newsTRAC

NEWSLETTER FOR TECHNICIANS IN REFRIGERATION AND AIR CONDITIONING (RAC) SERVICING SECTOR

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Inside...

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Compressor-Related Air Conditioners (AC) Mishaps: Understanding Risks and Prevention

By Shaurya Anand, Research Associate,
The Energy and Resources Institute (TERI)

With summer temperatures soaring, ACs have become an essential part of daily life. However, poor maintenance, faulty installation, and extreme heat can sometimes lead to incidents such as compressor failure, refrigerant leaks, and, in rare cases, result in fire mishaps. Many recent incidents have raised concerns about ACs catching fire and compressors exploding. In recent years, there have been reports of AC units catching fire or suffering compressor ruptures. Many of these incidents occur because systems are not operating within their design limits. These incidents not only result in financial losses but also pose serious risks to life and property.

Inappropriate handling, faulty installation, and inadequate maintenance can all contribute to serious AC mishaps, including compressor damage and, in rare cases, fire accidents. These risks arise from both consumer-related mistakes and service technician errors.

Consumers may skip preventive maintenance, choose the wrong AC size, overuse the system, or hire unqualified repair services. Technicians, on the other hand, may use substandard materials, make wiring mistakes, overcharge refrigerant, or mishandle flammable refrigerants—each of which can compromise safety and performance.

Figure 1 illustrates these common mistakes from both sides, highlighting how small oversights can escalate into serious hazards if left unaddressed.

Recent summers in India have seen tragic AC-related accidents. In March this year, a fire linked to an AC incident in Haryana claimed multiple lives. A similar case in Noida triggered a major fire in a residential building. These events underline the urgent need for safe installations, proper servicing, and heightened technician awareness—especially during heatwaves.

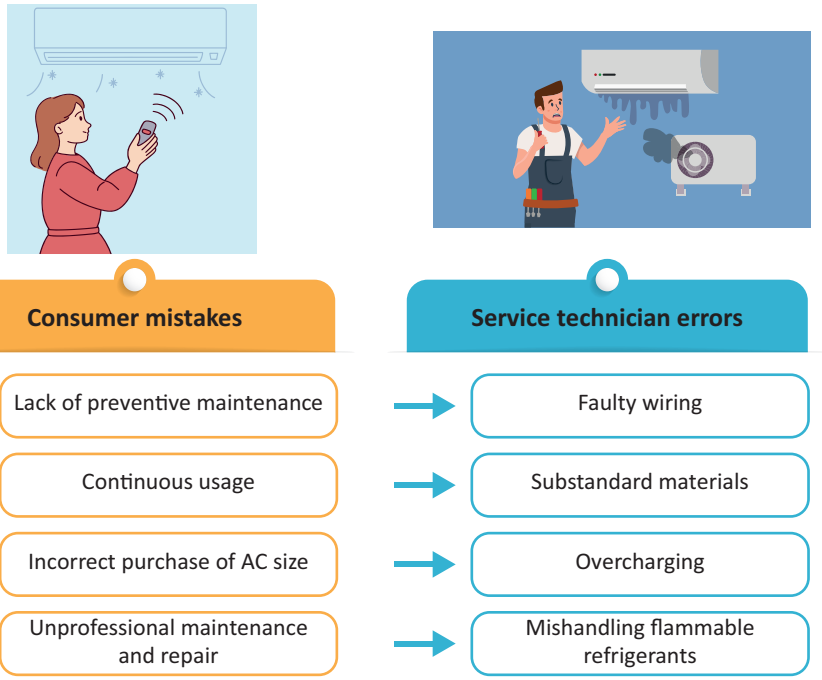


Figure 1 Common consumer mistakes and service technician errors leading to AC failures and safety risks

Why These Incidents Occur

An air conditioner works by rejecting heat from the refrigerant through the condenser coil into the surrounding air. For this process to work effectively, the outdoor temperature must be at least 5–10°C lower than the temperature inside the condenser.

However, during peak Indian summers, ambient temperatures often exceed 45°C, narrowing this critical temperature differential. As this temperature gap reduces, the system struggles to discharge heat efficiently, resulting in a significant rise in refrigerant pressure within the condenser. Researchers have demonstrated that even a modest increase in outdoor temperature—from 30°C to 36°C—can sharply increase condenser pressure, reducing cooling capacity and increasing mechanical stress on components.[1]

If this elevated pressure exceeds the system's design threshold, and if safety features such as high-pressure cut-outs or pressure relief valves are malfunctioning, the risk of equipment failure increases. This can result in refrigerant leaks, compressor casing rupture, electrical short circuits, or even fire hazards—especially in poorly ventilated or sealed indoor environments.

