

# MECHANIC (DOMESTIC, COMMERCIAL REFRIGERATION AND AIR CONDITIONING MACHINES)

COMPETENCY BASED CURRICULUM

(Duration: 2 Yrs.)

APPRENTICESHIP TRAINING SCHEME (ATS)

NSQF LEVEL- 5



SECTOR – CONSTRUCTION, CONSTRUCTION MATERIAL  
AND REAL ESTATE



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

# **MECHANIC (DOMESTIC, COMMERCIAL REFRIGERATION AND AIR CONDITIONING MACHINES)**



**APPRENTICESHIP TRAINING SCHEME (ATS)**

**Skill India**  
**NSQF LEVEL - 5**  
कौशल भारत - कुशल भारत

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

## **ACKNOWLEDGEMENT**

The DGT sincerely expresses appreciation for the contribution of the Industry, State Directorate, Trade Experts and all others who contributed in revising the curriculum. Special acknowledgement to the following industries/organizations who have contributed valuable inputs in revising the curricula through their expert members:

Special acknowledgement is extended by DGT to the following expert members who had contributed immensely in this curriculum.

**Co-ordinator for the course:** Sh. N. Nath, ADT, CSTARI- Kolkata

| <b>Sl. No.</b>                                                          | <b>Name &amp; Designation<br/>Shri/Mr./Ms.</b> | <b>Organization</b>  | <b>Mentor Council<br/>Designation</b> |
|-------------------------------------------------------------------------|------------------------------------------------|----------------------|---------------------------------------|
| <b>Expert group on restructuring of Apprenticeship Training Modules</b> |                                                |                      |                                       |
| <b>1.</b>                                                               | Unavane V. N.                                  | ITI Anudh, Pune      | Expert                                |
| <b>2.</b>                                                               | S.M. Sawant                                    | ITI Kurla            | Expert                                |
| <b>3.</b>                                                               | D.R. Markandy                                  | BTRI Vile Parle      | Expert                                |
| <b>4.</b>                                                               | D.N. Neogi                                     | Century Rayon Shehad | Expert                                |
| <b>5.</b>                                                               | Raja Sen,                                      | Century Rayon Shehad | Expert                                |

**Skill India**  
कौशल भारत - कुशल भारत

**CONTENTS**

| <b>Sl. No.</b> | <b>Topics</b>                                                           | <b>Page No.</b> |
|----------------|-------------------------------------------------------------------------|-----------------|
| 1.             | Background                                                              | 1-2             |
| 2.             | Training System                                                         | 3-7             |
| 3.             | Job Role                                                                | 8               |
| 4.             | NSQF Level Compliance                                                   | 9               |
| 5.             | General Information                                                     | 10              |
| 6.             | Learning Outcome                                                        | 11-15           |
| 7.             | Learning Outcome with Assessment Criteria                               | 16-18           |
| 8.             | Syllabus                                                                | 19-26           |
| 9.             | Syllabus - Core Skill                                                   | 27-34           |
|                | 9.1 Core Skill – Workshop Calculation & Science and Engineering Drawing |                 |
|                | 9.2 Core Skill – Employability Skill                                    |                 |
| 10.            | Details of Competencies (On-Job Training)                               | 35-39           |
| 11.            | List of Trade Tools & Equipment Basic Training - Annexure I             | 40-52           |
| 12.            | Format for Internal Assessment -Annexure II                             | 53              |

## **1. BACKGROUND**

---

### **1.1 Apprenticeship Training Scheme under Apprentice Act 1961**

The Apprentices Act, 1961 was enacted with the objective of regulating the programme of training of apprentices in the industry by utilizing the facilities available therein for imparting on-the-job training. The Act makes it obligatory for employers in specified industries to engage apprentices in designated trades to impart Apprenticeship Training on the job in industry to school leavers and person having National Trade Certificate (ITI pass-outs) issued by National Council for Vocational Training (NCVT) to develop skilled manpower for the industry. There are four categories of apprentices namely; **trade apprentice, graduate, technician and technician (vocational) apprentices.**

Qualifications and period of apprenticeship training of **trade apprentices** vary from trade to trade. The apprenticeship training for trade apprentices consists of basic training followed by practical training. At the end of the training, the apprentices are required to appear in a trade test conducted by NCVT and those successful in the trade tests are awarded the National Apprenticeship Certificate.

The period of apprenticeship training for graduate (engineers), technician (diploma holders and technician (vocational) apprentices is one year. Certificates are awarded on completion of training by the Department of Education, Ministry of Human Resource Development.

### **1.2 Changes in Industrial Scenario**

Recently we have seen huge changes in the Indian industry. The Indian Industry registered an impressive growth during the last decade and half. The number of industries in India have increased manifold in the last fifteen years especially in services and manufacturing sectors. It has been realized that India would become a prosperous and a modern state by raising skill levels, including by engaging a larger proportion of apprentices, will be critical to success; as will stronger collaboration between industry and the trainees to ensure the supply of skilled workforce and drive development through employment. Various initiatives to build up an adequate infrastructure for rapid industrialization and improve the industrial scenario in India have been taken.

### **1.3 Reformation**

The Apprentices Act, 1961 has been amended and brought into effect from 22<sup>nd</sup> December, 2014 to make it more responsive to industry and youth. Key amendments are as given below:

- Prescription of number of apprentices to be engaged at establishment level instead of trade-wise.
- Establishment can also engage apprentices in optional trades which are not designated, with the discretion of entry level qualification and syllabus.
- Scope has been extended also to non-engineering occupations.
- Establishments have been permitted to outsource basic training in an institute of their choice.
- The burden of compliance on industry has been reduced significantly.



**Skill India**  
कौशल भारत - कुशल भारत

## **2. TRAINING SYSTEM**

---

### **2.1 GENERAL**

Directorate General of Training (DGT) under Ministry of Skill Development & Entrepreneurship offers range of vocational training courses catering to the need of different sectors of economy/ Labour market. The vocational training programmes are delivered under aegis of National Council of Vocational Training (NCVT). Craftsman Training Scheme (CTS) and Apprenticeship Training Scheme (ATS) are two pioneer programmes of NCVT for propagating vocational training.

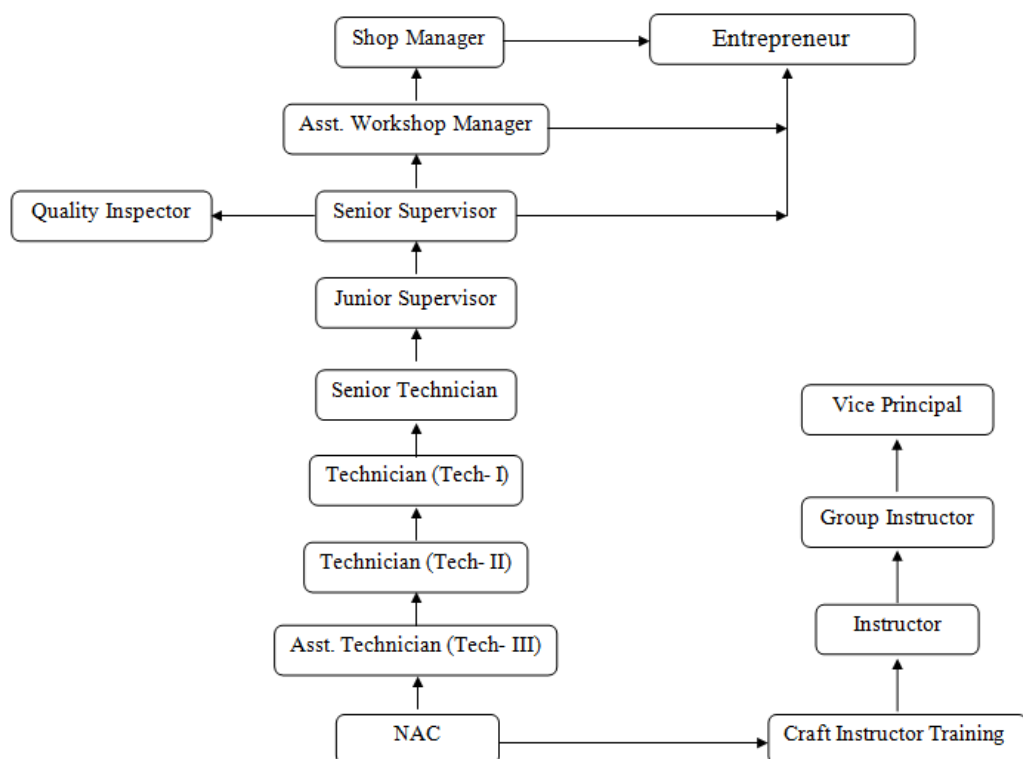
Fitter (Steel Plant) trade under ATS is one of the courses delivered nationwide through different industries. The course is of two years (02 Blocks) duration. It mainly consists of Domain area and Core area. In the Domain area Trade Theory & Practical impart professional - skills and knowledge, while Core area - Workshop Calculation and science, Engineering Drawing and Employability Skills imparts requisite core skills & knowledge and life skills. After passing out the training programme, the trainee is being awarded National Apprenticeship Certificate (NAC) by NCVT having worldwide recognition.

**Broadly candidates need to demonstrate that they are able to:**

- Read & interpret technical parameters/document, plan and organize work processes, identify necessary materials and tools;
- Perform task with due consideration to safety rules, accident prevention regulations and environmental protection stipulations;
- Apply professional skill, knowledge, core skills & employability skills while performing jobs and solve problem during execution.
- Check the job/assembly as per drawing for functioning, identify and rectify errors in job/assembly.
- Document the technical parameters related to the task undertaken.

## 2.2 CAREER PROGRESSION PATHWAYS:

- Can join Crafts Instructor Training Scheme (CITS) in the trade for becoming instructor in ITIs.
- Indicative pathways for vertical mobility.



## 2.3 COURSE STRUCTURE:

Table below depicts the distribution of training hours across various course elements during a period of two years (*Basic Training and On-Job Training*): -

**Total training duration details: -**

| Time<br>(in months)                       | 1-3       | 4-12      | 13-15      | 16-24      |
|-------------------------------------------|-----------|-----------|------------|------------|
| Basic Training                            | Block – I | -----     | Block – II | -----      |
| Practical Training<br>(On - job training) | ----      | Block – I | -----      | Block – II |

## ***Mechanic (Domestic, Commercial Refrigeration and Air Conditioning Machines)***

### **A. Basic Training**

For 02 yrs. course (Engg.) :-(**Total 06 months:** 03 months in 1<sup>st</sup>yr. + 03 months in 2<sup>nd</sup> yr.)

For 01 yr. course (Engg.) :-(**Total 03 months:** 03 months in 1<sup>st</sup>yr.)

| S No. | Course Element                               | Total Notional Training Hours |                   |
|-------|----------------------------------------------|-------------------------------|-------------------|
|       |                                              | For 02 Yrs. course            | For 01 Yr. course |
| 1.    | Professional Skill (Trade Practical)         | 550                           | 275               |
| 2.    | Professional Knowledge (Trade Theory)        | 240                           | 120               |
| 3.    | Workshop Calculation & Science               | 40                            | 20                |
| 4.    | Engineering Drawing                          | 60                            | 30                |
| 5.    | Employability Skills                         | 110                           | 55                |
|       | <b>Total (Including internal assessment)</b> | <b>1000</b>                   | <b>500</b>        |

### **B. On-Job Training:-**

For 02 yrs. Course (Engg.) :-( **Total 18 months:** 09 months in 1<sup>st</sup>yr. + 09 months in 2<sup>nd</sup> yr.)

Notional Training Hours for On-Job Training: 3120 Hrs.

For 01 yr. course (Engg.) :-( **Total 12 months**)

Notional Training Hours for On-Job Training: 2080 Hrs.

### **C. Total training hours:-**

| Duration                             | Basic Training | On-Job Training | Total     |
|--------------------------------------|----------------|-----------------|-----------|
| <b>For 02 yrs. course</b><br>(Engg.) | 1000 hrs.      | 3120 hrs.       | 4120 hrs. |
| <b>For 01 yr. course</b><br>(Engg.)  | 500 hrs.       | 2080 hrs.       | 2580 hrs. |

## **2.4 ASSESSMENT & CERTIFICATION:**

The trainee will be tested for his skill, knowledge and attitude during the period of course and at the end of the training programme as notified by Govt of India from time to time. The Employability skills will be tested in first two semesters only.

a) The **Internal assessment** during the period of training will be done by **Formative assessment method** by testing for assessment criteria listed against learning outcomes. The training

institute have to maintain individual trainee portfolio as detailed in assessment guideline (section-2.4.2). The marks of internal assessment will be as per the template (Annexure – II).

b) The final assessment will be in the form of summative assessment method. The All India Trade Test for awarding NAC will be conducted by NCVT on completion of course as per guideline of Govt of India. The pattern and marking structure is being notified by govt of India from time to time. **The learning outcome and assessment criteria will be basis for setting question papers for final assessment. The examiner during final examination will also check individual trainee's profile as detailed in assessment guideline (section-2.4.2) before giving marks for practical examination.**

### **2.4.1 PASS REGULATION**

The minimum pass percent for Practical is 60% & minimum pass percent for Theory subjects 40%. The candidate pass in each subject conducted under all India trade test.

### **2.4.2 ASSESSMENT GUIDELINE**

Appropriate arrangements should be made to ensure that there will be no artificial barriers to assessment. The nature of special needs should be taken into account while undertaking assessment. Due consideration should be given while assessing for team work, avoidance/reduction of scrap/wastage and disposal of scarp/wastage as per procedure, behavioral attitude, sensitivity to environment and regularity in training. The sensitivity towards OSHE and self-learning attitude are to be considered while assessing competency.

Assessment will be evidence based comprising the following:

- Job carried out in labs/workshop
- Record book/ daily diary
- Answer sheet of assessment
- Viva-voce
- Progress chart
- Attendance and punctuality
- Assignment
- Project work

Evidences of internal assessments are to be preserved until forthcoming semester examination for audit and verification by examination body. The following marking pattern to be adopted while assessing:

## ***Mechanic (Domestic, Commercial Refrigeration and Air Conditioning Machines)***

| Performance Level                                                                                                                                                                                                                                    | Evidence                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>(a) Weightage in the range of 60 -75% to be allotted during assessment</b>                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| For performance in this grade, the candidate with occasional guidance and showing due regard for safety procedures and practices, has produced work which demonstrates attainment of an acceptable standard of craftsmanship.                        | <ul style="list-style-type: none"> <li>• Demonstration of good skill in the use of hand tools, machine tools and workshop equipment</li> <li>• Below 70% tolerance dimension/accuracy achieved while undertaking different work with those demanded by the component/job/set standards.</li> <li>• A fairly good level of neatness and consistency in the finish</li> <li>• Occasional support in completing the project/job.</li> </ul> |
| <b>(b) Weightage in the range of above 75% - 90% to be allotted during assessment</b>                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| For this grade, the candidate, with little guidance and showing due regard for safety procedures and practices, has produced work which demonstrates attainment of a reasonable standard of craftsmanship.                                           | <ul style="list-style-type: none"> <li>• Good skill levels in the use of hand tools, machine tools and workshop equipment</li> <li>• 70-80% tolerance dimension/accuracy achieved while undertaking different work with those demanded by the component/job/set standards.</li> <li>• A good level of neatness and consistency in the finish</li> <li>• Little support in completing the project/job</li> </ul>                          |
| <b>(c) Weightage in the range of above 90% to be allotted during assessment</b>                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| For performance in this grade, the candidate, with minimal or no support in organization and execution and with due regard for safety procedures and practices, has produced work which demonstrates attainment of a high standard of craftsmanship. | <ul style="list-style-type: none"> <li>• High skill levels in the use of hand tools, machine tools and workshop equipment</li> <li>• Above 80% tolerance dimension/accuracy achieved while undertaking different work with those demanded by the component/job/set standards.</li> <li>• A high level of neatness and consistency in the finish.</li> <li>• Minimal or no support in completing the project.</li> </ul>                  |

### **3. JOB ROLE**

---

**Brief description of Job roles:**

Mechanic Refrigeration and Air Conditioning Unit installs and repairs refrigeration or air conditioning plant by replacing defective parts, re-seating valves, refitting coils, insulating, requiring electrical connections, soldering etc. Installs at site assembled air conditioning unit and refrigerators giving necessary power connections and making changes to units as necessary to attain desired results. Examine faulty equipment to ascertain nature and location of defects. Dismantle the equipment partly or completely according to nature of defects to remove damaged or worn out parts. Replaces or repairs defective parts. Replaces or repairs defective parts to units by re-seating valves, refitting coils, re insulating system, etc. over hauls units and reassembles them after cleaning components and replacing defective or worn out parts of pumps, compressors, motors, etc., Removes faulty sealed units or sub-units of refrigerators or air conditioning plants and obtains replacements. Conducts vacuum and pressure test of pipe lines and charges system with fresh refrigerant. Sets plant to desire cooling conditions prevents leakage and ensures attainment and maintenance of required temperature. Gets burnt out motors or generator repaired by Electrician or Electrical Winder and installs repaired ones to plant giving necessary electrical connections. May works in ice factory, cold storage plants, specialized air conditioning units or domestic refrigerators.

