



Certifying the
finest in HVACR

Air Distribution Installation

KATE

Knowledge Areas of
Technician Expertise

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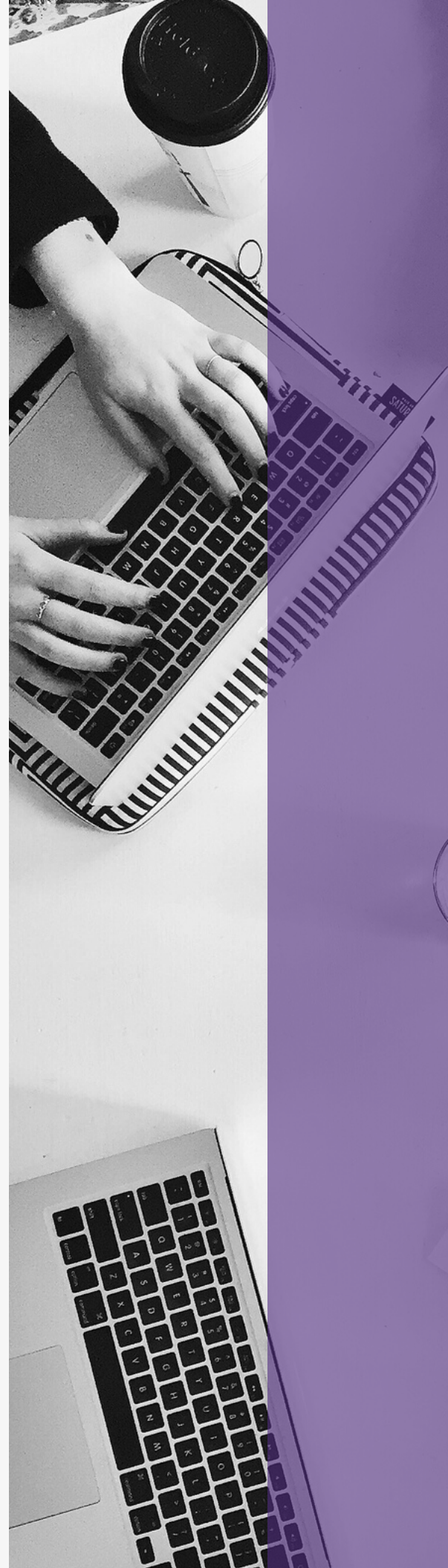
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Air Distribution - Installation Specialty Exam



Exam Information & Qualifications

The Air Distribution - Installation specialty exam tests a candidate's knowledge of the installation, service, maintenance, and repair of HVAC systems. System sizes are limited to 30 tons or less cooling capacity. This is a test and certification for technicians in the HVAC industry. The test is designed for top level installation 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 this specialty and the Core exam. This test will measure what 80% of the Air Distribution candidates have an 80% likelihood of encountering at least once during the year on a national basis. Suggested requirement is one year of field experience working on Air Distribution systems as an installation technician and technical training for theoretical knowledge.

Exam Copyrights

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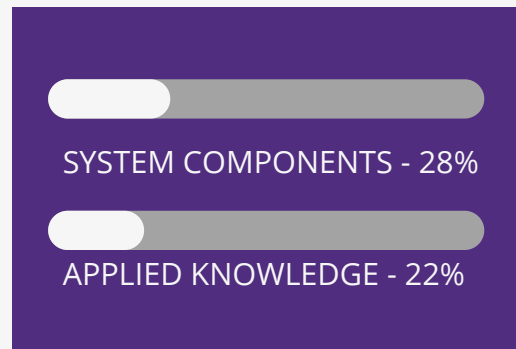
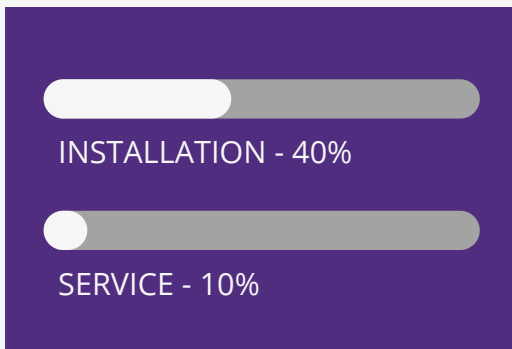
Passing Score Development Process



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



2.5 Hour Time Limit



Closed Book



100 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-Hydraulics 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



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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 **Air-to-Air Heat Pumps - Installation Exam** and should be used as reference material.

