



GOVERNMENT OF INDIA  
MINISTRY OF SKILL DEVELOPMENT & ENTREPRENEURSHIP  
DIRECTORATE GENERAL OF TRAINING

**COMPETENCY BASED CURRICULUM**

# REFRIGERATION AND AIR CONDITIONING TECHNICIAN

(Duration: Two Years)

**CRAFTSMEN TRAINING SCHEME (CTS)**

**NSQF LEVEL- 5**



**SECTOR – CAPITAL GOODS & MANUFACTURING**



Directorate General of Training

# REFRIGERATION AND AIR CONDITIONING TECHNICIAN

(Engineering Trade)

(Revised in 2019)

Version: 1.2

**CRAFTSMEN TRAINING SCHEME (CTS)**

**NSQF LEVEL - 5**

Developed By

Ministry of Skill Development and Entrepreneurship

Directorate General of Training

**CENTRAL STAFF TRAINING AND RESEARCH INSTITUTE**

EN-81, Sector-V, Salt Lake City,

Kolkata – 700 091

[www.cstaricalcutta.gov.in](http://www.cstaricalcutta.gov.in)

## 1. COURSE INFORMATION

---

During two-year duration of “Refrigeration and Air Conditioning Technician” trade a candidate is trained on professional skill, professional knowledge and Employability skill related to job role. In addition to this a candidate is entrusted to undertake project work, extracurricular activities and on job training to build up confidence. The broad components under Professional Skill subject are as below: -

**FIRST YEAR:** The trainee learns about personal safety and machinery safety, manipulating tools, instruments and equipment in refrigeration workshop. The trainee is able to perform fitting and sheet metal works related to repair refrigeration and air conditioning equipment. The trainee is able to work in electrical area to measure current, voltage, resistance and able to connect star and delta connections. The trainee is able to check and rectify the electrical defects in refrigerators. He will be able to identify the electronic components in refrigerator and rectify the defects. The trainee is able to operate gas welding machines for brazing in refrigeration systems. The trainee shall be able to repair, maintenance, Install, servicing, trouble shooting, fault detection, leak testing and gas charging, diagnosis & remedial measures in Refrigerator (Direct cool), Frost free refrigerator and Inverter technology Refrigerator.

The trainee shall be able to identify different compressor, dismantling and assembling compressors. The trainee shall be able to start the motor through DOL, Star Delta starter and changing DOR. The trainee shall be able to service condensers. The trainee shall be able to fix refrigerant controls and service evaporator. The trainee shall be able to Recover and Recharge of Refrigerant used in systems, transfer & handling of gas cylinders. The trainee shall be able to Retrofit CFC/HFC machine with ozone friendly refrigerant. The trainee shall be able to fix thermal insulation. The trainee shall be able to install window AC, test Electrical, electronic components, Fault diagnosis & remedial measures in window A.C. The trainee shall be able to Install, servicing, trouble shooting, fault detection, leak testing and gas charging in Split A.C (wall mounted), Split A.C (floor, ceiling /cassette mounted Split A.C), Split A.C ( ducted ), multi Split A.C and Inverter Split A.C. The trainee shall be able to Installation, servicing, trouble shooting, fault detection, leak testing and gas charging in Car Air Conditioner.

**SECOND YEAR:** The trainee learns about different commercial compressor and its dismantling, assembling, fault finding and rectification. They will be able to descaling in water cooled condensers, Evaporative condenser and Cooling tower, Selection of Expansion valves and its installations, Service air cooled evaporator and blower. The trainee shall be able to Install, service, maintenance, trouble shooting, fault finding and rectification, leak testing, evacuation and gas charging, electrical circuit repairing in water cooler & water dispenser, visible cooler, bottle cooler, deep freezer / display cabinet, ice cube machine and softy machine. They will be able to Service, operate, test electrical controls, test leak, evacuation and gas charging ,

Periodic maintenance in Ice candy plant, Ice plant, walk in cooler & reach in cabinet and cold storage.

The trainee learns about HVAC (study of psychrometry, blowers& fans, static and velocity pressure measurements). The trainee shall be able to make duct designing, duct making, insulating in ducts. The trainee shall be able to clean and fix air filters. The trainee shall be able to identify various components, Leak testing, evacuation, gas charging, Commissioning and troubleshooting of package A.C with air- and water-cooled condenser, split package. The trainee shall be able to trace electrical circuit, testing components, gas charging, Servicing AHU including fire dampers, Checking airflow, damper, temperature and pressure, operation, De-scaling condenser and cooling tower of central AC plant (Direct and Indirect). The trainee shall be able to Identify VRF / VRV system, Check and service of VRF / VRV system, connect master unit and IDU, identify the location of ODU, identify the size of piping's and laying work, Check control system and identify error code. The trainee shall be able to service and maintain the mobile A.C (bus, train).

The trainee also undergoes project work and Industrial visit/ In plant training at the end of each year which gives them more practical exposure and helps to build up confidence level.

