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Ultra-high-pressure refrigerant recovery

By Mark Key, Redi Controls, Inc.

Recover, recycle, and reclaim were terms that were once used interchangeably in the hvacr industry. Since the late 1980s and early 90s, these words acquired specific meanings when the new system servicing procedures were mandated by EPA and Clean Air Act regulations.

Before the regulations took effect, most technicians simply released the refrigerant charge to the atmosphere and then charged the system with new refrigerant. In the early 1980s, there was a growing concern about the effect that CFCs have on the ozone layer, and laws were passed to minimize refrigerant emissions to the atmosphere.

The current regulations and increased taxation of refrigerants have made the use of these older techniques illegal and unreasonably expensive.

Today, recovering refrigerant from a refrigeration or air conditioning system involves removing the charge from the system and storing it in a container or cylinder.

The service technician should transfer the charge carefully and comply with the recovery unit manufacturer's recommended operation and service instructions. This will assist in preventing contamination of the refrigerant charge and help maintain safe conditions during the service procedure.

Testing the purity of the charge is also recommended, as well as keeping a log for each system in order to track the charge condition. This ensures that future recovery, recycling, reclaiming and charge-replacement procedures can be implemented appropriately, in order to keep the refrigeration or air conditioning system operating at peak performance.

RETURNING THE CHARGE

In some cases, the refrigerant charge can be recovered and then returned to the system after repair. The service technician then assumes liability for future system performance.

Returning the charge to a system without checking purity may lead to the returning of a contaminated charge. It is advisable to replace the charge if the system has experienced a hermetic motor burnout.

Some ultra-high-pressure refrigerant systems are charged with trace amounts of pentane, propane, methane, or similar substances. One should consider any filter-drier's ability to absorb these substances if the charge is going to be put back into the system, since the mixture percentages could change.



Figure 1. Certified hvac technician Erich Hibner makes the connection to a very-high-pressure refrigerant recovery unit.

All technicians should be familiar and aware of the EPA codes and standards for handling refrigerants and servicing equipment as required by Type I, Type II, Type III or Universal Certifications.

USE THE RIGHT MACHINE

Ultra-high-pressure refrigerants, used primarily in low-temperature systems, cascade systems, environmental chambers, and other specialty systems, have saturated pressures ranging between 250 and 700 psi at room temperature.

Cascade systems typically maintain two charge types. One side contains R-12, -22, -502, etc., and the other side typically contains the ultra-high-pressure refrigerant charge, such as R-503, -13, -23, or SUVA®-95.

Whether you are repairing an existing system or changing out the existing charge with the new, environmentally safer alternative refrigerants, the existing refrigerant will have to be properly recovered.

A recovery system specifically designed to handle ultra-high-pressure refrigerants is necessary to accomplish this. There are certain characteristics to look for when choosing this type of recovery unit.

