



National Guidelines for the Air Conditioning and Refrigeration Sector of Trinidad and Tobago

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LIST OF ACRONYMS

<u>AC</u>	<u>AIR CONDITIONING</u>
<u>ARIA</u>	<u>AIR CONDITIONING AND REFRIGERATION INDUSTRY ASSOCIATION</u>
<u>CFC</u>	<u>CHLOROFLUOROCARBON</u>
<u>CP</u>	<u>COUNTRY PROGRAMME</u>
<u>GWP</u>	<u>GLOBAL WARMING POTENTIAL</u>
<u>HCFC</u>	<u>HYDROCHLOROFLUOROCARBON</u>
<u>HPMP</u>	<u>HCFC PHASE OUT MANAGEMENT PLAN</u>
<u>MAC</u>	<u>MOBILE AIR CONDITIONING</u>
<u>MP</u>	<u>MONTREAL PROTOCOL</u>
<u>NOU</u>	<u>NATIONAL OZONE UNIT</u>
<u>ODP</u>	<u>OZONE DEPLETING POTENTIAL</u>
<u>ODS</u>	<u>OZONE DEPLETING SUBSTANCES</u>
<u>R&R</u>	<u>RECOVERY AND RECYCLING</u>
<u>R-12</u>	<u>REFRIGERANT 12</u>
<u>R-22</u>	<u>REFRIGERANT 22</u>
<u>TPMP</u>	<u>TERMINAL PHASE OUT MANAGEMENT PLAN</u>
<u>TTBS</u>	<u>TRINIDAD AND TOBAGO BUREAU OF STANDARDS</u>
<u>UV</u>	<u>ULTRAVIOLET</u>
<u>UNDP</u>	<u>UNITED NATIONS DEVELOPMENT PROGRAMME</u>
<u>UNEP</u>	<u>UNITED NATIONS ENVIRONMENT PROGRAMME</u>

INTRODUCTION

The Government of the Republic of Trinidad and Tobago acceded to the Vienna Convention for the Protection of the Ozone Layer and the Montreal Protocol for the Phase-out of Ozone Depleting Substances (ODS) in 1989, and operates **under Article V(1) of the Montreal Protocol (MP)**. Trinidad and Tobago was the first country of the Caribbean Commonwealth to become a party to this multilateral environmental agreement.

Status of Ratification of Ozone Treaties are shown below:

Treaty	Date
Vienna Convention	28 Aug 1989 (Ac)
Montreal Protocol	28 Aug 1989 (Ac)
London Amendment	10 Jun 1999 (R)
Copenhagen Amendment	10 Jun 1999 (R)
Montreal Amendment	10 Jun 1999 (R)
Beijing Amendment	29 Oct 2003 (R)
Kigali Amendment	17 Nov 2017 (R)

R – Ratification

Ac - Accession

The accession to this Protocol committed Trinidad and Tobago to protect the ozone layer through measures to control emissions that deplete it, with the ultimate objective of their elimination on the basis of developments in technology.

The National Ozone Unit was established in August 1997 and resides within the Ministry responsible for the Environment. This National Ozone Unit manages activities of the country's phase-out programme within the context of the Country Programme (CP), approved by Cabinet in October 1996. The CP adopted a multi-sector, policy-based approach to meet the country's commitments for phasing-out ozone depleting substances (ODS). The phase out programme is supported through an import and export licensing system for all refrigerant and related equipment as well as all ODS, managed by the Ministry with responsibility for Trade and governed by Legal Notices related to the Import and Export Negative Lists. This is monitored by the Customs and Excise Division and the Trinidad and Tobago Bureau of Standards (TTBS). Several national standards relating to the air conditioning and refrigeration sector are also monitored by the TTBS. The National Ozone Unit also works closely with the Air Conditioning and Refrigeration Industry Association (ARIA).

National Guidelines

This document supports the regulatory framework for the total phase out of Ozone Depleting Substances (ODS) in Trinidad and Tobago by recommending technological options to reduce the

demand for ODSs. It will require revision as new technologies and regulatory advancements are made to address the challenges.

These National guidelines are designed to:

1. define minimum requirements of good practices for servicing refrigeration and air conditioning systems,
2. act as a resource document in technicians training and the development of training materials,
3. help to initiate communication between relevant stakeholders, including service companies from the informal sector,
4. reduce ODS consumption in a cost effective manner,
5. help ensure a smooth transition from ODS to non-ODS refrigeration technology by allowing existing refrigeration systems to run until the end of their useful life, thereby avoiding premature replacement, and
6. improve safety quality.

The Guidelines can be used as a reference resource for the reduction of CFC, HCFC and HFC emissions into the atmosphere. It applies to the industrial/commercial, residential domestic appliances, marine refrigeration and air conditioning, mobile refrigeration and mobile air conditioning sectors.

