HVAC

Duration: 2 Months | QP Code: ELE/Q3112

Module 1: Environment, Health & Safety — 16 hrs

Safety is an essential part of HVAC installation, servicing and maintenance. This module develops awareness of electrical, mechanical, refrigerant, fire and workplace hazards.

Topics Covered:

- Understand basic occupational health and safety requirements.
- Identify common hazards at HVAC work sites.
- Use PPE such as safety shoes, gloves, goggles, helmets and safety belts.
- Electrical safety while working on AC and refrigeration equipment.
- Safe handling of refrigerants and refrigerant cylinders.
- Safe use of ladders and hand tools.
- Fire safety and emergency procedures.
- Safe handling of pressure and compressed gases.
- Proper housekeeping and workplace cleanliness.
- Safe lifting, carrying and handling of HVAC equipment.
- First-aid awareness and accident reporting.
- Maintain safe working posture and workplace discipline.

Practical Training:

- PPE identification and correct usage.
- Safety inspection of an HVAC work area.
- Identification of electrical and refrigerant hazards.
- Fire extinguisher and emergency-safety demonstration.
- Safe handling of tools, cylinders and ladders.

Module 2: Introduction to HVAC & Refrigeration Fundamentals — 32 hrs

This module introduces the basic principles of heating, ventilation, air conditioning and refrigeration required for understanding HVAC systems.

Topics Covered:

- Introduction to HVAC and refrigeration.
- Applications of air conditioning and refrigeration.
- Basic terminology used in the HVAC industry.
- Heat, temperature and pressure.
- Sensible heat and latent heat.
- Relative humidity and humidity control.
- Basic psychrometric concepts.
- Temperature and pressure measurement.
- Units used in HVAC and refrigeration.
- Refrigeration effect and coefficient of performance.
- Basic refrigeration cycle.

- Compressor, condenser, expansion device and evaporator.
- Function of each refrigeration component.
- High-side and low-side of a refrigeration system.
- Refrigeration cycle on pressure-temperature conditions.
- Introduction to refrigerants.
- Refrigerant identification and basic properties.

Practical Training:

- Identification of refrigeration components.
- Identification and use of temperature and pressure measuring instruments.
- Demonstration of a basic refrigeration cycle.
- Reading suction and discharge pressure.
- Identification of high-side and low-side components.
- Basic refrigeration-cycle observation on a working machine.

Module 3: Basic Electrical & Electrical Controls for HVAC

40 hrs

This module provides the electrical knowledge required for installation, operation, maintenance and troubleshooting of HVAC equipment.

Topics Covered:

- Fundamentals of electricity.
- Voltage, current, resistance and power.
- AC and DC electrical systems.
- Single-phase and three-phase supply.
- Electrical symbols used in HVAC.
- Understanding electrical wiring diagrams.
- MCB, MCCB, fuse and overload protection.
- Contactor and relay.
- Capacitor and its applications.
- Thermostat and temperature sensors.
- Motors used in HVAC equipment.
- Single-phase and three-phase motors.
- Fan motors and blower motors.
- Compressor electrical connections.
- Basic control circuits.
- Electrical safety and isolation procedures.
- Use of multimeter and clamp meter.
- Continuity, voltage, current and resistance testing.
- Basic electrical fault finding.

Practical Training:

- Identification of electrical components.
- Making basic electrical connections.
- Testing capacitor health.
- Checking motor winding resistance.
- Checking compressor terminals.
- Testing contactor, relay, fuse and overload.
- Measuring voltage and current.
- Reading and tracing an AC electrical circuit.
- Identifying common electrical faults.
- Basic troubleshooting of an HVAC control circuit.

Module 4: Refrigeration System & Refrigerant Practices — 48 hrs

This module develops practical knowledge of refrigeration systems, refrigerant handling, evacuation, charging, recovery and piping practices.

Topics Covered:

- Detailed refrigeration cycle.
- Compressor types and applications.
- Condenser types.
- Evaporator types.
- Expansion devices.
- Capillary tube and thermostatic expansion valve.
- Electronic expansion valve – basic introduction.
- Filter drier and sight glass.
- Accumulator and receiver.
- Refrigerant piping and fittings.
- Refrigerant pressure and temperature relationship.
- Superheating and subcooling.
- Refrigerant charging methods.
- Refrigerant recovery.
- Vacuuming and dehydration.
- Leak detection methods.
- Refrigerant cylinder handling.
- Refrigerant charging by weight.
- Charging based on system requirements.
- Basic refrigerant safety and environmental awareness.

Practical Training:

- Copper pipe cutting and preparation.
- Flaring and swaging.
- Pipe bending.
- Brazing practice.
- Nitrogen purging during brazing.
- Leak testing.
- Vacuum pump operation.
- Vacuuming of refrigeration systems.
- Manifold gauge operation.
- Refrigerant charging practice.
- Refrigerant recovery practice.
- Checking suction and discharge pressure.
- Measuring superheat and subcooling.
- Identification of refrigerant-related faults.

Module 5: Window & Split AC – Installation, Servicing & Troubleshooting — 64 hrs

This module focuses on practical installation, servicing, maintenance and troubleshooting of commonly used residential air-conditioning systems.

Topics Covered:

- Construction and working of Window AC.
- Construction and working of Split AC.

- Indoor and outdoor unit components.
- Compressor and condenser operation.
- Evaporator and blower operation.
- Fan motors.
- Expansion devices.
- Air filters and drainage system.
- Installation requirements.
- Indoor unit installation.
- Outdoor unit installation.
- Copper pipe installation.
- Drain pipe installation.
- Electrical connection.
- Refrigerant piping practices.
- Vacuuming and leak testing.
- Refrigerant charging.
- AC commissioning.
- Airflow and temperature checking.
- Preventive maintenance.
- Cleaning of indoor and outdoor units.
- Coil cleaning.
- Filter cleaning.
- Drainage-system cleaning.
- Common electrical faults.
- Common refrigeration faults.
- Common airflow faults.
- Compressor-related faults.
- Refrigerant leakage and low-charge symptoms.
- Troubleshooting using pressure, temperature and electrical measurements.

