Refrigerant Recovery, Recycling & Cylinders
Refrigerant Recovery - Reasons?

• HCFCs
  ➢ because they destroy the ozone layer and threaten life on earth and also cause global warming

• HFCs
  ➢ because they cause global warming

* DU - Dobson unit
Recovery, Recycling, Reclamation

ISO – 11650: “Performance of refrigerant recovery and/or recycling equipment”

- **Recover**: to remove refrigerant in any condition from a system and store in an external container

- **Recycle**: to reduce contaminants in used refrigerants by separating oil, removing non-condensable gases, and using devices such as filter-driers to reduce moisture, acidity and particulate matter.

- **Reclaim**: to process used refrigerant to a new product (gas) specifications, and verify by chemical analysis of the refrigerant that new product specifications have been met.
Methods of Recovery

• Passive (No external recovery machine used)*
  ➢ Charge migration method
  ➢ Use of system compressor

• Active
  ➢ With a recovery machine

* Only with single substance / refrigerant
Charge Migration Method – Passive

1. Movement of refrigerant due to natural difference in pressure between system & recovery cylinder.

2. Process can be speeded up by:
   - Evacuating recovery cylinder
   - Placing recovery cylinder in ice bath

3. Only a small percentage of charge can be recovered

* Only with single substance / refrigerant
Charge Migration Method – Passive

Refrigeration system (Disable compressor)

* Only with single substance / refrigerant
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**Accelerated Passive Recovery using System Compressor**

1. Pump out refrigerant using System compressor as vapour (if service valve used) or as liquid from condenser exit

2. System compressor should not run below “0” PSIG

3. Higher percentage of recovery possible

4. Still, significant percentage of refrigerant will be left in the system

*Only with single substance / refrigerant*
Active Methods of Recovery

Simple Recovery Machine

- Recovers refrigerant as vapour
- Refrigerant vapour condensed before entering recovery cylinder

Recovery Machine with Oil Separation

- Separation of oil from system using oil separator
- Oil from recovery machine compressor returned back to compressor
1. Distillator
2. Valve
3. Drier
4. Compressor
5. Pressure control
6. Oil separator
7. Oil drain valve
8. Heat exchanger
9. Oil drain valve
10. Condensing unit
11. Sight glass
12. Valve
13. Access valve
A. Entry-suction
B. Exit-Pressure
Recovery Unit

Recovery unit
Oil less type

Refrigeration system
(Disable compressor)

Low pressure side
High pressure side
input
output
weigh scale

open
open
closed
open

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United Nations Environment Programme

Training Package HCFC Phase-out RACSS – UNEP 2014
• it must be ensured that the compressor does not suck in liquid refrigerant as this will cause serious damage
• The connection hoses between recovery units, systems and recovery cylinders should be kept as short as possible and with as large a diameter as practicable.
Connect the recovery cylinder to the recovery units vapour valve, and the recovery cylinder liquid valve to the liquid side on the disabled unit.

The recovery unit will pull the liquid refrigerant from the disabled unit when decreasing the pressure in the recovery cylinder.

Vapour pulled from the recovery cylinder by the recovery unit will then be pushed back to the disabled unit’s vapour side.
Suggested Guidelines for Refrigerant Recovery

- Do not vent any refrigerants. It is important to note that recovery of HC must be with specially designed recovery machine for HC. Please do not use compressor for recovery of HC refrigerant which may cause ignition of flame.

- Charges up to 400 gm - Passive method, (i.e. no Recovery Machine) can be used

- Charges greater than 400 gm - better to use active methods (i.e. using recovery machine)

- Refrigerants from a system that has suffered compressor burn-out cannot be re-used after recovery.

- Contaminated refrigerant should be recovered and kept separately for multi pass recycling or reclamation or destruction
Suggested Guidelines for Refrigerant Recovery

- Refrigerant from systems that have no burn-out can be recovered and reused.

- If oil is discoloured, (dark brown, black) it may be better to subject it to acid-test.

- If Acid-test is positive for Acidity, the refrigerant and oil should not be reused and should be kept separately for multi-pass recycling or reclamation or destruction.

- Always use recovery cylinder not disposable cylinder.
Recycling Machine
Recycling Machine Filter/Drier

Removal and absorption of:
- Acid
- Moisture
- Particulate matter

Recycling filter must be regularly changed according to manufacturers’ recommendation and refrigerant contamination state.
Safe refrigerant Capacity

Recovered refrigerant must be stored only in a specified refillable container or cylinder and properly labelled.

**Tare Weight** (empty cylinder) 14.4 Kgs

**W.C.** x .8 = Safe Refrigerant capacity

21.8 x 0.8 = 17.5 Kgs of recovered refrigerant can be safely added to the cylinder
Type of Refrigerant Cylinders

There are two types of cylinders

1) Disposable / non-refillable cylinders
2) Recovery / Refillable cylinders
Disposable and Non-refillable Cylinders

- Do not attempt to re-use these cylinders
- Never refill a disposable cylinder
- When scrapping a disposable cylinder, the internal cylinder pressure should be reduced to at least 0 psig
- Never leave used cylinders with residual refrigerant outdoors where the cylinder can rust
• The cylinder has a combination valve with separate ports (one for liquid and another for vapour) and a pressure relief device.

• Fill up to 80% of Cylinder Capacity in volume

• Do not mix the refrigerant cylinders

• Label the cylinders

Use only approved cylinders that are exclusively reserved for recovery
Cylinder Inspections and Re-testing

- The cylinder must have a Department of Transportation (DOT) stamp of approval and be rated for the refrigerant you are recovering.
- The containers must be hydrostatically tested and date stamped every 5 years.
- According to the ASME Pressure Vessel Code, the pressure rating must be 285 psig or higher for R-407C, and 400 psig or higher for R-410A.