ECO-COOL™

BULLETIN FOR REFRIGERATION TECHNICIANS

ISSUE NO. 18 NOVEMBER 2006

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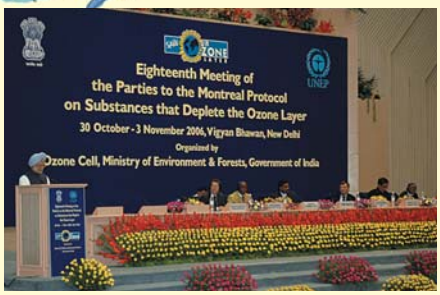
EDITORIAL



Dear Reader,

The 18th issue of Eco Cool almost coincides with the Eighteenth Meeting of the Parties to the Montreal Protocol on Substances that Deplete the Ozone Layer hosted by India from October 30 to November 3, 2006 in New Delhi. More than 550 delegates from all over the world attended this meeting to discuss and decide on a broad range of issues, e.g. multi-year exemptions for the use of methyl bromide, the difficulties faced by a number of countries in phasing out CFC based metered dose inhalers and key challenges regarding the future protection of the ozone layer. All participants expressed their gratitude to the Government and people of India for their warm hospitality and affirmed that the Montreal Protocol is one of the most successful multilateral environmental agreements till date. The levels of ozone-depleting substances (ODS) in the atmosphere which peaked in the early 1990s are declining as expected in line with decreasing production and consumption levels, proving that the Montreal Protocol is working.

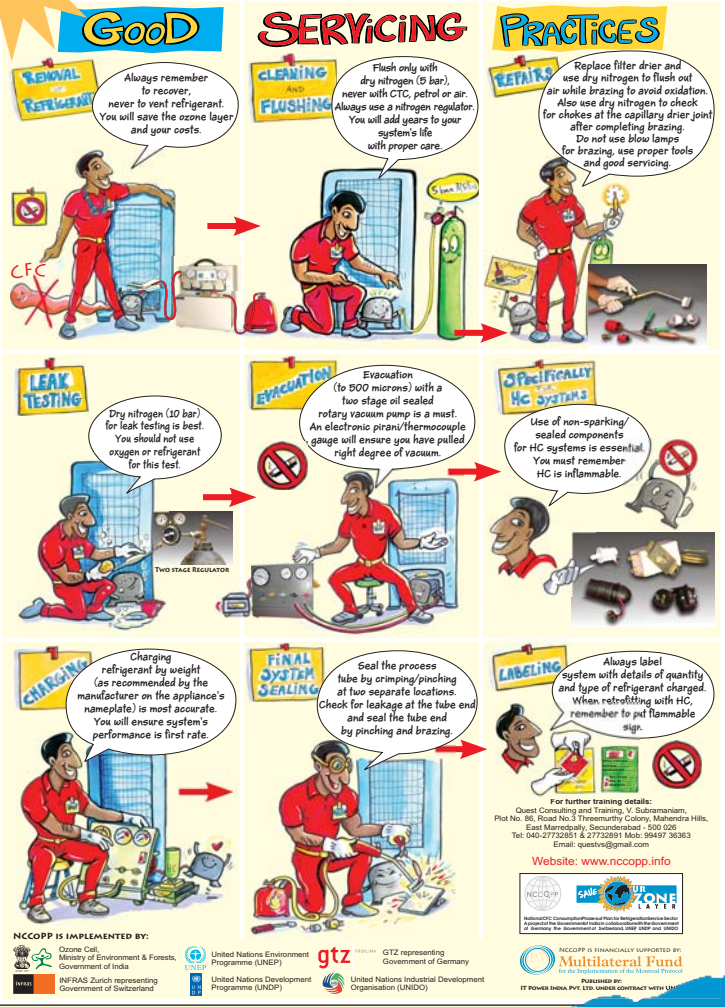
Notwithstanding the progress achieved, the ozone layer is still very fragile. Future levels of ODS in the atmosphere will depend on the quantity of emissions from existing CFC equipment, the still growing production of HCFCs and atmospheric transport. Latest scientific information has confirmed that global ozone depletion is at its peak level and from September 21 – 30, 2006, the average area of the Antarctic ozone hole was the largest ever observed, at 10.6 million square miles (which is more than eight times the size of India). It is now expected to disappear by 2065 only, which is fifteen years later than what had been predicted earlier. Scientists explain that this relates to a better understanding of atmospheric transport rather than to any failings of the Montreal Protocol. Furthermore, the net effect of climate change on ozone recovery is not clearly understood because the interactions between ozone depletion and climate change are complex and have multiple effects. Increased concentrations of greenhouse gases are cooling the stratosphere and thus change ozone levels, some greenhouse gases have direct impacts on ozone depletion, and most ozone-depleting substances are themselves powerful greenhouse gases. Therefore, we also need to better understand the interactions between ozone and climate in order to adopt appropriate policy measures to prevent the depletion of the ozone layer as well as global warming.

From these issues, it becomes very clear that the "job is not yet done" and all our contributions to the phase-out of ODS are even more important than ever. NCCoPP, under the lead of GTZ-PROKLIMA (on behalf of the Government of Germany), and in close co-operation with INFRAS (on behalf of the Government of Switzerland), UNDP and UNEP, is committed to enable the refrigeration servicing sector in India to take the right decisions and successfully phase-out the use of ODS. The program and its predecessor (HIDECOR) have already contributed significantly to provide training on good servicing practices to more than 15,000 Indian RSE technicians. However, there is still a huge quantity of CFC in existing equipment which needs to be addressed by proper refrigerant management such as recovery, recycling and reclamation. In this regard, Eco Cool continues to play an important role in providing relevant technical information so that you can offer the best services to your customers and at the same time, protect the environment for ourselves, our children and grandchildren.