Different refrigerants exhibit distinct pressure-temperature behaviours. For example:

R-22 and R-410A show rapid pressure rise at high condenser temperatures, with operating pressures exceeding 300 psi near 55–60°C	**R-134a** operates at lower pressures but still faces stress when ambient conditions approach 50°C	**R-744 (CO_2)** enters supercritical conditions above 31°C, where conventional pressure-temperature relationships break down, and system design becomes even more critical

[1] by Yusof et al. (2018) DOI: https://doi.org/10.1051/matecconf/201822502012

Understanding these thermodynamic characteristics and their impact under real-world temperatures is essential for safe installation and operation of air conditioners.

High ambient temperatures in Indian summers (>45 °C) put extra stress on cooling systems.

When the condenser coil temperature gets close to the outside temperature, heat rejection slows down. This causes refrigerant pressure to rise. If the system's safety devices (like pressure cut-outs or relief valves) fail or are absent, the excessive pressure can overload components, leading to serious failures—such as compressor burnout, refrigerant leaks, fire hazards, or even rupture which is depicted in Figure 2.

Solutions in context to India: What can be done?

Figures 3 and 4 below illustrate recommended solutions for both RAC technicians and consumers to enhance safety, efficiency, and reliability in refrigeration and air-conditioning systems.

DO YOU KNOW?

- A well-serviced AC can prevent life-threatening accidents.
- That buzzing sound and warm air aren't just signs of poor cooling—they could be early warnings of compressor stress. Ignoring routine maintenance, running the AC during extreme heat, or installing units in poorly ventilated spaces can push your system to the edge.
- In Indian summers, your AC's internal pressure can exceed the normal levels, especially if the air filters are clogged, condenser coils are dirty, or the refrigerant charge is incorrect.
- Poor servicing or skipped maintenance increases the chances of electrical shorts, fires, and even fire accidents in extreme cases.

☑ **Tip**: Always get your AC checked before peak summer. A little care goes a long way toward keeping your home safe and cool!

Figure 2 Mechanical risks to cooling systems during extreme heat events

For Technicians

During summers, condenser coil temperatures can reach **60°C or more**, especially in rooftop or west-facing installations. If high-pressure cut-outs are bypassed or not tested, the compressor might fail under rising internal pressure.

