सत्यमेव जयते
Government of India

Study on

PUBLIC PROCUREMENT POLICIES FOR HIRING TRAINED AND CERTIFIED REFRIGERATION AND AIR-CONDITIONING SERVICE TECHNICIANS

OZONE CELL
MINISTRY OF ENVIRONMENT, FOREST & CLIMATE CHANGE
GOVERNMENT OF INDIA

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MESSAGE

The significant increase of residential and commercial air-conditioners, motor vehicles and cold chain infrastructure has led to an expansion of market for the servicing sector. The Servicing sector is important as it is directly related to (i) consumption of refrigerants and (ii) optimum and efficient performance of equipment. Out of the total consumption of refrigerants in the country, about 45% is used for servicing. Proper maintenance and servicing not only improves the performance of the equipment by about 50% over its lifetime, but also contribute significantly to the reduction of greenhouse gas emissions. Appropriate interventions in this sector, mainly promoting engagement of trained and certified service technicians provide twin benefits of skill upgradation and environmental protection.

In recent years, emphasis has been given by various Governments to Public Procurement, which, over the years has become one of the crucial economic activities of any government and economy. Public Procurement also enables Governments to access a wider range of choices to get the best deals on goods and services. Considering the importance of the servicing sector in the coming years, it would be desirable to evolve policies for hiring trained and certified service technicians under the ambit of public procurement.

The study on Public Procurement Policies for Hiring Trained and Certified Refrigeration and Air-Conditioning Service aims to examine the benefits associated with the utilization of trained and certified technicians, to evaluate the influence of their specialized knowledge not only in improving the performance of the equipment, but also reduce leakage of refrigerants into the atmosphere through adopting good servicing practices.

I congratulate all those involved in the preparation of this report.

Date: 14.09.2023

(Bhupender Yadav)

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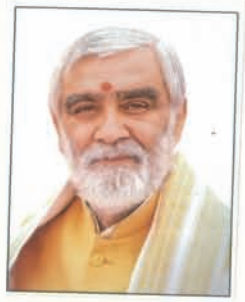

संदेश

ग्रीनहाउस गैस उत्सर्जन को कम करने के लिए मॉन्ट्रियल प्रोटोकॉल के किगाली संशोधन में हाइड्रोफ्लोरोकार्बन (एचएफसी) को चरणबद्ध तरीके से कम किए जाने के दौरान कम ग्लोबल वार्मिंग क्षमता वाली वैकल्पिक प्रौद्योगिकियों को अपनाने पर जोर दिया गया है। आने वाले वर्षों में, हाइड्रोक्लोरोफ्लोरोकार्बन (एचसीएफसी) और एचएफसी रेफ्रिजरेंट दोनों के साथ शीतलन उपकरणों के स्टॉक में वृद्धि के साथ-साथ सर्विसिंग की मांग बढ़ती जा रही है, जिसके लिए सर्विसिंग सेक्टर को बढ़ावा देना आवश्यक है।

'सर्विसिंग क्षेत्र' में तकनीशियनों के लिए एकीकृत प्रशिक्षण प्रणाली के लिए एचसीएफसी फेज आउट मैनेजमेंट प्लान (एचपीएमपी) के चरण-III को लागू किया जा सकता है, जिसे वर्ष 2030 तक कार्यान्वित किया जाना है। इसके माध्यम से सरकार देशभर में प्रशिक्षित और प्रमाणित सेवा तकनीशियनों को नियुक्ति देकर सर्विसिंग की भारी मांग को पूरा कर सकेगी।

यह प्रकाशन एक महत्वपूर्ण संसाधन सामग्री के रूप में काम करेगा और इसको सभी संबंधित हितधारकों के बीच व्यापक रूप से प्रसारित किया जाना चाहिए। इसके अलावा, इस अध्ययन की प्रस्तावित सिफारिशों को लागू करने के लिए भी प्रयास किए जाने चाहिए।

(अश्विनी कुमार चौबे)

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MESSAGE

With the majority of regions in India having a hot and humid climate, the use of Air conditioners in the country is growing rapidly.

Although HCFC-22, a refrigerant used in air-conditioners, is being phased out under the Hydrochlorofluorocarbon (HCFC) Phase out Management Plans (HPMPs) of the Montreal Protocol, a significant percentage of currently installed stock of ACs are charged with this refrigerant. HCFC-22 is not only an Ozone Depleting Substance (ODS), it also has a high global warming potential (GWP).

The increased use of low GWP refrigerants also poses challenges, not only relating to flammability, toxicity or both, but some of them also have very high operating pressures. Hence, the Refrigeration & Air Conditioning (RAC) servicing sector requires special attention, and interventions to upgrade the skills of the RAC Servicing technicians, as also the new technicians entering into this sector.

There is need for a unified training and certification system with focus on good service practices and on alternatives to currently used refrigerants, as also practices for handling and servicing of air conditioning equipment/appliances using flammable refrigerants.

The Study on Public Procurement Policies for Hiring Trained and Certified Refrigeration and Air-Conditioning Service Technicians will be highly beneficial for various stakeholders in getting professional service, as well as in promoting employment opportunities for the service technicians.

My compliments to the team for compiling this informative and useful document.

(Leena Nandan)

New Delhi,
September 12, 2023.

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ABBREVIATIONS

ACs	air conditioners
AMC	Annual Maintenance Contract
Btu	British thermal unit
CEEE	Consumer Electrical and Electronics
CFC	chlorofluorocarbon
CP	Country Program
CPWD	Central Public Works Department
CTC	carbon tetrachloride
ESSCI	Electronics Sector Skills Council of India
GeM	Government e-Marketplace
GFR	General Financial Rules
GoI	Government of India
HCFC	hydrochlorofluorocarbons
HFC	hydrofluorocarbons
HPMPs	HCFC Phase-out Management Plans
HVAC	Heating, Ventilation and Air Conditioning
ITIs	Industrial Training Institutes
kcal	kilocalories
kW	kilowatt
L1	lowest possible cost
LCCP	Life Cycle Climate Performance
LSEE	Large and Small Electrical and Electronic Equipment
MSDE	Ministry of Skill Development and Entrepreneurship
MSEs	Micro and Small Enterprises
ODS	ozone-depleting substances
OEMs	original equipment manufacturers

PPE	Personal protective equipment
PSUs	public sector undertakings
PWD	Public Works Department
RAC	Refrigeration and Air Conditioning
SC/ST	Scheduled Caste and Scheduled Tribe
SDGs	Sustainable Development Goals
SLA	service level agreement
SOPs	standard operating procedures
SP	Service Provider
TVET	Technical and Vocational Education and Training
W	watt

1. Introduction

The Montreal Protocol is a landmark international agreement that exemplifies the nation's dedication to safeguarding the Earth's delicate ozone layer and mitigating the adverse impacts of ozone-depleting substances. With increasing focus on protection of the ozone layer, India acceded to the Vienna Convention for the Protection of the Ozone Layer on March 18, 1991, and became a party to the Montreal Protocol on Substances that Deplete the Ozone Layer on June 19, 1992. India assumed a pivotal role in establishing the Multilateral Fund (MLF), the financial mechanism instituted under the Montreal Protocol via the London Amendment of 1990. Additionally, India has been proactively engaged in executing the Montreal Protocol within its borders. In 1993, the nation meticulously formulated a comprehensive Country Programme (CP) aimed at phasing out Ozone Depleting Substances (ODSs) in alignment with its National Industrial Development Strategy. The objectives of the CP included judicious utilization of the Protocol's financial mechanism and ensuring minimal impact on consumers, producers, and equipment manufacturers reliant on ODSs. The CP was updated in 2006 to align with evolving decisions of the Montreal Protocol as well as national policies, to emphasize economic continuity, indigenous production expansion, optimal replacement strategies, decentralized management, and obsolescence mitigation.

India's economic growth has been characterized by remarkable expansion, driven by strategic policy initiatives across a diverse range of sectors. This growth reflects the nation's resilience, entrepreneurial spirit, and ongoing commitment to sustainable development. At the present growth rate, India is projected to become one of the world's top three economies. This economic development entails higher energy usage across various sectors/subsectors of the economy and translates to increase in per capita income, better living and working conditions of the people, greater urbanization, etc. Cooling has been recognized as one of the essential requirements for achieving several sustainable goals. Growing demand for cooling agents presents several opportunities for the economy, including employment, but also poses environmental challenges unless met in a sustainable manner.

Since India is a tropical country, the challenge of meeting the demand for coolants that are non-ODS as well as environmentally sustainable requires a more systematic, collaborative, innovative approach. Increasing multi-sectoral cooling demand means more cooling system installations of refrigeration and air conditioning equipment (air conditioners, heating, ventilation, & Air conditioning (HVAC) equipment, chillers, water coolers etc.) as well as installation, repairs & maintenance of this equipment. Large-scale operation of cooling equipment in buildings, offices, warehouses, and transport has a bulk volume of cooling equipment and systems which also consume a considerable quantity and types of refrigerants and energy.

HVAC equipment would require periodic servicing, not just for proper functioning but also for efficient operation of the cooling equipment. This highlights the imminent role of the Refrigeration & Air Conditioning (RAC) servicing sector. The servicing sector is a key component of the RAC industry and handles a large number of refrigerants. The service level depends on the technicians' knowledge & skills as well as proper tools & equipment. The RAC servicing sector serves the applications in residential, industrial and commercial sectors owned by public and private entities. The recruitment of servicing technicians through public channels serves as a significant catalyst for the growth and development of the service industry. Consequently, it is imperative to conduct a thorough examination of the technician employment process within the realm of

public procurement. The implementation of international environmental agreements ties this investigation to the issue of having the appropriate equipment, training, and readiness to deal with new refrigerants and emerging technologies, etc., with regard to sustainable cooling in the broader sense. This report explores this often-neglected area in detail.

2. The Montreal Protocol and Its Implementation

The Montreal Protocol has been a strong driver of sustainable cooling across the globe. The first international agreement to protect the stratospheric ozone layer was established in 1985 with the adoption of the Vienna Convention for the Protection of the Ozone Layer. The Convention formed the foundation for the Montreal Protocol on Substances that Deplete the Ozone Layer. The Montreal Protocol was established in 1987 to regulate the production and consumption of chemicals that are harmful to the stratospheric ozone layer. All 198 nations were parties to the Vienna Convention and the Montreal Protocol, two international environmental treaties that have achieved universal ratification. The Montreal Protocol is considered to be the most effective environmental protection agreement to date.

