newsTRAC

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

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Inside...

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Ministry of Environment, Forest & Climate Change Government of India

UN environment United Nations Environment Programme

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Creating Innovative Solutions for a Sustainable Future

SAVE UR ZONE LAYER

Foreword

राजश्री रे
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सत्यमेव जयते

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ECONOMIC ADVISER
MINISTRY OF ENVIRONMENT, FOREST
AND CLIMATE CHANGE
GOVERNMENT OF INDIA

Message

The Government of India acknowledges the significant rise in the use of cooling appliances in the residential and commercial sectors due to rapid urbanization, growing aspirations of people, and changing working conditions. It is essential to ensure that these appliances operate effectively and efficiently with minimal environmental impact, and the role of the servicing sector industry is crucial in achieving this goal. As an integral component of the implementation of Hydrochlorofluorocarbons (HCFC) Phase-out Management Plans (HPMPs), the significance of energy efficiency in the servicing sector cannot be overstated.

Energy efficiency presents numerous benefits such as: reduces operating cost, mitigates the effects of climate change, improves customer satisfaction, ensures compliance with regulations, and provides a competitive advantage in the market. By adopting energy-efficient practices and equipment, the technicians in the servicing sector can significantly enhance operational efficiency, reduce environmental impact, and stay competitive in the market.

Servicing sector is an integral part of Refrigeration and Air-conditioning (RAC) industry and also consumes a significant proportion of refrigerants namely HCFCs, Hydrofluorocarbons (HFCs) etc. Therefore, servicing sector plays a pivotal role in the HCFC phase-out and HFC phase-down process. Good servicing practices reduce the refrigerant leakages and thus also contribute in reducing greenhouse gas emissions. The current edition of newsTRAC includes quick links to Good Servicing Practices - videos and training material for RAC technicians.

Ozone Cell of Ministry of Environment, Forest and Climate Change in collaboration with The Energy and Resources Institute is bringing out this 3rd edition of the newsTRAC, the quarterly newsletter with the theme "Promoting Good Servicing Practices for Refrigeration and Air-Conditioning (RAC) Servicing".

I commend the efforts of Ozone Cell, The Energy and Resources Institute, United Nations Environment Programme, and the contributing authors for bringing out the 3rd edition of the newsTRAC.

Rajasree

(Rajasree Ray)

Dated : September 11, 2024

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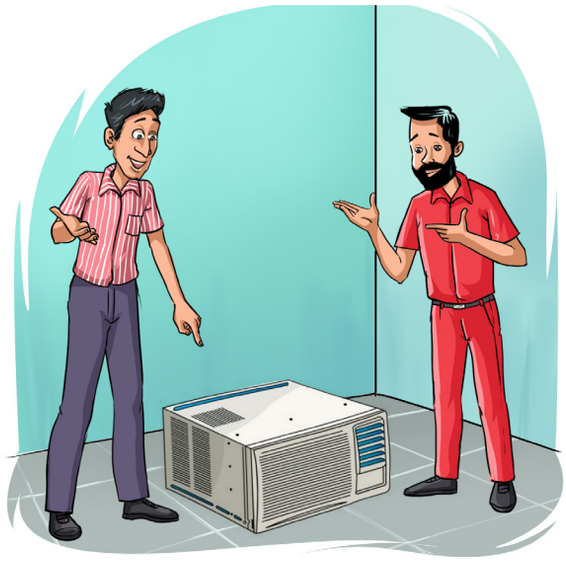
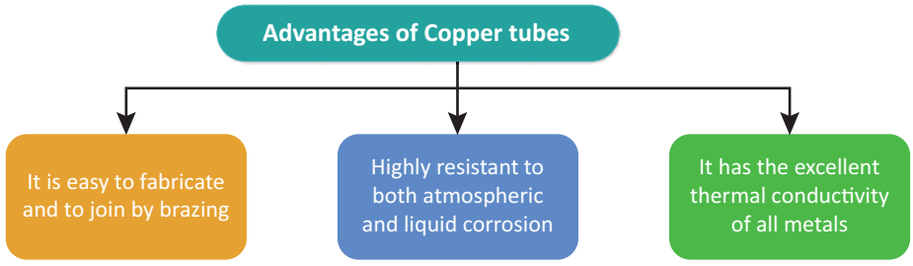
COPPER TUBING OPERATIONS FOR INSTALLATION AND SERVICING OF ROOM AIR CONDITIONER

