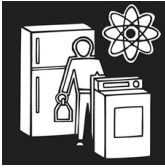


# RESIDENTIAL COMMERCIAL AND APPLIANCE TECHNOLOGY (VIRTUAL) (FORMERLY MAJOR APPLIANCE TECHNOLOGY)



## PURPOSE

To evaluate each contestant's preparation for employment and to recognize outstanding students for excellence and professionalism in the field of Residential & Commercial Appliance Technology.

First, download and review the General Regulations at: <http://updates.skillsusa.org>.

## ELIGIBILITY

Open to active SkillsUSA members enrolled in programs with but not limited to commercial or residential cooking, laundry, refrigeration or clean-up products. Could also include Facilities Management/Maintenance, Residential Appliance Technology, Commercial Appliance Technology and programs with HVACR as a segment within its needed curriculum and part of the career objective.

## CLOTHING REQUIREMENTS

### Class C: Contest Specific — Manufacturing/Construction Khaki Attire

- Official SkillsUSA khaki short-sleeve work shirt and pants.
- Black, brown or tan leather work shoes.
- Safety glasses with side shields or goggles. Prescription glasses may be used only if they are equipped with side shields. If not, they must be covered with goggles.

### Contest Clothing Notes (Apply ONLY to Virtual Competitions):

- Official SkillsUSA Competition Clothing recommended but NOT required.
- Contestant clothing options include the following:
  - Official Competition Clothing.
  - Trade Appropriate Clothing.

- Professional Dress.
- Business Casual.
- Clothing must meet industry safety standards.
- No identification of the contestant, school or state is allowed on clothing.
- No offensive, vulgar or inappropriate images or text are allowed on contestants clothing.
- No shorts or sleeveless shirts are allowed.
- Skirts must be at least knee-length.
- Proper Personal Protective Equipment (PPE) must be worn by contestant to meet all state, local and school requirements due to COVID-19.
- Scoring deductions may only be given and/or disqualification of contestant if clothing safety standards are not met.

These regulations refer to clothing items that are pictured and described at: [www.skillsusastore.org](http://www.skillsusastore.org). If you have questions about clothing or other logo items, call 800-401-1560 or 703-956-3723.

## EQUIPMENT AND MATERIALS

Supplied by the contestant:

1. Computer with high-speed internet capability and camera to use applications such as Zoom, Teams, etc. The minimum recommended internet bandwidth speeds for joining Zoom meetings, accessing on-demand curriculum and other online operations is 2.0 Mbps up and down. You can test your current internet speeds by following this link: [www.speedtest.net](http://www.speedtest.net). Allow the page to load and click on GO.
2. A secondary camera(s) may be required to provide judges with the ability to view contestants from different angles. Additional camera requirements will be located on the SkillsUSA website at <http://updates.skillsusa.org>.
3. A contest Proctor will be required to be on site to assist judges. A local industry expert is preferred to serve as the Proctor and shall not be an individual that has been involved with the training of the contestant(s). The Proctor will serve as the onsite "hands and eyes" for the judges. Proctor will follow instructions from the judges for safety and operations related to

the competition. Proctor may be asked by judges to perform several tasks such as operating a portable camera to show specific components or steps, measure parts, or any task that will provide judges with information needed to assist in accurate scoring of the contestant's work or presentation. However, the Proctor shall not serve as a judge nor have any influence on contestant scores.