It is important to note that these types of recovery units are

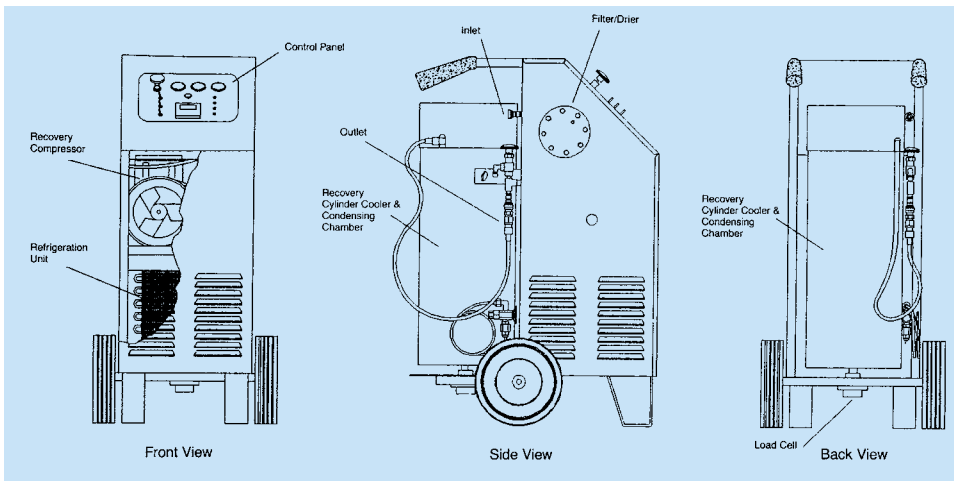


Figure 2. The first version of very-high-pressure recovery units had built-in, onboard cylinder cooling and condensing chambers.

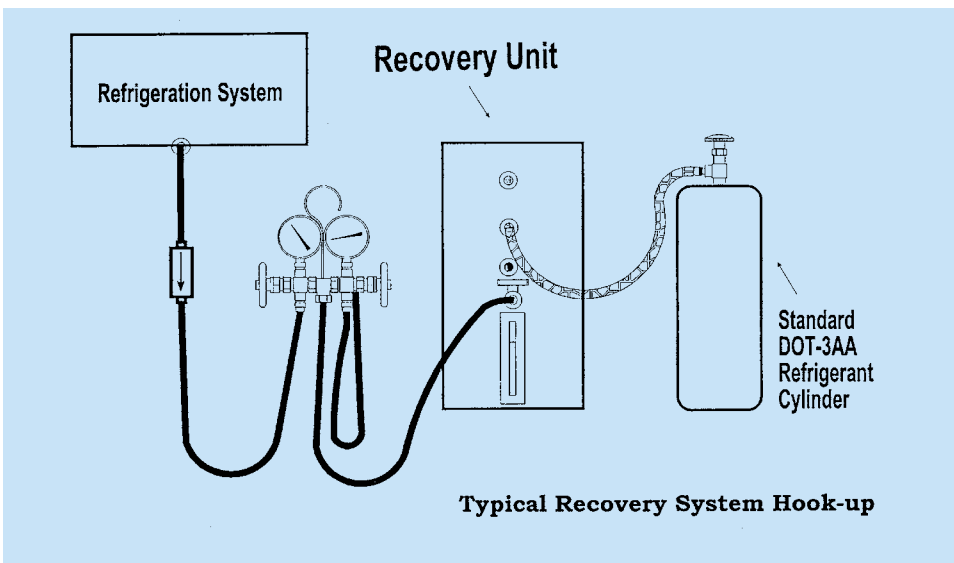


Figure 3. Today's very-high-pressure refrigerant recovery units are as portable and easy to use as standard recovery units.

Don't risk injury. Don't risk violating EPA regulations, which are associated with large fines. Don't risk damaging equipment. Don't risk losing valuable refrigerant.

often also used to recover Halon charges out of fire-suppression systems. Fire-suppression Halon systems are often found in high-tech computer operating facilities, some heavy industrial manufacturing applications, military aircraft fire-suppression systems, military armored vehicle fire-suppression systems, large hospital

complexes, pharmaceutical company facilities, various research laboratories, and other systems.

The first point to consider is the fact that an ultra-high-pressure refrigerant recovery unit must be Air-Conditioning and Refrigeration Institute (ARI) certified for use with the ultra-high-pressure

refrigerants, as required by the EPA.

It is imperative that a technician understand that recovery systems are certified for the types of refrigerants they are meant to recover. A unit certified for recovery of R-12 or -134a is not suitable for recovering R-503, -13, -23, or SUVA-95.

Using a recovery unit that is not ARI certified for the type of refrigerant being serviced is a violation of EPA regulations. Additionally, it is extremely dangerous to use a recovery unit not built to handle the higher pressures associated with the ultra-high-pressure refrigerants.

I heard of a technician who was injured when he used a system that was not designed to handle the pressures that can be associated with these types of refrigerants. The cylinder that was in the ice bath was exposed to ambient temperature.