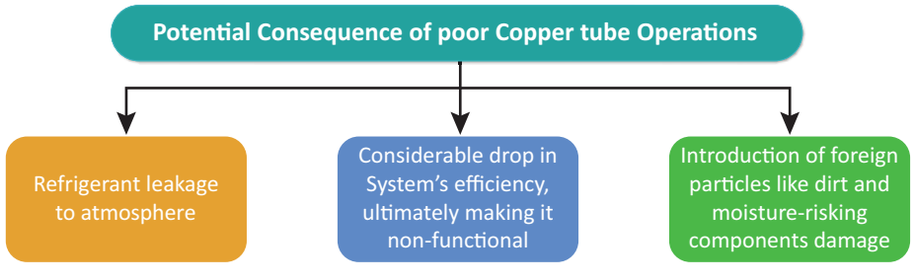
By Karamjit Singh Ladhar, National Vice President, RASSS



Refrigerants are the lifelines of refrigeration and air conditioning systems (RAC). In modern refrigeration and air conditioning equipment, Copper (Cu) tubes are predominantly used to carry out the refrigerant across the RAC system. The piping system provides a flow channel to the refrigerant which enables cooling and heating effects. Engineers have carefully selected Copper tubes because of the enormous benefits it offers as a base piping material.

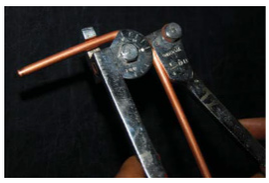
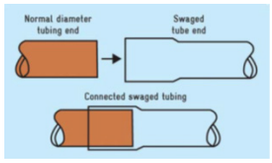
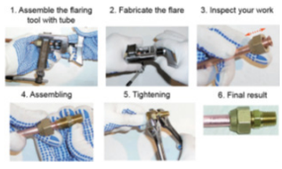
Technicians should understand the importance of Copper tubing maintenance and service. In a refrigeration system, the tube serves as a path between individual components and prevents the refrigerant from escaping to the atmosphere so sizing, installation layout and fittings must be done properly.





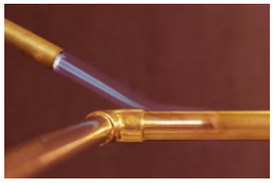
Details of Copper tubes operations in sequential order for the RAC servicing technicians

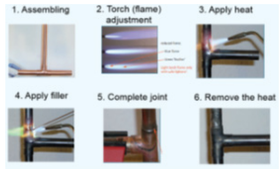
OPERATION	OPERATION DETAILS	PRECAUTIONS
Tube Selection	▪ Choose copper grade according to AC system type and refrigerant pressure. ▪ Type K, L, ACR Copper tubes are used in refrigeration and air conditioning.	▪ Selecting copper tubes that are not recommended will make the system inefficient and dangerous due to the explosion.
Straightening and Measuring 	▪ The straightening must be done from the head to the tail of the tube. ▪ In order to straighten the coil, one hand must hold it upright while the other must hold the free end stationary on a flat surface.	▪ Copper tubing should not be straightened out too much as it is difficult to recoil without bending.
Tube Cutting 	▪ The cutting of the tube should be done using a tube cutter. ▪ Cut parts should not have rough or slanted surfaces. The surface should be smooth and at a right angle to the tube's axis. ▪ To prevent contamination, place the plug or cap on the end of the coil after cutting the desired length.	▪ Care must be exercised not to damage the freshly cut ends. ▪ The surface of the cut part should not be rough or slanted. ▪ It's important to avoid excessive blade pressure because it can cause the tube to get pinched and leave a burr on the surface. ▪ Do not use a hacksaw or any other tool to cut soft copper tubing.
Reaming (De-Burring) 	▪ There will be some sharp burrs on the tube ends after cutting, and those must be removed. ▪ For removing these burrs reaming is done. ▪ Reamers are operated gently by positioning them at the tube's end to be reamed and rotating them. ▪ In addition to removing the outer burr, the inner burr is also removed with a reamer.	▪ During Reaming, Copper chips or burrs must not be allowed to enter the tubing. ▪ While reaming, the tube must be held upside down or at an angle so that the chips will fall to the ground. ▪ Any burrs or ridges on the inside of the tube will cause problems while assembling them.
Leak Testing 	▪ For Leak testing, apply soap solution to joints, connections and fittings while the system is running or under a standing pressure of nitrogen to identify leak points through appearance of bubbles. ▪ Electronic leak detector can also be used for leak detection.	▪ Soap solution for leak testing is usable only when the system is under positive pressure. ▪ For using such devices, ensure small quantity of refrigerant in system as most leak detectors are refrigerant based.

