CORE EXAM

Exam Information

Scope – Tests a candidate’s general knowledge, construction knowledge, and HVACR specific knowledge in the areas of safety, tools, basic construction, basic science, achieving desired conditions, taking measurements, and basic electricity.

Qualifications

➢ This exam is designed for technicians in the HVAC/R industry. This exam is a requirement for most installation or service specialty certifications.

Test Specifications

Closed Book 1.5 Hour Time limit 50 Questions Passing Score: Pass/Fail

Listed are the percentages of questions that will be in each section of the Core exam.

<table>
<thead>
<tr>
<th>Section Area Description</th>
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<tbody>
<tr>
<td>Safety</td>
<td>18%</td>
<td>Achieving Desired Conditions</td>
<td>14%</td>
</tr>
<tr>
<td>Tools</td>
<td>10%</td>
<td>Taking Temp. and Humidity Measurements</td>
<td>14%</td>
</tr>
<tr>
<td>Basic Construction</td>
<td>8%</td>
<td>Basic Electricity</td>
<td>26%</td>
</tr>
<tr>
<td>Using Basic Science</td>
<td>10%</td>
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</table>

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 to pass the exam.

  - Manuals “D” “J” “QI” – Quality Installation, and “S”
- ACCA Manuals “T” and “RS” – Latest Editions
- ACCA Residential Duct Diagnostics and Repair – Latest Edition
- International Code Council – Latest Editions
  - Mechanical, Plumbing, Energy Conservation, and Residential
- Uniform Mechanical Code – Latest Edition with Addendum
- ENERGY 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
- 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
- Generally accepted HVACR textbooks
- Generally accepted construction textbooks
- OSHA safety standards
- National Fire Protection Association – Latest Editions
  - Gas, Oil, and Electric

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 Copyrights

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Safety

Complying with Government Regulations
- Transportation regulations for hazardous materials
- Health and safety regs for hazardous materials
- Environmental regs for hazardous materials

Personal Safety and Work Practices
- Regs concerning confined spaces, hard hats, etc.
- Safety with hand tools
- Using ladders and scaffolds
- Refrigerant in confined spaces
- Safe driving practices
- Clothing, safety equipment, and hard hats
- Safety glasses
- Hearing protection
- Safe practices in repair
- Using warning symbols
- Safe handling of hazardous materials
- Safety within confined spaces
- Safe practices in troubleshooting and repair

Personal Safety Around Moving Machinery
- Blowers
- Pulleys
- Clothing requirements
- Condenser fans

Electrical Safety
- Overview of electrical safety
- Grounding-GFI requirements outdoor extension cords
- Personal protection

Safe Brazing and Soldering Practices
- Overview of safety
- Oxygen and acetylene safety
- Using purging gases-Nitrogen, Carbon Dioxide, etc
- Fire extinguishers
- Documentation for hazardous materials - MSDS

Safe Handling of Containers
- Disposal
- Securing containers for transport
- Signage and documentation for containers
- Proper storage
- Proper container filling

Understanding Hazmat
- Signage for hazardous materials
- Securing hazardous materials for transport
- Documentation for hazardous materials - MSDS
- Worker requirements for HAZMAT training

Tools

Tools
- Tools & Scales - Basic Math Measurement
  - Rulers, compass, square, protractor, etc.
  - Improvised measuring techniques
  - Basic scale drawings
  - Measurements - inches, feet, centimeters, millimeters, etc.
  - Understanding tolerances

Fabrication Tools
- Screwdrivers and nut drivers
- Wrenches, pliers, and allen wrenches
- Socket sets
- Levels and squares
- Tool maintenance and care
Saws and files
Drills, countersink, reamers, and bits
Punches, taps, and dies
Hammers
Metal tools - metal snips, sheers, benders, breaks, hand formers, calipers, rulers, stapler, etc.

**Tubing Tools**
- Benders - spring, lever, etc.
- Flaring tools
- Tube cutters
- Swaging tools
- Reamers

**Basic Construction**

**Plans and Specifications**
- Construction
- Materials
- Layout

**Plumbing (Piping) Layouts**
- Construction
- Materials
- Layout

**Room Specs - Clear Span & Ceiling Heights**
- Construction
- Materials
- Layout

**Roofing**
- Construction
- Materials
- Layout

**Ceilings**
- Construction
- Materials
- Layout

**Walls**
- Construction
- Materials
- Layout

**Floors**
- Construction
- Materials
- Layout

**Fenestration**
- Construction
- Materials
- Layout

**Girders & Trusses**
- Construction
- Materials
- Layout

**Chimneys**
- Construction
- Materials
- Layout

**Using Basic Science**

**Chemistry Basics**
- Properties of matter
- How chemicals react with each other
- Role of chemistry at the jobsite
- Oxidation and combustion
- Weight and density of materials

