ECO-COOL™

BULLETIN FOR REFRIGERATION TECHNICIANS

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CONTENTS

Editorial

A question often raised after the NCCoPP training programmes refers to the need to recover and recycle refrigerant from equipment being serviced. In this edition of Eco Cool we publicise the fact that two Mini-Reclamation centres will be set up in India during 2005. GTZ, the technical cooperation of the German government supporting NCCoPP, is inviting interested entrepreneurs to express their interest in setting up such centres. This will greatly respond to the RSE technicians' requirements. The equipment is highly subsidized for NCCoPP considers such facilities of utmost importance.

One technical article in this edition focuses on the characteristics of refrigerant blends – both HFC and HC – and how to handle the refrigerants. The second covers the training which NCCoPP is offering to the Mobile Air Conditioning sector. A major part of the 6000 servicing workshops from both organised and unorganised sector which are servicing vehicles in India are using CFC-12 to charge systems. The estimated population of vehicles circulating in this country with CFC-12 is around 2 million. This is therefore a large sector to address especially with the considerable reduction in the availability of CFCs as of end 2006. In view of this need, two MAC training programmes will be held in Chennai on 11-12th December.

Eco Cool is happy to announce that the first 53 servicing enterprises in Andhra Pradesh, Karnataka and Tamil Nadu who had opted for one of the packages under Phase 1 of the Equipment Support Scheme (ESS) have received the equipment. Phase 2 and soon Phase 3 of the ESS are now underway.

Please do not hesitate to send any enquiry concerning training, technical concerns or organisational issues to the Editorial Committee. We will respond to your questions as soon as possible.

NCCoPP contributes to CFC Phase-out

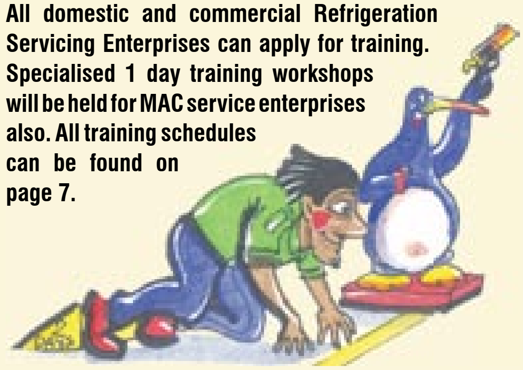
NCCoPP contributes to the Phase-out of CFCs in the RAC servicing sector by 2010 through:

- 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

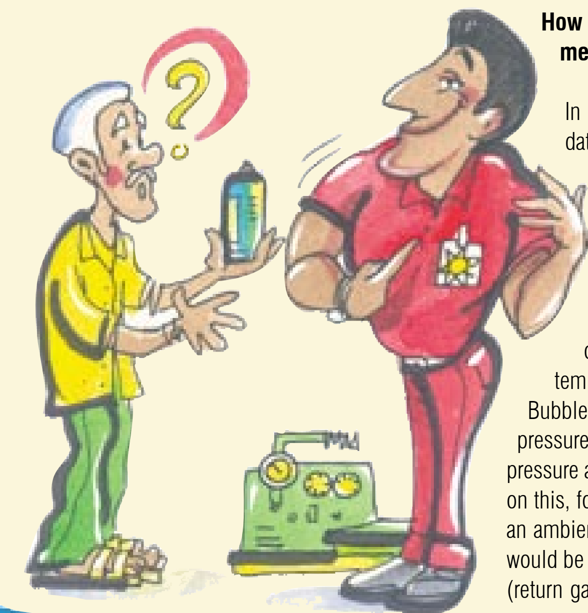
NCCoPP 2-day practical training programmes scheduled from 2005-2009 propose to cover:

- 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 also. All training schedules can be found on page 7.

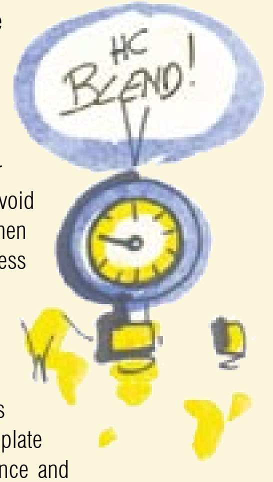


What you say to us Q and A



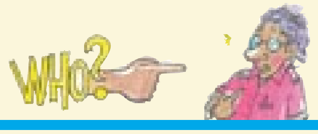
How do we charge HC blend by pressure method?

