DOCUMENT RESUME

ED 406 537 CE 073 763

TITLE	Engineering, Trade, and Technical Cluster. Occupational Analyses. Worker Task Lists and Supplementary Information for Selected Occupations.
INSTITUTION	Henrico County Public Schools, Glen Allen, VA. Virginia Vocational Curriculum and Resource Center.
SPONS AGENCY	Virginia State Dept. of Community Colleges, Richmond.
PUB DATE	96
NOTE	30p.; Developed by Northern Virginia Community College-Manassas Campus, Mountain Empire Community College, and Central Virginia Community College. For related documents, see CE 073 760-764.
AVAILABLE FROM	Virginia Vocational Curriculum and Resource Center, 2200 Mountain Road, Glen Allen, VA 23060-2208 ($10).
PUB TYPE	Guides - Classroom - Teacher (052)
EDRS PRICE	MF01/PC02 Plus Postage.
DESCRIPTORS	Buildings; *Carpentry; *Competence; Competency Based Education; Distributive Education; *Electricians; Electricity; Employment Qualifications; Engineering; Job Skills; *Maintenance; *Marketing; Occupational Clusters; *Occupational Information; Postsecondary Education; Sales Occupations; Secondary Education; Task Analysis; Technical Occupations; Trade and Industrial Education; Vocational Education
IDENTIFIERS	Virginia

ABSTRACT

This publication contains worker task lists and supplementary information for four occupations in the engineering, trade, and technical cluster: (1) general carpenter, (2) residential electrician, (3) industrial distribution occupations, and (4) residential and commercial maintenance specialist. The task lists were generated through the DACUM (Developing a Curriculum) process and/or by analysis by a panel of experts. The following supplementary information is provided for each occupation: (1) general carpenter--worker traits and attitudes and career paths; (2) residential electrician--traits and attitudes, trends, technical preparation needed, career insights from experts; (3) industrial distribution--traits and attitudes, knowledge and skills, job titles; and (4) maintenance specialist--traits and attitudes, knowledge, certification, general and technical skills, equipment, trends, career ladder. (KC)

OCCUPATIONAL ANALYSES

ENGINEERING, TRADE, AND TECHNICAL CLUSTER

Worker Task Lists and Supplementary Information
for Selected Occupations

GENERAL CARPENTER . . . . . .

RESIDENTIAL ELECTRICIAN . . . . . .

INDUSTRIAL DISTRIBUTION OCCUPATIONS . . . . . .

RESIDENTIAL/COMMERCIAL MAINTENANCE SPECIALIST . . . . . .

Commonwealth of Virginia
Virginia Community College System
Richmond, Virginia 23219

Occupational Analyses
Engineering, Trade, and Technical Cluster

WORKER TASK LISTS AND SUPPLEMENTARY INFORMATION FOR SELECTED OCCUPATIONS

Developed by

Northern Virginia Community College - Manassas Campus
Mountain Empire Community College
Central Virginia Community College

Produced by

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9-901.069AC

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Introduction

Employers in today's high-tech workplace need workers with a variety of qualifications. To be successful in most technical fields, workers must

- master a number of specific tasks
- understand and be able to use related technical concepts and theories
- exhibit traits and attitudes that employers find desirable.

Students who wish to enter technical career fields must have instruction that enables them to gain these qualifications. This instruction may be provided in several ways, including secondary vocational programs and community college technical degree or certificate programs.

The first step in designing a technical curriculum is to analyze one or more occupations to determine

- the tasks and activities performed by competent workers on the job
- the skills and knowledge workers need to perform these tasks
- the general skills, knowledge, traits, and attitudes necessary for employment success.

Instruction that reflects this information will help students compete for jobs in their chosen field.