OPERATION	OPERATION DETAILS	PRECAUTIONS
Bending 	▪ To perform neat, distortion-free bends Technicians should always use spring type or lever type. ▪ With these tools, technicians can control how much pressure is applied, which helps to prevent kinking. ▪ Lever-type tubing benders are easy to operate and are calibrated to allow accurate short radius bends up to 180°.	▪ Be sure to keep the entire tube surface round while bending. ▪ Ensure proper bender size and perform operation carefully to avoid bend damage. ▪ Never use your hand as it will flatten the tube.
Cleaning and Polishing 	▪ Always use abrasives to clean the copper tubes, such as polish, emery cloth, and wire brushes. ▪ Clean the surface with an abrasive plastic scouring pad.	▪ Wear gloves and a face mask to protect yourself from the chemicals. ▪ Ensure that no cleaning particles or contaminant enter the tube. ▪ Use a proper-sized fitting brush when cleaning interior fittings.
Swaging 	▪ In swaging, a copper tube is enlarged at one end so that end of another tube can be slipped into it. ▪ In order to perform swaging, a bearing block, hammer, and appropriate size swaging tool are required. ▪ The position of the tube above the flaring block should be equal to outer diameter (OD) +3 mm of the tube.	▪ Technicians should use only the soft copper tubes for swaging. ▪ It is very important to select the correct size hole for the tube ▪ The length of the overlap of the two copper tubes to be swaged should be equal to OD of the tubing.
Flaring 	▪ The flare connection allows copper tubing to be joined or sealed with pressure using a flare tool. ▪ Soft copper tube ends are flared at 45° angles. ▪ In order to connect the tubing to the fitting, the flared end is seated against the male portion of the fitting. ▪ There are several types of flaring tools for copper tubing, including bar-type tools that come with multiple bits for accommodating different pipe and tube sizes.	▪ Technicians should pay lot of attention to the process of flaring .Any improper connection will cause high pressure refrigerant leakage. ▪ Ensure to insert flare nut before performing operation otherwise there will be tube wastage. ▪ Flares for tubing and piping cannot be interchanged. Pipe flares have a 37° angle, while tubing flares have a 45° angle. ▪ Ensure there is no micro and small crack in flaring region. This will ensure no leakage. ▪ Never use Teflon tape for connecting Copper tubes.

OPERATION	OPERATION DETAILS	PRECAUTIONS

Brazing

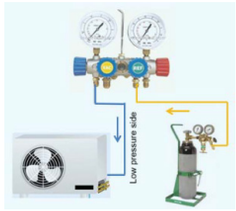




- The brazing process is a non-detachable heat-sensitive bonding method that involves joining two metals with a filler metal.
- To perform brazing, technician should have: - a striker, air-conditioning service wrench, brazing rods or filler material, & an acetylene-oxygen cylinder and torch.
- Oxygen in cylinder is normally @ 2200 psig when full while acetylene is @ 250 psig. Brazing requires less than 15 psig pressure. To verify it, two gauge set regulator is recommended. For Oxygen, use two stage regulator for ease of operation and control.
- The clearance between two tubes should be in the range 0.05 mm to 0.5 mm. Length of joint should be at least equivalent to the diameter of tubes in the case of same-size tubes.
- Brazing is done by heating the copper tube assembly and then running a layer of filler material (silver alloy brazing rod) on the top.
- While brazing, the heat source depends upon the size of the tubes to be brazed, so heat application requires utmost care.
- Heat is to be applied uniformly to both, tube, and fitting, by moving the torch around to ensure even heating before adding the filler material (rod).
- Observe the colour of the heated area. When the heated region gradually changes colour to red (a cherry red but not a bright red), apply filler material (rod) by lightly brushing the tip of the stick into the tube fitting area.
- Heat to be removed until the molten brazing alloy solidifies to a tan-black colour (approx. 10 to 15 seconds).

- The technician should note that If the temperature required to melt the alloy used to join copper tubing is above 450°C it is considered brazing, if less than 450°C, then soldering
- The brazing rod should melt on contact with the heated copper tubes and should never be heated directly by the torch flame and melted.
- "Safety First & Everywhere". During brazing, PPE like goggles, shoes, apron/lab coat and gloves exclusively designed for safety must be worn.
- Technicians shall not touch the brazing joint till it gets completely cooled.
- To avoid any oxidation, Nitrogen gas should be used at a very slow flow rate inside the tube assembly region.
- Allow brazing joint to cool naturally.
- Technicians should always clean the surfaces to be joined using emery or wire brush to have a clean and bright surface.
- Technicians should take care not to overheat the copper tube.