Installation

Duct Fabrication

- Duct Fabrication Equipment
 - Ductboard tools - 90 V-groove, end cutoff, female shiplap, hole cutter, stapler, etc.
 - Flex tools - tensioning strap tools, knives, etc.
 - Metal tools - metal snips, sheers, benders, breaks, hand formers, calipers, rulers, stapler, etc.
- Fabrication Techniques For Metal Duct
 - Making seams - pittsburgh and snap lock
 - Making transverse joints - drive slips, reinforced drive slips, "s" slip, and standing "s" slip Making cross breaks in rectangular duct
 - Crimping round pipe
- Fabrication Techniques For Ductboard
 - Layout of duct fitting
 - Groove cutting - hand / machine
 - Use of joint tape

Duct Installation

- Field Construction / Installation
 - Ductboard installation technique
 - Techniques for joining dissimilar duct
 - Duct of alternate materials - wood, aluminum, etc.

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Knowledge Areas of
Technician Expertise

Installation (continued)

- Installing Metal Duct
 - Assembly methods for rectangular duct
 - Installation technique - rectangular metal
 - Assembly methods for round duct
 - Installation technique - round metal
 - Hanging ductwork
 - Sealing metal duct
 - Insulation - internal and external, vapor barriers
 - Assembling for low noise and low pressure drop
- Installing Flexible Duct
 - Assembly methods - appropriate length
 - Flexible duct joints
 - Hanging flexible duct Installation technique - flex duct
 - Sealing flexible duct
- Installing Ductboard
 - Assembly methods for ductboard - supports
 - Installation technique - ductboard
 - Hanging methods for ductboard
 - Sealing ductboard
- Installing Grilles, Registers, Diffusers, & Damper
 - Mounting to ductwork Securing methods
- 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

KATES

Knowledge Areas of
Technician Expertise

Installation (continued)

System Setup

- Preparing System For Operation
 - Removing shipping restraints
 - Inspecting for concealed damage
 - Inspect wiring
- Preparing System For Operation
 - Removing shipping restraints
 - Inspecting for concealed damage
 - Inspect wiring
- Setting Damper Positions
 - Determining estimated damper positions
 - Setting and securing position
- Setting Registers And Diffusers
 - Determining estimated damper positions
 - Setting/securing position
- Setting Blower Speeds
 - Determining appropriate setting
 - Setting blower for setup checks
 - Setting blower for system operation

Airflow Measurements

- Introduction To Airflow Measurements
 - Introduction to airflow
 - Static pressure
- Airflow Velocity Measurements
 - Introduction to airflow velocity
 - Velometer - electronic and mechanical
 - Anemometer
 - Velocity measurement procedures
 - Gauge calibration

KATES

Knowledge Areas of
Technician Expertise

Installation (continued)

- Airflow Pressure Measurements
 - Overview of static pressure measurements
 - Inclined manometer
 - Diaphragm type differential pressure gauge
 - U-tube manometer
 - Electronic manometer / pressure measurement
 - Gauge / meter calibration
 - Absolute vs. Gauge Pressure
- Airflow Volume Measurements
 - Introduction to volume Airflow hood
 - Formulae for determining CFM of air
 - Formulae for weight of air
 - Locations for air volume measurements
- Airflow Checks & Design Tools
 - Using manufacturer's airflow charts and tables
 - Using a duct calculator and design charts

Service

Basic Air Distribution System Inspection

- Structural Integrity
 - Duct support
 - Joint integrity
- Noise Problems
 - Oil canning
 - Vibration
- Air Leaks
 - Smoke test - positive and negative envelope pressure

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Knowledge Areas of
Technician Expertise

Service (continued)

INSPECTION AND REPAIR OF METAL DUCT SYSTEMS

- Inspecting For Structural Integrity
 - Inspecting joints
 - Inspecting seams
 - Locating improper openings
 - Inspecting for proper support
- Inspecting For Leaks
 - Visual inspection
 - Inspection by sound
- Inspecting For Noise
 - Identifying air velocity noise
 - Identifying mechanical noise
- Repairing Metal Duct Systems
 - Repairing leaks
 - Repairing noise problems
 - Repairing structural integrity problems
 - Repairing/replacing internal and external insulation