In developing the Guidelines, direction was sought from the Guidebook for Implementation of Guidelines of Good Practice – Refrigeration Sector, developed by UNEP and the Multilateral Fund for the Implementation of the Montreal Protocol, and other guidelines of practice developed and in use by other countries in the Region. The majority of good practices recommended in those publications have been included here. In addition consultations were held with representatives of the Trinidad and Tobago National Ozone Unit (NOU), refrigeration and air conditioning technicians, relevant stakeholder sector groups and other Government Agencies including the Trinidad and Tobago Bureau of Standards, Customs and Excise Division and the Trade Licensing Unit.

Facing the Challenge: What You Need To Do

The Guidebook for Implementation of Good Practices from UNEP identifies the major stakeholders such as industry and trade associations, service workshops and technicians, system owners and operators, manufacturers and government. It also recommends a number of general principles that each group should follow. These are outlined below.

Government should:

1. strengthen the institutional framework and establish a suitable policy and regulatory support framework;
2. establish refrigerant recovery and recycling systems;
3. establish systems for the monitoring and control of ODS consumption, imports and exports;
4. train service technicians on good practices in refrigeration recovery and recycling;
5. train customs officers in the control and monitoring of ODS imports and exports;
6. conduct public awareness campaigns.

Government has already initiated all of the activities recommended above. Some have been completed while elements of others are ongoing. The implementation of these national guidelines

will significantly support the implementation and the sustainability of the activities that have already been undertaken.

Service Workshops and Technicians should:

1. remain aware of government policies, ODS phase out plans and the environmental implications of ODS emissions;
2. stay abreast of the regulatory requirements, alternative refrigerants and technologies, and all the cost implications;
3. keep informed of, and participate in, training opportunities and certification schemes for service technicians either through the National Ozone Unit or any other suitable entity;
4. procure the necessary recovering and recycling equipment;
5. establish the necessary record keeping procedures;
6. disseminate information to customers on the legal obligations, record keeping, self-inspection and preventative maintenance;
7. advise customers on their technological options and the associated cost implications.

Industry and Trade Associations should:

1. act as a liaison between stakeholders and initiate networking with regional and international associations, training institutes and research bodies;
2. collect and provide data for decision-making and monitoring to the NOU;
3. identify service workshops and technicians in the formal and informal sectors;
4. encourage system owners and operators, service technicians and workshops to adopt good servicing practices and inform on new and future legislation, micro and macroeconomic development, innovative and alternative technologies, business opportunities and partnerships;
5. promote technology transfer;
6. participate in the development of training and information materials including guidelines of good practice as well as in the organization of training workshops and seminars on technical options, good servicing practices and environmental awareness;
7. advise Government on the necessary legislative and support measures;
7. initiate voluntary action and business commitments;

System Owners and Operators should:

1. remain aware of Government policies, the ODS phase out schedule, and the environment implications of emission of gases;
2. obtain information on the regulatory requirements, record keeping, self-inspections and preventative maintenance and on innovative technology options;
3. establish a Refrigerant Management Plan at company level, including the necessary management committee and the designation of a facility refrigerant manager;
4. raise awareness and train employees;

Though this category is not currently applicable it may be relevant to Trinidad and Tobago in the future and the general rule for Manufacturers is that they should:

1. network and exchange information with other companies, research institutes, refrigerant producers and suppliers to ensure they are kept informed of policy developments and innovative technologies;

2. evaluate the technological option for the conversion of their manufacturing facility to non-ODS products;
3. train personnel in good practices and environmental management;
4. provide product stewardship and the necessary information to customers on servicing or retrofitting existing refrigeration systems;
5. display management commitment e.g. by issuing a company policy statement;
6. give high priority to the conversion of manufacturing facilities in order to reduce the future stock of ODS systems and ensure competitiveness in, and access to international markets.

SECTION 1

1.1 Redesign of Refrigerant Systems

1. **Design Principle** – in the refrigeration and air conditioning sector, there is always the possibility of refrigeration emissions into the atmosphere. It is very important that designers, engineers and equipment manufacturers are professionally skilled to design refrigerant systems and immediately adopt sound environmental practices to eliminate and control emissions.
2. **Education** – Equipment owners, managers and building contractors must be educated on the adverse effects of refrigerant emissions into the atmosphere and must pursue a comprehensive planned preventative maintenance program to avoid emissions.
3. **Documentation** – Equipment designers must document and know the required working pressures and temperature of every component of the refrigeration system which is associated with the respective design. This includes compressors, condensers, evaporators, relief valves, cut out connections, sight glass, gauges, oil switches, connecting pipes, etc. The designer's priority must be **Refrigerant Emission Control**.

1.2 Guidelines of Practice for the Redesign of Refrigerant Systems

1. Incorporate leak-detection components.
2. Include the appropriate pressure relief valve and ensure that there is nothing internally obstructing the relief valve and no visual deterioration or damage has occurred. If any damage is visible, reclaim the refrigerant and have the valve replaced.
3. Include charging valves and quick connects as possible.
4. Design with isolating and manifold valves to allow isolation of vessels and system components.
5. Improve system cleanliness by using the appropriate size filters and driers.
6. Incorporate vibration eliminators and adequate support to pipeline connections to avoid unacceptable stresses that could lead to leakage.
7. Design systems with a refrigerant containment such as a liquid line receiver which can hold the entire refrigerant charge in the system.
8. Incorporate separate pump-down condensing units and receivers in larger systems.
9. Minimize the lengths of hoses and pipes that require purging.
10. Ensure that serviceability is considered in the design
11. Perform leak testing of charging lines.
12. Minimize mechanical joints in the piping systems and use welded or brazed connections instead of flared or screwed connections, wherever possible.
13. In wet areas or high humid environments, systems that are susceptible to corrosion/rust must be adequately protected.

