

GeoExchange Installer Occupational Standards





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About the Electricity Sector Council

Approximately 100,000 Canadians are involved in the generation, transmission and distribution of one of our country's essential utilities: electricity. Their work powers homes and businesses across the country, fuelling everything from light bulbs, cell phones and refrigerators to water treatment plants and road vehicle assembly lines.

The Electricity Sector Council provides support to this dedicated team by working with industry employers and other stakeholders to research and resolve human resource and workplace development issues.

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Disclaimer: Please note that some of the tasks detailed in this document will require the services of a registered trades-person depending upon the province of work. Provincial regulations change from time to time, employers and employees should consult your provincial appropriate licensing authority for clarification regarding which tasks may be affected. It is the responsibility of the individual employer/employee to ensure they act within the regulation for their jurisdiction.

Area of Competence A: Work Safely

Task A.1: Follow safe work procedures

Subtasks:	Supporting knowledge and abilities:	Comments:
a) Identify corporate, provincial and federal policies required for workplace safety	<ul style="list-style-type: none"> Follow company policies and guidelines 	
b) Follow provincial and federal policies and/or regulations	<ul style="list-style-type: none"> Be aware of provincial and federal policies and/or regulations 	
c) Identify contact person when workplace safety policies are violated	<ul style="list-style-type: none"> Inform immediate supervisor of violation/incident 	
d) Provide information about incident/violation	<ul style="list-style-type: none"> Document information using appropriate corporate forms 	

Task A.2: Use and maintain personal protective equipment

Subtasks:	Supporting knowledge and abilities:	Comments:
a) Identify locations where personal protection equipment is required	<ul style="list-style-type: none"> • Be aware of your surroundings • Follow municipal codes, Occupational Health and Safety Guidelines or site requirements 	
b) Identify personal protective equipment requirements to enter specified environments	<ul style="list-style-type: none"> • Follow municipal codes, Occupational Health and Safety Guidelines or site requirements • Obtain authorization from specified field safety officer and supervisor 	
c) Identify expiry dates on specified equipment	<ul style="list-style-type: none"> • Inform field safety officer and supervisor of equipment concerns 	
d) Identify 'wear and tear' issues on equipment	<ul style="list-style-type: none"> • Inform field safety officer and supervisor of equipment concerns 	
e) Demonstrate safe and accepted practices for personal protection	<ul style="list-style-type: none"> • Follow municipal codes, Occupational Health and Safety Guidelines or site requirements 	

Task A.3: Service and maintain safety equipment

Subtasks:	Supporting knowledge and abilities:	Comments:
a) Maintain fire extinguishers	<ul style="list-style-type: none"> • Check labels, expiry dates, and gauges 	
b) Maintain other PPE	<ul style="list-style-type: none"> • For example: safety glasses, earplugs, ladders, fall arrest systems, etc. 	
c) Practice safe welding		

Task A.4: Operate motorized vehicles and equipment

Subtasks:	Supporting knowledge and abilities:	Comments:
a) Demonstrate ability to operate motor vehicle	<ul style="list-style-type: none"> • Possess required licenses • Obtain licenses, as required 	
b) Complete applicable driving programs, certifications and/or licenses	<ul style="list-style-type: none"> • For example: defensive driving, collision avoidance, skid control, vehicle backing, scissor lift and boom trucks, etc. 	
c) Secure equipment and loads	<ul style="list-style-type: none"> • Use appropriate barriers and tie downs per applicable regulations 	
d) Confirm that motorized vehicle is safe and ready to operate	<ul style="list-style-type: none"> • Comply with applicable regulations and maintenance procedures for motor vehicles 	

