

RESPONSIBLE USE GUIDE FOR MINIMIZING
FLUOROCARBON EMISSIONS IN
MANUFACTURING FACILITIES



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The practices listed in this guide are based on a survey of the industry's plant facilities. The survey, sent to members of the Air-Conditioning and Refrigeration Institute (ARI), included not only HVACR equipment manufacturers but also refrigerant manufacturers. This guide relates specifically to fluorocarbons.

Preface and Scope

The heating, ventilation, air-conditioning and refrigeration (HVACR) industry is committed to providing conditioned warm and cool air and refrigeration to improve the world's quality of life, health and productivity. The HVACR industry believes that a clean environment promotes well-being, and it is committed to carrying out its business in an environmentally beneficial fashion. This includes the responsible use of refrigerants, especially fluorocarbons, which allow HVACR equipment to fulfill its important roles.

The HVACR industry has a proud history of environmentally responsible use of refrigerants and it continues to improve an already good record handling refrigerants. For example, responses to an industry survey showed that in the last ten years the industry's expenditures to control refrigerant emissions beyond controls in place a decade ago are paying off. Already, over 50 percent of the responders have built facilities with a zero emission goal and over 70 percent of the responders have reduced emissions between 25 and 75 percent.

The manufacturing practices for residential and commercial equipment listed in this publication should be practiced in every HVACR or related facility where refrigerants are either produced, used, stored or transported. They are aimed at containing refrigerant emissions and environmental protection. These practices are intended to be used, and are most successfully used, as part of a comprehensive program which includes preventative maintenance, training, leak detection and testing, recovery and reclamation and design changes.

Section 1: *Refrigerant Recovery*

Refrigerant recovery is any process which recovers, reclaims, reuses or properly disposes of refrigerants.

- Recovery equipment should be available to all qualified (licensed, certified, or otherwise qualified) personnel in both manufacturing and testing laboratories
- All personnel using recovery equipment should be properly trained on equipment and applicable refrigerants.
- Recovered refrigerant should be either recycled, reclaimed or destroyed and appropriate records kept.

Section 2: *Process Piping Emissions*

Process piping includes the equipment manufacturers' pipes, valves, and pumps used for refrigerant processing within their facilities.

- All process and storage lines should be brazed or welded, where possible.
- All mechanical joints, piping, flanges, valves and pumps should be monitored for refrigerant leaks.
- Low emitting valves should be specified. Seal cap valves should be used where appropriate.
- Isolation valves should be located close to disconnect points. All connection points, metering points, electronic controls and pump connections should be monitored for leaks.
- Refrigerant recovery should be provided during refrigerant sampling.
- Refrigerant emissions should be minimized during start-ups or testing.

- All equipment and any lines should be emptied of refrigerant, without creating emissions, during scheduled/routine maintenance using recovery and/or disposal lines.
- All instrumentation should be calibrated routinely and per established procedures before filling new HVACR systems. Systems must be evacuated before filling.

Section 3: *Waste Handling*

Waste handling is the recovery, collection, and disposal of wastes (solid, liquid or gas) containing fluorocarbons.

- Refrigerants should be recovered during waste handling.
- Waste control device performance should be monitored.
- Any wastes containing refrigerants should be properly disposed.

Section 4: *Storage*

This applies to the storage of refrigerants in either bulk tanks or cylinders in the manufacturing facility.

All refrigerants must be stored in pressure vessels which comply with any applicable national, state and local laws and regulations.

Section 5: *Equipment Shipment and Transportation*

This applies to the relocation of finished equipment from manufacturing facilities to installation or warehousing sites.

- All assembled non pre-refrigerant charged equipment should be shipped with inert gas to ensure system integrity, where possible.
- Quality assurance tracking should be provided for all field reported holding charge and refrigerant charge leaks, Resulting data should be analyzed and design, manufacturing or transportation corrective actions should be implemented.
- An internal quality assurance process to document, investigate, monitor and follow-up on all field reported instances of systems leaks for both refrigerant charge and holding charge should be provided... A corrective action plan should be assessed and implemented for production solutions.
- All pre-charged equipment built as a complete operating system (high and low side) should be shipped with the design operational full refrigerant charge. The equipment data plate should be clearly marked as a fully charged system, with the weight of the system charge, with refrigerant type, and with the date of manufacture.
- All equipment should be assembled to prevent refrigerant piping and refrigerant bearing components (valves/filters) from contacting other components.
- All components in equipment which are subject to loading/unloading and/or transit vibration damage should be braced, restrained, and clamped, in compliance with appropriate shipping tests to prevent piping damage.

Section 6: *Laboratory Testing*

This applies to laboratory testing - for either chemical analysis or prototype testing of equipment.

- Laboratory testing should include simulated worst-case scenarios for operational vibration. Carefully observe for refrigerant leak areas and repair any found.
- Laboratory technicians must be trained and certified as appropriate by governmental and private organizations in the safe handling and use of applicable refrigerants.

- Laboratory test models should be assembled using a nitrogen purge for copper refrigerant piping to prevent circulation/plugging of contaminants.
- Laboratory test models should be pressurized and checked for leaks prior to evacuation and system refrigerant charging.
- Test models should be monitored to identify leaks during tests. The cause of the leak should be determined and appropriate remedial action taken.

Section 7: *Manufacturing Plant's Air Conditioning and Refrigeration Systems*

This applies to the manufacturing plant's air conditioning and refrigeration equipment.

- Install systems to minimize/prevent refrigerant leaks resulting from damaged piping. This may mean protecting or concealing piping, when practicable.
- Provide service valves and/or fittings to minimize emissions during operation, where possible.
- All systems should be installed for convenient service/maintenance and to encourage refrigerant recovery.



The Air-Conditioning and Refrigeration Institute (ARI) is the national trade association representing manufacturers of more than 90 percent of North American produced central air-conditioning and commercial refrigeration equipment.

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