Tech prep projects throughout Virginia have based their programs on occupational analysis. The method depends on local needs and circumstances, but at a minimum each results in lists of tasks and technical and employability skills. Methods include

- **DACUM (Developing A CurriculUM):** A panel of workers describes a single occupation (e.g., police officer) by writing tasks on cards and placing them on the wall. Adding, revising, rearranging, or discarding cards results in a picture of an occupation. A modified DACUM uses prepared cards which are edited by the panel.
- **Panel of Experts:** Experts in an occupational field (e.g., criminal justice) validate an existing task list and discuss "big picture" issues. Experts may be workers, managers, human resource specialists, or other industry representatives capable of predicting trends in employment, designing career paths, and determining standards of worker performance.

Although occupational analysis is primarily a local effort, tech prep project sites can validate lists generated in a different part of the state to begin their curriculum development process. Both secondary and postsecondary program designers and teachers can use occupational task lists and other employer information to update existing instruction, validate course content, and generate workplace applications in academic classes.

The collection of occupational analyses included in this guide are a part of the Engineering, Trade, and Technical cluster of occupations. Career clusters are the organizational basis for tech prep, as students begin early to explore a group of similar occupations, narrowing choices along the

educational path until they are highly qualified for a career specialty. For example, a student may begin by exploring hospitality occupations, decide to concentrate on food service, and pursue a career in dietetics.

Further information about the task lists published in this guide is available from the project directors:

- "General Carpenter" and "Residential Electrician"
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For additional information related to tech prep, please call Darlene Blake, Tech Prep Coordinator, Virginia Community College System, at (804) 371-6582. To request curriculum development resources or assistance from the VVCRC, please call (804) 261-5075 or send e-mail to vvcrc@pen.k12.va.us.

General Carpenter

WORKER TASK LIST

A. MASTERING BASIC CARPENTRY SKILLS
1. Read tape measure.
2. Compute architectural dimensions.
3. Use basic hand and power tools.
4. Determine dimensions from a blueprint.
5. Interpret building specifications.
6. Apply knowledge of local building codes.
7. Apply basic knowledge of other trades.
8. Create a safe working environment (includes knowledge of OSHA).
9. Make minor repairs to maintain equipment.
10. Select materials for installation.

B. CUTTING, SHAPING, AND FASTENING STOCK
1. Cut stock to size.
2. Crosscut dimensioned lumber to size.
3. Rip-saw dimensioned lumber to size.
4. Bore holes.
5. Fasten framing stock with nails.
6. Fasten stock with screws.
7. Construct a square frame.
8. Cut holes and patterns in stock.

C. ESTIMATING/SELECTING MATERIALS
1. Estimate interior underlayment.
2. Estimate rough framing materials.
3. Select windows.
4. Select doors and jambs.
5. Determine proper use of materials.
6. Cull out unsuitable materials.

D. BUILDING AND INSTALLING THE FOUNDATION
1. Inspect foundation.
2. Square foundation.
3. Level foundation.
4. Select steel beams.

E. FRAMING THE FLOOR
1. Check condition of foundation.
2. Install sill plate.

3. Install wood post.
4. Install solid and composite wood beam.
5. Install built-up wood girder.
6. Install steel beam.
7. Install Lally column.
8. Lay out floor framing detail on sill plate.
9. Cut floor joists.
10. Frame floor opening, to include fireplace/hearth box, etc. (include stripping of forms installed by carpenter).
11. Install floor joists.
12. Install cantilevered floor joists.
13. Install bridging and blocking.
14. Install subfloor sheathing.
15. Install prefabricated stair unit.

F. FRAMING THE WALLS

1. Lay out walls on floor deck.
2. Cut wall plates.
3. Lay out wall framing detail on wall plates.
4. Cut studs, headers, jacks, rough sills, and cripples.
5. Assemble corner and tee posts.
6. Assemble header.
7. Frame door opening.
8. Frame window opening.
9. Assemble wall section.
10. Install double top plate (cap plate).
11. Install wall blocking (backing).
12. Install fire stops.
13. Install corner brace.
14. Install exterior wall sheathing.
15. Raise and anchor wall section.
16. Plumb, align, and brace wall section.

