Manual for Refrigeration Servicing Technicians

Why you need this manual
When to use this manual
How to use this manual

Introduction

Welcome to the Manual for Refrigeration Servicing Technicians. It is an e-book for people who are involved in training and organization of service and maintenance of refrigeration and air-conditioning (RAC) systems. It is aimed at people who are:

- Service and maintenance technicians
- Private company service/maintenance managers
- Private company managers involved in developing their service and maintenance policy
- Private company technicians trainers
- Educational establishment RAC trainers and course developers
- National Ozone Units (NOUs) responsible for servicing and maintenance regulations and programmes related to the Montreal Protocol.

Why you need this Manual

Over recent years, attention on the issue of ozone depletion has remained focused on the obligatory phasing out of ozone depleting substances (ODS). At the same time, awareness of climate change has increased, along with the development of national and regional greenhouse gas (GHG) emissions reduction targets. In order to achieve reduction in emissions of both ODSs and GHGs, attention has to be paid to activities at a micro-level. This includes reducing leakage rates, improving energy-efficiency and preventing other environmental impacts, by directing the activities of individuals, and influencing the design and maintenance of equipment.

The manual is written for those who have a relatively comprehensive level of knowledge and understanding of RAC systems and associated technology. The material within this manual may be used for the purpose of developing training resources or parts of training courses, as well as general guidance and information for technicians on issues that are closely related to the use and application of alternative refrigerants. Most training courses are likely to cover a range of topics associated with RAC systems, and as such, the material within this manual may contribute towards those elements that address refrigerant use and handling.

Read on to find out how ▶

When to use the manual

The overall theme of this manual is to encourage technicians to work with systems in a more environmentally-friendly manner, and to get the equipment itself to have a lower impact. However, the primary motivation for technician operations carried out on a particular system is typically cost-orientated, rather than considering the environmental impact. It is often not recognised that actions resulting in a lesser environmental impact are consistent with a lower long-term cost impact. Conversely, the types of actions that are the "cheaper" options tend to lead to greater costs in the long term, as well as a worse environmental impact.

For example:

- A system that leaks may be topped-up or repaired. Topping-up may have a lower immediate cost, whereas repairing the leak takes more time and therefore costs more. However, in the long-term, the repaired system is less likely to leak thus the costs cease, whereas repeatedly topping-up a system over months and years results in a very high accumulated cost. Obviously, preventing leakage and thus fewer journeys to the equipment and better resulting efficiency is much more desirable from an environmental perspective.
- A system that is designed to work efficiently and is well maintained may cost more to build, but the pay-back period is generally much shorter than the equipment's lifetime. Similarly, the additional GHG emissions associated with constructing larger heat exchangers (for example) are minute compared to the reduction in GHG emissions from energy consumption that will be saved over the first year of operation.

So, when installing a new system or working on an existing system, the actions taken should ideally lead to the system operating with minimal impact on the environment. To achieve this, several aspects should be borne in mind:

- Reduce energy consumption by minimizing heat load and improving efficiency.
- Minimize leakage and other emissions whenever possible.
- Avoid the use of high global warming potential (GWP) refrigerants.

Read on to decide how you might use this manual to achieve this ▶

How to use this manual

The objectives on the page ▼ **When to use this manual** may be achieved through a variety of means, including those detailed within this manual and from other sources. When a technician arrives at a system to carry out activities that involve refrigerant handling, and as they begin their work, they must formulate a view as to how to deal with the system in hand.

The considerations as to what to do with the system may include:

Repair:
Whether to repair and refill with the same refrigerant.

Drop-in refrigerant change:
Whether to repair and drop-in with a new refrigerant, and if so, which refrigerant to use.

Retrofitting:
Whether to repair and retrofit with a new refrigerant, and if so, which refrigerant to use.

Redesign:
Whether to repair, and add refrigerant, but also carry out other improvements to improve the reliability and efficiency.

Replacement:
Whether to replace the entire system with a new one, and if so, which system and which refrigerant.

Read The Factors Affecting the Decision ▶

The Factors affecting the decision

The decision as to which approach to take is rarely an obvious one, and requires consideration of many aspects.

Type of refrigerant and its availability

If a system uses a chlorofluorocarbon (CFC) then it is likely to be difficult to obtain, or even prohibited. The same will apply to hydrochlorofluorocarbons (HCFCs) in the future.

Severity of leakage

For systems that have a history of high leakage, perhaps due to poor manufacture or construction, or being positioned in a vulnerable location, consideration should be given to replacing them, or redesigning/reinstalling the susceptible parts.

Charge of refrigerant

If a system has a small charge of controlled or less available refrigerant, then it may not be so problematic to retain it, whereas if the charge is large then it would be sensible to replace it.

Availability of alternative refrigerant

The choice of alternative refrigerant should ideally be a substance with zero ozone depleting potential (ODP) i.e. not a CFC or HCFC or a blend that contains either. It should have as low a GWP as possible.

Physical size of the system

If a system is very large, replacing it with a new system may require considerable cost.

Availability of similar (replacement) systems

If the system is particularly complex and a replacement is being considered, it should only be done provided a replacement system is easily available.

Availability of expertise associated with the type of system

Involved types of work or replacing parts or the entire system should only be done provided that sufficient expertise is available.

Degree of integration into application

Where a system is partially integrated into an application or a building, or is part of a much larger mechanical installation, it is likely to be much easier and more cost effective to carry out minimal work rather than trying to replace it with a new system.