Plan and organize assigned work and detect & resolve issues during execution. Demonstrate possible solutions and agree tasks within the team. Communicate with required clarity and understand technical English. Sensitive to environment, self-learning and productivity

Perform TPM (Total Production Management), TQM (Total Quality Management) and record keeping system.

**Reference NCO 2015: 7127.0100 - Mechanic, Refrigeration and Air- Conditioning**

## **4. NSQF LEVEL COMPLIANCE**

NSQF level for Fitter (Steel Plant) trade under ATS: **Level 5**

As per notification issued by Govt. of India dated- 27.12.2013 on National Skill Qualification Framework total 10 (Ten) Levels are defined.

Each level of the NSQF is associated with a set of descriptors made up of five outcome statements, which describe in general terms, the minimum knowledge, skills and attributes that a learner needs to acquire in order to be certified for that level.

Each level of the NSQF is described by a statement of learning outcomes in five domains, known as level descriptors. These five domains are:

- a) Process
- b) professional knowledge,
- c) professional skill,
- d) core skill and
- e) Responsibility.



The Broad Learning outcome of Fitter (Steel Plant) trade under ATS mostly matches with the Level descriptor at Level- 5.

The NSQF level-5 descriptor is given below:

| Level   | Process Required                                                                             | Professional Knowledge                                                                      | Professional Skill                                                                                                                                                  | Core Skill                                                                                                                             | Responsibility                                                                                   |
|---------|----------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|
| Level 5 | Job that requires well developed skill, with clear choice of procedures in familiar context. | Knowledge of facts, principles, processes and general concepts, in a field of work or study | A range of cognitive and practical skills required to accomplish tasks and solve problem by selecting and applying basic methods, tools, materials and information. | Desired mathematical skill, understanding of social, political and some skill of collecting and organizing information, communication. | Responsibility for own work and Learning and some responsibility for other's works and learning. |

**5. GENERAL INFORMATION**

|                                                                                                                           |                                                                                                                                                                                            |
|---------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Name of the Trade</b>                                                                                                  | <b>MECHANIC (DOMESTIC, COMMERCIAL REFRIGERATION AND A AIR CONDITIONING MACHINES)</b>                                                                                                       |
| <b>NCO-2015</b>                                                                                                           | 7127.0100                                                                                                                                                                                  |
| <b>NSQF Level</b>                                                                                                         | Level – 5                                                                                                                                                                                  |
| <b>Duration of Apprenticeship Training</b><br>(Basic Training + On-Job Training)                                          | Two years (02 Blocks each of 12 months duration).                                                                                                                                          |
| <b>Duration of Basic Training</b>                                                                                         | a) Block –I : 3 months<br>b) Block – II : 3 months<br><b>Total duration of Basic Training: 6 months</b>                                                                                    |
| <b>Duration of On-Job Training</b>                                                                                        | a) Block–I: 9 months<br>b) Block–II : 9 months<br><b>Total duration of Practical Training: 18 months</b>                                                                                   |
| <b>Entry Qualification</b>                                                                                                | Passed 10 <sup>th</sup> Class with Science and Mathematics under 10+2 system of Education or its equivalent                                                                                |
| <b>Selection of Apprentices</b>                                                                                           | The apprentices will be selected as per Apprenticeship Act amended time to time.                                                                                                           |
| <b>Instructors Qualification for Basic Training</b>                                                                       | As per ITI instructors qualifications as amended time to time for the specific trade.                                                                                                      |
| <b>Infrastructure for Basic Training</b>                                                                                  | As per related trade of ITI                                                                                                                                                                |
| <b>Examination</b>                                                                                                        | The internal examination/ assessment will be held on completion of each block.<br>Final examination for all subjects will be held at the end of course and same will be conducted by NCVT. |
| <b>Rebate to Ex-ITI Trainees</b>                                                                                          | 01 year                                                                                                                                                                                    |
| <b>CTS trades eligible for Mechanic (Domestic, Commercial Refrigeration and Air Conditioning machines) Apprenticeship</b> | Mechanic, Refrigeration and Air-Conditioning                                                                                                                                               |

**Note:**

- Industry may impart training as per above time schedule for different block, however this is not fixed. The industry may adjust the duration of training considering the fact that all the components under the syllabus must be covered. However the flexibility should be given keeping in view that no safety aspects is compromised.
- For imparting Basic Training the industry to tie-up with ITIs having such specific trade and affiliated to NCVT.

## **6. LEARNING OUTCOME**

---

### **6.1 GENERIC LEARNING OUTCOME**

The following are minimum broad Common Occupational Skills/ Generic Learning Outcome after completion of the Fitter (Steel Plant) course of 02 years duration under ATS.

#### **Block I & II:-**

1. Recognize & comply safe working practices, environment regulation and housekeeping.
2. Understand and explain different mathematical calculation & science in the field of study including basic electrical. *[Different mathematical calculation & science -Work, Power & Energy, Algebra, Geometry & Mensuration, Trigonometry, Heat & Temperature, Levers & Simple machine, graph, Statistics, Centre of gravity, Power transmission, Pressure]*
3. Interpret specifications, different engineering drawing and apply for different application in the field of work. *[Different engineering drawing-Geometrical construction, Dimensioning, Layout, Method of representation, Symbol, scales, Different Projections, Machined components & different thread forms, Assembly drawing, Sectional views, Estimation of material, Electrical & electronic symbol]*
4. Select and ascertain measuring instrument and measure dimension of components and record data.
5. Explain the concept in productivity, quality tools, and labour welfare legislation and apply such in day to day work to improve productivity & quality.
6. Explain energy conservation, global warming and pollution and contribute in day to day work by optimally using available resources.
7. Explain personnel finance, entrepreneurship and manage/organize related task in day to day work for personal & societal growth.
8. Plan and organize the work related to the occupation.

### **6.2 SPECIFIC LEARNING OUTCOME**

#### **Block – I**

1. Identify the Compressors viz Reciprocating, Rotary, Scroll & their advantages & limitations  
Dismantle & Assemble of compressor, Servicing of compressor parts, checking components, Checking pumping and repairing Gasket Cutting, Checking Lubricating system, Oil Charging in Hermetic compressor, Lapping of compressor parts

## ***Mechanic (Domestic, Commercial Refrigeration and Air Conditioning Machines)***

2. Service/flushing of condenser, Importance of keeping condenser clean ,Remove and replace of Drier/filter ,Remove and replace capillary tube , Servicing/flushing of evaporator, Leak Testing and repairing of evaporator.
3. Handle and taking care of refrigerant cylinders, transfer of refrigerant from storage to service cylinder, Refrigerant cylinders identification of Refrigerant ,safety in handling of Refrigerants, Safe handling of Refrigerant cylinders & valves, Testing of Relay, capacitors & O.L.Ps ,Testing & Adjusting of Thermostat.
4. Access sealed system using piercing plier and valves/use recovery machine to recover, CFC/HCF/HFCs: Basic tests for quality of recovered component needing change. Clean/flush with dry N2 chemicals Trichloroethylene, safety in handling, safety in handling N2 cylinder with 2 stage regulator, Replacement of component and brazing and sealing system, Leak testing with dry N2 Pressure test, evacuation uses 2 stages Rotary vacuum pump. Use of Micron level vacuum gauge to ensure proper vacuum level charging
5. Retrofit a CFC filled commercial and Domestic Refrigerator with Hydro carbons/HFCs using sealed components.
6. Repair/Service of HC Refrigeration system using correct technique and ensuring safety, stripping direct cooled domestic refrigerator, Cleaning/Inspection/Testing of components direct cooled Refrigerator.
7. Find fault of direct cooled Refrigerator, Rectification of faults etc. Stripping of components, tracing electric circuit, thermostat, Bi-metallic, Defrost heater, Timer, Air-ducting, fan motor, Air purifiers in Frost free refrigerator.
8. Trouble shooting in Frost free refrigerator , common problems in Refrigerators like
  - a) No cooling
  - b) Poor cooling
  - c) High Current
  - d) Electrical leakobserve various pressure, temperature, current and noise etc. Study of water cooler construction & water filters cleaning in (instant & storage)
9. Check water circuit, electrical circuit working and controls, Leak test, evacuation & Gas charging, making test jigs for fault finding.
10. Trouble shooting of commonly faced problem of water cooler like condenser fan failures, study of Bottle cooler, construction of electrical circuit, Leak Test, Evacuation & Gas charging, Making of test board.
11. Trouble shooting of commonly faced problem of Bottle Cooler like condenser fan, failures, corrosion etc. Repair & maintenance of deep freezer, visi cooler, electrical circuit, Leak Testing, Vacuuming & Gas charging of Deep freezer, Visi cooler, Trouble shooting of commonly faced problem of Deep freezer and visi cooler

## ***Mechanic (Domestic, Commercial Refrigeration and Air Conditioning Machines)***

12. Retrofit a Refrigerator with HFC 134a of water cooler, Deep cooler, visi cooler & limits on charge of HCs.
13. Repair a refrigerator cabinet & spray painting, testing electrical components, leak repairing, testing leak, vacuuming and gas charging of ice cuber.
14. Test electrical components, repairing leak, testing leak, vacuuming & gas charging of juice dispenser.
15. Measure the dry bulb & wet bulb temperature, using of sling psychrometer , study and use of psychrometric chart. Stripping, Cleaning, Inspection Testing of components like outer wrapper, Grills, Blower motor, condenser fan portion, evaporator & Condenser, Venture , sweep mechanism , Rotary switch & thermostat , electrical components like capacitors , PTCs electrical wiring , check of earth & continuity reassemble & test.
16. Service and repairing of Air-coolers/desert cooler, Stripping of Room cooler and condensing unit. Identifying and cleaning, inspection, testing of components & re-assembly of Split AC
17. Operate the tangential blower sweep and swing mechanism, test electrical and electronics component including special function like auto cool, sleep dry etc. wiring, servicing and trouble shooting of split AC.
18. Installation, inspection, testing, wiring of a Window A.C
19. Service a window AC, Test Leak, Vacuuming, Gas charging of window AC, Trouble shooting, also use of correct instruments and tools.
20. Installation, inspection, testing Electrical components, wiring in a Split AC.
21. Service a Split AC, Leak Test, Vacuuming, and Gas charging of split A.C.
22. Trouble shooting, also use of correct instruments & Tools, Servicing of blower, fan motors and cooling coils.
23. Dismantle and assemble of wobble plate comp used in Auto A.C. Mounting Brackets on Engine blocks and compressor on Brackets and adjustment of belt tension. Types of "O" Ring compression pipe joints and flared joints. Hot water systems and mixing valves for Temperature control.
24. Operate the electromagnetic clutches on compressors. Check air flow and direction control. Check HP-LP switches, receivers, fast idle control devices ,vacuum and gas charging , tracing of wiring based on diagrams, identification and function of key components like thermostat electrically operated valves, fuses connectors, HP/LP switches compressor clutch, alternator/battery.
25. Repair, evacuation and charging of Auto A.C. systems. Trouble shooting of common faults on :-
  - a) No cooling
  - b) Poor cooling
  - c) Reduced air supply
  - d) Engine overheating

## ***Mechanic (Domestic, Commercial Refrigeration and Air Conditioning Machines)***

- e) High compressor noise
- 26. Retrofit of CFC car A.C. system with HFC 134a.

### **Block – II**

1. Identify the refrigeration cycle and components for high, medium and low temperature application machines, identification of tubes and pipes, joints & pipe layout, observe safety and fire fighting equipments.
2. Draw the layout of Refrigeration cycle machines. Study lubrication system and lubricants. Refrigerant gas cylinder and their use, colour code and safety.
3. Practice in connecting domestic refrigerator electric motor with main supply, measurement of current in the circuit. Use of megger for insulation testing.
4. Test new evaporator coils for leak and choke. Repairing & cleaning of fins type evaporator & condenser coils.
5. Test condenser coils for leak and choke & repairing. De scaling of water cooled condenser. Servicing of air cooled condenser & straightening of fins.
6. Handle the gas cylinders, repair of leaky cylinder, reclaiming of refrigerant from dead refrigeration system. Charge the refrigeration oil & remove oil with the help of syphon or vacuum method.
7. Wire a hermetic compressor motor with relays, controls, cabinet light & find their fault & remedies.
8. Recover CFC / HCFC / HFCs by use of recovery Machine. Change the components, clean & flush with dry N<sub>2</sub>. Retrofitting of CFC filled commercial as well as domestic appliances with hydrocarbon, HFCs using sealed components.
9. Safe handling of N<sub>2</sub> cylinder with 2 stage regulator, Replacement of components, brazing sealed system, leak testing with dry N<sub>2</sub> pressure test. Evacuation of refrigeration system.
10. Trouble shooting- commonly faced problems in direct cooled refrigeration system in mechanical & electrical & their remedies. Retrofitting.
11. Trouble shooting- commonly faced problems in frost free refrigeration system in mechanical & electrical & their remedies. Retrofitting.
12. Service of ice cuber, testing electrical circuit, leak tests, evacuation and gas charging, check water circulating system. Retrofitting of existing system.
13. Service of water & bottle cooler, testing electrical circuit, leak tests, evacuation and gas charging. Retrofitting.
14. Service of deep freezer, testing electrical circuit, leak tests, evacuation and gas charging. Retrofitting.
15. Service of visi cooler, testing electrical circuit, leak tests, evacuation and gas charging. Retrofitting.

## ***Mechanic (Domestic, Commercial Refrigeration and Air Conditioning Machines)***

16. Operate Sling psychrometer, study and use of psychrometric charts, measurement of dry bulb and wet bulb temperature, relative humidity. Stripping, inspections & cleaning of outer wrapper, grills, slower motor. Condenser fans positions, evaporators, condenser and sweep mechanism, rotary switch and thermostat.
17. Service and maintenance of window A.C, testing the mechanical and electrical system for fault certification. Installation of Window A.C. Use of Remote Controls, identifying PCB & Remote related problems & replacing PCBs.
18. Service and repairing of air cooler/desert coolers stripping of air cooler / desert coolers stripping, inspection, cleaning & reassembly of components.
19. Service and maintenance of split A.C. safety aspects, leak testing, evacuation, gas charging & testing performance, installation of split A.C.
20. Dismantle and assembly of wobble plate compressor used in automobile A.C. assembling compressor on mounting brackets, engine adjustment, temperature controls, identification and functioning of key components like thermostat, electrical operating valves, fused connectors, clutch, alternator.
21. Select compressor, condenser, drier /filter, size & length calculation of capillary, evaporator selection in small capacity refrigerator
22. Select the compressor, condenser, drier/filter, size & length calculation of capillary, freezer selection, selection of commercial water cooler & bottle cooler.
23. Select the compressor, condenser, drier/filter, and size & length calculation of capillary for evaporator in Ice cube machines.
24. Select the compressor, condenser, drier /filter size & length calculation of capillary, evaporator selection for Window & split A.C.