India became a party to the Vienna Convention for the protection of the Ozone layer in 1991 and ratified the Montreal Protocol on Substances that Deplete Ozone Layer in 1992 to act on the Substances that Deplete the Ozone Layer and control the consumption of ODSs. Since then, India has ratified all amendments to the Montreal Protocol, with latest, Kigali Amendment, ratified in 2021. Table 1 provides the dates of accession by India to the Montreal Protocol and its amendments.

The Government of India has entrusted the tasks relating to implementation of the Montreal Protocol to the Ministry of Environment, Forest and Climate Change. Acting expeditiously and in the interests of global harmony, India rapidly phased out ODS such as chlorofluorocarbons (CFCs), carbon tetrachlorides (CTCs), and halons by 2010. Hydrochloroflurocarbons (HCFCs) were the new refrigerant gases which replaced the CFCs,

Table 1: Dates of Accession by India to the Montreal Protocol and its Amendments

Agreement/ Amendment	Ratification
Vienna Convention	18 March 1991
Montreal Protocol	19 June 1992
London Amendment	19 June 1992
Copenhagen Amendment	3 March 2003
Montreal Amendment	3 March 2003
Beijing Amendment	3 March 2003
Kigali Amendment	27 September 2021

CTCs and halons in end-use applications because they contained hydrogen and broke down more easily in the atmosphere than did CFCs. Though HCFCs had less ozone depletion and global-warming potential than CFCs they were still ODS. As a time-bound global approach, India has implemented the HCFC phase-out guided by HCFC Phase-out Management Plans (HPMPs).

HPMP stages were introduced in developing countries to enable compliance with the control targets of HCFCs. Under HPMP Stage I & II in India, several sector-specific measures have been taken to strengthen the RAC servicing sector. This includes capacity building of technicians through training programmes conducted by different organizations with the objective of promoting energy efficiency, development of sectoral strategies, actions integrating phase-out of HCFCs, and enabling the adoption of non-HCFC alternatives. In view of the significant role of the service sector in the HCFC phase-out in India, HPMP Stages highlighted the importance of sustainable jobs for technicians by means of targeted public and private procurement strategies.

3. RAC Servicing Sector and Training in India

The exponential growth of air-conditioning systems, vehicles, and cold chain infrastructure has caused the market for the servicing sector to grow by leaps and bounds. The servicing sector has a direct correlation with refrigerant consumption and equipment efficiency as approximately 40 - 45% of the country's refrigerant consumption caters to servicing needs. Effective maintenance can enhance equipment performance by up to 50% over its lifespan and noticeably curtail greenhouse gas emissions. Interventions in this area, thus, yield dual advantages: skill enhancement and environmental preservation.

The servicing sector has come under the spotlight in the implementation of the Montreal Protocol implementation, especially during the phase-out of CFCs and the ongoing HCFC reduction. The sector will continue to hold significance during the phase-down of hydrofluorocarbons (HFCs), which pose challenges on account of the flammability and safety concerns of their new alternative refrigerants. The servicing sector is a focal point in the Indian Cooling Action Plan (ICAP), introduced by the Ministry of Environment, Forest and Climate Change in 2019. The plan outlines a comprehensive vision for cooling strategies, encompassing demand reduction, refrigerant transition, energy efficiency enhancement, and advanced technology adoption up to 2037–38. In the interests of fostering uniformity in the servicing sector, ICAP suggests a standardized curriculum, training, and certification framework administered by a singular government entity.

The RAC servicing sector in India has a diverse range of establishments that provide maintenance services for all types of refrigeration and air conditioning systems. The sector is estimated to employ approximately 350,000technicians in formal and informal enterprises; however, the industry anticipates requirement for a higher volume of servicing technicians. Service workshops are considered formal when they are registered with relevant government authorities and have a minimum specified workforce employed, e.g., manufacturers' service centres and larger authorized service workshops. Many service RAC workshops in India operate in the informal sector and are small, or even tiny, with one or two 'all-round'/multi-skills technicians. RAC manufacturers operate their own sales and service networks. In order to attend to customers in smaller cities and towns, manufacturers' contract service workshops all over the country, known as 'authorized' or 'franchised' service workshops. In addition, there is a large informal service sector with no tie-ups to manufacturers, in large cities as well as small towns, which is closest to the customers.

Due to rapid urbanization and rising demand for cooling, the Indian RAC servicing sector is expected to witness tremendous growth in the coming decades. This growth, apart from generating large numbers of jobs in the sector, also presents an opportunity to build a future-ready servicing task force. The informal nature of the sector, along with the safety hazards posed by the occupation, necessitates an emphasis on workplace safety measures as well as social security benefits for service sector personnel. India has established training institutes to produce trained technicians. In order to strengthen the institution of existing service technicians by building the capacity, various training programmes are conducted primarily by government institutions, industry bodies, and bilateral agencies. For end-use servicing requests,

the technicians are hired by individuals, industries and building owners.

Currently, there are various training programmes available in the country—programmes for beginners as well as short-duration refresher course/ recognition of prior learning programmes for people who have been working in the sector for some time.

As per India's Technical and Vocational Education and Training (TVET) ecosystem, Industrial Training Institutes (ITIs) and Polytechnics are the two premier institutes that provide training and certification for technicians for the RAC servicing sector. The courses conducted by these institutes are comprehensive, of long-duration, and vocational in nature.

3.1 Industrial Training Institutes

Industrial Training Institutes (ITIs), both government and private, are under administrative control of the respective states/ UTs and the Directorate General of Training (DGT), Ministry of Skill Development and Entrepreneurship (MSDE), Government of India, which is a policymaking, awarding body for affiliation, assessment and certification. ITIs run training programmes under the Craftsmen Training Scheme.[1] These are mostly post-secondary schools that provide training in various trades and focus on building manpower for the industrial sector of the country. The course durations of (1) Refrigeration and Air conditioner Technician and (2) Central Air-condition Plant Mechanic under CTS scheme are 24 months and they mainly focus on the application and history of refrigeration and air-conditioning, as well as problems in air conditioning and refrigeration systems. After completion of the course, the trainees are awarded the National Trade Certificate (NTC) for employment or self-employment purposes.

3.2 Polytechnics

Polytechnics conduct a three-year diploma program after higher secondary schooling. Most of these programmes are in mechanical engineering, with refrigeration and air conditioning as elective courses.

3.3 Recognition of Prior Learning

Recognition of Prior Learning (RPL) programme was developed by the Electronics Sector Skills Council of India (ESSCI) to recognize and certify technicians who have prior experience in the servicing sector. In this three-day training programme practical training is provided to technicians for installation and repair of split and window ACs in residences.

3.4 HPMP Servicing Training

HPMP Servicing Training has been rolled out to strengthen the service sector as the HCFC Phase-out management plan is put into action to implement the Montreal Protocol in the country. Under this plan, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)—the German agency for international cooperation and the Ozone Cell have developed RAC training programmes for servicing technicians conducted with the help of training partners, with a team of over 60 trainers across the country. The training is provided free of cost to technicians. This two-day training programme focuses on practical training. Under HPMP Stage-I, a total of 11,276 technicians were trained through 408 training programmes, and under HPMP Stage-II a total of 17000 technicians were trained by December 2022.[2]

3.5 Training and Certification of RAC Service technicians under Skill India Mission

Ozone Cell has developed a project jointly with the Electronic Sector Skill Council of India (ESSCI) for upskilling and certifying 100,000 RAC service technicians under the Skill India Mission or Pradhan Mantri Kaushal Vikas Yojana of the Ministry of Skill Development and Entrepreneurship (MSDE). Under Phase-I of the project, 20,000 service technicians have been up-skilled, out of which 17,000 technicians have been certified. Under Phase 2 of the project, 24,000 technicians have been upskilled, out of which 21,000 technicians have been certified. Thus, a total of 44,000 technicians have been

1 https://dgt.gov.in/sites/default/files/NCVT_Affiliation_norms_ITIs.pdf

2 http://ozonecell.nic.in/wp-content/uploads/2022/09/1-Success-Story-Book-2022.pdf

upskilled, out of which 38,000 technicians have been certified in both phases.[3]

3.6 Private Sector Training Programmes

Private Sector Training Programmes are technology-bound learning schedules conducted by the original equipment manufacturers (OEMs) and industry Associations. These training are focused on technicians who have previous experience in the field.

3.7 Training for skill up-gradation of employees

Training for skill up-gradation of employees (e.g., Indian Society for Heating, Refrigerating and Air-conditioning Engineers (ISHRAE) certification programme): This programme is for ITIs, working professional in any organization or independently and focuses on customer service soft skills and covers different AC systems.

3.8 RAC Company-run institutes

Apart from these training programmes and courses most of the service personnel enter the RAC servicing field without any formal vocational training. These technicians learn servicing practices under the supervision of senior service personnel already practicing servicing in the field.

Besides the availability of trained technicians under the said programmes, the hiring practices of servicing technicians vary and mostly rely on conventional hiring procedures. Public procurement plays a key role in transforming the servicing sector to formalize the sector, which is a slow process.

3 http://ozonecell.nic.in/wp-content/uploads/2022/09/1-Success-Story-Book-2022.pdf

4. Public Procurement

4.1 Introduction

Public procurement refers to the purchase of goods and services by governments and other central/state departments/institutions. Public procurement wields enormous purchasing power, accounting for an average of 12% to 20% of gross domestic product (GDP) at a global level *(World Bank, 2020)*. Public procurement involves purchasing of goods or services by different entities such as union ministries, and departments of the government for public service delivery and encompasses activities ranging from assessment of procurement needs to award of contracts and final payment.

Owing to its linkages with Sustainable Development Goals (SDGs)(SDG target 12.7: Promote public procurement practices that are sustainable, in accordance with national policies and priorities)[4], public procurement has been a subject of global reforms. One such known reform is using public procurement as a preferred tool to transform least developed markets such as efficient cooling.

4.2 Public Procurement

4.2.1 Existing Policy Landscape in India

Public procurement in India is currently guided by multiple, well-founded procurement guidelines and policies applied to government departments and public sector undertakings (PSUs), namely:

- General Financial Rules, 2017 (GFR) and the Delegation of Financial Power Rules, 1978 (DFPR).
- Manual for Procurement of Goods, 2017; Manual for Procurement of Works, 2019, and
- Manual for Procurement of Consultancy and Other Services, 2017.

