



Certifying the  
finest in HVACR

# CHP-5 Installation

# KATE

Knowledge Areas of  
Technician Expertise

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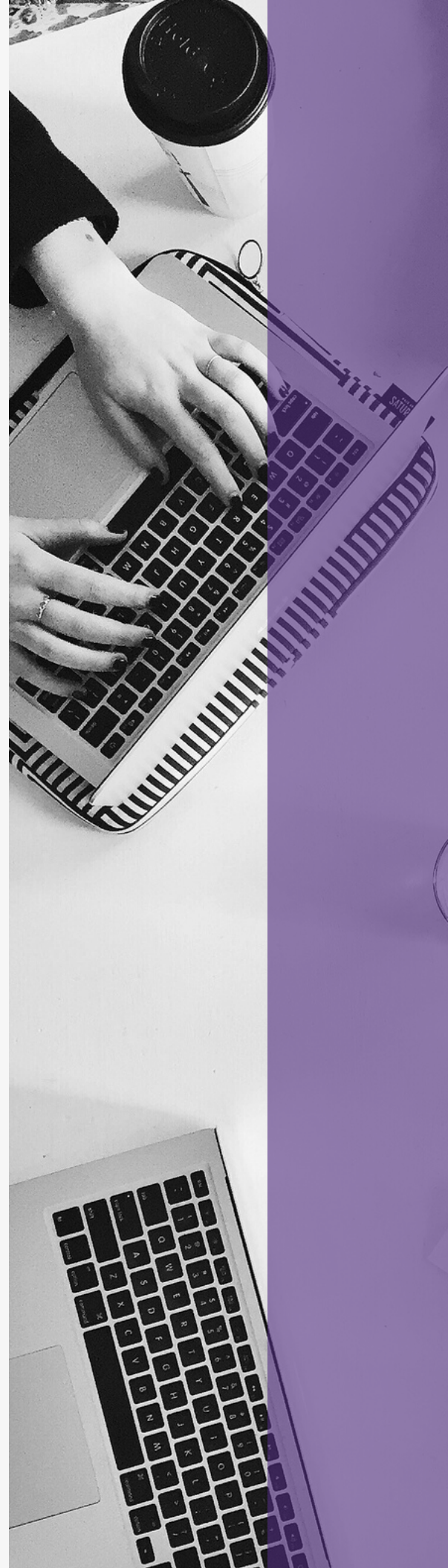
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# CHP-5: Installation Exam

## Exam Information & Qualifications



The Certified HVAC Professional (CHP-5): Installation exam tests a candidate's knowledge of the installation, service, maintenance, and repair of HVAC systems. This is a test and certification for technicians in the HVAC industry. The test is designed for top level technicians. This test for certification is not intended for the HVAC system designer, sales force, or the engineering community.

To become NATE-certified, you must pass all five of the Certified HVAC Professional exams (HVAC Fundamentals, Electrical and Controls, Comfort and Air Flow, Installation, and Service). This test will measure what 80% of candidates have an 80% likelihood of encountering at least once during the year on a national basis.