Task A.5: Establish a safe work area

Subtasks:	Supporting knowledge and abilities:	Comments:
a) Identify requirements for safe work area	<ul style="list-style-type: none"> • Follow completed job plan steps • Use corporate resources to identify hazards and risks found in work area 	
b) Create a safe work environment	<ul style="list-style-type: none"> • Follow completed job plan steps, and eliminate/ control/minimize hazards found in work area 	
c) Maintain safe work habits and a clean, orderly work area	<ul style="list-style-type: none"> • Follow completed job plan steps, and eliminate/ control/minimize hazards found in work area 	
d) Establish an exclusion zone when required	<ul style="list-style-type: none"> • For example, around open trenches and working heavy equipment 	

Task A.6: Follow safe excavation procedures

Subtasks:	Supporting knowledge and abilities:	Comments:
a) Follow provincial code requirements	<ul style="list-style-type: none"> • Attend training on safe excavation procedures 	

Task A.7: Demonstrate safe and proper use of required tools and equipment

Subtasks:	Supporting knowledge and abilities:	Comments:
a) Obtain safety training	<ul style="list-style-type: none"> • Per corporate/government policies and procedures 	
b) Demonstrate safe and proper use of required tools and equipment	<ul style="list-style-type: none"> • Follow corporate/government policies and guidelines 	
c) Follow established operating procedures	<ul style="list-style-type: none"> • Apply standard operating procedures 	
d) Use tools and equipment for their intended purposes	<ul style="list-style-type: none"> • Operate equipment safely and be aware of adverse conditions 	

Task A.8: Apply lock-out and tag-out procedures

Subtasks:	Supporting knowledge and abilities:	Comments:
a) Identify requirements for lock-out and tag-out	<ul style="list-style-type: none"> • Obtain training on hazard identification • Consult diagrams and procedures for lock-out of equipment as required 	
b) Apply lock-out and tag-out procedures	<ul style="list-style-type: none"> • Apply appropriate corporate policies 	

Task A.9: Administer First Aid and CPR

Subtasks:	Supporting knowledge and abilities:	Comments:
a) Participate in First Aid and CPR certification		
b) Identify the location of First Aid materials		
c) Apply First Aid and CPR procedures		
d) Identify location of qualified safety professionals	<ul style="list-style-type: none"> • For example, the location of qualified high-angle rescue personnel, hospitals, etc. 	
e) Maintain First Aid kit		

Task A.10: Follow WHMIS regulations

Subtasks:	Supporting knowledge and abilities:	Comments:
a) Participate in WHMIS training		
b) Identify items found in WHMIS guidelines	<ul style="list-style-type: none"> • Locate WHMIS inventory listing • Locate appropriate contact person 	
c) Identify and implement appropriate codes and standards concerning installation, operation and maintenance of geoexchange systems	<ul style="list-style-type: none"> • Inform WHMIS contact person of newly identified codes and standards 	

Task A.11: Complete appropriate safety training

Subtasks:	Supporting knowledge and abilities:	Comments:
a) Obtain safety training	<ul style="list-style-type: none"> • Per corporate policy 	
b) Complete safety training/certification	<ul style="list-style-type: none"> • For example: WHMIS, first aid, CPR, fire safety, work permit training, grounding and bonding code training, risk management/job planning training per corporate policies and/or provincial/federal guidelines 	
c) Complete appropriate forms/documentation for incident or near miss	<ul style="list-style-type: none"> • Per corporate policy 	
d) Participate in safety meetings, as required	<ul style="list-style-type: none"> • Per corporate policy 	

Task A.12: Correct safety hazards

Subtasks:	Supporting knowledge and abilities:	Comments:
a) Identify environmental hazards	<ul style="list-style-type: none"> • For example, weather conditions versus the task at hand 	
b) Identify personal safety hazards or work site hazards		
c) Identify environmental hazards associated with geoexchange installations	<ul style="list-style-type: none"> • For example, through demonstrated awareness of pertinent Material Safety Data Sheets (MSDSs), disposal procedures and other appropriate documents • For example, antifreeze, proper removal of oil tanks • Be aware of appropriate codes 	
d) Mitigate hazards	<ul style="list-style-type: none"> • Take action to eliminate or mitigate hazards 	