In 2017 GoI also launched an electronic portal—Government e-Marketplace (GeM)—to make the procurement process more transparent, efficient, and more accountable. The government issued Public Procurement (Preference to Make in India) Order 2017 to grant purchase preference to local suppliers based on certain conditions to promote manufacturing and production of goods and services in India (*Public Procurement (Preference to Make in India) Order*, 2017). The framework of public procurement in India broadly comprises the following elements:[5]

4.2.2 Provision under the Constitution

The Article 282 of the Constitution of India provides for financial autonomy in public spending. It authorizes and allows the central and state governments to contract for goods and services, executive power, and autonomy in public spending.

Other than constitutional provision, various other procurement rules and policies provide comprehensive guidelines for public procurement stated in Table 2.

To maintain the transparency and competition and for better probity, some laws such as Competition Act, 2002, Right to Information Act, 2005, Prevention of Corruption Act, 1988 and Prevention of Money Laundering Act, 2002 etc. also support public procurement.

4 SDG 12- https://sdgs.un.org/goals/goal12

5 https://taxguru.in/finance/public-procurement-india-legal-regulatory-provisions.html

Table 2: Chronology of Public Procurement Rules and Guidelines

RULES/POLICIES	INFORMATION
General Financial Rules (GFR),1947	Procurement in India mainly governed by the GFR. These are the general rules of GoI which are applicable to all government ministries/ departments. (Last modified in 2017).
Delegation of Financial Powers Rules (DFPR), 1978 (DFPR)	These rules delegate the government's financial powers to various ministries and subordinate authorities.
Public Procurement Bill, 2012	The Bill seeks to regulate and ensure transparency in procurement by the Central Government with some exemptions.
Manuals and Policies governing procurement by individual ministries/departments	Defense: Defense Procurement Procedure, 2016 ("DPP") Railways: Railway e-Procurement Systems (IREPS) etc.
Manual for Procurement of Goods (MPG), 2017	These are guidelines for the purchase of goods.
Public Procurement (preference to Make in India) Order, 2017.	This order grants purchase preference to local suppliers based on certain conditions to promote manufacturing and production of goods and services in India.

4.3 Public Procurement of Service Technicians

In India, public procurement, including for services, is governed by General Financial Rules (GFR) specified by the Department of Expenditure, Ministry of Finance, Government of India. The rules have applications across Central Government Ministries/Departments, attached offices and subordinate bodies.

The Manual for Procurement of Works, 2019, Department of Expenditure, Ministry of Finance, lays down the administrative procedures for procurement of works which include the mechanical and electrical works involving fabrication, installation, erection, repair and maintenance of a mechanical or electrical nature relating to machinery. Hiring of servicing technicians is mostly conducted by the government departments/ institutions to repair or perform preventive maintenance of refrigeration and air conditioning equipment. The government departments/ institutions adhere to the guidelines given in the manuals as and when the requirement arises. Abiding by the rules and standard operating procedures, the procurement processes focus on transparency in the hiring process and enabling a competitive business environment.

Detailed analysis has been carried out by mapping the existing procurement policies, methods and hiring processes for hiring RAC servicing technicians by various government departments, ministries, public sector units, and autonomous organizations. Much of the hiring of services in public procurement is currently happening electronically, through what is known as the e-procurement system, which entails procuring items electronically using the internet. This facility drastically reduces the tendering cycle time, reduces most of the indirect costs, and enhances transparency in procurement.

In public procurement, the primary objective of tendering is to hire a service provider/ contractor to deliver the contract in a fair and transparent manner. The buyer (also called the indenter) publishes a tender to the market to attract suppliers who can meet the buyer's requirements for a certain type of goods/services. Like most other procurement mechanisms, the tenders to hire servicing technicians can be broadly classified into open tendering, selective/limited tendering and empanelment, as shown in Figure 1.

While organizations hire the servicing technicians as per their own procurement policies, GeM serving as

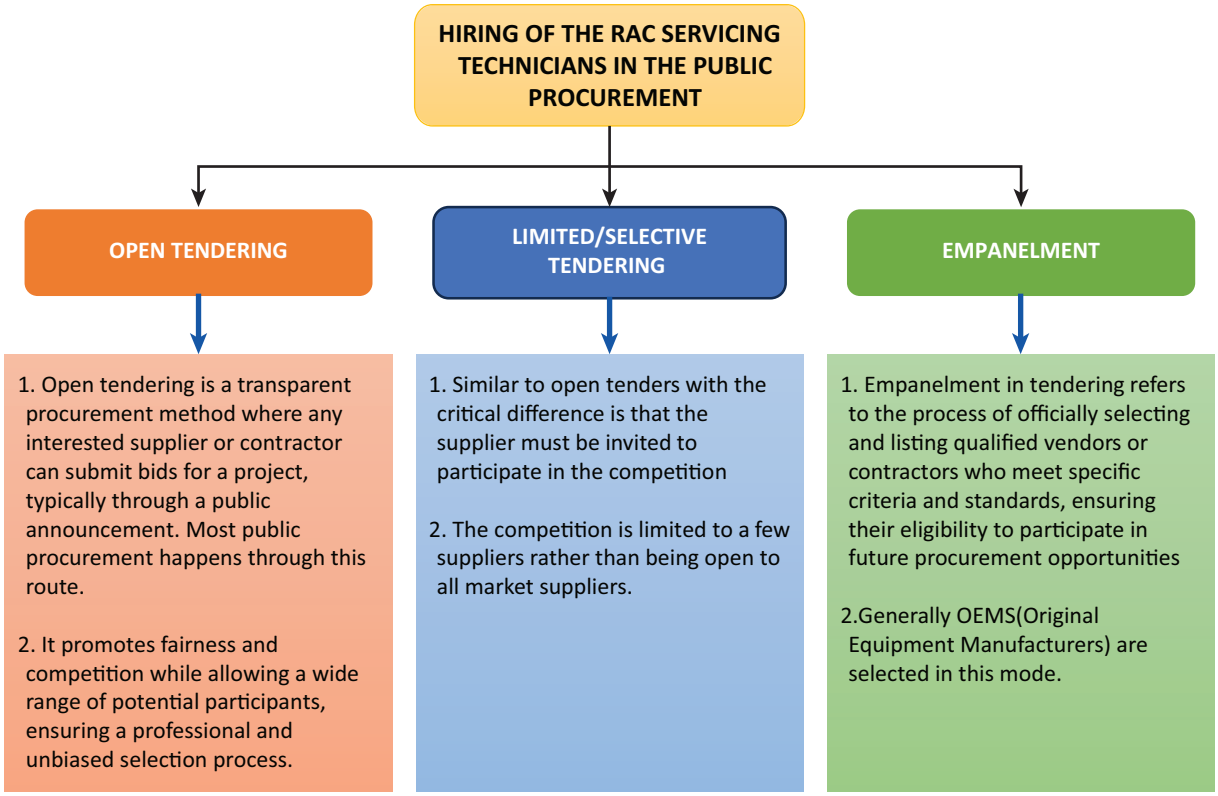

FIGURE 1: Types of Tenders

the facilitating portal to hire servicing technicians is an important mode of procurement. GeM, thus, plays a key role in procurement of servicing technicians.

4.3.1 Procurement Via Government E-Marketplace

Government e-Marketplace (GeM) is an online platform facilitating the procurement of common use services required under the ambit of public procurement of government departments / institutions/public sector units (PSUs).

There are three primary buying modes in GeM, and the platform indicates the appropriate mode based on the total monetary value of the procurement. The three purchasing modes available are Direct Purchase, Direct Purchase with L1 and e-bid/RA.

Procurement of a service is based on its level and complexity. One end of the spectrum is a set of standard services whose complexity is low and whose quality can be assessed using technical specifications. For slightly complex services it may be important for the buyer to establish relevant work experience. For project-based buying quality can be determined by numerous factors, including financial net worth, approach and methodology, and current ongoing work.

Buyers are one of the key stakeholders in the GeM ecosystem. Registration is mandatory for all buyers. Only after registration and authentication by GeM, can any transaction on the GeM portal be performed. Buyer user roles are based on the segregation of duties. One primary user (who may also be termed as point of contact) registers the organization and creates/modifies secondary users. Secondary users are those who are involved in the bidding process, including payment processing.

With minimal human intervention, GeM is a completely paperless, cashless, and system-driven e-marketplace for the procurement of common goods and services.

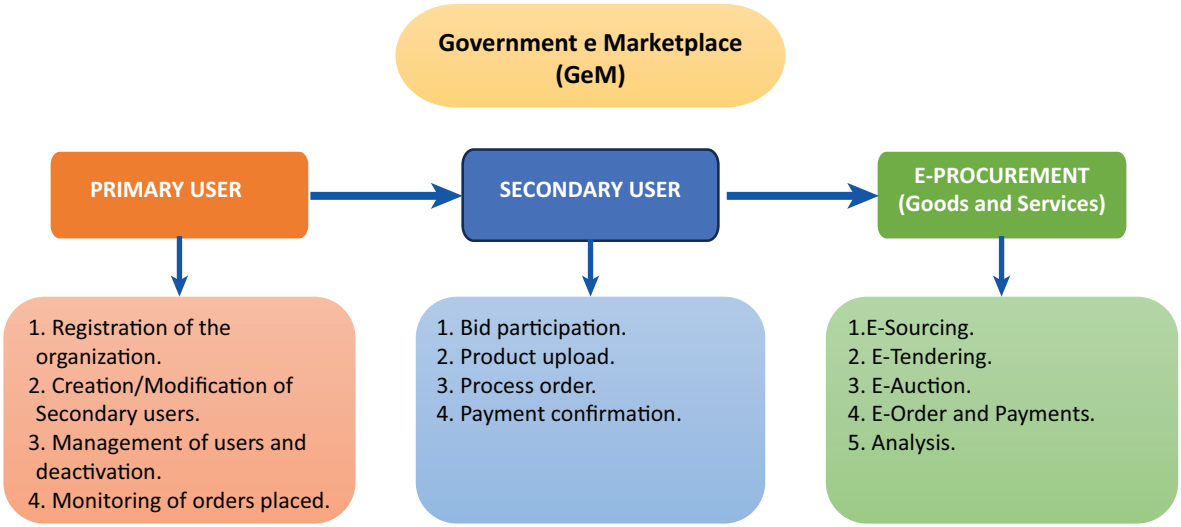

FIGURE 2: GeM: Segregation Based on Buyer/User Roles

The scope of procuring services under the GeM portal lies in its range of operation, including buyers, services and operation mechanisms.