## Exam Copyrights

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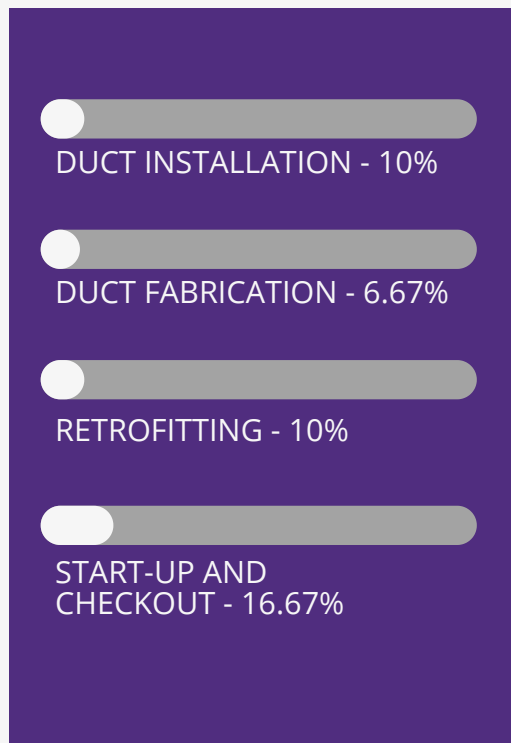
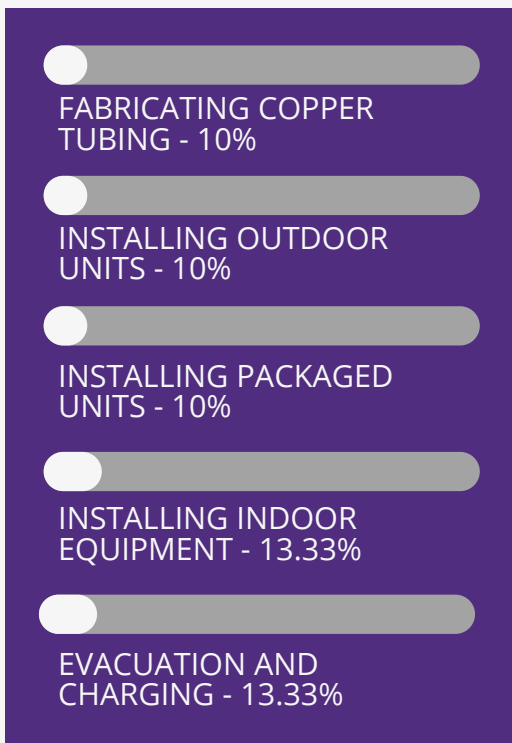
## Passing Score Development Process



The passing scores for the NATE tests were established using a systematic procedure (a Passing Score Study). This procedure employed the judgment of experienced HVAC professionals and educators representing various HVAC specialties and geographical areas. The passing scores were set using criteria defining competent performance. The passing score for different test forms may vary slightly due to the comparative difficulty of the test questions.

# Exam Subject Areas

Percentages of questions that will be in each section of the exam:



## Exam Specifications:



Passing Score: Pass/Fail



1 Hour Time Limit



Closed Book



30 Questions

# Industry References

The reference materials list below will be helpful in preparing for this exam. These materials may not contain all of the information necessary to be competent in this specialty or to pass the exam.



- American National Standards Institute (ANSI) / Air Conditioning Contractors of America (ACCA) Manuals – Latest Edition.
  - Manuals “D” “J” “QI” – Quality Installation, and “S”
- ACCA Manuals “T” and “RS” – Latest Editions
- ACCA Residential Duct Diagnostics and Repair – Latest Edition
- AHRI-Hydronics Section – IBO/RAH – Latest Edition
- International Energy Conservation Code - Latest Edition with Addendum
- International Mechanical Code - Latest Edition with Addendum
- International Plumbing Code - Latest Edition with Addendum
- Uniform Mechanical Code - Latest Edition with Addendum
- Specification of Energy-Efficient Installation and Maintenance Practices for Residential HVAC Systems developed by Consortium for Energy Efficiency (CEE) - Latest Edition with Addendum

**References continue on next page**

# Industry References (continued)

- ASHRAE Standard-62.2 - Latest Edition with Addendum
- ANSI//ASHRAE Standard- 152-2004 – Latest Edition with Addendum
- ENGERY STAR™ Home Sealing Standards – Latest Edition with Addendum
- Duct Calculators – Sheet Metal, Ductboard, and Flexible Duct
- American National Standards Institute (ANSI)/Sheet Metal and Air Conditioning Contractors' National Association, Inc. (SMACNA) Manuals
  - HVAC Duct Construction Standards - Metal and Flexible
- Sheet Metal and Air Conditioning Contractors' National Association, Inc. (SMACNA) Manuals
  - Fibrous Glass Duct Construction Standards, Residential Comfort System Installation Standards Manual, and HVAC Air Duct Leakage Test Manual
- Air Diffusion Council Flexible Duct Performance & Installation Standards
- North American Insulation Manufacturers Association (NAIMA) Manuals
  - Fibrous Glass Duct Construction Standards and A Guide to Insulated Air Duct Systems
- International Fuel Gas Code – Latest Edition with Addendum
- National Fuel Gas Code – Latest Edition with Addendum