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

## **7. LEARNING OUTCOME WITH ASSESSMENT CRITERIA**

| <b>GENERIC LEARNING OUTCOME</b>                                                                           |                                                                                                                                                                                                                       |
|-----------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>LEARNING OUTCOMES</b>                                                                                  | <b>ASSESSMENT CRITERIA</b>                                                                                                                                                                                            |
| 1. Recognize & comply safe working practices, environment regulation and housekeeping.                    | 1. 1. Follow and maintain procedures to achieve a safe working environment in line with occupational health and safety regulations and requirements.                                                                  |
|                                                                                                           | 1. 2. Recognize and report all unsafe situations according to site policy.                                                                                                                                            |
|                                                                                                           | 1. 3. Identify and take necessary precautions on fire and safety hazards and report according to site policy and procedures.                                                                                          |
|                                                                                                           | 1. 4. Identify, handle and store / dispose off dangerous/unsalvageable goods and substances according to site policy and procedures following safety regulations and requirements.                                    |
|                                                                                                           | 1. 5. Identify and observe site policies and procedures in regard to illness or accident.                                                                                                                             |
|                                                                                                           | 1. 6. Identify safety alarms accurately.                                                                                                                                                                              |
|                                                                                                           | 1. 7. Report supervisor/ Competent of authority in the event of accident or sickness of any staff and record accident details correctly according to site accident/injury procedures.                                 |
|                                                                                                           | 1. 8. Identify and observe site evacuation procedures according to site policy.                                                                                                                                       |
|                                                                                                           | 1. 9. Identify Personal Productive Equipment (PPE) and use the same as per related working environment.                                                                                                               |
|                                                                                                           | 1. 10. Identify basic first aid and use them under different circumstances.                                                                                                                                           |
|                                                                                                           | 1. 11. Identify different fire extinguisher and use the same as per requirement.                                                                                                                                      |
|                                                                                                           | 1. 12. Identify environmental pollution & contribute to avoidance of same.                                                                                                                                            |
|                                                                                                           | 1. 13. Take opportunities to use energy and materials in an environmentally friendly manner                                                                                                                           |
|                                                                                                           | 1. 14. Avoid waste and dispose waste as per procedure                                                                                                                                                                 |
|                                                                                                           | 1. 15. Recognize different components of 5S and apply the same in the working environment.                                                                                                                            |
| 2. Understand, explain different mathematical calculation & science in the field of study including basic | 2.1 Explain concept of basic science related to the field such as Material science, Mass, weight, density, speed, velocity, heat & temperature, force, motion, pressure, heat treatment, centre of gravity, friction. |

## Mechanic (Domestic, Commercial Refrigeration and Air Conditioning Machines)

|                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                            |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|
| electrical and apply in day to day work. <i>[Different mathematical calculation &amp; science -Work, Power &amp; Energy, Algebra, Geometry &amp; Mensuration, Trigonometry, Heat &amp; Temperature, Levers &amp; Simple machine, graph, Statistics, Centre of gravity, Power transmission, Pressure]</i>                                                                                                                     | 2.2 Measure dimensions as per drawing                                                                                                                      |
|                                                                                                                                                                                                                                                                                                                                                                                                                              | 2.3 Use scale/ tapes to measure for fitting to specification.                                                                                              |
|                                                                                                                                                                                                                                                                                                                                                                                                                              | 2.4 Comply given tolerance.                                                                                                                                |
|                                                                                                                                                                                                                                                                                                                                                                                                                              | 2.5 Prepare list of appropriate materials by interpreting detail drawings and determine quantities of such materials.                                      |
|                                                                                                                                                                                                                                                                                                                                                                                                                              | 2.6 Ensure dimensional accuracy of assembly by using different instruments/gauges.                                                                         |
|                                                                                                                                                                                                                                                                                                                                                                                                                              | 2.7 Explain basic electricity, insulation & earthing.                                                                                                      |
|                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                            |
| 3. Interpret specifications, different engineering drawing and apply for different application in the field of work. <i>[Different engineering drawing-Geometrical construction, Dimensioning, Layout, Method of representation, Symbol, scales, Different Projections, Machined components &amp; different thread forms, Assembly drawing, Sectional views, Estimation of material, Electrical &amp; electronic symbol]</i> | 3. 1. Read & interpret the information on drawings and apply in executing practical work.                                                                  |
|                                                                                                                                                                                                                                                                                                                                                                                                                              | 3. 2. Read & analyse the specification to ascertain the material requirement, tools, and machining /assembly /maintenance parameters.                      |
|                                                                                                                                                                                                                                                                                                                                                                                                                              | 3. 3. Encounter drawings with missing/unspecified key information and make own calculations to fill in missing dimension/parameters to carry out the work. |
|                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                            |
| 4. Select and ascertain measuring instrument and measure dimension of components and record data.                                                                                                                                                                                                                                                                                                                            | 4.1 Select appropriate measuring instruments such as micrometers, vernier calipers, dial gauge, bevel protector and height gauge (as per tool list).       |
|                                                                                                                                                                                                                                                                                                                                                                                                                              | 4.2 Ascertain the functionality & correctness of the instrument.                                                                                           |
|                                                                                                                                                                                                                                                                                                                                                                                                                              | 4.3 Measure dimension of the components & record data to analyse the with given drawing/measurement.                                                       |
|                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                            |
| 5. Explain the concept in productivity, quality tools, and labour welfare legislation and apply such in day to day work to improve productivity & quality.                                                                                                                                                                                                                                                                   | 5.1 Explain the concept of productivity and quality tools and apply during execution of job.                                                               |
|                                                                                                                                                                                                                                                                                                                                                                                                                              | 5.2 Understand the basic concept of labour welfare legislation and adhere to responsibilities and remain sensitive towards such laws.                      |
|                                                                                                                                                                                                                                                                                                                                                                                                                              | 5.3 Knows benefits guaranteed under various acts                                                                                                           |
|                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                            |

## Mechanic (Domestic, Commercial Refrigeration and Air Conditioning Machines)

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                 |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 6. Explain energy conservation, global warming and pollution and contribute in day to day work by optimally using available resources.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 6.1 Explain the concept of energy conservation, global warming, pollution and utilize the available resources optimally & remain sensitive to avoid environment pollution.                                                                      |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 6.2 Dispose waste following standard procedure.                                                                                                                                                                                                 |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                 |
| 7. Explain personnel finance, entrepreneurship and manage/organize related task in day to day work for personal & societal growth.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 7. 1. Explain personnel finance and entrepreneurship.                                                                                                                                                                                           |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 7. 2. Explain role of Various Schemes and Institutes for self-employment i.e. DIC, SIDA, SISI, NSIC, SIDO, Idea for financing/ non financing support agencies to familiarizes with the Policies /Programmes & procedure & the available scheme. |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 7. 3. Prepare Project report to become an entrepreneur for submission to financial institutions.                                                                                                                                                |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                 |
| 8. Plan and organize the work related to the occupation.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 8. 1. Use documents, drawings and recognize hazards in the work site.                                                                                                                                                                           |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 8. 2. Plan workplace/ assembly location with due consideration to operational stipulation                                                                                                                                                       |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 8. 3. Communicate effectively with others and plan project tasks                                                                                                                                                                                |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 8. 4. Assign roles and responsibilities of the co-trainees for execution of the task effectively and monitor the same.                                                                                                                          |
| <b>SPECIFIC OUTCOME</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                 |
| <b><u>Block- I &amp; II (Section:10)</u></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                 |
| <p><i>Assessment Criteria i.e. the standard of performance, for each specific learning outcome mentioned under <b>block – I &amp; II</b> (section: 10) must ensure that the trainee achieves well developed skill with clear choice of procedure in familiar context. Assessment criteria should broadly cover the aspect of <b>Planning</b> (Identify, ascertain, estimate etc.); <b>Execution</b> (perform, illustration, demonstration etc. by applying 1) a range of cognitive and practical skills required to accomplish tasks and solve problems by selecting and applying basic methods, tools, materials and information 2) Knowledge of facts, principles, processes, and general concepts, in a field of work or study 3) Desired Mathematical Skills and some skill of collecting and organizing information, communication) and <b>Checking/ Testing</b> to ensure functionality during the assessment of each outcome. The assessments parameters must also ascertain that the candidate is responsible for own work and learning and some responsibility for other's work and learning.</i></p> |                                                                                                                                                                                                                                                 |

**BASIC TRAINING (Block – I)**

**Duration: (03) Three Months**

| <b>Week No.</b> | <b>Professional Skills</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>Professional Knowledge</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|-----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1.</b>       | <p>Safety: - its importance, classification, personal, general, workshop and job safety.</p> <p>Occupational health and safety.</p> <p>Basic injury prevention, Basic first aid, Hazard identification and avoidance, safety signs for Danger, Warning, caution &amp; personal safety message.</p> <p>Preventive measures for electrical accidents &amp; steps to be taken in such accidents.</p> <p>Importance of housekeeping &amp; good shop floor practices.</p> <p>Disposal procedure of waste materials like cotton waste, metal chips/burrs etc.</p> <p>Fire &amp; safety: Use of Fire extinguishers.</p> <p>Safety regarding working with different types of steam and its First-Aid.</p> | <p>Importance of safety and general precautions observed in the in the industry/shop floor. All necessary guidance to be provided to the new comers to become familiar with the working of Institute system including stores procedures.</p> <p>Introduction of First aid. Safety attitude development of the trainee by educating him to use Personal Protective Equipment (PPE).</p> <p>Response to emergencies e.g.; power failure, fire, and system failure.</p> <p>Accidents- Definition types and causes.</p> <p>First-Aid, nature and causes of injury and utilization of first-aid.</p> <p>Introduction to 5S concept &amp; its application.</p> <p>Fire: - Types, causes and prevention methods. Fire Extinguisher, its types.</p> <p>Define environment, environment Pollution, Pollutants, type of Pollution (Air pollution, water pollution, soil pollution noise pollution, thermal pollution, radiation.</p> <p>Global warming its causes and remedies.</p> <p>Industrial Waste its types, sources and waste Management.</p> |
| <b>2.</b>       | <p><b>Basic Fitting :</b></p> <p>Marking on flat surfaces as per given drawing by using different marking tools and medias, Punching &amp; hacksawing, Filing surfaces flat &amp; square. Checking for flatness, straightness &amp; squareness.</p> <p>Filing &amp; Fitting of male &amp; female joints</p>                                                                                                                                                                                                                                                                                                                                                                                       | <p>Introduction to basic workshop tools &amp; operations like measuring, marking, hacksawing &amp; cutting. Tools used, their identification, use care &amp; maintenance, measurements, marking medias.</p> <p>Introduction to files, their types and uses, care &amp; maintenance, Bench &amp; pipe vice, their uses. Sprit levels &amp; their uses,</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |

## ***Mechanic (Domestic, Commercial Refrigeration and Air Conditioning Machines)***

|    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|    | <p>within accuracy of + 0.2mm. Using a spirit level and dial test indicator. Measurements by precision instruments. Drilling, reaming &amp; tapping as per given drawings. External thread cutting on pipes.</p>                                                                                                                                                                                                                                                                                                                                                 | <p>straight and angular measurements, Bevel Protractors. Introduction to precision measuring &amp; least count. Micrometers, Vernier &amp; Height gauges, applications, care &amp; maintenance. Dial gauge vernier &amp; indicator. Drilling, tapping &amp; reaming, types of drills &amp; reamers, different drilling operations, dies &amp; die stocks. Drilling machines, their types &amp; uses, holding devices &amp; fixtures. Types of fasteners, threads. Adhesives &amp; their applications.</p>                                                                                                                                                                                                                                                 |
| 3. | <p><b>Sheet Metal Work :</b><br/>Practice in cutting sheet metal to different shapes using various types of snips. Folding/Bending sheet metal to 90° using wooden mallet. Practice on hard soldering method (Lead &amp; Tin). Making holes on sheet metal by punching &amp; riveting. Straight &amp; oblique cutting, preparing A.C. ducts &amp; components as per given drawings. Riveting practice, practice on removing dents on spherical &amp; hemi spherical articles.</p>                                                                                | <p>Introduction to sheet metal work &amp; its applications, materials used for sheet metal work. Hand tools, measuring tools &amp; gauges used in sheet metal work. Different sheet metal operations, their necessity &amp; applications.<br/>Sheet metal joining processes, soldering Brazing &amp; welding.<br/>Sheet metal machinery, shears, forming &amp; folding machines, bending &amp; shearing machines seaming &amp; nibbling machines.<br/>Development of surfaces for simple objects like boxes, cylinders, cones, prism &amp; pyramids.<br/>Developing &amp; forming A.C. ducts &amp; components.</p>                                                                                                                                        |
| 4. | <p><b>Basic Welding :</b><br/>Setting beading practices, striking &amp; maintaining an arc. Setting up an oxy-acetylene flame. Laying short, straight line &amp; weaved beads on M.S. plates, Fillet welds in open corner, Tee &amp; Lap Joint, fusion runs with &amp; without filler rods. Preparing different joints with gas welding.<br/>Soldering &amp; brazing on sheet metal as per braze welding practice.<br/>Brazing of different size of copper, steel, aluminum pipes with different brazing material. Use of silver brazing by oxy-Ace process.</p> | <p>Metal joining processes. Introduction to gas &amp; arc welding. Different hand tools used in welding. Welding accessories like regulators, nozzles cylinders etc. Welding machines &amp; welding transformers, Oxy-Acetylene gas welding plant. Welding processes &amp; positions, welded joints, welding symbols, weld depositions, filler rods &amp; electrodes, their types &amp; selection, care &amp; maintenance. Fluxes, types &amp; application. Distortion in welding, welding defects, their causes &amp; remedial measures. Soldering &amp; brazing, Different types of solder, composition and use of flux- their effect on metal, method of soldering and brazing, Braze welding procedure. Brazing fluxes - their properties, types,</p> |

## Mechanic (Domestic, Commercial Refrigeration and Air Conditioning Machines)

|    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | constituents of fluxes.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 5. | <p><b>Basic Electricity:</b> Use of hand tools. Joining practice with single and multi-stand conductors. Joining practice of bare conductors, cable joints. Use of Aluminum flux and Alca 'P' solder. Demonstration and practice of crimping of various wires, Electrical symbols.</p> <p>Use of Multimeters and measurement of current, voltage, resistance in DC/AC circuits. Series circuits - Parallel circuits. Demonstration &amp; Practice on connecting &amp; replacement of common electrical accessories in circuits - Use of tong tester and megger.</p> | <p>Electricity, Safety - in electrical shops &amp; installations. General care &amp; maintenance of common electrical hand tools. Wires &amp; cables -conductors, Insulators &amp; semiconductors, their shapes, sizes with respect to low, medium &amp; high voltage. Crimping equipment -Single &amp; Multistranded conductors joining and soldering.</p> <p>Resistance, Voltage, Current, open circuit and short circuits-Ohm's law - Voltage drop in series &amp; parallel circuits, Electrical measuring Instruments viz., Multimeters, Testers. Common electrical accessories used in Industries, Bus-bars, Relays, Contactors, Circuit Breakers, etc. Fuses and their ratings, materials used. Earthing &amp; its importance. Preventive maintenance, routine &amp; periodical tests</p> |
| 6. | <p>Simple wiring practice with distribution boards, Junction Boxes, Main Switches two way and intermediate Switches. Identification of different parts of DC generators-testing and measuring the field and Armature resistances. Identification of different parts of AC Motors - Testing and measurement on Induction motors - and generators. Identification and testing of transformers. Grouping &amp; testing of cells for a specified voltage &amp; current - Preparation of battery charging.</p>                                                           | <p>Induction principles - Electro-magnetism-Faraday's Laws. Single phase &amp; Poly phase system 3 phase star-delta connections, Impedance &amp; power factor -Principles &amp; Applications of DC Motors, Series, Shunt &amp; compound motor - AC Motors. Transformers their types and applications. Rechargeable batteries - Care &amp; maintenance of cells. AC Motor starting with DOL Starter and Star - Delta Starter. Panel boards &amp; their designing.</p>                                                                                                                                                                                                                                                                                                                            |