In the absence of original refrigerant charge data on an appliance's name plate, charging by reading the back pressure (suction side) may have to be done. One must have access to the P-T chart of the HC blend so that against the desired evaporating temperature (say -23°C), the corresponding saturation pressure is read off. It is recommended to have the evaporating temperature as the mean of the Dew and BubblePoint and to read the corresponding saturation pressure on the P-T chart. This should be the suction pressure at which the appliance should operate. Based on this, for a mean evaporator temperature of -23°C at an ambient temperature of 32°C, the suction pressure would be approx. 5 psig. Other parameters like suction (return gas) line temperature, and observance of frost in the evaporator will also have to be kept in mind to ensure a reasonably correct charge. One must be careful that the charge is introduced in very small quantities and checked for pressure repeatedly to avoid charging excessively and then having to leak off the excess gas. Also it is worthwhile to use accurate electronic weighing scales to take the weight of the gas finally charged and to record this information on a nameplate or sticker for future reference and servicing. However, this makeshift method of charging is less desirable than charging by weight if the correct charge data is known in advance.



Newsflashes from NCCoPP

Equipment Support Scheme (ESS) Update



One of the components of the National CFC Consumption Phase-out Plan (NCCoPP) of India is the ESS for Refrigeration Service Enterprises (RSEs) for

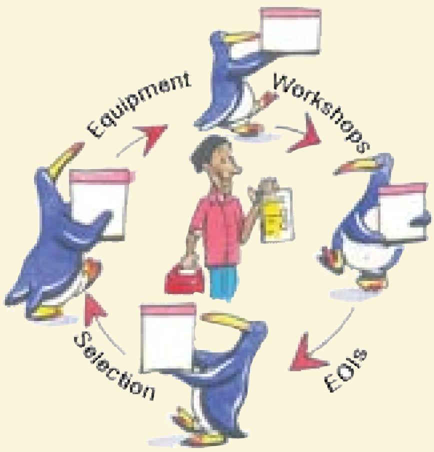
a) the purchase of equipment and tools necessary for servicing and repair of RAC appliances

b) the setting up of mini-reclamation centres

c) the support to selected Government ITIs

Equipment Support for RSEs for purchase of equipment and tools for servicing and repair of RAC appliances:

The ESS provides RSEs with financial assistance to upgrade their tools and equipment. This will definitely enable the RSEs to adopt good servicing practices during the repair and maintenance of CFC (R-12) and non-CFC appliances, and for retrofitting of CFC (R-12) based appliances with non-CFC refrigerants. The ESS is being implemented in phases throughout the country.



Phase 1 (2004 – 05): was implemented in the states of Andhra Pradesh, Karnataka, Tamil Nadu, including Pondicherry. The RSEs have benefited from this scheme and the first lot of equipment has been distributed in these states.

Phase 2 (2005 – 06): is being implemented in the states of Gujarat, Maharashtra and Kerala. Several RSEs have submitted Expression of Interest (EoIs) and these are currently being processed.

Phase 3 (2006 – 2007): the fourth NCCoPP core group meeting held on 20 September 05 resulted in the decision to implement ESS Phase 3 in the states of Rajasthan, Uttar Pradesh, Chandigarh, Uttranchal, Punjab, Haryana, Himachal Pradesh, Jammu and Kashmir, and Delhi. Introducing ESS at an early stage of the project will facilitate the provision of equipment support simultaneously to a wider section of RSEs in the country and equip them well in time to be ready for the upcoming peak season.

Equipment Packages:

The equipment packages offered in Phase 1 were revised in favour of the RSEs' demands.

Package A: E&C unit with weighing scale, set of hoses, and 2 piercing valves. Available to RSEs for a payment of Rs 5000/-

Package B: Package A and Recovery unit. Available to RSEs for a payment of Rs 8000/-

Package C: Recovery unit only. Available to RSEs for a payment of Rs 5000/-

How to apply:

The RSE will receive an EoI form through surface mail from the ESS Facilitator (ITPI). ITPI supports the project by inviting interested RSEs to participate in the scheme through the filling out of the Expression of Interest (EoIs) forms. On the basis of the EoIs received, ITPI shall establish a consolidated list of eligible enterprises in each state, taking into account the CFC (R-12) consumption. To facilitate the collection of the EoIs, and to explain the ESS in detail, ITPI has delegated State Facilitators to work with the RSEs in each of the states.

ESS Principal Distributor: UNDP has appointed ITPI as a Principal Distributor. In order to regulate the distribution activity at a state level, ITPI has deputed Local Distributors (LD) for each state. The role of the Principal Distributor begins on receipt of the final consolidated list from the ESS Facilitator. This is followed by informing the RSEs about their collection of the selected equipment. Against the draft, the LD hands over the equipment to the RSEs after making a demo of the unit.

Equipment Support for Mini-Reclamation Centres

The scheme aims at providing support to entrepreneurs to set up a business for Recovery and Recycling of refrigerants.

A focal activity of NCCoPP involves the training of Refrigeration Service Enterprise (RSE) technicians. During training the participant technicians are taught good service practices in handling alternate refrigerants while emphasizing the recovery of CFCs. So far the training programmes have helped in creating a demand for recycling of recovered refrigerants. With over 12,000 technicians already trained under NCCoPP and its forerunner projects, and another 6,000 technicians to be trained in the country until 2010, the need to provide adequate recycling/reclamation facilities for the RSE technicians is being strongly voiced.