Practical Training:

- Window AC component identification.
- Split AC indoor and outdoor unit identification.
- Split AC installation demonstration.
- Copper pipe cutting, bending and joining.
- Flaring and swaging.
- Brazing.
- Vacuuming and leak testing.
- Refrigerant charging.
- Indoor unit servicing.
- Outdoor unit servicing.
- Condenser and evaporator cleaning.
- Drain-line servicing.
- Electrical testing.
- Compressor testing.
- Fault simulation and troubleshooting.
- Complete AC servicing and commissioning.

Module 6: Ductable AC, Cassette AC, AHU & Basic Ducting **48 hrs**

This module provides basic knowledge and practical exposure to commercial air-conditioning equipment and air distribution systems.

Topics Covered:

- Introduction to commercial air conditioning.
- Basic working of ductable AC.
- Ductable indoor and outdoor units.
- Components of ductable AC.
- Basic working of cassette AC.
- Cassette AC components and installation requirements.
- Air Handling Unit (AHU).
- Basic AHU components.
- Blower and fan systems.
- Cooling coil.
- Filters and dampers.
- Fresh-air and return-air concepts.
- Supply and return air.
- Basic ducting principles.
- Types of ducts and insulation.
- Duct fittings and accessories.
- Air distribution and airflow.
- Basic duct leakage and insulation awareness.
- Servicing and maintenance of commercial AC systems.

Practical Training:

- Identification of AHU components.
- Cassette AC component identification.
- Ductable AC component identification.
- Filter and coil inspection.
- Blower inspection.
- Basic duct measurement.
- Duct fitting and air-distribution demonstration.
- Drainage-system inspection.
- Basic servicing of commercial AC equipment.
- Airflow and temperature measurement.

Module 7: Basic VRF/VRV System

40 hrs

This module introduces modern variable refrigerant flow systems used in residential, commercial and industrial applications.

Topics Covered:

- Introduction to VRF/VRV technology.
- Difference between conventional split AC and VRF.
- Basic VRF system architecture.
- Outdoor unit components.
- Indoor unit types.
- Cassette, ducted and wall-mounted indoor units.
- Compressor and inverter technology.
- Electronic expansion valves.
- Refrigerant piping system.
- Branch joints and headers.
- Communication wiring.
- Refrigerant flow control.

- Basic control system.
- Indoor and outdoor PCB overview.
- Sensors and temperature monitoring.
- Basic VRF commissioning procedure.
- Refrigerant charging and recovery.
- Basic VRF troubleshooting.
- Common communication and sensor faults.
- Error codes and fault identification.

Practical Training:

- Identification of VRF outdoor-unit components.
- Identification of different indoor units.
- Refrigerant piping identification.
- Branch joint and header identification.
- Communication wiring identification.
- Basic parameter checking.
- Reading operating pressures and temperatures.
- Error-code identification.
- Basic VRF troubleshooting.
- Demonstration of VRF commissioning procedure.

Module 8: Commissioning, Testing & Advanced Troubleshooting **56 hrs**

This module integrates the knowledge acquired during the course and develops systematic troubleshooting and commissioning skills.

Topics Covered:

- Pre-commissioning inspection.
- Installation-quality inspection.
- Electrical inspection.
- Refrigeration-system inspection.
- Pressure testing.
- Vacuum testing.
- Refrigerant charging verification.
- Electrical parameter checking.
- Operating-pressure measurement.
- Temperature measurement.
- Airflow checking.
- Superheat and subcooling checking.
- Compressor performance checking.
- Condenser and evaporator performance.
- Preventive maintenance procedures.
- Breakdown maintenance.
- Systematic troubleshooting methodology.
- Electrical fault diagnosis.
- Refrigeration fault diagnosis.
- Airflow-related faults.
- Drainage-related faults.
- Sensor and control faults.
- Compressor-related faults.
- Refrigerant leakage diagnosis.

- Low cooling and no-cooling complaints.
- Abnormal noise and vibration.
- High and low operating pressure conditions.
- Fault identification using instruments.
- Preparing service and maintenance reports.

Practical Training:

- Complete AC inspection.
- Electrical parameter measurement.
- Refrigeration pressure measurement.
- Temperature measurement.
- Leak testing.
- Vacuum testing.
- Refrigerant recovery and charging.
- Superheat and subcooling measurement.
- Preventive maintenance.
- Fault simulation.
- Systematic troubleshooting.
- Complete commissioning of an AC system.
- Preparation of service report.
- Real-machine troubleshooting practice.

Module 9: Workplace Communication & Employability Skills **16 hrs**

This module prepares trainees for employment in HVAC installation, servicing, maintenance and facility-management organizations.

Topics Covered:

- Workplace communication.
- Basic technical English used in HVAC.
- Communication with customers and supervisors.
- Workplace discipline and professional behaviour.
- Time management.
- Teamwork.
- Problem solving and decision making.
- Basic interview preparation.
- Resume/CV awareness.
- Understanding HVAC job roles.
- Basic customer-service etiquette.
- Reporting and documentation.
- Workplace etiquette.

Practical Training:

- HVAC technical vocabulary practice.
- Mock interview.
- Customer complaint handling.
- Job-site communication practice.
- Preparation of basic service reports.
- Workplace role-play activities.
- Practical & Industrial Exposure.