Contributed by GTZ

NEW!

The latest poster on 'Good Servicing Practices' is now available!
Please contact nccopp@itpi.co.in



NCCoPP CONTRIBUTES TO CFC PHASE-OUT

NCCoPP contributes to the phase-out of CFCs in the RAC servicing sector by 2010 through:

- Targeting CFC-Consuming RAC servicing sector firms
- Encouraging good servicing practices for CFC-based appliances
- Training the servicing sector technicians in handling new non-CFC technologies

NCCoPP 2-day practical training programmes scheduled from 2005 to 2009 propose to cover:

- CFC and ODS phase-out processes
- Servicing new HFC-134a and HC-based refrigerators and other commercial appliances, including retrofitting
- "Recovery & Recycling" (R&R) of CFC refrigerants
- Updates on technology and market changes, appropriate tools/ equipment
- Best Practices in servicing of Mobile Air-Conditioning (MAC)
- Retrofitting, review of retrofit options and good servicing practices for large commercial appliances using open-type compressors.

All domestic and commercial Refrigeration Servicing Enterprises can apply for training. Specialised 1 day training workshops will be held for MAC service enterprises. All training contacts can be found on page 7. For upcoming training programmes refer to page 6.

Good Servicing Practices and Retrofitting of MAC

The Mobile Air Conditioning (MAC) sector, particularly air conditioning of passenger cars is globally one of the largest consumers of refrigerants. The CFC free refrigerant now most commonly used in the manufacturing of MAC all over the world is HFC-134a. India has stopped the use of Chlorofluorocarbons (CFCs) in the manufacturing of MAC and other refrigeration equipments/appliances from January 01, 2003. However, there is a large population of cars fitted with CFC-12 charged air-conditioning systems. These units require servicing very frequently, especially in developing countries due to poor road conditions and high ambient temperature.

Car Air-conditioning System

Mobile air-conditioning, like stationary air-conditioning involves heating, cooling and dehumidification of air. For cooling & de-humidification, a vapour compression refrigeration system driven by the car engine is used. The heat required for warming the passenger compartment, usually, is provided by circulating warm coolant from the engine through a heater core. A typical car air-conditioning unit is shown in Fig 1.

Global Trends of Refrigerants for MAC

HFC-134a has been adopted globally as the refrigerant for manufacturing of new MAC units. The HFC-134a refrigerant does not have Ozone Depleting Potential (ODP) but it has relatively high Global Warming Potential (GWP). Attempts are being made to look for zero ODP and low GWP refrigerants for MAC. The potential refrigerants for the new systems are HFC-134a (low charge improved energy efficiency systems), Carbon dioxide (Transcritical cycle), HFC-152a and some new generation low GWP refrigerants to be introduced in near future by some of the major chemical manufacturers. Hydrocarbon blend (HC-290/ HC-600a) is currently being used as retrofit refrigerant in some countries. The performance with HFC-134a and Hydrocarbon blend is almost similar to CFC-12 as shown in Figs. 2 and 3. The CFC-12 based cars can be retrofitted with HFC-134a or HC blend.

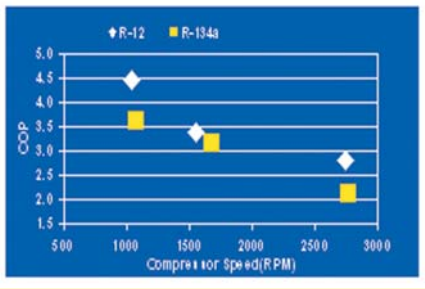


Fig. 2. COP vs. Compressor Speed

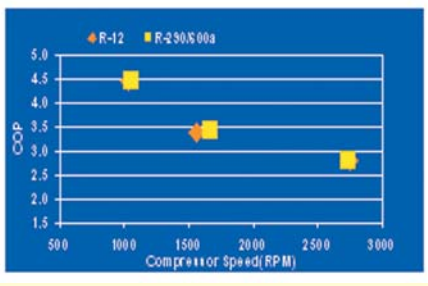


Fig. 3. COP vs. Compressor Speed

How to phase out CFCs from MAC servicing?

A large population of car air-conditioners continues to depend on CFC-12. The availability of virgin CFCs will sharply reduce from January 2007 as permitted production and consumption of CFCs will reduce to 15% of the base line and completely phase out by January 2010. It is expected that the price of CFC-12 will also increase substantially due to demand and supply. The technical options to address the CFC phase-out and continue to use the existing fleet of cars fitted with CFC-12 MAC are:

- Use of good servicing practices, including recovery and reuse of reclaimed refrigerant during maintenance of MAC units.
- Retrofitting of CFC-12-based systems either with HFC-134a or Hydrocarbon blend.

Good Servicing Practices for MAC

Proper servicing and repair procedures are vital for the safe and reliable operation of the system. Good servicing practices like recovery of refrigerant, deep evacuation of the system and exact amount of refrigerant charge, not only reduces the amount of refrigerant used but also results in a reliable, trouble-free and efficient operation of MAC.

Retrofitting of MAC

The term "retrofit" describes the procedures to convert a CFC-12 based MAC unit to any eco-friendly alternative refrigerant. Several retrofit refrigerants have been studied for retrofitting MAC but only two CFC/HCFC free refrigerants viz. HFC-134a and HC-blend have been practically used.

Retrofitting of MAC with HFC-134a

HFC-134a has been successfully used for retrofitting of CFC-12 based MAC units. The recent field studies show that there is no need to change any major system component of the MAC until the system components have deteriorated or have become non-functional due to long service. Generally, the process calls for recovery of the old refrigerant, removal of mineral oil, thorough cleaning of the system, installation of new seals like 'O' rings, gaskets, new service fittings, receiver-drier, dual-pressure switch and filling of POE lubricating oil as well as the HFC-134a refrigerant and labeling. In most cases, the simple retrofitting may provide the vehicle owner (in milder climates) either with MAC performance comparable to the CFC-12 system or MAC performance that is somewhat reduced, but still sufficient to satisfy the customer.