SECTION 2

2.1 Installation of Equipment

1. **Installation Principle** – Installation and servicing amounts to the single largest source of ODS emissions and must be done by certified technicians or engineers. No individual should attempt to perform installation or servicing of any refrigerant system if he/she is not trained, Professionally Certified by the National Ozone Unit or certified by a qualified institution or relevant authority.
2. **Brazing/welding** – The installer must be a qualified individual with the appropriate skills to administer professional welding and brazing techniques.
3. **Procedure** – it is mandatory that the installer adopt the proper installation procedure to avoid damage to pipeline and to eliminate leakages of refrigerant while equipment is being used or installed.

2.2 Guidelines of Practice for Installation of Equipment

1. Check the installation room for appropriate size of ventilation.
2. Maintain a minimum distance from the walls to avoid overheating of compressors and condensers, as per the manufacturer's recommendations and good engineering practices.
3. Ensure cleanliness of piping systems and fittings prior to placing into position and during installation.
4. Blow through the pipe – work with dry nitrogen to remove welding, brazing or cutting debris.
5. Check the accessibility of piping with regard to inspection, maintenance and repair and avoid refrigerant carrying lines in the ground or in waterways.
6. Check refrigerant lines and mechanical joints for tightness before introducing tracer gases.
7. Perform leak testing to ensure system tightness.
8. Check the pressure vessel document and pressure testing certificates and ensure that containers have appropriate nameplates.
9. Check the necessary safety equipment to ensure they are in working order (e.g. safety valves, high-pressure monitors, emergency stop systems, pressure relief and discharge lines.)
10. Ensure that serviceability is considered in the location and type of installation
11. Check the tightness of the system again before commissioning.
12. Label each system with clear details in accordance with labelling requirements as prescribed by the Trinidad and Tobago Bureau of Standards.
13. Recheck the commissioned system for tightness, transport and storage.
14. Prepare the service logbook containing all relevant service record data. The logbook must be accessible to service technicians.
15. Check that instruction for safe operation and maintenance are attached to the service logbook and are written in the local language.
16. Record installation and commissioning of the system in the service logbook

SECTION 3

3.1 System Operation and Maintenance

1. **Operation and maintenance principle** – Before and during start-up of any equipment a visual inspection must be done thoroughly. The entire refrigerant circuit must be examined

for signs of oil leakage, damaged lines or hoses, uncapped valves, missing or damaged o'rings and other components.

2. **Commissioning** – Once the system is fully charged with the correct amount of oil and refrigerant, run the unit for the recommended time and do other leak checks. Do not over charge the equipment.
3. **Maintenance** – The area around the equipment must be at the highest standards of cleanliness at all times, with proper labeling and periodic records. These maintenance habits must be adopted and respected during the operation and maintenance of the refrigerant system.

3.2 Guidelines of Practice for System Operation and Maintenance

1. Keep in mind that emissions of refrigerants have a negative impact on the environment.
2. Shut down systems and make repairs when leaks exist.
3. Some leaks are very hard to find because they can be vibration-dependent. This is why it is important to practice good service procedures and workmanship. Always double check the system before commissioning.
4. If evacuation is necessary, recover refrigerant from the discharge of the vacuum pump by means of a condenser and into a storage container.
5. Follow the instructions of the manufacturer for cleaning and flushing of contaminated systems and for the replacement of filters, driers, accumulators etc.
6. To prevent any cross contamination always identify refrigerant and oil prior to any system services procedure.
7. Raise the oil temperature prior to service work to reduce the amount of refrigerant dissolved in the oil.
8. Use the heat lamp to apply heat to the system.
9. If the refrigeration system has been opened to the atmosphere for servicing, evacuate and pressure-test the system thoroughly prior to commissioning.
10. Check the amount of remaining oil or lubricant in order to leave no more than the necessary amount in the system.
11. Always check the specified oil for a given refrigerant to avoid cross contamination.
12. In practice, if a recovery machine is attached to a cross contamination system and that crossed refrigerant charge is recovered, the recovery machine **MUST** be cleaned and filter-driers replaced.
13. Keep the outlet cap on the valve outlet and the valve-hood securely screwed onto the neck of the returnable cylinder at all times, except when discharging refrigerant.
14. Keep the returnable cylinder secured in an upright position.

3.3 Practices to Eliminate

1. **DO NOT** release the contents of charging lines into the atmosphere.
2. **DO NOT** use CFCs or HCFCs to clean tools, coils and machinery or as cleaning solvents.
3. **DO NOT** attempt to service a system before identifying the type of refrigerant and the oil used in the system.
4. **DO NOT** add lubrication oil to a system without establishing the type in use and the acidity level within the system.
5. **DO NOT** top-up a system that is short of refrigerant before examining for oil traces and leakages.
6. **DO NOT** recharge a refrigeration system if there are any doubts about its pressure integrity.