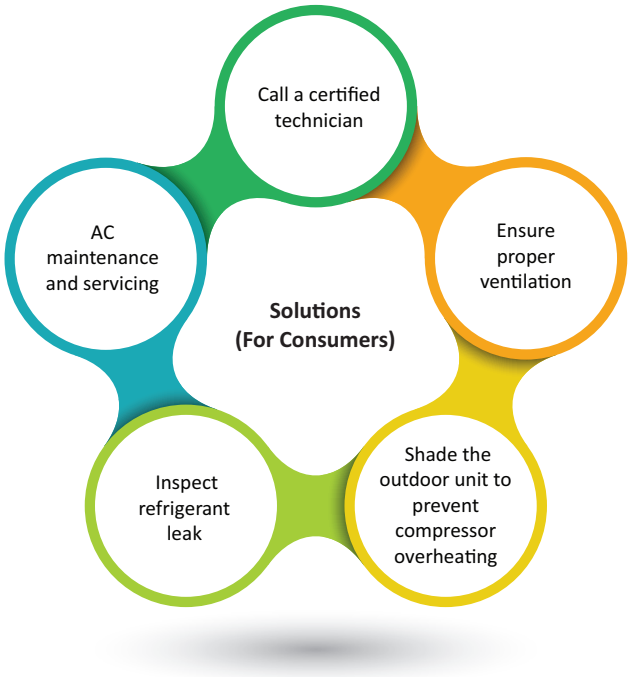


Figure 3 Action for consumers

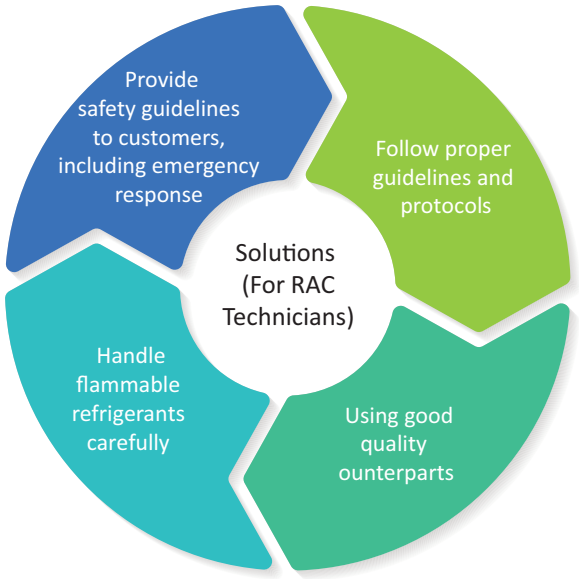


Figure 4 Action for service technicians

Corrosion: The Silent Threat to AC Performance

Air conditioners that operate in **corrosive environments**—such as areas with high humidity, coastal salt-laden air, or industrial pollution—face gradual but serious damage to their components. Over time, corrosion reduces the **thermal conductivity** of heat exchangers, making it harder for the system to transfer heat efficiently. This directly lowers cooling performance and forces the unit to consume more electricity to achieve the same comfort level. Corrosion doesn't just affect performance—it also weakens **metal joints, electrical contacts, and mounting points**. This can lead to **insulation breakdown**, short circuits, refrigerant leaks, or even unsafe operating conditions.

To combat these risks, technicians should recommend and apply **anti-corrosion protective coatings** on coils and exposed metal surfaces, and schedule **regular cleaning and inspection**—especially for ACs in coastal, industrial, or high-humidity regions. Preventive care not only extends equipment life but also protects user safety. An illustrated flowchart showing the corrosion process and its potential impact AC components are depicted in Figure 5.

To prevent damage from corrosive environments and potential safety hazards, here is the Technician's Preventive Checklist (Figure 6).

Corrosion may seem like a gradual process, but its effects on cooling systems are far-reaching, from reduced efficiency to serious safety risks. With simple preventive steps and timely maintenance, technicians can significantly extend equipment life and improve performance. As shown in the Figures 5 and 6, proactive care today helps avoid costly repairs and hazards tomorrow, ensuring reliable and sustainable cooling operations.

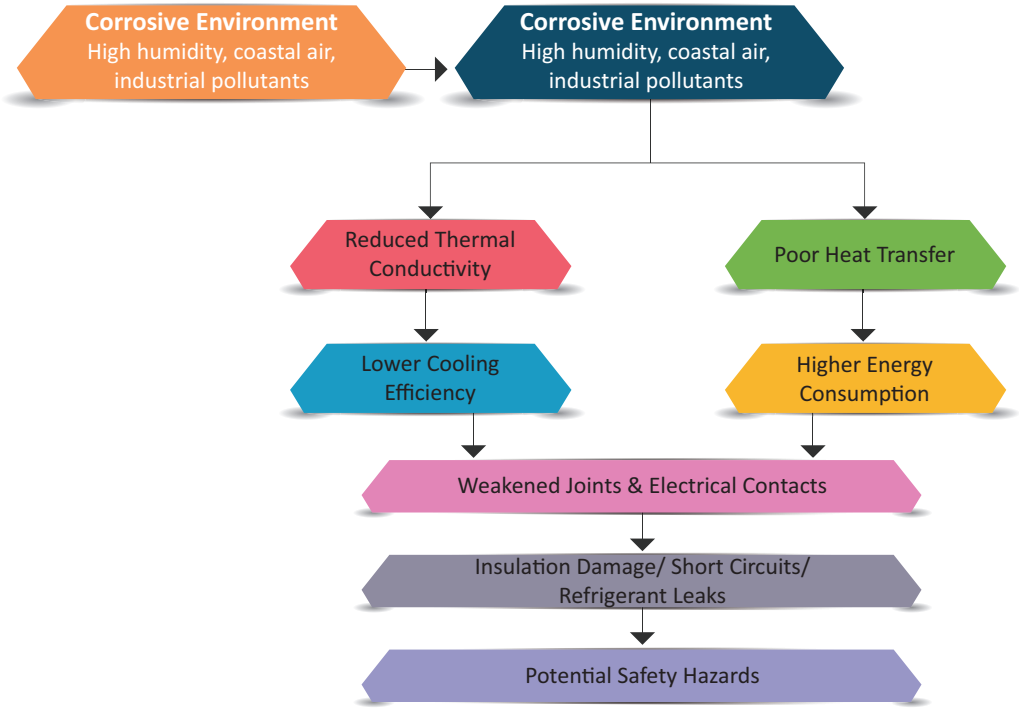


Figure 5 Impact of corrosion on AC components and preventive measures

Figure 6 Technician's preventive checklist flowchart

Electrical Safety in Air Conditioning Servicing: Preventing Accidents and Failures

