TPC – Air Conditioning and Refrigeration – Virtual and In-Person Syllabus

DESCRIPTION

Students are taught common practices and some "tricks-of-the-trade" for general operation and maintenance of their AC&R systems. They will learn about maintenance schedules and servicing, system diagnostics, troubleshooting, and fine-tuning to gain maximum efficiency. The course also covers an introduction to commercial and industrial chillers, regulatory laws and energy conservation. Overall, we will help you get the maximum life out of your Air Conditioning and Refrigeration systems while keeping it up and running as efficiently and consistently as possible.

COURSE OUTLINE

Day One - Discussion Topics

Fundamentals of AC&R

- Air Conditioning versus Refrigeration
- Laws of Thermodynamics and Heat Transfer

Regulation, Codes and Standards

- New Energy Efficiency Standards (S.E.E.R.)
- EPA Section 608 of the Clean Air Act
- ASHRAE, ASME
- Technician Licensing, Testing and Certification

Compression Refrigeration Cycle

- Saturation, Superheat, and Subcool
- Basic System Design
- Follow-the-Heat™

Refrigerants

- CFCs, HCFCs, HFCs, Inorganics
- Zeotropic and Azeotropic Refrigerant Mixtures
- Refrigerant Safety Including R-410a

Refrigerant Oils

- MO, AB, POE, PAG, PAO Oils & Properties
- Maintaining Oil Quality in Your AC&R System

Major AC&R System Components

- Evaporator
- Compressor
- Condenser
- Metering (Expansion) Device

Day Two - Discussion Topics

Auxiliary System Components

- Crankcase Heater
- Suction Accumulator
- Receiver
- Filter-Drier
- Sight Glass with Moisture Indicator
- Oil Separator
- Service Valves
- Muffler
- Refrigerant Controls

Refrigeration Systems

- Air, Water, and Ground-Source Heat Pumps
- Commercial Refrigeration
- Other specialty refrigeration systems

System Diagnostics, Servicing & Troubleshooting

- Service Tools and Equipment
- Manifold Gauge Set
- Recovery Machine
- Vacuum Pump
- Micron Gauge
- Leak Detection Equipment
- Recovering Refrigerant
- Charging the AC&R System
- Diagnosis, Common Failures, and Remedies
- Energy Conservation & Operating Efficiency

The EPA 608 exam is available to be taken at the conclusion of the class.

EPA 608 Technician Certification Testing

Section 608 of the Federal Clean Air Act requires that all persons who maintain, service, repair or dispose of appliances that contain regulated refrigerants be certified in proper refrigerant handling techniques by passing the EPA 608 Technician Certification exam. The EPA 608 exam is included in this course and is administered virtually after completing the training. Attendees are not required to take the exam for the successful completion of the course. While we cover material relevant to the test over the course of the training, this course is not designed to specifically prepare you to take the exam. We highly recommend that attendees who want to take the exam attend both days of training and take time to study beforehand. We will email out the EPA 608 study guide to all course registrants the day after registration to give you ample time to prepare. You can also request a copy of the study guide by sending an email to testing@tpctraining.com

Click here for more information on the EPA 608 Technician Certification Exam

TPC – Chilled Water Systems – Virtual and In-Person Syllabus

DESCRIPTION

Students will learn about components used in chilled water systems, uses and applications of chilled water systems among many other things. This seminar is perfect for anyone looking to increase their knowledge about chillers, cooling towers and other chilled water systems.

COURSE OUTLINE

Day One - Discussion Topics

Day One examines the basics of chilled water systems including chillers and cooling towers. We'll do an overview and review heat theories so students understand why things happen.

Chilled Water Systems Overview

- Introduction
- Component tasks
- System design
- Controls
- Codes and standards

Heat Transfer Theory

- Properties of matter: solid, liquid, vapor
- Laws of Thermodynamics
- Heat transfer theory:
    - Conduction
    - Convection
    - Radiation
    - Evaporation
- Principles of heat and temperature measurement
- British thermal unit, specific heat
- Sensible heat latent heat, superheat
- Gas laws
- Atmospheric pressure, vacuum
- Pressure/temperature and pressure/volume relationships

Compression Refrigeration Cycle

- Refrigeration cycle, change of state of refrigerant

- Heat transfer within the refrigeration cycle
- Follow-the-heat™

Day Two - Discussion Topics

Day Two introduces advanced topics such as refrigerants and equipment components, heat rejection systems and principles of heat movement.

Refrigerants

- Refrigerant composition, including new blends
- Refrigerant oils
- Refrigerant handling: recovery, recycling, reclamation

Equipment Components

- Compressors: reciprocating, scroll, screw, rotary, centrifugal
- Evaporators: tube-in-shell, tube-in-tube, coil-in-shell
- Condensers: water-cooled, air-cooled, evaporative
- Metering devices:
- Thermostatic expansion valve
- Electronic expansion valve
- High and low side floats
- Auxiliary refrigeration equipment

Heat Rejection Systems

- Cooling towers
- Evaporative coolers and condensers, heat exchangers
- Cooling tower operation and maintenance
- Water chemistry for open and closed re-circulating systems
- Glycol systems and fluids

Psychrometrics

- Principles of air movement
- Wet-bulb and dry-bulb temperatures
- Relative humidity and dew point temperatures
- Psychrometric chart exercises

TPC – HVAC Electrical Controls & Air Distribution – Virtual and In-Person Syllabus

DESCRIPTION

Designed for any worker involved in air distribution systems, this seminar will take students from the basics of HVAC electrical controls through air distribution and troubleshooting.

