workers in engineering department of petroleum production or pipeline company and advises management on engineering problems: Apportions work among engineering staff according to specialized training. Reviews engineering designs for neatness and accuracy. Directs engineering personnel in formulating plans, designs, cost estimates, and specifications for oil field or pipeline construction, maintenance, and modernization programs. Supervises engineering office workers computing operating budgets, compiling reports, and conducting special investigations and studies to evaluate efficiency of engineering programs. May apply knowledge of petroleum engineering to coordinate work of engineers engaged in solving problems concerned with environment [ENVIRONMENTAL ENGINEER (profess. & kin.)]. May be designated according to engineering department supervised as Chief Engineer, Drilling And Recovery (petrol. & gas); Chief Engineer, Pipeline (petrol. & gas); Chief Engineer, Production (petrol. & gas); Chief, Reservoir Engineering (petrol. & gas).
GOE: 05.01.08 STRENGTH: S GED: R6 M6 L6 SVP: 9 DLU: 77

010.167-014 DISTRICT SUPERVISOR, MUD-ANALYSIS WELL LOGGING (petrol. & gas) alternate titles: mud-analysis-well-logging supervisor, district; mud engineer; mud-logging superintendent

Plans and directs mud-sample testing operations: Consults with SUPERINTENDENT, OIL-FIELD DRILLING (petrol. & gas) and interprets drilling logs to determine status of wells being drilled. Plans and coordinates itinerary for WELL-LOGGING CAPTAIN, MUD ANALYSIS (petrol. & gas); WELL-LOGGING OPERATOR, MUD ANALYSIS (petrol. & gas) and other members of mobile field-laboratory crews to obtain maximum utilization of personnel with minimum disruption of drilling operations. Interprets mud analysis logs obtained by crews, for PETROLEUM ENGINEER (petrol. & gas).
GOE: 05.02.03 STRENGTH: S GED: R5 M5 L5 SVP: 8 DLU: 77

010.167-018 SUPERINTENDENT, OIL-WELL SERVICES (petrol. & gas) alternate titles: manager, oil-well services

Directs activities concerned with providing technical services, such as electrical well logging, gun perforating, directional or caliper surveying, and cementing, acidizing, and formation fracturing, to assist in solving special oil well drilling and production problems: Advises SUPERINTENDENT, DRILLING AND PRODUCTION (petrol. & gas) on specific servicing problems and recommends use of specialized tools, techniques, and services. Directs organization and training of personnel, and directly or through subordinate personnel supervises servicing operations. Supervises repair and maintenance of equipment. Keeps records of operations and prepares reports.
GOE: 05.02.01 STRENGTH: S GED: R5 M5 L5 SVP: 8 DLU: 77

010.261-010 FIELD ENGINEER, SPECIALIST (petrol. & gas)

Collects fluid samples from oil-or gas-bearing formations and analyzes sample to determine potential productivity of formation: Moves controls on panel to fire charge into formation and to operate hydraulic mechanism which thrusts and seals probe into perforation. Analyzes fluid in sample to determine potential productivity of formation.
GOE: 05.03.04 STRENGTH: L GED: R4 M4 L4 SVP: 7 DLU: 77

010.261-014 OBSERVER, ELECTRICAL PROSPECTING (petrol. & gas) alternate titles: electrical-logging engineer; electrical-prospecting operator

Measures resistance of earth formations to electrical charges, using electrical apparatus to obtain data for locating rock strata favorable to further petroleum exploration activities: Transports electrical equipment and instruments to designated locations, and directs and assists in laying out and connecting cables, electrodes, instrument panels, and other electrical equipment. Adjusts electrical instruments to eliminate electrical interferences from earth currents or weather conditions. Opens and closes circuits to send electrical current through electrodes into earth. Reads dials and records data of millivoltmeter readings at various receptor points along cable to detect loss of potential due to resistance of earth formations. Diagnoses cause of malfunctioning of instruments and cables and makes repairs.
GOE: 05.03.04 STRENGTH: L GED: R4 M4 L4 SVP: 6 DLU: 77

010.261-018 OBSERVER, GRAVITY PROSPECTING (petrol. & gas) alternate titles: gravity-prospecting operator; recorder, gravity prospecting

Records readings of gravity meter, torsion balance, and other gravity-measuring instruments at various points in terrain to obtain data regarding gravity characteristics indicating potential source of metallic ore or petroleum deposits: Sets up or directs set-up of instruments at specified location and records readings. Examines readings for accurate registration and adjusts instruments to specifications. Reads thermometers, barometers, and other instruments and records variations in temperature, barometric pressure, elevation, and other physical factors that affect instrument readings. May be designated according to instrument used as Gravity-Meter Observer (mine & quarry; petrol. & gas); Magnetometer Operator (mine & quarry; petrol. & gas).
GOE: 05.03.04 STRENGTH: L GED: R4 M4 L4 SVP: 6 DLU: 77

010.261-022 SURVEYOR, OIL-WELL DIRECTIONAL (petrol. & gas) alternate titles: oil-well-logging engineer

Measures sonar, electrical, or radioactive characteristics of earth formations in oil- or gas-well boreholes to evaluate productivity of oil- or gas-bearing reservoirs, using sonic, electronic, or nuclear measuring instruments: Signals HOISTING ENGINEER (any industry) to lower instruments into well, observing oscillograph and meters on control panel to verify operating condition of instruments. Turns dials on control panel to adjust instrument for specified recording and starts recording device when instruments reach bottom of borehole. Prints copies of recorded graphs in truck darkroom [DEVELOPER (photofinishing)]. Interprets graphs for customer to indicate identity, porosity, oil- or gas-bearing content, and productivity of geological formations. Measures borehole diameters, direction of borehole, and inclination of geological strata, using microcalipers, directional indicators (clinometers), and dipmeters. May be designated according to measuring instruments used as Acoustical Logging Engineer (petrol. & gas); Nuclear Logging Engineer (petrol. & gas).
GOE: 05.03.04 STRENGTH: L GED: R5 M5 L5 SVP: 7 DLU: 77

010.261-026 TEST-ENGINE EVALUATOR (petrol. refin.) alternate titles: research-test-engine evaluator

Collects and assists in evaluation of data obtained in testing petroleum fuels and lubricants under simulated operating conditions: Inspects engines after test runs have been made by TEST-ENGINE OPERATOR (petrol. refin.), for wear, deposits, and defective parts, using microscope and precision weighing and measuring devices to obtain accurate data. Records findings and assists in analyzing data. Assists in dismantling and reassembling engines during test runs. May obtain and analyze samples of engine-exhaust gas.
GOE: 05.01.04 STRENGTH: M GED: R4 M4 L4 SVP: 7 DLU: 77

010.267-010 SCOUT (petrol. & gas)

Investigates and collects information concerning oil well drilling operations, geological and geophysical prospecting, and land and lease contracts from other oil fields, the press, lease brokers, individuals, and organizations leading to possible discovery of new oil fields: Interviews individuals and observes field operations to obtain data, such as locations and depths of oil or gas wells or exploratory boreholes or of producing wells, subsurface and geophysical survey results, methods of well completion, and volume of oil or gas flow. Collects rock samples and cuttings and samples of oil or gas from wells. Inspects cores and notes recurrence of specific strata in various boreholes to confirm or disprove concepts of stratigraphy. Obtains information on purpose and locations of lease purchases, royalty contracts, and other agreements made by competitive companies. Observations may be confined to prospecting or to include drilling and producing activities. Must have knowledge of production engineering, oil field practices, and geology. May sketch subsurface contours of geological formations as indicated by data obtained. May negotiate with landowners for drilling leases, ore royalties, and land options [LEASE BUYER (mine & quarry; petrol. & gas)].
GOE: 05.03.04 STRENGTH: L GED: R5 M4 L4 SVP: 6 DLU: 77

010.281-010 DRAFTER, DIRECTIONAL SURVEY (petrol. & gas)

Plots oil- or gas-well boreholes from photographic subsurface survey recordings and other data. Computes and represents diameter, depth, degree, and direction of inclination, location of equipment, and other dimensions and characteristics of borehole. Performs other duties as described under DRAFTER (profess. & kin.) Master Title.
GOE: 05.03.02 STRENGTH: L GED: R5 M5 L5 SVP: 7 DLU: 77

010.281-014 DRAFTER, GEOLOGICAL (petrol. & gas)

Draws maps, diagrams, profiles, cross sections, directional surveys, and subsurface formations to represent geological or geophysical stratigraphy and locations of gas and oil deposits, performing duties as described under DRAFTER (profess. & kin.) Master Title: Correlates and interprets data obtained from topographical surveys, well logs, or geophysical prospecting reports, utilizing special symbols to denote geological and geophysical formations or oil field installations. May finish drawings in mediums and according to specifications required for reproduction by blueprinting, photographing, or other duplication methods.
GOE: 05.03.02 STRENGTH: S GED: R5 M5 L5 SVP: 6 DLU: 77

010.281-018 DRAFTER, GEOPHYSICAL (petrol. & gas)

Draws subsurface contours in rock formations from data obtained by geophysical prospecting party. Plots maps and diagrams from computations based on recordings of seismograph, gravity meter, magnetometer, and other petroleum prospecting instruments and from prospecting and surveying field notes. Performs other duties as described under DRAFTER (profess. & kin.) Master Title. May be designated according to method of prospecting as Drafter, Seismograph (petrol. & gas).
GOE: 05.03.02 STRENGTH: L GED: R5 M5 L5 SVP: 7 DLU: 77

010.281-022 WELL-LOGGING OPERATOR, MUD ANALYSIS (petrol. & gas) alternate titles: mud-analysis-well-logging operator

Analyzes mud and drill cuttings that are circulated through oil- or gas-well boreholes during drilling operations, using special testing equipment, to detect presence of oil or gas, and interprets findings to locate productive stratum: Attaches pump-stroke counter, mud-tank level indicator, and other measurement devices to drilling rig equipment, and connects electrical conductor cables to measurement devices and drilling rig monitoring instruments to prepare field laboratory for testing of mud and well cuttings. Detects presence of gas in mud by reading dial of gas-detection meter hooked up to detection devices in mud. Collects mud and drill cutting samples during drilling operations, and inspects samples to determine nature of earth formations encountered and presence of oil or gas in formation, using ultraviolet light, microscope, and other laboratory equipment. Keeps records of dial readings and tests made, and calculates depth of formations found to contain gas or oil. Performs minor repairs to electrical and mechanical equipment.
GOE: 02.04.01 STRENGTH: L GED: R4 M4 L4 SVP: 5 DLU: 77

011 METALLURGY AND METALLURGICAL ENGINEERING OCCUPATIONS

This group includes occupations concerned with the extraction of metals from ores, and their processing and conversion into final shape. Also includes the design and development of process methods. Accessory techniques needed include those used in chemistry, geology, ceramics, mineralogy, and in mining, chemical, and mechanical engineering.

011.061-010 FOUNDRY METALLURGIST (foundry) alternate titles: foundry technician

Conducts research to develop and improve methods of sand molding, melting, alloying, and pouring of metals: Makes experimental sand molds, and tests sand for permeability, strength, and chemical composition. Calculates quantity of alloying metals required. Melts alloys and pours metals under controlled conditions to make castings. Performs physical and radiographic tests and evaluates data to develop improved alloys and foundry techniques.
GOE: 05.01.01 STRENGTH: L GED: R5 M5 L5 SVP: 8 DLU: 77

011.061-014 METALLOGRAPHER (profess. & kin.)

Conducts microscopic, macroscopic, and other tests and investigations on samples of metals and alloys for purposes as metallurgical control over products or use in developing new or improved grades and types of metals, alloys, or production methods: Directs laboratory personnel in preparing of samples, such as polishing or etching, and designates area of sample where microscopic or macroscopic examination is to be made. Studies photomicrographs and performs microscopic examinations on samples to determine metal characteristics, such as crystal structure, porosity, and homogeneity. Interprets findings and prepares drawings, charts, and graphs for inclusion in reports for reference or instruction purposes, and writes reports regarding findings, conclusions, and recommendations. Coordinates and participates in performing special tests, such as end-quench hardenability, bend and tensile, and grain size tests.
GOE: 05.01.04 STRENGTH: S GED: R5 M5 L5 SVP: 8 DLU: 77

011.061-018 METALLURGIST, EXTRACTIVE (profess. & kin.) alternate titles: metallurgist, process

Originates, controls, and develops flotation, smelting, electrolytic, and other processes used in winning metals from their ores, for producing iron and steel, or for refining gold, silver, zinc, copper, and other metals: Studies ore reduction problems to determine most efficient methods of producing metals commercially. Controls temperature adjustments, charge mixtures, and other variables in blast-furnace operations and steel-melting furnaces to obtain pig iron and steel of specified metallurgical characteristics and qualities. Investigates methods of improving metallurgical processes, as in the reduction of alumina by electrolytic methods to produce aluminum, the distillation of molten ore to purify zinc, or selective oxidation methods to extract lead, nickel, mercury, and other nonferrous metals from their ores.
GOE: 05.01.06 STRENGTH: L GED: R6 M6 L6 SVP: 8 DLU: 77

011.061-022 METALLURGIST, PHYSICAL (profess. & kin.)

Investigates and conducts experiments concerned with physical characteristics, properties, and processing of metals to develop new alloys, applications, and methods of commercially fabricating products from metals: Conducts microscopic, x ray, x-ray diffraction, and spectroscopic studies of metals and alloys, such as steel, cast iron, and nonferrous alloys, to determine their physical characteristics, such as crystal structure, dispersion of alloy particles through basic metal, and presence of impurities, fractures, and other defects in metal samples. Develops melting, hot-working, cold-working, and heat-treating processes to obtain desired characteristics, such as ductility, malleability, elongation ability, durability, and hardness. Tests alloys in tension, compression, impact, bending, or fatigue devices to study physical characteristics for manufacturing purposes or determine compliance with manufacturing specifications and standards. Consults with engineers and officials to develop methods of manufacturing alloys at minimum costs. May specialize in particular area of physical metallurgy, such as development of improved techniques and materials, for use in production of pressed metallic-powder products.
GOE: 02.01.02 STRENGTH: L GED: R6 M6 L6 SVP: 8 DLU: 77

011.061-026 WELDING ENGINEER (profess. & kin.)

Develops welding techniques, procedures, and application of welding equipment to problems involving fabrication of metals, utilizing knowledge of production specifications, properties and characteristics of metals and metal alloys, and engineering principles: Conducts research and development investigations to develop and test new fabrication processes and procedures, improve existing or develop new welding equipment, develop new or modify current welding methods, techniques, and procedures, discover new patterns of welding phenomena, or to correlate and substantiate hypotheses. Prepares technical reports as result of research and development and preventive maintenance investigations. Establishes welding procedures to guide production and welding personnel relating to specification restrictions, material processes, pre- and post-heating requirements which involve use of complex alloys, unusual fabrication methods, welding of critical joints, and complex postheating requirements. Evaluates new developments in welding field for possible application to current welding problems or production processes. Directs and coordinates technical personnel in performing inspections to ensure workers' compliance with established welding procedures, restrictions, and standards; in testing welds for conformance with national code requirements; or testing welding personnel for certification. Contacts personnel of other agencies, engineering personnel, or clients to exchange ideas, information, or offer technical advice concerning welding matters. May perform experimental welding to evaluate new equipment, techniques, and materials.
GOE: 05.01.08 STRENGTH: L GED: R5 M5 L5 SVP: 8 DLU: 77

011.161-010 SUPERVISOR, METALLURGICAL-AND-QUALITY-CONTROL-TESTING (profess. & kin.) alternate titles: physical-testing supervisor

Directs and coordinates, through subordinate supervisory personnel, activities of workers engaged in testing finished and semifinished metal sample specimens to determine if metallurgical and physical properties meet manufacturing specifications: Reviews production schedules to ascertain work load and prepares schedules and priorities for work. Assigns personnel to specific work assignments and reviews test reports to determine if physical characteristics of sample specimens meet metallurgical specifications and quality control standards. Investigates causes of defective material and advises supervisory personnel of production department responsible of processing defects. Determines disposition of substandard material, according to established precedent or practice or upon approval of superior, such as downgrading, reprocessing, or scrapping material. Advises metallurgical personnel on problems involving quality control and testing techniques and methods and on application of metallurgical specifications to metal products.
GOE: 02.04.01 STRENGTH: L GED: R5 M5 L5 SVP: 8 DLU: 77

011.261-010 METALLURGICAL TECHNICIAN (profess. & kin.) alternate titles: metallurgical-laboratory assistant; metallurgical tester; physical-laboratory assistant

Examines and tests metal samples to determine their physical properties, under direction of METALLOGRAPHER (profess. & kin.): Conducts routine microscopic examinations of metals and alloys to determine their crystal structure, porosity, homogeneity, and other characteristics. Polishes or etches metal specimens and photographs samples, using photomicroscope, or directs photography technical personnel to take, develop, and mount photomicrographs. Examines metal and alloy samples with x-ray, gamma-ray, and magnetic-flux equipment to detect internal fractures, impurities, and similar defects in metals. Tests samples in pressure devices, hot-acid baths, and other apparatus to determine strength, hardness, elasticity, toughness, or other properties of metal.
GOE: 02.04.01 STRENGTH: L GED: R4 M4 L4 SVP: 6 DLU: 77

011.261-014 WELDING TECHNICIAN (profess. & kin.)

Conducts experiments and tests and evaluates data to assist welding engineering personnel in development and application of new or improved welding equipment; welding techniques, procedures, and practices; and specifications for material heat treating: Assists engineering personnel in testing and evaluating welding equipment, metals, and alloys. Evaluates data and conducts experiments to develop application of new equipment or improved techniques, procedures, or practices. Recommends adoption of new developments and applications to engineering personnel and demonstrates practicability of recommendations. Inspects welded joints and conducts tests to ensure welds meet company standards, national code requirements, and customer job specifications. Records inspection and test results and prepares and submits reports to welding engineering personnel. Conducts certification tests for qualification of personnel with national code requirements.
GOE: 05.01.01 STRENGTH: L GED: R4 M3 L3 SVP: 8 DLU: 77

011.261-018 NONDESTRUCTIVE TESTER (profess. & kin.)