Introduction

Air conditioners help keep our homes and offices cool, clean, and comfortable. But to work well, they need regular check-ups and repairs—just like any other machine. These repairs often involve electrical parts, which can be dangerous if not handled properly. That's why safety is so important during AC servicing.

Ignoring safety during AC servicing can lead to electric shocks, fires, or even damage to the AC itself. That's why it's important for both technicians and users to understand what can go wrong—and how to prevent it. In this article, we'll look at common electrical problems in air conditioners and share simple, practical tips to avoid accidents and keep everyone safe during maintenance.

Common Electrical Hazards in AC Servicing

Air conditioning systems run on electricity, and any fault in the electrical setup can lead to serious accidents, including electric shocks, fires, or equipment failure. Here are some common electrical hazards that technicians and users should watch out for during AC servicing:

1. Faulty Wiring

Old, damaged, or poorly connected wires are a major safety risk. If wires are corroded, frayed or not up to current safety standards, they can cause short circuits, sparks, or even fires. Proper inspection and replacement of faulty wiring is essential during servicing. Improper method adopted for wire connections is the major cause of fire hazard.

2. Overloaded Electrical Power Source Circuits

Connecting an AC to electrical power source with either old wiring or underrated capacity of wiring: Plugging an AC unit into a power source that already supports too many devices can overload the circuit. This can lead to overheating and increase the risk of fire. Older buildings are especially vulnerable due to limited electrical capacity.

It is necessary to check the connected load of the building and the apartment before the installation of ACs, specially in old buildings.

3. Electrical Component Failure

Air conditioners depend on several electrical components—such as capacitors, motors, relays, wiring, connectors, and circuit boards—to operate safely and efficiently. Failures in any of these parts can disrupt system operation, lead to overheating, or even pose fire and safety risks. For example, a faulty capacitor may overheat or burst, while damaged wiring, a failed relay, or a malfunctioning motor could also cause the system to shut down unexpectedly or trip breakers. Regular inspection, prompt replacement of worn components, and professional servicing are crucial to maintaining safe and reliable system operation.

4. Water-Induced Short Circuits

Clogged or blocked drain lines of indoor unit can cause water to leak inside the AC unit. If this water reaches electrical components, it can cause short circuits or sparks. Keeping drain lines clear helps prevent this risk.

5. Low-Quality Electrical Materials

Spurious parts used in repairs or during manufacturing—like low-quality wires or connectors—can fail under stress and cause electrical faults. Always use high-quality, certified materials when repairing or installing AC units.

Figure 7 presents the key causes of AC failures of air-conditioner failures which are often linked to electrical and material-related issues.

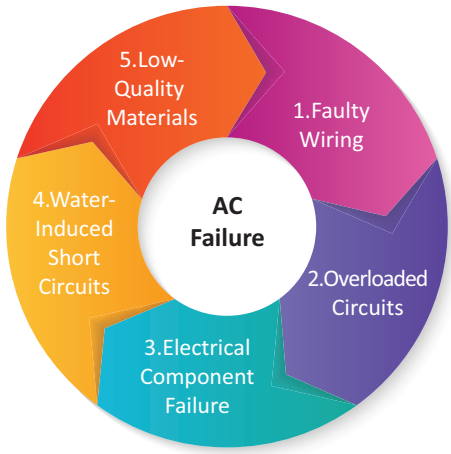


Figure 7 Key causes of AC failure

To prevent these electrical hazards during AC servicing, it's important not just to identify the risks, but also to take the right safety measures. Three of the most effective ways to improve electrical safety are using proper electrical connections, ensuring earthing (grounding), and installing reliable circuit protection devices like breakers or fuses. These measures form the foundation of safe electrical design and maintenance, especially in systems as power-intensive as air conditioners. The following safety measures can be implemented to directly reduce or eliminate electrical hazards.