7. DO NOT open the refrigerant side of a system unless absolutely necessary. Prior to opening, isolate the component to be serviced and recover the refrigerant.
8. DO NOT use CFC or HCFC as a tracer gas for leak testing.
9. DO NOT operate a system known to have leaks without establishing and rectifying the source of the leakage.
10. NEVER attempt to use a cylinder that is rusting or in an otherwise deteriorated condition.
11. NEVER leave any empty refillable or returnable cylinder open to the atmosphere because moisture may enter the apparatus and result in rapid internal rusting.
12. NEVER use any flushing liquid other than what is recommended for the system.
13. DO NOT flush the entire system with the power flushing equipment attached to the service ports.
14. ALWAYS be cautious when using flammable refrigerants in any air-conditioning system.
15. NEVER mix lubricants in a system.
16. NEVER overcharge a system with lubricant.

SECTION 4

4.1 Inspection and Preventative Maintenance

1. **Inspection principle** – Regular inspections must be done on refrigerant systems to monitor the reliability and continued efficiency of the equipment. Inspection for leaks and emissions must be a priority. For smaller systems, regular examination of obvious elements by the user can be very effective in preventing future problems.
2. **Preventative maintenance** – This is key to reducing refrigerant emissions into the atmosphere after installations and conversions. There are many benefits to the owner of the equipment by initiating a preventative maintenance program on a regular basis. Therefore, every owner or manager of any refrigerant system must adopt a preventative maintenance program and schedule for submission to the environmental authorities annually or as deemed necessary.
3. **Documentation and Data** – History of the equipment must be kept until the equipment is decommissioned. (see section 5)

4.2 Guidelines of Practices for Inspection and Preventative Maintenance

1. Draw up a preventative maintenance scheme and leak testing routine to ensure logical and sequential examination and serving of the system.
2. Follow the manufacturers' instructions for preventative maintenance.
3. Inspect the system for leakages or damages.
4. Only the refrigerant that is specified for the system should be used for leak checking.
5. Refrigerant that is used for leak checking must be recovered and should not release into the atmosphere.
6. Valves should be periodically examined; especially the relief valve.
7. Inspect the system for signs of abnormal vibration.
8. Monitor operating conditions and performance on a regular basis.
9. Run oil pumps weekly to ensure the lubrication of the mechanical seal faces, bearings and glands during periods of system shutdown. If this practice has not been followed, inspect and lubricate the items before starting the system.
10. Replace and tighten the seal caps on all valves.

11. Follow established leak-testing procedures, such as standard vacuum test. Use approved leak testing tools and equipment.
12. Use vacuum pump with clean pump oil.
13. Use non-ODS gas as a tracer when leak-testing, e.g. dry nitrogen.
14. Where possible, install permanent leak detection system with sensors at vulnerable locations.
15. Obtain professional advice when any abnormal condition is observed.
16. Record the results of preventative inspections to alert the owners and operators to the action taken and the future requirements.
17. Test cylinders for leaks at least at five-year intervals, especially recovery cylinders.

4.3 Practices to Eliminate

1. NEVER remove or deface the 'warning label' on refrigeration equipment or cylinders that cautions the user against physical contact or exposure to the refrigerant.
2. NEVER use a cylinder with a fault pressure-relief valve or with obvious structural impairments.

SECTION 5

5.1 Record Keeping and Documentation

1. **Record keeping principle** – Accurate records of refrigerant recovered, recycled and/or stored, including the type and quantity must be kept. All refrigerant cylinders including refrigerant systems must also be properly labeled as to the content and weight.
2. **Documentation** – The information recorded will depend on the size, type and application of the refrigeration system. For domestic refrigerators, operational parameters and performance indicators may not be available, but basic data concerning the equipment and its supplier should be recorded. The type and charge of refrigerant and the repair and servicing operations should be included.

5.2 Guidelines of Practice for Record Keeping and Documentation

1. Maintain a service book and manual accessible to service technicians. This should be kept in close proximity to the refrigeration systems being worked on.
2. Record the loss, recovery and consumption of refrigerant for each type of refrigerant at company level if your company operates numerous refrigeration systems.
3. Record the loss, recovery and consumption for each type of refrigerant and each customer, as well as the purchase and recycling data, if your company is in the service or disposal business.
4. Certify the purchase of R&R (Recovery and Recycling) equipment to the relevant government institutions if required.
5. Advise the owner of a company to maintain a refrigerant-use book for all refrigeration systems specifying the overall consumption of refrigerants.
6. Keep a copy of all records in a safe place and store them for the appropriate time period. A minimum of three years is recommended.
7. Any person who owns approved refrigerant recycling equipment certified for any refrigeration and air conditioning system **MUST** maintain records of the name and address of any facility to which the refrigerant is sent. Information on recovery, recycling or disposal of refrigerant should be provided to the National Ozone Unit annually.