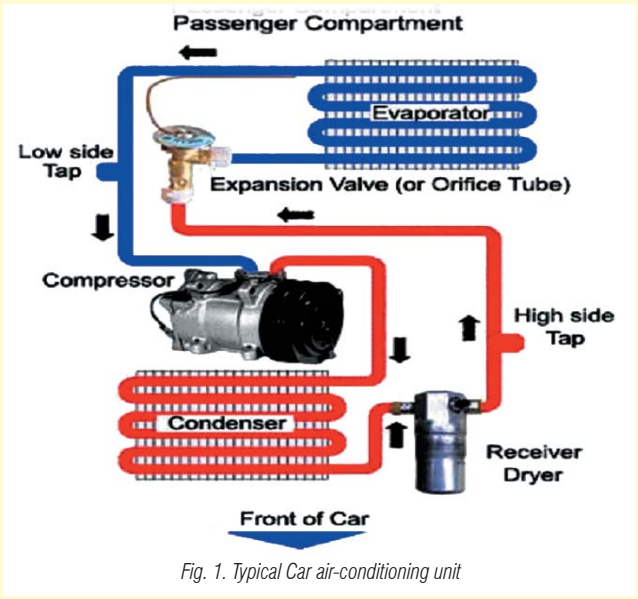


Fig. 1. Typical Car air-conditioning unit

Retrofitting with HC Blend

Hydrocarbon blend (approximately 50% propane / 50% iso-butane by weight, e.g. HR-12, CARE 30, Ecool – PIB, ECFC-12) has very similar properties to CFC –12 and it gives the same capacity and operates at similar pressures. This blend has successfully been used for retrofitting of MAC in some countries like Australia, Canada and USA. It is simpler to convert a CFC-12 based MAC to HC blend rather than HFC-134a refrigerant. The retrofitting of a CFC-12 MAC to HFC-134a requires change of some system components as mentioned above. Retrofitting to HC blend is a drop-in conversion and does not add much time to the normal service/repair of MAC. The conversion to HC blend involves simple processes such as recovery of CFC-12 refrigerant, cleaning and flushing of the system, repair and replacement of defective components, system oil compensation (no change of oil), pressure and leak testing, evacuation and check for vacuum holding, charge with HC blend and Labelling. It must be remembered that the HC charge is only 40% that of CFC-12. It is simple and economical to retrofit MAC with HC blend. However, hydrocarbon refrigerants are highly flammable. Proper safety precautions must be taken.

Dr. R.S.Agarwal
Email: *rsarwal@mech.iitd.ernet.in*

Technicians Corner
What you say to us Q and A

How can one recognize between R-12 and R-134a when it is in a cylinder without labeling?*

As the pressure temperature relationship of HFC 134a is quite close to that of R12 (that is one of the important reasons for considering it as a worthy substitute for CFC 12) it is not easy to distinguish the two using commercial pressure gauges at normal room temperatures of about 30^0-50^0 C in India. It may be necessary to use accurate test pressure gauges for this purpose and compare the readings with the PT chart of 134a. This has been covered in one of the earlier editions of Eco Cool, No 7 of June 2003. Abroad, to prevent the use of mixed refrigerants, refrigerant identifiers have been used. Refrigerant identifiers are electronic devices that use dispersive infra red technology to determine the weight concentration of all refrigerants like R12, 134a, 22 and HCs. They are primarily used for checking the purity of refrigerants when there is a doubt about whether the refrigerant to be used is mixed with other refrigerants. Many repair shops in the US use these devices as a precautionary measure, particularly in automobile AC, when they are not sure about the purity of the recovered refrigerant. The approximate price of such devices is about USD 1000 -1500

** This question has been asked by a technician during an NCCoPP training programme.*

New Equipment for Servicing

Refrigeration servicing combines diverse skills such as mechanical, electrical and electronics. With the entry of the non-ODS refrigerants and polyol ester oils, the requirement for better service practices and well-equipped service technicians has never been greater. Hence, there is an urgent need for RSEs to upgrade in terms of tools and equipment. To work safely and efficiently, you must have the right tools for the job. Use of proper tools and equipment would lead to accuracy, reliability, responsiveness and credibility which are select elements of quality service.

Here we are introducing some tools and equipment that are necessary for good servicing:

Evacuation and Charging Unit

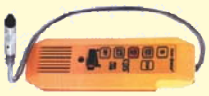
The Evacuation and gas charging unit is an important equipment. It is essential that the vacuum pump used on the unit is double stage. This is required to achieve deep vacuum. Proper maintenance of vacuum pump and frequent replacement of vacuum pump oil is required to ensure good vacuum level.

Piercing valves

An important tool needed to access a hermetically sealed refrigeration system is the piercing valve. It can be used on both the suction process tubes as well as the filter drier's process tube. The piercing valves are clamped to the refrigeration tubing and pierce the tube with a tapered needle. Some piercing valves have Schraeder valves at the outlet.

Single-pass Recovery and Recycling Unit

Electronic Leak Detector



Use of soap solution to check for bubbles that indicate leaks is an economical but a little rough method of checking for leaks in the field and can indicate leaks in the range of 20 to 40g per year. Electronic leak detectors are available for detecting leaks ranging from 2 to 20g a year. Obviously detectors with capabilities of 2 g/year will be much more costly.

Thermocouple or Pirani Vacuum Gauge

A precision micron vacuum gauge capable of measuring 5-5000 microns is recommended to measure the vacuum with precision and also to test the pressure rise / vacuum holding.