In view of government regulatory obligations and the mounting demand, the project has launched a business network for the recovery, recycling / reclaiming and reuse of CFC refrigerants in India. Two business centers in the state capital cities of India are proposed for the year 2005-2006. The scheme aims at providing support to entrepreneurs to set up a business model for Recovery, Recycling / Reclaiming and Reuse of refrigerants. The scheme aims at financially aiding interested entrepreneurs in purchasing the required Recycling/Reclamation equipment. The total cost of the equipment is estimated at 6,000 USD (equivalent to INR 2,64,000), but the entrepreneur will have to pay only 1,200 USD (equivalent to INR 52,800).

GTZ has invited qualified entrepreneurs from India to express their interest in providing the above-mentioned services.

Equipment Support to Government ITIs

The syllabus for the trade of Refrigeration and Air Conditioning Mechanic under Craftsman Training Scheme was revised under the HIDECOR project. To implement the revised syllabus the training institutes require equipment, tools, and appliances. The NCCoPP project has chosen to provide equipment support to 120 selected Government ITIs. These institutes, whose RAC instructors have already undergone instructor training programmes (at either ATI Howrah or ATI Hyderabad), will receive equipment under ESS. The ITIs which benefit from equipment support will ensure the adoption of the updated curriculum (in effect since June 2003) for Refrigeration and Air Conditioning training.

ESS Workshops

As per the decision taken during the Core Group Meeting (20 September 2005), the ESS Phase 3 activities have been advanced. Accordingly, 6 more ESS workshops will be conducted this year (November – December 2005). A tentative schedule for these workshops is as follows:

No.	Location	State	Date	State Facilitator
1	Kota	Rajasthan	01 Dec. 05	Surendra Bohra
2	Jaipur	Rajasthan	03 Dec. 05	Surendra Bohra
3	Jalandhar	Chandigarh - Punjab	19 Dec. 05	A. Kumar
4	Chandigarh	Chandigarh	20 Dec. 05	A. Kumar
5	Lucknow	Uttar Pradesh	22 Dec. 05	Rajesh M. Misra
6	Varanasi	Uttar Pradesh	24 Dec. 05	Rajesh M. Misra

Hydrocarbon & Other Refrigerant Blends

In the July issue of Eco Cool the use of Hydrocarbon (HC) refrigerants in new Appliances as well as in the retrofitting of CFC based Appliances was addressed. HC Blends (approximately 50% by weight, each of Propane(R 290) and Isobutane (R 600a) were recommended as drop in refrigerants in lieu of CFC12. In this article we shall take a closer look at the characteristics of refrigerant blends in general (whether HC or HFC based) as it is essential for the technician to understand this for effective handling of blends.

1. What are Refrigerant Blends?

Blends or Mixtures (as they are often referred to) are made up of two or more single component refrigerants. The need for examining Blends as alternatives to CFCs and HCFCs (that are phased out under the Montreal Protocol) became inevitable as it was found increasingly difficult and in some cases impossible to find single component environment friendly refrigerant substitutes.

2. What are the various categories of Blends?

There are two main categories: Azeotropes (Azeotropic Blends) and Zeotropes(Zeotropic Blends). Let us look at each of them

Azeotropes:

These are blends that behave like a single component refrigerant with unique P-T* relationship which is different from its component refrigerants. Azeotropes would therefore be the most sought after substitutes after single component refrigerants. However it has not been possible to find suitable Azeotrope substitutes for all single component refrigerants that need replacement. Azeotropes are usually designated by three digit numbers beginning with the digit 5, as per ASHRAE Standard 34.

** P-T stands for Pressure-Temperature relationship.*

Examples are R 502, R 507, R 508B.

R 502 is CFC based azeotrope and is a blend of 48.8% by weight of R22 & 51.2% R 115 and was created to reduce the high head temperatures and oil miscibility occurring in R22 applications at low temperatures of -30C & below. It has been phased out (as it is CFC based) and replaced by R507 or R404A both of which are HFC based.

R 507 is an azeotrope of 50% by weight of R 125 and R143a and is HFC based and a substitute for R 502.

R 508B is an azeotrope of 46% by weight of R23 (HFC) & 54% of R 116 (PFC) and is a substitute for R 13, a CFC used for very low temperature applications (-75 to-85°C) mainly in cascade systems.

Zeotropes

These are blends that have a P-T* relationship which is a natural combination of the components' properties. The Pressure for the blends falls between the properties of the components and can be calculated according to established formulae. The concentration of the components in the vapour is different from that in the liquid at a given pressure and temperature. Zeotropic blends are subject to Fractionation and Temperature glide which was referred to in the July issue of this newsletter.

Examples of Zeotropic Blends begin with the 50% by weight blend of Propane and Isobutane which are drop in substitutes for CFC 12 in Refrigeration and MACs and was discussed in some depth in the July issue of this newsletter.