Using BIS-certified wires and connectors is one of the most important electrical safety steps. Avoid twisted joints, as they can lead to loose connections and overheating. Properly covered wires prevent electricity leakage, shocks, short circuits, water ingress, and other hazards caused by low-quality repair materials

Proper earthing (grounding) is also essential. If something goes wrong and a part becomes live with electricity, earthing gives that electricity a safe path to flow into the ground. This protects people from getting shocked and also keeps the AC unit safe. It's especially helpful when there are faulty components or any unexpected water inside the system.

Circuit breakers or fuses protect the system from overloading or short circuits. If too much power flows through, or a part like the capacitor fails, these devices automatically cut off the power. This stops the risk of fire or damage. They are very useful for handling issues like overloaded circuits, sudden failures, or water touching electrical parts.

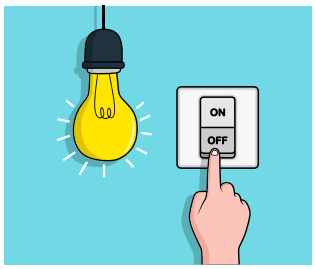
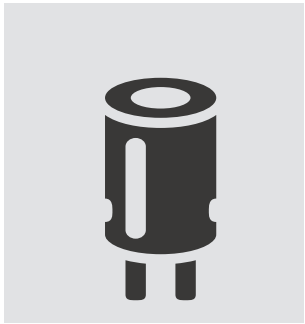
Refer to Table 1 to understand how these three key safety measures: BIS certified components, Earthing, and Circuit Breakers help in preventing or reducing the risks of different electrical hazards during AC servicing.

To manage AC failures safely and avoid electric shocks or arc flashes, technicians should follow a mix of personal protection and smart electrical practices as explained in Table 2.

Table 1: Hazards and their solutions

Hazards	Solutions		
	BIS Wire & Connectors	Earthing	Circuit Breaker
Faulty Wiring	☑	☑	☑
Overloaded Circuits	☑	☒	☑
Capacitor Failure	☒	☒	☑
Water-Induced Short Circuits	☑	☑	☑
Faulty Electrical Components	☒	☑	☑
Low-Quality Electrical Materials	☑	☑	☑

Table 2: Safety measures

Wear Safety Gear (Personal Protective Equipment- PPE)		▪ Use PPE which includes gloves, goggles, helmets, and protective shoes to protect yourself from electric shocks, sharp edges, and chemical splashes during repairs. Flame-resistant clothing can prevent injury in case of sudden electric arcs.
Turn Off Power Before Work		▪ Always switch off the power supply before starting any repair. Use a multi-meter to make sure no electricity is flowing. This is one of the most direct ways to prevent any shock or arc flash.
Use Insulated Tools		▪ Choose tools with rubber or plastic-coated handles. These tools help avoid shock if you accidentally touch a live wire or charged part.
Handle Capacitors, Contactors, and Relays Carefully		▪ Capacitors can still hold electric charge even after the AC is off—so they must be safely discharged. Contactors and relays control high-voltage components, so it's important to know how they work and handle them properly to avoid sparks or short circuits
Stay Trained and Prepared		▪ Regularly check your tools and safety gear, stay updated with safety guidelines, and always assess the work area before starting. Water or clutter increases the chance of slipping or short-circuits due to contact with live parts. A dry, tidy workspace reduces unexpected risks.

Reinventing Comfort: Smart Air Conditioning for Today's Homes

While careful servicing practices and safety precautions greatly reduce risks, technology is also playing an increasing role in making air conditioners safer. Traditional ACs depend on users and technicians to spot problems. But what if the system could detect risks early, alert you, and even act automatically to prevent an accident? This is where Smart ACs are transforming the game.

> "Electrical safety is not just about protecting machines—it's about protecting lives."

As we know ACs make our lives more comfortable, especially in hot weather. But like any machine that runs on electricity, they need to be handled with care—especially during servicing. Many accidents can be avoided just by using the right tools, turning off the power, and following simple safety steps.

What are Smart ACs?

One effective way to reduce these risks is by switching to smart ACs. Smart ACs are just like regular ACs—but with an integrated intelligence system. They connect to your

phone or home Wi-Fi, allowing you to control temperature, modes, and scheduling remotely. More importantly, they come with built-in sensors and software that monitor performance, detect faults, and even send safety alerts. This makes them not only more energy-efficient but also safer when it comes to electrical risks and maintenance.