## ***Mechanic (Domestic, Commercial Refrigeration and Air Conditioning Machines)***

|     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 7.  | Identification and testing of different types of electronic components, symbols. Testing of capacitors, Identification and Testing of assorted diodes, PNP/NPN Transistors - Uni - junction Transistor, Field effect, Transistor & Silicon Controlled Rectifier ICs etc. Soldering & de-soldering practice - Demonstration on Rectifiers - Identification of ICs Full wave & bridge rectifier circuits, voltage regulators, construction of low voltage power supply, construction of transistor, amplifier circuits. Multivibrator circuits, CR circuits for wave shaping, wiring of SCR, UJT for motor control. | Fundamentals of electron theory - passive components semiconductor devices - Symbols -specifications - Diodes, Transistors, Uni-junction Transistor, Field effect Transistor Silicon Controlled Rectifier & ICs. Half wave, full wave & Bridge rectifier with filters, DC Power supply.<br>Rectification and Rectifiers, zener diode as voltage regulator, Transistor parameters- CB,CC,CE configuration, amplification, photo diodes, transistors, multivibrations CR & LR circuits, SCRs, UJT & ICs. |
| 8.  | Testing solid state thermostats, PTCR, remote controls. Operating & testing contactors, relay, pressure controls, timer, solenoid, heater, pressure controls, Identification of keys& display of microprocessor trainer kit.                                                                                                                                                                                                                                                                                                                                                                                      | Thermistor, RTDs, Electronic thermostat, principle of remote control & controllers. Use & specifications of contactors, starter & crankcase heater etc., Introduction to Microprocessors.                                                                                                                                                                                                                                                                                                              |
| 9.  | Introduction to operations on copper tubing like bending, flaring, swedging, pinching etc. & tools used. Study & sketch refrigerator parts, storing arrangement, Fitting refrigerator doors & hinges, Tube brazing. Safety in handling tools & equipment.                                                                                                                                                                                                                                                                                                                                                         | History of refrigeration, its principle & need. Introduction to refrigeration equipment, constructional details of a refrigerator. Heat and temperature. Types of heat and its measurement. Thermometers & thermometric conversions. Atmosphere, air & its constituents. Properties of gases & gas laws. Measurement of pressure. Pressure gauges. Humidity, relative humidity & dew point temperature.                                                                                                |
| 10. | Refrigerator cleaning, inspection, testing of components in refrigeration system. Tracing the electrical components and testing relay, OLP, Thermostat, light assembly, door switch etc. To remove & refix refrigerator doors. To cut & fix door gaskets. Refrigerator installation, care & maintenance.                                                                                                                                                                                                                                                                                                          | Functions of refrigeration system components i.e. condensers, evaporators and capillary tube. Compressor, its types & working principle. Reciprocating compressors. Comparative study of sealed & open type compressors, Internal construction of a sealed compressor, its part & their functions. Introduction to soldering & brazing, their applications. Brazing Vs welding. Advantages &                                                                                                           |

## ***Mechanic (Domestic, Commercial Refrigeration and Air Conditioning Machines)***

|     |                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                |
|-----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|     |                                                                                                                                                                                      | disadvantages. Brazing Processes. Defects & remedial measures.                                                                                                                                                                                                                                                                                 |
| 11. | Dismantling & assembly of a sealed compressor & valve plates, lapping of valve plates & reeds Oil charging of a compressor<br>Recovering CFC / HCFC / HFC by using recovery machines | Compressor lubrication method. Lubricants & their properties. Comparative study of compressors and other component used for R.12, R.134 a & HCs. Refrigerants & their properties Comparative study of refrigerants Ozone depletion & its causes, need for elimination of refrigerant emission through recovery recycling, phasing out of CFCs. |
| 12. | Repairing rewiring & servicing of a refrigerator. Leak testing in the system Evacuation & gas charging of a refrigerator. Trouble shooting of electrical & mechanical faults         | Methods of leak testing & instruments used. Electronic leak detectors, their types & uses.<br>Defect diagnosis with the help of problem trees                                                                                                                                                                                                  |
| 13. | <b>Revision &amp; Internal Assessment</b>                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                |

**Note:** - *More emphasis to be given on video/real-life pictures during theoretical classes. Some real-life pictures/videos of related industry operations may be shown to the trainees to give a feel of Industry and their future assignment.*

**Skill India**  
कौशल भारत - कुशल भारत

**BASIC TRAINING (Block – II)**

**Duration: (03) Three Months**

| <b>Week No.</b> | <b>Professional Skills</b>                                                                                                                                                                                                                                                         | <b>Professional Knowledge</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|-----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.              | Tripping the components of frost Free Refrigerator, tracing electrical circuits & defrost, Inspection & testing.<br>Retrofitting of CFC filled refrigerator with Non CFC refrigerant i.e. 134a & HC 600. Use of sealed components.                                                 | Study of Frost Free Refrigerators, Refrigeration system of Frost Free Refrigerators, components & their functions, electrical components, wiring, automatic defrost & air duct system. Comparative study of refrigerators available in the market.<br>Scope and methodology of retrofitting CFC appliances with HFC & HCS refrigerants, study of refrigerator components using HC refrigerants. Comparative study of performance of refrigerators using different refrigerants. |
| 2.              | Dismantling & Assembly of an Air conditioner, study of different components, their functions & specifications. Calculating Relative Humidity by using sling psychrometric.                                                                                                         | Introduction to Air conditioning, its past, present & future. Air conditioning Fundamentals. Constructional details and functioning of room air conditioner. Air circulation system. Psychrometric & psychrometric charts, construction & use of sling psychrometer.                                                                                                                                                                                                            |
| 3.              | Study & testing of thermostatic relay, capacitors, OLP, blower motor. Inspecting & testing condenser & evaporator coil. Checking of electrical wiring by CSR method. PSC circuits in Room A.C.                                                                                     | Study of mechanical & electrical components of Window A. C. & Split A.C., Role of each part. Split A.C., its constructional details, comparison with window air conditioner advantages & Disadvantages.<br>Air cooled condensers: Constructional details & selection.                                                                                                                                                                                                           |
| 4.              | Dry Servicing & brought down servicing of Air conditioners. Brazing & water immersion testing of evaporator & condenser coils. Evacuating & gas charging of an Air conditioner. Performance Testing for Air Velocity, grill & condenser temperature & smooth running of fan motor. | Air cleaning: Filters, their types and specifications. Air flow measurements Use of velocity meters. Performance Testing criterion.<br>Principles of pipe sizing & study of services valves for charging at site. Principle of working of infra red remote control, study of electronic circuits.                                                                                                                                                                               |

## ***Mechanic (Domestic, Commercial Refrigeration and Air Conditioning Machines)***

|     |                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                         |
|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 5.  | Testing all weather air conditioners. Trouble shooting electrical & mechanical faults.                                                                                                                                                                                                                                | Fault diagnosis in window & split A.C. units with the help of problem trees.                                                                                                                                                                                                                                                                            |
| 6.  | Water cooler construction (Instantaneous and storage) refrigeration circuit, electrical circuit, working and control, soldering of copper tubes with stainless steel, Trouble shooting of commonly faced problem like condenser Fan Failure, corrosion etc.                                                           | <ul style="list-style-type: none"> <li>a. Water storage, distribution and drainage</li> <li>b. Refrigeration system using R-22 and components in lieu of R-12,</li> <li>b) Retrofitting with HFC-134a &amp; HCs</li> <li>c) Electrical and control system</li> <li>d) Insulation and Energy conservation</li> </ul>                                     |
| 7.  | Checking- and servicing visi cooler, deep freezer, Preventive maintenance and Trouble Shooting. Retrofitting with Hydrocarbons and HFC 134a.                                                                                                                                                                          | Chest type bottle coolers, Deep Freezers and visi coolers Description, Construction and function substituting R-12 with R-134a or Hydrocarbon (Montreal protocol) Low temperature thermostat, different type of deep freezer construction.                                                                                                              |
| 8.  | Ice Candy Plant, refrigeration circuit, electrical circuit, working and control. Cold storage Plant, types of condenser cooling coil used, expansion devices, refrigerant used and electrical circuit study. Drawing out layout of a typical chilling plant.                                                          | Ice Candy Plant, Refrigerant used, Brine agitator, Expansion Device; used, Electrical Motor Controls etc.<br>Cold storage plant construction, refrigeration system with condenser & coil type used, RCD device used, super heat concept, electrical devices used. Chilling plants constructional details, System of refrigeration.                      |
| 9.  | Dismantling a pump unit from foundation. Checking the parts, servicing re-installing & testing the unit for performance & power consumption. Identifying parts of pumps & valves & note their functions.<br>Preparing a problem tree for fault diagnosis.                                                             | Pumps, types & applications. Centrifugal pumps, their constructional details & applications. Working of a centrifugal pump. Calculations of heads, frictional losses, selection of pump. Valve, their types & applications. Sluice valve, butterfly valve, non return valves, constructional details & principle of working. Fault diagnosis.           |
| 10. | Sketching & dimensioning the parts of a typical package unit and study its constructional & operational details. Operating a package unit for its working and performance. Study the installation details & duct system of a package unit. Rewire a package unit. Mechanical, electrical & operational fault finding. | Package Air conditioners, their need, types & applications Ductable & non ductable units. Constructional details of a package unit. Electrical wiring & refrigerant system controls & electrical controls. Installation & operational details. Fault diagnosis with help of a problem tree. Comparative study of package units available in the market. |

## ***Mechanic (Domestic, Commercial Refrigeration and Air Conditioning Machines)***

|     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 11. | <p>Installation, servicing &amp; re-installing a car A.C. unit. To test, service &amp; adjust different controls and switches. To check &amp; test the total system for performance.</p> <p>Study of typical central A.C. system using vapour absorption system.</p>                                                                                                                                                                                                                                                  | <p>Automobile air conditioning, need &amp; applications. Difference between a room A.C. and automobile A.C. Study the details of a typical automotive air conditioning system parts and their functions.</p> <p>Installation &amp; operation of a Car A.C.</p> <p>Trouble shooting with the help of a problem tree.</p> <p>Vapour Absorption Refrigeration system.</p> <p>Typical refrigeration cycle. Ammonia &amp; Lithium Bromide absorption system.</p> <p>Advantages &amp; disadvantages of vapour absorption refrigeration system. Air Refrigeration, steam jet refrigeration &amp; non- conventional refrigeration.</p>                                |
| 12. | <p>Studying and drawing the layout &amp; piping arrangement of the given Central A.C. Plant.</p> <p>Studying &amp; drawing the chilling water &amp; condensate water circuits.</p> <p>Studying different controls.</p> <p>Maintenance of pumps, compressors &amp; controls.</p> <p>Studying &amp; drawing the panel board connections &amp; wiring.</p> <p>Testing, pumping down &amp; re-testing the plant. Evacuating &amp; gas charging the system. Designing Central A.C. systems for different applications.</p> | <p>Introduction to Central A.C. plants, selection &amp; applications. Direct &amp; Indirect cooling, Air &amp; water as media for cooling.</p> <p>Central A.C. Plant system components, Compressor, condenser &amp; chiller. Fan coiled units &amp; Air handling units. Cooling Towers, their types, constructional details &amp; operation. Cooling Tower installation &amp; maintenance make up water arrangements. Types of compressors used, loading and unloading arrangements.</p> <p>Ducting &amp; its installation. Different switches &amp; controls. Trouble shooting. Heat load calculations for different site conditions &amp; applications.</p> |
| 13. | <b>Assessment / Examination (03 days)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |

**Note:** - More emphasis to be given on video/real-life pictures during theoretical classes. Some real-life pictures/videos of related industry operations may be shown to the trainees to give a feel of Industry and their future assignment.

## 9. SYLLABUS - CORE SKILLS

### 9.1 WORKSHOP CALCULATION SCIENCE & ENGINEERING DRAWING

#### BLOCK I

| Topic No. | a) Engineering Drawing                                                                                                                                                                                                                                                                                                                                           | Duration (in hours) | b) Workshop Science & Calculation                                                                                                                                     | Duration (in hours) |
|-----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
| 1         | Engineering Drawing:<br>Introduction and its importance<br>Different types of standards used in engineering drawing.<br>Drawing Instruments: their uses<br>Drawing board, T-Square, Drafter (Drafting M/c), Set Squares, Protractor, Drawing Instrument Box (Compass, Dividers, Scale, Diagonal Scales etc.), Pencils of different Grades, Drawing pins / Clips. | 30                  | <b>Units &amp; Measurements-</b><br>FPS, CGS, MKS/SI unit, unit of length, Mass and time. Fundamentals and derived units<br>Conversion of units and applied problems. | 20                  |
| 2         | Lines :<br>types and applications in Drawing as per BIS SP:46-2003<br>Drawing geometrical object using all types of lines.<br><b>Drawing of Geometrical Figures:</b> Angle, Triangle, Square, Rectangle and Circle.<br><b>Letters:</b> - Lettering styles, Single stroke letters and numbers as per IS standard.<br>Lettering practice                           |                     | <b>Material Science :</b><br>properties -Physical & Mechanical, Types - Ferrous & Non-Ferrous, difference between Ferrous and Non-Ferrous metals                      |                     |
| 3         | <b>Dimensioning-</b> Types of dimension, elements of dimensions, Methods of indicating Values, Arrangement, Alignment and indication of dimensions.<br><b>Scales:-</b> Types use and construction. Representative factor of scale.                                                                                                                               |                     | <b>Mass .Weight and Density :</b><br>Mass, Unit of Mass, Weight, difference between mass and weight, Density, unit of density,                                        |                     |

## Mechanic (Domestic, Commercial Refrigeration and Air Conditioning Machines)

|   |                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                    |  |
|---|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| 4 | <p>Method of presentation of Engineering Drawing</p> <ul style="list-style-type: none"> <li>- Pictorial View</li> <li>- Orthogonal View</li> <li>- Isometric view</li> </ul>                                                                                                                                                                                                         | <p><b>Speed and Velocity:</b><br/> Rest and motion, speed, velocity, difference between speed and velocity, acceleration, retardation.<br/> Average Velocity, Acceleration &amp; Retardation. Related problems.<br/> Circular Motion: Relation between circular motion and Linear motion, Centrifugal force, Centripetal force</p> |  |
| 5 | <p><b>Constructions:</b> - Draw proportionate free hand sketches of plane figures. Sketch horizontal, vertical and inclined line by free hand, Draw circles by free hand using square and radial line method, Draw arcs and ellipse by free hand</p>                                                                                                                                 | <p><b>Ratio &amp; Proportion :</b><br/> Simple calculation on related problems.<br/> <b>Percentage:</b><br/> Introduction, Simple calculation.</p>                                                                                                                                                                                 |  |
| 6 | <p><b>Projections:</b><br/> Concept of axes plane and quadrant.<br/> Orthographic projections<br/> Method of first angle and third angle projections (definition and difference)<br/> Symbol of 1<sup>st</sup> angle and 3<sup>rd</sup> angle projection as per IS specification.<br/> Free hand Drawing of Orthographic projection from isometric/3D view of geometrical blocks</p> | <p><b>Work, Power and Energy:</b> work, unit of work, power, unit of power, Horse power of engines, mechanical efficiency, energy, use of energy, potential and kinetic energy, examples of potential energy and kinetic energy.<br/> Meaning of H.P., I.H.P., B.H.P., and F.H.P. and CC and Torque.</p>                           |  |

## Mechanic (Domestic, Commercial Refrigeration and Air Conditioning Machines)

### B. Block- II

| Topic No. | a) Engineering Drawing                                                                                               | Duration (in hours) | b) Workshop Science & Calculation                                                                                                                                                                                                                                                                                                             | Duration (in hours) |
|-----------|----------------------------------------------------------------------------------------------------------------------|---------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
| 1         | <b>Screw :-</b><br>Its Types and Sizes, Screw thread, their standard forms as per BIS, external and internal thread. | 30                  | <b>Algebra:</b><br>Addition, Subtraction, Multiplication, Division, Algebraic formula, Linear equations (with two variables )                                                                                                                                                                                                                 | 20                  |
| 2         | <b>Rivets and Joints:-</b><br>Prepare a drawing sheet on rivets nomenclature and Joints.                             |                     | <b>Heat &amp; Temperature:</b><br>Heat and temperature, their units, difference between heat and temperature, boiling point, melting point, scale of temperature, relation between different scale of temperature, Thermometer, pyrometer, transmission of heat, conduction, convection, radiation.                                           |                     |
| 3         | Free hand Sketches for simple pipe line with general fittings.                                                       |                     | <b>Mensuration:</b> Area and perimeter of square, rectangle, parallelogram, triangle, circle, semi circle, Volume of solids - cube, cuboid, cylinder and Sphere.<br>Surface area of solids - cube, cuboid, cylinder and Sphere.<br>Volume of cut-out solids: hollow cylinders, frustum of cone, block section. Volume of simple solid blocks. |                     |
| 4         | Reading of drawing. Simple exercises related to missing lines, dimensions. How to make queries.                      |                     | <b>Basic Electricity:</b><br>Introduction, use of electricity, how electricity is produced, Types of current_ AC, DC, their comparison, voltage,                                                                                                                                                                                              |                     |