G. FRAMING THE CEILING

1. Lay out ceiling framing detail on top wall plate.
2. Cut ceiling joists.
3. Install ceiling joists.
4. Frame ceiling opening.
5. Install ribband (balloon framing).
6. Install strongback (stiffener or catwalk).
7. Install ceiling backing (deadwood or nailers).
8. Fasten ceiling joists to partition walls.
9. Frame interior bulkhead.

10. Install disappearing stair unit.

H. FRAMING THE ROOF

1. Lay out roof framing detail on cap plate.
2. Lay out common, header, and cripple rafters.
3. Cut rafters.
4. Install ridgeboard.
5. Frame roof opening.
6. Install rafters.
7. Install sub-fascia.
8. Frame gable end overhang.
9. Frame blind valley (overlay valley).
10. Frame gable dormer.
11. Frame shed dormer.
12. Install collar beams (rafter ties).
13. Install rafter support purlins.
14. Install roof sheathing.
15. Frame chimney saddle (cricket).

I. INSTALLING TRUSSES

1. Lay out for truss installation.
2. Set trusses by hand.
3. Set trusses with light crane (includes helping set up/break down crane).
4. Brace trussed roof assembly according to manufacturer's specifications.
5. Frame opening in roof assembly.
6. Repair trusses according to engineering instructions.
7. Select trusses per plans.
8. Identify sound engineering practices.

J. CONSTRUCTING AND INSTALLING STAIRS

1. Lay out straight run stair stringer.
2. Cut basement stair components.
3. Construct basement stair unit.

K. INSTALLING DOORS AND WINDOWS

1. Install prehung window according to manufacturer's specifications.
2. Install prehung exterior door according to manufacturer's specifications.
3. Install sidelight.
4. Install transom.
5. Assemble and install sliding glass or French patio door.
6. Install inside jamb for garage door.
7. Plumb and square doors and windows.

L. FRAMING PORCHES AND DECKS

1. Install ledger board, fasteners, and flashing.
2. Install wood support posts.
3. Install solid wood beam.
4. Install built-up wood girder.
5. Install deck joists.
6. Install decking (planking).
7. Install railing.
8. Install footings.
9. Identify superstructure of attachment.
10. Lay out, cut, construct, and install stairs.

M. INSTALLING EXTERIOR FINISHES

1. Construct box cornice.
2. Construct rake cornice.
3. Case exterior opening.
4. Install wood jamb window unit.
5. Install prehung exterior door unit.
6. Hang exterior door.
7. Install exterior door jamb.
8. Install corner board for wood siding.
9. Install wood fascia.
10. Install wood soffit.
11. Install prefabricated column.
12. Install bevel siding.
13. Install fixed exterior features.

N. INSTALLING INTERIOR FINISHES

1. Install wall paneling.
2. Install closet accessories (includes selection of closet accessories).
3. Install shelving.
4. Install baseboards.
5. Install ceiling molding.
6. Case interior opening.
7. Install interior door jamb.
8. Hang interior door.
9. Install prehung interior door unit.
10. Install folding (accordion) door.
11. Install sliding door.
12. Install bi-fold door.
13. Install pocket door.
14. Install cylinder lockset.
15. Install mortise lockset.

16. Install door holder.
17. Install flush bolt.
18. Install door plate.
19. Install weatherstripping.
20. Construct open shelving.
21. Install wall cabinet and hardware (includes selection of hardware).
22. Install base cabinet and hardware (includes selection of hardware).
23. Install recessed medicine cabinet.
24. Select prefabricated cabinets.
25. Install prefabricated counter tops.