As per the general terms and conditions specified by GeM, the contract to hire servicing technicians is designed to be comprehensive, inclusive of installation, repairs, and replacement of the spare parts without any extra cost and expenses to the Service Provider (SP). The servicing technicians are mandated to carry out quarterly routine services, preventive maintenance and breakdown maintenance for AC/HVAC systems covered under the Annual Maintenance Contract (AMC). The scope of the Annual Comprehensive Maintenance Service places the obligation for upkeep and smooth working of the HVAC/Air Conditioning System within the premises of the buyer's department on the SP, as per the provision laid down in service level agreement (SLA) and other provisions contained in the contract.

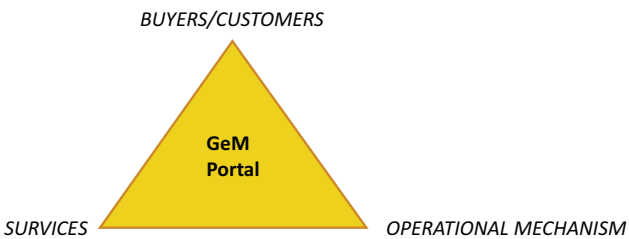

FIGURE 3: GeM Portal Overview

The comprehensive contract includes replacement of faulty spares like compressors, starting capacitors, running capacitors, relays, thermostats, fan capacitors, fan motors, selector switches, power contactors, control contactors, external time switch units provided for specific time running of A.Cs, stabilizers, rewinding of motors, providing ball bearing of motors, fan blades, drive belt, electronic control circuitry, remote control units, condenser, air handling units, centrifugal fan, filters, cooling coils, heating coils, water coils, preheater, heater, volume control diffusers, damper, humidifier, mixing box, duct line/pipeline, cassette, chiller/cooling tower, boiler, water pump, water pipeline, water drain/ sewage line, valves, vibration isolators etc. including gas changing and attending all complaints and breakdowns of all types of air-conditioning systems.

The specific scope covering requirements/ guidelines of the maintenance schedule for effective maintenance of each cooling/HVAC system to be carried out shall be provided by the buyer with the approval of the competent authority at the time of bidding.

A contract generated through GeM includes the following documents.

The AMC details the scope of work, the stakeholder's obligation, and the terms and conditions of all services covered, as understood by all parties in the contract.

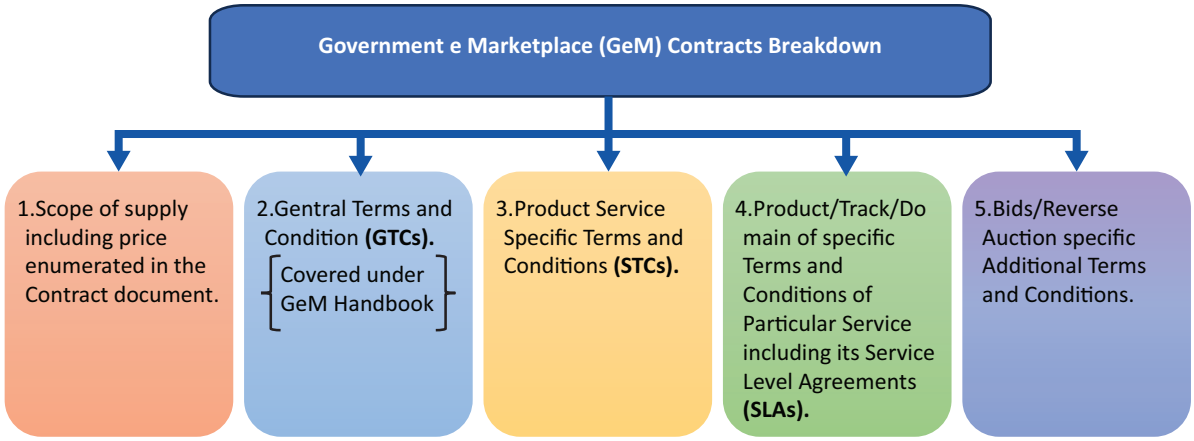

FIGURE 4: GeM Contract Overview

Currently, the GeM portal displays RAC servicing details as follows.

4.3.1.1 PART 1: GENERAL SECTION

The GeM portal under the services tab displays AMC servicing for Air Conditioners, HVAC and water coolers. The selection provides a variety of filters for buyers based on their requirements. The filters give buyers customizable options under the following categories:

A. Air Conditioners:

4.3.1.1.1 Annual Maintenance Contract (AMC) Category

An annual maintenance contract or contract maintenance agreement is an agreement between parties–usually buyers/customers and a service provider – that specifies the scope of maintenance. Equipment maintenance aims to minimize costly breakdowns and maintain machinery at its best. The GeM portal for cooling equipment servicing provides options for AMC based on cooling apparatus functionality. For air conditioner servicing the GeM portal provides the following options for buyers:

» Air Conditioners
» Hot & Cold Air conditioners

The buyer can choose as per their cooling needs. The GeM portal shows results based on the selection in tabular format in the same window.

4.3.1.1.2 Type of Air Conditioner

Cooling systems are available in a variety of shapes, sizes, and appearances. For instance, there are various types of ACs in the market, designed for a certain space and fulfilling a specific purpose. With respect to ACs, the GeM portal has the following options for maintenance available for buyers:[6]

- Window AC
- High Wall Split AC
- Ceiling Mount Split AC (Cassette AC)
- Floor Standing Split AC

4.3.1.1.3 AMC Brand

This option consists of a list of different OEM brands so that buyers can select according to their requirement for their cooling system maintenance.

4.3.1.1.4 Nominal Cooling Capacity in Ton

Nominal Cooling capacity refers to the capacity claimed by manufacturers while selling their products. Air conditioner cooling capacity is described in 'tons.' One ton means the rate of heat transfer needed to freeze one ton of water in 24 hours. This is nearly equivalent to 3.517 kW (12,000 Btu/hr or 3000 kcal/hour) of cooling. It is also known as 'nameplate capacity' as it is claimed by the OEMs and displayed on a metallic name plate on cooling devices. Nominal Cooling capacity is influenced by multiple variables such as coil size and thickness, cfm (Cubic Feet per Minute) specifications, and thermal expansion valve versus capillary. It is worth mentioning that the Actual cooling capacity is slightly lesser as it is influenced by heat generated by indoor supply fans and

5 GeM

the operating conditions such as cooling space, ambient temperature and moisture, room occupants etc. For ACs, the GeM portal covers all cooling capacities that can be operated in Indian climatic conditions, namely:

- Ton/3000 kcal/hr. (3489 W) (11897 Btu/hour)
- 1.5 Ton/4500 kcal/hr (5233 W) (17845 Btu/hour)
- 2.5 Ton/7500 kcal/hr (8722 W) (29742 Btu/hour)
- Ton/9000 kcal/hr (10467 W) (35691 Btu/hour)
- Ton/6000 kcal/hr (6978 W) (23794 Btu/hour)
- Other/ assorted rating (as specified under specific Scope by Buyer)

4.3.1.1.4 Vintage

Vintage means the period in which something was made. The vintage of a cooling system provides information about how old the cooling system is and what kind of maintenance is to be carried out by the service provider. Technically the vintage is the difference between the current year and the year of production. The importance of the vintage criteria derives from the fact that wear and tear of sub-components such as compressors, coils, filters, power systems and breakdowns are a time-dependent phenomenon. Since repair and maintenance of mechanical equipment is highly time-dependent, the vintage gives a complete picture of the range of cooling systems whose service is to be carried out. The GeM portal has the following vintage criteria:

- Up to 3 years
- 3 to 5 years
- to 7 years
- to 9 years
- 10 years and above

4.3.1.1.5 Technology of Air Conditioner

A typical RAC system consists of four major components: compressor, condenser, expansion valve, and evaporator. Compressor, a major component of ACs, consumes about 85% of the power used for operation of the unit. A lot of innovations are happening in compressor technology in order to reduce power consumption by air conditioners. Currently the most energy-efficient air conditioners are inverter air conditioners. Inverter air conditioners are equipped with a variable-speed compressor motor that allows provision of cooling as needed for the space in which it is being used, and the power used reduces upon cooling by adjusting compressor speed. Non-inverter air conditioners have fixed-speed compressor motors which, upon reaching the desired temperature, automatically shut off and start again. Hot and Cold/ All-weather ACs are designed to provide comfortable temperatures round the year. During the winter, they ensure optimum level of comfort through faster heating. Even in peak winter temperatures, this type of AC provides heating by operating in heating mode, resulting in uniform space heating. The GeM portal covers all the major technologies for buyers to select according to their requirements, in addition to providing opportunities for different types of service providers across the country on a digital platform. The GeM portal includes the following AC technologies:

- Inverter (Variable Speed type)
- Non-Inverter (Fixed Speed type)
- Hot and Cold/ All-weather AC - Non-inverter (Fixed Speed type)
- Hot and Cold/ All-weather AC - Inverter (Variable Speed type)

4.3.1.1.6 Number of Routine/ Preventive Maintenance Services per Year

AC/HVAC preventive maintenance is a necessary activity carried out periodically to ensure that the cooling equipment(s) operates at maximum efficiency. It also prolongs the running life of the equipment. Additionally, studies have shown that regular maintenance reduces electricity bills.

The GeM portal comprehensively covers maintenance based on global standard practices. The maintenance service offered on the portal can be described as follows:

The maintenance service is usually aligned to specifications of Central Public Works Department (CPWD) 2004, 2005(E) & 2017. For routine maintenance, the SLA explicitly mentions that periodic/ routine maintenance shall be as per the industry standard/ maintenance manual of the concerned air conditioning system.

The buyers/customers usually add the number of routine/ preventive maintenance service per year based on their installed system in their specific scope of work.

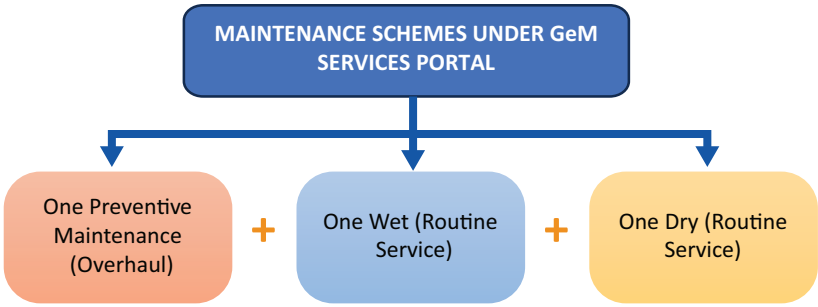

FIGURE 5: Overview of Maintenance Schemes under GeM Portal

The number varies from buyer to buyer as is influenced by the installed capacity, scale of operation, vintage condition and the technology involved in the concerned cooling system.