## Mechanic (Domestic, Commercial Refrigeration and Air Conditioning Machines)

|   |                                                                                            |  |                                                                                                                                                                                                                                                                                                                                                                                                            |  |
|---|--------------------------------------------------------------------------------------------|--|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
|   |                                                                                            |  | resistance, their units. Conductor, insulator, Types of connections - series, parallel, electric power, Horse power, energy, unit of electrical energy. Concept of earthling.).                                                                                                                                                                                                                            |  |
| 5 | Simple exercises related to trade related symbols. Basic electrical and electronic symbols |  | <b>Simple machines</b><br><b>Transmission of power:</b> - Transmission of power by belt, pulleys & gear drive.<br><b>Heat treatment process:</b> - Heat treatment and advantages. Annealing, Normalizing, Hardening, Tempering                                                                                                                                                                             |  |
| 6 | Free hand sketch of trade related components / parts /cutting tool indicating angles.      |  | <b>Trigonometry:</b><br>Trigonometrical ratios, measurement of angles. Trigonometric tables. Finding the value of unknown sides and angles of a triangle by Trigonometrical method. Finding height and distance by trigonometry. Application of trigonometry in shop problems. (viz. taper angle calculation). Calculate the area of triangle by using trigonometry and application of Pythagoras theorem. |  |
| 7 |                                                                                            |  | <b>Concept of pressure -</b><br><b>Definition:-</b> Force, Pressure, and their units, atmospheric pressure, gauges used for measuring pressure, problems. Introduction to pneumatics & hydraulics systems.                                                                                                                                                                                                 |  |
| 8 | Simple exercises related to trade related Test Papers. Solution of NCVT test papers.       |  |                                                                                                                                                                                                                                                                                                                                                                                                            |  |

## **9.2 EMPLOYABILITY SKILLS**

**(DURATION: - 110 HRS.)**

| <b>Block – I</b><br><b>(Duration – 55 hrs.)</b>             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|-------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1. English Literacy</b><br>Duration : 20 Hrs. Marks : 09 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Pronunciation</b>                                        | Accentuation (mode of pronunciation) on simple words, Diction (use of word and speech)                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Functional Grammar</b>                                   | Transformation of sentences, Voice change, Change of tense, Spellings.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Reading</b>                                              | Reading and understanding simple sentences about self, work and environment                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Writing</b>                                              | Construction of simple sentences Writing simple English                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Speaking / Spoken English</b>                            | Speaking with preparation on self, on family, on friends/ classmates, on know, picture reading gain confidence through role-playing and discussions on current happening job description, asking about someone's job habitual actions. Cardinal (fundamental) numbers ordinal numbers. Taking messages, passing messages on and filling in message forms Greeting and introductions office hospitality, Resumes or curriculum vita essential parts, letters of application reference to previous communication.                                                      |
| <b>2. I.T. Literacy</b><br>Duration : 20 Hrs. Marks : 09    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Basics of Computer</b>                                   | Introduction, Computer and its applications, Hardware and peripherals, Switching on-Starting and shutting down of computer.                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Computer Operating System</b>                            | Basics of Operating System, WINDOWS, The user interface of Windows OS, Create, Copy, Move and delete Files and Folders, Use of External memory like pen drive, CD, DVD etc, Use of Common applications.                                                                                                                                                                                                                                                                                                                                                              |
| <b>Word processing and Worksheet</b>                        | Basic operating of Word Processing, Creating, opening and closing Documents, use of shortcuts, Creating and Editing of Text, Formatting the Text, Insertion & creation of Tables. Printing document. Basics of Excel worksheet, understanding basic commands, creating simple worksheets, understanding sample worksheets, use of simple formulas and functions, Printing of simple excel sheets.                                                                                                                                                                    |
| <b>Computer Networking and Internet</b>                     | Basic of computer Networks (using real life examples), Definitions of Local Area Network (LAN), Wide Area Network (WAN), Internet, Concept of Internet (Network of Networks), Meaning of World Wide Web (WWW), Web Browser, Web Site, Web page and Search Engines. Accessing the Internet using Web Browser, Downloading and Printing Web Pages, Opening an email account and use of email. Social media sites and its implication. Information Security and antivirus tools, Do's and Don'ts in Information Security, Awareness of IT - ACT, types of cyber crimes. |
| <b>3. Communication Skills</b>                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |

## Mechanic (Domestic, Commercial Refrigeration and Air Conditioning Machines)

|                                                     |                                                                                                                                                                                                                                                                                                                                                   |            |
|-----------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| Duration : 15 Hrs.                                  |                                                                                                                                                                                                                                                                                                                                                   | Marks : 07 |
| <b>Introduction to Communication Skills</b>         | Communication and its importance<br>Principles of Effective communication<br>Types of communication - verbal, non verbal, written, email, talking on phone.<br>Non verbal communication -characteristics, components-Para-language<br>Body language<br>Barriers to communication and dealing with barriers.<br>Handling nervousness/ discomfort.  |            |
| <b>Listening Skills</b>                             | Listening-hearing and listening, effective listening, barriers to effective listening guidelines for effective listening.<br>Triple- A Listening - Attitude, Attention & Adjustment.<br>Active Listening Skills.                                                                                                                                  |            |
| <b>Motivational Training</b>                        | Characteristics Essential to Achieving Success.<br>The Power of Positive Attitude.<br>Self awareness<br>Importance of Commitment<br>Ethics and Values<br>Ways to Motivate Oneself<br>Personal Goal setting and Employability Planning.                                                                                                            |            |
| <b>Facing Interviews</b>                            | Manners, Etiquettes, Dress code for an interview<br>Do's & Don'ts for an interview.                                                                                                                                                                                                                                                               |            |
| <b>Behavioral Skills</b>                            | Problem Solving<br>Confidence Building<br>Attitude                                                                                                                                                                                                                                                                                                |            |
| <b>Block – II</b><br><b>Duration – 55 hrs.</b>      |                                                                                                                                                                                                                                                                                                                                                   |            |
| <b>4. Entrepreneurship Skills</b>                   |                                                                                                                                                                                                                                                                                                                                                   |            |
| Duration : 15 Hrs.                                  |                                                                                                                                                                                                                                                                                                                                                   | Marks : 06 |
| <b>Concept of Entrepreneurship</b>                  | Entrepreneur - Entrepreneurship - Enterprises:-Conceptual issue<br>Entrepreneurship vs. Management, Entrepreneurial motivation.<br>Performance & Record, Role & Function of entrepreneurs in relation to the enterprise & relation to the economy, Source of business ideas, Entrepreneurial opportunities, The process of setting up a business. |            |
| <b>Project Preparation &amp; Marketing analysis</b> | Qualities of a good Entrepreneur, SWOT and Risk Analysis. Concept & application of PLC, Sales & distribution Management. Different Between Small Scale & Large Scale Business, Market Survey, Method of marketing, Publicity and advertisement, Marketing Mix.                                                                                    |            |
| <b>Institutions Support</b>                         | Preparation of Project. Role of Various Schemes and Institutes for self-employment i.e. DIC, SIDA, SISI, NSIC, SIDO, Idea for financing/ non financing support agencies to familiarizes with the Policies /Programmes & procedure & the available scheme.                                                                                         |            |
| <b>Investment Procurement</b>                       | Project formation, Feasibility, Legal formalities i.e., Shop Act, Estimation & Costing, Investment procedure - Loan procurement - Banking Processes.                                                                                                                                                                                              |            |

## ***Mechanic (Domestic, Commercial Refrigeration and Air Conditioning Machines)***

|                                                                  |                                                                                                                                                                                                                 |
|------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>5. Productivity</b>                                           |                                                                                                                                                                                                                 |
| Duration : 10 Hrs. <span style="float: right;">Marks : 05</span> |                                                                                                                                                                                                                 |
| <b>Benefits</b>                                                  | Personal / Workman - Incentive, Production linked Bonus, Improvement in living standard.                                                                                                                        |
| <b>Affecting Factors</b>                                         | Skills, Working Aids, Automation, Environment, Motivation - How improves or slows down.                                                                                                                         |
| <b>Comparison with developed countries</b>                       | Comparative productivity in developed countries (viz. Germany, Japan and Australia) in selected industries e.g. Manufacturing, Steel, Mining, Construction etc. Living standards of those countries, wages.     |
| <b>Personal Finance Management</b>                               | Banking processes, Handling ATM, KYC registration, safe cash handling, Personal risk and Insurance.                                                                                                             |
| <b>6. Occupational Safety, Health and Environment Education</b>  |                                                                                                                                                                                                                 |
| Duration : 15 Hrs. <span style="float: right;">Marks : 06</span> |                                                                                                                                                                                                                 |
| <b>Safety &amp; Health</b>                                       | Introduction to Occupational Safety and Health importance of safety and health at workplace.                                                                                                                    |
| <b>Occupational Hazards</b>                                      | Basic Hazards, Chemical Hazards, Vibroacoustic Hazards, Mechanical Hazards, Electrical Hazards, Thermal Hazards. Occupational health, Occupational hygienic, Occupational Diseases/ Disorders & its prevention. |
| <b>Accident &amp; safety</b>                                     | Basic principles for protective equipment.<br>Accident Prevention techniques - control of accidents and safety measures.                                                                                        |
| <b>First Aid</b>                                                 | Care of injured & Sick at the workplaces, First-Aid & Transportation of sick person.                                                                                                                            |
| <b>Basic Provisions</b>                                          | Idea of basic provision legislation of India.<br>safety, health, welfare under legislative of India.                                                                                                            |
| <b>Ecosystem</b>                                                 | Introduction to Environment. Relationship between Society and Environment, Ecosystem and Factors causing imbalance.                                                                                             |
| <b>Pollution</b>                                                 | Pollution and pollutants including liquid, gaseous, solid and hazardous waste.                                                                                                                                  |
| <b>Energy Conservation</b>                                       | Conservation of Energy, re-use and recycle.                                                                                                                                                                     |
| <b>Global warming</b>                                            | Global warming, climate change and Ozone layer depletion.                                                                                                                                                       |
| <b>Ground Water</b>                                              | Hydrological cycle, ground and surface water, Conservation and Harvesting of water.                                                                                                                             |
| <b>Environment</b>                                               | Right attitude towards environment, Maintenance of in -house environment.                                                                                                                                       |
| <b>7. Labour Welfare Legislation</b>                             |                                                                                                                                                                                                                 |
| Duration : 05 Hrs. <span style="float: right;">Marks : 03</span> |                                                                                                                                                                                                                 |
| <b>Welfare Acts</b>                                              | Benefits guaranteed under various acts- Factories Act, Apprenticeship Act, Employees State Insurance Act (ESI), Payment Wages Act, Employees Provident Fund Act, The Workmen's compensation Act.                |
| <b>8. Quality Tools</b>                                          |                                                                                                                                                                                                                 |

## ***Mechanic (Domestic, Commercial Refrigeration and Air Conditioning Machines)***

|                                  |                                                                                                                                                                                                                                                  |            |
|----------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| Duration : 10 Hrs.               |                                                                                                                                                                                                                                                  | Marks : 05 |
| <b>Quality Consciousness</b>     | Meaning of quality, Quality characteristic.                                                                                                                                                                                                      |            |
| <b>Quality Circles</b>           | Definition, Advantage of small group activity, objectives of quality Circle, Roles and function of Quality Circles in Organization, Operation of Quality circle. Approaches to starting Quality Circles, Steps for continuation Quality Circles. |            |
| <b>Quality Management System</b> | Idea of ISO 9000 and BIS systems and its importance in maintaining qualities.                                                                                                                                                                    |            |
| <b>House Keeping</b>             | Purpose of House-keeping, Practice of good Housekeeping.                                                                                                                                                                                         |            |
| <b>Quality Tools</b>             | Basic quality tools with a few examples.                                                                                                                                                                                                         |            |



**Skill India**  
कौशल भारत - कुशल भारत

## **10. DETAILS OF COMPETENCIES (ON-JOB TRAINING)**

---

BROAD LEARNING TO BE COVERED IN INDUSTRY FOR MECHANIC (DOMESTIC, COMMERCIAL REFRIGERATION AND AIR CONDITIONING MACHINES) TRADE:

1. Safety and best practices /Basic Industrial Culture (5S, KAIZEN, etc.)
2. Record keeping and documentation
3. Testing, repairing, assembling, installing different Refrigeration and Air Conditioning machines.
4. Check the performance of different components as per requirement and check functionality.
5. Carryout maintenance of different systems.
6. *Note: Actual training will depend on the existing facilities available in the establishments.*

The **competencies/ specific outcomes** on completion of On-Job Training are detailed below: -

### **Block – I**

1. Identify the Compressors viz Reciprocating, Rotary, Scroll & their advantages & limitations  
Dismantle & Assemble of compressor, Servicing of compressor parts, checking components, Checking pumping and repairing Gasket Cutting, Checking Lubricating system, Oil Charging in Hermetic compressor, Lapping of compressor parts
2. Service/flushing of condenser, Importance of keeping condenser clean ,Remove and replace of Drier/filter ,Remove and replace capillary tube , Servicing/flushing of evaporator, Leak Testing and repairing of evaporator.
3. Handle and taking care of refrigerant cylinders, transfer of refrigerant from storage to service cylinder, Refrigerant cylinders identification of Refrigerant ,safety in handling of Refrigerants, Safe handling of Refrigerant cylinders & valves, Testing of Relay, capacitors & O.L.Ps ,Testing & Adjusting of Thermostat.
4. Access sealed system using piercing plier and valves/use recovery machine to recover, CFC/HCF/HFCs: Basic tests for quality of recovered component needing change. Clean/flush with dry N2 chemicals Trichloroethylene, safety in handling, safety in handling N2 cylinder with 2 stage regulator, Replacement of component and brazing and sealing system, Leak testing with dry N2 Pressure test, evacuation uses 2 stages Rotary vacuum pump. Use of Micron level vacuum gauge to ensure proper vacuum level charging
5. Retrofit a CFC filled commercial and Domestic Refrigerator with Hydro carbons/HFCs using sealed components.

## ***Mechanic (Domestic, Commercial Refrigeration and Air Conditioning Machines)***

6. Repair/Service of HC Refrigeration system using correct technique and ensuring safety, stripping direct cooled domestic refrigerator, Cleaning/Inspection/Testing of components direct cooled Refrigerator.
7. Find fault of direct cooled Refrigerator, Rectification of faults etc. Stripping of components, tracing electric circuit, thermostat, Bi-metallic, Defrost heater, Timer, Air-ducting, fan motor, Air purifiers in Frost free refrigerator.
8. Trouble shooting in Frost free refrigerator , common problems in Refrigerators like
  - a) No cooling
  - b) Poor cooling
  - c) High Current
  - d) Electrical leakobserve various pressure, temperature, current and noise etc. Study of water cooler construction & water filters cleaning in (instant & storage)
9. Check water circuit, electrical circuit working and controls, Leak test, evacuation & Gas charging, making test jigs for fault finding.
10. Trouble shooting of commonly faced problem of water cooler like condenser fan failures, study of Bottle cooler, construction of electrical circuit, Leak Test, Evacuation & Gas charging, Making of test board.
11. Trouble shooting of commonly faced problem of Bottle Cooler like condenser fan, failures, corrosion etc. Repair & maintenance of deep freezer, visi cooler, electrical circuit, Leak Testing, Vacuuming & Gas charging of Deep freezer, Visi cooler, Trouble shooting of commonly faced problem of Deep freezer and visi cooler
12. Retrofit a Refrigerator with HFC 134a of water cooler, Deep cooler, visi cooler & limits on charge of HCs.
13. Repair a refrigerator cabinet & spray painting, testing electrical components, leak repairing, testing leak, vacuuming and gas charging of ice cuber.
14. Test electrical components, repairing leak, testing leak, vacuuming & gas charging of juice dispenser.
15. Measure the dry bulb & wet bulb temperature, using of sling psychrometer , study and use of psychrometric chart. Stripping, Cleaning, Inspection Testing of components like outer wrapper, Grills, Blower motor, condenser fan portion, evaporator & Condenser, Venture , sweep mechanism , Rotary switch & thermostat , electrical components like capacitors , PTCs electrical wiring , check of earth & continuity reassemble & test.
16. Service and repairing of Air-coolers/desert cooler, Stripping of Room cooler and condensing unit. Identifying and cleaning, inspection, testing of components & re-assembly of Split AC
17. Operate the tangential blower sweep and swing mechanism, test electrical and electronics component including special function like auto cool, sleep dry etc. wiring, servicing and trouble shooting of split AC.