SUPPLEMENTARY INFORMATION

TRAITS AND ATTITUDES

Motivation
Teamwork
Ability to see the big picture
Ability to see gray areas – everything is not black and white
Ability to make good value judgments
Ability to solve problems
Pursuit of excellence – do your best, take pride in your work, have respect for the structure, serve the client
Willingness to pay dues
Integrity
Willingness to take responsibility
Ability to enjoy work
Ability to create an environment for success – surround yourself with successful people
Trustworthiness – keep your word, take care of people who work for you
Persistence – keep the goal in sight, keep going until you reach it
Initiative
Ability to plan upcoming work
Willingness to network
Willingness to ask questions
Passion for the work

CAREER PATH

The panel stated that experience is the most important factor in hiring and advancement in the construction trades.

A high school program completer would always begin at the *carpenter helper* level then move up to *general carpenter* as the employer saw proof of competence. Experience and proven competence as a general carpenter may result in advancement to *lead carpenter.* The title *master carpenter* is reserved for those who spend years continuously improving their skills.

Carpenters may work for a single construction company or may hire on for only one job or one type of job.

At any point along the way, a person may decide to move into construction management. The manager may prepare for employment through education or experience or a combination of the two.

Contractors generally own their own businesses. They (and carpenters) may specialize in different types of residential housing, from low-end production housing and room/deck additions to custom homes and historical renovation.

The panel stated that there are no carpenter apprenticeship programs in the Northern Virginia region. Members talked about the problem of "pigeonholing" or requiring, for the sake of efficiency, carpenters to work all the time on a single construction element such as windows.

RESIDENTIAL ELECTRICIAN

Worker Task List

A. MASTERING ELECTRICAL ENERGY FUNDAMENTALS

1. Interpret and apply the relationship among the following terms:

circuit	watt
conductor	A.C.
insulator	D.C.
amp	single phase
volt	three phase
ohm	resistance.
current	

2. Identify and use various types of metering equipment, including voltage meter, ohm meter, amp meter, harmonics meter, and transients meter.

B. ENFORCING SAFETY

1. Practice safe work procedures that reflect knowledge of the causes and dangers of electrical shock and the effect of electrical current on the human body.
2. Follow industry safety guidelines and articulate how the following NEC guidelines relate to safety:
   - NEC article 110-6(a)
   - NEC article 210-8
   - NEC article 430-102.
3. Adhere to OSHA guidelines for worker safety.
4. Practice job-site safety by wearing appropriate clothing, ensuring eye and ear protection, and maintaining safe working conditions.
5. Administer CPR.
6. Take responsibility for personal liability issues related to safety.

C. USING TOOLS

1. Inspect the condition of a ladder and set up.
2. Erect scaffolding and guardrails.
3. Interpret instruction manuals.
4. Select appropriate tool for the task/job.
5. Inspect the mechanical and electrical condition of tools.
6. Follow safe-use practices for hand tools.
7. Use and maintain power-actuated and hydraulic tools.
8. Use a chalk line.

D. MARKING OUT THE DWELLING

1. Interpret blueprints.
2. Designate devices and outlet locations per minimum code.
3. Locate the center of a room.
4. Locate and mark the placement of major appliances and equipment.

E. BOXING OUT THE DWELLING

1. Select and install single gang and multiple gang device and outlet boxes in *noncombustible* wall finishes (NEC Article 370-20).
2. Select and install single gang and multiple gang device and outlet boxes in *combustible* wall finishes (NEC Article 370-20).
3. Calculate box fill.
4. Select and install boxes for ceiling/paddle fans (NEC Article 370-27c).
5. Mount floor boxes.
6. Align and install housings for recess lights.
7. Install bathroom exhaust fan housings.
8. Cut and install spacer blocks around trim areas.
9. Cut and fasten furring strips to poured or block walls in unfinished areas.
10. Mount device rings for telephone and television outlets.

F. DRILLING OUT THE DWELLING

1. Plan circuit layout.
2. Chisel corner studs.
3. Drill or bore holes to maintain structural integrity of the dwelling.

G. SELECTING CABLE

1. Identify various sizes of NM cable and their applications.
2. Identify various sizes of SEC and their applications.
3. Identify various sizes of UF cable and their applications.
4. Identify types of raceways and their applications.
5. Identify various types of cable insulation and their applications.
6. Identify TV cable.
7. Identify bell wire and define its applications.
8. Identify telephone cable.