Conducts radiographic, penetrant, ultrasonic, and magnetic particle tests on metal parts to determine if parts meet nondestructive specifications: Reviews test orders to determine type of test requested, test procedures to follow, and part acceptability criteria. Applies agents, such as cleaners, penetrants, and developers, and couplant (light oil which acts as medium), to parts, or heats parts in oven, to prepare parts for testing. Determines test equipment settings according to type of metal, thickness, distance from test equipment, and related variables, using standard formulas. Calibrates test equipment, such as magnetic particle, x-ray, and ultrasonic contact machines,

to standard settings, following manual instructions. Sets up equipment to perform tests, and conducts tests on parts, following procedures established for specified tests performed. Examines surface-treated materials during penetrant and magnetic particle tests to locate and identify cracks or other defects, using black light. Moves transducer probe across part when conducting ultrasonic tests and observes CRT (cathode ray tube) screen to detect and locate discontinuities in metal structure [ULTRASONIC TESTER (any industry) 739.281-014]. Examines film when conducting radiographic tests to locate structural or welding flaws. Marks tested parts to indicate defective areas. Evaluates test results against designated standards, utilizing knowledge of metals and testing experience. Prepares reports outlining findings and conclusions. May perform similar tests on nonmetallic parts or structures.
GOE: 05.07.01 STRENGTH: M GED: R4 M3 L3 SVP: 6 DLU: 88

011.261-022 LABORATORY ASSISTANT, METALLURGICAL (steel & rel.) alternate titles: metallurgical analyst; metallurgical inspector

Analyzes data obtained from investigation of physical and chemical properties of metals, or processes used in recovering metals from their ores to select method, standards, and procedures of examination and testing and conducts tests: Analyzes operating records and test reports, or by personal observation and investigation, determines conformance to established procedures, methods, and standards. Conducts physical, chemical, and process examinations, using metallurgical equipment and instruments for routine, special, and experimental investigations. Writes report indicating deviations from specifications and recommends corrective measures for approval.
GOE: 02.04.01 STRENGTH: L GED: R4 M4 L4 SVP: 7 DLU: 77

011.281-014 SPECTROSCOPIST (profess. & kin.) alternate titles: spectrographer; spectrographic analyst

Conducts spectrographic examinations of metal and mineral samples under established procedures, using spectrograph, spectrometer, densitometer, and other measuring instruments: Analyzes densitometer or spectrometer readings to measure density ratio of specific elements in sample. Computes percentage composition of sample by comparing intensity ratio with standard charts. Investigates deviations from standard, performing further examinations by other spectrographic procedures and methods to establish degree of conformance to standard. Records quantitative determination, procedure, and standard applied for each sample examined.
GOE: 02.04.01 STRENGTH: L GED: R4 M4 L4 SVP: 7 DLU: 77

011.361-010 TESTER (profess. & kin.) alternate titles: physical tester; testing-machine operator

Measures tensile strength, hardness, ductility, or other physical properties of metal specimens, using following prescribed series of operations: Determines tensile strength on tension-testing machines. Measures dimensions of specimen with scales and micrometers and records measurements. Screws or clamps specimen in holders on machine. Clamps extensometer onto specimen and connects wire from extensometer to automatic stress-strain recorder. Turns handwheels or moves levers to apply tension to specimen at specified rate. Notes reading of indicator dial on control panel of machine or observes stress-strain curve (curve obtained by plotting applied tension against resultant elongation) being drawn by recorder to determine yield point and tensile strength of specimen. Removes pieces of broken specimen from machine, fits them together, and measures amount of elongation. Makes simple calculations of values, such as unit tensile strength and percentage elongation, using tables. Records readings and calculations on special forms. Measures hardness of specimens [HARDNESS INSPECTOR (heat treating) 504.387-010]. Measures ductility of sheet metal specimens in sheet metal testing machine. May test specimens for plasticity and compression. May specialize in testing iron or steel sheets for ductility and be designated Sheet Tester (steel & rel.).
GOE: 02.04.01 STRENGTH: L GED: R4 M4 L3 SVP: 5 DLU: 77

012 INDUSTRIAL ENGINEERING OCCUPATIONS

This group includes occupations concerned with the design and installation of integrated systems of personnel, materials, machinery, and equipment. Accessory techniques may include those used in mechanical and various other engineering specialities. Typical specializations are plant layout; production methods and standards; cost control; quality control; time, motion, and incentive studies; and methods, production, and safety engineering.

012.061-010 PRODUCT-SAFETY ENGINEER (profess. & kin.)

Develops and conducts tests to evaluate product safety levels and recommends measures to reduce or eliminate hazards: Establishes procedures for detection and elimination of physical and chemical hazards and avoidance of potential toxic effects and other product hazards. Investigates causes of accidents, injuries, and illnesses resulting from product usage and develops solutions. Evaluates potential health hazards or damage which could result from misuse of products and applies engineering principles and product standards to improve safety. May participate in preparation of product usage and precautionary label instructions.
GOE: 05.01.02 STRENGTH: S GED: R6 M6 L6 SVP: 8 DLU: 77

012.061-014 SAFETY ENGINEER (profess. & kin.)

Develops and implements safety program to prevent or correct unsafe environmental working conditions, utilizing knowledge of industrial processes, mechanics, chemistry, psychology, and industrial health and safety laws: Examines plans and specifications for new machinery or equipment to determine if all safety precautions have been included. Determines amount of weight that can be safely placed on plant floor. Tours plant to inspect fire and safety equipment, machinery, and facilities to identify and correct potential hazards and ensure compliance with safety regulations. Determines requirements for safety clothing and devices, and designs, builds, and installs, or directs installation of safety devices on machinery. Conducts or coordinates safety and first aid training to educate workers about safety policies, laws, and practices. Investigates industrial accidents to minimize recurrence and prepares accident reports. May conduct air quality tests for presence of harmful gases and vapors.
GOE: 05.01.02 STRENGTH: L GED: R6 M6 L6 SVP: 8 DLU: 88

012.061-018 STANDARDS ENGINEER (profess. & kin.)

Establishes engineering and technical limitations and applications for items, materials, processes, methods, designs, and engineering practices for use by designers of machines and equipment, such as aircraft, automobiles, and space vehicles: Communicates with management of industrial organization to maintain knowledge of current and proposed projects in order to develop appropriate standards for design and production of new items. Evaluates data in scientific journals, suppliers' catalogs, government standards documents, and other sources of information on materials, processes, and parts to update knowledge of available resources. Prepares specification sheets and standard drawings designating parts and materials acceptable for specific uses, using knowledge of primary engineering discipline and related disciplines. Examines all factors involved to confirm that standards will result in most economic use of material and labor consistent with safety and durability of final product. Reviews standards prepared with other departmental specialists to assure consistency with existing standards and those in other specialized disciplines. Communicates with user personnel to confirm knowledge of standards and cooperation of various project groups. Follows established procedures for retention of data developed to assure optimum storage and retrieval by manual or automated methods.
GOE: 05.01.06 STRENGTH: S GED: R5 M5 L5 SVP: 8 DLU: 77

012.067-010 METROLOGIST (profess. & kin.)

Develops and evaluates calibration systems that measure characteristics of objects, substances, or phenomena, such as length, mass, time, temperature, electric current, luminous intensity, and derived units of physical or chemical measure: Identifies magnitude of error sources contributing to uncertainty of results to determine reliability of measurement process in quantitative terms. Redesigns or adjusts measurement capability to minimize errors. Develops calibration methods and techniques based on principles of measurement science, technical analysis of measurement problems, and accuracy and precision requirements. Directs engineering, quality, and laboratory personnel in design, manufacture, evaluation, and calibration of measurement standards, instruments, and test systems to ensure selection of approved instrumentation. Advises others on methods of resolving measurement problems and exchanges information with other metrology personnel through participation in

government and industrial standardization committees and professional societies.
GOE: 05.01.04 STRENGTH: S GED: R6 M6 L6 SVP: 8 DLU: 77

012.167-010 CONFIGURATION MANAGEMENT ANALYST (profess. & kin.)

Analyzes proposed changes of product design to determine effect on overall system, and coordinates recording of modifications for management control: Confers with manufacturer or customer representatives to establish change-reporting procedure, and prepares directives for change authorization and documentation by company and subcontractor personnel. Analyzes proposed part-design changes and exhibits to prepare report of effect on overall product for management action, using knowledge of engineering, manufacturing, and procurement activities. Confers with department managers to obtain additional information or to interpret policies and procedures for reporting changes in product design. Audits subcontractor's inspection or technical documents preparation procedure to verify compliance with contract requirements. Coordinates activities of personnel preparing manual or automated records of part-design change documents and $T3first-article configuration inspection.$T1
GOE: 05.01.06 STRENGTH: L GED: R5 M4 L5 SVP: 8 DLU: 77

012.167-014 MANAGER, QUALITY CONTROL (profess. & kin.)

Plans, coordinates, and directs quality control program designed to ensure continuous production of products consistent with established standards: Develops and analyzes statistical data and product specifications to determine present standards and establish proposed quality and reliability expectancy of finished product. Formulates and maintains quality control objectives and coordinates objectives with production procedures in cooperation with other plant managers to maximize product reliability and minimize costs. Directs, through intermediate personnel, workers engaged in inspection and testing activities to ensure continuous control over materials, facilities, and products. Plans, promotes, and organizes training activities related to product quality and reliability. May investigate and adjust customer complaints regarding quality.
GOE: 05.02.03 STRENGTH: L GED: R5 M5 L5 SVP: 8 DLU: 88

012.167-018 FACTORY LAY-OUT ENGINEER (profess. & kin.) alternate titles: planning engineer

Plans layout of complete departments of industrial plant or commercial establishment to provide maximum possible operating efficiency: Measures and studies available floor space and draws plan of floor space to scale, using drafting tools. Studies sequence of operations to be performed and flow of materials. Studies and measures machines, conveyors, benches, furnaces, and other equipment. Coordinates all available knowledge and information into finished scale drawing, showing most efficient location for each piece of equipment and necessary working area around each. May use computer-assisted design/drafting equipment.
GOE: 05.01.06 STRENGTH: L GED: R5 M5 L5 SVP: 8 DLU: 88

012.167-022 FIRE-PREVENTION RESEARCH ENGINEER (profess. & kin.) alternate titles: loss-prevention research engineer

Conducts research to determine cause and methods of preventing fires and prepares educational materials concerning fire prevention for insurance companies, performing duties as described under RESEARCH ENGINEER (profess. & kin.) Master Title.
GOE: 05.01.01 STRENGTH: S GED: R5 M5 L5 SVP: 7 DLU: 77

012.167-026 FIRE-PROTECTION ENGINEER (profess. & kin.) alternate titles: fire-loss-prevention engineer

Advises and assists private and public organizations and military services for purposes of safeguarding life and property against fire, explosion, and related hazards: Makes studies of industrial, mercantile, and public buildings, homes, and other property before and after construction, considering factors, such as fire resistance of construction, usage or contents of buildings, water supplies and water delivery, and egress facilities. Designs or recommends materials or equipment, such as structural components protection, fire-detection equipment, alarm systems, fire extinguishing devices and systems, and advises on location, handling, installation, and maintenance. Recommends materials, equipment, or methods for alleviation of conditions conducive to fire. Devises fire protection programs, and organizes and trains personnel to carry out such programs. May evaluate fire departments and adequacy of laws, ordinances, and regulations affecting fire prevention or firesafety. Conducts research and tests on fire retardants and firesafety of materials and devices and to determine fire causes and methods of fire prevention. May determine fire causes and methods of fire prevention. May teach courses on fire prevention and protection at accredited educational institutions. May advise and plan for prevention of destruction by fire, wind, water, or other causes of damage.
GOE: 05.01.02 STRENGTH: L GED: R5 M5 L5 SVP: 7 DLU: 77

012.167-030 INDUSTRIAL ENGINEER (profess. & kin.)

Plans utilization of facilities, equipment, materials, and personnel to improve efficiency of operations: Studies functional statements, organization charts, and project information to determine functions and responsibilities of workers and work units and to identify areas of duplication. Establishes work measurement programs and analyzes work samples to develop standards for labor utilization. Analyzes work force utilization, facility layout, and operational data, such as production costs, process flow charts, and production schedules, to determine efficient utilization of workers and equipment. Recommends methods for improving worker efficiency and reducing waste of materials and utilities, such as restructuring job duties, reorganizing work flow, relocating work stations and equipment, and purchase of equipment. Confers with management and engineering staff to implement plans and recommendations. May develop management systems for cost analysis, financial planning, wage and salary administration, and job evaluation.
GOE: 05.01.06 STRENGTH: S GED: R5 M5 L5 SVP: 7 DLU: 90

012.167-034 INDUSTRIAL-HEALTH ENGINEER (profess. & kin.) alternate titles: industrial hygiene engineer

Plans and coordinates private or government industrial health program requiring application of engineering principles and technology to analyze and control conditions contributing to occupational hazards and diseases: Conducts plant or area surveys to determine safe limits of exposure to materials or conditions, such as temperatures, noise, dusts, fumes, vapors, mists, gases, solvents, and radiation which are known or suspected of being real or potential detriments to health, and implements or recommends control measures. Directs workers engaged in field and laboratory verification of compliance with health regulations. Provides technical guidance to management, labor organizations, government agencies, and civic groups regarding health-related problems, such as stream and air pollution and correct use of protective clothing or accessories.
GOE: 05.01.02 STRENGTH: S GED: R5 M5 L5 SVP: 7 DLU: 77

012.167-038 LIAISON ENGINEER (aircraft mfg.)

Coordinates activities to evaluate and resolve engineering-related production problems encountered in assigned area of aircraft manufacturing facility: Reviews production schedules, engineering specifications, orders, and related information to maintain current knowledge of manufacturing methods, procedures, and activities in assigned area. Confers with quality control, material, manufacturing, and other department personnel to provide technical support. Interprets engineering drawings and facilitates correction of errors on drawings and documents identified during manufacturing operations. Investigates reports of defective, damaged, or malfunctioning parts, assemblies, equipment, or systems to determine nature and scope of problem. Examines, measures, inspects, or tests defective part for conformance to engineering design drawings or blueprint specifications, using precision measuring and testing instruments, devices, and equipment. Consults with project engineers to obtain specialized information. Evaluates findings to formulate corrective action plan and coordinates implementation of plan. Maintains records or oversees recording of information by others to ensure engineering drawings and documents are current and that engineering-related production problems and resolutions are documented. Serves as member of material review board to determine disposition of defective or damaged parts. May specialize in investigating and resolving tooling problems and be designated Tool Liaison (aircraft mfg.).
GOE: 05.01.06 STRENGTH: L GED: R5 M5 L4 SVP: 7 DLU: 88

012.167-042 MANUFACTURING ENGINEER (profess. & kin.)

Plans, directs, and coordinates manufacturing processes in industrial plant: Develops, evaluates, and improves manufacturing methods, utilizing knowledge of product design, materials and parts, fabrication processes, tooling and production equipment capabilities, assembly methods, and quality control standards. Analyzes and plans work force utilization, space requirements, and workflow, and designs layout of equipment and workspace for maximum efficiency [INDUSTRIAL ENGINEER (profess. & kin.) 012.167-030]. Confers with planning and design staff concerning product design and tooling to ensure efficient production methods. Confers with vendors to determine product specifications and arrange for purchase of equipment, materials, or parts, and evaluates products according to specifications and quality standards. Estimates production times, staffing requirements, and related costs to provide information for management decisions. Confers with management, engineering, and other staff regarding manufacturing capabilities, production schedules, and other considerations to facilitate production processes. Applies statistical methods to estimate future manufacturing requirements and potential.
GOE: 05.01.06 STRENGTH: L GED: R5 M5 L5 SVP: 8 DLU: 89

012.167-046 PRODUCTION ENGINEER (profess. & kin.)

Plans and coordinates production procedures in industrial plant: Directs production departments. Regulates and coordinates functions of office and shop. Introduces efficient production line methods. Initiates and directs procedures to increase company output.
GOE: 05.01.06 STRENGTH: L GED: R5 M5 L5 SVP: 8 DLU: 87

012.167-050 PRODUCTION PLANNER (profess. & kin.) alternate titles: planner, chief; planning supervisor; process planner; production-planning supervisor; production scheduler; scheduler; tool-and-production planner

Plans and prepares production schedules for manufacture of industrial or commercial products: Draws up master schedule to establish sequence and lead time of each operation to meet shipping dates according to sales forecasts or customer orders. Analyzes production specifications and plant capacity data and performs mathematical calculations to determine manufacturing processes, tools, and human resource requirements. Plans and schedules workflow for each department and operation according to previously established manufacturing sequences and lead times. Plans sequence of fabrication, assembly, installation, and other manufacturing operations for guidance of production workers. Confers with department supervisors to determine status of assigned projects. Expedites operations that delay schedules and alters schedules to meet unforeseen conditions. Prepares production reports. May prepare lists of required materials, tools, and equipment. May prepare purchase orders to obtain materials, tools, and equipment.
GOE: 05.01.06 STRENGTH: L GED: R5 M4 L4 SVP: 7 DLU: 86

012.167-054 QUALITY CONTROL ENGINEER (profess. & kin.)

Plans and directs activities concerned with development, application, and maintenance of quality standards for industrial processes, materials, and products: Develops and initiates standards and methods for inspection, testing, and evaluation, utilizing knowledge in engineering fields such as chemical, electrical, or mechanical. Devises sampling procedures and designs and develops forms and instructions for recording, evaluating, and reporting quality and reliability data. Establishes program to evaluate precision and accuracy of production equipment and testing, measurement, and analytical equipment and facilities. Develops and implements methods and procedures for disposition of discrepant material and devises methods to assess cost and responsibility. Directs workers engaged in measuring and testing product and tabulating data concerning materials, product, or process quality and reliability. Compiles and writes training material and conducts training sessions on quality control activities. May specialize in areas of quality control engineering, such as design, incoming material, process control, product evaluation, product reliability, inventory control, metrology, automated testing, software, research and development, and administrative application. May manage quality control program [MANAGER, QUALITY CONTROL (profess. & kin.) 012.167-014].
GOE: 05.01.04 STRENGTH: L GED: R6 M6 L6 SVP: 8 DLU: 89

012.167-058 SAFETY MANAGER (profess. & kin.)

Plans, implements, and coordinates program to reduce or eliminate occupational injuries, illnesses, deaths, and financial losses: Identifies and appraises conditions which could produce accidents and financial losses and evaluates potential extent of injuries resulting from accidents. Conducts or directs research studies to identify hazards and evaluate loss producing potential of given system, operation or process. Develops accident-prevention and loss-control systems and programs for incorporation into operational policies of organization. Coordinates safety activities of unit managers to ensure implementation of safety activities throughout organization. Compiles, analyzes, and interprets statistical data related to exposure factors concerning occupational illnesses and accidents and prepares reports for information of personnel concerned. Maintains liaison with outside organizations, such as fire departments, mutual aid societies, and rescue teams to assure information exchange and mutual assistance. Devises methods to evaluate safety program and conducts or directs evaluations. Evaluates technical and scientific publications concerned with safety management and participates in activities of related professional organizations to update knowledge of safety program developments. May store and retrieve statistical data, using computer.
GOE: 05.01.02 STRENGTH: S GED: R6 M6 L6 SVP: 8 DLU: 88

012.167-062 SUPERVISOR, VENDOR QUALITY (any industry) alternate titles: chief, vendor quality

Directs and coordinates quality inspection of parts, components, and materials produced by subcontractors and vendors, and surveillance of subcontractors' manufacturing processes: Directs sampling inspection, and testing of received parts, components, and materials to determine conformance to standards. Conducts periodic and special surveys of subcontractors' facilities and manufacturing processes to determine adequacy and capability of quality control and ability to comply with complete quality specifications. Reviews quality problems with engineering personnel and directs action required to correct defects. Prepares periodic and special reports concerning departmental activities, problems, subcontractors' quality system, schedules, and rejected items. Aids in organizational planning by participating in departmental conferences.
GOE: 05.03.06 STRENGTH: S GED: R5 M5 L5 SVP: 7 DLU: 77

012.167-070 TIME-STUDY ENGINEER (profess. & kin.) alternate titles: efficiency expert; manager, production; methods-and-procedures analyst; production engineer; production expert; time-study analyst; work-measurement engineer

Develops work measurement procedures and directs time-and-motion studies to promote efficient and economical utilization of personnel and facilities: Directs or conducts observation and analysis of personnel and work procedures to determine time-and-motion requirements of job duties. Analyzes work study data and equipment specifications to establish time and production standards. Applies mathematical analysis to determine validity and reliability of sampling and work study statistics. Applies principles of industrial engineering and applied psychology to evaluate work methods proposals and to develop recommendations to management affecting work methods, wage rates, and budget decisions. Trains INDUSTRIAL ENGINEERING TECHNICIAN (profess. & kin.) in time-and-motion study principles and techniques.
GOE: 05.01.06 STRENGTH: L GED: R5 M5 L5 SVP: 8 DLU: 77

012.167-074 TOOL PLANNER (any industry) alternate titles: processor

Analyzes blueprints or prototype parts to determine tools, fixtures, and equipment needed for manufacture and plans sequence of operations for fabrication and assembly of products, such as aircraft assemblies, automobile parts, cutting tools, or ball bearings: Studies engineering blueprints, drawings, models, and other specifications to obtain data on proposed part. Applies knowledge of functions and processes of various departments and capacities of machines and equipment to determine tool requirements and establish sequence of operations to fabricate and assemble parts. Lists operations to be performed on routing card or paper, indicates machines, cutting tools, fixtures, and other equipment to be used, and estimates times needed to perform each operation. May prepare reports for PRODUCTION

PLANNER (profess. & kin.) in scheduling work for entire plant. May plan tool and operation sequences for only one department. May specify type of material to be used in construction of tools.
GOE: 05.01.06 STRENGTH: S GED: R5 M5 L5 SVP: 8 DLU: 77

012.167-078 DOCUMENTATION ENGINEER (profess. & kin.)