2 Stage Nitrogen Regulator

The pressure of nitrogen in the cylinder is above 2000 psi, and such pressure can cause serious accident. To avoid any unpleasant event, a 2-stage regulator must be used for regulating its output pressure to safe working limits of about 10 bar (145 psig).

Brazing Equipment

We are recommending the use of imported torches using Propane or Butane with air which perform better than the Indian Swirljet torches.

CJ Mathew
Email: *cjmathew@vsnl.com*

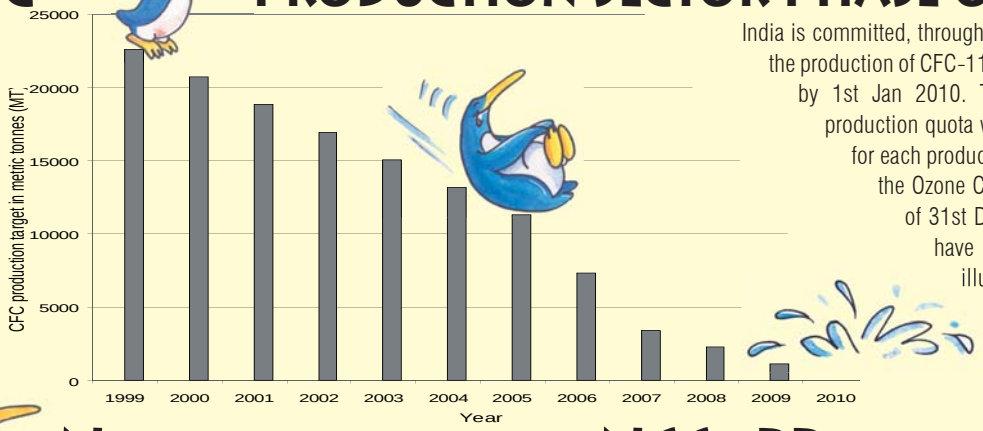
Equipment available under NCCoPP

Under NCCoPP, you can avail of these equipment at highly subsidized rates. The various equipment under offer are:

Package	Description of the items included in the package	Payment by RSEs in Indian Rupees (INR)
A	Evacuation and Charging unit with weighing scale, a set of hoses and 2 piercing valves	5,000
B	Equipment under Package A and Recovery unit	8,000
C	Recovery unit	5,000

For more details on how you can avail of these benefits and the contacts refer to page 4.

CFC Production Sector Phase out in India



India is committed, through the Montreal Protocol, to phase out the production of CFC-11, CFC-12 and CFC-113a completely by 1st Jan 2010. This is being achieved through a production quota which has been allocated every year for each producer. To monitor the production levels, the Ozone Cell conducts audits twice a year. As of 31st December 2005, 11324 MT of CFCs have been phased out. The graph below illustrates the decline in the availability of CFCs in the coming years until 2010 when no CFCs will be produced in the country.

Newsflashes from NCCoPP

Equipment Support Scheme (ESS) Update

RSEs can benefit from the ESS, by availing new equipment (Evacuation & Charging unit, the Recovery unit and the Reclamation unit) at highly subsidized rates. This scheme is underway in a number of states around the country and is currently at various stages of completion. Here's a brief update on the ESS Scheme under NCCoPP. Read on to know about the new regions which will benefit from this scheme in the coming years.

Invitation for Expression of Interest

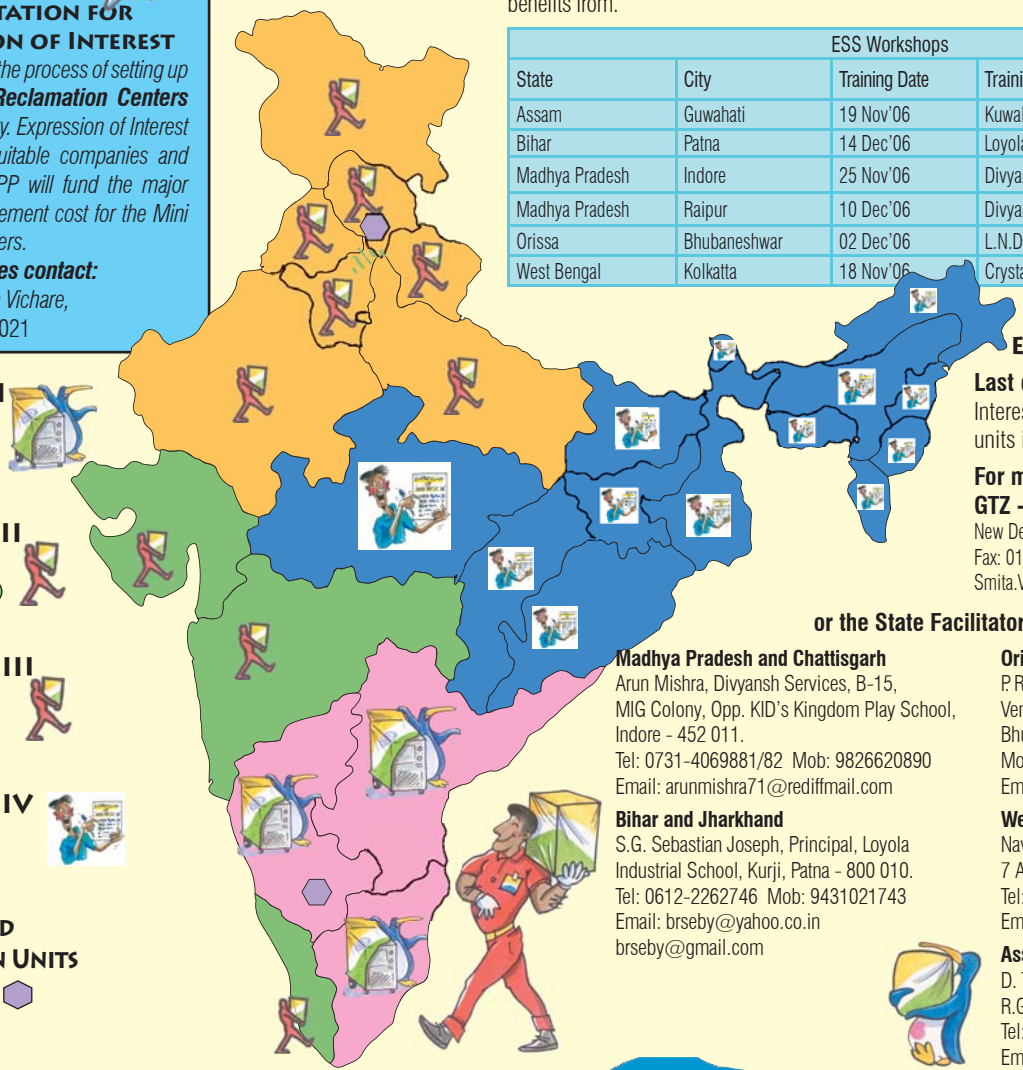
NCCoPP is in the process of setting up additional ***Mini Reclamation Centers*** *all over the country. Expression of Interest is invited from suitable companies and operators. NCCoPP will fund the major part of the procurement cost for the Mini Reclamation Centers.*

