

UA-NJ Air Conditioning & Refrigeration Division Training Curriculum

1st Year

Basic Mathematics

Subjects

- Using formulas as an expression of logical sequence in solving problems.
- Measuring using a ruler
- Change of State formulas and application
- Square footage use and explanation
- Cubic footage determination
- Sensible heat formulas
- Basic electric formulas and terms
- Substitution of symbols and numbers
- Fraction theory
- Reading p/t charts and Temperature / BTU graph

Basic Refrigeration & A/C I

Subjects

- Basic Physics
 - Heat, Temperature & Heat Flow
 - Matter & Energy
 - Measuring Temperature / Temperature Scales
 - Atmospheric Pressure
- Refrigeration Cycles
 - Moving Heat
 - Vapor-compression cycle
 - Refrigerants
 - Evaporation / condensation
 - Vapor-compression refrigeration cycle
 - Four major components
 - Pressure / temperature relationship
 - Typical refrigeration systems
 - Types of compressors
 - Types of metering devices
 - Other components / accessories of refrigeration cycle
- Tools used in refrigeration work
 - UA Tool List
 - Other Hand Tools & Specialty Tools
 - Schrader core remover, pinch-off, benders, special drivers
- Introduction to Servicing AC / Refrigeration systems
 - Using gauges & p/t chart
 - Using leak detecting tools
 - Using evacuation tools

1st Year continued

Basic Electricity I

Subjects

- Electrical Energy
 - Introduction / Safety
 - Electrical Charges & Magnetism
 - Basic Electrical Terms
 - Conductors / Insulators
 - Measuring Electricity
- Electrical Quantities
 - Voltage / Current / Resistance
- Types of Electricity
 - Static / DC / AC
- Electrical Circuits
 - Series / Parallel
- Using Electrical Meter
 - Voltage / Amperage / Resistance
- Principles of Electricity
 - Ohm's Law
 - Kirchhoff's Law
 - Electrical Power (Watts)
- Simple Control Circuit
 - Loads & Switches
 - Low voltage control components / Relays
 - Basic Electrical Drawings
 - Applied Electrical Circuits
- Safety PPE
 - Basic Meter Usage

Soldering & Brazing

Subjects

- Safety Fundamentals
 - PPE, fire prevention, ventilation, workstation setup
- Copper Tube Basics
 - Types (K, L, M, Refrigeration), cutting, reaming, cleaning, and preparation
- Soldering & Brazing Equipment
 - Torches, hoses, tips, regulators, flame types (neutral, carburizing, oxidizing)
- Air-acetylene Systems
 - Setup, operation, safe handling, and best uses
- Oxy-acetylene Systems
 - Setup, operation, flame adjustment, and applications
- Acetylene & Oxygen Cylinder Safety
 - Storage, transport, regulator use, flashback arrestors, check valves
- Filler Alloys & Fluxes
 - Types of Solders, silver-bearing alloys, flux functions, application, and cleanup
- Soldering copper tube
 - Joint preparation, fluxing, heating, solder flow by capillary action
- Brazing copper tube
 - Tube prep, nitrogen purging, heating sequence, filler rod feeding, joint finishing
- Nitrogen use & Regulator Safety
 - Purging, pressure control, cylinder handling, flow rates
- Pressure Testing for Leaks
 - Test equipment, soap solution, electronic detection, safe pressures, documenting

Health & Safety

Subjects

Complete Job Safety & Health UA Manual - The recognition of job safety & health hazards, and a Certification in OSHA 30. Also included is important information concerning the employer's responsibilities in accident prevention, along with an employee's rights and responsibilities.