Others are:

R 404A, Blend of 44% R 125 , 52% of R 143a & 4% of R134a, all by weight , all HFCs and substitute for R 502.

R 407C, Blend of 23% of R-32, 25% of R 125 and 52% of R 134a, all by weight, all HFCs and a substitute for R22

R 410A, Blend of 50% by weight of R 32 and 50% by weight of R 125, all HFCs and a substitute for R22.

Zeotropic Blends are usually designated by numbers beginning with the digit 4, as per ASHRAE Standard 34.

3. Fractionation In Zeotropic Blends

3.A. Introduction

Consider two refrigerants A & B in their respective cylinders as shown in the Fig. 1. The cylinder at the extreme left contains Refrigerant 'A' whilst the cylinder at the extreme right contains Refrigerant 'B'.

Referring to Fig. 1 , the following may be observed:

(a) The refrigerant 'A' has a higher pressure(lower boiling point) eg Propane as compared to refrigerant 'B' eg Isobutane(higher boiling point) and therefore exerts a higher pressure P_A as compared to pressure P_B that refrigerant 'B' exerts on its cylinder. Also shown in the diagram in Cylinders 'A' and 'B' are the molecules of the refrigerant that are constantly moving from liquid to vapour and vice versa at the surface of the liquid. Vapour and liquid at equilibrium transfer the same number of molecules back and forth. As P_A is higher than P_B molecules of A move at a faster rate than those of B, as indicated in the diagram.

(b) When the two refrigerants are mixed, say, in a 50-50% proportion by weight as shown in the cylinder in the middle of the Fig. 1, it can be seen that molecules of both 'A' and 'B' constantly move from liquid to vapour and vice versa at the surface of the liquid. Refrigerant 'A' however will transfer back and forth to the vapour at a higher rate or speed than 'B'due to reasons explained in (a) above.

(c) Thus when 'A' and 'B' are mixed they form a zeotrope where the individual refrigerant molecules behave as if the other type did not exist. As 'A' transfers back and forth at a higher speed it follows that that there are more molecules of 'A' in the vapour space than molecules of 'B'. The greater the difference in the saturation pressures or boiling points of 'A' and 'B', the greater the difference in the speeds of transfer of molecules at the liquid surface. Consequently, greater the difference in number of molecules of 'A' and 'B'in the vapour space.

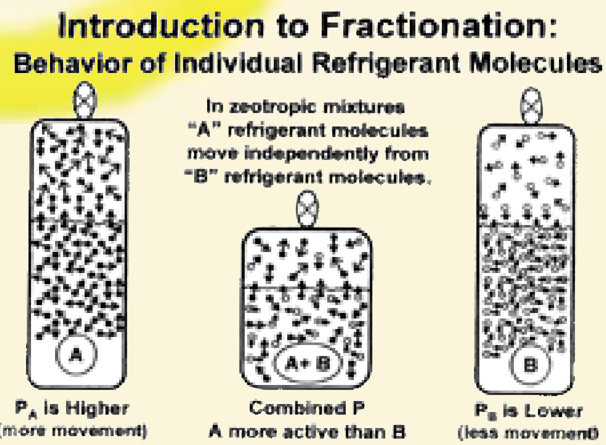


Figure 1: Behavior of individual refrigerant molecules

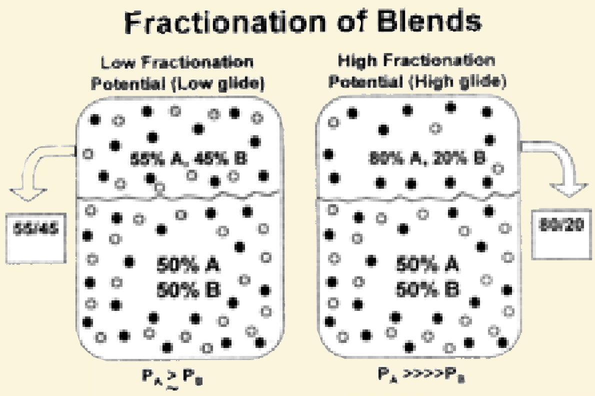


Figure 2: Fractionation of blends

3.B. Fractionation of Blends

Moving forward, let us examine two Cylinders containing 50% by weight of refrigerant components ‘A’ & ‘B’ in Fig. 2 :

(a) In the cylinder to the left, the Refrigerant ‘A’ has a boiling point that is lower than that of ‘B’ but the difference in boiling points is not very high and so the difference in pressures exerted by ‘A’ and ‘B’ are not very high. This has been shown as $P_A > P_B$ in the diagram. Because of this, the vapour in the space above the liquid will have about 55% of molecules of ‘A’ and 45% of molecules of ‘B’.