Plans, directs, and coordinates preparation of project documentation, such as engineering drawings, production specifications and schedules, and contract modifications, to ensure customer contract requirements are met: Reviews contract to determine documentation required for each phase of project, applying knowledge of engineering and manufacturing processes. Schedules due dates for drawings, specifications, software, technical manuals, and other documents. Monitors status of project to ensure documentation is submitted according to schedule. Reviews and verifies project documents for completeness, format, and compliance with contract requirements. Submits project documentation to management for approval, and transmits approved documents to customer. Confers with engineers, managers, customers, and others to discuss project, prepare documents, or modify contract schedules.
GOE: 05.01.06 STRENGTH: L GED: R5 M5 L5 SVP: 8 DLU: 86

012.167-082 MATERIAL SCHEDULER (aircraft mfg.) alternate titles: commodities requirements analyst; material planning and acquisition analyst; production control scheduler

Develops and analyzes lists of raw materials, purchased parts, equipment, and other items required to manufacture aircraft and aerospace products: Reviews and evaluates engineering drawings and blueprints to estimate quantity and type of materials, parts, or other items required. Converts requirements to orders of conventional sizes and quantities, considering factors such as existing inventories, unavoidable waste, and kind of material to be used. Reviews material lists for conformance to company standard practices in regard to parts and materials used. Schedules deliveries based on production forecasts, material substitutions, storage and handling facilities, and maintenance requirements. Prepares or authorizes preparation of purchase requisitions. Estimates need to reorder supplies due to rejections and engineering changes during manufacturing cycle. Confers with purchasing, engineering, planning, and other personnel to exchange information regarding inventories, schedules, and related issues.
GOE: 05.03.03 STRENGTH: S GED: R5 M5 L5 SVP: 7 DLU: 87

012.187-014 SHOE-LAY-OUT PLANNER (boot & shoe) alternate titles: shoe planner

Plans detailed instructions of operations in manufacture of newly designed shoes: Compiles manufacturing data from designer specifications, such as last to be used, size runs, ornamentation, saddle height, strap width, and color. Computes sizes of parts, such as inserts, linings, quarters, or vamps according to shoe size specifications or following $T3standard size system.$T1 Lists specifications, such as materials, stitching, and findings for each shoe size. May cut paper patterns of shoe design. May cut traced design into pattern of shoe parts.
GOE: 05.03.02 STRENGTH: S GED: R5 M5 L4 SVP: 8 DLU: 77

012.261-010 AIR ANALYST (profess. & kin.) alternate titles: air tester

Analyzes samples of air in industrial establishments or other work areas to determine amount of suspended foreign particles and effectiveness of control methods, using dust collectors: Starts dust collector apparatus that draws air through machine and precipitates dust on tubes, plates, electrodes, or in flasks. Weighs or otherwise determines amount of collected particles, such as lead, rock, or coal dust. Compares weight or count of particles with volume of air passed through machine, and computes percentage of concentration per cubic foot of air tested, using mathematical and chemical formulas. Prepares summary of findings for submission to appropriate department. May recommend remedial measures.
GOE: 05.01.04 STRENGTH: L GED: R5 M5 L4 SVP: 5 DLU: 77

012.261-014 QUALITY CONTROL TECHNICIAN (profess. & kin.)

Tests and inspects products at various stages of production process and compiles and evaluates statistical data to determine and maintain quality and reliability of products: Interprets engineering drawings, schematic diagrams, or formulas and confers with management or engineering staff to determine quality and reliability standards. Selects products for tests at specified stages in production process, and tests products for variety of qualities, such as dimensions, performance, and mechanical, electrical, or chemical characteristics. Records test data, applying statistical quality control procedures. Evaluates data and writes reports to validate or indicate deviations from existing standards. Recommends modifications of existing quality or production standards to achieve optimum quality within limits of equipment capability. May set up and perform destructive and nondestructive tests on materials, parts, or products to measure performance, life, or material characteristics. May prepare graphs or charts of data or enter data into computer for analysis. May specialize in particular area of quality control engineering, such as design, incoming material, process control, product evaluation, inventory control, product reliability, research and development, and administrative application.
GOE: 02.04.01 STRENGTH: L GED: R5 M5 L4 SVP: 7 DLU: 89

012.267-010 INDUSTRIAL ENGINEERING TECHNICIAN (profess. & kin.)

Studies and records time, motion, methods, and speed involved in performance of maintenance, production, clerical, and other worker operations to establish standard production rate and to improve efficiency: Prepares charts, graphs, and diagrams to illustrate workflow, routing, floor layouts, material handling, and machine utilization. Observes workers operating equipment or performing tasks to determine time involved and fatigue rate, using stop watch, motion-picture camera, electrical recorder, and similar equipment. Recommends revision of methods of operation or material handling, alterations in equipment layout, or other changes to increase production or improve standards. Aids in planning work assignments in accordance with worker performance, machine capacity, production schedules, and anticipated delays. May be designated according to type of studies analyzed as Methods-Study Analyst (profess. & kin.); Motion-Study Analyst (profess. & kin.); Pace Analyst (profess. & kin.); Time-Study Analyst (profess. & kin.).
GOE: 05.03.06 STRENGTH: L GED: R5 M5 L4 SVP: 7 DLU: 81

012.281-010 SMOKE TESTER (smelt. & refin.)

Tests emissions from smokestack to determine if electrostatic precipitator and flue recovery systems are operating within prescribed standards: Measures force of gas flow by observing manometer attached to Pitot tube placed at various points in stack. Obtains solids contained in gas by drawing metered quantity of flue exhaust through filter bag. Computes total amount of gases and solids lost, using specified formula.
GOE: 02.04.01 STRENGTH: L GED: R4 M4 L3 SVP: 5 DLU: 77

013 AGRICULTURAL ENGINEERING OCCUPATIONS

This group includes occupations concerned with the application of engineering principles and techniques for the solution of agricultural problems. Also includes the design and development of agricultural machinery and structures. Accessory techniques needed may be those used in civil, mechanical, power, and electrical engineering; mineralogy; chemistry; and biology. Typical specializations are soil and water conservation; farm electrification; farm fire protection; pest control; and farm power and machinery, farm structures, and rural roads engineering.

013.061-010 AGRICULTURAL ENGINEER (profess. & kin.)

Applies engineering technology and knowledge of biological sciences to agricultural problems concerned with power and machinery, electrification, structures, soil and water conservation, and processing of agricultural products: Develops criteria for design, manufacture, or construction of equipment, structures, and facilities. Designs and uses sensing, measuring, and recording devices and instrumentation to study such problems as effects of temperature, humidity, and light, on plants or animals, or relative effectiveness of different methods of applying insecticides. Designs and directs manufacture of equipment for land tillage and fertilization, plant and animal disease and insect control, and for harvesting or moving commodities. Designs and supervises erection of structures for crop storage, animal shelter, and human dwelling, including light, heat, air-conditioning, water supply, and waste disposal. Plans and directs construction of rural electric-power distribution systems, and irrigation, drainage, and flood-control systems for soil and water conservation. Designs and supervises installation of equipment and instruments used to evaluate and process farm products, and to automate agricultural operations. May conduct radio and television educational programs to provide assistance to farmers, local groups, and related farm cooperatives. Workers are usually designated according to area of specialty or product.
GOE: 05.01.08 STRENGTH: L GED: R5 M5 L5 SVP: 8 DLU: 77

013.061-014 AGRICULTURAL-RESEARCH ENGINEER (profess. & kin.)

Conducts research to develop agricultural machinery and equipment, performing duties as described under RESEARCH ENGINEER (profess. & kin.) Master Title.
GOE: 05.01.01 STRENGTH: L GED: R5 M5 L5 SVP: 8 DLU: 77

013.061-018 DESIGN-ENGINEER, AGRICULTURAL EQUIPMENT (profess. & kin.)

Designs agricultural machinery and equipment, performing duties as described under DESIGN ENGINEER, PRODUCTS (profess. & kin.) Master Title.
GOE: 05.01.07 STRENGTH: L GED: R5 M5 L5 SVP: 8 DLU: 77

013.061-022 TEST ENGINEER, AGRICULTURAL EQUIPMENT (profess. & kin.)

Conducts tests on agricultural machinery and equipment, performing duties as described under TEST ENGINEER (profess. & kin.) Master Title.
GOE: 05.01.04 STRENGTH: L GED: R5 M5 L5 SVP: 8 DLU: 77

013.151-010 SALES ENGINEER, AGRICULTURAL EQUIPMENT (profess. & kin.)

Sells agricultural machinery and equipment and provides technical services to client, performing duties as described under SALES ENGINEER (profess. & kin.) Master Title.
GOE: 05.01.05 STRENGTH: L GED: R5 M5 L5 SVP: 8 DLU: 77

013.161-010 AGRICULTURAL-ENGINEERING TECHNICIAN (profess. & kin.)

Prepares original layout and completes detailed drawings of agricultural machinery and equipment, such as farm machinery, irrigation, power, and electrification systems, soil and water conservation equipment and agricultural harvesting and processing equipment: Applies biological and engineering knowledge, design principles, and theories to ensure compliance with company policy, and an end product which will perform as required. Maintains working knowledge of functions, operations, and maintenance of various types of equipment and materials used in the industry to assure appropriate utilization.
GOE: 05.01.07 STRENGTH: S GED: R5 M5 L4 SVP: 7 DLU: 77

014 MARINE ENGINEERING OCCUPATIONS

This group includes occupations concerned with the design, development, and installation of ship machinery and related equipment, including propulsion machines and power supply systems. Accessory techniques needed are those used in mechanical and electrical engineering. Typical specializations are construction and repair, design and layout, consulting, research, and the administration of engineering enterprises and government regulatory activities.

014.061-010 DESIGN ENGINEER, MARINE EQUIPMENT (profess. & kin.)

Designs marine machinery and equipment performing duties as described under DESIGN ENGINEER, PRODUCTS (profess. & kin.) Master Title.
GOE: 05.01.07 STRENGTH: L GED: R5 M5 L5 SVP: 8 DLU: 77

014.061-014 MARINE ENGINEER (profess. & kin.)

Designs and oversees installation and repair of marine powerplants, propulsion systems, heating and ventilating systems, and other mechanical and electrical equipment in ships, docks, and marine facilities: Studies drawings and specifications and performs complex calculations to conceive equipment and systems designed to meet requirements of marine craft or facility. Oversees and evaluates operation of equipment during acceptance testing and shakedown cruises. May specialize in design of equipment, such as boilers, steam-driven reciprocating engines, heat exchangers, fire-control and communication systems, electric power systems, or piping and related fittings and valves.
GOE: 05.01.03 STRENGTH: L GED: R6 M5 L5 SVP: 8 DLU: 77

014.061-018 RESEARCH ENGINEER, MARINE EQUIPMENT (profess. & kin.)

Conducts research on marine machinery and equipment, performing duties as described under RESEARCH ENGINEER (profess. & kin.) Master Title.
GOE: 05.01.01 STRENGTH: L GED: R5 M5 L5 SVP: 8 DLU: 77

014.061-022 TEST ENGINEER, MARINE EQUIPMENT (profess. & kin.)

Conducts tests on marine machinery and equipment, performing duties as described under TEST ENGINEER (profess. & kin.) Master Title.
GOE: 05.01.04 STRENGTH: L GED: R5 M5 L5 SVP: 8 DLU: 77

014.151-010 SALES ENGINEER, MARINE EQUIPMENT (profess. & kin.)

Sells marine machinery and equipment and provides technical services to client, performing duties as described under SALES ENGINEER (profess. & kin.) Master Title.
GOE: 05.01.05 STRENGTH: L GED: R5 M5 L5 SVP: 8 DLU: 77

014.167-010 MARINE SURVEYOR (profess. & kin.) alternate titles: ship surveyor

Surveys marine vessels and watercraft, such as ships, boats, tankers, and dredges, to ascertain condition of hull, machinery, equipment, and equipage, and to determine repairs required for vessel to meet requirements for insuring: Examines underwater section of hull while ship is drydocked to ascertain conditions that indicate

repairs are required. Takes readings on tailshaft and tailshaft bearings. Inspects condition of propellers, rudders, and sea valves. Inspects above waterline section of ship, such as hatchways, freeing ports, ventilators, bulkheads, fittings, and attachments, for compliance with operating standards, and compliance with standards for protection of crew. Observes operating tests on machinery and equipment and inspects opened up machinery for interior condition. Observes testing of cargo gear for compliance with testing standards and issues or endorses certificate for gear tested. Prepares reports on types of surveys conducted, recommended actions and repairs, or conditions remedied. Submits report to client.
GOE: 05.03.06 STRENGTH: L GED: R5 M4 L4 SVP: 8 DLU: 77

014.167-014 PORT ENGINEER (ship-boat mfg.; water trans.)

Coordinates repair and maintenance functions furnished operating fleet to minimize loss of revenue and cost of repairs: Reviews repair request and compares request with previous work accomplished on ship concerned and similar vessels to determine that expenditures are economically sound. Prepares recommendations for work, and initiates procurement of materials. Inspects machinery, equipment, or spaces outlined in work request, draws up job specifications, and obtains bids from contractors or shipyards to perform repairs. Maintains contact with contractors to ensure completion of work at minimum cost. Investigates machinery casualties to determine cause, and advises ship's officers in methods of operation to prevent recurrence of casualty or maloperation. Maintains records of engineering costs for each vessel, such as repairs, supplies, and personnel. Cooperates with regulatory bodies to ensure that requirements for alterations, repair, or modifications are kept at minimum cost consistent with safety. May represent ferry system interests in ferry and terminal construction and maintenance activities, and in union contract negotiations.
GOE: 05.01.06 STRENGTH: S GED: R5 M4 L3 SVP: 8 DLU: 77

014.281-010 DRAFTER, MARINE (profess. & kin.)

Draws structural and mechanical features of ships, docks, and other marine structures and equipment, performing duties of DRAFTER (profess. & kin.) Master Title. Works from general design drawings and notes made by ARCHITECT, MARINE (profess. & kin.) or MARINE ENGINEER (profess. & kin.).
GOE: 05.03.02 STRENGTH: S GED: R5 M5 L4 SVP: 7 DLU: 77

015 NUCLEAR ENGINEERING OCCUPATIONS

This group includes occupations concerned with the reasearch, development, and application of scientific knowledge of nuclear reactions and radiations, and principles of engineering applied to the production of heat and power, transmutation of elements, and production of neutrons, gamma radiation, and radioisotopes.

015.021-010 HEALTH PHYSICIST (profess. & kin.)

Devises and directs research, training, and monitoring programs to protect plant and laboratory personnel from radiation hazards: Conducts research to develop inspection standards, radiation exposure limits for personnel, safe work methods, and decontamination procedures, and tests surrounding areas to ensure that radiation is not in excess of permissible standards. Develops criteria for design and modification of health physics equipment, such as detectors and counters, to improve radiation protection. Assists in developing standards of permissible concentrations of radioisotopes in liquids and gases. Directs testing and monitoring of equipment and recording of personnel and plant area radiation exposure data. Requests bioassay samples from individuals believed to be exposed. Consults with scientific personnel regarding new experiments to determine that equipment or plant design conforms to health physics standards for protection of personnel. Conducts research pertaining to potential environmental impact of proposed atomic energy related industrial development to determine qualifications for licensing. Requisitions and maintains inventory of instruments. Instructs personnel in principles and regulations related to radiation hazards. Assigns film badges and dosimeters to personnel, and recommends changes in assignment for health reasons. Advises public authorities on methods of dealing with radiation hazards, and procedures to be followed in radiation incidents, and assists in civil defense planning. May specialize in research concerning decontamination of radioactive equipment and work areas in nuclear plants, laboratories, and other facilities and be designated Nuclear-Decontamination Research Specialist (profess. & kin.).
GOE: 05.01.02 STRENGTH: L GED: R6 M5 L5 SVP: 8 DLU: 81

015.061-010 DESIGN ENGINEER, NUCLEAR EQUIPMENT (profess. & kin.)

Designs nuclear machinery and equipment, performing duties as described under DESIGN ENGINEER, PRODUCTS (profess. & kin.) Master Title.
GOE: 05.01.07 STRENGTH: L GED: R5 M5 L5 SVP: 8 DLU: 77

015.061-014 NUCLEAR ENGINEER (profess. & kin.)

Conducts research into problems of nuclear energy systems; designs and develops nuclear equipment; and monitors testing, operation, and maintenance of nuclear reactors: Plans and conducts nuclear research to discover facts or to test, prove, or modify known nuclear theories concerning release, control, and utilization of nuclear energy. Evaluates findings to develop new concepts of thermonuclear analysis and new uses of radioactive processes. Plans, designs, and develops nuclear equipment such as reactor cores, radiation shielding, and associated instrumentation and control mechanisms. Studies nuclear fuel cycle to define most economical uses of nuclear material and safest means of waste products disposal. Monitors nuclear tests and examines operations of facilities which process or utilize radioactive or fissionable material to ensure efficient functioning and conformance with safety specifications, regulations, and laws. Prepares technical reports, utilizing knowledge obtained during research and development activities and inspectional functions. May direct operating and maintenance activities of operational nuclear facility.
GOE: 05.01.03 STRENGTH: S GED: R6 M6 L5 SVP: 8 DLU: 77

015.061-018 RESEARCH ENGINEER, NUCLEAR EQUIPMENT (profess. & kin.)

Conducts research on nuclear equipment and machinery, performing duties as described under RESEARCH ENGINEER (profess. & kin.) Master Title.
GOE: 05.01.01 STRENGTH: L GED: R5 M5 L5 SVP: 8 DLU: 77

015.061-022 TEST ENGINEER, NUCLEAR EQUIPMENT (profess. & kin.)

Conducts tests on nuclear machinery and equipment, performing duties as described under TEST ENGINEER (profess. & kin.) Master Title.
GOE: 05.01.04 STRENGTH: L GED: R5 M5 L5 SVP: 8 DLU: 77

015.061-026 NUCLEAR-FUELS RECLAMATION ENGINEER (profess. & kin.)

Plans, designs, and oversees construction and operation of nuclear fuels reprocessing systems: Performs research and experiments to determine acceptable methods of reclaiming various types of nuclear fuels. Designs nuclear fuel reclamation systems and equipment for pilot plants. Communicates with vendors and contractors, and computes cost estimates of reclamation systems. Writes project proposals and submits them to company review board. Studies safety procedures, guidelines, and controls, and confers with safety officials to ensure that safety limits are not violated in design, construction, or operation of systems and equipment. Oversees nuclear fuels reprocessing system construction and operation, conferring with construction supervisory and operating personnel. Tests system equipment and approves equipment for operation. Monitors operations to detect potential or inherent problems. Initiates corrective actions and orders plant shutdown in emergency situations. Identifies operational and processing problems and recommends solutions. Maintains log of plant operations, and prepares reports for review by plant officials.
GOE: 05.01.03 STRENGTH: L GED: R6 M5 L5 SVP: 7 DLU: 86

015.061-030 NUCLEAR-FUELS RESEARCH ENGINEER (profess. & kin.)