H. PULLING CABLE

1. Calculate conductor voltage drops for long runs.
2. Pull general lighting circuit cables.
3. Pull small appliance circuit cables.
4. Pull laundry circuit.
5. Pull dryer circuit.
6. Pull GFCI circuits(s) to bathrooms, garage, and exterior outlets.
7. Calculate wire size and pull cooking appliance cables.

8. Pull garbage disposal cable.
9. Calculate wire size and pull water heater cable.
10. Calculate wire size and pull HVAC equipment cables.
11. Pull smoke alarm cable.
12. Pull telephone cable.
13. Pull TV cable.
14. Pull door chime.

I. TYING IN CABLE

1. Make up splices in outlet and device boxes.
2. Secure cables in place.
3. Install kickplates.

J. BUILDING ELECTRICAL SERVICE

1. Calculate size of electrical service.
2. Install electric meter socket.
3. Install service entrance conductor.
4. Install electrical service panel.
5. Install ground rods and grounding conductor.
6. Install main grounding conductor to the cold water pipe.
7. Connect the branch circuit *grounding* conductors and *grounded* conductors (neutrals) in the electrical panel.

K. INSTALLING/CONNECTING ELECTRICAL ITEMS

1. Install switches and convenience outlets.
2. Connect range, oven, and dryer receptacles.
3. Install cover plates.
4. Connect cooktop and oven units.
5. Connect range hood and exhaust fan.
6. Install lighting fixtures.
7. Install door chime, transformer, and push buttons.
8. Connect water heater.
9. Connect dishwasher.
10. Connect garbage disposal.
11. Install exterior-fused disconnect switches.
12. Connect HVAC equipment.
13. Install post lamps.
14. Install circuit breakers in the electrical service panel.
15. Label circuit breakers.
16. Test, troubleshoot, and correct check-out problems.

SUPPLEMENTARY INFORMATION

TRAITS AND ATTITUDES

- Positive attitude
- Belief in value of your work
- Honesty
- Dependability
- Willingness to work hard
- Willingness to accept responsibility
- Courtesy
- Human relations skills
- Communication skills
- Cooperation
- Willingness to learn
- Willingness to accept criticism
- Accountability
- Willingness to admit uncertainty or mistakes
- Commitment to staying drug-free
- Logical thinking skills
- Time-management skills

FUTURE TRENDS IN RESIDENTIAL ELECTRICIAN FIELD

- Fiber optic cabling
- Home controls, i.e., "smart houses" with computerized environmental, safety, and food preparation controls
- Local Area Networks (LANS)
- Computerization, increasing sophistication of electrician's work environment

TECHNICAL PREPARATION NEEDED IN RESIDENTIAL ELECTRICIAN FIELD

- Solid foundation in basics of electricity
- Knowledge of home construction
- Math skills a must, including Algebra I and II
- Physics coursework a plus because of exposure to electricity theory
- Reading proficiency
- Writing proficiency
- Foreign language skills increasingly desirable, particularly for service work
- NEC is paramount in the industry. It is the most well-worn reference guide, as safety is extremely critical to this line of work.

High school students should have

- foundation in electricity theory
- knowledge of terms
- familiarity with tools
- knowledge of safety.

Community college students should have

- hands-on experience across the board
- specialization skills.

CAREER INSIGHTS SHARED BY PANEL OF EXPERTS

- Two-year or advanced degrees not required for employment, but enhance employee with self-esteem and opportunity for advancement.
- Few women are in the field. Panelists attributed the lack of women primarily to the physical demands of handling heavy cabling.
- Panelists say a "career path" doesn't really exist in their field. They agree that a foundation in the basics, solid work experience, a journeyman's or similar certification, and one or more specializations are key to advancement and success.
- In northern Virginia, electricians are experiencing a lull in business. Rather than scheduling work six months ahead as was the case a few years ago, their schedules now run monthly.
- Service work and new construction work are about even. But panelists say new home construction is definitely slowing in northern Virginia. They are seeing more custom-built homes as opposed to cookie-cutter developments.

