The General Trade Knowledge portion of the examination is administered daily in Computer Based Testing (CBT) format. It will consist of 80 equally weighted questions.

The examination will have questions relating to the following content areas and necessary knowledge for each area includes:
- reading and interpreting plans and specifications
- reading and interpreting codes
- basic mathematics
  (addition, subtraction, multiplication, division, calculations of area and volume, fractions, decimals, percentages, calculating the sides of triangles, square roots, powers of numbers, and solving simple algebraic equations for unknown variables)

You should be prepared to respond to examination questions on any of the content areas listed. Questions asked and content areas tested on previous examinations should not be assumed to be the only possible questions to be asked or content areas to be tested on this examination.

The percentage of questions shown for each content area may vary by as much as plus or minus three (3) percent. Please refer to the Candidate Information Brochure and the Reference List for additional information.

### Content Area A 25%
#### Swimming Pools

1. **Site Survey and Collector Orientation**
   - Knowledge of shading effects (e.g., current, future)
   - Knowledge of site selection tools
   - Knowledge of collector layouts
   - Ability to match design to site conditions
   - Knowledge of design temperature

2. **Designing pool and spa heating systems**
   - Knowledge of temperature requirements
   - Knowledge of length of swim season

3. **Installing solar collectors**
   - Knowledge of collector types (e.g., low, medium temperature)
   - Knowledge of different types of roof sealants and waterproofing
   - Knowledge of roof penetration methodologies
   - Knowledge of mechanical roof attachments for different types of roofs
   - Knowledge of wind loading requirements
   - Knowledge of mounting systems (e.g., ballasted, ground mounted)

4. **Piping system**
   - Knowledge of potential harm to property if improperly installed
   - Knowledge of connection methods (e.g., compression fittings, threaded, solvent welding)
   - Knowledge of securing piping (e.g., hanging, burying)
   - Knowledge of galvanic corrosion
knowledge of materials and fittings

5. **Attaching system plumbing components**
   - ability to properly install and design components for the higher temperatures normally associated with solar
   - knowledge of high temperature limit cut off requirements

6. **Connecting electrical control systems**
   - knowledge of alternating and direct current systems
   - knowledge of GFCI requirements

7. **Activating, inspecting and troubleshooting systems**
   - knowledge of all system components
   - ability to inspect subcontracted work

8. **Demonstrating system operation to owners**
   - knowledge of freeze protection requirements and methods

9. **Complying with safety procedures and building codes**
   - knowledge of code requirements (e.g., SVRS (suction, vacuum, release systems) requirements)
   - knowledge of dangers associated with higher temperatures (e.g., above 104 degrees)
   - knowledge of permitting requirements
   - knowledge of OSHA

**Content Area B 25%**

**Domestic Hot Water**

1. **Site Survey and Collector Orientation**
   - Knowledge of shading effects (e.g., current, future)
   - Knowledge of site selection tools
   - Knowledge of collector layouts
   - Ability to match design to site conditions
   - Knowledge of design temperature

2. **Designing solar domestic hot water systems**
   - Knowledge of collector types (e.g., low, medium, high temperature)
   - Knowledge of potential system pressures (positive and negative)
   - Knowledge of requirements for isolated systems (e.g., pressure relief valves)
   - Knowledge of impact of adding solar to existing system (e.g., electrical, plumbing)
   - Knowledge of system sizing for application (e.g., pipe size, pump size, array size)
   - Knowledge of energy yield, and economic analysis
   - Knowledge of active and passive heat dissipation methods
   - Knowledge of storage tanks
   - Knowledge of industry collector ratings and system approvals (e.g., SRCC, IAPMO, FSEC)

3. **Installing solar water heating systems**
   - Knowledge of different types of roof sealants and waterproofing
   - Knowledge of roof penetration methodologies
   - Knowledge of mechanical roof attachments for different types of roofs
   - Knowledge of wind loading requirements
   - Knowledge of mounting systems (e.g., ballasted, ground mounted)

4. **Piping system**
   - Knowledge of connection methods (e.g., soldering, brazing, compression fittings, threaded, solvent welding)
   - Knowledge of pipe selection, securing and insulating, UV protection
   - Knowledge of thermal expansion effects
   - Knowledge of drain capabilities
   - Knowledge of galvanic corrosion
   - Knowledge of materials and fittings