Area of Competence B: Plan Installation

Task B.1: Read and interpret technical drawings

Subtasks:	Supporting knowledge and abilities:	Comments:
a) Use drawings to guide work, planning and procurement	<ul style="list-style-type: none"> Interpret and apply knowledge of appropriate drawing standards. For example: symbols and labels 	
b) Check site against plan		

Task B.2: Estimate site requirements

Subtasks:	Supporting knowledge and abilities:	Comments:
a) Establish optimum system location for installation	<ul style="list-style-type: none"> Verify the proposed location of collector and other major components with the client 	
b) Estimate tools and equipment		

Task B.3: Confirm applicability of initial design

Subtasks:	Supporting knowledge and abilities:	Comments:
a) Identify suitable locations for subsystem components	<ul style="list-style-type: none"> For example, this might include: piping, water heater, valves, and ancillary equipment for complete system installation Follow drawings 	
b) Identify constraints and other options for installation	<ul style="list-style-type: none"> Consider local/provincial/territorial code requirements 	
c) Evaluate geological compatibility	<ul style="list-style-type: none"> Consider that factors such as composition and properties of soil and rock can affect heat transfer rates Soil with good heat transfer properties require less piping to gather heat 	<ul style="list-style-type: none"> Large and/or sharp rocks can damage pipe. Soil conditions other than that specified in the design should be reported to the designer of the system.
d) Evaluate land availability	<ul style="list-style-type: none"> Consider that the amount and layout of land, landscaping, and location of underground utilities or sprinkler systems affects system design 	
e) Confirm applicability of initial design versus actual site	<ul style="list-style-type: none"> Rectify/report discrepancies 	

Task B.4: Ensure necessary permits are in place

Subtasks:	Supporting knowledge and abilities:	Comments:
a) Ensure appropriate permits are posted	<ul style="list-style-type: none"> Have support documentation on site 	

Task B.5: Coordinate activities with others

Subtasks:	Supporting knowledge and abilities:	Comments:
a) Coordinate activities with co-workers		
b) Coordinate activities with General Contractor (GC) and sub-trades	<ul style="list-style-type: none"> • Understand communication protocols • Exchange necessary information • Understand mechanical room layout and equipment location 	
c) Coordinate activities with homeowner and/or building operator	<ul style="list-style-type: none"> • Consider impact on surrounding environment and properties 	
d) Coordinate activities with suppliers	<ul style="list-style-type: none"> • Consider logistics 	
e) Coordinate activities with inspectors	<ul style="list-style-type: none"> • Know inspection stages 	

Task B.6: Estimate time, materials, tools, and labour required

Subtasks:	Supporting knowledge and abilities:	Comments:
a) Identify scheduling requirements	<ul style="list-style-type: none"> Follow job plan to determine amount of time required for installation 	
b) Identify equipment and tool requirements	<ul style="list-style-type: none"> Follow job plan to determine tools and equipment required for installation (including safety systems) 	
c) Identify labour requirements	<ul style="list-style-type: none"> Follow job plan to determine labour requirements for installation 	
d) Identify material requirements and create procurement list	<ul style="list-style-type: none"> Determine amount of material necessary 	
e) Determine installation sequence to optimize use of time and materials	<ul style="list-style-type: none"> Follow job plan to co-ordinate optimal labour and material use 	

Task B.7: Maintain installation material inventory

Subtasks:	Supporting knowledge and abilities:	Comments:
a) Ensure availability of inventory		
b) Follow inventory system and ordering and purchasing procedures for shop and service vehicle	<ul style="list-style-type: none"> Be aware of inventory system, ordering and purchasing procedures Establish standard stocking levels in vehicle Stock vehicle with site-specific materials 	

Area of Competence C: Install Heat Exchanger (Open or Closed)