INDUSTRIAL DISTRIBUTION OCCUPATIONS

Worker Task List

A. SELLING PRODUCTS
1. Present professional image.
2. Establish customer relationships.
3. Use product knowledge to answer customer questions.
4. Resolve customer complaints.
5. Use proactive sales technique.
6. Demonstrate products.
7. Negotiate contracts.
8. Write/enter orders.
9. Coordinate with inventory control.
10. Coordinate deliveries.
11. Coordinate with sales team.
12. Maintain sales records.
13. Participate in trade shows.

B. CONDUCTING COUNTER SALES
1. Greet customers.
2. Collect payment.
3. Create point of purchase display.
4. Maintain point of purchase display.
5. Assist warehouse operations.

C. CONDUCTING INSIDE SALES
1. Answer telephone.
2. Use proactive telemarketing techniques.
3. Quote products.
4. Place special orders with vendors.
5. Follow up on customer calls.
6. Expedite back orders from customers.
7. Maintain customer files.
8. Maintain library.

D. CONDUCTING OUTSIDE SALES
1. Analyze sales history reports.
2. Implement call schedule.
3. Identify new customers.
4. Entertain customers.
5. Relay competitor information to home office.
6. Coordinate installation/maintenance.

7. Gather information on economic development.
8. Assist in gathering credit information.
9. Set up training sessions.

E. CONTROLLING INVENTORY/PURCHASING
1. Identify vendors.
2. Verify stock levels.
3. Purchase products.
4. Negotiate with vendors.
5. Maintain vendor files.
6. Expedite back orders from vendors.
7. Coordinate stock levels with sales.
8. Identify inactive products.
9. Coordinate return of products.
10. Maintain inventory records.
11. Disseminate product information.

F. SHIPPING AND RECEIVING PRODUCTS
1. Organize warehouse.
2. Oversee unloading of products.
3. Verify incoming goods.
4. Stock products.
5. Pick orders.
6. Pack orders.
7. Stage orders.
8. Oversee loading of products.
9. Resolve claims and errors.

G. DISPATCHING PRODUCT SERVICES
1. Organizing orders according to route.
2. Coordinate with sales, purchasing and warehouse.
3. Determine method of shipment.
4. Assign shipment to carrier.
5. Resolve shipping emergencies.
6. Supervise employee schedules.
7. Schedule preventative maintenance.
8. Assign service representative.
9. Maintain vehicles.
10. Maintain company property.
11. Maintain plant maintenance supplies.
12. Maintain driver files.
13. Monitor delivery tickets.
14. Maintain carrier and service vendor files.

15. Provide proof of delivery.

H. CONTINUING EDUCATION
1. Upgrade computer skills.
2. Read trade journals.
3. Attend training sessions.
4. Attend trade shows.

SUPPLEMENTARY INFORMATION

TRAITS AND ATTITUDES

- Cooperation
- Initiative
- Assertiveness
- Personal appearance/hygiene
- Self-confidence
- Ability to get along with people
- Empathy
- Ability to deal positively with rejection
- Persistence
- Ability to be a hard worker
- Ability to change/improve
- Consistency in performance
- Effort beyond requirements
- Teamwork
- Ability to give credit to others
- Ability to handle stress well
- Job satisfaction
- Honesty
- Dependability
- Promptness
- Flexibility

KNOWLEDGE AND SKILLS

- English - grammar, spelling, legibility, clarity
- Math - Algebra
- Common sense
- Product knowledge
- Accounting/credit collection
- Interpersonal skills
- Computer skills
- Telephone skills
- Calculator skills
- Keyboarding skills