**Electrons in Electricity**
- Fundamental electrical concepts
- Electrical charge
Conductors
Insulators
Dielectrics

**Electrical Basic Terms**
- Voltage
- Amps - milliamps, microamps, etc.
- Resistance - Ohm's, megohms, etc.
- Power - watts

**Magnetism**
- Magnetic principles in electricity
- Magnetic components - coils
- Magnetic components - transformer

**AC and DC Circuits**
- Simple DC circuit
- Basic control and loads
- Polarity
- Ohm's Law in DC circuits
- Introduction to AC circuits
- Effects of AC on controls and loads

**Basic Circuit Analysis**
- Difference between AC & DC power
- Series circuits
- Parallel circuits
- Ohm's Law
- Current distribution in multiple load circuits
- Complex circuits

**Electricity - Generation and Distribution**
- Intro to electrical distribution
- Transformer distribution
- Impact of available electrical power on equipment

**Solid State Electronics**
- Introduction to basic solid state components
- Overview of solid state devices in HVAC
- Solid state sensing devices
- Introduction to basic solid state components
- Fundamental solid state circuits

**Pressure Measurements**
- Overview of pressure systems
- Pressure laws and pressure measurement terminology
- Temperature vs. Pressure
- Gas laws

**Mathematics**

**Arithmetic**
- Whole numbers - add, subtract, multiply and divide
- Fractions - add, subtract, multiply and divide
- Decimals - add, subtract, multiply and divide
- Percentages, ratios, and proportions
- Rounding off of values
- Interpolation
- Calculators
- Combined calculations
- Mixed numbers
- Conversion of number forms
- Using sequences and series to predict results

**Algebra**
- Basic linear single variable equations
- Using basic algebra in problem solving
- Transposing formulas

**Geometry**
- Geometric figures used in HVAC - points, lines, rectangles, parallelograms, rhombuses, squares, trapezoids, etc.
- Units of measurement. Typical computations using geometry. The right triangle. 30-60-90, 45-45-90.
Parallels and perpendiculars
Estimating areas, perimeters, and volumes of irregular figures

Graphs, Charts & Tables
Introduction to basic graphs, plots, and tabular data
Graphs and tables used in instruction sheets
Blueprint reading

Mechanics
Simple machines - levers, gears, etc.
Conservation of energy
Complex machines - how mechanisms work
Basics of fluid mechanics

Gas Laws

Electrical Load Types
Capacitive - momentary and continuous
Inductive - momentary and continuous
Resistive - momentary and continuous

Power
Electrical power formulae - conversion of power
Introduction to power factor

Achieving Desired Conditions
Temperature
Role of temperature in comfort
Regional temperature considerations and comfort

Humidity
Role of humidity in comfort
Adjusting system performance for humidity control

Air Quality
Ventilation - comfort
Air cleaning for comfort
Ventilation - comfort
Odor control

Sound
Equipment source
Airflow source
Equipment
Airflow

Taking Temp & Humidity Measurements
Physical Measurements - Temperature & Heat
Latent heat
Sensible heat
Temperature
Fundamentals of humidity
Convection
Conduction
Radiation
BTU - Definition and use

Thermometers
Liquid column thermometers
Mechanical thermometers
Electronic thermometers
Infrared thermometers
Gauge / meter calibration
Recording thermometers - digital and analog
Dry bulb and wet bulb Delta T

Humidity Measurement and Calculations
Sling psychrometer
Wet and dry bulb thermometers
Electronic humidity measurement
Gauge / meter calibration
Using psychrometric chart
Humidity probes attachments for use with meters
Enthalpy

Basic Electricity
Symbols
- Introduction to basic symbols
- Use of symbols in diagrams
- Symbol standards

Field Wiring Diagrams
- Basics of field diagram layout
- Use of field diagrams

Pictorial Diagrams
- Basics of pictorial diagram layouts
- Use of pictorial diagrams

Schematic (Ladder) Diagrams
- Basics of schematic (ladder) diagram layouts
- Reading schematics for determining sequences
- Reading schematics for wiring connections

Single Phase Motors
- Types
- Components
- Operating principles
- Torque characteristics
- Tapped multi-speed
- Selecting single phase motors

Three Phase Motors
- Types
- Rotation
- Components
- Operating principles
- Selecting multi-phase motors
- Torque characteristics

Variable Speed Motors
- Variable speed motors - ECM, BPM, and VSIM

Actuator Motors
- Overview of damper motors
- Dual position
- Proportional

Digital Electrical Meters
- Identify meters and instruments
- Digital electrical meters - use and setups
- Voltage measurements
- Resistance measurements
- Amperage measurements
- Use with temperature probes
- Meter calibration and maintenance
- RMS - correction and meter types
- Millivolt measurements
- Milliampere measurements