4.3.1.1.7 Condition of Air Conditioners (at the time of bidding)

In most cases, manufacturers offer limited warranties on parts, which are only honoured if failure occurred because of a manufacturing defect. Poor/wrong installation and poor maintenance is not covered by the warranty. Another important point in this aspect is the functionality of the cooling system which helps the service providers in deciding the extent of resources required for servicing and repair. The resources can include repair tools, welding kits, pressure gauges, refrigerants, labour, safety gear, etc. The GeM portal has the following options available in this regard:

- Under Warranty and Functional
- Under AMC and Functional
- Functional

Typically, warranties cover only major elements and do not cover air filters, fan belts, lubrication, electrical wiring, or other similar components.

The GeM SLA has a warranty provision in this regard. The SLAs clearly mention that the service provider shall provide a minimum warranty of six months for the replaced part from the date of such replacement /repair.

4.3.1.1.8 Type of AMC

GeM portal gives the option of 'comprehensive maintenance' in the AMC. A comprehensive maintenance contract not only offers preventive maintenance, but also covers all repairs, maintenance, and spare parts. There are various benefits of a comprehensive AMC, such as predictable, fixed costs, guaranteed maintenance access and support at any time, better logistical management, reduced downtime, and extended lifetime. The procedural details are generally laid out in the scope of the contract.

4.3.1.1.9 Physical Inspection/ Visit by Service Provider Required before Bid Closure

There are also provisions for buyers to choose the option for physical inspection/ visit by service provider.

B. HVAC (Heating, Ventilation, and Air Conditioning):

HVAC systems encompass a comprehensive approach to indoor climate control in diverse settings. Unlike standalone air conditioners, HVAC systems integrate heating, cooling, ventilation, and humidity regulation, offering a holistic solution for optimal comfort and indoor air quality. This comprehensive functionality, combined with advanced controls and energy-efficient design, sets HVAC systems apart as a sophisticated choice for maintaining ideal environmental conditions. GeM provides a comprehensive set of options to buyers so that they can choose the correct service providers based on the HVAC system installed on their premises. The options available for HVAC system servicing are as follows: -

Type of Centralised Air Conditioning System

HVAC systems contain all-air, air-water, and all-water systems. GeM covers all types which are as follows:-

a. All air system type centralised air conditioning system for cooling/heating purposes
b. All water system type centralised air conditioning system for cooling/heating purposes
c. Air-water system type centralised air conditioning system for cooling/heating purposes

Total Cooling Capacity

The complete cooling capacity of an HVAC system signifies the quantity of heat the system can eliminate to achieve lowered temperatures within a specified environment. This measure is expressed in units such as Tons or kilowatts (kW), subject to standards and system attributes. GeM provides the following options for buyers: -

a. Up to 50 Ton
b. 51-100 Ton
c. 101-150 Ton
d. 150-200 Ton
e. 201-250 Ton

Total Heating Capacity

The total heating capacity of an HVAC system refers to the amount of heat energy that the system can produce to raise the temperature within the desired space. It's measured in units like British Thermal Units (BTUs) or kilowatts (kW), depending on the region or system specifications. The heating capacity considers factors such as the efficiency of the system, the temperature difference between the desired indoor temperature and the outdoor temperature, and the size of the space being heated.

GeM systems provide a wide spectrum which caters to every buyer's need. These are: -

a. Up to 50 kW
b. 51-100 kW
c. 101-150 kW
d. 150-200 kW
e. 201-250 Kw
f. n/a

Vintage

It is an important parameter as by acknowledging the vintage, technicians can tailor their servicing approach, identifying and rectifying age-related issues promptly, optimizing performance, and prolonging the operational lifespan of the system. Options available on GeM are:-

a. Up to 3 years
b. 3 to 5 years
c. 5 to 7 years
d. 7 to 9 years
e. 10 years and above

Number of On-Site Dedicated Manpower (Service Engineer / System Administrator) Provided: -

This is based on the buyer's requirements. Gem has the following options: -

a. 0
b. 1
c. 2

Duty Hours for Dedicated Manpower Provided

a. 8 hrs/day
b. 9 hrs/day
c. 10 hrs/day
d. 12 hrs/day
e. 24 hrs/day
f. n/a (no dedicated manpower required)

Working Days in a Week

HVAC is large and works continuously so it requires a support technician for its operations and maintenance. Gem provides the following options for buyers to select:

a. 5 days
b. 5 and half days / 6 days a week with alternate Saturday off
c. 6 days
d. 7 days

Frequency of Preventive Maintenance Visits

The efficacy of preventive maintenance for HVAC systems hinges on a range of critical parameters. These include routine inspections and cleaning to safeguard against dust accumulation and system inefficiencies, timely replacement of filters to maintain air quality, calibration of control systems for optimal performance, lubrication of moving parts to mitigate wear and tear, and comprehensive system testing to identify and rectify potential issues before they escalate. Option in GeM system are:-

a. Fortnightly
b. Monthly

c. Bi-Monthly
d. Quarterly

Condition of System (At the Time of Bidding)

In many instances, manufacturers provide limited warranties for components, which are valid solely if the malfunction is attributed to a manufacturer's defect. Incorrect or substandard installation as well as inadequate maintenance can lead to the warranty becoming void. Furthermore, the operational state of the cooling system assumes significance as it aids service providers in gauging the necessary resources for maintenance and repair tasks. These resources encompass tools for repairs, welding kits, pressure gauges, refrigerants, labour allocation, and safety equipment. The GeM portal offers the subsequent choices in this regard:

a. Covered by Warranty and Functioning
b. Covered by AMC and Functioning
c. Functioning

Type of AMC

Within the GeM Portal, the provision of a Comprehensive Maintenance option exists within the framework of an Annual Maintenance Contract (AMC). A Comprehensive Maintenance contract surpasses preventive maintenance, encompassing repairs, maintenance tasks, and requisite spare parts. This type of agreement yields several advantages, including anticipated, consistent expenditures, assured availability of maintenance assistance around the clock, improved logistical coordination, minimized periods of non-operability, and an elongated operational lifespan. The specific procedural particulars are typically delineated within the scope of the contract.

Billing / Payment Frequency

Contains billing/payment frequency details for buyers which include Monthly or Quarterly.

4.3.1.2 Part 2: Administrative Part

4.3.1.2.1 Micro and Small Enterprises (MSE)

The government of India order on MSE "Public Procurement Policy for Micro and Small Enterprises (MSEs) Order, 2012" and Public Procurement (Preference to Make-in-India) Order, 2017 sought to create a supportive ecosystem for MSEs by supporting them in marketing of their products and services The s The policy rests upon the core principle of competitiveness, adhering to sound procurement practices and execution of supplies in accordance with a system which is fair, equitable, transparent, competitive, and cost-effective. Salient features of the Policy are:

- Every Central Ministry /Department / PSUs shall set an annual target for 20% procurement from MSE Sector.
- A sub-target of 4% out of the 20% target of annual procurement earmarked for procurement from MSEs owned by SC/ST entrepreneurs.
- Overall procurement goal of a minimum 20% has become mandatory from 1st April 2015.
- Tender sets are free of cost and exempt from payment of earnest money to registered MSEs.
- MSEs quoting price within price band L-1 + 15%, when L1 is from someone other than MSE, shall be allowed to supply at least 20% of the tendered value at L-1 subject to lowering of price by MSEs to L-1.
- 358 items are reserved for exclusive procurement from MSEs.
- Ministry/Department/CPSUs shall prepare their annual procurement plan to be uploaded on their official website.
- For enhancing the participation of MSEs in government procurement, Ministry/Department/ CPSUs shall conduct Vendor Development Programmes or Buyer Seller Meets for MSEs, especially for SC/ST entrepreneurs.

GeM acknowledges the government's support for MSEs in the form of relaxation wherein, if the bidder is a Micro or Small Enterprise under the latest definitions under MSME rules, they shall be exempted from the requirement of "Bidder Turnover" criteria and "Experience Criteria".

The government's push for women's empowerment and inclusivity is also visible on the GeM portal. A large number of programmes have been developed and implemented by various Ministries of GoI to encourage entrepreneurship in the country. Further, women have been given special provisions and incentives to ensure their participation and share in the entrepreneurship process.

4.3.1.2.2 Start-up

GeM supports the government's push for Make in India as well as development and support of the domestic supply chain by providing relaxation in the form of exemptions for start-ups. The Gem portal provides Start-up Exemption for years of experience, thus bringing them to a level playing field.

Turnover Criteria

GeM supports the government's push for Make in India, women entrepreneurs and MSE sectors in the economic sense as well. If the bidder is a Micro or Small Enterprise as per the latest definitions under MSME rules, the bidder shall be exempted from the requirement of "Bidder Turnover" criteria and "Experience Criteria". If the bidder is the OEM of the offered products, it would also be exempted from the "OEM Average Turnover" criteria.

In case any bidder is seeking exemption from Turnover / Experience Criteria, the supporting documents to prove their eligibility for exemption must be uploaded for evaluation by the buyer, to be verified by GeM.

Past Experience of Similar Services

Past experience requirement is based on buyer/customer discretion. Therefore, in the GeM portal, the buyer can place customizable past experience requirements. The most frequent experience criteria across the tenders on GeM are based on monetary values as well as working years. The bidder must have successfully executed/ completed at least one single order of 80% of the estimated bid value, or 2 orders each of 50% of the estimated bid value, or else, 3 orders each of 40% of the estimated bid value for similar service(s) in the last three years to any central / state government organization / PSU / public listed company.

Copies of contracts/work orders and documentary evidence of successful execution/completion in support of Past experience of similar services, along with names, address and contact details of clients is uploaded by the service providers with the bid for verification by the buyer.

It is to be noted that since this depends on the buyer, it is not a mandatory criterion, and is sometimes ignored by the buyers.

Figure 6 and Figure 7 outline the distribution of services hired via GeM during 2020–2023.