INSPECTION AND REPAIR OF DUCTBOARD SYSTEMS

- Inspecting For Structural Integrity
 - Inspecting joints
 - Inspecting seams
 - Locating improper openings
 - Inspecting for proper support
- Inspecting For Leaks
 - Visual inspection
 - Inspection by sound
- Inspecting For Noise
 - Identifying air velocity noise
 - Identifying mechanical noise

KATES

Knowledge Areas of
Technician Expertise

Service (continued)

- Repairing Ductboard Duct Systems
 - Repairing leaks
 - Repairing noise problems
 - Repairing structural integrity problems

Inspection And Repair Of Flexible Duct Systems

- Inspecting For Structural Integrity
 - Inspecting joints
 - Locating improper openings
 - Inspecting for proper support
 - Inspecting for improper routing
- Inspecting For Leaks
 - Visual inspection
 - Inspection by sound
- Inspecting For Noise
 - Identifying air velocity noise
 - Identifying mechanical noise
- Repairing Flexible Duct Systems
 - Repairing leaks
 - Repairing noise problems
 - Repairing structural integrity problems

Inspection And Repair Of Grilles And Registers

- Inspecting For Structural Integrity
 - Inspecting joints
 - Inspecting for proper mounting
 - Inspecting for proper settings and adjustments
- Inspecting For Noise
 - Inspecting for noise with operating blower
 - Inspecting for proper seal
 - Inspecting for proper settings

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Knowledge Areas of
Technician Expertise

Service (continued)

- Repairing Grilles And Registers
 - Repairing leaks
 - Repairing noise problems
 - Repairing structural integrity problems
- Inspecting For Leaks
 - Visual inspection
 - Inspection by sound

Introduction To Electrical Troubleshooting

- Low Voltage Field Wiring
 - Voltage tests
 - Troubleshooting equipment with electronic devices
 - Equipment continuity tests
- Line Voltage Field Wiring
 - Voltage tests
 - Troubleshooting equipment with electronic devices
 - Equipment continuity tests

System Components

Introduction To Systems

- Heat Transfer And The Basic Cooling Cycle
 - Heat transfer and cooling
 - Basic refrigeration circuit - 7 components

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Knowledge Areas of
Technician Expertise

System Components (continued)

Duct Systems

- Basic Duct Systems
 - Overview of duct systems
 - Duct configuration - extended plenum
 - Duct configuration - reducing extended plenum
 - Duct configuration - perimeter radial
 - Duct configuration - perimeter loop
 - Duct configuration - overhead radial
 - Duct configuration - branching flexible
 - Duct configuration - concentric
- Duct Location
 - Attic
 - Basement
 - Crawlspace
 - Slab
 - Roof
 - Furr down
 - Exposed
 - Chases
- Basic Zone Systems
 - Equipment zoned
 - Air side zoned
- Duct Materials
 - Define / recognize ductboard
 - Define / recognize metal duct
 - Define / recognize flexible duct
 - Define / recognize PVC pipe
 - Insulating material

KATES Knowledge Areas of Technician Expertise

System Components (continued)

- Fitting Nomenclature
 - Define / recognize plenum
 - Define / recognize transition
 - Define / recognize elbow - 90 degrees and 45 degrees
 - Define / recognize round duct
 - Define / recognize rectangular duct
 - Define / recognize turning vanes
 - Return configurations - ducted, central, etc.
 - Define / recognize wye - rectangular and round
 - Define / recognize damper - rectangular and round
 - Sheet metal duct joints - "s" and drive, snaplock, button lock, etc.
 - Define/recognize flexible/canvas connector
- Dampers
 - Balancing Splitters Economizers Fresh air Fire
- Grilles
 - Types and uses
 - Selecting grilles by volume and velocity
- Registers
 - Types and uses
 - Selecting registers
 - Selecting registers by air spread and throw capacity
- Diffusers
 - Types and uses
 - Selecting diffusers
 - Selecting diffusers by air spread and throw capacity
- Filtration Systems
 - Media type filters
 - Electronic air cleaners (EAC's)
 - Electrostatic filters - non-electric
-

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Knowledge Areas of
Technician Expertise

System Components (continued)

- Ventilation Systems
 - Attic exhaust
 - Residential exhaust(s)
 - Lt. Commercial exhaust(s)
 - Heat / energy recovery ventilators
 - Infiltration
- Humidifiers
 - Fundamentals of operation
 - Types
 - Duct material requirements
 - Installation support and location