Task C.1: Ensure location of utilities

Subtasks:	Supporting knowledge and abilities:	Comments:
a) Confirm existence of other buried services		
b) Contact the appropriate utilities or jurisdictional authorities	<ul style="list-style-type: none"> • Obtain a locates or clearance number • Lay out on site map 	All services, lot lines and proposed loop location are drawn on a site plan and acknowledged by the owner.
c) Confirm existence of other buried services with client	<ul style="list-style-type: none"> • For example, septic fields 	
d) Confirm property lines, easements, and boundaries		

Task C.2: Install a vertical closed-loop system

Subtasks:	Supporting knowledge and abilities:	Comments:
a) Construct loops	<ul style="list-style-type: none"> • Fuse fittings/pressure test loops 	
b) Mark out loop field	<ul style="list-style-type: none"> • Ensure adequate loop spacing 	
c) Drill holes	<ul style="list-style-type: none"> • Adjust to actual drilling conditions 	
d) Load the loop and grout line		
e) Grout holes	<ul style="list-style-type: none"> • Use approved grouting material • Grout to code 	
f) Build supply and return header	<ul style="list-style-type: none"> • Fuse fittings • Trench to required depths and per regulations 	
g) Bring supply and return lines into building per regulations	<ul style="list-style-type: none"> • Ensure water-proofing, damp-proofing and soil gas protection 	
h) Pressure test at all checkpoints prior to backfilling	<ul style="list-style-type: none"> • Follow CSA-C448 Code 	
i) Document results of pressure tests		
j) Rectify any deficiencies if required		
k) Install tracer wire/burial tape		
l) Map location of ground heat exchanger	<ul style="list-style-type: none"> • Use GPS or triangulation as required 	
m) Backfill with appropriate soil type	<ul style="list-style-type: none"> • Obtain knowledge of appropriate soil types 	

Task C.3: Install a horizontal closed-loop system

Subtasks:	Supporting knowledge and abilities:	Comments:
a) Mark out loop field	<ul style="list-style-type: none"> • Ensure adequate loop spacing 	
b) Excavate necessary area	<ul style="list-style-type: none"> • Adjust to actual digging conditions 	
c) Install loops	<ul style="list-style-type: none"> • Fuse fittings 	
d) Connect supply and return header	<ul style="list-style-type: none"> • Fuse fittings • Trench to required depths and per regulations 	
e) Bring supply and return lines into building per regulations	<ul style="list-style-type: none"> • Ensure water-proofing, damp-proofing and soil gas protection 	
f) Document results of pressure tests		
g) Rectify any deficiencies if required		
h) Install tracer wire/burial tape		
i) Map location of ground heat exchanger	<ul style="list-style-type: none"> • Use GPS or triangulation as required 	
j) Backfill with appropriate soil type	<ul style="list-style-type: none"> • Obtain knowledge of appropriate soil types 	

Task C.4: Install a submerged closed-loop system

Subtasks:	Supporting knowledge and abilities:	Comments:
a) Mark out loop location per regulations	<ul style="list-style-type: none"> • Ensure adequate loop spacing • Ensure adequate depth and suitable bottom conditions • Obtain permission from jurisdictional authorities 	Follow loop designers layout and installation procedures.
b) Construct or assemble purchased loop	<ul style="list-style-type: none"> • Fuse fittings/pressure test loops 	Pressure test may require air only
c) Build supply and return header	<ul style="list-style-type: none"> • Fuse fittings • Trench to required depths and per regulations • Fuse fittings/pressure test loops 	Pressure test may require air only
d) Excavate necessary area	<ul style="list-style-type: none"> • Adjust to actual digging conditions 	
e) Submerge and anchor the loop to necessary depths		
f) Bring lines into building per regulations	<ul style="list-style-type: none"> • Conduct pressure test 	
g) Backfill with appropriate soil type		
h) Install tracer wire/burial tape		
i) Map location of ground heat exchanger	<ul style="list-style-type: none"> • Use GPS or triangulation as required 	
j) Pressure test at all checkpoints	<ul style="list-style-type: none"> • Follow CSA-C448 Code 	
k) Document and review pressure tests		