8. Any person who owns approved refrigerant-recycling equipment **MUST** retain records demonstrating that all persons authorized to operate the equipment are certified by the relevant training institutions.
9. Any person who sells or distributes ODS refrigerants must verify that the purchaser is properly trained.
10. The seller **MUST** have a reasonable basis for believing that the information presented by the purchaser is accurate. A certified ID must be shown

ALL RECORDS MUST be maintained for at least 3 years

Entities that service air-conditioning and refrigeration systems **MUST** keep the records on-site and **MUST** allow a representative of the Ministry with responsibility for the Environment to access all required records. Where applicable, the following must be recorded:

1. Retrofitting Data
2. Refrigerant-Use Data
3. Technical and Design Data
4. User Specific Data
5. Manufacturer's instructions for safe service and maintenance.

SECTION 6

6.1 Recovery, Recycling and Reclamation

1. **Recovery Principle** – Most refrigerants are stable chemical substances and will therefore have very long lifespans. Apart from environmental impacts due to the emission of these gases, it will be of economic interest for the gases to be removed, recycled and re-used as much as possible. The service technician must be aware of acceptable methods of recovering refrigerants.
2. **Recycling** – Ensure that the recycling equipment is intended for the type of refrigerant being processed. Service organizations or service technicians must ensure that any recycled refrigerant is of the quality that meets appropriate industry standards of purity and an approved recycling machine must be used to recycle refrigerants.
3. **Reclamation** – This process involves the chemical purification of contaminated refrigerants

6.2 Guidelines of Practice for Recovery, Recycling and Reclamation

1. **All refrigerants must be recovered** during service and maintenance as well as at decommissioning for reuse, recycling, reclamation or final disposal and destruction.
2. Use certified (recovery and recycling) R&R equipment that meets relevant specifications
3. Recycling equipment **MUST** be able to separate lubricant from recovered refrigerant.
4. Recovered contaminated refrigerant must be appropriately stored for final destruction, as guided by the NOU.
5. The equipment should have an 80% shut-off device and a mechanical pressure-relief valve.
6. Use recovery cylinders or recovery bags as temporary receivers for very small systems where permanent liquid receivers are not installed.
7. Use purge compressors and portable evacuation devices to recover refrigerant from refrigerant drums and cylinders.

8. All refrigerant R&R devices are to be used and maintained only by trained refrigeration technicians in accordance with the manufacturers' instructions.
9. Determine the amount of lubricant removed during the refrigerant removal process and add new lubricant.
10. Discard lubricants. NEVER reuse lubricants.
11. High, low and center-service hoses should have shut-off valves within 12 inches (30cm) of their service ends.
12. These valves MUST be closed prior to removal of the hose from the air conditioning system. This will reduce the volume of refrigerant that would otherwise be vented into the atmosphere.
13. During, all service operations, the valves should be closed until connected to the system or the charging source, to avoid introduction of air and to contain the refrigerant.
14. When the service manifold gauge set is disconnected from the system or when the center-hose is moved to another device that cannot accept refrigerant pressure, the gauge set hoses should first be attached to the recovery equipment to recover the refrigerant from the hoses.

6.3 Practices to Eliminate

1. NEVER trap liquid refrigerant in a hose for too long.
2. DO NOT use the recovery unit if no pressure is present in the system.
3. Never heat the refrigerant line with an open flame.

SECTION 7

7.1 Handling and Storage of Refrigerants

1. **Handling refrigerants** – Refrigerants are gases that are useful in refrigeration and air conditioning systems are extremely dangerous outside of them. They require careful handling and safe storage facilities.
2. **Storage of refrigerants** – Refrigerants must be stored in a ventilated area and must be stored in accordance to the manufacturer's specifications. Every organization or user of refrigerant must adhere to safety procedures set by the Ministry with responsibility for the Environment.

7.2 Guidelines of Practice Handling and Storage of Refrigerants

1. Follow industry recommended procedures and use approved equipment for handling and storing refrigerants.
2. Use closed-loop refrigerant transfer equipment when removing, charging and storing refrigerants.
3. Any portable container used from the transfer of reclaimed or recycled refrigerants MUST meet certification standards.
4. Control safe cylinder filling levels by measured weights. Liquid net weights must not exceed 80% of the cylinder's internal volume.
5. Transfer refrigerant to another container by using a pump or by establishing a pressure difference between the containers.
6. Cool refrigerant cylinders to the ambient temperature prior to use.
7. Store refrigerants in a manner conducive to refrigerant conservation during periods of system shutdown.

8. Request permission to use third-party containers as temporary receivers. Contaminated refrigerants may cause corrosion.
9. Store refrigerant cylinders upright and secure in a ventilated area away from direct heat. Maximum exposure temperature is 50°C (degrees Celsius).
10. Inspect stored cylinder containing refrigerants for leaking glands and defective gaskets on the cap. Observe local regulations on handling, transport and storage of virgin, recovered, contaminated or recycled refrigerants.
11. Always utilize a marked 'CLEAN' recovery tank from recycled refrigerant and a marked 'DIRTY' recovery tank for recovered, but not for recycled refrigerant.
12. Check refrigerant cylinders for non-condensable vapour prior to use. (Note: cylinder must stand for approximately six (6) hours prior to examination).