JOB TITLES

- Dispatcher
- Industrial Department Manager
- Warehouse/Transportation Supervisor
- Truck Driver
- General Manager
- Warehouse Manager
- Inside Salesperson
- Outside Salesperson
- Counter Salesperson

RESIDENTIAL/COMMERCIAL MAINTENANCE SPECIALIST

WORKER TASK LIST

A. PERFORMING SAFE WORK PRACTICES

1. Construct and erect scaffolds.
2. Store equipment and materials (including hazardous items and materials).
3. List and post safety hazards within building.
4. Follow regulations for safe disposal of paint and other hazardous materials.
5. Identify cumulative effect of lead, asbestos, dust, and other environmental hazards.
6. Extinguish fires with appropriate fire extinguisher.
7. Carry and place ladder.
8. Abide by material safety data sheets.
9. Practice proper lifting techniques.
10. Use lock out/tag out procedures.
11. Analyze task to determine required protective equipment and other safety requisites.
12. Use personal protective equipment/clothing (e.g., safety glasses, safety shoes, hearing protection, respiratory protection, etc.).
13. Inspect and maintain lawn mowers and other small machinery for safe operation.
14. Inspect power tools for safe cords, blades, etc.
15. Identify and follow OSHA regulations related to various job tasks.
16. Obtain certification for tasks, as required (e.g., use of pest control chemicals, etc.).

B. PERFORMING PAINTING AND RELATED ACTIVITIES

1. Clean painted surfaces.
2. Remove paint by using scraper/paint remover.
3. Fill in cracks in plaster using spackling compound.
4. Prepare new wood for painting.
5. Prepare a variety of surfaces for painting (metal, sheetrock, plaster, masonry, etc.).
6. Paint/repaint/spot paint surfaces.
7. Prepare surface for wallpaper.
8. Spot repair stucco.
9. Caulk doors and windows.
10. Replace damaged or worn floor tile.
11. Varnish wood surface.

C. CARING FOR GROUNDS

1. Sharpen lawn mower blade.
2. Mow lawn.
3. Prepare seedbed.
4. Fertilize plants.
5. Spray plants for pest control.
6. Renovate turf.

7. Reseed worn spots on turf.
8. Prune shrubbery.
9. Inspect and clean drop inlets to remove grass clippings and other debris.
10. Patch small holes in concrete (e.g., sidewalks, walls, etc.).
11. Patch asphalt in parking lots and other areas.

D. PERFORMING GENERAL MAINTENANCE, REPAIR, AND INSTALLATION FUNCTIONS

1. Install/replace glass.
2. Inspect flashing, pitch pockets, etc. for need of repair.
3. Patch composition shingle/built-up roof.
4. Unclog downspouts.
5. Free window from sash.
6. Clean glass surface.
7. Clean metal surfaces using wire brush/steel wool.
8. Clean metal surfaces using solvent.
9. Cut lumber to size with a variety of saws (e.g., radial arm saw, portable power saw, handsaw, table saw, etc.).
10. Cut irregular shapes with band saw.
11. Drill holes in metal with portable device.
12. Remove damaged screws and other threaded hardware.
13. Tighten loose furniture components.
14. Free sticking doors.
15. Ease sticking drawers.
16. Identify parts of buffing machine.
17. Disassemble and clean buffing machine.
18. Replace butt hinge.
19. Replace acoustical tile.
20. Install, adjust, and remove commercial and residential egress/door lock systems.
21. Rebuild stair step.
22. Realign door.
23. Install resilient floor covering.
24. Install furring strips.
25. Install drop ceiling.
26. Hang drapes.
27. Install blinds.
28. Fill nail holes.
29. Cut molding using miter box.
30. Cut sheet metal.
31. Remove broken bolt.