Studies behavior of various fuels and fuel configurations in differentiated reactor environments to determine safest and most efficient usage of nuclear fuels, applying theoretical and experiential knowledge of reactor physics and thermal and metallurgical characteristics of nuclear fuels and fuel cell claddings: Analyzes available data and consults with other scientists to determine parameters of experimentation and suitability of analytical models. Designs fuels behavior tests and coordinates activities of experimental research team in performance and analysis of test operations. Monitors test reactor indicators of factors such as neutron power level, coolant level, and vital pressure, temperature and humidity readings, and changes or modifies procedures to meet test goals. Synthesizes analyses of test results and prepares technical reports to disseminate findings and recommendations. Formulates equations that describe phenomena occurring during fissioning of nuclear fuels and develops analytical models for nuclear fuels research.
GOE: 05.01.03 STRENGTH: L GED: R6 M6 L6 SVP: 8 DLU: 86

015.067-010 NUCLEAR-CRITICALITY SAFETY ENGINEER (profess. & kin.)

Conducts research and analyzes and evaluates proposed and existing methods of transportation, handling, and storage of nuclear fuel to preclude accidental nuclear reaction at nuclear facilities: Reviews and evaluates fuel transfer and storage plans received from nuclear plants. Studies reports of nuclear fuel characteristics to determine potential or inherent problems. Reads blueprints of proposed storage facilities and visits storage sites to determine adequacy of storage plans. Forecasts nuclear fuel criticality (point at which nuclear chain reaction becomes self-sustaining), given various factors which may exist in fuel handling and storage, using knowledge of nuclear physics, calculator, and computer terminal. Determines potential hazards and accident conditions which may exist in fuel handling and storage and recommends preventive measures. Summarizes findings and writes reports. Confers with project officials to resolve situations where hazard is beyond acceptable levels. Prepares proposal reports for handling and storage of fuels to be submitted to government review board. Studies existing procedures and recommends changes or additions to guidelines and controls to ensure prevention of self-sustaining nuclear chain reaction.
GOE: 05.01.02 STRENGTH: L GED: R6 M6 L5 SVP: 8 DLU: 86

015.137-010 RADIATION-PROTECTION ENGINEER (profess. & kin.)

Supervises and coordinates activities of workers engaged in monitoring radiation levels and condition of equipment used to generate nuclear energy to ensure safe operation of plant facilities: Evaluates water chemical analysis data in primary and supportive plant systems to determine compliance with radiation content and corrosion control regulations. Investigates problems, such as radioactive leaks in reactors and auxiliary systems, or excessive radiation or corrosion of equipment, applying knowledge of radiation protection techniques and principles of chemistry and engineering to correct conditions. Confers with departmental supervisors, manufacturing representatives, and regulatory agency staff to discuss problems, to develop tests to detect radioactive leaks, and to design plans to monitor equipment and safety programs. Directs workers in testing and analyzing water samples and monitoring processing system. Prepares reports, such as environmental monitoring operation report, radioactive waste releases, and shipping reports, for review by administrative personnel and submission to regulatory agency. May prepare employee performance reviews and related reports.
GOE: 05.01.02 STRENGTH: L GED: R5 M4 L5 SVP: 8 DLU: 86

015.151-010 SALES ENGINEER, NUCLEAR EQUIPMENT (profess. & kin.)

Sells nuclear machinery and equipment and provides technical services to client, performing duties as described under SALES ENGINEER (profess. & kin.) Master Title.
GOE: 05.01.05 STRENGTH: L GED: R5 M5 L5 SVP: 8 DLU: 77

015.167-010 NUCLEAR-PLANT TECHNICAL ADVISOR (utilities)

Monitors plant safety status, advises operations staff, and prepares technical reports for operation of thermal-nuclear reactor at electric-power generating station: Observes control-room instrumentation systems and confers with operating personnel to ensure safe operation of plant. Walks throughout plant and observes machinery, equipment, and operating procedures to identify potential hazards. Examines locations of accidents and transients (sudden changes of voltage or load) and obtains data to formulate preventive measures. Implements changes in systems, procedures, structure, or equipment to improve safety. Compares critical parameters with plant transient predictions and accident analysis and determines whether response of plant safety systems is sufficient. Formulates corrective actions, calculates critical parameters from raw data, and computes rate of control rod withdrawal during reactor startup. Confers with operating personnel to provide technical assistance and to discuss maintenance activities, abnormal conditions, and safe operation of plant. Prepares reports to inform management officials of any proposed changes or irregularities in plant operation or systems.
GOE: 05.01.02 STRENGTH: L GED: R6 M5 L5 SVP: 8 DLU: 86

015.167-014 NUCLEAR-TEST-REACTOR PROGRAM COORDINATOR (profess. & kin.)

Evaluates, coordinates, and oversees testing of nuclear reactor equipment: Analyzes test proposal to ensure that test is valid and feasible. Identifies and resolves problems, such as incompatibilities between proposal and nuclear test-reactor system. Coordinates technical and financial agreements involving feasibility, scope, purpose, and cost of project in nuclear test facility. Assists engineering personnel in interpretation of test language, mathematical formulas, and computer codes used in test. Writes operational instructions. Inspects general condition of nuclear test-reactor vessel and related systems. Verifies setup of nuclear test-reactor for compliance with specifications. Observes control room instrumentation to ensure that performance factors such as neutron power level, chemical composition of coolant, and reactor temperatures and pressures are carried out as prescribed. Evaluates and resolves operational problems. Coordinates activities directed toward removal of test specimens from reactors and subsequent chemical, metallurgical, or mechanical analysis. Compiles report of test results.
GOE: 05.01.04 STRENGTH: L GED: R5 M5 L5 SVP: 8 DLU: 86

015.261-010 CHEMICAL-RADIATION TECHNICIAN (government ser.)

Tests materials and monitors operations of nuclear-powered electric generating plant, using specialized laboratory equipment and chemical and radiation detection instruments: Collects samples of water, gases, and solids at specified intervals during production process, using automatic sampling equipment. Analyzes materials, according to specified procedures, to determine if chemical components and radiation levels are within established limits. Records test results and prepares reports for review by supervisor. Assists workers to set up equipment and monitors equipment that automatically detects deviations from standard operations. Notifies personnel to adjust processing equipment, quantity of additives, and rate of discharge of waste materials, when test results and monitoring of equipment indicate that radiation levels, chemical balance, and discharge of radionuclide materials are in excess of standards. Carries out decontamination procedures to ensure safety of workers and continued operation of processing equipment in plant. Calibrates and maintains chemical instrumentation sensing elements and sampling system equipment, using handtools. Assists workers in diagnosis and correction of problems in instruments and processing equipment. Advises plant personnel of methods of protection from excessive exposure to radiation.
GOE: 11.10.03 STRENGTH: L GED: R4 M3 L3 SVP: 6 DLU: 86

015.362-010 ACCELERATOR OPERATOR (profess. & kin.)

Controls operation of particle accelerator used in research experiments involving properties of subatomic particles: Reviews experiment schedule to ascertain particle beam parameters specified by experimenter (scientist), such as energy, intensity, and repetition rate. Communicates with accelerator maintenance personnel to ensure readiness of support systems, such as vacuum, water cooling, and radiofrequency power source. Sets control panel switches, according to standard procedures, to route electric power from source and direct particle beam through injector unit. Turns panel controls and watches meters and panel lights to adjust beam steering units and direct beam to accelerator. Pushes console buttons in prescribed sequence to control beam path in accelerator. Adjusts controls to increase beam pulse rate, energy, and intensity to specified levels. Notifies experimenter in target control room when beam parameters meet specifications. Pushes control levers to steer beam to experimenter's

target, as directed. Monitors readings at console during experiment to ensure accelerator systems meet specifications and notifies experimenter of condition. Alters beam parameters during experiment as directed. Ensures that maintenance workers vacate hazardous locations before operations. Records data in log relative to beam specifications, equipment settings used, and beam conditions obtained for future reference. Participates in maintenance and modification of systems as member of team. May be designated according to type of accelerator operated.
GOE: 02.04.01 STRENGTH: L GED: R5 M4 L5 SVP: 7 DLU: 77

015.362-014 GAMMA-FACILITIES OPERATOR (profess. & kin.) alternate titles: pile operator; reactor-service operator

Controls gamma radiation equipment to irradiate materials for scientific research: Inserts capsules of materials to be irradiated into tubes leading to reactor core, using extension tool. Computes radiation time and dosage for experiments, and gamma intensities required at various distances from grid, using standard formulas, conversion tables, and slide rule, and submits data to supervisor for review. Tends cutoff saw, mounted on water-filled canal floor (radiation shield), that cuts fuel elements to size to fit into shielding boxes, using extension tools. Places fuel elements in geometric configurations around tube in gamma facility according to radiation intensity specifications. Lowers experimental materials, such as foods, plastics, or metal, into tube to subject material to irradiation for specified period of time. Lowers extension tool into floor of canal and transfers materials from completed experiments, and spent fuel elements discharged from reactor, to storage area on canal floor or into cask for subsequent shipment. Writes summary of irradiation activities performed. Monitors instruments and gauges that control heating, ventilating, steam, and water systems, and instruments that record gamma intensity, temperatures of experiments, and fuel elements in canal.
GOE: 02.04.01 STRENGTH: M GED: R4 M4 L4 SVP: 7 DLU: 77

015.362-018 HOT-CELL TECHNICIAN (profess. & kin.) alternate titles: irradiation technician

Operates remote-controlled equipment in hot cell to conduct metallurgical and chemical tests on radioactive materials: Controls slave manipulators from outside cell to remove metal or chemical materials from shielded containers inside hot cell and places on bench or equipment work station. Tests chemical or metallurgical properties of materials according to standardized procedures, and observes reaction through cell window. Sets up and operates machines to cut, lap, and polish test pieces, following blueprints, x-ray negatives, and sketches. Tests physical properties, using equipment, such as tensile tester, hardness tester, metallographic unit, micrometer, and gauges. Immerses test sample in chemical compound to prepare for testing. Places irradiated nuclear fuel materials in environmental chamber to test reaction to temperature changes. Records results of tests for further analysis by engineers, scientists, or customers. Places specimen in shielded container for removal from cell, using manipulators. Participates in cleaning and decontamination of cell during maintenance shutdown. May devise adapters and fixtures for use in hot cell operations.
GOE: 02.04.01 STRENGTH: L GED: R4 M3 L4 SVP: 7 DLU: 77

015.362-022 RADIOISOTOPE-PRODUCTION OPERATOR (profess. & kin.) alternate titles: isotope-production technician

Controls laboratory compounding equipment enclosed in protective hot cell to prepare radioisotopes and other radioactive materials for use as tracers for biological, biomedical, physiological, and industrial purposes according to written procedures: Places specified amounts of chemicals into container to be irradiated at nuclear reactor or with other irradiation equipment. Secures vacuum pump head to outlet valve on special container to replace air with inert gas, and routes container to irradiation facility. Receives irradiated chemicals delivered in shielded cell. Moves manipulator to open container and transfer irradiated contents into glass vessel. Opens pneumatic valves or uses manipulators to add specified types and quantities of chemical reagents into glass vessel to produce radioactive product. Controls manipulators to pour liquids required to perform standard chemical analyses involving titration and filtration. Withdraws radioactive sample for transport to chemical laboratory for analysis. Fills shipping container inside cell with prescribed quantity of radioisotope material for shipment pending sample approval.
GOE: 02.04.01 STRENGTH: L GED: R4 M3 L4 SVP: 6 DLU: 77

015.362-026 REACTOR OPERATOR, TEST-AND-RESEARCH (profess. & kin.)

Controls operation of nuclear reactor to create fissionable materials used for research purposes, study structure of atoms, and determine properties of materials: Positions fuel elements (uranium) and object to be irradiated in position in reactor core, using slave manipulators. Installs instrumentation leads in core to measure operating temperature and pressure in reactor working from mockups, blueprints, and wiring and instrumentation diagrams. Activates reactor and inserts object to be irradiated into rabbit (pneumatic) tube, beam hole, or irradiation tunnel according to size of object and nature of experiment. Monitors instruments at console and reactor panels to control chain reaction, following directions of nuclear experimenters. Calculates applicable limits of operating factors, such as temperature and pressure, using standard formulas, and adjusts controls to maintain operating conditions, such as power level, airflow and waterflow, temperature, and radiation and neutron levels in reactor within operating limits. Records data, such as type of material irradiated, exposure time, pile atmospheric conditions, and position of control rods in core. Disassembles reactor parts, such as core plug (shield) and control rods, using crane and handtools. Lifts spent fuel elements and irradiated objects from core, using extension tool, and drops them through chute into canal for recovery of fissionable material. May work as member of team and alternate between operating reactor controls and monitoring instruments, gauges, and other recording devices in control room.
GOE: 02.04.01 STRENGTH: L GED: R4 M4 L4 SVP: 7 DLU: 77

015.384-010 SCANNER (profess. & kin.)

Compiles lists of events (collisions of atomic nuclei) from photographs of bubble chamber, cloud chamber, or other particle detector, and operates machine to record characteristics of events into computers: Observes projected photographs to locate particle tracks, locate and count events indicated by tracks, and identify nature of observed events. Receives instructions from scientist directing project as to specific events that are important in experiment, and identifies such events from other events. Turns cranks to move projector and locates point on track under crosshairs of eyepiece. Enters data into computer to record coordinates of particles. Repeats process to record successive stages of tracks resulting from each event to provide information for scientists to identify particles. May use microscope fitted with scales and protractors to scan photographic emulsions previously exposed to direct radiation and to compute direction, angle, length, curvature, density, and depth of tracks from standard formulas.
GOE: 02.04.01 STRENGTH: S GED: R4 M3 L4 SVP: 6 DLU: 77

017 DRAFTERS, N.E.C.

This group includes occupations, not elsewhere classified, concerned with preparing drawings used to communicate engineering ideas and information.

017.161-010 DRAFTER, CHIEF, DESIGN (utilities)

Oversees DRAFTERS, ARCHITECTURAL (profess. & kin.); DRAFTERS, ELECTRICAL (profess. & kin.); DRAFTERS, MECHANICAL (profess. & kin.); and DRAFTERS, STRUCTURAL (profess. & kin.) in drawing designs of indoor and outdoor facilities and structures of electrical or gas power plants and substations. Consults with engineering staff on development of plans and designs for buildings and installations and prepares layout diagrams to ensure accurate interpretation of designs by workers supervised.
GOE: 05.03.02 STRENGTH: L GED: R5 M5 L5 SVP: 8 DLU: 77

017.261-010 AUTO-DESIGN CHECKER (auto. mfg.) alternate titles: checker, product design

Examines detail, layout, and master drawings of either auto-body or chassis parts, assemblies, and systems, for practicality of design, accuracy of mathematical calculations, dimensional accuracy, projection, and conformity to specifications and standards, using computerized work aids. Applies knowledge of auto-body and chassis design, methods of manufacture and assembly, and drafting techniques and procedures. Discusses necessary changes with staff members and coordinates corrections.
GOE: 05.03.02 STRENGTH: L GED: R5 M4 L4 SVP: 8 DLU: 90

017.261-014 DESIGN DRAFTER, ELECTROMECHANISMS (profess. & kin.)

Drafts designs of electromechanical equipment such as aircraft engine subassemblies, electronic optical-character-recognition and related data processing systems, gyroscopes, rocket engine control systems, automatic materials handling and processing machinery, or bio-medical equipment: Confers with engineers and other drafters to interpret design concepts, determine nature and type of required detailed working drawings, and coordinate work with others. Drafts detail and assembly drawings performing duties described under DRAFTER (profess. & kin.) Master Title. Compiles data, computes quantities, determines materials needed, and prepares cost estimates.
GOE: 05.03.02 STRENGTH: S GED: R5 M5 L4 SVP: 7 DLU: 77

017.261-018 DETAILER (profess. & kin.)

Drafts detailed drawings of parts of machines or structures from rough or general design drawings: Shows dimensions, material to be used, and other information necessary to make detailed drawing clear and complete. Makes tracing of finished drawing on semitransparent paper from which blueprints can be made. Performs other duties as described under DRAFTER (profess. & kin.) Master Title. May specialize in preparing detail drawings for specific type of machine, structure, or product.
GOE: 05.03.02 STRENGTH: S GED: R4 M4 L4 SVP: 7 DLU: 77

017.261-022 DETAILER, FURNITURE (profess. & kin.)

Prepares detailed shop drawings in scale or full size, from blueprints of FURNITURE DESIGNER (furniture), showing methods of construction and upholstering, and indicating sizes and kinds of material to be used. Performs other duties as described under DRAFTER (profess. & kin.) Master Title.
GOE: 05.03.02 STRENGTH: L GED: R4 M4 L4 SVP: 7 DLU: 77

017.261-026 DRAFTER, COMMERCIAL (profess. & kin.)

Performs general duties of DRAFTER (profess. & kin.) Master Title in all-round drafting, such as laying out location of buildings, planning of arrangements in offices, large rooms, store buildings, and factories, and drawing of charts, forms, and records. Paints and washes colored drawings when required.
GOE: 05.03.02 STRENGTH: S GED: R5 M5 L4 SVP: 6 DLU: 77

017.261-030 DRAFTER, DETAIL (profess. & kin.)

Makes detailed drawings, in accordance with customers' orders, to provide shop departments with accurate information for manufacture of structural and ornamental construction parts: Confers with customers. Makes freehand sketches of designs and drawings of approved sketches. Advises supervisory personnel on difficult or obscure problems.
GOE: 05.03.02 STRENGTH: S GED: R4 M4 L4 SVP: 7 DLU: 77

017.261-034 DRAFTER, HEATING AND VENTILATING (profess. & kin.)

Draws plans for installation of heating, air-conditioning, and ventilating equipment, performing duties of DRAFTER (profess. & kin.) Master Title. May calculate heat loss and heat gain for buildings for use in determining equipment specifications, using calculator and following standardized procedures. May specialize in drawing plans for installation of refrigeration equipment only and be designated Drafter, Refrigeration (profess. & kin.).
GOE: 05.03.02 STRENGTH: S GED: R5 M5 L4 SVP: 7 DLU: 77

017.261-038 DRAFTER, PLUMBING (profess. & kin.)

Performs duties of DRAFTER (profess. & kin.) Master Title but specializes in drawing of plans for installation of plumbing equipment.
GOE: 05.03.02 STRENGTH: S GED: R5 M5 L4 SVP: 7 DLU: 77

017.261-042 DRAFTER, AUTOMOTIVE DESIGN (auto. mfg.)

Designs and drafts working layouts and master drawings of automotive vehicle components, assemblies, and systems from specifications, sketches, models, prototype or verbal instructions, applying knowledge of automotive vehicle design, engineering principles, manufacturing processes and limitations, and conventional and computer drafting techniques and procedures, using drafting instruments and computerized work aids: Analyzes specifications, sketches, engineering drawings, ideas and related design data to determine critical factors affecting design of components based on knowledge of previous designs and manufacturing processes and limitations. Draws rough sketches and performs mathematical computations to develop design and work out detailed specifications of components. Applies knowledge of mathematical formulas and physical laws and uses conventional and computerized work aids to make calculations. Performs preliminary and advanced work in development of working layouts and final master drawings adequate for detailing parts and units of design. Makes revisions to size, shape and arrangement of parts to create practical design. Confers with AUTOMOTIVE ENGINEER (auto. mfg.) 007.061-010 and others on staff to resolve design problems. Specializes in design of specific type of body or chassis components, assemblies or systems, such as door panels, chassis frame and supports, or braking system.
GOE: 05.03.02 STRENGTH: L GED: R5 M4 L4 SVP: 7 DLU: 90

017.281-010 AUTO-DESIGN DETAILER (auto. mfg.)