For example, they can warn you if a part is overheating, remind you to clean clogged filters, or even turn off automatically if there's a voltage problem. This kind of early warning and control system makes smart ACs a safer choice, especially in places with unstable power or limited electrical safety awareness.

Key Features that improve safety and performance are:

Fault Detection and Alerts	Smart ACs can detect issues such as overheating capacitors, voltage irregularities, clogged filters, or blocked airflow. Users receive notifications on their phone or via the AC display, ensuring problems are caught early before they cause accidents.
Automatic Protection	If unsafe conditions occur—like a sudden power surge or overheating motor—the AC can automatically shut down. This prevents electrical fires, equipment damage, or shocks that might occur if the system were to keep running.
Preventive Maintenance	Many smart ACs send reminders for routine maintenance tasks such as cleaning or replacing filters, checking refrigerant levels, or servicing electrical parts. These reminders reduce the chances of system failure due to neglect.
Energy Management	Smart ACs can optimize cooling by learning user preferences, adjusting modes automatically, and avoiding overuse. This reduces strain on electrical components and lowers the risk of overheating or circuit overload.
Integration with Home Safety Systems	Some models can connect with smart home devices like smoke detectors or energy management systems, creating an additional layer of protection and efficiency.

These features highlight how smart ACs actively manage risks and prevent common failures. But the difference becomes even clearer when we compare them directly with traditional ACs. Table 3 shows how smart ACs address the safety concerns that older models struggle with.

Table 3 Safety feature comparison between traditional and smart air conditioners

Safety Concerns	Traditional AC	Smart AC
Electrical Overload & Short Circuits	Uses a lot of power when starting, which can damage wires or trip switches.	Starts smoothly using smart tech, reducing pressure on wiring.
Overheating & Heat Build-up	Can get in an unsafe zone if installed in a closed space, the condenser coil is corroded, and free air circulation is restricted.	Has sensors to track heat and can shut down automatically in case the operations cross safe limits.
Power Fluctuations	It can break if there are sudden drops or spikes in electricity.	Checks power levels and protects itself from damage.
Lack of Maintenance	Dirt builds up in filters if not cleaned regularly, causing problems.	Sends alerts to remind you to clean or get it serviced.
Grounding & Earthing Issues	It can be unsafe if not installed correctly, leading to electric shocks.	Needs proper installation too but can detect and warn about such issues.
Manual Fault Detection	You only notice a problem after something stops working.	Gives real-time alerts to catch and fix issues early.

Choosing the Perfect Smart AC: Tips for First-Time Buyers (Figure 8)

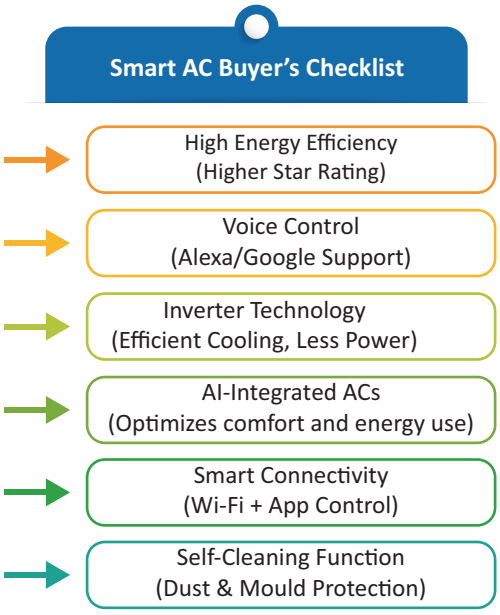


Figure 8 Smart AC features

The future of Smart Air Conditioning

A step toward eco-friendly, energy-efficient, and healthy living is represented by the integration of smart air conditioners, which goes beyond simple convenience. Smart cooling appears to have a bright future thanks to developments like AI-powered climate management, improved energy storage, and better air quality monitoring. Smart air conditioners will become more effective, intuitive, and easily incorporated into daily living as technology advances. Adopting these clever, environmentally friendly cooling solutions is not only a method to improve comfort in the face of warming temperatures and climate change, but it is also an essential step in lowering our carbon footprint and building a more sustainable future for posterity.