# KATES

## Knowledge Areas of Technician Expertise

All NATE exams are based on Knowledge Areas of Technician Expertise (KATES), statistically proven job task analysis from experts in the HVACR industry. This KATES outline covers all information tested in the **CHP-5: Installation Exam** and should be used as reference material.

### Fabricating Copper Tubing

- Refrigerant Line Installation
  - Locating, mounting, and routing
  - Understanding limitations of length and diameter
- Bending Copper Tubing
  - Making a proper bend with spring benders
  - Making a proper bend with cam type benders
- Copper Tubing Preparation
  - Cutting copper tubing
  - Reaming copper tubing
  - Cleaning copper tubing
  - Swaging copper tubing
- Brazing
  - Overview of brazing copper to copper
  - Using air / fuel to solder
  - Use of purging gas when brazing
  - Oxyacetylene brazing
  - Overview of brazing copper to brass
  - Overview of brazing copper to steel
  - Selection of brazing materials
- Flare Fittings
  - Making a flare fitting - single and double
  - Installing with flare fittings
- Brazing & Soldering Equipment
  - Brazing products - rods, flux, etc.
  - Gas purging equipment in field brazing
  - Air / Fuel systems - acetylene, propane, MAP, etc.
  - Oxyacetylene brazing equipment
  - Soldering products - solder, flux, and torches
  - Tool maintenance and care



# KATES Knowledge Areas of Technician Expertise

## Installing Outdoor Units

- Installing and Connecting Outdoor Units
  - Locating unit
  - Preparing site
  - Placing unit
  - Wiring outdoor units
  - Connecting refrigerant lines

## Installing Packaged Units

- Installing and Connecting Packaged units
  - Locating equipment
  - Preparing site
  - Lifting unit
  - Sealing unit
  - Wiring

## Installing Indoor Equipment

- Installation of indoor air handlers / furnaces
  - Installing coil and air handler / furnace
  - Connecting refrigerant lines
  - Wiring electronic air cleaners
  - Installing fixed metering devices
  - Connecting ductwork
  - Connecting condensate lines
  - Wiring air handler / furnace
  - Wiring thermostats
  - Bulb location selection for TEV's
  - TEV's - installation
  - Auxiliary heat
  - Handling - lifting, hanging
  - Trapping for condensate lines



# KATES Knowledge Areas of Technician Expertise

## Installing Indoor Equipment (continued)

- Connecting Utilities
  - Connection of gas piping
  - Connection of field wiring
- Installation of Metal Venting Systems
  - Determination of routing
  - Cutting of metal vent systems to proper length
  - Securing of metal vent systems
  - Assembly of metal vent systems
  - Installation of vent termination
- Installation of PVC / ABS Venting Systems
  - Determination of routing
  - Cutting PVC & ABS pipe to proper length
  - Sealing PVC pipe
  - Sealing ABS pipe
  - Installation of vent termination
  - Dry-fitting the assembly
  - Securing of pipe

## Evacuation and Charging

- Safe Handling of Refrigerant Containers
  - Disposal
  - Securing refrigerants for transport
  - Signage and documentation for refrigerants
  - Proper container filling
  - Proper storage
- Evacuation
  - Overview - use of a vacuum pump
  - Overview - use of a micron gauge
  - Use of a manifold gauge set in evacuation
  - Deep single evacuation process
  - Removing core of access valves
- Leak Checking and Detection
  - Overview of leak checking detection
  - Leak checking with electronic leak detectors
  - Gas pressurization for leak checking
  - Leak checking with ultrasonic leak detectors
  - Leak checking with soap solutions