Drafts full-size or scale detail drawings of either auto-body or chassis parts and assemblies from specifications, master drawings, layouts, models, prototypes, sketches, or verbal instructions, for engineering and manufacturing purposes [DRAFTER (profess. & kin.) Master Title], applying knowledge of auto-body or chassis structure and methods of manufacture and assembly.
GOE: 05.03.02 STRENGTH: L GED: R4 M4 L3 SVP: 6 DLU: 90

017.281-014 DRAFTER APPRENTICE (profess. & kin.)

Performs duties as described under APPRENTICE (any industry) Master Title.
GOE: 05.03.02 STRENGTH: S GED: R5 M5 L4 SVP: 6 DLU: 77

017.281-018 DRAFTER, ASSISTANT (profess. & kin.)

Copies plans and drawings prepared by DRAFTER (profess. & kin.) Master Title by tracing them with ink and pencil on transparent paper or cloth spread over drawings, using triangle, T-square, compass, pens, and other drafting instruments. Makes simple sketches or drawings under close supervision.
GOE: 05.03.02 STRENGTH: S GED: R4 M4 L3 SVP: 7 DLU: 77

017.281-026 DRAFTER, AUTOMOTIVE DESIGN LAYOUT (auto. mfg.)

Prepares working layouts and master drawings of automotive vehicle components, assemblies, or systems from specifications, prior layouts, well-defined sketches, models or verbal instructions sufficient for detailing, applying knowledge of conventional and computerized drafting techniques and procedures, automotive vehicle design, manufacturing processes and limitations, using conventional drafting instruments and computerized work aids: Studies specifications, sketches, notes, and other design data and measures prior layouts, using scales and dividers, to determine details and dimensions of components being laid out from superimposed views and sections of parts on layouts. Lays out on vellum major or minor components, assemblies, or systems in full-scale working layouts. Performs mathematical calculations to work out detailed additions to specifications, applying knowledge of mathematical formulas, using slide rule or digital calculators. Develops design of details not completely defined. Projects sections and auxiliary views of components on layouts. Makes corrections, revisions, and changes to layouts as directed by AUTO-DESIGN CHECKER (auto. mfg.) 017.261-010 or DRAFTER, AUTOMOTIVE DESIGN (auto. mfg.) 017.261-042. Drafts master drawing of approved design on mylar, aluminum, or other materials. Specializes in laying out specific type of body or chassis components, assemblies, or systems. Coordinates and works in conjunction with other workers designing, laying out, or detailing same or related structures. May direct activities of detailers.
GOE: 05.03.02 STRENGTH: L GED: R4 M4 L3 SVP: 7 DLU: 90

017.281-030 DRAFTER, OIL AND GAS (petrol. & gas; petrol. refin.)

Drafts plans and drawings for layout, construction, and operation of oil fields, refineries, and pipeline systems from field notes, rough or detailed sketches, and specifications: Develops detail drawings for construction of equipment and structures, such as drilling derricks, compressor stations, gasoline plants, frame, steel, and masonry buildings, piping manifolds and pipeline systems, and for manufacture, fabrication, and assembly of machines and machine parts [DRAFTER, ARCHITECTURAL (profess. & kin.); DRAFTER, CIVIL (profess. & kin.); DRAFTER, MECHANICAL (profess. & kin.)]. Prepares maps of pipeline systems and oil and gas locations, using field survey notes and aerial photographs [DRAFTER, CARTOGRAPHIC (profess. & kin.)]. May draft topographical maps or develop maps to represent geological stratigraphy and locations of oil and gas deposits, using geological and geophysical prospecting and surveying data [DRAFTER, GEOLOGICAL (petrol. & gas); DRAFTER, GEOPHYSICAL (petrol. & gas)].
GOE: 05.03.02 STRENGTH: L GED: R4 M4 L3 SVP: 7 DLU: 77

017.281-034 TECHNICAL ILLUSTRATOR (profess. & kin.) alternate titles: engineering illustrator; production illustrator

Lays out and draws illustrations for reproduction in reference works, brochures, and technical manuals dealing with assembly, installation, operation, maintenance, and repair of machines, tools, and equipment: Prepares drawings from blueprints, designs, mockups, and photoprints by methods and techniques suited to specified reproduction process or final use, such as blueprint, photo-offset, and projection transparencies, using drafting and optical equipment. Lays out and draws schematic, perspective, orthographic, or oblique-angle views to depict function, relationship, and assembly-sequence of parts and assemblies, such as gears, engines, and instruments. Shades or colors drawing to emphasize details or to eliminate undesired background, using ink, crayon, airbrush, and overlays. Pastes instructions and comments in position on drawing. May draw cartoons and caricatures to illustrate operation, maintenance, and safety manuals and posters.
GOE: 05.03.02 STRENGTH: S GED: R5 M5 L4 SVP: 7 DLU: 77

017.684-010 TAPER, PRINTED CIRCUIT LAYOUT (electron. comp.)

Places (tapes) adhesive symbols and precision tape on sheets of mylar in conformance with preliminary drawing of printed circuit board (PCB) to produce master layout: Places, aligns, and secures preliminary drawing of PCB and successive layers of transparent sheets of mylar on lighted drafting table, using register bar. Selects specified symbols and width of tape to indicate peak voltage potential. Cuts tape and places tape and adhesive symbols on specified sheets of mylar to outline board size, to indicate connector pads, placement of various components, and to trace circuitry of PCB as indicated on underlying preliminary drawing, using utility knife, precision grid, and straightedge. Places specified adhesive identification and reference numbers on master layout. Reproduces blueprint copy of master layout, using print machine. Inspects copy to verify accuracy.
GOE: 05.03.02 STRENGTH: S GED: R2 M2 L2 SVP: 2 DLU: 86

018 SURVEYING/CARTOGRAPHIC OCCUPATIONS

This group includes occupations concerned with determining, delineating, planning, and positioning tracts of land, natural and constructed features, coastlines, and land areas. Typical specialized surveys include property, cartography, construction, geodesy, hydrography, mining, photogrammetry, topography, land development, and mapping.

018.131-010 SUPERVISOR, CARTOGRAPHY (profess. & kin.)

Supervises and coordinates activities of DRAFTERS, CARTOGRAPHIC (profess. & kin.); PHOTOGRAMMETRISTS (profess. & kin.); and other personnel concerned with preparation of maps or map components: Develops design concept of map product. Defines production specifications, such as projection, scale, size, and colors. Provides guidelines for source material to be used, such as maps, automated mapping products, photographs, survey data, and place names. Supervises and coordinates compilation and editing of product components and monitors reproduction. Performs other duties as described under SUPERVISOR (any industry) Master Title.
GOE: 05.03.02 STRENGTH: S GED: R5 M5 L5 SVP: 8 DLU: 77

018.161-010 SURVEYOR, MINE (profess. & kin.)

Conducts surveys at surface and subsurface mine sites to obtain data used in planning mining operations: Takes instrument readings of sun or stars and calculates longitude and latitude to determine mine location. Directs survey technicians and helpers [SURVEYOR HELPER (any industry) 869.567-010] in use of electronic surveying equipment, light emitting systems, or other instruments to transfer surface survey positions and directions to underground areas and to survey assigned sections. Computes data necessary for driving and connecting underground passages to control direction and extent of mining operation. Computes volume of coal or ore in portions of mine, using survey data. Surveys and calculates volume of material deposits, spoil piles, or veins, and amount of overburden to be removed. Drafts or directs others to draft maps of survey data. May assist MINE SUPERINTENDENT (mine & quarry) 181.117-014 and MINING ENGINEER (mine & quarry) 101.061-014 in planning mining operations. May conduct surveys of tunnels, subway sites, and underground storage facilities.
GOE: 05.03.01 STRENGTH: L GED: R5 M5 L4 SVP: 7 DLU: 80

018.167-010 CHIEF OF PARTY (profess. & kin.)

Leads work of survey party under direction of LAND SURVEYOR (profess. & kin.), performing surveying duties not requiring licensure.
GOE: 05.03.01 STRENGTH: L GED: R5 M5 L4 SVP: 7 DLU: 77

018.167-014 GEODETIC COMPUTATOR (profess. & kin.) alternate titles: topographic computator

Calculates latitude, longitude, angles, areas, and other information for mapmaking from field notes secured by engineering survey party, using reference tables and calculating machine or computer.
GOE: 05.03.01 STRENGTH: S GED: R5 M5 L4 SVP: 6 DLU: 77

018.167-018 LAND SURVEYOR (profess. & kin.)

Plans, organizes, and directs work of one or more survey parties engaged in surveying earth's surface to determine precise location and measurements of points, elevations, lines, areas, and contours for construction, mapmaking, land division, titles, mining or other purposes: Researches previous survey evidence, maps, deeds, physical evidence, and other records to obtain data needed for surveys. Develops new data from photogrammetric records. Determines methods and procedures for establishing or reestablishing survey control. Keeps accurate notes, records, and sketches to describe and certify work performed. Coordinates findings with work of engineering and architectural personnel, clients, and others concerned with project. Assumes legal responsibility for work and is licensed by state.
GOE: 05.01.06 STRENGTH: L GED: R5 M5 L4 SVP: 7 DLU: 77

018.167-022 MANAGER, LAND SURVEYING (profess. & kin.)

Plans, directs, and coordinates work of survey parties, and related staff, engaged in surveying earth's surface and preparing reports and legal descriptions of land: Develops organization policy or interprets it to staff. Prepares or approves budget for unit or organization within assigned area of responsibility. Coordinates work of LAND SURVEYOR (profess. & kin.) with that of legal, engineering, architectural, and other staff on project. Directs survey parties and projects, and reviews and certifies completed work to satisfy legal requirements. Writes or directs the writing of descriptions of land to satisfy legal requirements according to standard surveying practices. Appears as expert witness in court in cases involving land or boundary disputes. Monitors new technology, and evaluates and purchases or authorizes purchase of new equipment and supplies. Selects new staff for employment and takes disciplinary action when necessary. Assumes legal responsibility for work performed and is licensed by state.
GOE: 05.02.06 STRENGTH: L GED: R5 M5 L4 SVP: 8 DLU: 77

018.167-026 PHOTOGRAMMETRIC ENGINEER (profess. & kin.)

Plans, coordinates, and directs activities of workers concerned with conducting aerial surveys and preparing topographic materials from aerial photographs and other data: Analyzes survey objectives and specifications, utilizing knowledge of survey uses, such as municipal and ecological planning, property and utility mapping, and petroleum and mineral exploration. Selects most appropriate and economical survey methods, using knowledge of capabilities of aerial photography and applications of remote sensing (imagery through electronic scanning). Estimates cost of survey. Advises customers and department supervisors regarding flights for aerial photography and plans for ground surveys designed to establish base lines, elevations, and other geodetic measurements. Prepares charts and tables for aerial navigation, to specify flight path, altitude, and airspeed of camera-carrying aircraft. Computes geodetic measurements and interprets survey data from ground or aerial photographs or remote-sensing images to determine position, shape, and elevation of geomorphic and topographic features. Conducts research in surveying and mapping methods and procedures, using knowledge of techniques of photogrammetric map compilation, electronic data processing, and flight and control planning. May direct one or more phases of technical operations concerned with preparing survey proposals, negotiating with clients, scheduling activities, conducting surveys, processing data, reviewing work quality, and training and assigning personnel.
GOE: 05.03.01 STRENGTH: S GED: R6 M6 L5 SVP: 8 DLU: 77

018.167-030 SUPERVISOR, MAPPING (petrol. & gas; pipe lines)

Supervises and coordinates activities of workers engaged in mapping production areas of petroleum or natural gas company: Supervises drafting personnel in drafting maps used for exploration, leasing of lands, and construction and operation of production facilities, such as pumping stations, storage tanks, drilling derricks, and pipelines. Reviews completed maps for neatness and accuracy. May supervise production of blueprints, photostats, and photographs.
GOE: 05.03.02 STRENGTH: S GED: R4 M4 L4 SVP: 7 DLU: 77

018.167-034 SURVEYOR ASSISTANT, INSTRUMENTS (profess. & kin.)

Obtains data pertaining to angles, elevations, points, and contours used for construction, map making, mining, or other purposes, using alidade, level, transit, plane table, Theodolite, electronic distance measuring equipment, and other surveying instruments. Compiles notes, sketches, and records of data obtained and work performed. Directs work of subordinate members of survey team. Performs other duties relating to surveying work as directed by CHIEF OF PARTY (profess. & kin.).
GOE: 05.03.01 STRENGTH: L GED: R5 M5 L4 SVP: 7 DLU: 77

018.167-038 SURVEYOR, GEODETIC (profess. & kin.)

Plans, directs, or conducts surveys of land areas of such size that shape and size of earth exerts sufficient influence on survey measurements to require use of special high-accuracy techniques, including astronomical observations and complex computations to compile data used in preparation of geodetic maps and charts.
GOE: 05.03.01 STRENGTH: L GED: R5 M5 L4 SVP: 7 DLU: 77

018.167-042 SURVEYOR, GEOPHYSICAL PROSPECTING (petrol. & gas)

Locates and marks sites selected for conducting geophysical prospecting activities concerned with locating subsurface earth formations likely to contain petroleum deposits. Makes precise determinations of elevations and records other characteristics of terrain. May obtain permits for prospecting from property owner.
GOE: 05.03.01 STRENGTH: L GED: R5 M4 L4 SVP: 6 DLU: 77

018.167-046 SURVEYOR, MARINE (profess. & kin.) alternate titles: surveyor, hydrographic

Makes surveys of harbors, rivers, and other bodies of water to determine shore lines, topography of bottom, or other items for such purposes as determining navigable channels, and securing data for construction of breakwaters, piers, and other marine structures.
GOE: 05.03.01 STRENGTH: M GED: R5 M5 L4 SVP: 7 DLU: 77

018.261-010 DRAFTER, CARTOGRAPHIC (profess. & kin.) alternate titles: map maker; mapper

Draws maps of geographical areas to show natural and constructed features, political boundaries, and other features, performing duties described under DRAFTER (profess. & kin.) Master Title: Analyzes survey data, source maps and photographs, computer or automated mapping products, and other records to determine location and names of features. Studies legal records to establish boundaries of properties, and local, national, and international areas of political, economic, social, or other significance. Geological maps are drawn by DRAFTER, GEOLOGICAL (petrol. & gas).
GOE: 05.03.02 STRENGTH: S GED: R4 M4 L3 SVP: 7 DLU: 77

018.261-018 EDITOR, MAP (profess. & kin.)

Verifies accuracy and completeness of topographical maps from aerial photographs and specifications: Views photographs and other reference materials, such as old maps and records and examines corresponding area of map to verify correct identification of specified topographical features and accuracy of contour lines. Verifies correct location and accuracy of scaled distances between control points and reference lines. Examines reference materials to detect omission of topographical features, poor register, or other defects in photography or draftsmanship. Marks errors and makes corrections, such as numbering grid lines or lettering names of rivers or towns.
GOE: 05.03.02 STRENGTH: L GED: R4 M4 L4 SVP: 7 DLU: 77

018.261-022 MOSAICIST (profess. & kin.)

Lays out and matches aerial photographs to form photographic mosaic of geographic area for subsequent use in photogrammetric activities, such as topographical mapping: Lays out photographic prints on table according to sequence in which photographs were taken during flightpath of aircraft. Examines prints to locate established landmarks and notes absence of normal overlap of adjacent prints indicating deflection of aircraft from prescribed flightpath. Locates and marks specified reference points, such as structures and highway or rail junctions. Computes and measures scaled distances between reference points to establish exact relative position of adjoining prints. Trims excess from edges of overlapping prints and glues prints to backing board, maintaining scaled distances between reference points and alignment of adjoining prints.
GOE: 05.03.02 STRENGTH: S GED: R4 M4 L4 SVP: 7 DLU: 77

018.261-026 PHOTOGRAMMETRIST (profess. & kin.) alternate titles: cartographic technician

Analyzes source data and prepares mosaic prints, contour maps, profile sheets, and related cartographic materials requiring technical mastery of photogrammetric techniques and principles: Prepares original maps, charts, and drawings, from aerial photographs, and survey data and applies standard mathematical formulas and photogrammetric techniques to identify, scale, and orient geodetic points, elevations, and other planimetric or topographic features and cartographic detail. Graphically delineates aerial photographic detail, such as control points, hydrography, topography, and cultural features, using precision stereoplotting apparatus or drafting instruments. Revises existing maps and charts and corrects maps in various stages of compilation. May prepare rubber, plastic, or plaster three-dimensional relief models.
GOE: 05.03.02 STRENGTH: S GED: R4 M4 L4 SVP: 7 DLU: 77

018.262-010 FIELD-MAP EDITOR (profess. & kin.)

Identifies and verifies information shown on aerial photographs used in map making: Travels over photographed area to observe and record all cultural and drainage features shown and not shown on photograph. Verifies numbers, names, and classes of roads and highways, location and number of railroads, location of state and county lines, and location and identification of streams, rivers, lakes, schools, and major buildings. Marks observations on map overlay, using specified symbols. Determines elevation of hills, trees, and buildings, using geometry. Obtains boundary and other official information from county records. May use stereoscope to combine information from two aerial maps.
GOE: 05.03.02 STRENGTH: L GED: R4 M3 L3 SVP: 6 DLU: 77

018.281-010 STEREO-PLOTTER OPERATOR (profess. & kin.) alternate titles: stereo operator; stereoptic projection topographer

Draws topographical maps from aerial photographs, using instruments that produce simultaneous projections of two photographs, taken from different positions, in manner that permits stereoscopic viewing for delineation of planimetric detail and drawing of contours: Orients plotting instruments to form three-dimensional stereo image. Views stereoscopic image by using anaglyphic, binocular, or image alternator techniques. Determines contour interval and vertical scale of image, using mathematical table. Traces contours and topographical details to produce map.
GOE: 05.03.02 STRENGTH: L GED: R4 M4 L4 SVP: 7 DLU: 77

019 OCCUPATIONS IN ARCHITECTURE, ENGINEERING, AND SURVEYING, N.E.C.

This group includes occupations, not elsewhere classified, concerned with the application of the theoretical and practical aspects of engineering and architecture.

019.061-010 BIOMEDICAL ENGINEER (profess. & kin.)

Conducts research into biological aspects of humans or other animals to develop new theories and facts, or test, prove, or modify known theories of life systems, and to design life-support apparatus, utilizing principles of engineering and bio-behavioral sciences: Plans and conducts research concerning behavioral, biological, psychological, or other life systems. Studies engineering aspects of bio-behavioral systems of humans, utilizing knowledge of electrical, mechanical, chemical, or other engineering principles and knowledge of human anatomy and physiology. Develops $T3mathematical models$T1 to simulate human bio-behavioral systems in order to obtain data for measuring or controlling life processes, utilizing knowledge of computer, graphics, and other related technologies. Designs and develops instruments and devices, such as artificial organs, cardiac pacemakers, or ultrasonic imaging devices, capable of assisting medical or other health-care personnel in observing, repairing, or treating physical ailments or deformities, using knowledge of materials compatible with body tissues, energy exchanges within the body, and instrumentation capable of measuring and controlling body functions. May specialize in design and development of biomedical equipment used by medical facilities and be known as Clinical Engineer (profess. & kin.).
GOE: 02.02.01 STRENGTH: S GED: R6 M6 L5 SVP: 8 DLU: 77

019.061-014 MATERIALS ENGINEER (profess. & kin.)