Task C.5: Install an open-loop system

Subtasks:	Supporting knowledge and abilities:	Comments:
a) Connect to the established source of water	<ul style="list-style-type: none"> • Coordinate per regulations and manufacturer's recommendations 	Applies to Standing Column Well systems
b) Connect to established rejection system	<ul style="list-style-type: none"> • Trenching, hand digging, plumbing 	
c) Install pump and piping		Plumbing may include upgrading the well pump and/or pressure tank by licensed/qualified professionals.
d) Install plumbing and flow control per design		
e) Backfill with appropriate soil type		

Task C.6: Install a vertical DX loop

Subtasks:	Supporting knowledge and abilities:	Comments:
a) Construct or purchase loop	<ul style="list-style-type: none"> • Braze fitting/pressure test loops 	
b) Mark out loop field	<ul style="list-style-type: none"> • Ensure adequate loop spacing 	
c) Drill holes	<ul style="list-style-type: none"> • Adjust to actual drilling conditions • Take sample soil • Conduct pH test 	
d) Load the loop and grout line		
e) Verify line pressure		
f) Grout holes	<ul style="list-style-type: none"> • Use approved grouting material • Grout to code 	
g) Excavate the trench	<ul style="list-style-type: none"> • Trench to required depths and per regulations 	
h) Braze liquid and vapour header		
i) Bring and insulate lines		
j) Pressure test at all checkpoints		
k) Document and review pressure tests		
l) Backfill with appropriate soil type		
m) Install tracer wire/burial tape		
n) Rectify any deficiency if required		
o) Map location of ground heat exchanger	<ul style="list-style-type: none"> • Use GPS or triangulation as required 	
p) Install proper corrosion protection system, if applicable	<ul style="list-style-type: none"> • To be installed if pH is lower than 6 	

Task C.7: Install a horizontal DX loop

Subtasks:	Supporting knowledge and abilities:	Comments:
a) Construct loops	<ul style="list-style-type: none"> • Braze fittings/pressure test loops 	
b) Mark out loop field	<ul style="list-style-type: none"> • Ensure adequate loop spacing 	
c) Excavate necessary area	<ul style="list-style-type: none"> • Adjust to actual digging conditions 	
d) Load the loop		
e) Braze liquid and vapour header		
f) Bring and insulate lines		
g) Backfill with appropriate soil type		
h) Install tracer wire/burial tape		
i) Map location of ground heat exchanger	<ul style="list-style-type: none"> • Use GPS or triangulation as required 	
j) Pressure test at all checkpoints prior to backfilling header		
k) Document and review pressure tests		
l) Rectify any deficiency if required		
m) Install proper corrosion protection system, if applicable	<ul style="list-style-type: none"> • To be installed if pH is lower than 6 	

Task C.8: Document as built system

Subtasks:	Supporting knowledge and abilities:	Comments:
a) Map the ground heat exchanger on the site survey form	<ul style="list-style-type: none">• Use GPS and/or triangulated diagram	

Area of Competence D: Install Heat Pump

Task D.1: Ensure distribution system meets specifications

Subtasks:	Supporting knowledge and abilities:	Comments:
a) Assess installation parameters		
b) Determine if faults exist		
c) Investigate corrective actions		
d) Address concerns with appropriate person		

Task D.2: Determine optimum placement for heat pump

Subtasks:	Supporting knowledge and abilities:	Comments:
a) Determine the best location for the heat pump	<ul style="list-style-type: none"> • Consider that the greatest efficiency can be achieved by centrally locating the heat pump • Consider that the main service doors should remain clear of obstruction 	
b) Discuss options with client	<ul style="list-style-type: none"> • Consider possible noise levels and location 	