Interested parties contact:
GTZ India, *Smita Vichare,*
Tel: 011- 26611 021

ESS Phase IV

The facilitation process in the Phase 4 states is currently underway and ESS workshops have been held or will be held shortly in the following places. The purpose of these workshops is to inform RSE about the various equipment offered under the scheme and the discounts they can benefits from.

ESS Workshops			
State	City	Training Date	Training Partner
Assam	Guwahati	19 Nov'06	Kuwality Coolers (D. Talukdar)
Bihar	Patna	14 Dec'06	Loyola Industrial School (S.G.S. Joseph)
Madhya Pradesh	Indore	25 Nov'06	Divyansh Services (A. Mishra)
Madhya Pradesh	Raipur	10 Dec'06	Divyansh Services (A. Mishra)
Orissa	Bhubaneshwar	02 Dec'06	L.N.Dash
West Bengal	Kolkatta	18 Nov'06	Crystal Refrigeration Co. (N. Lamba)



Invitation for Expression of Interest

Last date for submission of Expression of Interest (EOI) forms for the E&C and R&R units is **31st December 2006**.

For more information contact:
GTZ - Proklima, A-33 Gulmohar Park, New Delhi - 110049, Tel: 011-26611021, 62528840
Fax: 011-26537673 Email: Markus.Wypior@gtz.de
Smita.Vichare@proklima.org

or the State Facilitators listed below:

Madhya Pradesh and Chattisgarh
Arun Mishra, Divyansh Services, B-15, MIG Colony, Opp. KID's Kingdom Play School, Indore - 452 011.
Tel: 0731-4069881/82 Mob: 9826620890
Email: arunmishra71@rediffmail.com

Bihar and Jharkhand
S.G. Sebastian Joseph, Principal, Loyola Industrial School, Kurji, Patna - 800 010.
Tel: 0612-2262746 Mob: 9431021743
Email: brseby@yahoo.co.in
brseby@gmail.com

Orissa
P. Rana, M/s. Sai Trading Works, SCR-206, Venus Inn Road, Bapuja Nagar, Bhubaneswar - 751 009. Tel: 0674-234 1447
Mob: 09861099334
Email: pnrana@rediffmail.com

West Bengal
Navin Lamba, Crystal Refrigeration Company, 7 A.J.C. Bose Road, Kolkata - 700 017.
Tel: 033-22476488 Mob: 9830820848
Email: nl@vsnl.net

Assam and North Eastern States
D. Talukdar, Kuwality Coolers, Das Complex R.G. Barua Road, Guwahati - 781 024.
Tel: 0361-2202229 Mob: 9864017889
Email: kuwalitycoolers@rediffmail.com

Newsflashes from Ozone Layer

As asthma inhaler phase-out date nears, India to seek technology transfer

The next critical challenge facing developing countries like India is the phasing out of CFC-containing Metered Dose Inhalers (MDIs) which had been left for last as they are considered an 'essential drug'. This issue was a key agenda item in a meeting of all parties on the Montreal Protocol addressed by Prime Minister Manmohan Singh recently in New Delhi.

The deadline of 2010 for a 100% CFC-free world has been agreed upon by all countries. The developed nations have already phased out CFC inhalers but India, along with countries like China, Sri Lanka, Pakistan and Bangladesh, believe it will be difficult to meet the deadline unless conditions are made easier for the necessary technology transfer.

India has an estimated 22 to 25 million asthma and bronchitis patients who depend on MDIs. These contain CFC which is used to propel the medicine into the lungs. But the shift to non-CFC alternatives would make MDIs more expensive as well as give them a different look, thereby making it a challenge for health practitioners to promote them.

In India, the only non-CFC version for two formulations has been developed by Cipla. Imported inhalers require a lengthy approval and registration process and could cost nearly Rs. 150 more than those containing CFCs.

The Multilateral Fund, presently at US $2 billion, is assisting developing countries to comply with the terms laid down by the Montreal Protocol. According to the guidelines, funds are approved for projects relating to companies which are set up before 1995. However, in developing nations, most of the industries manufacturing inhalers were set up after 1995.

India has till now successfully tapped the Multilateral Fund to phase out CFC in the consumption sector – 269 projects worth $90 million covering 750 enterprises in aerosol, foam, halon, refrigeration and air-conditioning, and solvent sector have been assisted in the change over.

New Delhi is presently working with UNDP to come up with a strategy for the transition to non-CFC MDIs. 13 developing countries including India will be meeting in Sri Lanka in December to frame a regional strategy on this issue.