# KATES

Knowledge Areas of  
Technician Expertise

## Evacuation and Charging (continued)

- Charging Method
  - Weigh in method
  - Superheat method and where used
  - Subcooling method and where used
  - Charging blended refrigerants

## Duct Installation

- Duct Fabrication Equipment
  - Ductboard tools - 90 V-groove, end cutoff, female shiplap, hole cutter, stapler, etc.
  - Metal tools - metal snips, sheers, benders, breaks, hand formers, calipers, rulers, stapler, etc.
  - Flex tools - tensioning strap tools, knives, etc.
- Installing Metal Duct
  - Assembly methods for rectangular duct
  - Assembly methods for round duct
  - Hanging ductwork
  - Sealing metal duct
  - Insulation - internal and external
- Installing flexible duct
  - Assembly methods - appropriate length
  - Hanging flexible duct
  - Sealing flexible duct
  - Installation technique
- Installing Ductboard
  - Assembly methods for ductboard - supports
  - Hanging methods for ductboard
  - Sealing ductboard
  - Installation Technique
- Installing grilles, registers, diffusers, and dampers
  - Mounting to ductwork
  - Securing methods
  - Sealing materials
- Field Construction / Installation
  - Techniques for joining dissimilar duct
  - Duct of alternate materials - wood, aluminum, etc.

# KATES

## Knowledge Areas of Technician Expertise

### Duct Installation (continued)

- Chases used as ducts
  - Floor joists as air ducts
  - Vertical chases
- Reconnecting Duct when Replacing Equipment
  - Reconnecting metal duct
  - Reconnecting flexible duct
  - Reconnecting ductboard duct
- Installation of Plenums and Duct
  - Sizing plenums for physical fit
  - Types and styles of plenums selected
  - Insulation of plenums and ducts

### Duct Fabrication

- Fabrication techniques for metal duct
  - Seam types - pittsburgh and snap lock
  - Joint types - drive slips, reinforced drive slips, "s" slip, and standing "s" slip
  - Use of strength breaks in rectangular duct
- Fabrication techniques for ductboard
  - Layout of duct fitting
  - Groove cutting - hand / machine
  - Use of joint tape

### Retrofitting

- Equipment Component Retrofitting
  - Changing out an outdoor unit
  - Changing out an indoor unit
  - Modifying ductwork for replacement equipment

# KATES

## Knowledge Areas of Technician Expertise

### Start-up and Checkout

- Pre-start procedures
  - Surveying installation - checking equipment match
  - Inspect connections for tightness
  - Set dip switches/jumpers on CEM motors
  - Set speed taps on multi-speed motors
  - Set adjustable pulleys on belt driven blowers
  - Ensure clean filter is in place and accessible
  - Adequate combustion air provisions
  - Venting system
  - Gas supply and proper shutoff
  - Ensure condensate line is flowing
- Start-up Procedures and Checks
  - Surveying installation
  - Supply voltage checks
  - Motor checks
  - Checking sequences
  - Check fan rotation
  - Check scroll compressor rotation - high noise level, etc.
  - Start-up checklist and preparation
  - Metering device - refrigerant circuit checks
  - Airflow checks
  - Reversing valve checks
  - Pressure checks
  - Temperature checks - dry bulb, wet bulb, etc.
  - Flame quality check
  - Firing rate
  - Check call for heat sequences
  - Check thermostat and set heat anticipator
  - Manifold gas pressure check
- Leak Detection Tools
  - Soap solution
  - Electronic leak detectors
  - Use of dye leak detectors
  - Ultrasonic leak detector
  - Pressurization for leak detection
  - Meter calibration and maintenance
  - Halide leak detector (nonflammable refrigerants only)