Pressure Testing



- Once all the tubes are connected and brazed, pressure testing procedures must be applied for leak testing.
- Pressure testing is initiated by pressurizing the system with Oxygen-Free Dry Nitrogen (OFDN) to a higher-pressure value than the operating pressure.
- Nitrogen cylinder have pressure @ 2200 psig. Technicians must use nitrogen regulator to bring this pressure to @ 200-400 psig before applying pressure to air-conditioner. Failure to do this can explode the system.
- Check the system for pressure holding for at least 15 minutes to ensure there is no leak in the system. Keep noticing the pressure gauge for any changes such as pressure drop, if any.

- Technicians shall use two Nitrogen regulator on Nitrogen cylinder.
- As pressure of Nitrogen cylinder and Oxygen cylinder is similar, keep both cylinders at proper location to avoid mixing.
- Ensure that Nitrogen cylinder is used and not Oxygen for pressure testing.
- The system should not be pressurized with values that are above the system's test pressures
- The system should never be started when pressurized with OFDN.

INVERTER AC: SERVICING AND REPAIR PERSPECTIVES

With rapid urbanization and population growth, the use of Air conditioners is expected to rise steadily. The present consumer base is becoming more and more conscious about technology, which will accelerate the sales of inverter AC in the domestic AC market segment. Air conditioners with inverter technology adjust the temperature by varying motor speed rather than turning the motor on and off. With an inverter air conditioner, there is less power loss, which can save energy, hence not only helping consumers with fewer bills but also echoes toward sustainability.

Difference between Fixed Speed AC and Inverter AC

To understand the core difference, inverter technology can be seen as analogous to the accelerator in a car. If we want to increase speed while driving in a vehicle we put on the accelerator pedal, on similar line inverters ac variable speed compressors draw less power or more power depending on the temperature of the room and conditions such as incoming air and the level set in the thermostat. The inverter is actually an electronic power component that continuously adjusts the electric supply frequency of an electric motor.

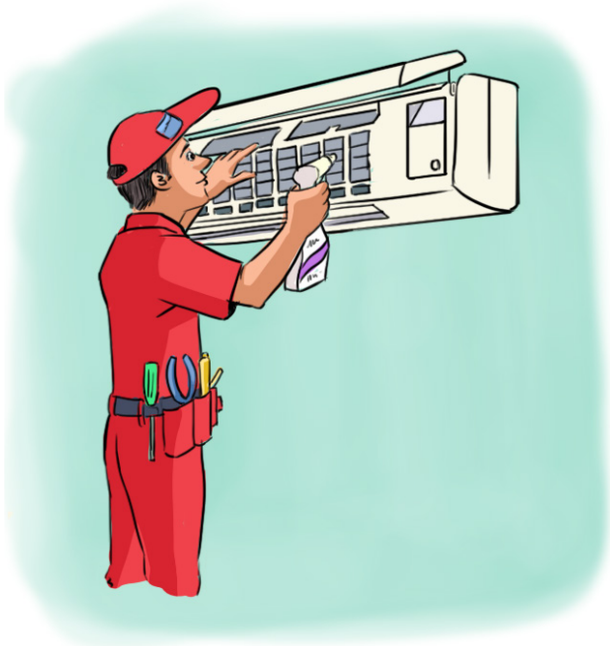


Table 1: Major Differences between Inverter AC and Fixed Speed (Non-Inverter) AC

PARAMETERS	FIXED SPEED AC /NON-INVERTER AC	INVERTER AC
Technology	Fixed speed compressors	Variable speed compressors
Energy consumption	More	Less
Noise levels	More, due to frequent ON /OFF	Less, due to smooth operation
Thermal Comfort	Less due to frequent ON /OFF cycles	More, due to smooth interrupted operation
Cooling Capacity	Fixed	Varies as per cooling load
Usage Recommendation	Buy, if: - ▪ Normal Daily Usage	Buy, if: - ▪ Daily usage is large ▪ Performance is the priority ▪ Flexible Buying budget ▪ Electricity Bill Reduction

Key differences between the construction of fixed speed and Inverter AC unit are as tabulated below:

Parameters	Fixed speed	Inverter
Compressor	Fixed Speed Compressor	Variable Speed Compressor
Controller	There is no PCB / Controller	Specially designed Outdoor PCB
Motor	AC motor	AC/DC fan motor
Communication	One way communication	Two-way communication

Main Electrical Components in Inverter AC

1 WIRING

1. The indoor and outdoor unit is connected by a 4-core wire.
2. In case of Inverter unit communication between the indoor and outdoor unit is through a signal wire.
3. It is important that the signal wire should not have any joints. Loose joint can lead to a communication error.
4. Different colour coded wire to be used in Inverter AC and same colour wire should not be used.