5. **Addressing problems caused by water conditions**
   - Knowledge of water chemistry (e.g., scaling, erosion)
   - Knowledge of effects of high temperature on system component

6. **Installing components unique to indirect (closed loop) systems**
   - Knowledge of capacities
   - Knowledge of pressures
   - Knowledge of hazards of glycol systems
   - Knowledge of cleaning system
   - Knowledge of pressure testing
   - Knowledge of heat exchangers
   - Knowledge of heat transfer fluids and labeling requirements
   - Knowledge of measuring specific gravity and pH
7. Commissioning systems
   knowledge of all system components
   ability to inspect subcontracted work
   knowledge of programming controls,
   monitoring/metering equipment

8. Servicing Systems
   Knowledge of maintenance requirements
   Knowledge performance verification
   Knowledge of recommissioning requirements
   Knowledge of anode rods

9. Demonstrating system operation to owners
   knowledge of labeling requirements and
   manuals to be delivered

10. Using tools and equipment
    knowledge of multi-meters
    knowledge of thermometers
    knowledge of pressure gauges
    knowledge of flow meters
    knowledge of infrared cameras

11. Connecting electrical control systems
    knowledge of proper sensor placement
    knowledge of wiring (e.g., sizing, shielding,
    connections, securing, UV protection,
    grounding)

12. Complying with safety procedures and
    building codes
    knowledge of code requirements
    knowledge of OSHA
    knowledge of dangers associated with higher
    temperatures (e.g., tempering valves, pressure
    relief)
    knowledge of permitting requirements

Content Area C 50%
Photovoltaics

1. Site Survey and Module Orientation
   Knowledge of shading effects (e.g., current,
   future)
   Knowledge of site selection tools
   Knowledge of array layouts
   Ability to match design to site conditions

   Knowledge of string sizing to local site
   conditions (e.g., geographic temperatures)

2. Designing photovoltaic systems to meet end-
   use requirements
   knowledge of system performance projections
   Match design to customer expectations
   Knowledge of system sizing for application
   Knowledge of energy yield, and economic
   analysis

3. Designing Grid Tied systems
   knowledge of utility interconnection
   knowledge of National Electrical Code
   knowledge of battery back-up
   knowledge of inverters (e.g., string, micro, AC
   panels)
   knowledge of module types (e.g., single or poly
   crystal, thin film)
   knowledge of balance of systems (BOS)

4. Designing Standalone/Non-grid Connected
   Systems
   Knowledge of system types (e.g., pumping,
   lighting, remote power)
   Knowledge of battery sizes, types, storage and
   installation
   Knowledge of charge and load controllers

5. Designing with hybrid systems
   Knowledge multiple power sources (e.g., wind,
   hydro, generator)
   Knowledge of programming systems
   Knowledge of balancing power sources

6. Installing photovoltaic systems
   knowledge of D.C. circuits
   knowledge of wire sizing and types
   knowledge of voltage drops
   knowledge of grounding
   knowledge of DC/AC disconnects
   knowledge of different types of roof sealants and
   waterproofing
   knowledge of penetration methodologies
   knowledge of mechanical roof attachments for
   different types of roofs
   knowledge of wind loading requirements
   knowledge of mounting systems (e.g., ballasted,
   ground mounted)
   knowledge of labeling requirements
   knowledge of wire termination and torque
   requirements
7. **Commissioning systems**
   - knowledge of all system components
   - ability to inspect subcontracted work
   - knowledge of programming controls, monitoring/metering equipment
   - knowledge of expected voltages and currents
   - Knowledge of testing of wiring, insulation and connections
   - Knowledge of documentation requirements (e.g., system start up data)

8. **Using photovoltaic tools and equipment**
   - Knowledge of tools and measuring devices
   - Knowledge of multi-meters
   - Knowledge of infrared cameras
   - Knowledge pyranometers
   - Knowledge of measuring specific gravity (batteries)
   - Knowledge of torque wrenches, crimping tools

9. **Maintaining PV Systems**
   - Knowledge of module cleaning requirements
   - Knowledge of battery equalization methods and controller settings
   - Knowledge of system performance monitoring

10. **Complying with safety procedures and building codes**
    - knowledge of OSHA
    - knowledge of permitting requirements
    - knowledge of PPE