4.3.2 Hiring By Government Institutions

CPWD is the main procurement body involved in maintenance and repairs of all government buildings

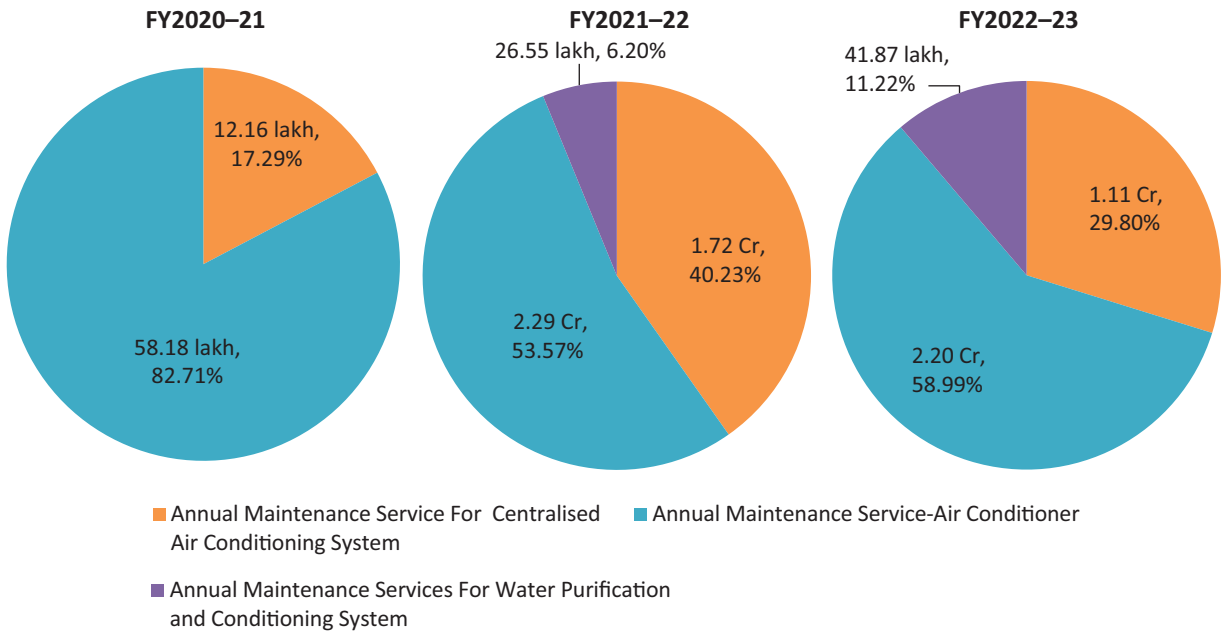

FIGURE 6: Breakup of Annual Maintenance Service for Different Types of Air Conditioning for Last 3 Years through GeM Portal.

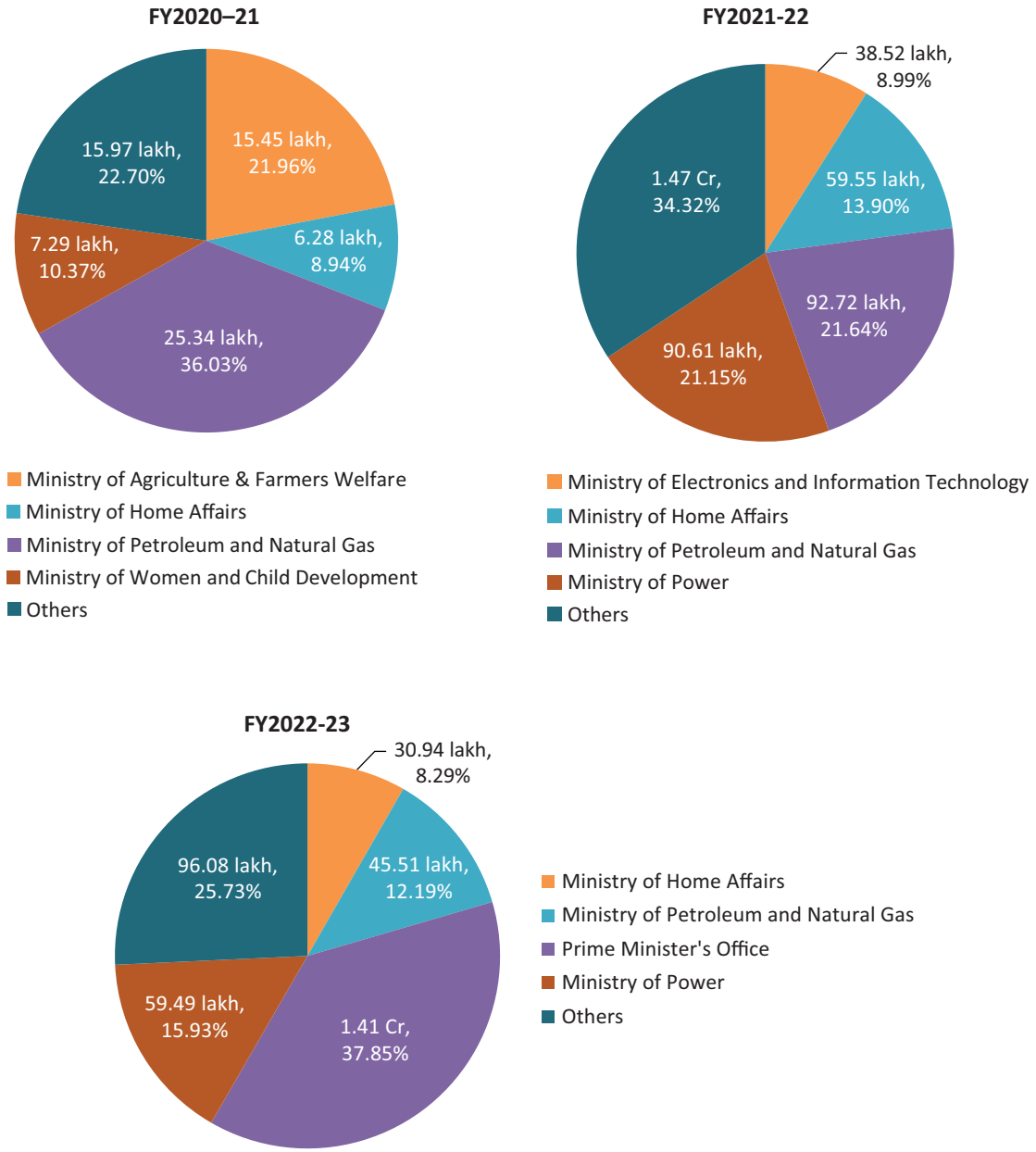

FIGURE 7: Ministry-wise Demand for AMC for Air Conditioning for Last 3 Years through GeM Portal

as well as other works as assigned by the central government ministries, departments, PSUs, autonomous bodies and other organizations. CPWD maintains the central government buildings under Ministry of Urban Development, as well as buildings constructed by CPWD from funds provided by user departments. To carry out the procurement, CPWD facilitates the bidders by enlisting them in accordance with "Rules for enlistment of contractors in CPWD 2022". There are also provisions to hire non-listed bidders in the works of CPWD, although opportunities for enlisted contractors are greater.

There are primarily two categories of enlistments, namely, B&R (Buildings & Roads) and Horticulture. For the purpose of this study, the Buildings & Roads category has been considered since refrigeration and air conditioning repair, as well as maintenance including electrical &mechanical services are part of this category.

The figure below contains the relevant criteria for enlistment of contractors as per the CPWD manuals.

"Make in India" Public Procurement Policy, "Skill India" Policy, and pollution control measures in construction as notified by the CPWD Directorate from time to time, have been made part of the manuals. Certain standard operating procedures are followed for original, specialized electrical and mechanical works including HVAC. The Standard Operating Procedures (SOPs) for the CPWD Manual 2019, in general, are a compendium of standard procedures and workflows as prevalent in CPWD. General specifications for HVAC works are followed by contractors performing works related to air conditioning,

The specifications do take in to account the ODSs and global warming potential of refrigerants and set out the details of such refrigerants used under the ambit of CPWD.

During the evolution of procurement processes for RAC servicing technicians, replacement of refrigerants and Ozone Depletion Potential (ODP) are additionally assumed to remain aligned with national regulations. It is also ensured that RAC machines are unaffected due to refrigerant production phase-out date and no phase-out date is specified for equipment that uses that refrigerant.

The works related to refrigeration and air conditioning should adhere to the Safety Code (Indian standards 660) for Mechanical Refrigeration and Safety Code (Indian standards 659) for Air Conditioning. To cover the risks, the contractor bears insurance related responsibility, including third party insurance, as may be necessary to cover the risk.

Many autonomous organizations such as Indian Institutes of Technology (IITs,) All India Institutes of Medical Sciences (AIIMS) adhere to the manual specification and schedule of rates given by Public Works Department (PWD) to hire servicing technicians to perform various services. Currently, the following refrigerants are under practice by CPWD works, as per the CPWD manual:

Procurement of services for RAC equipment servicing in government departments and ministries follows the sequential steps depicted below:

The e-Tendering process captures the scope of work in detail. It covers multiple sub sectors related to servicing of the RAC system as follows:

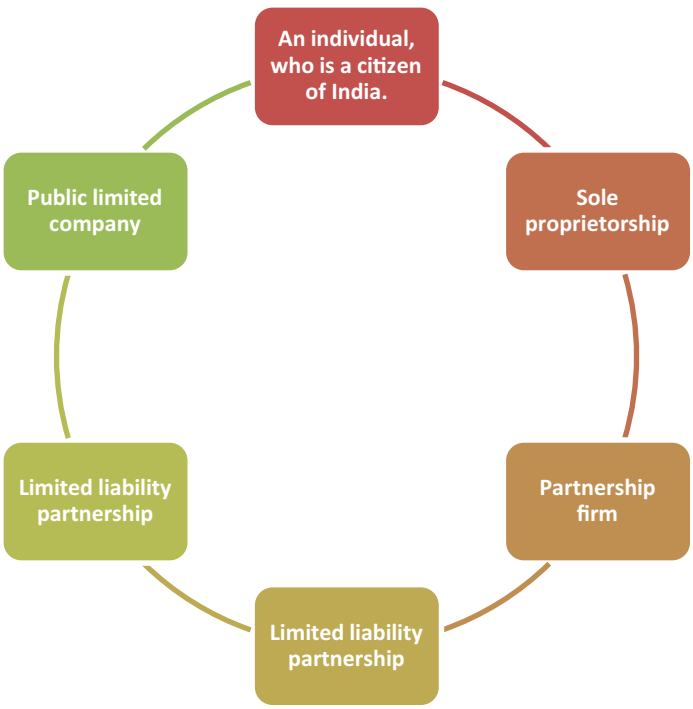

FIGURE 8: Eligibility Criteria for Enlistment

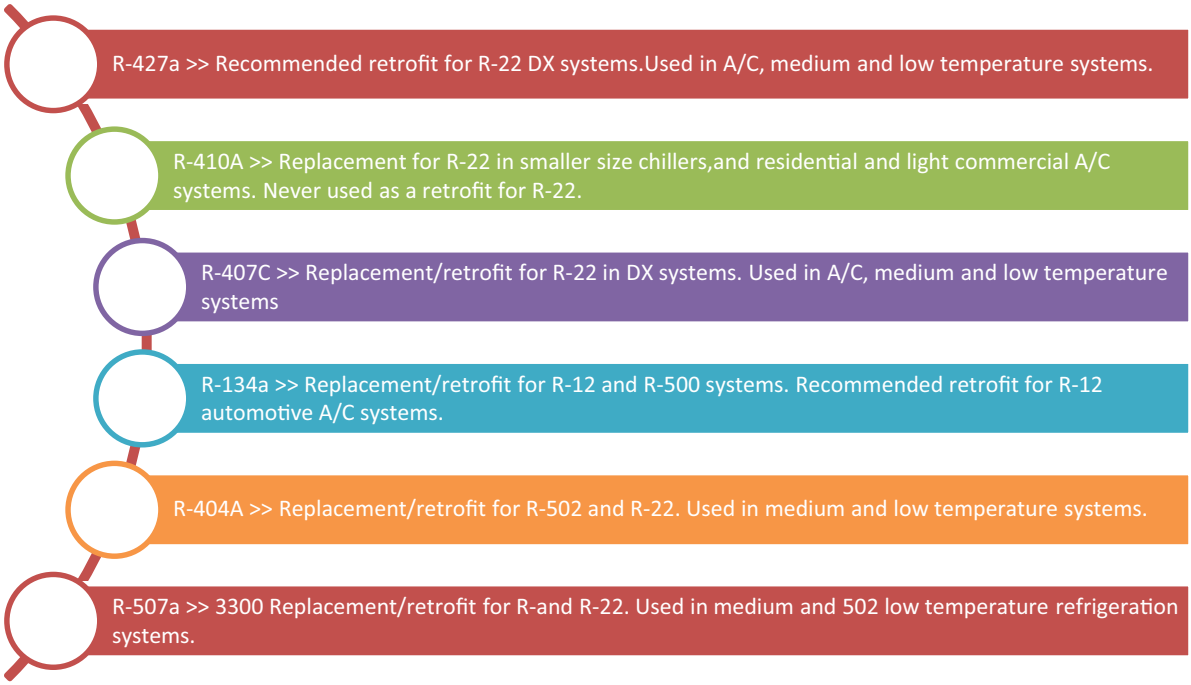

FIGURE 9: Refrigerants under Practice as per CPWD HVAC Manual[7]

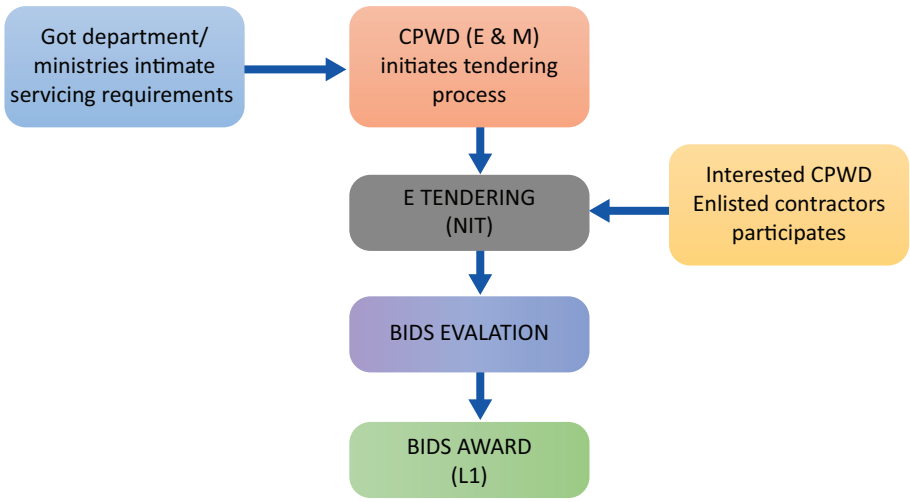

FIGURE 10: Flow Chart of Bid Mechanism

4.3.2.1 Categories of RAC system servicing

The tree branch reveals that CPWD covers the entire spectrum of RAC systems installed in public offices for the last 7 to 10 years.

4.3.2.2 Refrigerants

Refrigerants in the RAC systems in the public sector are as follows:

7 General specifications for heating, ventilation & air-conditioning (HVAC) works (2017) HVAC.pdf (cpwd.gov.in)

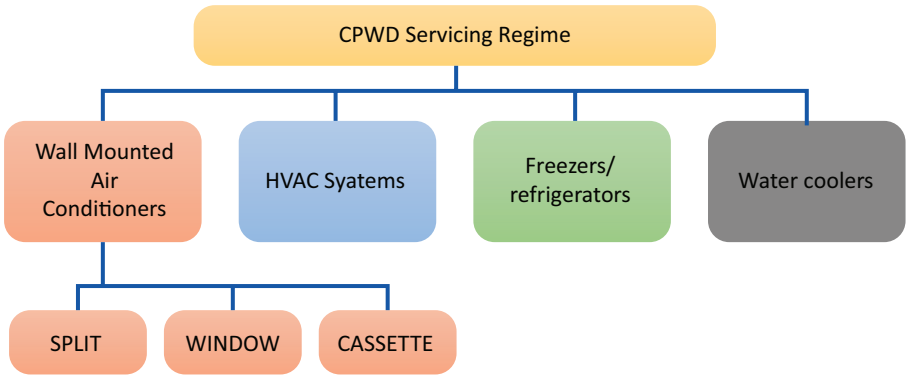

FIGURE 11: RAC Systems under the Purview of CPWD

Table 3: RAC Systems and Refrigerants

S. N.	RAC Systems	Refrigerants
1	Wall-mounted Air Conditioners (split, window, or cassette type)	R-22, R-32, R-410a
2	HVAC System (Central Air Conditioning System, Central Heating System, VRV/ VRF Type Air Conditioning System, Mechanical Ventilation System)	R-410a
3	Direct Expansion (DX) Chillers)	R-22, R-407c, R-410a, R-717, R-134a,
4	Freezers/ Refrigerators	R-134a

4.3.2.3 Servicing Frequency

Maintenance service of RAC equipment is carried out every year depending upon onset of seasons, apart from attending breakdowns of the system. In other words, RAC equipment is serviced before the onset of the summer season, which comes under preventive maintenance as per the CPWD manual.

4.3.2.4 Procurement Method

CPWD has divided the procurement of service based on the RAC equipment. The principal mode of hiring any contract is solely through open bids via the eTendering process. The details are comprehensively laid down in the GoI rules and regulations and various CPWD manuals listed in Table 4.

Table 4: CPWD Procurement Rules/Regulations/ Manuals

S. N	Rules/Regulations/ Manuals	Year(s) of Publication
1	General Specifications For Heating, Ventilation & Air-Conditioning (HVAC) Works	2017
2	Maintenance Manual	2000, 2003, 2007, 2012, 2019
3	CPWD Works Manual	2014, 2019, 2022 (13.07.2022), 2022 (13.12.2022)
4	Rules for the Enlistment of Contractors in CPWD	2019, 2020, 2021 2020, 2022
5	General Financial Rules (GFRs)	2017

In open tendering, the objective is to obtain goods or services at the lowest possible cost (also called a L1). So L1 basis is considered for hiring service providers. This philosophy promotes competition and minimizes discrimination. In the case of RAC systems, each air conditioning work has its own requirements.

The CPWD manual 2017 gives clear instructions that these general specifications shall be supplemented with tender specifications as may be required for a particular work. The tender specifications, wherever they differ from these general specifications, shall have over-riding value and shall be followed for that work.

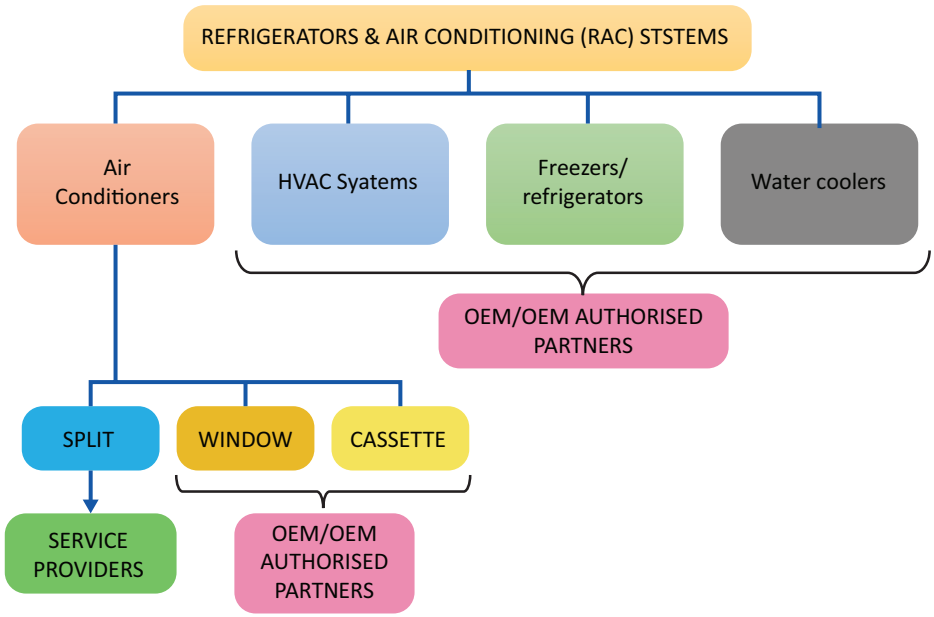

FIGURE 12: RAC Equipment Servicing Regime as per CPWD

To understand the framework for hiring RAC servicing technicians, one needs to consider how RAC systems are categorized. The RAC systems, as per CPWD, are classified in line with marketplace categorization, into air conditioners, HVAC systems, freezers /refrigerators and water coolers depicted in Fig. 12.Most of the servicing is done through OEM/OEM-authorized service partners. In all cases except split air conditioners, all servicing is carried out through e Tendering (via AMC via bidding) which is awarded to OEM/OEM-authorized partners. This ensures the fulfilment of genuine part replacement, credibility of servicing and adherence to good servicing practices.