## ***Mechanic (Domestic, Commercial Refrigeration and Air Conditioning Machines)***

18. Installation, inspection, testing, wiring of a Window A.C
19. Service a window AC, Test Leak, Vacuuming, Gas charging of window AC, Trouble shooting, also use of correct instruments and tools.
20. Installation, inspection, testing Electrical components, wiring in a Split AC.
21. Service a Split AC, Leak Test, Vacuuming, and Gas charging of split A.C.
22. Trouble shooting, also use of correct instruments & Tools, Servicing of blower, fan motors and cooling coils.
23. Dismantle and assemble of wobble plate comp used in Auto A.C. Mounting Brackets on Engine blocks and compressor on Brackets and adjustment of belt tension. Types of "O" Ring compression pipe joints and flared joints. Hot water systems and mixing valves for Temperature control.
24. Operate the electromagnetic clutches on compressors. Check air flow and direction control. Check HP-LP switches, receivers, fast idle control devices ,vacuum and gas charging , tracing of wiring based on diagrams, identification and function of key components like thermostat electrically operated valves, fuses connectors, HP/LP switches compressor clutch, alternator/battery.
25. Repair, evacuation and charging of Auto A.C. systems. Trouble shooting of common faults on :-
  - a) No cooling
  - b) Poor cooling
  - c) Reduced air supply
  - d) Engine overheating
  - e) High compressor noise
26. Retrofit of CFC car A.C. system with HFC 134a.

### **Block – II**

25. Identify the refrigeration cycle and components for high, medium and low temperature application machines, identification of tubes and pipes, joints & pipe layout, observe safety and fire fighting equipments.
26. Draw the layout of Refrigeration cycle machines. Study lubrication system and lubricants. Refrigerant gas cylinder and their use, colour code and safety.
27. Practice in connecting domestic refrigerator electric motor with main supply, measurement of current in the circuit. Use of megger for insulation testing.
28. Test new evaporator coils for leak and choke. Repairing & cleaning of fins type evaporator & condenser coils.
29. Test condenser coils for leak and choke & repairing. De scaling of water cooled condenser. Servicing of air cooled condenser & straightening of fins.

## ***Mechanic (Domestic, Commercial Refrigeration and Air Conditioning Machines)***

30. Handle the gas cylinders, repair of leaky cylinder, reclaiming of refrigerant from dead refrigeration system. Charge the refrigeration oil & remove oil with the help of syphon or vacuum method.
31. Wire a hermetic compressor motor with relays, controls, cabinet light & find their fault & remedies.
32. Recover CFC / HCFC / HFCs by use of recovery Machine. Change the components, clean & flush with dry N<sub>2</sub>. Retrofitting of CFC filled commercial as well as domestic appliances with hydrocarbon, HFCs using sealed components.
33. Safe handling of N<sub>2</sub> cylinder with 2 stage regulator, Replacement of components, brazing sealed system, leak testing with dry N<sub>2</sub> pressure test. Evacuation of refrigeration system.
34. Trouble shooting- commonly faced problems in direct cooled refrigeration system in mechanical & electrical & their remedies. Retrofitting.
35. Trouble shooting- commonly faced problems in frost free refrigeration system in mechanical & electrical & their remedies. Retrofitting.
36. Service of ice cuber, testing electrical circuit, leak tests, evacuation and gas charging, check water circulating system. Retrofitting of existing system.
37. Service of water & bottle cooler, testing electrical circuit, leak tests, evacuation and gas charging. Retrofitting.
38. Service of deep freezer, testing electrical circuit, leak tests, evacuation and gas charging. Retrofitting.
39. Service of visi cooler, testing electrical circuit, leak tests, evacuation and gas charging. Retrofitting.
40. Operate Sling psychrometer, study and use of psychrometric charts, measurement of dry bulb and wet bulb temperature, relative humidity. Stripping, inspections & cleaning of outer wrapper, grills, slower motor. Condenser fans positions, evaporators, condenser and sweep mechanism, rotary switch and thermostat.
41. Service and maintenance of window A.C, testing the mechanical and electrical system for fault certification. Installation of Window A.C. Use of Remote Controls, identifying PCB & Remote related problems & replacing PCBs.
42. Service and repairing of air cooler/desert coolers stripping of air cooler / desert coolers stripping, inspection, cleaning & reassembly of components.
43. Service and maintenance of split A.C. safety aspects, leak testing, evacuation, gas charging & testing performance, installation of split A.C.
44. Dismantle and assembly of wobble plate compressor used in automobile A.C. assembling compressor on mounting brackets, engine adjustment, temperature controls, identification and functioning of key components like thermostat, electrical operating valves, fused connectors, clutch, alternator.

## ***Mechanic (Domestic, Commercial Refrigeration and Air Conditioning Machines)***

45. Select compressor, condenser, drier /filter, size & length calculation of capillary, evaporator selection in small capacity refrigerator
46. Select the compressor, condenser, drier/filter, size & length calculation of capillary, freezer selection, selection of commercial water cooler & bottle cooler.
47. Select the compressor, condenser, drier/filter, and size & length calculation of capillary for evaporator in Ice cube machines.
48. Select the compressor, condenser, drier /filter size & length calculation of capillary, evaporator selection for Window & split A.C.

### **Note:**

1. Industry must ensure that above mentioned competencies are achieved by the trainees during their on job training.
2. In addition to above competencies/ outcomes industry may impart additional training relevant to the specific industry.



**Skill India**  
कौशल भारत - कुशल भारत

**ANNEXURE – I**

**INFRASTRUCTURE FOR PROFESSIONAL SKILL & PROFESSIONAL KNOWLEDGE**

**TRADE: MECHANIC (DOMESTIC, COMMERCIAL REFRIGERATION AND AIR  
CONDITIONING MACHINES)**

**LIST OF TOOLS & EQUIPMENTS FOR 20 APPRENTICES**

**A. Trainees Toolkit**

| Sr. No. | Names of the tools & Equipments      | Quantity |
|---------|--------------------------------------|----------|
| 1.      | Steel rule 300 mm                    | 20 Nos.  |
| 2.      | Outside spring caliper 150 mm        | 20 Nos.  |
| 3.      | Inside spring caliper 150 mm         | 20 Nos.  |
| 4.      | Hermaphrodite caliper 150 mm         | 20 Nos.  |
| 5.      | Divider spring 150 mm                | 20 Nos.  |
| 6.      | Hammer B.P. 0.5 kg.                  | 20 Nos.  |
| 7.      | Combination plier 150 mm             | 20 Nos.  |
| 8.      | File flat bastard 300mm              | 20 Nos.  |
| 9.      | File flat 2 <sup>nd</sup> cut 250 mm | 20 Nos.  |
| 10.     | Engineers screw driver               | 20 Nos.  |
| 11.     | File flat smooth 200 mm              | 20 Nos.  |
| 12.     | Cold chisel flat 25 x 200 mm         | 20 Nos.  |
| 13.     | Combination Pliers 200mm insulated   | 20 Nos.  |
| 14.     | Screw Driver 100mm 200mm             | 20 Nos.  |
| 15.     | Neon Tester 500V pencil bit type     | 20 Nos.  |
| 16.     | Electrician Knife                    | 20 Nos.  |
| 17.     | Hammer ball peen 0.25kg              | 20 Nos.  |
| 18.     | File round 150mm                     | 20 Nos.  |
| 19.     | Tweezers                             | 20 Nos.  |

**B. General Shop outfit:**

| Sr. No. | Names of the tools & Equipments                        | Quantity |
|---------|--------------------------------------------------------|----------|
| 20.     | Granite Surface plate 1000mm x 630mm grade 1           | 4 Nos.   |
| 21.     | Metal stand table for surface plate 900 x 900 x 1200mm | 4 Nos.   |
| 22.     | Screw Driver Set (multiheads)                          | 1set     |
| 23.     | Scribing block universal 300mm                         | 2 Nos.   |
| 24.     | "V" Block universal 300 mm                             | 2 Nos.   |
| 25.     | Try square 150mm                                       | 2 Nos.   |
| 26.     | Outside spring caliper 200 mm                          | 2 Nos.   |
| 27.     | Divider spring 200 mm                                  | 2 Nos.   |
| 28.     | Inside spring caliper 200 mm                           | 2 Nos.   |

## ***Mechanic (Domestic, Commercial Refrigeration and Air Conditioning Machines)***

|     |                                                                  |          |
|-----|------------------------------------------------------------------|----------|
| 29. | Straight edge steel 1 meter                                      | 1No.     |
| 30. | Spirit level 2V 250, 05 meter                                    | 1No.     |
| 31. | Screwdriver, heavy duty 300mm with handle                        | 4 Nos.   |
| 32. | Hammer lead 1 kg.                                                | 2 Nos.   |
| 33. | Combination set 300mm                                            | 2 Nos.   |
| 34. | Spindle blade screw driver 100mm                                 | 2 Nos.   |
| 35. | Allen hexagonal keys 2.5 to 12                                   | 2 Sets   |
| 36. | Spanner D.E.C.P. series 2(7 pcs. each)                           | 6 sets   |
| 37. | Adjustable spanner 12 Nos                                        | 3 Nos.   |
| 38. | Reduction sleeve MT as required                                  | 1set     |
| 39. | Angle palate size 200 x 100 x 200mm                              | 2 Nos.   |
| 40. | Angle plate adjustable 250 x 150 x 175                           | 2 Nos.   |
| 41. | Solid parallels in pairs (Different sizes) in metric             | 12 pairs |
| 42. | Oil can pressure feed 500mg                                      | 6 Nos.   |
| 43. | Oil stone 150 x 50 x 25mm                                        | 2 Nos.   |
| 44. | Twist drills 3mm to 13mm (Parallel Shank)                        | 1set     |
| 45. | Drill chuck 0-20 with taper shank                                | 1No.     |
| 46. | Centre drill A1 to 5                                             | 2 sets   |
| 47. | Grinding wheel dresser (star type)                               | 1No.     |
| 48. | Clamps C 100mm                                                   | 2 Nos.   |
| 49. | Clamps C 200mm                                                   | 2 Nos.   |
| 50. | Tap and die set in box metric pitch                              | 1set     |
| 51. | Drill HSS taper shank                                            | 1set     |
| 52. | File H/R 2 <sup>nd</sup> cut 250mm                               | 4 Nos.   |
| 53. | File triangular smooth 200mm                                     | 4 Nos.   |
| 54. | Needle file set                                                  | 1No.     |
| 55. | File square 2 <sup>nd</sup> cut 250 mm                           | 4 Nos.   |
| 56. | Reamer 6mm to 13mm by 1 mm                                       | 1set     |
| 57. | Hacksaw adjustable 250-300 mm with blades                        | 8 Nos.   |
| 58. | Magnifying glass 75mm                                            | 2 Nos.   |
| 59. | Micrometer outside 0-25mm                                        | 4 Nos.   |
| 60. | Micrometer outside 25-70 mm                                      | 4 Nos.   |
| 61. | Micrometer outside 50-75mm                                       | 2 Nos.   |
| 62. | Micrometer depth gauge 0-150mm                                   | 8 Nos.   |
| 63. | Direct reading Vernier caliper 0 to 300                          | 4 Nos.   |
| 64. | Vernier height gauge 250mm                                       | 1No.     |
| 65. | Vernier bevel protractor with least count of 5 minutes           | 1No.     |
| 66. | Dial Gauge                                                       | 4 Nos.   |
| 67. | Lever Type dial gauge                                            | 4 Nos.   |
| 68. | Dial gauge stand                                                 | 4 Nos.   |
| 69. | Screw pitch gauge for metric pitches (0.5 to 7mm)                | 2 sets   |
| 70. | Radius gauge metric set (1-6mm)                                  | 1set     |
| 71. | Feeler gauge                                                     | 1No.     |
| 72. | Sensitive Drilling machine pillar 12mm capacity with accessories | 2 Nos.   |
| 73. | Drilling machine pillar 20mm capacity with accessories           | 1No.     |
| 74. | Planner 18" wooden                                               | 2 Nos.   |

## ***Mechanic (Domestic, Commercial Refrigeration and Air Conditioning Machines)***

|      |                                                                         |            |
|------|-------------------------------------------------------------------------|------------|
| 75.  | Handsaw 24"                                                             | 6 Nos.     |
| 76.  | Pedestal grinder                                                        | 1No.       |
| 77.  | Hand Drilling Machine Power (10mm)                                      | 1Nos.      |
| 78.  | Planner Wooden 9"                                                       | 4 Nos.     |
| 79.  | Steel Jack planner 9"                                                   | 1No.       |
| 80.  | Centre punch 100 mm                                                     | 17 Nos.    |
| 81.  | Ordinary Wooden Mallet 50mm                                             | 17 Nos.    |
| 82.  | Cross Peen Hammer 0.25 kg with handle                                   | 17 Nos.    |
| 83.  | Protractor with blade 150mm                                             | 17 Nos.    |
| 84.  | Steel tape 2 meters                                                     | 17 Nos.    |
| 85.  | Hammer peaning with handle                                              | 4 Nos.     |
| 86.  | Hammer creasing with handle                                             | 4 Nos.     |
| 87.  | Hammer Planishing with handle                                           | 4 Nos.     |
| 88.  | Hammer Block with handle                                                | 2 Nos.     |
| 89.  | D.E.Spanner G.P. (6mm to 32 mm) (set of 12 spanner)                     | 2 Set      |
| 90.  | Handvice 50mm                                                           | 16 Nos.    |
| 91.  | Steel wire Brush 50mm x 150mm                                           | 16 Nos.    |
| 92.  | Gloves for welding (Leather and Asbestos)                               | 16 Nos.    |
| 93.  | Leather Apron                                                           | 16 Nos.    |
| 94.  | Tongs, Close mouth and pick up ( 1 each)                                | 4pairs     |
| 95.  | Portable Electric drill (single phase)                                  | 2 Nos.     |
| 96.  | Round File 2 <sup>nd</sup> cut 250mm                                    | 4 Nos.     |
| 97.  | Triangular file smooth 250mm                                            | 4 Nos.     |
| 98.  | Punch Round 3mm, 4mm & 6mm Dia                                          | 4 Nos.     |
| 99.  | Punch Round 4mm Dia                                                     | 4 Nos.     |
| 100. | File Flat 250mm smooth                                                  | 2 Nos.     |
| 101. | File half round 300mm smooth                                            | 2 Nos.     |
| 102. | Hand Groover 3mm, 4mm, 5mm                                              | 4 Nos.     |
| 103. | Grip Wrench 200mm                                                       | 2 Nos.     |
| 104. | Ladle 150mm Dia                                                         | 2 Nos.     |
| 105. | Hand Drill 0 to 6mm, 8mm, 10mm, & 12mm                                  | 2 Nos.each |
| 106. | Liquefied Petroleum Gas (LPG) Cylinder, Regulator and Torch with Burner | 2 Nos.     |
| 107. | D.E.Grinder Pedestal motorized 200 mm                                   | 1 No.      |
| 108. | LPG 2.5 kg Cylinder for swirl jet torch                                 | 4 Nos.     |
| 109. | Welding Transformer (200 to 400 amps)                                   | 2 Nos.     |
| 110. | Slip roll former 1.6mm x 1000mm                                         | 1 No.      |
| 111. | Anvil 50kgs with stand                                                  | 1 No.      |
| 112. | Swirl Jet Torch                                                         | 4 Nos.     |
| 113. | Snip (Straight) 300mm                                                   | 8 Nos.     |
| 114. | Snip (Straight) 150 mm                                                  | 8 Nos.     |
| 115. | Shear (Straight) 450 mm                                                 | 4 Nos.     |
| 116. | Shear (Straight) 600 mm                                                 | 4 Nos.     |
| 117. | Stakes Half moon                                                        | 2 Nos.     |
| 118. | Stake Hatchet                                                           | 2 Nos.     |
| 119. | Stake funnel                                                            | 2 Nos.     |