4. The contestant's instructor or advisor shall be on site to observe all competition activities to ensure a safe and healthy competition experience for all participants. That instructor or advisor will not be allowed to interact or interfere with the competitor unless a safety issue arises that requires interaction. Any other support or interaction between the contestant and the instructor/advisor will result in disqualification.
5. All competitors must create a one-page résumé and submit an electronic copy to the technical committee chair at least seven (7) days in advance of the competition. Failure to do so will result in a 10-point penalty. Instructions for submission of the electronic résumé copy will be provided on the SkillsUSA website at <http://updates.skillsusa.org>.
6. Contest appliances
7. Contest specialized tools
8. Toolbox, tool bag or tool case
9. Assortment or sets of hand screwdrivers (e.g., flat, Phillips, Roberts, Safety Torx)
10. Nut drivers, standard SAE and metric Assortment or sets of pliers (e.g., common, needle nose, channel lock, diagonal, arc joint)
11. Assortment or sets of pliers (e.g., common, needle nose, channel lock, diagonal, arc joint)
12. ¼" drive socket set, standard SAE and metric sockets, 10-12 oz. hammer
13. Adjustable wrenches, assorted sizes (e.g., 4", 6", 8")
14. Allen wrenches, standard SAE and metric, assorted sizes
15. Assortment or sets of open-end and box-end wrenches, standard SAE and metric
16. Flashlight
17. Pocket thermometer or heat meter
18. Volt-Ohm meter with standard probes and mini electronic probes

19. Amperage meter, probe, or clamp-on style.  
Can be integrated with a Volt-Ohm meter
20. Gloves (optional)
21. Employability assessment/résumé

**Note:** The tools listed above are a minimal suggestion. The contestant may bring additional tools at their discretion. No electric or battery-powered tools are allowed.

## SCOPE OF THE CONTEST

Technicians utilize their mechanical and customer service skills to troubleshoot, repair, and provide preventive maintenance on equipment that can include service to consumers' homes, restaurants, hotels, hospitals, cafeterias, schools, and universities. The contest is defined by industry standards and is subject to the manufacturers involved; make sure to check website for updates.

## Knowledge Performance

The contest may include written knowledge assessments that assess knowledge:

- Technical assessment: Installing, servicing and repairing household appliances.
- Customer Relations/Oral assessment.
- Employability assessment/résumé and/or some SkillsUSA knowledge.

## Skill Performance

The contest includes a series of stations where contestants will demonstrate the ability to perform jobs and skills such as electrical and mechanical diagnostic skills selected from commercial or residential cooking equipment and/or refrigeration products. They will also need to accurately diagnose and repair residential appliances: washers, dryers, refrigerators, ovens, cook-tops, microwaves and dishwashers and sealed systems. Which is determined by the SkillsUSA Championships technical committee.

## Contest Description

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residential appliances: washers, dryers, refrigerators, ovens, cook-tops, microwaves and dishwashers and sealed systems. Which is determined by the SkillsUSA Championships technical committee.

### Contest Guidelines

1. The contest will assess a participant's skill while practicing accuracy, good workmanship, speed and the safe use of tools and test equipment.
2. All industry standard and safety practices will be followed and assessed as a part of this contest.

### Standards and Competencies

**Note for Virtual Competitions:** Contestants may not be required to perform all the standards and competencies listed in this section. However, contestants should be prepared to perform components in all areas. Prior to the competition, the technical committee may determine which standards and competencies contestants will be perform for the virtual contests. The technical committee will determine if additional information is needed for contestants prior to the competition. These changes will be posted on the SkillsUSA Championships contest update website at: <http://updates.skillsusa.org>.

1. \* indicates demonstration is applicable to Residential products
2. \*\* indicates demonstration is applicable to Commercial products
3. \*\*\* indicates demonstration is applicable to Residential and Commercial products

#### RCAT 1.0 — \*\*\*Demonstrate knowledge and use of diagnostic tools, equipment, technical literature, electrical, gas, water, steam and hydraulic systems

- 1.1 Demonstrate correct use of basic hand tools
- 1.2 Demonstrate correct use of specialty tools
- 1.3 Display knowledge of meters for the task at hand.
- 1.4 Read wiring schematic/diagrams and tech sheets
- 1.5 Demonstrate knowledge of electrical supply sources for the required task at hand.