Condition/state of equipment

For systems in a very poor condition, where perpetual maintenance and repairs are likely, then installation of a new system may be appropriate.

Age of system

If a system is very old and is using outdated technology and parts, it could be appropriate to replace it, whereas newer equipment may have modern design and already use suitable refrigerants.

Current level of reliability

If the reliability of the system and its components are poor, resulting in repeated service visits and losses of parts and refrigerant, then a replacement system may be the preferred option.

System efficiency and potential for efficiency improvement

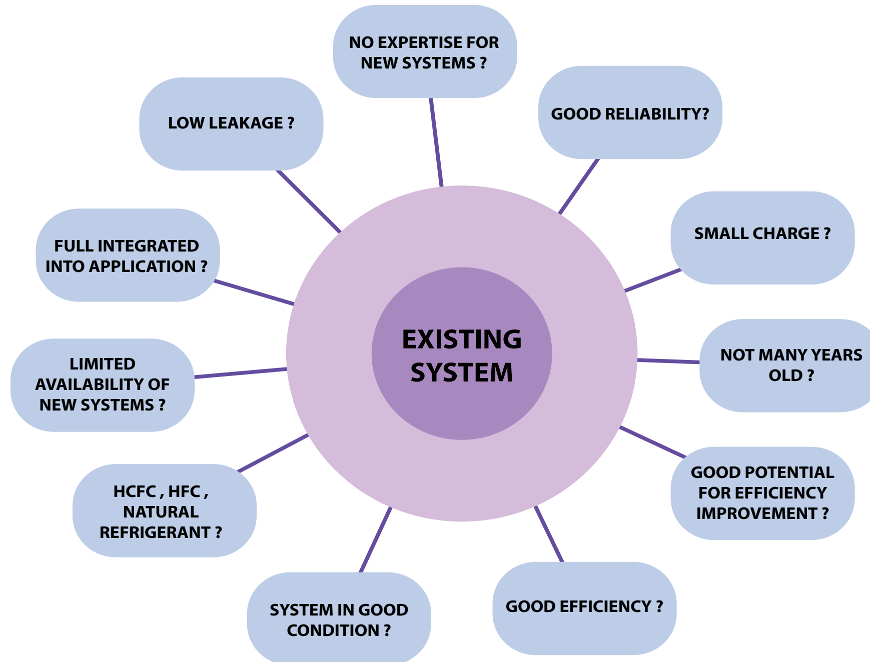
If a system has a poor level of efficiency, it is necessary to consider whether there are viable operations that could be carried out to help improve the efficiency, but it is such that this is not possible, then adoption of a new system should be considered.

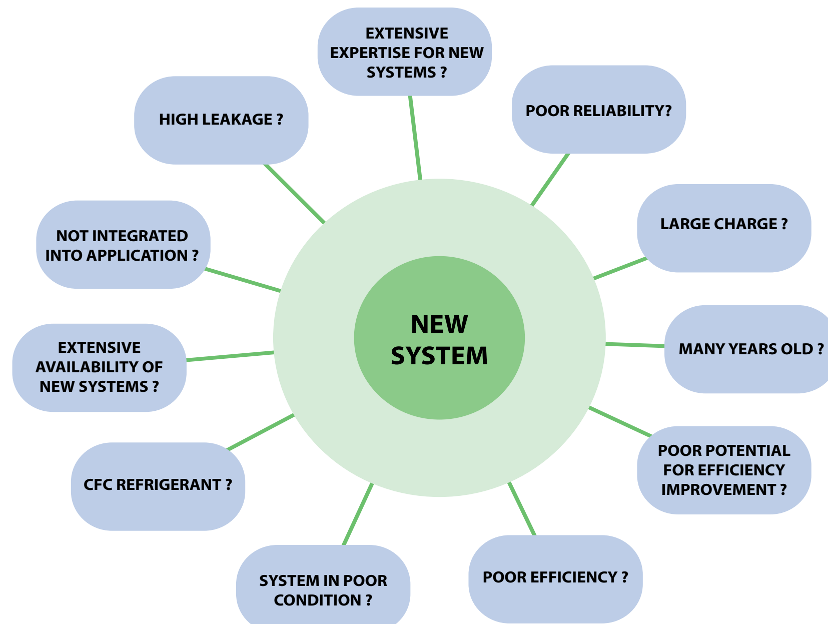
The choice is often complex and a function of many different factors. Typically, the age of the equipment is a leading factor in terms of which conclusions are drawn in terms of how the equipment should be handled, for the reasons implied above.

Introduction

How to assess conditions

Here is an overview of conditions for the refill, drop-in, retro-fit and new system options, which includes considerations that should be given to how a system is handled.





Considering these factors, read the conditions below and then select the option you might choose

The conditions ▶

Introduction

Condition	Observation			
Refrigerant type and availability	HFC, CO_2, HC, NH_3	CFC, HCFC	HCFC	CFC
Severity of leakage	low	low	medium	high
Charge of refrigerant	high	medium	medium	low
Alternative refrigerant availability	poor	good	good	good
Physical size of system	large	large	medium	small
Availability of similar systems	none	none	none	many
Availability of system expertise	none	some	some	much
Degree of integration	high	high	medium	low
Condition/state of equipment	good	good	fair	poor
Age of system	new	medium	medium	old