Bridging the Gender Gap in the RAC Sector

By Ms Aditi Shah, Aditi Air Conditioning Pvt. Ltd

India's Refrigeration and Air Conditioning (RAC) sector is expanding rapidly, creating demand for skilled technicians, engineers, and service professionals. Traditionally, this space has been male-dominated, but today the industry is witnessing a gradual yet steady shift. With the rise of sustainable cooling, skill development initiatives, and growing awareness of inclusivity, there are increasing opportunities for women to participate and thrive in the sector.

Understanding Challenges and Emerging Pathways for Women in RAC

The RAC service and maintenance segment is often perceived as physically demanding and technical. While women's participation in RAC is slowly increasing, the sector is evolving in ways that can unlock new opportunities. Some challenges—such as limited training access, workplace inclusivity, and safety concerns—have historically discouraged women from entering the field. However, these are increasingly being addressed through targeted interventions, skill programmes, and supportive networks (Figure 9).

Modern technology, safer refrigerants, and better tools are changing this perception. Automated diagnostic devices, lightweight equipment, and improved safety practices are making the profession more accessible for all.

Strengthening Support Systems

Professional associations and communities such as ISHRAE, ASHRAE, UNEP's Women in Refrigeration & Air Conditioning, and The Real Women in Construction Industry are actively creating platforms for women to connect, learn, and grow. These networks provide

Figure 9 Expanding opportunities for women in RAC

mentorship, knowledge-sharing, and visibility to women professionals, ensuring they are not just part of the workforce but also future leaders in the sector.

Breaking Barriers, Creating Opportunities

The traditional perception that blue-collar jobs in RAC services are less suited for women is gradually shifting to a more inclusive view: with the right training, safety protocols, and support, women can excel in this profession. Women entrepreneurs in the RAC sector are opening new avenues through dedicated skill training, flexible learning formats, and mentorship opportunities. These efforts are creating pathways for women technicians, entrepreneurs and engineers to enter the field with confidence.

Promoting gender equality (SDG 5) ensures that women technicians and engineers have equal access to training, tools, and career opportunities. A more inclusive workforce also fosters innovation, safety, and sustainability in cooling services.

Building an Inclusive and Future-Ready RAC Sector

India is poised for a massive surge in demand for cooling systems, driven by urbanization, rising temperatures, and economic growth. Meeting this demand requires a large, skilled, and diverse workforce that includes women. Sustainable cooling also intersects with food security, healthcare, education, and climate action—making inclusivity even more critical.

Women bring valuable perspectives to the RAC sector. Their participation contributes to stronger workplace culture, enhanced customer trust, and innovative problem-solving approaches. Across India, women are already excelling in diverse RAC roles—from research and design to servicing and entrepreneurship. With supportive training and inclusive policies, this participation is expected to grow.

By equipping women with technical skills (SDG 4), promoting financial independence and gender equality (SDG 5), and creating decent work opportunities (SDG 8), the RAC sector can unlock wide-ranging benefits. This ripple effect supports nutrition (SDG 2), health (SDG 3), sustainable cities (SDG 11), and climate goals (SDG 13) (Figure 10).

Figure 10 Women's participation in the RAC sector and its alignment with key SDGs

Looking Ahead

India's growing RAC sector is shaping the economy while also opening doors for broader participation and inclusive development. With sustained support, structured training, and greater visibility, more women can step into roles that strengthen the industry's capacity for sustainable and inclusive growth. Beyond technical and entrepreneurial opportunities, emerging spaces such as aggregator platforms, assembly lines, app-based services, software solutions, and training roles are creating new pathways where knowledge-sharing and coordination are central.

These opportunities complement established roles in servicing, design, and entrepreneurship, allowing women to engage across the full spectrum of the industry. By contributing as technicians, entrepreneurs, and trainers, women can play an active part in building both the present workforce and the next generation of RAC professionals. Together, these evolving pathways point towards a sector that is more diverse, skilled, and future-ready—well-positioned to deliver sustainable and inclusive cooling solutions for years to come.

Mr Rangrej Irfan has 35 years of experience working as a full-time RAC service technician and supervisor.

From the field:

Mr Rangrej Irfan has 35 years of experience working as a full-time RAC service technician and supervisor.

What is the nature of your job?

Ans: I work full-time with *Aditi Airconditioning Pvt. Ltd.* as a RAC technician and supervisor. My responsibilities include servicing different types of domestic air-conditioning units and guiding junior technicians through hands-on training and troubleshooting.