2 EARTHING

1. Earthing is very important for trouble-free operation of Inverter air conditioners.
2. We need to ensure that proper earthing is available at the site as well as proper earthing is done in both IDU as well as ODU.
3. The recommended voltage between Neutral and Earth should be less than 2 V.

3 OUTDOOR PCB CONTROLLER

1. A high-capacity electrolytic capacitors are used inside the outdoor unit controller. This capacitor for air conditioner has polarity terminal labelled with + or - marks.
2. A certain amount of time is required for the charge to dissipate (charging voltage DC 310 V) after the power is turned off.
3. Approximately 180 seconds will be required for the charge to dissipate if the outdoor control circuit board is normal.
4. Allow at least 30 minutes for the charge to dissipate if the outdoor control circuit board appears to be malfunctioning.

4 THERMAL PASTE APPLICATION IN OUTDOOR PCB

1. Make sure thermal paste is applied when replacing the outdoor PCB (Printed Circuit Boards).
2. The thermal paste on the outdoor PCB ensures uniform rejection of heat from the IPM (Intelligent Power Module) and IGBT (insulated-gate bipolar transistor) and thus maintains IPM temperature.
3. The IPM module is the inverter AC module which controls the speed of the compressor and the outdoor fan, this is what makes the unit energy efficient.

How to Perform Diagnosis of Communication Signal Errors in Inverter AC

COMMUNICATION SIGNAL ERROR

1. Indoor controller unit transmits signal to outdoor controller around every half seconds
2. The outdoor unit will respond to indoor once the valid data is received. Communication errors will occur if the signal between the indoor and outdoor units is disrupted.
3. The error code will be displayed at the display panel. The code will vary depending on the AC brand, so technicians must refer to the service manual before proceeding for servicing.

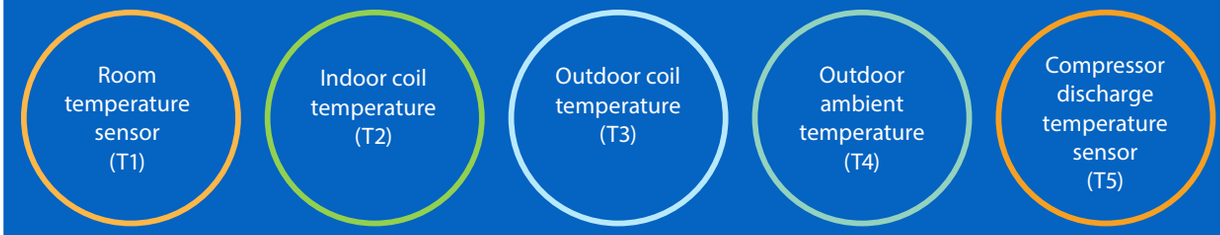
DIAGNOSIS OF COMMUNICATION SIGNAL ERROR

1. Always use a multimeter to test the DC voltage between port 2 and port 3 of outdoor unit.
2. The red pin of multimeter connects with port 2 while the black pin is for port 3.
3. When AC is in normal running condition, the voltage will move alternately between -25V to 25V (mentioned voltage can change with respect to various model).
4. If the outdoor unit has malfunction, the voltage will move alternately with positive value. But if the indoor unit has malfunction, the voltage will be a certain value.

How to Perform Diagnosis of Temperature Sensor Functioning and Outdoor PCB IPM Continuity Check

CHECKING TEMPERATURE SENSOR FUNCTIONING

1. Technician should first make sure that the temperature sensor is disconnected from the PCB.
2. Using a multimeter, the technician should measure the resistance value of the following:



3. Measure the resistance value of each winding by using multimeter.
4. Technician should refer to the Temperature Sensor Resistance Value Table from the service manual of the corresponding AC.
5. A faulty temperature sensor will result in erratic operating cycles.