UA Heritage

Subjects

History of the United Association

2nd Year

EPA 608 Universal Certification

Subjects

- EPA 608 regulations and environmental responsibility
- Overview of ozone depletion and global warming impacts
- Understanding refrigerant types and classifications
- Safe handling and storage of refrigerants
- Leak detection methods and repair requirements
- Recovery, recycling, and reclaiming refrigerants
- Charging and reclaiming procedures for all systems
- System components and operation for small and large appliances
- Core universal certification preparation
- Type I small appliances certification
- Type II high pressure and medium pressure systems certification
- Type III low pressure systems certification

Electric II – Motors & Wiring Diagrams

Subjects

- Electrical Safety
- Basic Electricity Review
- Electrical Wiring Diagram Types
- Parts of the Wiring Diagrams
- Use of Diagrams
- Graphical Symbols
- ANSI Standard Diagrams
- Reading a Schematic Diagram
- Manufacturer's Electrical Diagrams
- Single Phase Motor Types
 - Capacitors / Why they're used
 - PSC
 - Capacitor Start / Run
- Motor Relays
 - Current Relay
 - Potential Relay
- Three Phase Motors
 - Voltage Unbalance
- Power Supplies
- Delta/WYE Connections
- ECM – Basic
- Control Relays & Contactors
- Circuit Loads & Terminology
- Operating & Safety Controls

2nd Year continued

Refrigeration & A/C II

Subjects

Complete vapor compression cycle and its components
Recovery recycle and reclaim of refrigerants
Evacuation and dehydrating practical practices
Use of paper and digital PT apps
Bubble point, dew point, fractionation and glide
Proper use of analog and digital tools
Scales tare net and gross cylinder weights
Enthalpy diagrams
Compression ratios
System components including compressors, evaporators, condensers and metering devices
Specialized study of the five different types of vapor compression methods
Loading and unloading compressor logic and industry techniques
Compound compression: racks and compressors
Refrigeration oil types and application
Safety practices and environmental compliance in refrigeration and air conditioning

A2L A3 Refrigerants Awareness

Subjects

Introduction to low Global Warming Potential GWP refrigerants
Overview of A2L mildly flammable refrigerants
Overview of A3 highly flammable refrigerants
Basic physical and chemical characteristics of A2L and A3 refrigerants
Understanding flammability risks and associated hazards
Proper handling, storage procedures for flammable refrigerants
Regulatory guidelines and safety standards for A2L and A3 refrigerants
Personal protective equipment PPE requirements
Leak detection and emergency response awareness
Safe installation and service practices
Increased safety measures compared to non-flammable refrigerants
Summary of best practices for working safely with flammable refrigerants

Customer Relations – Based on MSCA Program

Subjects

Customer Relations
Appearance
Work Habits
Service Procedures
Listening to the Customer
Explaining Repairs
Do's & Don'ts

3rd Year

Control Theory

Subjects

- General Control Theory
- Basic types of control systems
- Definitions of Terms
- Control Action
- On / Off Control
 - Conventional Thermostats
 - Heat Anticipation
- Reset control
- Energy sources
- Mode of control
- Controllers
- Dual input controls

Servicing & Electrical Troubleshooting

Subjects

- Electrical Safety
- Reading & Interpreting Wiring Schematics
- Sequence of Operation
- Servicing Procedures
- Troubleshooting Electrical Circuits
- Problem Solving

New Technologies

Subjects

- Fundamental
- Mechanical

3rd Year continued

Refrigeration and A/C III

Subjects

Liquid metering devices, including fixed orifice, cap tube, piston, TXV, TEV, EEV, and automatic valves
Total superheat and subcooling charging methods
TXV and TEV operating forces, bulb charges, and nomenclature
OEM manufacturer training resources from Parker, Sporlan, Alco, Danfoss, and others
Application of powerheads and field-assembled Q and BQE body kits
Electronic expansion valves and head pressure controls
Low ambient control logics and types
Flooded condenser winter and summer charging calculations
Specialized refrigeration differential valve terminology and applications including ORI, ORD, ORO, CPR, EPR, SORIT, ORIT, and LLS valves operation
AC Hot gas bypass and refrigeration hot gas defrost
Compound compressor and rack systems
Refrigeration piping practices
Year-appropriate troubleshooting lab stations

Crane & Rigging

Subjects

Safety
Knots & Hitches
Slings, Sizes, & Selection
Shackles & Pins
Crane Signals
Crane Awareness