Basic Gas Furnaces

- Gas Heat - Components
 - Define heat exchanger
 - Define fan controls
 - Define limit controls
 - Define vent system
 - Define limit controls
 - Define vent system
- Gas Heat - Operation
 - Define combustion air system
 - Air side requirements

Basic Oil Furnaces

- Oil Heat - Components
 - Define limit controls
 - Define heat exchanger
 - Define vent system
- Oil Heat - Operation
 - Define combustion air system
 - Air side requirements

KATES

Knowledge Areas of
Technician Expertise

System Components (continued)

Basic Air Conditioning / Heat Pumps

- Basic Components
 - Define evaporator Define condenser Define compressor
- Basic Operation
 - Air side requirements

Basic Airflow Principles

- Introduction To Airflow
 - Velocity Static pressure
 - Airflow volume - CFM / SCFM (Static CFM)
- Blowers And Fans
 - Introduction to indoor blowers
 - Indoor blowers - types and selection
 - Fan operation
 - Adjustable pulley

Applied Knowledge: Regs, Codes, and Design

Air Quality Regulations

- Indoor Air Quality
 - Fresh air supplies

Electrical Code

- Requirements
 - Overview of electrical code
 - Circuit breaker and fuse requirements
 - General wiring practices
 - Class I wire sizing
 - Class II wire sizing
 - Conduit sizing
 - Definitions

KATES Knowledge Areas of Technician Expertise

Applied Knowledge (continued)

State And Local Regulations And Codes

- State And Local Regulations
 - State requirements for technicians
- Codes
 - Plumbing
 - Municipalities
 - HVAC for Lt. Commercial

Fire Protection Regulations And Codes

- Required Components
 - Return air sensors
 - Fire dampers
- Fire Prevention
 - Overview

Design Considerations - Comfort

- Temperature
 - Designing for capacity
 - Using industry standards
- Humidity
 - Role of humidity in comfort
 - Using industry standards
- Indoor Air Quality
 - Ventilation - comfort
 - Air cleaning for comfort
 - Industry standards for air quality
 - Outside air
- Sound Level
 - Equipment location considerations
 - Isolation, mounting pad, duct, and structure
 - Duct systems

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Knowledge Areas of
Technician Expertise

Applied Knowledge (continued)

Design Considerations - Residential

- Split Systems
 - Ventilation - fresh air
 - Ventilation - equipment
- Air Balancing
 - Blower speed adjustments
 - Damper position adjustments
- Retrofit Installations
 - Insulation
 - Vapor barrier

Design Considerations - Components

- Blueprint Reading
 - Determination of dimension from scale blueprint / plans
 - Introduction to blueprints/plans reading
 - Visualizing duct layout from blueprints/plans
- Special Ducts & Fittings
 - Working drawings vs. Isometric drawings
 - Markings and abbreviations for duct fitting and manufacturing
 - Measurement for replacement of special duct or fitting
- Ducts & Fittings
 - Specifying physical dimensions
 - Sketching duct layout
 - Duct fitting equivalency - EQ to duct size
- Static Pressure Losses In Filtration Systems
 - Filter grilles
 - Electronic air cleaners (EAC's) Electrostatic
 - Media type filters
- Diffusers
 - Selecting diffusers
 - Proper locations

KATES

Knowledge Areas of
Technician Expertise

Applied Knowledge (continued)

- Grilles
 - Selecting grilles
 - Proper locations
- Registers
 - Selecting registers
 - Proper locations

Mechanical Code

- Equipment Access
 - Minimum clearance
 - Electrical disconnects
 - Fire dampers
- Refrigerant Line Routing
 - Support requirements
 - Inspection requirements
- Condensate Drains
 - Materials
 - Sizing

Industry Standards

- Equipment Standards
 - Introduction to industry standards
 - AHRI standards for ratings
- System Standards
 - Introduction to industry standards
 - Industry standards

Design Considerations - Light Commercial

- Split Systems
 - System designs - closets, basements, etc.
 - Air distribution systems
 - Ventilation - fresh air
 - Ventilation - equipment

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Knowledge Areas of
Technician Expertise

Applied Knowledge (continued)

- Packaged Systems
 - System designs
 - Economizers
 - Ventilation - equipment
- Air Balancing
 - Duct sizing
 - Blower speed adjustments
 - Damper position adjustments
 - Measurement of air flow rate
 - Fan laws