(b) On the other hand, the cylinder to the right contains two refrigerants ‘A’ and ‘B’ which have a big difference in boiling points like Propane and Isobutane and because of this the difference in pressures exerted by the two components will also be quite high. This has been shown as $P_A >>>> P_B$. On account of this, the vapour space above the liquid will be occupied by 80% of molecules of ‘A’ and 20% of molecules of ‘B’.

(c) When vapour is removed from the cylinders, it follows, that two things will happen:

(i) The vapour will come out of the cylinders at a composition of 55% of ‘A’ and 45% of ‘B’ in the case of the cylinder to the left and at 80% of ‘A’ and 20% of ‘B’ in the case of the cylinder to the right. In both the cases it can be observed that the vapour will not come out at 50% each of ‘A’ and ‘B’ which is the original composition of the refrigerant.

(ii) The liquid left behind boils more of the high pressure component i.e. ‘A’ out of the liquid to replace the vapour and this leads to an eventual change in the liquid composition because more of the ‘A’ component leaves compared to the original liquid composition.

Fractionation is the change in composition of a blend because one (or more) of the components is lost or removed faster than the other.

The greater the difference in boiling points or pressures of the two starting components ‘A’ and ‘B’, the greater the difference in the vapour composition compared to the liquid. This will worsen the effect of fractionation of the blend. Thus it can be inferred that the effects of fractionation will be worse in the case of the cylinder on the right and the blend in this cylinder will be referred to as a High Fractionation Blend as compared to the Low Fractionation Blend in the cylinder to the left.

Temperature glide will be higher for high fractionation blends than for low fractionation blends. The blend of Propane and Isobutane would be an example of a high fractionation blend where the temperature glide is about 8°C whereas R404A is an example of a low fractionation blend which has a temperature glide of about 1°C. Such low fractionation blends are also known as Near-Azeotrope Refrigerant Mixtures or NARMS. In between is R407C which has a temperature glide of about 5°C.

C. What does Fractionation mean to the Technician?

It is apparent from the foregoing analysis that it is not correct to charge Zeotropes into a Refrigeration system by opening the valve of the cylinder and releasing vapour into the system, as is done for single component refrigerants like R12 or R134a or for Azeotropes like R502 or R 507. To avoid this Zeotropes must be removed from the cylinder as a liquid. See Fig. 3

From Fig. 3, it can be seen that the blend can be removed as a liquid by turning the cylinder upside down so that the valve is at the bottom or by forcing the liquid through a dipstick if the cylinder is provided with a dipstick.

Additionally the following care should also be taken:

(a) When releasing liquid from the cylinder into a refrigeration system, ensure that the liquid is evaporated into a vapour before the refrigerant enters the suction side of the compressor. This is done by using a callibrated capillary to throttle the liquid into a vapour enroute to the compressor. Release of the refrigerant should be done slowly whilst charging.

(b) Charging should always be done by weight and the entire weight of the liquid that has been extracted from the cylinder through the valve and throttled into a vapour should be charged into the system.

Acknowledgements:

(1) Refrigerant Reference Guide, National Refrigerants Inc, PA 19154, USA for all the diagrams.

(2) ASHRAE Fundamentals and Refrigeration Handbooks.

(3) Industrial Refrigeration Handbook, Wilbert Stoecker, McGraw Hill.

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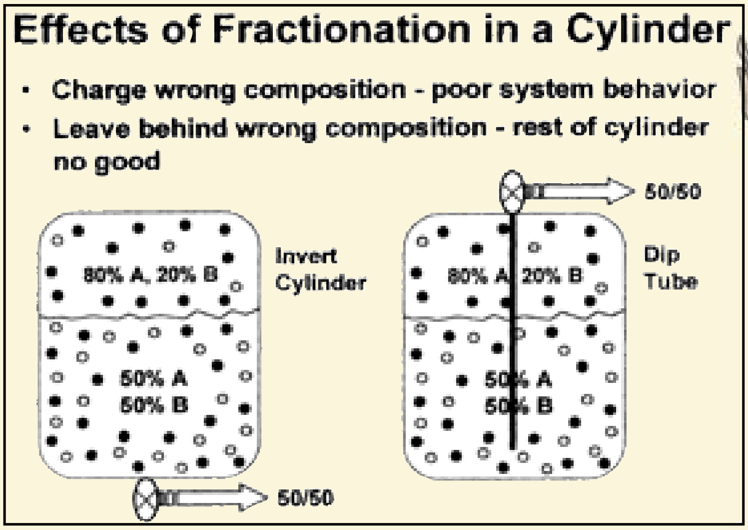
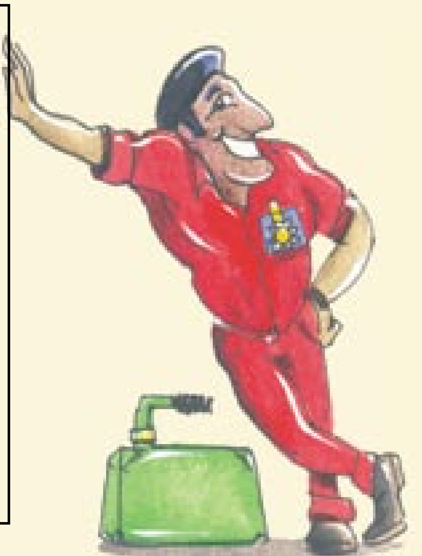