4th Year

Hydronics

Subjects

- Types of Systems
- Definition of Terms
- System pressures & relief valves
- Filling a system
- Air in water / expansion tanks
- System Accessories
 - PRV valve / Flo-control valve
- Piping
- Pumps & GPM calculations
- Properties of Natural Gas
- Combustion & Flame characteristics
- Natural Gas Burners
- Metering Natural Gas & Gas pressures
- Gas Venting
- Gas pipe pressure testing
- Pipe sizing
- Primary/Secondary Loop System
- Gas Line Sizing
- Combustion, Electrical, Gas, and Water Side Safety

Electro Mechanical Principles (AC&R)

Subjects

- Transformers / VA calculations
- Motor Controllers
- NEMA Ratings
- Thermal OL Protection
- Lockout / Reset Relays
- Copeland Compressors
 - Terminal Plate Connections
 - Model Number ID
 - Electronic Motor Protectors
 - Robertshaw
 - Texas Instruments
 - Scroll Compressor
 - Discus Compressor
- Carlyle (Carrier) Compressors
 - 06D / 06E
 - Familiarization & Service
- Capacity Control
 - Hot Gas
- Oil Failure Controls
 - Copeland Sentronic Pump / Control
- Control Settings
- Typical Conditions AC&R
- Troubleshooting AC&R
- Manufacturers apps in the classroom & shop
- Compressor Diagnosis
- Defrost
- Specialty Refrigeration Components

4th Year continued:

Oil Heat

Subjects

- Combustion Theory
- Oil Supply Systems
- Piping Systems
- Fuel Pump Units
- Types of Burners
- High Pressure Gun Type Burners
- Oil Nozzles
- Staging of Combustion

Heat Pump Fundamentals

Subjects

- Heat Pump Cycle
 - Review refrigeration cycle
 - Refrigerant Flow reversal
 - Piping Arrangement
- Heat Pump Classification
 - Air to Air / Water to Air
 - Geothermal (Ground Source) Heat Pumps
- Heat Pump Components
 - Coils / Compressors / Reversing Valve / Accessories
- Reversing Valve
 - How it works / operation
 - Parts of the Reversing Valve
 - Troubleshooting Reversing Valve
- Defrost Mode (Air Source HP's)
 - Defrost controls
- Ground Source Heat Pumps
 - Types of Systems (Open or Closed Loop)
 - Refrigeration Piping Arrangements
 - Domestic Hot Water Heating
- Heat Pump Servicing Guidelines
- Ductless Multi-Zone (Daikin & Mitsubishi)
- Basic Wiring

5th Year

Advanced A/C Principals - Applied Systems

Subjects

Fundamentals & Properties of Air
Air Quality
Infiltration, Ventilation, & Virus
Calculating Outdoor Air
Human comfort
Air Distribution - Ducts & accessories
Economizers
History & Future of Controls
Automatic Controls – New Technologies
Computer Room Applications in HVAC
Heat Load Calculation (Basic)
Psychrometrics
Turbocor
CO2
New ASHRAE Standards

Building Automation Fundamentals

Subjects

Digital direct control DDC systems and architecture
Understanding inputs and outputs in control systems
Low voltage polarity and wiring
Discrete binary and pulse width modulation PWM signals
Analog signals including VDC and mA standards
Difference between analog and digital signals
Control system logic and programming fundamentals
Networking communication protocols including BACnet LonWorks Mod bus and BACnet over IP
Field wiring practices and installation standards
Specialized tools such as tracers tone generators signal generators current sync loops and specialized meters
Active shop assignments and hands-on exposure
Developing point and equipment lists and a sequence of operations for system design
Student presentations demonstrating project understanding and practical application

5th Year Continued

Chilled Water Systems

Subjects

- Centrifugal Systems
 - Expansion Devices for Flooded Evaporators
 - Centrifugal Compressors
- Screw Chiller Technology
 - Trane Helical Rotary
 - Carrier 30 GX, HX
 - Sequence of Operation & Checkout
- VAV Box
 - Operation & Service
- Understanding Electronic Controls
 - Variable Speed Controls
- Air Flow System Layout
- Chilled Water & Hot Water System Piping Layouts
- Pump components and understanding pump detail
- Terminal Unit Piping