## ***Mechanic (Domestic, Commercial Refrigeration and Air Conditioning Machines)***

|      |                                                                                            |        |
|------|--------------------------------------------------------------------------------------------|--------|
| 120. | Stake Anvil                                                                                | 2 Nos. |
| 121. | Nylon Hammer (40mm Dia) with Handle                                                        | 8 Nos. |
| 122. | Snip(Bend) 300mm                                                                           | 4 Nos. |
| 123. | Snip (Straight) 300mm                                                                      | 8 Nos. |
| 124. | Snip (Straight) 150 mm                                                                     | 8 Nos. |
| 125. | Shear (Straight) 450 mm                                                                    | 4 Nos. |
| 126. | Shear (Straight) 600 mm                                                                    | 4 Nos. |
| 127. | Stakes Half moon                                                                           | 2 Nos. |
| 128. | Stake Hatchet                                                                              | 2 Nos. |
| 129. | Stake funnel                                                                               | 2 Nos. |
| 130. | Stake Anvil                                                                                | 2 Nos. |
| 131. | Nylon Hammer (40mm Dia) with Handle                                                        | 8 Nos. |
| 132. | Snip(Bend) 300mm                                                                           | 4 Nos. |
| 133. | Pliers side cutting 200mm                                                                  | 4 Nos. |
| 134. | Pliers round nose 200mm                                                                    | 4 Nos. |
| 135. | Pliers fat nose 150mm                                                                      | 4 Nos. |
| 136. | Pliers long nose 200mm                                                                     | 4 Nos. |
| 137. | Firmer chisel 25mm                                                                         | 4 Nos. |
| 138. | Hammer ball pein 1.0kg                                                                     | 1 No.  |
| 139. | Wall jumper octagonal 37mm x 450mm                                                         | 1 No.  |
| 140. | Center punch 100mm                                                                         | 1No.   |
| 141. | Steel measuring tape 20mts                                                                 | 1No.   |
| 142. | Allen keys                                                                                 | 1Set   |
| 143. | Spanner double ended set of 6                                                              | 2 sets |
| 144. | Electric soldering iron 35W                                                                | 4 Nos. |
| 145. | Electric soldering iron 125W                                                               | 2 Nos. |
| 146. | Rubber gloves 5000V                                                                        | 2Pairs |
| 147. | Multimeter 0-5, 100, 200, 500 mill amperes 0-100-1000, 10000 ohms<br>0150, 300, 600V AC/DC | 2 Nos. |
| 148. | Bar magnet                                                                                 | 1No.   |
| 149. | Horse shoe magnet                                                                          | 1No.   |
| 150. | Electric Drill Machine 6mm capacity universal type 250V                                    | 1No.   |
| 151. | D.C.Shunt motor 1 H.P. 250V (Laboratory type)                                              | 2 Nos. |
| 152. | Universal motor 750W AC/DC 250V                                                            | 2 Nos. |
| 153. | Squirrel cage induction motor 1 H.P., 230V with DOL starter                                | 1Nos.  |
| 154. | Transformer single phase 500 ma./250/12V                                                   | 4 Nos. |
| 155. | L.F. oscilloscope with Attenuation probes                                                  | 1No.   |
| 156. | Star Delta starter (contact type 8 points)                                                 | 1No.   |
| 157. | Tong Tester                                                                                | 1No.   |
| 158. | Megger                                                                                     | 1No.   |
| 159. | DC Power Supply 0V-110V/5A                                                                 | 1No.   |
| 160. | Auto – transformer – varies 230v                                                           | 1No.   |
| 161. | Crimping tools                                                                             | 1Set   |

**C. General Shop Outfit, Machinery and Installation**

| <b>Sr. No.</b> | <b>Names of the tools &amp; Equipments</b>                                        | <b>Quantity</b> |
|----------------|-----------------------------------------------------------------------------------|-----------------|
| 162.           | Flaring tool set, single type for tube 4.7mm to 16mm O.D.                         | 4 sets          |
| 163.           | Electrical drill portable drill with chuck & key, capacity 6.4mm.                 | 2 Nos.          |
| 164.           | Swaging tool, punch type, set of size for tube 4.7mm to 16mm O.D.                 | 4 sets          |
| 165.           | Swaging tool, screw type, with adaptor set of size for tube 4.7mm to 16mm O.D.    | 1 set           |
| 166.           | Gas cylinder truck two wheel type.                                                | 1 No.           |
| 167.           | Bending spring external type, for copper tube 3mm to 16mm DIA.                    | 4 sets          |
| 168.           | Line tester 500 v. heavy duty.                                                    | 4 Nos.          |
| 169.           | Pipe cutter miniature for copper tube 3mm to 16mm DIA.                            | 4 Nos.          |
| 170.           | Tong tester 0-10-30 amps. 0 - 500 v. (clamp on multimeter).                       | 4 Nos.          |
| 171.           | Pipe cutter with built in reamer & space cutter, for copper tube 3mm to 32mm .    | 1 No.           |
| 172.           | Knife folded stainless steel - 150mm.                                             | 4 Nos.          |
| 173.           | pinch of tool, for copper tube, 6mm to 18mm DIA.                                  | 4 Nos.          |
| 174.           | Voltmeter, AC/DC portable precision gread teak wood case leather belt 0 to 5 amp. | 2 each          |
| 175.           | Ratchet spanner of 6.4sq.mm reversible                                            | 4 Nos.          |
| 176.           | Ammeter, AC/DC portable, precision gread teak wood case leather belt 0 to 5 amp.  | 2 Nos.          |
| 177.           | Capillary plague gauge.                                                           | 2 Nos.          |
| 178.           | Megger - 1000 v.                                                                  | 1 No.           |
| 179.           | Pinch of plier / crimping plier tool 6mm -18mm. DIA.                              | 2 Nos.          |
| 180.           | Wattmeter multirange upto 1 kw.                                                   | 1 No.           |
| 181.           | Piercing plier 6-18mm & reversing valve with access fitting.                      | 2 Nos. Each     |
| 182.           | Multimeter analog type.                                                           | 1 Nos.          |
| 183.           | Spanner double ended 4.7mm to 16mm.                                               | 5 sets          |
| 184.           | Multimeter digital type.                                                          | 1 No.           |
| 185.           | Spanner double ended 19mm to 31.8mm.                                              | 1 set           |
| 186.           | Stop watch.                                                                       | 1 No.           |
| 187.           | Ring spanner off set 4.7mm to 16mm.                                               | 5 sets          |
| 188.           | Filler gauge 0.05mm - 1mm.                                                        | 1 Set           |
| 189.           | Ring spanner off set 19mm to 31.8mm.                                              | 1 set           |
| 190.           | Wire gauge metric & whit worth.                                                   | 1 Set           |
| 191.           | Box spanner size 6.4mm to 10mm.                                                   | 2 sets          |
| 192.           | Refrigerant cylinder 2.5 kg.                                                      | 2 Nos.          |
| 193.           | Wrench adjustable length 150mm.                                                   | 1 No.           |

## ***Mechanic (Domestic, Commercial Refrigeration and Air Conditioning Machines)***

|      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |             |
|------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|
| 194. | I) Evacuating & refrigerant charging station, compression.<br>a) Rotary two stage vacuum pump & motor (with gas ballast & anti suck back) manifold with gauges & valves & capable of pulling vacuum upto 50 microns of Hg & with provision of connecting to a microns level vacuum gauge.<br>b) Graduated charging cylinder with provision for temperature correction & all necessary isolating valves.<br>II) Evacuating & charging station as above but fitted with weighing scale (upto 2 kg. In lieu of (b) above & with accuracy of +/-1g for charging hydrocarbons. | 1 No.       |
| 195. | Wrench adjustable length 200mm.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 2 Nos.      |
| 196. | Two stage rotary vacuum pump capacity approx. 60 - 100 rpm, capable of evacuating to 50 microns of Hg & fitted with gas ballast, anti suck back valve & single phase motor.                                                                                                                                                                                                                                                                                                                                                                                               | 1 No.       |
| 197. | Wrench adjustable length 250mm.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 2 Nos.      |
| 198. | Scraper triangular blade removable 60mm.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 2 Nos.      |
| 199. | Pipe wrench size 50 & 150 mm.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 01 No. each |
| 200. | Pressure testing tank with lighting arrangement, pressure gauge ( 0 to 35kg/sq.cm.) double stage.                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 1 No.       |
| 201. | Torque wrench 300mm, 12.7mm square drive right & left hand.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 1 set       |
| 202. | Heating kit with infra red bulb. ( 200 watt capacity.)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 1 No.       |
| 203. | Valve key -t handle - 4.7mm & 6.4mm.sq.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 4 sets      |
| 204. | Refrigerator, compression type 165 litres                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 1 No.       |
| 205. | Socket set, reversible ratchet, 12.7mm square drive with extension 4.7mm to 31.2mm.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 2 sets      |
| 206. | Refrigerator, compression type 300 litres double door, double compressor system.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1 No.       |
| 207. | Socket set, reversible ratchet, 1/2" square drive with extension 3/16" to 1/4" BSW & SR.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1 set       |
| 208. | Work bench 1000mm x 600mm x 800mm. High.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 2 Nos.      |
| 209. | Pressure gauge diameter 63mm with recalibration set                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 4 Nos.      |
| 210. | Portable air- LPG brazing kit with 2 kg. LPG cylinder, torches, hoses, stand make.<br>A) with straight flame.<br>B) with ethylene/ swirl jet flame.                                                                                                                                                                                                                                                                                                                                                                                                                       | 1 No.       |
| 211. | Compound gauge, diameter 63mm. with recalibration set screw, scale vacuum 76mm. Pressure 15 kg/sq.cm.                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 4 Nos.      |
| 212. | Pliers flat nose 150mm.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 1 No.       |
| 213. | Service man thermometer in metal case - 30 <sup>0</sup> C to +30 <sup>0</sup> C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 4 Nos.      |
| 214. | Tap set with matching drills 3mm to 16mm.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 1 Set       |
| 215. | Gas leak detector for halogen gas.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 2 Nos.      |
| 216. | Micron vacuum gauge capable of reading upto 20                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 1 No.       |

## ***Mechanic (Domestic, Commercial Refrigeration and Air Conditioning Machines)***

|      |                                                                                                                                       |             |
|------|---------------------------------------------------------------------------------------------------------------------------------------|-------------|
|      | microns.                                                                                                                              |             |
| 217. | L-Allen key set size 1.5mm to 6.4mm.                                                                                                  | 4 Sets      |
| 218. | Sensor thermometer (digital).                                                                                                         | 2 Nos.      |
| 219. | T-Allen key set size 5/32" to 1/8".                                                                                                   | 4 Sets      |
| 220. | Fin straightener/fin comb.                                                                                                            | 4 Nos.      |
| 221. | Screw driver, plastic handle, 6mm TIP length 100mm to 150mm.                                                                          | 4 each      |
| 222. | HC refrigerant in cylinders / disposable containers.                                                                                  | 2 Nos.      |
| 223. | Screw driver, plastic handle, 10mm TIP length 200mm to 250mm.                                                                         | 4 each      |
| 224. | 134 A refrigerant in cylinders.                                                                                                       | 2 Nos.      |
| 225. | Philips screw driver - complete set in leather case.                                                                                  | 2 sets      |
| 226. | Recovery unit one each for cfc & 134A refrigerants with recovering cylinders                                                          | 1 Nos.      |
| 227. | Screw driver, plastic handle, 3mm TIP length 100mm to 150mm. Insulated.                                                               | 1 set       |
| 228. | Refrigerator 170 lit. using 134a refrigerant                                                                                          | 1 No.       |
| 229. | Pliers combination insulated length 200mm.                                                                                            | 2 Nos.      |
| 230. | Pliers long nose 200mm.                                                                                                               | 2 Nos.      |
| 231. | Fire extinguisher power type.                                                                                                         | 2 Nos.      |
| 232. | Hammer ball peen 220 gms.                                                                                                             | 4 Nos.      |
| 233. | Dry N <sub>2</sub> in cylinder with 2 stage regulator or commercial N <sub>2</sub> in cylinder with drier unit and 2 stage regulator. | 1 No.       |
| 234. | Hammer nylon 300 gms.                                                                                                                 | 4 Nos.      |
| 235. | Trichloroethylene bottle.                                                                                                             | 1 No.       |
| 236. | Engineers rule 300mm long.                                                                                                            | 1 No.       |
| 237. | Two way manifold with gauges.                                                                                                         | 1 No.       |
| 238. | Tape measuring 2m graduation in mm.                                                                                                   | 1 No.       |
| 239. | Four way manifold with gauges.                                                                                                        | 1 No.       |
| 240. | Chisel flat length 150mm.                                                                                                             | 4 Nos.      |
| 241. | Filter driers for cfc - 12 & hfc - 134A for repairs - retrofits.                                                                      | 8 Nos.      |
| 242. | Hack saw tubular metal frame adjustable.                                                                                              | 4 Nos.      |
| 243. | Sealed ex - proof components for use in h.s appliances : thermostat, sealed o/p's. solid state PTC's, door switches, lamp holders     | 4 Nos. each |
| 244. | Centre punch length 100mm.                                                                                                            | 4 Nos.      |
| 245. | Safety gloves, eye protection glasses.                                                                                                | 4 Nos.      |
| 246. | Oil can pressure type - 1 litre.                                                                                                      | 2 Nos.      |
| 247. | Schrader valve core removal tool.                                                                                                     | 1 No.       |
| 248. | File, flat medium, double cut, length 200mm.                                                                                          | 4 Nos.      |
| 249. | Acid test kit.                                                                                                                        | 1 No.       |
| 250. | File round , fine double cut, length 150mm.                                                                                           | 4 Nos.      |

## ***Mechanic (Domestic, Commercial Refrigeration and Air Conditioning Machines)***

|      |                                                                                                                              |                    |
|------|------------------------------------------------------------------------------------------------------------------------------|--------------------|
| 251. | Pop rivet gun.                                                                                                               | 1 No.              |
| 252. | File flat , fine double cut, length 150mm.                                                                                   | 4 Nos.             |
| 253. | Brazing alloy rods for 1/4"to7/8" tubes-Cu tocu, cu to steel, cu to brass & appropriate fluxes                               | 1Set               |
| 254. | File square , fine double cut, length 150mm.                                                                                 | 4 Nos.             |
| 255. | l) Hermetic compressors 1/8hp to 1/2hp) for use in repair work of appliances for CFCs & HFCs 1) Hermetic compressor for 134a | 2/3 No.<br>1/2 No. |
| 256. | Engineers square 200mm long.                                                                                                 | 2 Nos.             |
| 257. | Ball valves service valves, hand shut of valves of 1/4"to 7/8"                                                               | 2 Nos. Each        |
| 258. | Soldering iron exchangeable copper tip 65 watts.                                                                             | 5 Nos.             |
| 259. | Quick couplers , process tube adaptors for 1/4",3/8"                                                                         | 2 pairs each       |
| 260. | Pipe bending tool, lever type with degree indicator, for tube O.D. 6.4mm to 16mm.                                            | 2 Sets             |
| 261. | Compressors testers for small hermetic compressors                                                                           | 1 No.              |
| 262. | Hand blower portable complete 1/10 HP.                                                                                       | 1 No.              |
| 263. | Evaporator of direct cooled refrigerator with capillary heat exchanger                                                       | 1 No.              |
| 264. | Tap & die set 3mm to 16mm size                                                                                               | 1 Set              |
| 265. | Evaporator of frost free refrigerator                                                                                        | 1 No.              |
| 266. | Tap set with matching drills 1/4" to 5/8".                                                                                   | 1 Set              |
| 267. | Bellow type thermostats, H.P.stat, L.P.stat, humid stat, solenoid valves                                                     | 1 No. each         |
| 268. | Tape & die set 1/4" to 5/8" SAE size                                                                                         | 1 Set              |
| 269. | Electrical accessories: current & potential relays, start & run capacitors, PTCs, overload protectors, relays, contactors    | 1 No. each         |
| 270. | Digital type clampmeter                                                                                                      | 1 No.              |
| 271. | Puller 3 legged, with flexible arm 300mm.                                                                                    | 1 No.              |
| 272. | Bench vice 75mm jaw.                                                                                                         | 2 Nos.             |
| 273. | Electrical drill portable drill with chuck & key, capacity 6.4mm.                                                            | 2 Nos.             |
| 274. | Pedestal grinder, double ended wheel dia 200mm. 3000rpm.                                                                     | 1 No.              |
| 275. | Oxy-Acetylene welding set complete with cylinders regulators welding torches with difference nozzles                         | 1 No.              |
| 276. | Capillary plague gauge.                                                                                                      | 2 Nos.             |
| 277. | Voltmeter, AC/DC portable precision gread teak wood case leather belt 0 to 500 V.                                            | 2 Nos.             |
| 278. | Ammeter, AC/DC portable, precision gread teak wood case leather belt 0 to 30 V                                               | 2 Nos.             |
| 279. | Technometer digital, multirange 0 rpm to 3000 rpm. Portable small size in leather case.                                      | 1 No.              |
| 280. | Refrigerant cylinder 2.5 kg.                                                                                                 | 2 Nos.             |
| 281. | Dial thermometer remote control, armoured capillary dial                                                                     | 2 Nos.             |