Task D.3: Plumb the heat pump

Subtasks:	Supporting knowledge and abilities:	Comments:
a) Adhere to flow requirements listed to ensure optimum functioning	<ul style="list-style-type: none"> Per installation manual, local, and plumbing codes 	
b) Install appropriate plumbing lines	<ul style="list-style-type: none"> Supply and discharge plumbing lines must be of adequate size to handle water flow 	
c) Make hot water connections, if applicable		
d) Plumb condensate drain, if applicable	<ul style="list-style-type: none"> Per local codes 	
e) Plumb exterior exchanger	<ul style="list-style-type: none"> Per local codes 	

Task D.4: Review electrical service

Subtasks:	Supporting knowledge and abilities:	Comments:
a) Ensure appropriate type and size of service is installed	<ul style="list-style-type: none"> Per code 	

Task D.5: Install low-voltage controls

Subtasks:	Supporting knowledge and abilities:	Comments:
a) Ensure correct location	<ul style="list-style-type: none"> Per specifications 	
b) Install appropriate type of controls	<ul style="list-style-type: none"> Per system design 	
c) Run appropriate wiring between controls and equipment	<ul style="list-style-type: none"> Per manufacturer's instructions and code 	

Task D.6: Purge and flush closed-loop system (DX system excluded)

Subtasks:	Supporting knowledge and abilities:	Comments:
a) Connect properly-sized purge equipment		
b) Isolate heat pump from loop		
c) Flush water through the loop to remove air and debris		
d) Isolate loop from heat pump / heat pump from loop		
e) Reverse valves and flush heat pump of air and debris		
f) Hydrostatically test complete system		
g) Add proper amount of antifreeze	<ul style="list-style-type: none"> • Verify antifreeze percentage • Use MSDS sheets 	
h) Label system	<ul style="list-style-type: none"> • Per code 	

Task D.7: Evacuate and charge (DX/split system)*

Subtasks:	Supporting knowledge and abilities:	Comments:
a) Connect vacuum pump	<ul style="list-style-type: none"> • Evacuate system per manufacturer's instructions • Be aware of appropriate policies and procedures • Know proper refrigerant amounts and levels of evacuation 	
b) Connect refrigerant bottle to appropriate port	<ul style="list-style-type: none"> • Charge system per manufacturer's instructions. • Be aware of appropriate policies and procedures • Know proper refrigerant amounts and levels of evacuation 	

**This task must be performed by a licensed refrigeration technician.*

Area of Competence E: Commission and Maintain GeoExchange System

Task E.1: Interpret documentation

Subtasks:	Supporting knowledge and abilities:	Comments:
a) Interpret start-up information	<ul style="list-style-type: none"> For example, installation manuals, wiring diagrams, drawings, and other specifications 	

Task E.2: Commission the heat pump

Subtasks:	Supporting knowledge and abilities:	Comments:
a) Inspect wiring and connections	<ul style="list-style-type: none"> Check all high voltage field wiring and electrical connections 	
b) Inspect low voltage thermostat		
c) Follow start-up procedures	<ul style="list-style-type: none"> Per corporate and/or manufacturer's recommendations 	

Task E.3: Verify overall system operation and functionality

Subtasks:	Supporting knowledge and abilities:	Comments:
a) Determine evaluation points for system monitoring, maintenance, and troubleshooting	<ul style="list-style-type: none"> • For example: sensor calibration, heat exchanger fluid integrity, and pump orientation 	
b) Determine system plumbing installation is correctly installed	<ul style="list-style-type: none"> • Per schematics 	
c) Determine electrical installation is correctly installed	<ul style="list-style-type: none"> • Per schematics 	
d) Verify system start-up and shut-down functionality		
e) Verify overall system operation and functionality	<ul style="list-style-type: none"> • Complete appropriate documentation 	