- 1.6 Demonstrate knowledge of all electrical circuits.
- 1.7 Demonstrate knowledge of all electrical circuits.
- 1.8 Demonstrate correct use of gas specialty tools, e.g. Fluid and pressure manometers.
- 1.9 Demonstrate knowledge of gas tubing, surface burner types, oven burner types, orifices, orifice sizes
- 1.10 Demonstrate knowledge of steam/water systems, e.g. steam supply sources, steam cooking, steam cleaning, water quality and supply, water filters.
- 1.11 Demonstrate knowledge of electronic controls, e.g. customer user interfaces, electronic control boards, relay boards, power boards

### Laundry

#### RCAT 2.0 — \*Washer: Diagnose and service common failures on various types of residential top-load and front-load washing machines according to the manufacturer's specifications

- 2.1 Demonstrate the ability to operate and service components related to residential washers
- 2.2 Demonstrate knowledge to service washing systems: hoses, diverters, check valves, pumps, valves, and seals
- 2.3 Demonstrate knowledge of drive systems: belts, transmissions, agitators, wash impellers, clutches, brakes, pulleys, and multi-phase drive motors
- 2.4 Demonstrate knowledge of mechanical systems: leveling legs, suspension systems, cabinet/base structure, door lock systems

#### RCAT 3.0 — \*Dryer: Diagnose and service common failures on various types of residential electric and gas dryers per manufacturer's specifications

- 3.1 Demonstrate the ability to operate and service components related to residential electrical and gas dryers
- 3.2 Demonstrate knowledge to service drive system: belts, idler pulleys of all types
- 3.3 Demonstrate knowledge to service and repair drying systems: time dry, auto dry, sensor control dry and electronic control dry

- 3.4 Demonstrate knowledge to service and repair mechanical systems: leveling legs, drum rollers, drum support bearings, drum glides, door springs, door latches and cabinet/base structure
- 3.5 Demonstrate knowledge to service and repair air flow systems: cabinet duct system, blower wheels, drum/door seals, lint filter and air flow sensors
- 3.6 Demonstrate knowledge of dryer steam systems
- 3.7 Demonstrate the ability to operate and service components related to residential electrical and gas dryers
- 3.8 Demonstrate knowledge to service drive system: belts, idler pulleys of all types
- 3.9 Demonstrate knowledge to service and repair drying systems: time dry, auto dry, sensor control dry and electronic control dry
- 3.10 Demonstrate knowledge to service and repair mechanical systems: leveling legs, drum rollers, drum support bearings, drum glides, door springs, door latches and cabinet/base structure
- 3.11 Demonstrate knowledge to service and repair air flow systems: cabinet duct system, blower wheels, drum/door seals, lint filter and air flow sensors
- 3.12 Demonstrate knowledge of dryer steam systems

## Cooling

### **RCAT 4.0 — \*\*\* Diagnose and service common failures on various types of refrigerators per manufacturer's specifications**

- 4.1 Demonstrate knowledge of icemaker system; module, thermostat, thermistor, cube mold/tray and heater
- 4.2 Demonstrate knowledge of ice and water dispenser systems; auger motor, crusher mechanism, ice bucket components, dispenser door mechanism, condensation heaters and ice- level sensing devices
- 4.3 Demonstrate knowledge of mechanical systems: leveling legs/rollers, door operation/alignment, door gasket replacement, freezer/fresh food compartment controls
- 4.4 Demonstrate knowledge of air-circulation systems: air ducts, diverters, baffles, and fan motors

- 4.5 Demonstrate knowledge of sealed system: basic refrigeration theory, identify/diagnose leaks and restrictions in condenser/post loop tubing/evaporator/heat exchanger/drier filter, compressor operation and diagnostics
- 4.6 Demonstrate knowledge and understanding of various refrigerant gasses currently used in refrigeration products with a sealed system

## Cooking

### **RCAT 5.0 — \*\*\* Diagnose and service common failures on various types of electric and gas ranges per manufacturer's specifications**