Evaluates technical and economic factors, recommending engineering and manufacturing actions for attainment of design objectives of process or product by applying knowledge of material science and related technologies: Reviews plans for new product and factors, such as strength, weight, and cost to submit material selection recommendations ensuring attainment of design objectives. Plans and implements laboratory operations to develop material and fabrication procedures for new materials to fulfill product cost and performance standards. Confers with producers of materials, such as metals, ceramics, or polymers, during investigation and evaluation of materials suitable for specific product applications. Reviews product failure data and interprets laboratory tests and analyses to establish or rule out material and process causes.
GOE: 05.01.06 STRENGTH: S GED: R5 M5 L5 SVP: 8 DLU: 77

019.061-018 OPTICAL ENGINEER (profess. & kin.) alternate titles: optical designer

Designs optical systems with specific characteristics to fit within specified physical limits of precision optical instruments, such as still- and motion-picture cameras, lens systems, telescopes, and viewing and display devices: Determines specifications for operations and makes adjustments to calibrate and obtain specified operational performance. Determines proper operation of optical system and makes adjustments to perfect system. Designs mounts for components to hold them in proper planes in relation to each other and instrument in which they will be used. Designs inspection instruments to test optical systems for defects, such as aberrations and deviations. May work with electrical and mechanical engineering staff to develop overall design of optical system.
GOE: 05.01.07 STRENGTH: S GED: R6 M5 L5 SVP: 8 DLU: 77

019.061-022 ORDNANCE ENGINEER (chemical; ordnance)

Designs, tests, and coordinates development of explosive ordnance material to meet military procurement specifications and to prepare project proposals for negotiating production contracts: Participates in discussions with military authorities to determine characteristics desired in explosive material, nature of target objective, and type of delivery system to be used. Prepares or directs preparation of design drawings and specifications for approval by procurement authorities, according to knowledge of explosives and plastics chemistry, ballistics theory, fuse technology, metallurgy, electronics, fluidics, and techniques of efficient production. Tests sample shells, warheads, or similar material under simulated military conditions [PROOF TECHNICIAN (ordnance)]. Evaluates tests to determine acceptability of ordnance items or need for redesign. Presents findings orally and in writing to procurement authorities and demonstrates successful designs on proving ground. May negotiate procurement contracts. May coordinate pilot or serial production of ordnance items. May participate in development of delivery systems, fire-control components, and nonexplosive material. May be designated according to type of ordnance item developed.
GOE: 05.01.08 STRENGTH: L GED: R6 M6 L5 SVP: 8 DLU: 77

019.061-026 RELIABILITY ENGINEER (profess. & kin.)

Analyzes preliminary engineering-design concepts of major product, such as aircraft, naval vessel, or electronic communication or control system to recommend design or test methods for attaining customer-specified operational reliability, using knowledge of reliability engineering and other technologies: Analyzes preliminary plans and develops reliability engineering program to achieve customer reliability objectives. Analyzes projected product utilization and calculates cumulative effect on final system reliability of individual part reliabilities. Drafts $T3failure mode and effect analysis$T1 sheets or formulates $T3mathematical models,$T1 using computer-aided engineering equipment, to identify units posing excessive failure risks and support proposed changes in design. Enters data to simulate electrical inputs, transient conditions, temperature, stress, and other factors to develop computer models, and analyzes and adjusts design to predict and improve system reliability. Advises and confers with engineers in design review meetings to give reliability findings and recommendations. Determines units requiring environmental testing and specifies minimum number of samples to obtain statistically valid data. Reviews subcontractors' proposals for reliability program and submits evaluation for decision. Reviews engineering specifications and drawings, proposing design modifications to improve reliability within cost and other performance requirements. Observes conduct of tests at supplier, plant, or field locations to evaluate reliability factors, such as numbers and causes of unit failures. Monitors failure data generated by customer using product to ascertain potential requirement for product improvement.
GOE: 05.01.04 STRENGTH: S GED: R6 M6 L5 SVP: 8 DLU: 86

019.081-010 MAINTAINABILITY ENGINEER (profess. & kin.)

Analyzes engineering design of proposed product, such as aircraft, naval vessel, or electronic control or navigation system, and submits specifications for maintenance requirements, utilizing knowledge of maintainability engineering and related technologies: Analyzes customer's initial proposal for product utilization and recommends basic product specifications and techniques for satisfying customer requirements. Reviews engineering specifications and drawings during development and proposes design refinements to improve ratio of operational time to maintenance time. Participates in engineering discussions concerning design alternatives effecting product maintainability. Determines crew makeup, training requirements, and maintenance time by evaluating data from tests and maintainability programs of related products. Reviews subcontractor's technical practices for assuring maintainability of equipment and parts and submits evaluation for management decision. Specifies standardized tests or drafts new test programs for demonstrating product maintainability in company or supplier test. Observes maintainability tests at supplier and plant locations to verify operations are conducted according to standards.
GOE: 05.01.08 STRENGTH: S GED: R5 M4 L5 SVP: 8 DLU: 77

019.081-014 PHOTOGRAPHIC ENGINEER (profess. & kin.) alternate titles: photo-optical instrumentation engineer

Designs and constructs special-purpose photographic equipment and materials for use in scientific or industrial applications, utilizing knowledge of various engineering disciplines, chemistry, and photographic equipment and techniques. Plans setup of equipment, specific procedures, and materials needed to meet data acquisition and measurement requirements. May advise others in such fields as high speed photography, radiography, graphic arts, and aerial and space photography.
GOE: 05.01.07 STRENGTH: L GED: R5 M4 L4 SVP: 8 DLU: 77

019.081-018 POLLUTION-CONTROL ENGINEER (profess. & kin.)

Plans and conducts engineering studies to analyze and evaluate pollution problems, methods of pollution control, and methods of testing pollution sources to determine physiochemical nature and concentration of contaminants: Reviews data collected by POLLUTION-CONTROL TECHNICIAN (profess. & kin.) from pollution emission sources. Performs engineering calculations to determine pollution emissions from various industrial sources and to evaluate effectiveness of pollution control equipment. Reviews compliance schedules and inspection reports to ensure compliance with pollution control regulations. Recommends issuance or denial of permits for industries to construct or operate facilities. Advises enforcement personnel of noncompliance or unsatisfactory compliance with regulations. Develops or modifies techniques for monitoring pollution. Calibrates and adjusts pollution control monitors to ensure accurate functioning of instruments. May be designated according to specialty as Air-Pollution Engineer (profess. & kin.); Noise-Abatement Engineer (profess. & kin.); Water Quality-Control Engineer (profess. & kin.).
GOE: 05.01.02 STRENGTH: L GED: R6 M6 L6 SVP: 8 DLU: 77

019.161-010 SUPERVISOR, ESTIMATOR AND DRAFTER (utilities)

Supervises ESTIMATORS AND DRAFTERS (utilities) in drawing up specifications, instructions, and cost estimates for installation of gas or electric-power distribution systems: Studies work orders or construction proposals and selects appropriate survey procedures and schedules work assignments. Reviews completed construction drawings and cost estimates for accuracy and conformity to standards and regulations. Confers with engineers and subordinates and assists in field surveys to resolve problems. Directs maintenance of files of blueprints, maps, construction sketches, cost estimates, and related records.
GOE: 05.03.02 STRENGTH: S GED: R5 M5 L5 SVP: 8 DLU: 77

019.161-014 TEST TECHNICIAN (profess. & kin.)

Prepares specifications for fabrication, assembly, and installation of apparatus and control instrumentation used to test experimental or prototype mechanical, electrical, electromechanical, hydromechanical, or structural products, and conducts tests and records results, utilizing engineering principles and test technology: Confers with engineering personnel to resolve fabrication problems relating to specifications and to review test plans, such as types and cycles of tests, conditions under which tests are to be conducted, and duration of tests. Fabricates precision parts for test apparatus, using metalworking machines such as lathes, milling machines, and welding equipment, or interprets specifications for workers fabricating parts. Examines parts for conformance with dimensional specifications, using precision measuring instruments. Coordinates and participates in installing unit or system to be tested in test fixtures, connecting valves, pumps, hydraulic, mechanical or electrical controls, cabling, tubing, power source, and indicating instruments. Activates controls to apply electrical, hydraulic, pneumatic, or mechanical power and subject test item to successive steps in test cycle. Monitors controls and instruments and records test data for engineer's use. May recommend changes in test methods or equipment for engineering review. Workers are classified according to engineering specialty or type of product tested.
GOE: 05.01.04 STRENGTH: L GED: R5 M4 L4 SVP: 7 DLU: 77

019.167-010 LOGISTICS ENGINEER (profess. & kin.) alternate titles: logistics specialist

Directs and coordinates program activities designed to provide subcontractors, management, and customers with logistics technology that ensures effective and economical support concerned for manufacturing or servicing of products, systems, or equipment: Analyzes contractual commitments, customer specifications, design changes, and other data to plan and develop logistic program activities from conceptual stage through life-cycle of product. Develops and implements program activities, coordinates efforts of subcontractors, production departments, and field service personnel, and resolves problems in area of logistics to ensure meeting of contractual commitments. Develops and initiates preparation of handbooks, bulletins, and information systems to provide and supply logistics support. Compiles data on standardization and interchangeability of parts to expedite logistics activities. Determines logistic support sequences and time phasing, problems arising from location of operational area, and other factors, such as environmental and human factors affecting personnel. May perform special research or technical studies critical to logistic support functions. May utilize computer techniques for analysis, simulation or information systems and documentation.
GOE: 05.01.06 STRENGTH: S GED: R5 M5 L5 SVP: 8 DLU: 77

019.167-014 PROJECT ENGINEER (profess. & kin.) alternate titles: chief engineer

Directs, coordinates, and exercises functional authority for planning, organization, control, integration, and completion of engineering project within area of assigned responsibility: Plans and formulates engineering program and organizes project staff according to project requirements. Assigns project personnel to specific phases or aspects of project, such as technical studies, product design, preparation of specifications and technical plans, and product testing, in accordance with engineering disciplines of staff. Reviews product design for compliance with engineering principles, company standards, customer contract requirements, and related specifications. Coordinates activities concerned with technical developments, scheduling, and resolving engineering design and test problems. Directs integration of technical activities and products. Evaluates and approves design changes, specifications, and drawing releases. Controls expenditures within limitations of project budget. Prepares interim

and completion project reports.
GOE: 05.01.08 STRENGTH: L GED: R5 M5 L5 SVP: 8 DLU: 87

019.167-018 RESOURCE-RECOVERY ENGINEER (government ser.)

Plans and participates in activities concerned with study, development, and inspection of solid-waste resource recovery systems and marketability of solid-waste recovery products: Conducts studies of chemical and mechanical solid-waste recovery processes and system designs to evaluate efficiency and cost-effectiveness of proposed operations. Inspects solid-waste resource recovery facilities to determine compliance with regulations governing construction and use. Collects data on resource recovery systems and analyzes alternate plans to determine most feasible systems for specific solid-waste recovery purposes. Prepares recommendations for development of resource recovery programs, based on analysis of alternate plans and knowledge of physical properties of various solid-waste materials. Confers with design engineers, management personnel, and others concerned with recovery of solid-waste resources to discuss problems and provide technical advice. Coordinates activities of workers engaged in study of potential markets for reclaimable materials. Lectures civic and professional organizations and provides information about practices to media representatives to promote interest and participation in solid-waste recovery practices.
GOE: 05.01.02 STRENGTH: S GED: R6 M6 L5 SVP: 8 DLU: 86

019.187-010 PACKAGING ENGINEER (profess. & kin.)

Plans and directs activities concerned with design and development of protective packaging containers: Analyzes engineering drawings and specifications of product to determine physical characteristics of item, special-handling and safety requirements, and type of materials required for container. Consults with establishment's purchasing and production departments to determine costs and feasibility of producing proposed packaging. Develops or directs development of sketches, specifications, samples, and written analyses of proposed packaging in order to present design for approval. May confer with customers or sales representatives to draw up contracts. May advise employer or customers on efficient packing procedures, innovations in packaging materials, and utilization of sealing and fastening devices.
GOE: 05.03.09 STRENGTH: S GED: R5 M4 L5 SVP: 7 DLU: 77

019.261-010 BIOMEDICAL EQUIPMENT TECHNICIAN (profess. & kin.) alternate titles: biomedical electronics technician; biomedical engineering technician

Repairs, calibrates, and maintains medical equipment and instrumentation used in health-care delivery field: Inspects and installs medical and related technical equipment in medical and research facilities for use by physicians, nurses, scientists, or engineers involved in researching, monitoring, diagnosing, and treating physical ailments or dysfunctions. Services various equipment and apparatus, such as patient monitors, electrocardiographs, blood-gas analyzers, x-ray units, defibrillators, electrosurgical units, anesthesia apparatus, pacemakers, blood-pressure transducers, spirometers, sterilizers, diathermy equipment, in-house television systems, patient-care computers, and other related technical paraphernalia. Repairs, calibrates, and maintains equipment, using handtools, power tools, measuring devices, and knowledge of manufacturers' manuals, troubleshooting techniques, and preventive-maintenance schedules. Safety-tests medical equipment and health-care facility's structural environment to ensure patient and staff safety from electrical or mechanical hazards. Consults with medical or research staff to ascertain that equipment functions properly and safely, utilizing knowledge of electronics, medical terminology, human anatomy and physiology, chemistry, and physics. May demonstrate and explain correct operation of equipment to medical personnel. May modify or develop instruments or devices, under supervision of medical or engineering staff. May work as salesperson or service technician for equipment manufacturers or their sales representatives.
GOE: 02.04.02 STRENGTH: L GED: R4 M4 L4 SVP: 6 DLU: 77

019.261-014 ESTIMATOR AND DRAFTER (utilities) alternate titles: detail and lay-out drafter; distribution estimator; lay-out and detail drafter

Draws up specifications and instructions for installation of voltage transformers, overhead or underground cables, and related electrical equipment used to conduct electrical energy from transmission lines or high-voltage distribution lines to consumers: Studies work order request to determine type of service, such as lighting or power, demanded by installation. Visits site of proposed installation and draws rough sketch of location. Takes measurements, such as street dimensions, distances to be spanned by wire and cable, or space available in existing buildings and underground vaults which affect installation and arrangement of equipment. Estimates materials, equipment, and incidentals needed for installation. Draws master sketch showing relation of proposed installation to existing facilities. Makes other drawings, such as pertaining to wiring connections or cross sections of underground cables, as required for instructions to installation crew. Consults POWER-DISTRIBUTION ENGINEER (utilities) 003.167-046 on difficulties encountered. May draft sketches to scale [DRAFTER, ELECTRICAL (profess. & kin.) 003.281-010]. May estimate labor and material costs, using pricelists and records on previous projects. May inspect completed installation of electrical equipment and related building circuitry to verify conformance with specifications. May perform duties of LAND SURVEYOR (profess. & kin.) 018.167-018 and prepare specifications and diagrams for installation of gas distribution pipes owned by gas-electric utility.
GOE: 05.03.02 STRENGTH: L GED: R5 M5 L5 SVP: 7 DLU: 77

019.261-018 FACILITIES PLANNER (any industry) alternate titles: office-planning representative

Plans utilization of space and facilities for government agency or unit or business establishment consistent with requirements of organizational efficiency and available facilities and funds: Inspects buildings and office areas to evaluate suitability for occupancy, considering such factors as air circulation, lighting, location, and size. Measures or directs workers engaged in measurement of facilities to determine total square footage available for occupancy. Computes square footage available for each member of staff to determine whether minimum space restrictions can be met. Draws design layout, showing location of furniture, equipment, doorways, electrical and telephone outlets, and other facilities. May review real estate contracts for compliance with government specifications and suitability for occupancy of employing agency. May direct workers engaged in moving furniture and equipment and preparing facilities for occupancy.
GOE: 05.01.06 STRENGTH: L GED: R5 M5 L5 SVP: 7 DLU: 77

019.261-022 TEST TECHNICIAN (agric. equip.)

Tests experimental and production agricultural equipment, such as tractors and power mowers and components to evaluate their performance, using test equipment and recording instruments: Reads data sheet denoting operating specification for unit or component and type of evaluation required. Tests unit for conformance with operating requirements, such as resistance to vibration, specified horsepower, and tensile strength and hardness of parts, using test equipment, such as bend-fatigue machine, dynamometer, strength tester, hardness tester, analytical balance, and electronic recorder. Records data from dial readings and graphs and computes values, such as horse-power and tensile strength, using algebraic formulas. Operates unit to evaluate attachment performance, such as depth of tillage or harvesting capabilities for different types of crops. Draws sketches and describes test procedures and results in test data log.
GOE: 05.03.07 STRENGTH: L GED: R4 M4 L4 SVP: 6 DLU: 77

019.261-026 FIRE-PROTECTION ENGINEERING TECHNICIAN (profess. & kin.)

Designs and drafts plans and estimates costs for installation of fire protection systems for facilities and structures, applying knowledge of drafting, physical science, engineering principles, and fire protection codes: Analyzes blueprints and specifications prepared by ARCHITECT (profess. & kin.) 001.061-010 to determine dimensions of system to meet fire protection codes. Determines design and size of system components, using calculator or computer. Drafts detailed drawing of system to ensure conformance to specifications and applicable codes. May negotiate relocation of system components with SUPERINTENDENT, CONSTRUCTION (construction) 182.167-026 to resolve conflicts of co-location with other systems. May inspect fire-damaged structures to detect malfunctions. May specialize in one type of fire protection system, such as foam, water, dry chemical, or vaporous gas or specialize in one type of establishment, such as construction, insurance, or government.
GOE: 05.03.02 STRENGTH: L GED: R4 M4 L4 SVP: 7 DLU: 86

019.261-030 LABORATORY TECHNICIAN (auto. mfg.)

Tests chemical and physical properties of materials used in manufacturing or assembling motor vehicles: Performs standard chemical and physical tests on parts, solutions, and materials used in producing motor vehicles, using conventional and computerized machines and work aids. Conducts quantitative and qualitative analyses to determine chemical and physical properties of experimental and developmental materials [LABORATORY TESTER (any industry) 029.261-010].
GOE: 02.04.01 STRENGTH: L GED: R4 M4 L4 SVP: 5 DLU: 90

019.261-034 LASER TECHNICIAN (electron. comp.; inst. & app.)

Constructs and tests prototype gas or solid-state laser devices, applying theory and principles of laser engineering and electronic circuits: Reviews project instructions, such as assembly layout, blueprints, and sketches, and confers with engineering personnel to clarify laser device specifications. Interprets production details, such as dimensions and functional requirements, for workers engaged in grinding mirror blanks, coating mirror surfaces, and machining metal parts. Installs and aligns optical parts, such as mirrors and waveplates, in laser body, using precision instruments. Turns controls of vacuum pump and gas transfer equipment to purge, evacuate, and fill laser body with specified volume and pressure of gases, such as helium, neon, or carbon dioxide, to test laser beam. Assembles completed laser body in chassis, and installs and aligns electronic components, tubing, and wiring to connect controls, such as valves, regulators, dials, and switches. Sets up precision electronic and optical instruments to test laser device, using specified electrical or optical inputs. Tests laser for gas leaks, using leak detector. Analyzes test data and reports results to engineering personnel. May prepare and write technical reports to recommend solutions to technical problems.
GOE: 05.03.05 STRENGTH: M GED: R5 M4 L4 SVP: 7 DLU: 90

019.267-010 SPECIFICATION WRITER (profess. & kin.)