OUTDOOR PCB IPM CONTINUITY CHECK

1. Turn the power off, & wait for 15 minutes to let the large capacity electrolytic capacitors in the outdoor PCB discharge completely to avoid any shocks.
2. Dismount the IPM.
3. Use a digital tester to measure the resistance between P and UVWN; UVW and N as shown in Table 1.

Table 2: Digital Tester Normal Resistance Values

Digital Tester		Normal Resistance Value	Digital Tester		Normal Resistance Value
(+) Red	(-) Black	∞ (very large value in M Ω)	(+) Red	(-) Black	∞ (very large value in M Ω)
P	N		U	N	
	U		V		
	V		W		
	W		(+) Red		

External Interferences and Inverter ACs

For an inverter AC to vary it's cooling and heating capacities, they operate by modulating the compressor speed through pulse-width modulation (PWM) and high-frequency control signals. As a result, it is susceptible to external interferences such as noise and is likely to cause electromagnetic interference with nearby wireless devices. This issue is mitigated by using noise filters in the inverter AC. However, depending upon the installation location and condition some external interference can still cause problems in the normal operating cycle of inverter AC.

NOISE INTERFERNCE
Signal wires are subjected to high-frequency noise, causing abnormal pulses and malfunctions

- POSSIBLE SUSCEPTIBLE LOCATIONS
  1. TV broadcast stations.
  2. Radio (short wave) stations.
  3. Electronic welding workshops.
- ISSUES
  1. The unit may turn OFF suddenly during operation.
  2. Indicator lamps may flicker.
- SERVICING TIPS
  1. Use shielded wires.
  2. Remove the unit from the noise source.

ELECTRO-MAGNETIC INTERFERNCE
High-speed switching of the microcomputer and compressor generates noise. The noise radiates through space and affects any nearby wireless devices (televisions, laptops, smartphones, etc.).

- POSSIBLE SUSCEPTIBLE LOCATIONS
  1. A television or radio is located near the AC unit & wirings.
  2. The antenna/dish cable for a TV is located close to the AC unit & wirings.
  3. Locations where television and radio signals are weak.
- ISSUES
  1. There is noise or distortion in the TV feed.
  2. Static occurs in the radio output sound.
- SERVCING TIPS
  1. Select a separate power source.
  2. Keep the AC & it's wiring at least 1 meter away from wireless devices and antenna cables.
  3. Change the wireless device antenna to a high-sensitivity antenna.
  4. Change the antenna cable to a BS coaxial cable.
  5. Use a noise filter (for the wireless device).
  6. Use a signal booster.

ALTERNATIVE REFRIGERANTS TO HCFCs AND THEIR CHARACTERISTICS

By Kapil Singhal, Managing Director, B P Refcool, Gurgaon

- India became Party to the Montreal Protocol on 19th June, 1992.
- With continued efforts from different stakeholders, industry and the policies developed by the Ministry of Environment, Forest and Climate Change, (MOEF & CC) India has successfully phased-out the production and consumption of CFCs, CTC and halons, and Methyl Chloroform as on 1st January, 2010.
- HCFCs were developed as low-ODP transitional substances to substitute high-ODP CFCs in some applications.
- The 19th Meeting of the Parties (MOP) held in September 2007 on the occasion of 20th Anniversary of the Montreal Protocol, agreed to accelerate the phase-out of hydrochlorofluorocarbons (HCFCs) by 10 years for early recovery of the ozone layer.

Evaluation of Alternatives to HCFCs

In India, two types of refrigerants are commonly used: HCFC-22 and HCFC-123. They are used for different purposes, including air conditioning, refrigeration, and chillers. They do, however, have specific requirements that cannot be met by a single alternative for all applications. Each application requires a unique solution, which may or may not target the same customers.

Key evaluation criteria for alternative refrigerants would be

- Environmental properties
- Safety properties
- Thermodynamic properties which include the energy performance of the system.

Environmental Properties

The two most important environmental properties of refrigerants are their impact on ozone depletion and global warming. Ozone depletion potential (ODP) is a measure of its impact on the ozone layer and global warming potential

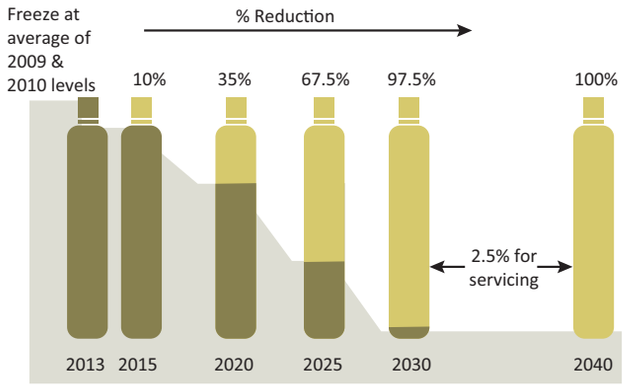


Figure 1: Montreal (Accelerated) Phase-Out Schedule for Developing Countries

(GWP) is the impact on the global warming for the particular refrigerant.