- 5.1 Possess a knowledge of cooking systems: surface cooking, standard/convection bake, broil, induction, steam, microwave
- 5.2 Demonstrate knowledge of LP and natural gas fundamentals and theory
- 5.3 Demonstrate knowledge of conventional electric and induction cooking systems
- 5.4 Demonstrate knowledge of gas cooking systems, gas conversion
- 5.5 Demonstrate knowledge of self- clean system
- 5.6 Demonstrate knowledge of motors: fan, servo/actuator
- 5.7 Demonstrate knowledge of mechanical systems: leveling legs, door locks, door structure and seals, door springs/hinges, cabinet/base structure
- 5.8 Demonstrate knowledge of microwave operations: conventional, convection and inverter technologies
- 5.9 Demonstrate knowledge of microwave cooking theory
- 5.10 Demonstrate knowledge of door lock mechanisms
- 5.11 Demonstrate knowledge of high-voltage heating system: magnetron, transformer, capacitor, and diode
- 5.12 Demonstrate knowledge of convection components
- 5.13 Demonstrate knowledge of mechanical systems: door structure and seals, door springs/hinges, wave guide and cabinet/base structure

## Cleaning

### RCAT 6.0 — \*\*\* Diagnose and service common failures on various types of dishwashers per manufacturer's specifications

- 6.1 Possess a knowledge of dishwasher operations
- 6.2 Demonstrate knowledge of water circulation system: hoses, diverters, check valves, pumps, valves, and seals
- 6.3 Demonstrate knowledge of water heating and drying system: thermistors, heaters, and relays
- 6.4 Demonstrate knowledge of mechanical systems: leveling legs, cabinet/base structure, door lock mechanism, door structure and door/tub gasket
- 6.5 Demonstrate theoretical knowledge of thermal, chemical and mechanical energy of temperature, detergent, water quality and circulation

## Refrigerant Tubing Connections

### RCAT 7.0 — \*\*\* Assemble a closed loop tubing project that exhibits all techniques of brazing copper and steel tubing, compression and flaring techniques, resistance/infrared technique, to complete a refrigeration closed loop sealed system repair per manufacturers' specifications

- 7.1 Demonstrate correct usage of the acetylene/oxygen or turbo torch brazing equipment and connection(s) joint using refrigeration compression tools and fittings such as LOKRING, brass, steel and copper tubing and fittings
- 7.2 Braze materials using heat trap paste, flux, 45-percent high silver alloy brazing material, 15-percent silver alloy brazing rod and saddle/access valves
- 7.3 Use of basic/specialty hand tools: swedging tool, tubing bender, triangular file, burr remover, sanding cloth, valve core removal tool, triangular file or cap tube cutter, process tube adaptor, pinch off tools and fitting/cleaning brush
- 7.4 Practice leak detection methods
- 7.5 Follow proper safety practices: fire extinguisher at hand, gloves, safety glasses and flame-retardant mat

## RCAT 8.0 — \*\*\* Knowledge Performance and Interpersonal Skills

- 8.1 The SkillsUSA Framework is used to pinpoint the Essential Elements found in Personal Skills, Workplace Skills, and Technical Skills Grounded in Academics. Students will be expected to display or explain how they used some of these Essential Elements. Please reference the graphic below, as you may be scored on specific elements applied to your project. For more, visit: [www.skillsusa.org/about/skillsusa-framework/](http://www.skillsusa.org/about/skillsusa-framework/)



## Committee Identified Academic Skills

The technical committee has identified that the following academic skills are embedded in this contest.

### Math Skills

- Use fractions to solve practical problems.
- Solve practical problems involving percentages.

### Science Skills

- Describe and recognize elements, compounds, mixtures, acids, bases and salts.
- Describe and recognize solids, liquids and gases.
- Describe characteristics of types of matter based on physical and chemical properties.
- Use knowledge of physical properties (shape, density, solubility, odor, melting point, boiling point, color).
- Use knowledge of chemical properties (acidity, basicity, combustibility, reactivity).
- Understand the modern model of atomic structure.
- Use knowledge of classification of elements as metals, metalloids and nonmetals.