Figure 3: Effects of fractionation in a cylinder



Mobile Air-Conditioning

Within the Mobile Air Conditioning (MAC) sector, air conditioning of passenger cars is, globally, the largest consumer of refrigerants. The CFC-free refrigerant now most commonly used in the manufacturing of MAC all over the world is HFC-134a. India stopped the use of Chlorofluorocarbons (CFCs) in the manufacturing of MAC and other refrigeration equipments/appliances from January 01, 2003, and has also adopted HFC-134a refrigerant for new MACs in place of CFC-12. However, there is a large population of cars with CFC-12 charged systems. These units require servicing very frequently due to operating conditions that include high ambient temperature.

With India progressively phasing out both the production and consumption of CFCs by the end of the year 2009 (50% phased out by 2004, and 85% to be phased out by end of 2006), the large population of CFC-12 filled MAC systems will face shortage of CFCs in due course. This challenge can be addressed to a certain extent by:

(a) Using good service practices that would lead to considerable reduction of CFC consumption.

(b) Retrofitting CFC filled systems with CFC-free alternatives like HFC 134a or HC Blends, thereby eliminating CFC use.

NCCoPP has initiated to conduct one-day MAC training programmes in different parts of the country. The training programmes will include both theory and practical sessions. The main topics that will be covered are:

- Characteristics of HFC and HC refrigerants
- Safe handling of refrigerants
- Introduction to tools and equipments for good servicing of MAC
- Good Service Practices for CFC and HFC based MAC
- Retrofitting of CFC based MAC with HFC-134a and HC Blend
- Hands-on training on good service practices and retrofitting using HFC-134a and HC refrigerants

Alternative refrigerants for MAC

Several refrigerants have been studied to replace CFCs as refrigerants in MAC but HFC-134a refrigerant has been universally adopted for manufacturing of new MAC units. HFC refrigerants do not have ozone depletion potential (ODP) but they do have a relatively high Global Warming Potential (GWP). Although the global warming potential of HFCs is less than that of CFCs, it is significantly higher than that of natural refrigerants such as carbon dioxide and hydrocarbons. Attempts are being made to look for zero ODP and low GWP refrigerants for MAC like carbon dioxide, HFC-152a and HC-blend and work is also in progress to develop reduced charge, energy efficient HFC-134a systems.

Good Servicing Practices for MAC

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

Retrofitting of MAC

There are still large numbers of CFC-12 based MAC in India as well as all over the world. Retrofitting is one of the potential options to reduce consumption of CFC in servicing of existing MAC units. The term "retrofit" describes the procedure of converting a CFC-12 based MAC unit into any eco-friendly alternative refrigerant based unit. Several retrofit refrigerants have been studied for purposes of retrofitting MAC, but only two CFC/HCFC free refrigerants have been practically used so far:

- HFC-134a
- HC-blend (approximately 50% by weight of propane and isobutane)

Retrofitting of MAC with HFC-134a

HFC-134a has been used in many countries as retrofit refrigerant for MAC. A considerable amount of work was carried out during the early period of Montreal Protocol (1994-97) to retrofit MAC units with HFC-134a. The studies reveal that the following two approaches were adopted for retrofitting of MAC:

- OEM Retrofits
- Least-Cost Retrofit also known as Economy Retrofits

OEM Retrofits

Vehicle manufacturers (also known as Original Equipment Manufacturers or OEMs) have developed retrofit kits or guidelines for some of the MAC systems used in the cars/vehicles manufactured by them. These procedures were designed to provide the best level of performance with the new HFC-134a system and also give the greatest assurance of comparable performance of retrofitting to the original MAC. In most of the cases, however, the cost is relatively high. The cost of OEM retrofits amounts to US $ 650 or more, including labour charges depending on the system.

Least-Cost Retrofit or Economy Retrofits

Many car owners may express interest for least-cost retrofit. Procedures required for a least-cost retrofit are simple and do not require major component changes. Generally, the process calls for removal of the old refrigerant, installation of new seals like 'O' rings, gaskets, new service fittings, Receiver drier etc., a new label, and the addition of a polyalkylene glycol (PAG) or polyolester (POE or ester) lubricant as well as the HFC-134a refrigerant. For many vehicles, this simple, least-cost retrofit may provide the vehicle owner in milder climates, either with MAC performance comparable to the CFC-12 system, or MAC performance that, although reduced, is still sufficient to satisfy the customer.