Source: *http://www.indianexpress.com/*

For more information:

http://www.indianexpress.com/story/15793.html

FAQs

This section will focus on a variety of FAQs and will look at it topic-wise. In this issue we focus on technical issues under RAC specific to "HFC Refrigerants".

Q1. Can we charge R12 in a 134a system? What will be the consequences?

Apart from violating the Ozone Rules, the following technical problems can also arise:

a) Cross contamination of R12 and 134a can lead to an unpredictable performance.

b) Capillary for 134a systems is usually about 40% to 60% longer than those for R12 for the same bore of capillary. This will affect performance.

c) Compressor motor can get overloaded and burn out.

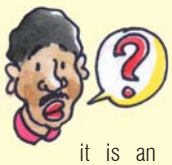
Q2. How to check the pumping of a 134a Compressor?

The best option is to enquire from the compressor manufacturer or OEM the appropriate way this can be tested. In India, KCL, Tecumseh and Godrej have their own method recommendations. One universal that can be adopted, subject to Compressor manufacturers agreeing, is to use a Compressor tester, which comprises of a Receiver like vessel with a relief valve and pressure gauge at one end and a hose with a quick coupler at the other end. The compressor has to be connected to Nitrogen through a syringe to avoid moisture. The syringe needle has to penetrate the rubber plug on the suction tube stub. The discharge tube stub is then connected to the quick coupler mentioned above. Nitrogen pressure should not exceed 0.5 to 1 barg. After all the connections are made, the compressor has to build its own pressure of 16 bar. After the compressor is switched off, a pressure of 12 to 14 bar must be held for 60 seconds. The loss of pressure should not exceed 2 bar in 60 seconds.

Q3. What should be the charge weight of 134a against a specific charge weight of R12?

It should be approx 90% of the charge weight of R12.

Q4. If the evaporator is found leaking in a 134a system, how do we service it?



If the evaporator of a refrigerator is damaged and if it is an aluminum evaporator, it is advisable to replace it and also the compressor, as a low side leak will have definitely allowed a lot of outside air and humidity to enter the system and contaminate it.

Q5. Can we retrofit a CFC appliance with R-134a by changing the oil alone?

We have to ensure that the percentage of mineral oil left behind should be only 1% (at least 5%) by weight. This is done by emptying the mineral oil from the compressor, filling POE oil and then running the system on R12 for at least 48 hours. After that, the percentage of mineral oil is measured using a Refractometer. If it is found higher than 5%, the process is repeated again and again till the percentage is brought down to at least 5% or better still 1%. It has been found that it is necessary to run the system at least three times like this i.e. totally for 6 to 7 days to reduce the residual mineral oil to this level. All this is time consuming, labour intensive and also does not guarantee safe working with 134a later. So, even small hermetic appliances were never retrofitted with 134a. They were either replaced or continued to operate with CFCs on recovered CFCs.

Q6. Is it required to change expansion valve and other components for CFC 12 system while retrofit with R-134a?

In systems using Thermostatic Expansion Valves or TXVs, the TXV may have to be changed or reset to suit the higher pressure ratios. Other components like Filter driers , Compressor oil etc also have to be changed. For oil change, the procedure described under Q5 has to be followed.

Q7. Can we use HC blend in Air conditioners of capacity less than I TR capacity?

Theoretically, using a HC blend is like using R12 in an AC. Apart from the fact that the capacity will reduce by over 40%, if the system to be retrofitted is a R22 system, the electricals in the system will have to be made exproof or sealed, as in the case of refrigerators. Additionally, the capillary will also have to be changed. The main problem again will be the charge which will exceed the limit. Even a 0.75 TR AC has a charge of about 600 to 700 grams R22 and the equivalent HC charge will be in excess of the limits mentioned in the previous question. It is therefore not recommended.