Which refrigerants do you commonly handle, and how do you manage flammable refrigerants safely?

Ans: Most of my work involves R-410A and R-32 systems. I first learned about these refrigerants during my ITI course, but I acquired detailed handling skills through on-site experience. This practical exposure has been crucial in developing confidence in managing flammable refrigerants safely. In my view, if refrigerant types were clearly labelled on compressor nameplates, it would greatly assist service technicians in the field.

Are you professionally trained? What training have you undergone?

Ans: I completed the full RAC technician course from State ITI, which gave me the fundamentals of servicing operations such as evacuation, flushing, and refrigerant charging. Beyond that, I have received continuous practical training from *Aditi Airconditioning Pvt. Ltd.* and periodic refresher sessions organized in partnership with manufacturers and government-led initiatives. These opportunities help me stay updated with the latest servicing methods and technologies.

Would you be interested in future training programmes to stay current with new refrigerants and technologies?

Ans: Yes, definitely. While I feel confident in handling existing technologies, including advanced systems like VRF, I believe continuous learning is important. Training on next-generation refrigerants and modern servicing techniques will be highly valuable in the coming years.

What type of information would you like to see in the *newsTRAC* newsletter for service technicians?

Ans: Information on the latest servicing practices, emerging refrigerants, and new technologies is always valuable. It helps technicians like me stay prepared for changing market needs.

HPMP
HCFC Phase-Out Management Plan, Servicing Sector

GOOD SERVICE PRACTICES FOR ROOM AIR-CONDITIONERS

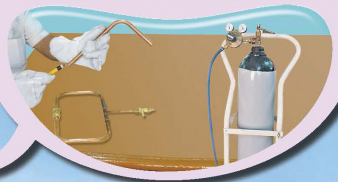
RECOVER RECYCLE RECLAIM

RECOVERY OF REFRIGERANT FROM SYSTEM FOR REUSE IN THE SAME SYSTEM

REPAIR/REPLACE DEFECTIVE PARTS WITH OEM PARTS

PROPER BRAZING &/OR FLARING

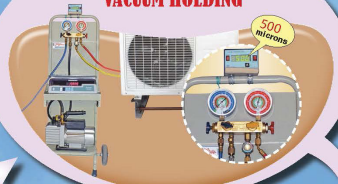
CLEANING/ POLISHING AND FLUSHING WITH OXYGEN FREE DRY NITROGEN



Committed to **Quality Service**
Committed to **The Environment**

LEAK/ PRESSURE TESTING WITH OXYGEN FREE DRY NITROGEN

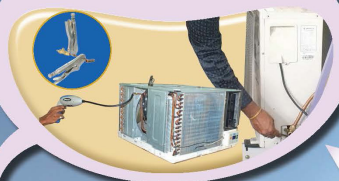
EVACUATION AND VACUUM HOLDING



Boiling Point of Water °C	Vapor Pressure in Microns
100	7,59,968
50	92,456
30	31,750
10	8,641
0	4,572
-10	1,722
-23.35	500

Our aim 500 microns

SEALING PROCESS TUBE/CLOSING VALVES

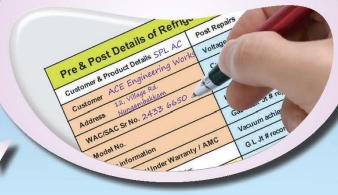


REFRIGERANT CHARGING BY WEIGHT

SAFETY ALWAYS

CHECK FOR PROPER OPERATION AND FINAL LEAK CHECK

RECORD DETAILS OF WORK DONE



SAVE OUR OZONE LAYER

HPMP (HCFC PHASE-OUT MANAGEMENT PLAN): SERVICING SECTOR

A Project of the Ozone Cell, Ministry of Environment & Forests (MoEF), Government of India in co-operation with the Government of Germany represented by Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH and United Nations Environment Programme (UNEP)

giz

UN environment programme

www.ozonecell.nic.in

Ready Reference for Good Servicing Practices Videos

Basic tools overview

Evacuation of Air Conditioner

Flaring

Leak Detection

Refrigerant Charging

Want to learn and explore more about good servicing practices, scan here:

Ministry of Environment, Forest & Climate Change
Government of India

For further information

Ozone Cell, Ministry of Environment, Forest and Climate Change

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Fax: 011-24642175
Website: http://ozonecell.nic.in/

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