7.3 Practices to Eliminate

1. DO NOT vent refrigerant in atmosphere.
2. DO NOT dispose of any refrigerant and refrigeration system by using methods other than R&R, reclaim, reuse, adequate storage or destruction.
3. DO NOT exceed the designated maximum working pressure shown on the refrigerant cylinder.
4. DO NOT mix refrigerants. In many cases reclamation by specialists will not be possible and destruction is the only alternative.
5. DO NOT connect refrigerant containers to systems or other containers at a higher pressure, temperature or height, because back flow of the refrigerants may result in overfilled and liquid-filled containers with a subsequent danger or bursting.
6. DO NOT heat refrigerant cylinders by flame, radiant heaters or direct contact heaters in order to drive refrigerant into another vessel.
7. DO NOT drop a cylinder. This may lead to valve or valve thread damage. Warning should be clearly shown in storage areas.
8. DO NOT cool down receiving refrigerant cylinder by venting refrigerant into the atmosphere in order to transfer the refrigerant.
9. DO NOT fill refrigerant cylinders with mixtures of refrigerant and oil.

SECTION 8

8.1 National Guidelines for Disposal of ODS Refrigerants and Systems

1. Advise owners of refrigeration systems with major leaks, pipe fractures, compressor breakdown or burnt out motor, whether or not repair of the system is economically feasible.
2. Remove and recover all refrigerant and oil from systems that are to be decommissioned, scrapped or dismantled.
3. Dispose of contaminated or mixed end-of-life refrigerant in a manner that is in accordance with the guidelines of the Montreal Protocol by either recovery, recycling or incineration by an approved method for that type of refrigerant.
4. Recovered gas should be stored in approved recovery cylinders bearing yellow and grey colour scheme as outlined in the national standard on labelling of refrigerant containers
5. Store and transport empty cylinders in dry environments.
6. Observe national regulations concerning the collection, transport, storage and destruction of hazardous waste; contact refrigerant suppliers, refrigeration associations or appropriate government institutions for guidance.
7. Empty and properly discard contents of cylinders exhibiting extreme rust.

8. At the disposal facility, the empty disposal cylinder valve should be rendered useless (with the valve still open) by breaking off the valve or puncturing the container. This will avoid misuse of the container by untrained individuals.
9. NEVER leave used cylinders with the residual refrigerant outdoors where the cylinder can rust. The internal pressure of a cylinder with one ounce of liquid refrigerant is exactly the same as a full cylinder. An abandoned cylinder will eventually deteriorate and potentially explode if the cylinder wall weakens.

SECTION 9

9.1 Retrofitting and Alternatives

Retrofitting is often expensive and not economically advisable to dispose of some systems because of ODSs. It is therefore advisable to fit the new or alternative gases into the old systems. Retrofitting to alternative refrigerant should be considered when replacement of the existing system is not economical.

9.2 National Guidelines for Retrofitting and Alternatives

1. Consider the expected energy efficiency, performance and operating cost of the retrofitted system in addition to the direct cost of retrofitting.
2. Consider the properties of the alternative refrigerant, such as flammability, toxicity and its global warming potential, as some of these properties may imply additional safety measures.
3. Consider retrofitting when major damage of the existing system requires expensive repair work.
4. Consult the system manufacturer for the appropriate alternative refrigerant/lubricant and the necessary replacement of system components such as compressor, filter-driers etc.
5. Consult the system manufacturer for the appropriate retrofitting procedure that is in general equipment specific.
6. Investigate the operating parameters and the performance data of the existing system before retrofitting
7. Investigate the operating parameters and the performance data of the system and control settings after completion of the retrofitting procedure.
8. When a system is retrofitted, the technician must apply detailed labels, giving specific information about the new refrigerant (see appendix 7).
9. The label's background colour is unique to the refrigerant manufacturer.
10. The label for the old refrigerant MUST be covered or removed.
11. Record the retrofitting procedure in the Service Logbook (see appendix 7).
12. ALWAYS follow the original equipment manufacturer's recommendations to avoid injury and loss of coverage under the warranty.
13. ALWAYS use the retrofit refrigerant that has been recommended by the original system manufacturer.
14. When retrofitting a system, re-label indicating the new refrigerant in the system, and affix new fittings that are unique to the new refrigerant. All re-labelling must be done in accordance with labelling requirements as prescribed by the Trinidad and Tobago Bureau of Standards.
15. One of the most important system changes is the lubricant, which when used in a system, should ALWAYS be identified on the unit. This is to avoid potential lubricant incompatibilities.

16. Cracked or damaged hoses should ALWAYS be replaced with new barrier hoses.
17. Compressor shut-off switches in some systems have pressure relief devices that automatically release refrigerant to the atmosphere. To use a new refrigerant; the technician MUST also install a high pressure shut-off switch. This switch will prevent the compressor from increasing the pressure to the point where the refrigerant is vented.
18. Whether the system is new or retrofitted, the service technician MUST use only the equipment manufacturer's specified lubricant package, or recommended alternative.