Retrofitting of MAC using Hydrocarbon (HC) – Blend

Hydrocarbons have been used as refrigerants for decades in refrigeration systems. Their use is growing especially in domestic refrigeration and retrofitting of MAC, inspite of their flammable characteristics. HC-blend (a blend of 290/HC-600a; 50% / 50% by weight) has also been used for retrofitting MAC in some countries. Although HC refrigerants are flammable, their use in MAC as retrofit/drop-in refrigerant has not posed any difficulty if proper safety precautions are adopted.

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** For details of upcoming MAC training programmes refer to page 7*

Training Contacts And Coverage

The following organisations manage all training in India through the appointed training partners:

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ESS Facilitator, Principal Distributor and National Partner for Awareness Raising:
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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, LG 6, Mourya Centre,
16 Race Course Road, Indore - 452 008.
Tel: 0731-506 98 81 / 82 Mobile: 98931 21261
E-mail: arunmishra71@hotmail.com

Maharashtra: Abraham Mathew, Max Cooling Systems [M1], 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
E-mail: higrop@ndb.vsnl.net.in

Orissa: L. N. Dash, B-12, BJB Nagar,
Bhubaneswar - 751 014.
Tel: 0674-243 52 80, Mobile: 94370 82401
E-mail: 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
E-mail: bohra@bohraappliances.com

Tamil Nadu: S. Kanaga Sabapathi, Siva Refrigeration,
13/8 A V M Nagar, II-Street, Virugambakkam,
Chennai 600092. Tel: 044-259 30 842
Mobile: 98403 44694 E-mail: 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,
E-mail: rajeshm@kircop.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
E-mail: nl@vsnl.net

Industry Training Partners:

Kirloskar Copeland Ltd., V. G.Sardesai,
1202/1, Ghole Road, Pune - 411 005.
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E-mail: sardesai@kircop.com

Whirlpool of India Limited, A. Natarajan,
28, N.I.T., Faridabad - 121 001, Haryana.
Tel: 0129-223 17 81/244 13 31 Mobile: 98100 14504
E-mail: a_natarajan@email.whirlpool.com

Technicians Trained under NCCoPP

53 Andhra Pradesh	**48 Assam**	**78 Bihar**	**22 Chattisgarh**
76 Haryana	**28 Himachal Pradesh**	**59 Jammu & Kashmir**	**47 Karnataka**
174 Kerala	**130 Madhya Pradesh**	**50 New Delhi**	**104 Orissa**
55 Punjab	**216 Rajasthan**	**44 Tamil Nadu**	**292 Uttar Pradesh**
29 Uttaranchal			**109 West Bengal**

Book Post

NCCoPP Training Programme Schedule (2005–2006)

RSE Training

State	City	Training Date	Training Partner
Andhra Pradesh	Vishakapatnam	23-24 Dec. 05	Maega Services(T. Veerender Nath)
Assam	Guwahati	19-20 Nov. 05	Godrej (S.A. Juvekar)
Assam	Agartala	23-24 Nov. 05	Godrej (S.A. Juvekar)
Assam	Guwahati	10-11 Dec. 05	Kuwality Coolers (D.Talukdar)
Assam	Guwahati	28-29 Jan. 06	Kuwality Coolers (D.Talukdar)
Bihar	Patna	15-16 Nov. 05	Godrej (S.A. Juvekar)
Bihar	Patna	07-08 Jan. 06	Loyola Industrial School (S.G. Sebastian Joseph)
Chattisgarh	Raipur	11-12 Feb. 06	Divyansh Services (Arun Mishra)
Delhi	Delhi	16-17 Dec. 05	Hindustan Refrigeration Stores (Jaspal Singh)
Delhi	Delhi	21-22 Jan. 06	Hindustan Refrigeration Stores (Jaspal Singh)
Gujarat	Rajkot	19-20 Nov. 05	Kirti Freeze (Naranbhai M. Patel)
Gujarat	Ahemedabad	26-27 Nov. 05	Kirti Freeze (Naranbhai M. Patel)
Haryana	Yamuna Nagar	12-13 Nov. 05	Anant Enterprises (A. Kumar)
Haryana	Hissar	24-25 Dec. 05	Anant Enterprises (A. Kumar)
Himachal Pradesh	Kangra	24-25 Sep. 05	Anant Enterprises (A. Kumar)
Jammu & Kashmir	Udhampur	18-19 Feb. 06	Anant Enterprises (A. Kumar)
Jharkhand	Ranchi	26-27 Nov. 05	Loyola Industrial School (S.G. Sebastian Joseph)
Kerala	Kunnamkulam	01-02 Oct. 05	V.R. Enterprises (V. Vijayakumar)
Kerala	Cannanore	22-23 Oct. 05	V.R. Enterprises (V. Vijayakumar)
Kerala	Palghat	19-20 Nov. 05	V.R. Enterprises (V. Vijayakumar)
Kerala	Trichur	17-18 Dec. 05	V.R. Enterprises (V. Vijayakumar)
Kerala	Ernakulam	07-08 Jan. 06	V.R. Enterprises (V. Vijayakumar)
Madhya Pradesh	Gwalior	14-15 Oct. 05	Godrej (S.A. Juvekar)
Madhya Pradesh	Jhansi	17-18 Oct. 05	Godrej (S.A. Juvekar)
Madhya Pradesh	Indore	09-10 Dec. 05	Divyansh Services (Arun Mishra)
Madhya Pradesh	Bhopal	16-17 Dec. 05	Divyansh Services (Arun Mishra)
Madhya Pradesh	Jabalpur	13-14 Jan. 06	Divyansh Services (Arun Mishra)