## 5. LEARNING OUTCOME

---

*Learning outcomes are a reflection of total competencies of a trainee and assessment will be carried out as per the assessment criteria.*

### 5.1 LEARNING OUTCOMES (TRADE SPECIFIC)

#### FIRSTYEAR

1. Identify trade related hazards and safety procedures following safety precautions.
2. Produce fitting jobs as per drawing (Range of operations: marking, sawing, filing, drilling, reaming, taping and dieing etc.).
3. Produce Sheet metal components (range of operation – marking, metal cutting, bending, riveting and soldering etc.).
4. Identify electrical safety. Join different wire, measure power, currents, volts and earth resistance etc. Connect single phase, 3 phase motors i.e. star and delta connections.
5. Identify the electronic components and their colour code i.e. transistor, capacitor, diode, amplifier, I.C and able to work soldering.
6. Perform gas welding, brazing, soldering observing related safety.
7. Identify RAC tools and equipment and recognise different parts of RAC system. Perform copper tube cutting, flaring, swaging, brazing.
8. Test mechanical & electrical components. Perform leak test, vacuuming, gas charging, wiring & installation of refrigerator.
9. Perform door alignment, door gasket fitting, replace door switch.
10. Test compressor motor terminal, start compressor Direct with relay & without relay, technique of flushing, leak testing, replacing capillary & filter drier, evacuation & gas charging.
11. Check components of frost-free refrigerator (electrical / mechanical), wiring of frost-free freeze & air distribution in refrigerator sector. Leak detection, evacuators & gas charging.
12. Dismantle, repair and assemble hermetic, fixed and variable speed compressor, and test performance.
13. Identify the terminals of sealed compressor and their wiring and measure current, volts, watts and use of DOL starter with different types of motors
14. Perform selection of Hermetic compressor for different appliances, starting methods, testing controls & safety cut out used in sealed compressor.
15. Identify the components of control system of Inverter A.C and wiring of control system
16. Perform servicing & de-scaling of condenser (internals &externals) used in different appliances

17. Perform fitting & adjustment of drier, filter & refrigerant controls used in different refrigeration system.
18. Perform servicing of different evaporator used in different appliances.
19. Carry out Recovery and Recycling of Refrigerant used, alternative of CFC, HFC re-cover, transfer & handling of gas cylinders.
20. Retrofit CFC/HFC machine with ozone friendly refrigerant with understanding of the compatibility.
21. Pack thermal insulation and prevent cooling leakage.
22. Install window AC, test Electrical & electronics components & Fault diagnosis & remedial measures.
23. Perform servicing of electrical & electronic control test, installation, wiring, fault finding & remedial measures of different split AC.
24. Perform servicing of car AC. Fault diagnosis & remedial measures

## **SECOND YEAR**

25. Carry out servicing, dismantling, checking different parts of different types of commercial compressor, re-placing worn out parts, Check lubrication system. Assemble & check performance.
26. Perform servicing of different types of water-cooled condenser.
27. Perform servicing and performance test of Cooling tower
28. Conduct Servicing, backwash & re-generate Water treatment plant of circulating water.
29. Perform Fitting of expansion valve, adjustment of refrigerant flow according to heat load.
30. Perform servicing of evaporator & chillers.
31. Carry out servicing and retrofit of Water cooler and dispenser.
32. Service, retrofit of visible cooler and bottle cooler and test performance.
33. Conduct servicing of deep freezer and test performance.
34. Install, service, repair, gas charging and testing performance of Ice Cube machine.
35. Repair, servicing & retrofit of ice candy plant.
36. Perform servicing of Ice plant and evaporative condenser.
37. Perform Servicing and preventive maintenance of walk in cooler & cold storage.
38. Study psychrometric chart and measure psychrometric properties using psychrometric, anemometer i.e. DBT, WBT, RH, air flow etc.
39. Perform servicing of motor and blowers used in different air conditioning system.
40. Construct, install, pack thermal and acoustic insulation of different air ducts.
41. Perform servicing and maintenance of different types of air filters.
42. Perform servicing, installation, fault diagnosis and remedial measures on Package AC with Air cooled condenser.

43. Carry out Servicing, installation, fault diagnosis and remedial measures in Package A.C. with water cooled condenser.
44. Identify the various components of central AC test electrical components and make wiring. Servicing of A.H.U, damper, check air flow, De-scaling of condenser and CT servicing.
45. Pump down the system, top up oil and gas and check temperature and pressure.
46. Identify components of DX system. Test components, make wiring of DX system. Test leak and evacuate, gas charge the system and check the performance. Maintenance, trouble shoot and operate the plant.
47. Identify the different parts of VRF/VRV system, check and service VRF/VRV system.
48. Identify different parts of indirect or chillers system. Check components and make wiring, leak test, evacuate and gas charge/ top up. Servicing the plant and trouble shoot.
49. Identify chilled water pipe line. Servicing of dampers, FCU and water control valves.
50. Troubles shoot both Central A.C. plant DX and indirect system. Check different control system, installation of other major components, servicing of all parts including cooling tower and water treatment plant.
51. Perform Servicing, fault diagnosis, repair and maintenance of mobile A.C. leak test, evacuation, gas charging, check magnetic clutch and make wiring. Test performance after start.
52. Perform preventive maintenance of different plants. Maintain log book based on daily operation.