Upcoming Training Programme Schedule

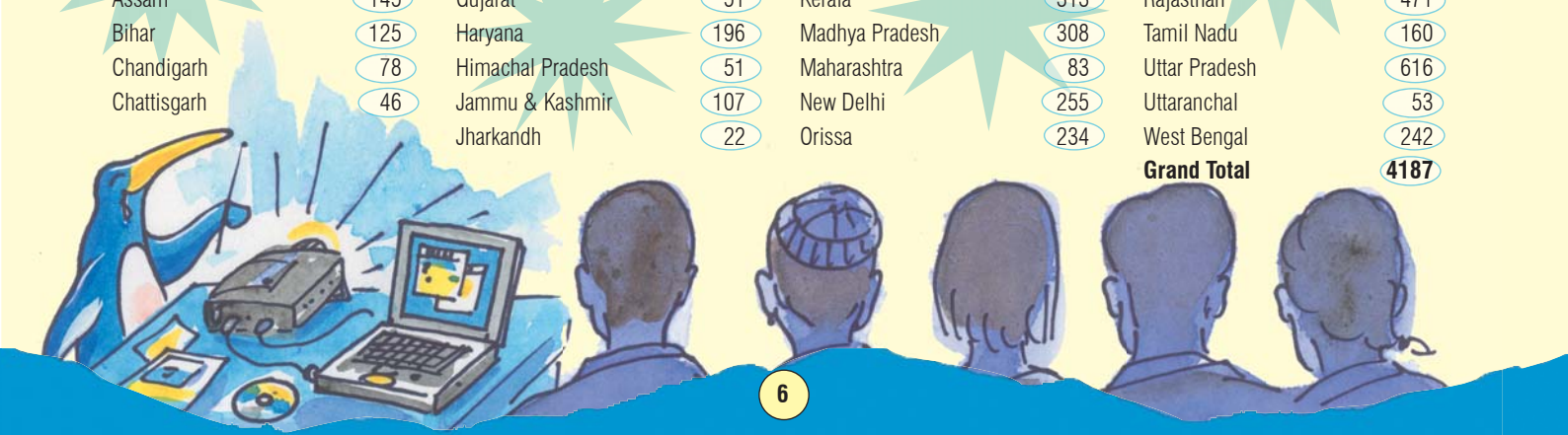
RSE Training Programs			
State	City	Training Date	Training Partner
Andhra Pradesh	Hyderabad	18-19 Nov'06	Maega Services (V. Nath)
Andhra Pradesh	Vijayawada	25-26 Nov'07	Maega Services (V. Nath)
Assam	Guwahati	23-24 Dec'06	Kuwality Coolers (D. Talukdar)
Assam	Silchair	27-28 Jan'07	Kuwality Coolers (D. Talukdar)
Bihar	Patna	25-26 Nov'06	Loyola Industrial School (S.G.S. Joseph)
Bihar	Patna	20-21 Jan'07	Loyola Industrial School (S.G.S. Joseph)
Delhi	Delhi	18-19 Nov'06	Hindustan Refrigeration Stores (J.Singh)
Delhi	Delhi	16-17 Dec'06	Hindustan Refrigeration Stores (J.Singh)
Gujarat	Ahmedabad	25-26 Nov'06	Kirti Freeze (N.M. Patel)
Gujarat	Himmatnagar	03-04 Dec'06	Kirti Freeze (N.M. Patel)
Gujarat	Visnagar	23-24 Dec'06	Kirti Freeze (N.M. Patel)
Haryana	Ambala	11-12 Nov'07	Ananth Enterprises (A. Kumar)
Haryana	Panipat	10-11 Feb'07	Ananth Enterprises (A. Kumar)
Himachal Pradesh	Una	24-25 Feb'07	Ananth Enterprises (A. Kumar)
Jharkandh	Jamshetpur	07-08 Nov'06	Godrej (S.A. Juvekar)
Jharkandh	Ranchi	10-11 Nov'06	Godrej (S.A. Juvekar)
Karnataka	Bangalore	16-17 Dec'06	Dewpoint Services (C.J. Mathew)
Kerala	Malappuram	09-10 Dec'06	V.R. Enterprises (V. Vijayakumar)
Kerala	Kochi	06-07 Jan'07	V.R. Enterprises (V. Vijayakumar)
Kerala	Quillon	20-21 Jan'07	V.R. Enterprises (V. Vijayakumar)
Madhya Pradesh	Indore	11-12 Nov'06	Divyansh Services (A. Mishra)
Madhya Pradesh	Ujjain	18-19 Nov'06	Divyansh Services (A. Mishra)
Madhya Pradesh	Bhopal	20-21 Jan'07	Divyansh Services (A. Mishra)
Madhya Pradesh	Jabalpur	16-17 Dec'06	Divyansh Services (A. Mishra)
Maharashtra	Pune	09-10 Dec'06	Max Cooling Systems (A. Mathew)
Maharashtra	Satara	27-28 Jan'07	Max Cooling Systems (A. Mathew)
Maharashtra	Chiplun	10-11 Feb'07	Max Cooling Systems (A. Mathew)
Maharashtra	Mumbai	24-25 Feb'07	Max Cooling Systems (A. Mathew)
Maharashtra	Akola	21-22 Nov'06	Godrej (S.A. Juvekar)
Orissa	Bhubaneshwar	05-06 Nov'06	L.N.Dash
Orissa	Cuttack	08-09 Nov'06	L.N.Dash
Orissa	Rourkela	11-12 Nov'06	L.N.Dash
Punjab	Ferozpur	18-19 Nov'06	Ananth Enterprises (A. Kumar)
Punjab	Hoshiarpur	23-24 Dec'06	Ananth Enterprises (A. Kumar)
Punjab	Patiala	29-30 Jan'07	Ananth Enterprises (A. Kumar)
Punjab	Mohali	27-28 Jan'07	Ananth Enterprises (A. Kumar)
State	City	Training Date	Training Partner
Rajasthan	Hanumangarh	18-19 Nov'06	Bohra Services (S. Bohra)
Rajasthan	Baswara	06-07 Jan'07	Bohra Services (S. Bohra)
Rajasthan	Jaipur	30-31 Jan'07	Bohra Services (S. Bohra)
Rajasthan	Jalore	02-03 Feb'07	Bohra Services (S. Bohra)
Tamil Nadu	Chennai	02-03 Dec'06	Shakti Refrigeration (R.K. Kannan)
Uttar Pardesh	Jaunpur	04-05 Nov'06	Isha Enterprises (R.M. Misra)
Uttar Pardesh	Varanasi	18-19 Nov'06	Isha Enterprises (R.M. Misra)
Uttar Pardesh	Agra	23-24 Dec'06	Isha Enterprises (R.M. Misra)
Uttar Pardesh	Lakhimpur	06-07 Jan'07	Isha Enterprises (R.M. Misra)
Uttar Pardesh	Jhansi	27-28 Jan'07	Isha Enterprises (R.M. Misra)
Uttranchal	Roorkee	16-17 Dec'06	Ananth Enterprises (A. Kumar)
West Bengal	Kolkata	11-12 Nov'06	Crystal Refrigeration Co. (N. Lamba)
West Bengal	Malda/Siliguri	20-21 Jan'07	Crystal Refrigeration Co. (N. Lamba)
West Bengal	Asansol	00-00 Feb'07	Crystal Refrigeration Co. (N. Lamba)

MAC Training			
State	City	Training Date	Training Partner
Punjab	Jallandhar	15 Dec'06	Ananth Enterprises (A. Kumar)
Rajasthan	Kota	16 Dec'06	Bohra Services (S. Bohra)
Uttar Pradesh	Lucknow	21 Jan'07	Isha Enterprises (R.M. Misra)
Gujarat	Ahmedabad	Feb'07	Kirti Freeze (N.M. Patel)
Karnataka	Bangalore	20 Jan'07	Dewpoint Services (C.J. Mathew)
West Bengal	Kolkata	Jan'07	Crystal Refrigeration Co. (N. Lamba)