## ***Mechanic (Domestic, Commercial Refrigeration and Air Conditioning Machines)***

|      |                                                                                                                                                                                                                                                            |        |
|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|
|      | 75mm. -50°C to +50°C.                                                                                                                                                                                                                                      |        |
| 282. | Anemometer ( Vane type)                                                                                                                                                                                                                                    | 1 No.  |
| 283. | Sling pycrometer mounted on aluminium back, scale - 50 C to +50 C.                                                                                                                                                                                         | 2 Nos. |
| 284. | Pilot tube & inclined tube manometer                                                                                                                                                                                                                       | 1 No.  |
| 285. | Hermetic compressors 1.5 (AC)                                                                                                                                                                                                                              | 1 No.  |
| 286. | Sensor thermometer (digital).                                                                                                                                                                                                                              | 2 Nos. |
| 287. | Hammer ball peen 450 gms.                                                                                                                                                                                                                                  | 4 Nos. |
| 288. | Scriber 150mm length                                                                                                                                                                                                                                       | 4 Nos. |
| 289. | Puller 3 legged, with flexible arm 120mm.                                                                                                                                                                                                                  | 1 No.  |
| 290. | frost free Refrigerator 260 liters use in H.C. Refrigerant                                                                                                                                                                                                 | 2 Nos. |
| 291. | Cut section of semi-harmatic screw compressor                                                                                                                                                                                                              | 1 No.  |
| 292. | Ammeter, AC/DC portable, precision gread teak wood case leather belt 0 to 30 V                                                                                                                                                                             | 2 Nos. |
| 293. | Variance input 230 v. output 400 v. Amp. Portable complete with metet& controls.                                                                                                                                                                           | 1 No.  |
| 294. | R.L.C. bridge.                                                                                                                                                                                                                                             | 1 No.  |
| 295. | Wrench adjustable length 200mm.                                                                                                                                                                                                                            | 2 Nos. |
| 296. | Air compressor, two stage for oil - less dry air, with rush proof tank assembly, heater & controls max. pr. 10kg/sq.cm. Capacity 45 litre, motor 1 hp.                                                                                                     | 1 No.  |
| 297. | Scraper triangular blade removable 60mm.                                                                                                                                                                                                                   | 2 Nos. |
| 298. | Lapping plate 250mm x 200mm.                                                                                                                                                                                                                               | 2 Nos. |
| 299. | Spray outfit, 'V' twin motor 1/2 hp. Delivery upto 120 litre free air pressure upto 3kg/sq.cm. With spray gun & fitting.                                                                                                                                   | 1 No.  |
| 300. | Punch hole for cutting gasket, 4.7mm to 16mmDIA.                                                                                                                                                                                                           | 4 Nos. |
| 301. | Deep frizer 165 litres - 18°C.,1/4 hp.                                                                                                                                                                                                                     | 1 No.  |
| 302. | Scissor, gasket cutting stainless steel, length 25mm.                                                                                                                                                                                                      | 4 Nos. |
| 303. | Bottle cooler 110 litres 1/6 hp.                                                                                                                                                                                                                           | 1 No.  |
| 304. | Water cooler instantaneous type.                                                                                                                                                                                                                           | 1 No.  |
| 305. | Water cooler storage type.                                                                                                                                                                                                                                 | 1 No.  |
| 306. | Ice candy unit complete with stainless steel tank, mould box, thermocol insulated sunmica body, agitator, compressor, motor ele. Temperature, pressure, refrigerant control gauges, motor, pipe fitting ele 3000kcal/hr. working trainer model/ simulator. | 1 No.  |
| 307. | Cold storage plan complete with all controls & accessories including cooling tower & water treatment plant capacity 15000 kcal/hr. or working trainer model/ simulator.                                                                                    | 1 No.  |
| 308. | Welding table 900mm x 900mm x 700mm high.                                                                                                                                                                                                                  | 1 No.  |
| 309. | Micrometer outside measurement 0 to 25mm.                                                                                                                                                                                                                  | 2 Nos. |
| 310. | Tape measuring 10m graduation in mm.                                                                                                                                                                                                                       | 1 No.  |
| 311. | Vernier height gauge 250mm.                                                                                                                                                                                                                                | 1 No.  |

## ***Mechanic (Domestic, Commercial Refrigeration and Air Conditioning Machines)***

|      |                                                                                                                                  |                 |
|------|----------------------------------------------------------------------------------------------------------------------------------|-----------------|
| 312. | Vernier Caliper gauge 250mm.                                                                                                     | 1 No.           |
| 313. | Sensor thermometer (digital).                                                                                                    | 2 Nos.          |
| 314. | Divider spring joint length 150mm.                                                                                               | 4 Nos.          |
| 315. | Caliper spring joint out side length 150mm.                                                                                      | 4 Nos.          |
| 316. | Caliper spring joint in side length 150mm.                                                                                       | 4 Nos.          |
| 317. | Caliper, odd leg, spring joint length 150mm.                                                                                     | 4 Nos.          |
| 318. | Filter driers for cfc - 12 & HFC - 134A for repairs - retrofits.                                                                 | 8 Nos.          |
| 319. | Small capacity shell & tube condenser.                                                                                           | 1 No.           |
| 320. | Fan coil unit with water valves (2 & 3way).                                                                                      | 1 No.           |
| 321. | Marking block, unversed spindle 200mm.                                                                                           | 2 Nos.          |
| 322. | Shell & tube, DX chillers ( small).                                                                                              | 1 No.           |
| 323. | V - block with clamp 75mm.                                                                                                       | 2 Nos.          |
| 324. | Circulating water pump ( small).                                                                                                 | 1 No.           |
| 325. | Surface plate with stand 600mm x 450mm.                                                                                          | 1 Set           |
| 326. | Angle plate, 120° C 100mm 90° C.                                                                                                 | 1 No.           |
| 327. | Safety shoes ( optional).                                                                                                        | NIL             |
| 328. | Pipe threading dies protection glasses.                                                                                          | 1 No.           |
| 329. | Refractometer( optional).                                                                                                        | 1 No.           |
| 330. | Hand formers & 20 g capacity lock former.                                                                                        | 1 No.           |
| 331. | Plumb weight 200g.                                                                                                               | 1 No.           |
| 332. | Snipper sheet metal straight nose 200mm.                                                                                         | 1 No.           |
| 333. | Visi cooler                                                                                                                      | 1 No.           |
| 334. | Desktop Personnel Computers Intel Pentium-IV-CPU, 17" Monitor, Key Board, FDD, HD 80 GB, Window XP Professional Operating System | 8 Nos.          |
| 335. | UPS 600 VA                                                                                                                       | 8 Nos.          |
| 336. | Suitable Computer Tables                                                                                                         | As per required |
| 337. | Shoe Rack                                                                                                                        | As per required |
| 338. | Computer Chairs                                                                                                                  | 17 Nos.         |
| 339. | Vacuum cleaner                                                                                                                   | 1 No.           |
| 340. | Spanner double ended 4.7mm to 16mm.                                                                                              | 5 sets          |
| 341. | Descaling pumpset with stainless steel impeller & housing complete with motor 1 hp& accessories.                                 | 1 No.           |
| 342. | Micron vacuum gauge capable of reading upto 20 microns.                                                                          | 2 Nos.          |
| 343. | Components for car AC systems.                                                                                                   | 1 each          |
|      | A) Wobble plate compressor with mounting                                                                                         |                 |
|      | B) Serpentine evaporator.                                                                                                        |                 |
|      | C) Parallel flow condenser.                                                                                                      |                 |
|      | D) Hoses, tubes, receiver, expansion valve.                                                                                      |                 |
|      | E) electrical components & wiring harness.                                                                                       |                 |
| 344. | Air compressor, two stage for oil - less dry air, with rush proof tank assembly, heater & controls max. pr. 10kg/sq.cm.          | 1 No.           |

***Mechanic (Domestic, Commercial Refrigeration and Air Conditioning Machines)***

|      |                                                                                                                                                                                                                                          |        |
|------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|
|      | Capacity 45 ltr, motor 1 hp.                                                                                                                                                                                                             |        |
| 345. | Air conditioning, direct & indirect water chiller. Complete with all controls including humidity control ele capacity 15000kcal/hr. or working trainer model/ simulator. Alternatively, a packaged air -conditioner of similar capacity. | 1 No.  |
| 346. | Reciprocating compressor with provision of capacity control etc. for demonstration. Capacity 9000kcal/hr. semi hermetic open type.                                                                                                       | 1 No.  |
| 347. | Recovery unit one each for cfc & 134A refrigerants with recovering cylinders                                                                                                                                                             | 1 No.  |
| 348. | Condensing unit with open type compressor air-cooled condenser, controls cap.3000 k.cal/ hr.                                                                                                                                             | 1 No.  |
| 349. | Condensing unit with open type compressor, evaporative condenser, with electric control cap.3000 k.cal/hr.                                                                                                                               | 1 No.  |
| 350. | Working model of absorption system of Refrigeration cap. 3000 k.cal/hr.                                                                                                                                                                  | 1 No.  |
| 351. | Air-velocity meter (Digital type)                                                                                                                                                                                                        | 1 No.  |
| 352. | Testing machine for calibration & testing fo electrical starter, relay, contractor, solenoid valve. LP, HP, Oil pressure cut out.                                                                                                        | 1 No.  |
| 353. | Package A/C 7.5 ton cap. Water cool type                                                                                                                                                                                                 | 1 No.  |
| 354. | Package A/C 3 ton Air cooled type                                                                                                                                                                                                        | 1 No.  |
| 355. | Small capacity shell & Tube type condenser                                                                                                                                                                                               | 1 No.  |
| 356. | Fan coil unit with water valve ( 2 & 3 way)                                                                                                                                                                                              | 1 No.  |
| 357. | Shell & tube type Dx chiller (Small)                                                                                                                                                                                                     | 1 No.  |
| 358. | Thermostatic Exp. Valve                                                                                                                                                                                                                  | 1 No.  |
| 359. | Solenoid valve                                                                                                                                                                                                                           | 1 No.  |
| 360. | HP, LP, Oil pressure cut out switch                                                                                                                                                                                                      | 1 each |
| 361. | Cut section of Dxchiller                                                                                                                                                                                                                 | 1 No.  |
| 362. | Cut section of Shell & tube type condenser                                                                                                                                                                                               | 1 No.  |
| 363. | Cut section of Hermatic Scroll comp                                                                                                                                                                                                      | 1 No.  |
| 364. | Cut section of Hermatic Reciprocating compressor                                                                                                                                                                                         | 1 No.  |
| 365. | Table model of vapur absorption system                                                                                                                                                                                                   | 1 No.  |
| 366. | Screw compressor (open type)                                                                                                                                                                                                             | 1 No.  |

**Note:** - In case of any tools and equipments repeated in the above tool list only one (1) item to be considered for procurement.

**INFRASTRUCTURE FOR WORKSHOP CALCULATION & SCIENCE AND ENGINEERING  
DRAWING**

**TRADE: Fitter (Steel Plant)**

**LIST OF TOOLS& EQUIPMENTS FOR -20APPRENTICES**

1) **Space Norms** : 45 Sq. m.(For Engineering Drawing)

**2) Infrastructure:**

| <b>A : TRAINEES TOOL KIT:-</b> |                                    |                          |                 |
|--------------------------------|------------------------------------|--------------------------|-----------------|
| <b>Sl. No.</b>                 | <b>Name of the items</b>           | <b>Specification</b>     | <b>Quantity</b> |
| 1.                             | Draughtsman drawing instrument box |                          | 20+1 set        |
| 2.                             | Set square celluloid               | 45° (250 X 1.5 mm)       | 20+1 set        |
| 3.                             | Set square celluloid               | 30°-60° (250 X 1.5 mm)   | 20+1 set        |
| 4.                             | Mini drafter                       |                          | 20+1 set        |
| 5.                             | Drawing board                      | (700mm x500 mm) IS: 1444 | 20+1 set        |
| <b>B : Furniture Required</b>  |                                    |                          |                 |
| <b>Sl. No.</b>                 | <b>Name of the items</b>           | <b>Specification</b>     | <b>Quantity</b> |
| 1                              | Drawing Board                      |                          | 20              |
| 2                              | Models : Solid & cut section       |                          | as required     |
| 3                              | Drawing Table for trainees         |                          | as required     |
| 4                              | Stool for trainees                 |                          | as required     |
| 5                              | Cupboard (big)                     |                          | 01              |
| 6                              | White Board                        | (size: 8ft. x 4ft.)      | 01              |
| 7                              | Trainer's Table                    |                          | 01              |
| 8                              | Trainer's Chair                    |                          | 01              |

| TOOLS & EQUIPMENTS FOR EMPLOYABILITY SKILLS                                                              |                                                                                                                                                    |          |
|----------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| Sl. No.                                                                                                  | Name of the Equipment                                                                                                                              | Quantity |
| 1.                                                                                                       | Computer (PC) with latest configurations and Internet connection with standard operating system and standard word processor and worksheet software | 10 Nos.  |
| 2.                                                                                                       | UPS - 500VA                                                                                                                                        | 10 Nos.  |
| 3.                                                                                                       | Scanner cum Printer                                                                                                                                | 1 No.    |
| 4.                                                                                                       | Computer Tables                                                                                                                                    | 10 Nos.  |
| 5.                                                                                                       | Computer Chairs                                                                                                                                    | 20 Nos.  |
| 6.                                                                                                       | LCD Projector                                                                                                                                      | 1 No.    |
| 7.                                                                                                       | White Board 1200mm x 900mm                                                                                                                         | 1 No.    |
| <b>Note: - Above Tools &amp; Equipments not required, if Computer LAB is available in the institute.</b> |                                                                                                                                                    |          |

**Skill India**  
कौशल भारत - कुशल भारत

**FORMAT FOR INTERNAL ASSESSMENT**

| Name & Address of the Assessor :     |                                 |                        |                      |                   |                         | Year of Enrollment :                            |                          |                                    |                             |                     |                        |                                 |              |
|--------------------------------------|---------------------------------|------------------------|----------------------|-------------------|-------------------------|-------------------------------------------------|--------------------------|------------------------------------|-----------------------------|---------------------|------------------------|---------------------------------|--------------|
| Name & Address of ITI (Govt./Pvt.) : |                                 |                        |                      |                   |                         | Date of Assessment :                            |                          |                                    |                             |                     |                        |                                 |              |
| Name & Address of the Industry :     |                                 |                        |                      |                   |                         | Assessment location: Industry / ITI             |                          |                                    |                             |                     |                        |                                 |              |
| Trade Name :                         |                                 |                        | Semester:            |                   |                         | Duration of the Trade/course:                   |                          |                                    |                             |                     |                        |                                 |              |
| Learning Outcome:                    |                                 |                        |                      |                   |                         |                                                 |                          |                                    |                             |                     |                        |                                 |              |
| Sl. No                               | Maximum Marks (Total 100 Marks) | 15                     | 5                    | 10                | 5                       | 10                                              | 10                       | 5                                  | 10                          | 15                  | 15                     | Total internal assessment Marks | Result (Y/N) |
|                                      | Candidate Name                  | Father's/Mother's Name | Safety consciousness | Workplace hygiene | Attendance/ Punctuality | Ability to follow Manuals/ Written instructions | Application of Knowledge | Skills to handle tools & equipment | Economical use of materials | Speed in doing work | Quality in workmanship | VIVA                            |              |
| 1                                    |                                 |                        |                      |                   |                         |                                                 |                          |                                    |                             |                     |                        |                                 |              |
| 2                                    |                                 |                        |                      |                   |                         |                                                 |                          |                                    |                             |                     |                        |                                 |              |