- Understand Law of Conservation of Matter and Energy.
- Describe phases of matter.
- Describe and identify physical changes to matter.
- Predict chemical changes to matter (types of reactions, reactants, products and balanced equations).
- Use knowledge of mechanical, chemical and electrical energy.
- Use knowledge of heat, light and sound energy.
- Use knowledge of temperature scales, heat and heat transfer.
- Use knowledge of speed, velocity and acceleration.
- Use knowledge of work, force, mechanical advantage, efficiency and power.
- Use knowledge of principles of electricity and magnetism.
- Use knowledge of static electricity, current electricity and circuits.
- Use knowledge of magnetic fields and electromagnets.
- Use knowledge of motors and generators.

#### Language Arts Skills

- Provide information in conversations and in group discussions.
- Provide information in oral presentations.
- Demonstrate use of such verbal communication skills as word choice, pitch, feeling, tone and voice.
- Demonstrate use of such nonverbal communication skills as eye contact, posture and gestures using interviewing techniques to gain information.
- Analyze mass media messages.
- Identify words and phrases that signal an author's organizational pattern to aid comprehension.
- Understand source, viewpoint and purpose of texts.
- Organize and synthesize information for use in written and oral presentations.
- Demonstrate knowledge of appropriate reference materials.
- Use print, electronic databases and online resources to access information in books and articles.
- Demonstrate persuasive writing.
- Demonstrate informational writing.

- Edit writing for correct grammar, capitalization, punctuation, spelling, sentence structure and paragraphing.

#### Connections to National Standards

State-level academic curriculum specialists identified the following connections to national academic standards.

##### Math Standards

- Numbers and operations.
- Algebra.
- Measurement.
- Data analysis and probability.
- Problem solving.
- Reasoning and proof.
- Communication.
- Connections.
- Representation.

*Source:* NCTM Principles and Standards for School Mathematics. For more information, visit: [www.nctm.org](http://www.nctm.org).

##### Science Standards

- Understands the structure and properties of matter.
- Understands the sources and properties of energy.
- Understands forces and motion.
- Understands the nature of scientific inquiry.
- Understands the scientific enterprise.

*Source:* McREL compendium of national science standards. To view and search the compendium, visit: <http://www2.mcrel.org/compendium/browse.asp>.

##### Language Arts Standards

- Students read a wide range of print and nonprint texts to build an understanding of texts, of themselves, and of the cultures of the United States and the world; to acquire new information; to respond to the needs and demands of society and the workplace; and for personal fulfillment. Among these texts are fiction and nonfiction, classic and contemporary works.
- Students apply a wide range of strategies to comprehend, interpret, evaluate and appreciate texts. They draw on their prior experience, their interactions with other readers and writers, their knowledge of word meaning and of other texts, their word identification strategies, and their

understanding of textual features (e.g., sound-letter correspondence, sentence structure, context, graphics).

- Students adjust their use of spoken, written and visual language (e.g., conventions, style, vocabulary) to communicate effectively with a variety of audiences and for different purposes.
- Students employ a wide range of strategies as they write and use different writing process elements appropriately to communicate with different audiences for a variety of purposes.
- Students conduct research on issues and interests by generating ideas and questions and by posing problems. They gather, evaluate and synthesize data from a variety of sources (e.g., print and nonprint texts, artifacts, people) to communicate their discoveries in ways that suit their purpose and audience.
- Students use a variety of technological and information resources (e.g., libraries, databases, computer networks, video) to gather and synthesize information and to create and communicate knowledge.
- Students use spoken, written and visual language to accomplish their own purposes (e.g., for learning, enjoyment, persuasion and the exchange of information).

**Source:** IRA/NCTE Standards for the English Language Arts. To view the standards, visit: [www.ncte.org/standards](http://www.ncte.org/standards).