OTC based Institutional User Retrofit Training			
State	City	Training Date	Training Partner
Punjab	Bhatinda	16 Feb'07	Ananth Enterprises (A. Kumar)
Uttar Pradesh	Lucknow	21 Feb'07	Isha Enterprises (R.M. Misra)
Rajasthan	Jaipur	06 Feb'07	Bohra Services (S. Bohra)

Technicians Trained

State	TOTAL
Andhra Pradesh	251
Assam	145
Bihar	125
Chandigarh	78
Chattisgarh	46
Goa	44
Gujarat	51
Haryana	196
Himachal Pradesh	51
Jammu & Kashmir	107
Jharkandh	22
Karnataka	145
Kerala	313
Madhya Pradesh	308
Maharashtra	83
New Delhi	255
Orissa	234
Punjab	191
Rajasthan	471
Tamil Nadu	160
Uttar Pradesh	616
Uttaranchal	53
West Bengal	242
Grand Total	**4187**



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Godrej & Boyce Mfg Co. Ltd. (Appliance Division) S A Juvekar, L.B.S. Marg, HO Service, Plant 11, Pirojsha Nagar, Mumbai - 400 079 Tel: 022-6796 6603 / 6623 Fax: 022-6796 6066 Email: saj@godrej.com www.godrejsmartcare.com

Training Partners:

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Assam: D.Talukdar, Kuwality Coolers, Das Complex, R.G.Barua Road, Guwahati - 781 024 Tel: 0361-220 22 29 Mobile: 98640 17889 Email: kuwalitycoolers@rediffmail.com

Bihar: S.G Sebastian Joseph, Principal Loyola Industrial School, Kurji, Patna - 800 010 Tel: 0612 - 226 27 46 Mobile: 94310 21743 Email: brseby@yahoo.co.in

Chandigarh: A. Kumar, Ananth Enterprises, 5397/1, Modern Residential Complex, Manimajra, Chandigarh -160 101 Tel: 0172-273 51 63 Mobile: 98143 01541, Email: chandigarhozone@yahoo.co.in

Gujarat: Naranbhai M. Patel, Kirti Freeze, Kirti House, Ashirwad Complex (Opp. Bata Showroom), Ashram Road, Ahmedabad - 380 009 Tel: 079-265 80 466 Mobile: 94263 01242 Email: zeelpower@satyam.net.in

Karnataka: C. J. Mathew, Dewpoint Services, 808 10th A main, 1st stage, Indira Nagar, Bangalore - 560 038. Tel: 080-252 99 325 Mobile: 98450 70594 Email: cjmathew@vsnl.com

Kerala: V.Vijayakumar, V.R. Enterprises, Building No. 39/3463, (East Part), Thekkumcheril Building, Ravipuram Road, Kochi - 682 016 Tel: 0484-235 60 93 Mobile: 94474 64821 Email: vijayakumar@kircop.com

Madhya Pradesh: Arun Mishra, Divyansh Services, B-15, MIG Colony, Opp. KID'S Kingdom Play School, Indore-452011 Tel: 0731-4069881 / 82 Mobile: 09826620890 Email: arunmishra71@rediffmail.com

Maharashtra: Abraham Mathew, Max Cooling Systems, 2, Butte Patil Residency, 363/5, Shivaji Nagar, Pune - 411 005 Tel: 020-255 34 737 Mobile: 94220 11095 Email: maxcoolengg@yahoo.com

New Delhi: Jaspal Singh, Hindustan Refrigeration Stores, 2,4 & 5 Nethaji Subhash Marg, Darya Ganj, New Delhi -110 002 Tel: 011-232 71 898/59 650 Mobile: 98100 19794 Email: higrop@ndb.vsnl.net.in

Orissa: L. N. Dash, B-12, BJB Nagar, Bhubaneswar - 751 014 Tel: 0674-243 52 80 Mobile: 94370 82401 Email: lndash@rediffmail.com

Rajasthan: Surendra Bohra, Bohra Services, 60 Gem Enclave, Pradhan Marg, Malviya Nagar, Jaipur - 302 017. Tel: 0141-252 24 00 Mobile: 94140 66848 Email: bohra@bohraappliances.com

Tamil Nadu: Mr.R.Kamala Kannan M/s.Sakthi Refrigeration & Air-conditioning Enterprises, 0/1-Kanakkar Street, Near Venkateswara Theatre, Thiruvottiyur, Chennai-600 019 Tel: 044-2573 3833 Mobile: 94443 88495 Email : id_skssaba@yahoo.co.in

Uttar Pradesh: Rajesh M. Misra, Isha Enterprises, B-1/56, Sector - B, Aliganj, Lucknow - 226 024 Tel: 0522-233 05 78 Mobile: 94150 24423, Email: rajeshm@emersonclimatetechindia.com

West Bengal: Navin Lamba, Crystal Refrigeration Company, 7, A.J.C Bose Road, Kolkata - 700 017 Tel: 033-224 76 48 8 Mobile: 98308 20848 Email: nl@vsnl.net

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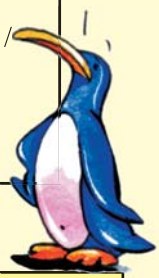

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Manisha Dolia

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For all correspondence write to: ECO-COOL ™, IT Power India Pvt. Ltd., No.6 & 8, Romain Rolland Street, Pondicherry - 605 001. Tel: 0413-222 78 11 or 234 24 88 Fax: 234 07 23 Email: md@itpi.co.in

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