However, the servicing route is slightly different for split air conditioners. Split air conditioners are separate compact units which are designed for handling one or more adjoining rooms. Thus, unlike integrated HVAC systems or other systems which require extensive air tunnels and insulation, split ACs require much lesser installation procedures. These factors increase the variability of different brands of split ACs procured and installed in the same building, while their quantities may vary depending on building size (rooms), number of people, etc. As such, CPWD hires service providers for split ACs through AMC in the e Tendering system. This further suggests that the mode of hiring also depends on the size, capacity, and compactness of the installed RAC systems.

It is to be noted that whenever the installation of new RAC system is to be carried in public premises, the CPWD notifies tender though e-Tendering on Central Public Procurement Portal and CPWD portal. There is a servicing clause within the installation framework which must be fulfilled by OEM/OEM-authorized partners. Apart from that periodic maintenance, servicing before the onset of summer season is also included in this clause.

4.3.2.5 AMC Procurement Characteristics

Stakeholder consultation with CPWD revealed the following characteristics of CPWD tenders. They are guided by the CPWD manual as well as relevant rules and regulation such as GFR rules:

4.3.2.5.1 Qualification

As per the CPWD manual only qualified personnel who are thoroughly familiar with the type of equipment and system should be awarded servicing qualifications. Both servicing qualifications and work experience are mandatory criteria for servicing RAC systems. In the RAC servicing sector, the criteria for service providers are work-based, as follows:

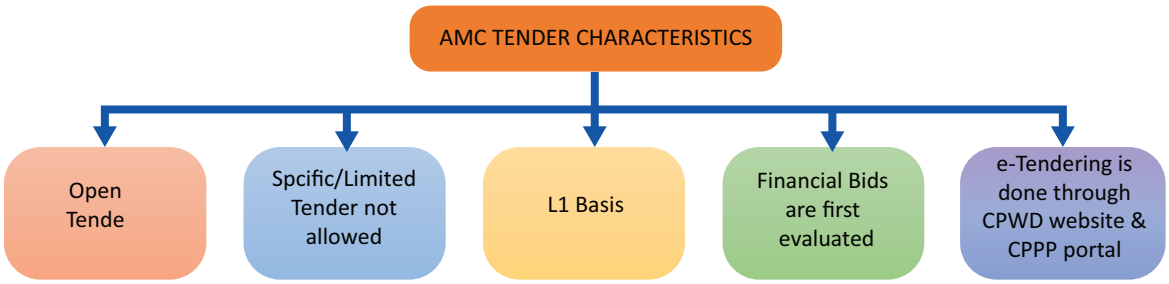

FIGURE 13: Characteristics of an AMC Tender

Table 5: Qualification Requirements for RAC Servicing Work

S. N	Work Type	Acceptable Qualification for Mechanics
1.	For small-scale mechanic work	Qualified technicians, ITI is desirable
2.	For large systems such as centralized AC, VRV systems	Qualified technicians, Diploma is desirable.

4.3.2.5.2 Experience of Service Providers

There is no specific rule governing the work experience of service provider (contractor), so it varies from tender to tender. However, contractors and mechanics with work experience are always preferred. The notion behind the work experience criteria is to hire competent service providers for servicing the RAC equipment. Multiple factors affect the requirement of work experience such as the scope of work, work duration, project costs, etc.

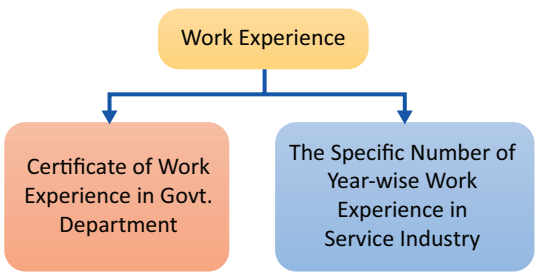

FIGURE 14: Work Experience Details for RAC Service Technicians

Usually, work experience can consist of the following options.

4.3.2.5.3 MSE/Start-up

To support GoI initiatives such as 'Start-up India' and the development of MSE sector, CPWD provides conditions of prior turnover and prior experience in public procurement to all start-ups (whether MSEs or otherwise), subject to meeting of quality and technical specifications in accordance with the relevant provisions of GFR rules.

4.3.2.5.4 Scope of inclusion of trained and certified technicians through GeM

Extensive conversations were conducted with GeM in order to thoroughly resolve this situation. The prospective inclusion of these requirements is now being deliberated by GeM, with indications of their probable willingness to include a requirement for qualified and trained technicians. Nevertheless, GeM has expressed a strategic choice to refrain from imposing these standards. The rationale behind this strategy stems from the acknowledgment that imposing mandatory compliance measures may unintentionally lead to the exclusion of a substantial portion of potential bidders from participating in the process.

4.3.2.5.5 Other Provisions

Exclusions

The central air-conditioning system included in these specifications is operated by means of reciprocating / scroll or centrifugal or screw type compressors. Therefore, only vapour compression type refrigeration equipment

is covered in CPWD's HVAC specification. Absorption type refrigeration equipment is excluded from the scope of these specifications.

Water coolers / desert coolers and water softening plants for treatment of water are also excluded from the scope of CPWD's HVAC specifications.

Safety

RAC system works is required not only in dealing with the system, but also for refrigerant gases, welding requirements as well electrical wiring systems. Therefore, CPWD has ensured that the service works are carried out is as per best practices around the world and follows Indian statutory acts, rules, standards, and codes. The terms are incorporated in every CPWD tender which has to be followed strictly by the contractors/service providers:

- All components shall conform to relevant Indian Standard Specifications, wherever existing, amended to date. A list of such standards is appended in Appendix B, CPWD Manual 2017.
  - All works shall conform to the National Building Code as well as relevant BIS codes.
  - All electrical works shall be carried out in accordance with the provisions of the Indian Electricity Act, 2003 and Indian Electricity Rules, 1956 amended to date. They shall also conform to CPWD General Specifications for Electrical works, Part-I: Internal, 2013 and Part-II: External, 1994 and Part IV (Sub-station), 2013, as amended to date.
  - All components shall conform to the Energy Conservation Building Code 2007, 2017, 2021(revised) of India as amended or revised up to date.
  - All the work carried out by the contractors/SPs must follow safety codes and labor regulations.

Dismantling, Recycle, Recovery, and Reclaim

As per the CPWD manual, there is the provision of dismantling, and replacement during the servicing of the RAC system should be done only by qualified and authorized service providers.

Dismantling of air conditioners should be done carefully and safely to avoid any potential hazards, such as refrigerant leaks, electrical shocks, and sharp edges. It is important to note that the process of dismantling an air conditioner can vary, depending on the make and model of the unit. As per CPWD, The entire dismantling process is carried out by OEM/OEM-authorized partners.

Replacement covers a wide range of items including subcomponents related to compressors, evaporators, TEV, fittings, and refrigerant gas. For recycling of these components it is the responsibility of service providers to safely deliver them to designated recyclers safely.

Presently there is no provision for recovery and reclaim of refrigerants of RAC equipment.

4.3.2.5.6 Extended Producer Responsibility (EPR)

The approach of Extended Producer Responsibility states that producers are accountable for the collection and processing of their products upon reaching the end of their useful life. The current e-Waste (Management) Rules, 2022[8] re-aimed to formalize the e-waste recycling sector of the country.

The regulations are applicable to all manufacturers, producers, refurbishers, dismantlers, and recyclers engaged in the production, sale, transfer, purchase, refurbishment, dismantling, recycling, and processing of e-waste or electrical and electronic equipment specified in Schedule I. CHAPTER VII of the rule deals with reduction in the use of hazardous substances in the manufacture of electrical and electronic equipment and their components or consumables or parts or spares.

In Schedule I, the following categories of RAC equipment including their components, consumables, parts, and spares are covered under the above rules.

The Electrical and Electronic Equipment Codes are designated by category alphabet combined with EEE followed by serial number in Schedule I Table of E-Waste (Management) Rules, 2016. It is applicable to every producer of electrical and electronic equipment and their components or consumables or parts or spares listed in Schedule I.

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Table 6: Schedule 1—List of RAC Electrical and Electronic Equipments		
Categories of Electrical and Electronic Equipment		**Code**
Consumer Electrical and Electronics (CEEE)	Refrigerator	CEEW2
	Air- Conditioners excluding centralized air conditioning plants	CEEW4
Large and Small Electrical and Electronic Equipment (LSEE)	Large cooling appliances	LSEEW1
	Freezers	LSEEW2
	Other large appliances used for refrigeration, conservation, and storage of food	LSEEW3

5. Gaps and Recommendations

This study revealed some key gaps present in the existing public procurement of RAC service technicians through different platforms such as GeM portal and Central Public Procurement Portal (CPPP). These are tabulated below:

Gaps	Recommendations	Action by
Lack of specified criteria (essential/desirable) for service technicians in procurement / tender documents relating to servicing of RAC equipment	To develop standardized training module including curriculum for training of RAC service technicians including master trainers	MSDE
	To Develop and Implement unified certification system for RAC Service Technicians including Master Trainers	MSDE
Lack of basic safety requirements for technicians to be associated in servicing like Personal Protection equipment (PPE) in procurement/ tender documents	To include as a mandatory clause in procurement tenders relating to basic safety requirements for service technicians of RAC equipment	CPWD/State PWDs/ GeM
Lack of Standard Operating Procedure (SOP) in the procurement/tender documents for engagement of agencies /service technicians for servicing of RAC equipment	To develop SOP comprising good service practices to be followed, safety precautions to be taken, tools equipment including PPE needed while servicing	CPWD/State PWDs/GeM
Lack of standardized evaluation process for engagement of trained service technicians through public procurement	To develop a standardized evaluation process for engagement of trained and certified service technicians	CPWD/State PWDs/GeM
Updating of CPWD manual to eliminate phased out refrigerants and include currently used refrigerants for servicing	Periodic review and updating of CPWD manual relating to servicing of RAC equipment	CPWD/State PWDs
Updating of ITI Syllabus for RAC Trade to include current technologies/trends used in servicing	Periodic review and updating of ITI Syllabus for RAC Trade considering refrigerant technological developments from time to time.	DGT, MSDE
Lack of social security scheme for service technicians	To develop and implement social security of service technicians	Ministry of Labour and employment
Lack of information on service technicians	To develop a centralized database of trained and certified RAC service technicians	Refrigeration and Air conditioners Manufacturers Association (RAMA)
Lack of inventory of trained and certified RAC service technicians	To develop a centralized inventory of trained and certified RAC service technicians	MSDE

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