Interprets architectural or engineering plans and prepares material lists and specifications to be used as standards by plant employees or contracting personnel in material processing or in manufacturing or construction activities: Analyzes plans and diagrams, or observes and makes notes on material processing, to determine material and material processing specifications, or specifications for manufacturing or construction activities. Writes technical descriptions specifying material qualities and properties, utilizing knowledge of material standards, industrial processes, and manufacturing procedures. May draw rough sketches or arrange for finished drawings or photographs to illustrate specified materials or assembly sequence. Workers usually specialize and are designated according to engineering specialization, product, or process.
GOE: 05.03.02 STRENGTH: S GED: R5 M4 L4 SVP: 7 DLU: 77

019.281-010 CALIBRATION LABORATORY TECHNICIAN (aircraft mfg.; electron. comp.) alternate titles: engineering laboratory technician; quality assurance calibrator; standards laboratory technician; test equipment certification technician

Tests, calibrates, and repairs electrical, mechanical, electromechanical, and electronic measuring, recording, and indicating instruments and equipment for conformance to established standards, and assists in formulating calibration standards: Plans sequence of testing and calibration procedures for instruments and equipment, according to blueprints, schematics, technical manuals, and other specifications. Sets up standard and special purpose laboratory equipment to test, evaluate, and calibrate other instruments and test equipment. Disassembles instruments and equipment, using handtools, and inspects components for defects. Measures parts for conformity with specifications, using micrometers, calipers, and other precision instruments. Aligns, repairs, replaces, and balances component parts and circuitry. Reassembles and calibrates instruments and equipment. Devises formulas to solve problems in measurements and calibrations. Assists engineers in formulating test, calibration, repair, and evaluation plans and procedures to maintain precision accuracy of measuring, recording, and indicating instruments and equipment.
GOE: 02.04.01 STRENGTH: L GED: R5 M5 L4 SVP: 7 DLU: 88

02 OCCUPATIONS IN MATHEMATICS AND PHYSICAL SCIENCES

This division includes occupations concerned with research pertaining to the physical universe, and the application of established mathematical and scientific laws and principles to specific problems and situations.

020 OCCUPATIONS IN MATHEMATICS

This group includes occupations concerned with the development of methodology in mathematics, statistics, and actuarial science; and the application of original and standardized mathematical techniques to the solution of problems in the social and physical sciences, engineering, and business.

020.067-014 MATHEMATICIAN (profess. & kin.)

Conducts research in fundamental mathematics and in application of mathematical techniques to science, management, and other fields, and solves or directs solutions to problems in various fields by mathematical methods: Conducts research in such branches of mathematics as algebra, geometry, number theory, logic, and topology, and studies and tests hypotheses and alternative theories. Conceives and develops ideas for application of mathematics to wide variety of fields, including science, engineering, military planning, electronic data processing, and management. Applies mathematics or mathematical methods to solution of problems in research, development, production, logistics, and other functional areas, utilizing knowledge of subject or field to which applied, such as physics, engineering, astronomy, biology, economics, business and industrial management, or cryptography. Performs computations, applies methods of numerical analysis, and operates or directs operation of desk calculators and mechanical and electronic computation machines, analyzers, and plotters in solving problems in support of mathematical, scientific, or industrial research activity. Acts as advisor or consultant to research personnel concerning mathematical methods and applications. May be designated according to function as Mathematician, Applied (profess. & kin.); Mathematician, Research (profess. & kin.).
GOE: 02.01.01 STRENGTH: S GED: R6 M6 L6 SVP: 8 DLU: 81

020.067-018 OPERATIONS-RESEARCH ANALYST (profess. & kin.)

Conducts analyses of management and operational problems and formulates mathematical or simulation models of problem for solution by computers or other methods: Analyzes problem in terms of management information and conceptualizes and defines problem. Studies information and selects plan from competitive proposals that affords maximum probability of profit or effectiveness in relation to cost or risk. Prepares model of problem in form of one or several equations that relates constants and variables, restrictions, alternatives, conflicting objectives and their numerical parameters. Defines data requirements and gathers and validates information applying judgment and statistical tests. Specifies manipulative or computational methods to be applied to model. Performs validation and testing of model to ensure adequacy, or determines need for reformulation. Prepares reports to management defining problem, evaluation, and possible solution. Evaluates implementation and effectiveness of research. May design, conduct, and evaluate experimental operational models where insufficient data exists to formulate model. May specialize in research and preparation of contract proposals specifying competence of organization to perform research, development, or production work. May develop and apply time and cost networks, such as Program Evaluation and Review Techniques (PERT), to plan and control large projects. May work in association with engineers, scientists, and management personnel in business, government, health, transportation, energy, manufacturing, environmental sciences or other technologies.
GOE: 11.01.01 STRENGTH: S GED: R6 M6 L6 SVP: 7 DLU: 77

020.067-022 STATISTICIAN, MATHEMATICAL (profess. & kin.) alternate titles: statistician, theoretical

Conducts research into mathematical theories and proofs that form basis of science of statistics and develops statistical methodology: Examines theories, such as those of probability and inference, to discover mathematical bases for new or improved methods of obtaining and evaluating numerical data. Develops and tests experimental designs, sampling techniques, and analytical methods, and prepares recommendations concerning their utilization in statistical surveys, experiments, and tests. Investigates, evaluates, and prepares reports on applicability, efficiency, and accuracy of statistical methods used by physical and social scientists, including

STATISTICIANS, APPLIED (profess. & kin.), in obtaining and evaluating data.
GOE: 11.01.01 STRENGTH: S GED: R6 M6 L6 SVP: 8 DLU: 77

020.162-010 MATHEMATICAL TECHNICIAN (profess. & kin.) alternate titles: data-reduction technician

Applies standardized mathematical formulas, principles, and methodology to technological problems in engineering and physical sciences in relation to specific industrial and research objectives, processes, equipment and products: Confers with professional, scientific, and engineering personnel to plan project. Analyzes raw data from computer or recorded on photographic film or other media. Selects most practical and accurate combination and sequence of computational methods, using algebra, trigonometry, geometry, vector analysis and calculus to reduce raw data to meaningful and manageable terms. Selects most economical and reliable combination of manual, mechanical, or data processing methods and equipment consistent with data reduction requirements. Modifies standard formulas to conform to data processing method selected. Translates data into numerical values, equations, flow charts, graphs or other media. Analyzes processed data to detect errors. May operate calculator or computer.
GOE: 11.01.02 STRENGTH: S GED: R5 M5 L5 SVP: 7 DLU: 77

020.167-010 ACTUARY (profess. & kin.)

Applies knowledge of mathematics, probability, statistics, principles of finance and business to problems in life, health, social, and casualty insurance, annuities, and pensions: Determines mortality, accident, sickness, disability, and retirement rates; constructs probability tables regarding fire, natural disasters, and unemployment, based on analysis of statistical data and other pertinent information. Designs or reviews insurance and pension plans and calculates premiums. Ascertains premium rates required and cash reserves and liabilities necessary to ensure payment of future benefits. Determines equitable basis for distributing surplus earnings under participating insurance and annuity contracts in mutual companies. May specialize in one type of insurance and be designated Actuary, Casualty (profess. & kin.); Actuary, Life (profess. & kin.).
GOE: 11.01.02 STRENGTH: S GED: R5 M5 L5 SVP: 8 DLU: 77

020.167-026 STATISTICIAN, APPLIED (profess. & kin.)

Plans data collection, and analyzes and interprets numerical data from experiments, studies, surveys, and other sources and applies statistical methodology to provide information for scientific research and statistical analysis: Plans methods to collect information and develops questionnaire techniques according to survey design. Conducts surveys utilizing sampling techniques or complete enumeration bases. Evaluates reliability of source information, adjusts and weighs raw data, and organizes results into form compatible with analysis by computers or other methods. Presents numerical information by computer readouts, graphs, charts, tables, written reports or other methods. Describes sources of information, and limitations on reliability and usability. May analyze and interpret statistics to point up significant differences in relationships among sources of information, and prepare conclusions and forecasts based on data summaries. May specialize in specific aspect of statistics or industrial activity reporting and be designated by specialty as Demographer (profess. & kin.) I; Statistician, Analytical (profess. & kin.); Statistician, Engineering And Physical Science (profess. & kin.).
GOE: 11.01.02 STRENGTH: S GED: R5 M5 L4 SVP: 7 DLU: 77

020.167-030 WEIGHT ANALYST (profess. & kin.) alternate titles: weight engineer

Analyzes and calculates weight data of structural assemblies, components, and loads for purposes of weight, balance, loading, and operational functions of ships, aircraft, space vehicles, missiles, research instrumentation, and commercial and industrial products and systems: Studies weight factors involved in new designs or modifications, utilizing computer techniques for analysis and simulation. Analyzes data and prepares reports of weight distribution estimates for use in design studies. Confers with design engineering personnel in such departments as preliminary design, structures, aerodynamics, and sub-systems to ensure coordination of weight, balance, and load specifications with other phases of product development. Weighs parts, assemblies, or completed product, estimates weight of parts from engineering drawings, and calculates weight distribution to determine balance. Prepares reports or graphic data for designers when weight and balance requires engineering changes. Prepares technical reports on mass moments of inertia, static and dynamic balance, dead weight distributions, cargo and fuselage compartments, and fuel center of gravity travel. May prepare cargo and equipment loading sequences to maintain balance of aircraft or space vehicle within specified load limits. May analyze various systems, structures, and support equipment designs to obtain information on most efficient compromise between weight, operations, and cost. May conduct research and analysis to develop new techniques for weights estimating criteria.
GOE: 07.02.03 STRENGTH: M GED: R5 M5 L5 SVP: 7 DLU: 77

021 OCCUPATIONS IN ASTRONOMY

This group includes occupations concerned with the investigation of celestial phenomena to increase basic scientific knowledge, or for practical application in such fields as navigation and guidance. Also includes occupations concerned with the visual and instrumental observation of astronomical phenomena and the recording and evaluation of data.

021.067-010 ASTRONOMER (profess. & kin.)

Observes and interprets celestial phenomena and relates research to basic scientific knowledge or to practical problems, such as navigation: Studies celestial phenomena by means of optical, radio, or other telescopes, equipped with such devices as cameras, spectrometers, radiometers, photometers, and micrometers, which may either be on ground or carried above atmosphere with balloons, rockets, satellites, or space probes. Interprets information obtained in terms of basic physical laws. Determines sizes, shapes, brightness, spectra, and motions, and computes positions of sun, moon, planets, stars, nebulae, and galaxies. Calculates orbits of various celestial bodies. Determines exact time by celestial observations, and conducts research into relationships between time and space. Develops mathematical tables giving positions of sun, moon, planets, and stars at given times for use by air and sea navigators. Conducts research on statistical theory of motions of celestial bodies. Analyzes wave lengths of radiation from celestial bodies, as observed in all ranges of spectrum. Studies history, structure, extent, and evolution of stars, stellar systems, and universe. May design new and improved optical, mechanical, and electronics instruments for astronomical research. May specialize in either observational or theoretical aspects of stellar astronomy, stellar astrophysics, interstellar medium, galactic structure, extragalactic astronomy, or cosmology.
GOE: 02.01.01 STRENGTH: L GED: R6 M6 L6 SVP: 8 DLU: 77

022 OCCUPATIONS IN CHEMISTRY

This group includes occupations concerned with research and development in the chemical and physical properties and compositional changes of substances. Specialization generally occurs in one or more branches of chemistry, such as organic chemistry, inorganic chemistry, physical chemistry and analytical chemistry. Chemistry specializations within the field of environmental control are also included here. Occupations concerned with biochemistry are found in Group 041.

022.061-010 CHEMIST (profess. & kin.)

Conducts research, analysis, synthesis, and experimentation on substances, for such purposes as product and process development and application, quantitative and qualitative analysis, and improvement of analytical methodologies: Devises new equipment, and develops formulas, processes, and methods for solution of technical problems. Analyzes organic and inorganic compounds to determine chemical and physical properties, utilizing such techniques as chromatography, spectroscopy, and spectrophotometry. Induces changes in composition of substances by introduction of heat, light, energy, and chemical catalysts. Conducts research on manufactured products to develop and improve products. Conducts research into composition, structure, properties, relationships, and reactions of matter. Confers with scientists and engineers regarding research, and prepares technical papers and reports. Prepares standards and specifications for processes, facilities, products, and tests. May be

designated according to chemistry specialty as Chemist, Analytical (profess. & kin.); Chemist, Inorganic (profess. & kin.); Chemist, Organic (profess. & kin.); Chemist Physical (profess. & k in.).
GOE: 02.01.01 STRENGTH: L GED: R6 M6 L5 SVP: 8 DLU: 81

022.061-014 CHEMIST, FOOD (profess. & kin.)

Conducts research and analysis concerning chemistry of foods to develop and improve foods and beverages: Experiments with natural and synthetic materials or byproducts to develop new foods, additives, preservatives, anti-adulteration agents, and related products. Studies effects of various methods of processing, preservation, and packaging on composition and properties of foods, such as color, texture, aroma, taste, shelf life, and nutritive content. Tests food and beverage samples, such as starch, sugar, cereals, beer, canned and dehydrated food products, meats, vegetables, dairy foods, and other products to ensure compliance with food laws, and standards of quality and purity. May perform, or supervise workers performing, quality control tests in food processing, canning, freezing, brewing or distilling. May specialize in particular food or process.
GOE: 02.02.04 STRENGTH: L GED: R6 M5 L5 SVP: 7 DLU: 77

022.081-010 TOXICOLOGIST (pharmaceut.)

Conducts research on toxic effects of cosmetic products and ingredients on laboratory animals for manufacturer of cosmetics: Applies cosmetic ingredient or cosmetic being developed to exposed shaved skin area of test animal and observes and examines skin periodically for possible development of abnormalities, inflammation, or irritation. Injects ingredient into test animal, using hypodermic needle and syringe, and periodically observes animal for signs of toxicity. Injects antidotes to determine which antidote best neutralizes toxic effects. Tests and analyzes blood samples for presence of toxic conditions, using microscope and laboratory test equipment. Dissects dead animals, using surgical instruments, and examines organs to determine effects of cosmetic ingredients being tested. Prepares formal reports of test results.
GOE: 02.04.02 STRENGTH: L GED: R5 M4 L5 SVP: 8 DLU: 86

022.137-010 LABORATORY SUPERVISOR (profess. & kin.)

Supervises and coordinates activities of personnel engaged in performing chemical and physical tests required for quality control of processes and products: Directs and advises personnel in special test procedures to analyze components and physical properties of materials. Compiles and analyzes test information to determine operating efficiency of process or equipment and to diagnose malfunctions. Confers with scientists or engineers to conduct analyses, interpret test results, or develop nonstandard tests. Performs other duties as described under SUPERVISOR (any industry) Master Title. May adjust formulas and processes based on test results. May test and analyze sample products. May prepare test solutions, compounds, and reagents for use by laboratory personnel in conducting tests. May conduct research to develop custom products and investigate complaints on existing products.
GOE: 02.04.01 STRENGTH: L GED: R5 M5 L4 SVP: 7 DLU: 86

022.161-010 CHEMICAL LABORATORY CHIEF (profess. & kin.) alternate titles: chief chemist; director, chemical laboratory

Plans and directs activities of chemical laboratory in industrial, research, governmental, or other organization: Plans, coordinates, and directs programs for research, product development, improvement of manufacturing processes; or for analysis and testing of substances to support criminal investigations, to detect toxins, or to verify composition of manufactured and agricultural products, and natural resources, such as air, soil, and water. Coordinates research and analysis activities according to applicable government regulations, manufacturing processes, or other considerations, and approves modification of formulas, standards, specifications, and processes. Reviews research, testing, quality control, and other operational reports to ensure that quality standards, efficiency, and schedules are met. Interprets results of laboratory activities to laboratory personnel, management, and professional and technical societies, and prepares reports and technical papers. May prepare and administer budgets. May advise and assist in obtaining patents for products, processes, or equipment.
GOE: 02.01.02 STRENGTH: L GED: R6 M6 L6 SVP: 8 DLU: 78

022.161-014 COLORIST (profess. & kin.) alternate titles: color maker; color matcher

Develops color formulas for printing textile and plastic materials and compares customer's sample with standard color card, or blends pigments into vinyl solution and compares results with sample to determine formula required to duplicate colors. Selects dyes according to properties desired by customer. Records color formula and issues formula and mixing procedure to SUPERVISOR, COLOR-PASTE MIXING (textile) for assignment to appropriate workers. Prepares color sequence chart to guide CLOTH PRINTER (any industry) in setting up printing machine. Compares printed patch with customer's sample to verify color shade and position of design. Files folder containing color patch and formula for each design for use as printing standard. Coordinates color shop activities with printing department production schedule. May inspect printed material to ensure adherence to customer and plant specifications. May mix colors. May inventory and requisition supplies.
GOE: 02.04.01 STRENGTH: L GED: R5 M5 L4 SVP: 7 DLU: 77

022.161-018 PERFUMER (chemical)

Evaluates odors of aromatic chemicals to set production standards and ensure adherence by workers engaged in compounding and finishing operations: Directs workers engaged in preparation of work orders for compounding department and reviews batch sheets prepared for distillation department to ensure compliance with formulas devised in perfume laboratory. Visits compounding and distillation areas and determines, by smelling, odor qualities of prepared materials. Approves batches for finishing, from knowledge of odor characteristics and odor blends conforming with customer or laboratory standards. Resmells sample in air-filtered room, using blotter strips dipped in aromatic chemicals to evaluate fragrances for specific characteristics, such as odor, body, harmony, strength, and permanence. Compares odor and color of current sample with samples of previous batches. Rejects batches not meeting criteria, and notifies distillation personnel to redistill product. May devise production formulas and be designated Creative Perfumer (chemical).
GOE: 02.01.02 STRENGTH: L GED: R5 M5 L4 SVP: 7 DLU: 77

022.261-010 CHEMICAL LABORATORY TECHNICIAN (profess. & kin.)

Conducts chemical and physical laboratory tests of solid materials, liquids, and gases, and analyzes test data for variety of purposes, such as research, product development, quality control, criminal investigation, and establishing standards, involving experimental, theoretical, or practical application of chemistry and related sciences: Sets up laboratory equipment and instrumentation required for tests, research, or process control. Tests and analyzes products, such as food, drugs, fertilizers, plastics, paints, detergents, paper, petroleum, and cement, to determine strength, stability, purity, chemical content, and other characteristics. Tests and analyzes materials and substances, such as ores, minerals, gases, soil, water, and pollutants. Documents results of tests and analyses. May prepare chemical solutions for use in processing materials, following standardized formulas or experimental procedures. May test and analyze radioactive and biological materials, applying knowledge of radiochemical procedures, emission spectrometry, and related techniques.
GOE: 02.04.01 STRENGTH: L GED: R5 M4 L4 SVP: 7 DLU: 88

022.261-014 MALT-SPECIFICATIONS-CONTROL ASSISTANT (beverage)

Keeps perpetual inventory of malt and barley in storage elevators and determines formulas for blending malt: Compiles continuous records of malt and barley supplies by location, amount, physical characteristics, and chemical analysis. Writes orders to malt house to produce and blend standard malt types. Notifies purchasing department of barley supplies in storage. Analyzes physical and chemical test results to classify incoming barley shipments. Selects tanks and issues orders for storing barley and malt in elevators. Analyzes customer orders to determine if special malt blends are needed. Determines blend formulas, using established chemical and mathematical procedures. Mixes sample of blend by hand, orders chemical and physical testing by laboratory, and compares results with specifications. Sends formula and sample to

malt elevators and customers.
GOE: 05.02.03 STRENGTH: S GED: R4 M4 L3 SVP: 7 DLU: 77

022.261-018 CHEMIST, INSTRUMENTATION (profess. & kin.)

Conducts chemical analyses of wastewater discharges of industrial users of municipal wastewater treatment plant to determine industrial waste surcharge assessments and to ensure that users meet pollution control requirements: Conducts chemical analyses of samples, using special instrumentation, such as gas chromatograph with electron capture, flame ionization, and thermal conductivity detectors, ultraviolet-visible recording spectrophotometer with photometry attachments, and infrared spectrophotometer. Compares findings with industry declared data and legal requirements and notes variations to be used in determining industrial waste surcharge assessments and to regulate industrial waste discharges. Develops new procedures in use of equipment and procedures for analyzing samples. Directs subordinate laboratory personnel in routine tests.
GOE: 02.01.01 STRENGTH: L GED: R5 M5 L4 SVP: 7 DLU: 87

022.261-022 CHEMIST, WASTEWATER-TREATMENT PLANT (profess. & kin.)