Task E.4: Troubleshoot

Subtasks:	Supporting knowledge and abilities:	Comments:
a) Identify any deficiencies	<ul style="list-style-type: none"> For example, in: materials, workmanship, function or appearance 	
b) Take corrective action, as applicable		

Task E.5: Complete documentation

Subtasks:	Supporting knowledge and abilities:	Comments:
a) Complete appropriate documentation and transfer to stakeholders	<ul style="list-style-type: none"> Ensure appropriate documentation is attached to heat pump 	
b) Review system and component warranties and requirements with owner/operator		

Task E.6: Demonstrate system to owner/operator

Subtasks:	Supporting knowledge and abilities:	Comments:
a) Demonstrate operation and functionality		
b) Demonstrate start-up and shut-down procedures		
c) Demonstrate simple maintenance procedures		
d) Identify all markings and labels		
e) Identify safety issues		

Area of Competence F: Demonstrate Personal Competencies

Task F.1: Follow a code of ethics

Subtasks:	Supporting knowledge and abilities:	Comments:
a) Work safely	<ul style="list-style-type: none"> Follow corporate safety rules and regulations Follow Occupational Health and Safety Act 	
b) Conduct self in professional manner	<ul style="list-style-type: none"> Show respect for job and others 	
c) Honour corporate and personal privacy rules		

Task F.2: Read, comprehend, and apply technical information

Subtasks:	Supporting knowledge and abilities:	Comments:
a) Interpret materials to install and maintain geexchange system	<ul style="list-style-type: none"> For example: installation manuals, wiring diagrams, technical drawings, schematics and other specifications 	
b) Find applicable information in manufacturer's materials	<ul style="list-style-type: none"> Including installation manuals, wiring diagrams, drawings, plumbing diagrams, and other specifications 	
c) Follow all relevant local codes and bylaws, CAN/CSA C448 Standard, and/or manufacturer's requirements		

Task F.3: Be a self starter

Subtasks:	Supporting knowledge and abilities:	Comments:
a) Look for solutions to assigned tasks	<ul style="list-style-type: none"> Utilize practical experience 	
b) Recognize problems and search for solutions	<ul style="list-style-type: none"> Familiarize self with equipment 	
c) Recognize system shortcomings and suggest improvements		
d) Anticipate next steps		
e) Maintain a thorough understanding of system dynamics		

Task F.4: Work independently

Subtasks:	Supporting knowledge and abilities:	Comments:
a) Choose best methods to complete assigned tasks	<ul style="list-style-type: none"> Be self-motivated 	
b) Respond to emergency calls	<ul style="list-style-type: none"> Identify trouble and diagnose if further resources are required 	
c) Identify and repair faulty equipment	<ul style="list-style-type: none"> Perform repairs or contact appropriate person to perform repairs 	
d) Manage time	<ul style="list-style-type: none"> Complete and utilize time management training Rely on past history and work experience 	

Task F.5: Make decisions

Subtasks:	Supporting knowledge and abilities:	Comments:
a) Make decisions based on facts and experience	<ul style="list-style-type: none"> • Be accountable for decisions made 	
b) Communicate problems/solutions to supervisor		

Task F.6: Be a team player

Subtasks:	Supporting knowledge and abilities:	Comments:
a) Work with composite crews	<ul style="list-style-type: none"> • Communicate effectively • Utilize good listening skills 	
b) Be aware of your role and the role(s) of others		

Task F.7: Demonstrate leadership

Subtasks:	Supporting knowledge and abilities:	Comments:
a) Accept challenges	<ul style="list-style-type: none"> • Use problem-solving skills • Know your limits 	
b) Show initiative		
c) Exhibit confidence		
d) Inspire and motivate		

Task F.8: Participate in continuous learning

Subtasks:	Supporting knowledge and abilities:	Comments:
a) Attend courses offered by equipment manufacturers	<ul style="list-style-type: none"> • Exhibit a willingness to learn about new equipment 	
b) Choose appropriate courses based on job description	<ul style="list-style-type: none"> • Recognize courses required for present and future proficiency 	
c) Complete in-house training	<ul style="list-style-type: none"> • Recognize and participate in courses applicable to present and future proficiency 	
d) Learn from others		