Overall, this HVAC Electrical Controls & Air Distribution training program is designed to teach students how to "control" their electrical controls and use fundamental air distribution principles for achieving consistent HVAC comfort and efficiency in buildings, plants and facilities.

COURSE OUTLINE

Day One - Discussion Topics

HVAC system problems can be divided into three major categories - Air Distribution, Electrical or Mechanical. The part that causes most service headaches is the electrical portion and most of that can be traced back to control problems. So day one of this Electrical Controls & Air Distribution seminar concentrates on overcoming the most common service problems encountered in HVAC systems by teaching students to understand, troubleshoot and test HVAC electrical controls.

Basic Electricity

- Basic electricity & Ohm's Law
- Meters & tools for taking electrical measurements
- Electrical circuits: series & parallel

Control Circuits

- Schematics
- Ladder Diagrams
- Developing Wiring Diagrams

Controls

- Overloads
- Relays
- Contactors
- Control Transformer
- Starting Relay
- Defrost Timer
- Thermostat
- High Pressure Control
- Low Pressure Control
- Oil Pressure Control

Troubleshooting

- General Troubleshooting Techniques
- Common Problem Areas
- Commercial Air Conditioning
- Heat Pump Control
- Pump Down Cycle

Day Two - Discussion Topics

Many common problems found in HVAC systems are relatively easy to correct, but are often overlooked. These problems are not electrically related at all even though many times we can get tricked into thinking they are. Yet a non-electrical problem can be as frustrating to find and fix as an electrical one, and may be even more discomforting to the people who have to live with it. So in day two of this Electrical Controls & Air Distribution training program we'll help you eliminate the complaints of "too hot", "too cold", "not enough air" or "I feel a draft", by concentrating on the most often overlooked and ignored problems in HVAC systems – the "V" in "HVAC" – or ventilation, air distribution and air balancing!

Determining and Improving Air Flow

- 400 cfm per ton
- How many square feet per ton?
- Air mixture at the cooling coil

Exhaust Air

- Positive pressure
- Negative pressure

Make-Up Air

- Positive pressure
- Negative pressure
- Conditioning the "make up" air

Troubleshooting the Air Distribution System

- Temperature difference across the coil
- Balance in the system
- Short cycling
- Duct sizing
- Noise
- How to use a Ductulator

TPC – Variable Frequency Drives (VFDs) – Virtual and In-Person Syllabus

DESCRIPTION

Students will learn how to improve VFD control and efficiency, troubleshoot and fix VFDs, reduce equipment downtime, and eliminate chronic VFD problems. Students will perform hands-on activities with a real-life variable frequency drive. Students will input motor data into the variable frequency drive, set parameters for speed control and overcurrent protection, and check fault codes. Students will complete this VFD training course with the ability to lower the cost of VFD operation, thus alleviating the need for hiring costly outside service contractors, all while establishing a culture of safe work practices among employees.

COURSE OUTLINE

Day One - Discussion Topics

VFD Safety Review

- Electrical Hazards
- Establishing an Electrically Safe Work Condition
- Personal Protective Equipment & Insulated Tools

Electrical Basics Review

- Multimeter, Clamp-On, Megohmmeter
- Single Phase and Three Phase Motors
- Motor Troubleshooting and Replacement
- Basic Control Circuits & Troubleshooting

What VFDs Do

- Motion Control / Motor Speed
- Air Flow / Liquid Flow / Pressure Control
- Eliminates the need for:
    - Variable Transmission or Sheave
    - Variable Vanes or Dampers on Fans
    - Variable Valves on Pumps

Benefits of Using a VFD

- Energy Savings
- Easier Maintenance
- Enhanced System Monitoring

Load Types

- Constant Torque – Conveyors, Positive Displacement Pumps, Superchargers
- Variable Torque – Centrifugal Fans or Pumps, Saws, Routers, Planers

VFD Options

- Bypass – Two or Three Contactor Style, Disconnect Switch Style, Soft Starter
- Fusing – VFD or Bypass Protection
- Input / Output Reactors
- Motor Overload Device
- Transient Protection
- Auxiliary Relays
- Power Line Phase Reversal Detection

Day Two - Discussion Topics

Installation of a VFD

- Environmental Concerns
- Clearances
- Conduit Entry

Customer Connections

- Safety Circuit
- Start / Stop
- Jog
- Status Indication
- Fault Indication
- Remote Speed Reference
- Monitoring of Motor Parameters

Wiring & Grounding VFDs

- Induced Signals
- Inductive, capacitive
- Incoming Power (line) Wiring
- Motor (load) Wiring
- Control Wiring
- Proper Grounding Methods

Controlling a VFD

- Keypad Controls
- Terminal Strip Control – Automatic, Manual
- Bus Communication Control
- Open Loop Control
- Manual Operation
- Automatic Operation
- Sensorless Flux Vector
- Closed Loop Control
- PI Loop Configuration
- Sensor or Transducer Feedback
- Motor Shaft Encoder Feedback

VFD Setup, Programming, & Troubleshooting

- Language & Display

- Control Modes
- Open Loop, Closed Loop
- Motor Data
- Power (kW) and RPM
- Voltage, FLA Current
- Service Factor, Power Factor
- References & Limits
- Motor Speeds – Min, Max and Preset
- Ramp Times
- Speed Reference
- Skip Frequencies
- Limits for Alarms or Faults
- Inputs / Outputs – Analog, Digital, and Relay
- Application Functions
- Reset
- Flying Start
- Sleep Mode
- Switching Frequency
- No Load
- Phase Loss
- Closed Loop Functions
- Normal / Inverse
- Anti Windup
- Start-up Frequency
- Lowpass Filter