Analyzes samples of streams, raw and treated wastewater, sludge, and other byproducts of wastewater treatment process to determine efficiency of plant processes and to ensure that plant effluent meets water pollution control requirements, using standard laboratory equipment: Conducts tests for settleable solids, suspended solids, total solids, volatile solids, volatile acids, alkalinity, pH, dissolved oxygen demand, turbidity, and other substances. Initiates changes in laboratory procedures and equipment in order to increase efficiency of laboratory. Directs laboratory personnel in prescribed laboratory techniques and performance of routine tests.
GOE: 02.04.02 STRENGTH: L GED: R5 M5 L4 SVP: 7 DLU: 87

022.281-010 ASSAYER (profess. & kin.)

Tests ores and minerals and analyzes results to determine value and properties of components, using spectrographic analysis, chemical solutions, and chemical or laboratory equipment, such as furnaces, beakers, graduates, pipettes, and crucibles: Separates metals or other components from dross materials by solution, flotation, or other liquid processes, or by dry methods, such as application of heat to form slags of lead, borax, and other impurities. Weighs residues on balance scale to determine proportion of pure gold, silver, platinum, or other metals or components. May specialize in testing and analyzing precious metals and be designated Gold-And-Silver Assayer (profess. & kin.).
GOE: 02.04.01 STRENGTH: L GED: R5 M5 L4 SVP: 7 DLU: 77

022.281-014 CHEMIST, WATER PURIFICATION (waterworks)

Analyzes water in purification plant to control chemical processes which soften it or make it suitable for drinking: Analyzes samples of filtered water to ensure that quantities of solids left in suspension are below prescribed limits. Determines amounts of liquid chlorine to be used in chlorinators to destroy microbes and other harmful organisms, basing amounts on findings of MICROBIOLOGIST (profess. & kin.). Determines kinds and amounts of chemicals to be used in removing minerals, acids, salts, and other inorganic compounds from water to soften it. Tests samples extracted from various points in distribution system, such as mains, tanks, pumps, and outlets, to discover possible sources of water contamination.
GOE: 02.04.02 STRENGTH: L GED: R6 M6 L6 SVP: 7 DLU: 77

022.281-018 LABORATORY TESTER (plastic-synth.)

Examines, measures, photographs, and tests synthetic fiber samples to facilitate quality control of forming, treating, and texturing processes, performing any combination of following tasks: Dips several twisted threads in melted wax and directs stream of cold water over threads to congeal wax. Slices threads crosswise, using microtome. Dissolves wax, using solvent, and positions thread sample on microscope slide. Inserts slide in microscope and photographs sample, using standard microphotographic equipment and techniques. Develops, prints, and labels photographs. Analyzes photographs to determine whether structure and other characteristics of thread meet plant standards. Determines tensile strength of thread samples, using device that draws material between two jaws until breakage occurs. Measures cross-sectional area of thread samples, using planimeter. Immerses samples in water, corrosives, or cleaning agents to detect shrinkage or damage. Places thread samples in dye bath to evaluate permeability of dye and exposes samples to controlled light source to ascertain fade resistance. Prepares and submits reports of findings to production personnel to facilitate quality control of product.
GOE: 02.04.01 STRENGTH: L GED: R4 M3 L3 SVP: 6 DLU: 77

022.381-010 YEAST-CULTURE DEVELOPER (beverage)

Selects and cultivates yeast cells to develop pure yeast culture for brewing beer and malt liquors: Samples beer in fermenting stages to select specimens containing yeast cells having specific reproduction characteristics. Prepares cover glasses and slides with smears of yeast preparation taken from beer samples. Examines slides under microscope to isolate specific cells and record position of cells. Incubates slides to allow colonies of cells to form. Inoculates cells with hopped wort, using sterile needle to transfer cells from slides to flasks containing wort. Cultivates cells in flasks by incubation and propagates single cell cultures by transferring cells to additional flasks. Siphons developing yeast culture from flasks to tanks and pumps yeast culture from tanks to sterile barrels. Seals barrels with sterile bung and packs sealed barrels in dry ice to prevent yeast degeneration. Cleans and sterilizes equipment.
GOE: 02.04.02 STRENGTH: M GED: R4 M2 L4 SVP: 5 DLU: 77

023 OCCUPATIONS IN PHYSICS

This group includes occupations concerned with the investigation of the laws of matter and energy and their application to problems in such fields as science, engineering, medicine, environment, and production.

023.061-010 ELECTRO-OPTICAL ENGINEER (profess. & kin.)

Conducts research and plans development and design of gas and solid state lasers, masers, infrared, and other light emitting and light sensitive devices: Designs electronic circuitry and optical components with specific characteristics to fit within specified mechanical limits and to perform according to specifications. Designs suitable mounts for optics and power supply systems. Incorporates methods for maintenance and repair of components and designs, and develops test instrumentation and test procedures. Confers with engineering and technical personnel regarding fabrication and testing of prototype systems, and modifies design as required. May conduct application analysis to determine commercial, industrial, scientific, medical, military, or other use for electro-optical devices. May assist with development of manufacturing, assembly, and fabrication processes.
GOE: 05.01.07 STRENGTH: S GED: R6 M6 L6 SVP: 8 DLU: 77

023.061-014 PHYSICIST (profess. & kin.)

Conducts research into phases of physical phenomena, develops theories and laws on basis of observation and experiments, and devises methods to apply laws and theories of physics to industry, medicine, and other fields: Performs experiments with masers, lasers, cyclotrons, betatrons, telescopes, mass spectrometers, electron microscopes, and other equipment to observe structure and properties of matter, transformation and propagation of energy, relationships between matter and energy, and other physical phenomena. Describes and expresses observations and conclusions in mathematical terms. Devises procedures for physical testing of materials. Conducts

instrumental analyses to determine physical properties of materials. May specialize in one or more branches of physics and be designated Physicist, Acoustics (profess. & kin.); Physicist, Astrophysics (profess. & kin.); Physicist, Atomic, Electronic And Molecular (profess. & kin.); Physicist, Cryogenics (profess. & kin.); Physicist, Electricity And Magnetism (profess. & kin.); Physicist, Fluids (profess. & kin.). May be designated: Physicist, Light And Optics (profess. & kin.); Physicist, Nuclear (profess. & kin.); Physicist, Plasma (profess. & kin.); Physicist, Solid Earth (profess. & kin.); Physicist, Solid State (profess. & kin.); Physicist, Thermodynamics (profess. & kin.).
GOE: 02.01.01 STRENGTH: L GED: R6 M6 L6 SVP: 8 DLU: 77

023.067-010 PHYSICIST, THEORETICAL (profess. & kin.)

Designs, conceives, and interprets experiments in physics and formulates theories consistent with data obtained: Analyzes results of experiments designed to detect and measure previously unobserved physical phenomena. Applies mathematical methods to solution of physical problems.
GOE: 02.01.01 STRENGTH: S GED: R6 M6 L6 SVP: 8 DLU: 77

024 OCCUPATIONS IN GEOLOGY

This group includes occupations concerned with the investigation of the composition, structure, and physical and biological history of the earth's crust and the application of this knowledge in such fields as archeology, mining, construction, and environmental impact. Typical specializations are ecomonic geology, historical geology, mineralogy, mining geology, paleontology, petroleum geology, petrology, physiography, structural geology, subsurface geology.

024.061-010 CRYSTALLOGRAPHER (clock & watch)

Conducts studies of nonmetallic minerals used in horological industry. Performs experimental research concerned with projects, such as development of diamond tools and dies, fabrication of jeweled bearings, and development of grinding $T3laps III$T1 and wheels. Tests industrial diamonds and abrasives to determine grain size, pattern, crystalline orientation, goniometric features and other factors in order to appraise their suitability for use, using optical, x-ray, and other precision instruments. Repairs diamond and abrasive tools. Develops improved methods of fabricating silicon-carbide compounds into bearings and investigates substitution of other materials.
GOE: 02.01.02 STRENGTH: L GED: R6 M6 L6 SVP: 8 DLU: 77

024.061-014 GEODESIST (profess. & kin.)

Studies size, shape, and gravitational field of earth: Employs surveying and geodetic instruments, such as transits, theodolites, and other engineering instruments, in setting up and improving network of triangulation over earth's surface, in order to provide fixed points for use in making maps. Establishes bench marks (known points of elevation). Performs gravimetric surveying to determine variations in earth's gravitational field, and provides data used in determination of weight, size, and mass of earth.
GOE: 02.01.01 STRENGTH: L GED: R6 M6 L6 SVP: 8 DLU: 77

024.061-018 GEOLOGIST (profess. & kin.)

Studies composition, structure, and history of earth's crust: Examines rocks, minerals, and fossil remains to identify and determine sequence of processes affecting development of earth. Applies knowledge of chemistry, physics, biology, and mathematics to explain these phenomena and to help locate mineral, geothermal, and petroleum deposits and underground water resources. Studies ocean bottom. Applies geological knowledge to engineering problems encountered in construction projects, such as dams, tunnels, and large buildings. Studies fossil plants and animals to determine their evolutionary sequence and age. Prepares geologic reports and maps, interprets research data, and recommends further study or action. May specialize in area of study and be designated Geomorphologist (profess. & kin.); Oceanographer, Geological (profess. & kin.); Photogeologist (profess. & kin.). May conduct or participate in environmental studies and prepare environmental reports. Workers applying principles of rock and soil mechanics for engineering projects may be designated Geological Engineer (profess. & kin.). Workers applying all branches of geologic knowledge to conditions that affect planning, design, construction, operation and safety to engineering projects may be designated Engineering Geologist (profess. & kin.).
GOE: 02.01.01 STRENGTH: L GED: R6 M6 L6 SVP: 8 DLU: 77

024.061-022 GEOLOGIST, PETROLEUM (petrol. & gas)

Explores and charts stratigraphic arrangement and structure of earth to locate gas and oil deposits: Studies well logs, analyzes cores and cuttings from well drillings, and interprets data obtained by electrical or radioactive well logging and other subsurface surveys to identify earth strata. Examines aerial photographs, evaluates results of geophysical prospecting, and prepares surface and subsurface maps and diagrams depicting stratigraphic arrangement and composition of earth and probable deposits of gas and oil. Recommends acquisition, retention, or release of property leases or contracts. Estimates oil reserves in proven or prospective fields, and consults with PETROLEUM ENGINEERS (petrol. & gas) concerning drilling and production methods. May direct drilling of shallow exploratory wells.
GOE: 02.01.02 STRENGTH: L GED: R6 M6 L5 SVP: 8 DLU: 77

024.061-026 GEOPHYSICAL PROSPECTOR (petrol. & gas)

Studies structure of subsurface rock formations to locate petroleum deposits: Conducts research, using geophysical instruments such as seismograph, gravimeter, torsion balance, and magnetometer, pendulum devices, and electrical-resistivity apparatus to measure characteristics of earth. Computes variations in physical forces existing at different locations and interprets data to reveal subsurface structures likely to contain petroleum deposits. Prepares charts, profiles or subsurface contour maps, and determines desirable locations for drilling operations. Directs field crews drilling boreholes and collecting samples of rock and soil for chemical analysis of hydrocarbon content. May specialize in particular instrumentation and be designated Electrical Prospector (petrol. & gas); Gravity Prospector (petrol. & gas); Magnetic Prospector (petrol. & gas); Seismic Prospector (petrol. & gas).
GOE: 02.01.02 STRENGTH: L GED: R6 M6 L6 SVP: 8 DLU: 77

024.061-030 GEOPHYSICIST (profess. & kin.)

Studies physical aspects of earth, including its atmosphere and hydrosphere: Investigates and measures seismic, gravitational, electrical, thermal, and magnetic forces affecting earth, utilizing principles of physics, mathematics, and chemistry. Analyzes data obtained to compute shape of earth, estimate composition and structure of earth's interior, determine flow pattern of ocean tides and currents, study physical properties of atmosphere, and help locate petroleum and mineral deposits. Investigates origin and activity of glaciers, volcanoes, and earthquakes. Compiles data to prepare navigational charts and maps, predict atmospheric conditions, prepare environmental reports, and establish water supply and flood-control programs. May study specific aspect of geophysics and be designated Geomagnetician (profess. & kin.); Glaciologist (profess. & kin.); Oceanographer, Physical (profess. & kin.); Tectonophysicist (profess. & kin.); Volcanologist (profess. & kin.).
GOE: 02.01.01 STRENGTH: L GED: R6 M5 L5 SVP: 8 DLU: 77

024.061-034 HYDROLOGIST (profess. & kin.)

Studies distribution, disposition, and development of waters of land areas, including form and intensity of precipitation, and modes of return to ocean and atmosphere: Maps and charts water flow and disposition of sediment. Measures changes in water volume due to evaporation and melting of snow. Studies storm occurrences and nature and movement of glaciers, and determines rate of ground absorption and ultimate disposition of water. Evaluates data obtained in reference to such problems as flood and drought forecasting, soil and water conservation programs, and planning water supply, water power, flood control, drainage, irrigation, crop production, and inland navigation projects.
GOE: 02.01.01 STRENGTH: L GED: R6 M6 L6 SVP: 8 DLU: 77

024.061-038 MINERALOGIST (profess. & kin.)

Examines, analyzes, and classifies minerals, gems, and precious stones: Isolates specimen from ore, rocks, or matrices. Makes microscopic examination to determine shape, surface markings, and other physical characteristics. Performs physical and chemical tests and makes x-ray examinations to determine composition of specimen and type of crystalline structure. Identifies and classifies samples. Develops data and theories on mode of origin, occurrence, and possible uses of minerals.
GOE: 02.01.01 STRENGTH: L GED: R6 M6 L6 SVP: 8 DLU: 77

024.061-042 PALEONTOLOGIST (profess. & kin.)

Studies fossilized remains of plants and animals found in geological formations to trace evolution and development of past life and identify geological formations according to nature and chronology: Recovers and assembles fossilized specimens, notes their positions, and classifies them according to their botanical or zoological family and probable age. Prepares treatises on findings for furtherance of scientific study, or as in aid to location of natural resources, such as petroleum-bearing formations. May organize scientific expeditions and supervise removal of fossils from deposits and matrix rock formations. May specialize in study of plant fossils and be designated Paleobotanist (profess. & kin.). May specialize in study of fossilized micro-organisms and be designated Micropaleontologist (profess. & kin.).
GOE: 02.01.01 STRENGTH: L GED: R6 M6 L6 SVP: 8 DLU: 77

024.061-046 PETROLOGIST (profess. & kin.)

Investigates composition, structure, and history of rock masses forming earth's crust. Applies findings to such fields of investigation as causes of formations, breaking down and weathering, chemical composition and forms of deposition of sedimentary rocks, methods of eruption, and origin and causes of metamorphosis.
GOE: 02.01.01 STRENGTH: L GED: R6 M6 L5 SVP: 8 DLU: 77

024.061-050 SEISMOLOGIST (profess. & kin.)

Studies and interprets seismic data to locate earthquakes and earthquake faults: Reviews, analyzes, and interprets data from seismographs and geophysical instruments. Establishes existence and activity of faults, and direction, motion, and stress of earth movements before, during, and after earthquakes. Conducts research on seismic forces affecting deformative movements of earth. May issue maps or reports indicating areas of seismic risk to existing or proposed construction or development.
GOE: 02.01.01 STRENGTH: L GED: R6 M6 L6 SVP: 8 DLU: 77

024.061-054 STRATIGRAPHER (profess. & kin.)

Studies relative position and order of succession of deposits containing or separating archaeological fossil or plant material. Studies relation of life of past ages, evolutionary changes as recorded by fossil animals and plants, and successive changes in distribution of land and sea as interpreted from character of fossil content of sedimentary rocks.
GOE: 02.01.01 STRENGTH: L GED: R6 M6 L5 SVP: 8 DLU: 77

024.161-010 ENGINEER, SOILS (profess. & kin.)

Studies and analyzes surface and subsurface soils to determine characteristics for construction, development, or land planning: Inspects proposed construction site, and sets up test equipment and drilling machinery to obtain data and soil and rock samples. Analyzes data and soil samples through field and laboratory analysis, to determine type, classification, characteristics, and stability of soil. Computes bearing weights, prepares maps, charts, and reports of test results. May make recommendations regarding foundation design, slope angles, grading or building heights. May participate in environmental studies and prepare environmental impact reports.
GOE: 05.01.08 STRENGTH: L GED: R6 M5 L6 SVP: 7 DLU: 77

024.167-010 GEOPHYSICAL-LABORATORY CHIEF (profess. & kin.) alternate titles: director, geophysical laboratory; engineer, geophysical laboratory; research engineer, geophysical laboratory; superintendent, geophysical laboratory

Plans, directs, and coordinates research activities of geophysical laboratory to develop new or improved instruments and methods for measuring physical characteristics of earth's crust which provide data for petroleum or mineral exploration: Consults with management and field and laboratory technical personnel to determine specific phases of geophysical prospecting in which improved processes might be evolved by study and experimentation. Plans research programs and initiates and directs experiments to improve prospecting procedures, explore possibilities of new theories, and develop improved or new instruments. Directs and coordinates activities concerned with designing, building, and field testing experimental instruments and maintenance and repair of laboratory and prospecting instruments.
GOE: 02.04.01 STRENGTH: L GED: R6 M6 L6 SVP: 9 DLU: 77

024.267-010 GEOLOGICAL AIDE (petrol. & gas)

Examines and compiles geological information to provide technical data to GEOLOGIST, PETROLEUM (petrol. & gas) 024.061-022, using surface and subsurface maps, oil and gas well activity reports, and sand and core analysis studies: Studies geological reports to extract well data and posts data to maps and logs. Draws subsurface formation contours on charts to lay out and prepare geological cross section charts. Compiles information regarding well tests, completions, and formation tops to prepare oil or gas well records. Records net sand and sand percentage counts and calculates isopachous values to compile sand analysis data. Studies directional logs and surveys to calculate and plot formation tops. Reads well activity reports and records key well locations in drilling activity book. Assembles and distributes prepared charts, maps, and reports to geologist requesting material. Maintains file record systems and geological library. Attends SCOUT (petrol. & gas) 010.267-010 meeting to compile information on well activity. Contacts competitors to acquire oil and gas samples from wells. Operates computer terminal for input and retrieval of geological data.
GOE: 02.04.01 STRENGTH: L GED: R5 M5 L5 SVP: 8 DLU: 86

024.284-010 PROSPECTOR (any industry)

Explores likely regions to discover valuable mineral deposits, using topographical maps, surveys, reports, and knowledge of geology and mineralogy: Examines outcrops, placer, and stream channels for mineral content. Drills, dynamites, or digs trenches or pits along rock formations or creek beds to obtain rock samples. Breaks off samples and tests them for presence of minerals with heat, acid, magnifying glass, or by pulverizing and washing or panning. Assays samples for preliminary quantitative estimate. Collects data on rock formations, using geophysical instruments and devices, such as geiger counters and electronic sounding equipment, and determines feasibility of staking and developing claim. Stakes claim according to federal or state legal requirements. Develops mineral deposits by means of placer or hard rock mining. May sell interests in discovered areas.
GOE: 05.03.04 STRENGTH: H GED: R4 M4 L4 SVP: 7 DLU: 77

024.364-010 PALEONTOLOGICAL HELPER (profess. & kin.)

Prepares, classifies, and sorts rock and fossil specimens: Records receipt of fossil and rock samples from outcroppings, quarries, oil or gas wells, boreholes, or other sources. Cleans, washes, and prepares samples, using probes, brushes, or cleaning solutions to remove extraneous matter. Separates rock and fossil specimens and classifies them into general categories of fossilization. Compiles background data of rock or fossil. Sacks and labels specimens. Mounts specimen for study or

experimentation.
GOE: 02.04.01 STRENGTH: L GED: R3 M2 L2 SVP: 6 DLU: 77

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