E. MAINTAINING AND REPAIRING PLUMBING AND WATER SYSTEMS

1. Unclog drains.
2. Thaw frozen water pipes.
3. Replace faucet components.
4. Cut and join plastic pipe.
5. Cut and join metal tubing.
6. Clear sewage using power sewer auger.
7. Install basic plumbing fixtures.
8. Repair flush valves, ball valves, and gate valves.
9. Understand backflow preventer.
10. Troubleshoot exterior plumbing systems.

F. MAINTAINING AND REPAIRING ELECTRICAL SYSTEMS

1. Troubleshoot electrical system.
2. Remove and replace fuses.
3. Replace faulty electrical cords and plugs.
4. Replace light switches.
5. Replace fluorescent bulb/tube.
6. Replace ballast in fluorescent lights.
7. Replace defective light socket and tighten.
8. Replace defective electrical wall outlet.
9. Locate circuit overload.
10. Change bulbs and ballast in high intensity discharge (HID) fixtures.

G. MAINTAINING HEATING AND COOLING SYSTEMS

1. Clean and lubricate fans/ventilators.
2. Lubricate air compressor.
3. Calibrate and adjust thermostat.
4. Remove dust from heating/cooling system.
5. Lubricate systems.
6. Light gas-/oil-fed system.
7. Change filters.
8. Replace fuse on air conditioner.
9. Recharge system with refrigerants.
10. Replace door seals on refrigerator.
11. Troubleshoot heating/cooling system problems.
12. Solder and braze pipes.
13. Use electrical/refrigerator test equipment.
14. Set outdoor units.
15. Route copper lines.

SUPPLEMENTARY INFORMATION

TRAITS AND ATTITUDES

- Flexibility/willingness to do many jobs
- Courtesy to customers/fellow employees
- Assertiveness/self-starter
- Dependability
- Ability to work independently
- Ability to exhibit interpersonal relations skills
- Ability to deal with crisis situations
- Accuracy
- Ability to understand the importance of doing a good job
- Willingness to work odd hours

KNOWLEDGE

- Basic carpentry
- Basic cabinetmaking
- Basic electricity (wiring, grounding, etc.)
- Basic electronics
- Basic business principles (profit/loss/ productivity, etc.)
- Business management
- Basic landscaping
- Basic plumbing

CERTIFICATION

- Journeyman
- Master
- Driver's license
- Chemical pest control
- Electrician

GENERAL AND TECHNICAL SKILLS

- Ability to read a rule
- Ability to read a basic blueprint
- Ability to read a pressure/temperature chart
- Ability to read schematics
- Ability to read meters (volt, ohm, etc.)
- Ability to understand and use terminology of the field
- Ability to spell correctly
- Ability to write legibly
- Basic math skills (formulas, fractions, decimals, trigonometry)
- Computer literacy (e.g., for e-mail, computer-controlled lighting, etc.)
- Possession of a driver's permit

EQUIPMENT

- Hand tools
- Power tools
- Ladders
- Scaffolding
- Meters
- Paint brush

TRENDS IN THE INDUSTRY

- Computerization
- Increased emphasis on productivity
- Downsizing/low employment rate
- Hiring of managers with business background as opposed to maintenance background
- Increased number of women in field

RESIDENTIAL/COMMERCIAL MAINTENANCE CAREER LADDER

With Secondary Education

Apprentice
Assistant
Maintenance person
Trainee - mechanic
Trainee - electrician

With Secondary Education and Experience

Mechanic A, Mechanic B, Senior Mechanic
Electrician A, Electrician B, Senior Electrician
Journeyman (requires certification)

With Experience and with College Coursework in Maintenance

Technician
Master (requires certification)

With Experience and with College Coursework in Business/Interpersonal Skills

Maintenance Supervisor

Note: For the most part, personnel in the first two categories are paid on an hourly basis, whereas those in the last two categories are paid on a salaried basis. Panelists emphasized that students should know that entry-level wages are low in the field of residential/commercial maintenance.

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Office of Educational Research and Improvement (OERI)
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CE073763

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