9.3 Practices to Eliminate

1. DO NOT substitute refrigerants with drop-in alternatives without consulting the system manufacturer.
2. NEVER attempt to put any replacement refrigerant into an existing system without first investigating compatibility and retrofitting the system as required.

SECTION 10

10.1 Safety Requirements

All engineering work requires a great measure of safety to prevent equipment damage, personnel injuries and loss of life. Whatever you do, think, "**Safety First**". This can never be over-emphasized.

10.2 National Guidelines for Safety Requirements

1. Always read and follow system manufacturer recommendations for installation requirements
2. Ensure system is installed in a location for ease of serviceability
3. Use pressure relief valves to protect equipment from exceeding the maximum working pressure.
4. Use dual-relief valves with change-over devices to facilitate the repair or replacement of pressure-relief valves without impairing plant protection.
5. Ensure the maximum working pressure is not exceeded when combining a bursting disc and a pressure relief valve to prevent any restriction to the inlet of the relief valve in the event of a bursting disc rupture.
6. Avoid the trapping of liquid refrigerant between two points of a system when not protected by a pressure relief valve for example a bypass check valve, to lower vapor pressure side of the system.
7. Install alarm systems to warn of excessive machine pressure during shutdown.
8. Use specific colours as prescribed by the American Society of Heating, Refrigerating and Air-Conditioning Engineers for containers of different refrigeration types
9. Comply with mandatory safety precautions from systems retrofitted with or using alternative refrigerants, such as hydrocarbons or ammonia. These might be flammable or toxic.
10. Properly label all cylinders using country-approved hazard label where applicable.
11. Use proper protective caps over cylinder valves to prevent damage to the valve on top of the cylinder.
12. Always read your recovery equipment operator's manual before using equipment.
13. Always read the product label and the product safety data sheet.
14. Use only approved refillable storage cylinder.

15. Take proper safety precaution when using all AC equipment.
16. Exercise extreme caution when working with refrigerants. The hoses may contain liquid refrigerant under high pressure.
17. The sale of refrigerants is restricted only to people certified by the relevant body.
18. When handling refrigerants, wear side-shield safety glasses, impervious gloves and other protective equipment or clothing.
19. Ensure that shower and eye wash fountains of the deluge type are readily accessible in case of refrigerant contact with the skin or eye.
20. Store auxiliary breathing apparatus in readily accessible areas in case an abnormally high concentration of refrigerant vapor should develop in the storage, handling or production areas.
21. As with any chemical, if a spill occurs, clear the area immediately and only return wearing an approved respirator and other personal protective equipment.
22. Before using or handling any refrigerant, personnel should be familiar with safety requirements for the specific product.
23. Good ventilation of at least four (4) air changes per hour must be provided in areas where high concentrations of the heavy vapours can accumulate and exclude oxygen. The vapours are several times heavier than air.
24. Prolonged inhalation of refrigerant is extremely dangerous and can cause death.
25. Take care not to dent, cut or scratch cylinders or valves which are not known to be empty of liquid and vapour.
26. Protect cylinder from moisture, salt or corrosive chemicals.
27. Always open the valves slowly and close after each use.

10.3 Practices to Eliminate

1. NEVER use any equipment if you do not understand its operation
2. DO NOT exceed the manufacturer's recommended pressure or system strength test pressure when leak testing.
3. DO NOT overfill refrigerant containers, tanks, drums, recovery units, receivers etc.
4. DO NOT refill disposable cylinders.
5. DO NOT use open flame on any refrigerant system that has not been properly evacuated for servicing.
6. DO NOT service refrigeration systems unless wearing protective clothing, including goggles and gloves.
7. DO NOT attempt to service equipment unless fully trained in the safe handling of refrigerants.
8. DO NOT work with refrigerants in a confined space lacking ventilation.
9. DO NOT blow off a piping system with air or oxygen to remove welding brazing or cutting debris. This may cause contamination and possible explosion. ONLY dry nitrogen should be used for this task.
10. DO NOT pressurize refrigeration or piping systems with air or oxygen.
11. NEVER leave any refrigerant recovery or recovery-recycling machine ON and unsupervised.
12. NEVER overfill any storage cylinder beyond its rated capacity.
13. NEVER drop the cylinder or hit it with a hammer or any other object.
14. NEVER apply live steam or direct flame to the cylinder.
15. NEVER lift a cylinder by the valve cover or valve.
16. NEVER remove the valve from a cylinder or attempt to repair it.

17. NEVER operate where flammable vapour is present.
18. NEVER attempt to fill any vessels, containers, cylinders, charging equipment or storage tanks that are not approved or equipped with a safety-vent valve.
19. NEVER use the recovery unit in the vicinity of spilled or open containers of gasoline, thinners or any other flammable liquid or vapor, unless your equipment is expressly designed (explosion-proof designs) for such environments.
20. DO NOT transfer refrigerant to non-refillable cylinders.
21. DO NOT tamper with the safety device.
22. NEVER refill disposable cylinder.
23. DO NOT fill any storage tank or vessel with refrigerant beyond 80% of its capacity.