- Direct emissions are due to the release of refrigerant (during normal operation because of leaks from pipes and components or during regular servicing)
- Indirect emissions are due to energy consumption of the equipment

Safety Properties

There are two important safety properties of refrigerants toxicity and flammability. ASHRAE 34 as well as Indian standard IS16656, highlights safety classification of refrigerants as follows:

Alpha numeric classification "A" and "B" for toxicity and Numeric classification 1, 2, 2L, & 3 for flammability.

- **Toxicity classification** is based on chronic (long term) impact as follows:
  a. Class A with OEL >= 400 ppm
  b. Class B with OEL < 400 ppm

Where OEL (Occupational Exposure Limit) is the 8-hour time-weighted average (TWA) concentration to which nearly all workers can be repeatedly exposed for a normal 8 h workday and a 40 h workweek without adverse effect.

- The **flammability classification** is based on flame propagation:
  a. Class 1 – exhibits no flame propagation

b. Class 2L - exhibits flame propagation when tested at 60°C and 101.3 kPa, LFL > 0.10 kg/m³ and burning velocity <= 10 cm/s at 23 °C and 101.3 kPa, and heat of combustion < 19 MJ/kg

c. Class 2 - exhibits flame propagation when tested at 60°C and 101.3 kPa, LFL > 0.10 kg/m³ at 23°C and 101.3 kPa, and heat of combustion < 19 MJ/kg

d. Class 3 - exhibits flame propagation when tested at 60°C and 101.3 kPa, LFL <= 0.10 kg/m³ or heat of combustion >= 19 MJ/kg

Where LFL is the lower flammability limit.

ASHRAE Classification

Highly Flammablility	A3	B3
Flammable	A2	B2
Lower Flammablility	A2L	B2L
No Flame Propagation	A1	B1
	Lower Toxicity	Higher Toxicity

Thermodynamic Properties

Thermodynamic properties are important when selecting a refrigerant for a specific application. It is critical that you select the proper refrigerant for the application. We must select refrigerants with high refrigeration capacity, compatibility with compressor oil, a high critical temperature, and a low discharge temperature. If we select the inaccurate refrigerant, we may develop a system that is too expensive, too large, or doesn't last very long. The major thermodynamic properties are discussed in the following Table 2.

Table 3: Thermodyanmic Properties of Refrigerants

Current Refrigerants Used	Sector	Alternative	GWP	Safety Classification	Thermodynamic Properties		Remarks
					Boiling Point (°C)	Critical Temp (°C)	
HCFC-22	Room Air Conditioners	R-290	3	A3	-42.100	96.700	Flammable and already in use in some small charge systems.
	Room Air conditioners (Mini-split and window air conditioners)	R-32	677	A2L	-51.700	78.100	Mildly Flammable and widely used in India in Room ACs.
HCFC-22	Commercial Refrigeration	R-290	3	A3	-42.100	96.700	Flammable and already in use in some small charge systems.
	Self-contained units (Display cabinet, water cooler, bottle cooler, visi coolers, ice cream cabinets and chest freezers)	R-448A	1273	A1	1.153	83.600	Very limited use in India due to higher cost and low availability .
		R-454A	238	A2L	1.163	78.900	Very limited use in India due to higher cost and low availability.
		R-404A	3943	A1	1.015	72.100	High GWP is a concern, is used now but seems as short term.
HCFC-22	Medium capacity chillers	R-410A	1924	A1	-51.400	71.400	High GWP is a concern, is used now but seems as short term.
	Multi-Split, VRF ACs, ducted, packaged, roof top	R-410A	1624	A1	1.191	86.000	Low capacity and high glide is a concern.
HCFC-22	Industrial and Commercial Refrigeration	R-448A	1273	A1	1.153	83.600	High GWP is a concern, is used now but seems as short term.
		R-407F	1674	A1	1.161	82.600	Low capacity and high glide is a concern.
		R-404A	3943	A1	1.015	72.100	High GWP is a concern, is used now but seems as short term.
HCFC-22	Chillers	R-410A	1924	A1	-51.400	71.400	High GWP is a concern, is used now but seems as short term.
	Scroll	R-407C	1624	A1	1.191	86.000	Low capacity and high glide is a concern.
HCFC-123	Centrifugal	HFC-514A	2	B1	37.850	178.100	Very limited use in India due to higher cost and low availability.
		HCFO-1233zd	1	A1	18.300	165.600	Very limited use in India due to higher cost and low availability.