State	City	Training Date	Training Partner
Orissa	Bhubaneshwar	22-23 Oct. 05	L.N. Dash
Orissa	Cuttack	09-10 Nov. 05	L.N. Dash
Orissa	Angol	12-13 Nov. 05	L.N. Dash
Orissa	Raurkela	20-21 Dec. 05	Godrej (S.A. Juvekar)
Orissa	Behrampur	23-24 Dec. 05	Godrej (S.A. Juvekar)
Punjab	Patiala	27-28 Sep. 05	Godrej (S.A. Juvekar)
Punjab	Ludhiana	19-20 Nov. 05	Anant Enterprises (A. Kumar)
Punjab	Barnala	07-08 Jan. 06	Anant Enterprises (A. Kumar)
Punjab	Ludhiana	04-05 Feb. 06	Anant Enterprises (A. Kumar)
Punjab	Amritsar	25-26 Feb. 06	Anant Enterprises (A. Kumar)
Rajasthan	Udaipur	20-21 Sep. 05	Godrej (S.A. Juvekar)
Rajasthan	Bikaner	23-24 Sep. 05	Godrej (S.A. Juvekar)
Rajasthan	Chittaurgarh	12-13 Nov. 05	Bohra Services (Surendra Bohra)
Rajasthan	Swaimadhupur	17-18 Dec. 05	Bohra Services (Surendra Bohra)
Rajasthan	Ganganagar	21-22 Jan. 06	Bohra Services (Surendra Bohra)
Rajasthan	Alwar	11-12 Feb. 06	Bohra Services (Surendra Bohra)
Tamil Nadu	Chennai	22-23 Oct. 05	Siva Refrigeration (S.Kanaga Sabapathi)
Uttar Pradesh	Kanpur	24-25 Sep. 05	Isha Enterprises (Rajesh M. Misra)
Uttar Pradesh	Aligarh	03-04 Oct. 05	Godrej (S.A. Juvekar)
Uttar Pradesh	Allahabad	06-07 Oct. 05	Godrej (S.A. Juvekar)
Uttar Pradesh	Varanasi	12-13 Nov. 05	Isha Enterprises (Rajesh M. Misra)
Uttar Pradesh	Jaunpur	26-27 Nov. 05	Isha Enterprises (Rajesh M. Misra)
Uttar Pradesh	Jhansi	03-04 Dec. 05	Isha Enterprises (Rajesh M. Misra)
Uttar Pradesh	Gorakpur	18-19 Dec. 05	Isha Enterprises (Rajesh M. Misra)
Uttar Pradesh	Moradabad	09-10 Jan. 06	Isha Enterprises (Rajesh M. Misra)
Uttar Pradesh	Lucknow	11-12 Feb. 06	Isha Enterprises (Rajesh M. Misra)
Uttaranchal	Haridwar	15-16 Oct. 05	Anant Enterprises (A. Kumar)
West Bengal	Kolkata	26-27 Nov. 05	Crystal Refrigeration Co (Navin Lamba)
West Bengal	Kharagpur	09-10 Dec. 05	Crystal Refrigeration Co (Navin Lamba)
West Bengal	Kolkata, Howrah	21-22 Jan. 06	Crystal Refrigeration Co (Navin Lamba)
West Bengal	Howrah, Asansol	04-05 Feb. 06	Crystal Refrigeration Co (Navin Lamba)

ITI Instructors Training

State	City	Training Date	Training Partner
Andhra Pradesh	Hyderabad	07-11 Nov. 05	ATI Vidyanagar (V.M. Rao & T. Veerender Nath)
Andhra Pradesh	Hyderabad	21-25 Nov. 05	ATI Vidyanagar (V.M. Rao & T. Veerender Nath)
Andhra Pradesh	Hyderabad	12-16 Dec. 05	ATI Vidyanagar (V.M. Rao & T. Veerender Nath)

MAC Training

State	City	Training Date	Training Partner
Tamil Nadu	Chennai	11 Dec. 05	Siva Refrigeration (S. Kanaga Sabapathi)
Tamil Nadu	Chennai	12 Dec. 05	Siva Refrigeration (S. Kanaga Sabapathi)
Andhra Pradesh	Hyderabad	04 Jan. 06	Maega Services (T. Veerender Nath)
Andhra Pradesh	Hyderabad	05 Jan. 06	Maega Services (T. Veerender Nath)

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