Task F.9: Demonstrate organizational skills

Subtasks:	Supporting knowledge and abilities:	Comments:
a) Multi-task effectively		
b) Demonstrate time-management skills		
c) Organize and maintain company property		

Task F.10: Train and mentor others

Subtasks:	Supporting knowledge and abilities:	Comments:
a) Train new workers	<ul style="list-style-type: none"> • Utilize good communication skills 	
b) Recognize when others are in need of assistance		
c) Demonstrate patience		
d) Develop mentoring skills	<ul style="list-style-type: none"> • Demonstrate effective technical and mentoring skills with peers and trainees 	

Task F.11: Communicate

Subtasks:	Supporting knowledge and abilities:	Comments:
a) Speak clearly	<ul style="list-style-type: none"> • Use effective interpersonal skills • Understand operational limitations of cell phones, two way radios, etc. 	
b) Speak at audience level	<ul style="list-style-type: none"> • Be aware of who you are speaking to • Use discretion when speaking 	
c) Be concise when speaking	<ul style="list-style-type: none"> • Use effective interpersonal skills 	
d) Be assertive	<ul style="list-style-type: none"> • Follow through 	
e) Listen	<ul style="list-style-type: none"> • Listen and respond to audience response 	
f) Ask questions to ensure understanding	<ul style="list-style-type: none"> • Utilize good listening and questioning skills • Listen and respond to audience response 	
g) Follow company policies and procedures regarding cell phone use	<ul style="list-style-type: none"> • For example, pull off to the side of the road or use a hands-free set • Be aware of the information being transmitted over the telephone 	
h) Write clearly	<ul style="list-style-type: none"> • Be concise and to the point 	
i) Apply basic grammar and spelling skills		
j) Write detailed technical reports	<ul style="list-style-type: none"> • Use proper format for report writing • Adhere to company policy and procedures 	

Task F.12: Demonstrate professionalism

Subtasks:	Supporting knowledge and abilities:	Comments:
a) Maintain a clean and neat appearance		
b) Use correct vocabulary to convey problems		
c) Respect others	<ul style="list-style-type: none"> • Respect schedules of others, etc. 	
d) Maintain personal development		
e) Speak professionally of competitors		

Task F.13: Maintain a clean and neat worksite

Subtasks:	Supporting knowledge and abilities:	Comments:
a) Respect the property of others	<ul style="list-style-type: none"> • Clean-up worksite 	
b) Keep working equipment clean and in proper working order		

General Knowledge and Skills

- Basic electrical knowledge
- Basic piping and/or plumbing knowledge
- Basic sheet metal knowledge
- Basic geexchange knowledge
- Time management skills
- Basic construction knowledge
- Interpersonal skills
- HVACR knowledge
- Basic pump knowledge
- Mechanical knowledge
- Ability to work with heavy equipment
- Basic knowledge of hydronics
- Knowledge of safe working procedures and practices

Future Trends and Concerns

- Need for continued emphasis on quality of workmanship
- Rising energy prices will increase demand for geexchange energy
- Need for innovation to reduce costs
- Need for financing options for customers
- Increasingly advanced technologies
- Lack of skill / shortage of new competent workers
- Increased complexity of systems (i.e. hybrid systems)
- Increased demand for services
- Meeting increased customer objectives / expectations
- Need for defined career paths for geexchange installation techs
- Need for more educational opportunities for geexchange installation techs
- Need for geexchange installation training
- Need for energy conservation and education
- Dealing with increasing regulations
- Decreasing greenhouse gas emissions
- Lack of appropriate mentoring / training of new workers
- Increased demand for services
- Meeting increased customer objectives / expectations
- Establish as a separate trade

