

# UA-NJ Air Conditioning & Refrigeration Division Training Curriculum

## 1st Year

### Basic Mathematics for HVAC

#### 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

#### 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

1<sup>st</sup> 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

Copper Tube Soldering & Brazing

Subjects

- Safety
- Copper Tube
- Soldering & Brazing Equipment
- Acetylene Tank Safety
- Filler Alloys & Fluxes
- Soldering copper tube
- Brazing copper tube
- Nitrogen use & Regulator Safety
- Pressure Testing for Leaks

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.

## 2nd Year

### EPA Refrigerant Handling Certification Test Preparation

#### Subjects

- Certification Procedure
  - Test content outline
  - Types of Certification
- Refrigerants
  - History
  - Chemical Structure
  - Types of Refrigerants
- Environmental Issues
  - Ozone
  - Human Hazards
  - EPA Regulations - Clean Air Act
- Refrigerant Safety
- Three R's
  - Recover / Recycle / Reclaim
- Recovery Requirements & Techniques
- Refrigerant Leaks
  - Detection
  - Repair Requirements
- EPA Certification Test Outline - Internet EPA Site Access
- Mid-term UA-EPA Certification Test

### 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

2<sup>nd</sup> Year continued

Refrigeration II - Operation & Service

Subjects

Condensers

Evaporative type

Water cooled

Air Cooled

Evaporators

Dry expansion

Flooded

Compressors

Reciprocating / Scroll / Rotary / Screw / Centrifugal

Reciprocating Compressors

Construction

Failure causes

Tear-down

Autopsy of a Compressor (complete program)

## 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
- PI controls
- PID controls

### Servicing & Electrical Troubleshooting

#### Subjects

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

### Customer Relations – Based on MSCA Program

#### Subjects

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

3<sup>rd</sup> Year continued

Refrigeration III (Commercial)

Subjects

- Expansion Devices, TXV
  - Purpose
  - Construction
  - Operation
  - Types
  - Bulb Charges
  - Distributors
  - Servicing
- Manufacturers
  - Sporlan
  - Alco
  - Danfoss
- Application of Bulb Charges
- Balanced Port TEV
- Electronic Expansion Valves
- Head Pressure Controls
  - Head Master
  - ORI
  - ORD
  - ORO
- Troubleshooting Iced Evaporators
- Defrost Controls
- CPR, EPR, Sorit, Orit, CDA Valves
  - Operation and Adjustments
- Oil Pump Operation
- Troubleshooting Oil Problems
  - Oil Floats
  - Oil Separators
- Compressor Maintenance & Service
- Hill Parallel Compressor (Rack) System
  - Start up
  - Operation
  - Electronic Expansion Valves
  - EPR
  - Hot Gas Valves
  - Oil Failure Control
  - Control Wiring
- Refrigeration Piping Practices

## 4th Year

### Natural Gas Heating

#### Subjects

- Properties of Natural Gas
- Combustion & Flame characteristics
- Natural Gas Burners
- Metering Natural Gas & Gas pressures
- Gas Venting
- Gas pipe pressure testing
- Pipe sizing

### 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

### Mechanical / Electrical Systems & Devices

#### 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

4<sup>th</sup> 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

Rigging

Subjects

- Safety
- Knots & Hitches
- Slings Sizes & Selection
- Shackles & Pins
- Crane Signals

On-line Class: 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



## 5th Year

### AC Applications & Theory

#### Subjects

- Fundamentals & Properties of Air
- Infiltration & Ventilation
- Calculating Outdoor Air
- Human comfort
- Air Distribution - Ducts & accessories
- Types of fans
- Measuring CFM & pressure
- Automatic Controls
- Computer Room Applications in HVAC

### Building Automation Fundamentals

#### Subjects

- Hardware & Software
- Inputs & Outputs
- Networks and Devices
- Communications
- Programming Introduction (Basic)
- Internet Resources

### Applied Systems

#### Subjects

- Centrifugal Systems
  - Expansion Devices for Flooded Evaporators
  - Centrifugal Compressors
  - Carrier 32 MP Microprocessor Control
- Screw Chiller Technology
  - Trane Helical Rotary
  - Carrier 30 GX, HX
- Honeywell W973 Control
- Honeywell W7100 Control
  - Economizers
  - Sequence of Operation & Checkout
- Barber Colman HVP Type VAV Box
  - Operation & Service
- VVT System (Carrier) Overview & Familiarization
- Understanding Electronic Controls
  - Micro Processors
  - Variable Speed Controls

5<sup>th</sup> Year Continued

Advanced A/C Principles

Subjects

Steam Technology  
Chemical dehumidification  
Heat Recovery systems  
Make-up air units  
Economizers

Pneumatics

Subjects

Air Station  
Function of Air Station  
Air Filtration  
Pressure Regulators  
Thermostats  
Controllers  
Sensors  
Transmitters  
Receiver Controllers  
Switches & Relays  
Controlled Devices