Sanjay, works as a residential and commercial RAC technician in Delhi. In 2022, Mr Sanjay participated in a training program organized by GIZ and gained valuable knowledge and skills related to training. During an interview with NewsTRAC, he discussed his employment history, job duties, challenges faced, and level of job satisfaction.

From the field:

Sanjay, works as a residential and commercial RAC technician in Delhi.

What is the nature of your job?

Ans: After completing my ITI and 12th, I have been working as a full-time residential RAC technician in Delhi. I work with authorised OEMs. I service Split AC, window AC, refrigerators, and air purifiers throughout the year.

What type of refrigerant do you deal with in your job ?

Ans: Most of the refrigerants encountered during servicing are R-32 and R-410A. During handling safety guidelines is followed and risk factors are eliminated such a ventilating the room before servicing, taking out ignition sources from the room, using the right tools etc.

Have you undergone any professional training, such as ITI, GIZ, ISHRAE, or Skill India? Are you familiar with these training programs?

Ans: I have done my ITI in Refrigeration and Air Conditioning. In 2022, I have also attended the GIZ training programme on Good servicing practices in Refrigeration and air conditioning.

What type of tools do you carry for servicing jobs?

Ans: I carry a variety of tools for servicing refrigerators and air conditioners. It includes RAC tools such as vacuum pumps, tube cutters, refrigerant recovery cylinders, pressure gauges, thermometers, and hand tools such as wrenches, pliers, tube cutters and screwdrivers.

What type of government initiative is required for sustaining the business?

Ans: I think the government should focus on strengthening and expanding training infrastructure which will help aspiring RAC technicians better prepared to deal with new emerging technologies and challenges in the RAC sector in India.

Would you be interested in participating in training programs to enhance your skills as a RAC technician?

Ans: Yes, I would like to learn new things like new technologies, the latest refrigerants and servicing practices so as to better serve the customers effectively.

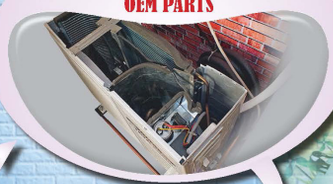
HPMP
HCFC Phase-Out Management Plan, Servicing Sector

GOOD SERVICE PRACTICES FOR ROOM AIR-CONDITIONERS

RECOVER RECYCLE RECLAIM

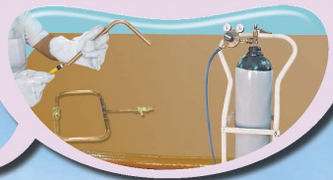
RECOVERY OF REFRIGERANT FROM SYSTEM FOR REUSE IN THE SAME SYSTEM

REPAIR/REPLACE DEFECTIVE PARTS WITH OEM PARTS



PROPER BRAZING &/OR FLARING

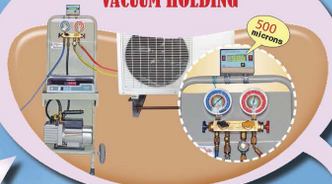
CLEANING/ POLISHING AND FLUSHING WITH OXYGEN FREE DRY NITROGEN



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

LEAK/ PRESSURE TESTING WITH OXYGEN FREE DRY NITROGEN

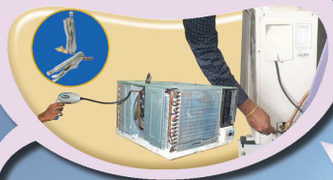
EVACUATION AND VACUUM HOLDING



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

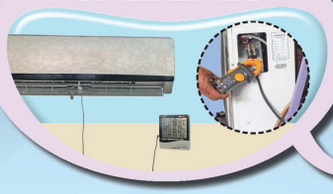


REFRIGERANT CHARGING BY WEIGHT

SAFETY ALWAYS

SAVE OUR OZONE LAYER

CHECK FOR PROPER OPERATION AND FINAL LEAK CHECK



RECORD DETAILS OF WORK DONE

HPMP 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 · Government of India · 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

SAVE OUR OZONE LAYER

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Creating Innovative Solutions for a Sustainable Future

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