SECTION 11

11.1 Training and Certification

Knowledge is power and acquiring it brings perfection in carrying out daily activities. Ensure that any National or Professional Certification is obtained.

11.2 National Guidelines for Training and Certification

1. Be aware of certification requirements for service technicians and encourage participation in such training and certification schemes.
2. Be aware of certification requirements for R&R equipment and purchase and use only certified equipment.
3. Inform customers about certification requirements and advantages of contracting with certified service technicians. Once this is established, only persons properly trained and certified may repair or service any air conditioning or refrigeration systems or perform any service on any system involving refrigerants.

SECTION 12

12.1 Regulatory Framework

Effective communication brings proper information and the awareness thereof improves positive statements.

12.2 National Guidelines

1. Be informed about regulatory requirements for the installation, servicing operations and decommissioning of refrigeration system if any.
2. Be informed about regulatory requirements concerning transport, handling, storage, import and export of refrigerant, refrigeration equipment and R&R equipment and the disposal and destruction of refrigerants.
3. Be informed about regulatory requirements concerning record-keeping and documentation if any.
4. Be informed about the certification procedures for refrigeration and R&R equipment, as well as service workshops and technicians. The training or certification of service technicians and other persons handling refrigerants will become compulsory for the purchase of refrigerants.
5. Be informed about the economic incentives or penalties that may influence the viability of technological options.

6. Be informed about the legal status of national and international standards and specifications for refrigeration and R&R equipment, labelling and guidelines of good servicing practice. Such guidelines may exist on a voluntary or a legally binding basis.
7. Be informed about enforcement measures, such as penalties, fines or withdrawal of operating or servicing permits in cases of non-compliance if any.
8. Inform customers of regulatory obligation and the associated risks of non-compliance if any.

13.0 FURTHER INFORMATION

Frequently Asked Questions

What are ozone depleting substances?

Certain chemicals are recognized as ozone-depleting substances (ODS) because they release chlorine or bromine atoms which destroy the stratospheric ozone. Most ODS are also greenhouse gases.

What are chlorofluorocarbons and hydrochlorofluorocarbons?

Chlorofluorocarbons (CFCs) and hydrochlorofluorocarbons (HCFCs) are the most well-known ozone depleting substances. CFCs and HCFCs are a family of long-lasting synthetic chemicals developed as a substitute for ammonia in refrigerators and air conditioners. They have also been used as blowing agents in foam product manufacturing, as cleaning solvents for electrical components, in aerosol sprays, and in hospital sterilization procedures.

What are ozone depleting substances used for?

The most common uses of ozone depleting substances are as refrigerants in commercial, home and vehicle air conditioners and refrigerators, foam blowing agents, solvents, aerosol spray propellants, fire extinguishing agents and chemical reactants.

How does ozone depletion happen?

The ozone depletion process begins when chlorofluorocarbons (CFCs) and other ozone-depleting substances (ODS) leak from equipment (1). Winds efficiently mix the troposphere and evenly distribute the gases. CFCs and HCFCs are extremely stable, and do not dissolve in rain. After a period of several years, ODS molecules reach the stratosphere, about 10 kilometres above the Earth's surface (2). Strong ultra-violet (UV) light breaks apart the ODS molecule. CFCs and HCFCs release chlorine atoms, and halons release bromine atoms (3). It is these atoms that actually destroy ozone. It is estimated that one chlorine atom can destroy over 100,000 ozone atoms before finally being removed from the stratosphere (4). Large increases in stratospheric chlorine and bromine remove ozone faster than natural ozone creation reactions can keep up. Therefore, ozone levels fall.

What is the effect of ozone layer depletion?

Since ozone filters out harmful UVB radiation, less ozone means higher UVB levels at the surface. As depletion increases, more UVB (5) enters the earth's atmosphere. UVB has been linked to

skin cancer, cataracts, damage to materials like plastics, and harm to certain crops and marine organisms. Although some UVB reaches the surface even without ozone depletion, its harmful effects will increase as a result of this problem (6).

Prohibited ODS Based Equipment and Substances

Prohibited Import of ODS and associated blends

Since January 2008

- Chlorofluorocarbons (CFC)
- Carbon Tetrachloride
- Halon

Since January 2013

- Hydrochlorofluorocarbons (HCFC) is allowed for import under a quota system only to registered quota holders with the Ministry responsible for Trade and the National Ozone Unit.

Since January 2015

- Methyl Bromide (for non-quarantine and pre shipment)

Prohibited Import of Equipment using ODS or associated blends

Since January 2008

CFC based equipment have been banned from import

Since January 2015

All assembled HCFC equipment have been banned from import

It is to be noted that import and export of all refrigerant and equipment and parts require a license.

14.0 REFERENCES

Koppen, Halvart. 1998. Guidebook for Implementation of Codes of Good Practice_ Phasing out ODS in Developing Countries, Paris: United Nations Environment Programme.

National Ozone Unit Blog site: <http://nou-tt.blogspot.com/>