The rapidly increasing pressure built up in the cylinder, escaped back to the recovery unit, and its internal piping was not designed to handle the excessive pressure. The unit simply overpressurized and exploded, sending shrapnel into the technician's face.

I have heard of a number of cases of severe-injury accidents when ARI-certified equipment for R-12 recovery was used to recover the very-high-pressure refrigerant R-503. It is important to note that manufacturers will not warranty units that are not used within their stated guidelines. Manufacturers develop these guidelines for the safety of the operators.

Don't risk injury. Don't risk violating EPA regulations, which are associated with large fines. Don't risk damaging equipment. Don't risk losing valuable refrigerant.

FASTER, EASIER, BETTER

When these EPA regulations first appeared, system operators used the inefficient method of dry ice baths to attempt to recover these ultra-high-pressure refrigerants.

The first series of very-high-pressure refrigerant recovery units had onboard cylinder cooling chambers. The cool-down process took a significant amount of time, and the units were quite large.

Today these methods are obsolete, since the current technology in recovery units provides portable machines capable of pumping against the high pressures created by the refrigerant as it is collected in the recovery cylinder.

Recovery unit features

Additional important features and benefits to consider are:

- ✓ Units must be capable of recovering to atmospheric pressure as required by EPA (ARI certification implies this capability). A unit that can recover to 25 in. Hg minimizes the amount of refrigerant that can be left in the system being evacuated.
- ✓ The recovery unit should not be sensitive to ambient temperatures. The unit should be capable of recovering into standard, seamless steel DOT-3AA cylinders (designed specifically for use with very-high-pressure refrigerants).
- ✓ The unit should operate on standard 120 vac if it is intended for use in different areas and jobsites.
- ✓ Consider the unit's portability. Can the unit be easily transported from one facility to the next?
- ✓ What hoses and other devices are required to perform the recovery process on ultra-high-pressure refrigerants, and do these options come with the unit? Note: Standard manifold gauges are used to connect from the refrigeration system to the recovery unit (refrigeration system should be shut down, not operating). Steel hoses must be used to transfer the refrigerant from the recovery system into the storage cylinder;
- ✓ Is the unit Year 2000 (Y2K) compliant? If the unit has a microprocessor board, or if it uses a timing chip, you may want to find out.
- ✓ How is the technical service? The manufacturer should be able to support technical calls with trained technicians and engineers familiar with their recovery systems. (I would suggest calling the manufacturer to determine their ability to assist with technical questions prior to purchasing the recovery unit.)
- ✓ The system must be ARI certified for these veryhigh-pressure refrigerant applications. It is not safe, and it is a violation of EPA guidelines, to use a recovery unit that is not ARI certified for operation with the type of refrigerant being recovered.
- ✓ Finally, can the recovery unit be used to recover refrigerant from both sides of the machine?

The elimination of the dry ice bath also eliminates the potential of dry ice burns and other dangers associated with using dry ice in confined spaces.

Dry ice baths were also inefficient, since a large number of cylinders were required in order to evacuate the machine to the appropriate vacuum level required by EPA (each cylinder holding a very small amount of the charge), which also took a significant amount of time to transfer the charge to a large number of cylinders.

Also eliminated is the time needed to precool the cylinder and the need to monitor and keep the cylinder at a constant temperature.

Since ultra-high-pressure systems range in refrigerant charge capacities, it is important to note the size of the charge being recovered. System charge sizes range from a few ounces to several-hundred pounds, an important factor to consider when selecting this type of recovery unit.

The transfer rate of the recovery system is important for larger charges. The internal piping of the system should be minimized in order to minimize or eliminate the amount of the charge that may be left

in this area.

(For more features to consider in the purchase of a recovery unit, see accompanying article to the right.)

EXPENSIVE PROPOSITION

Very-high-pressure refrigerant recovery has a significant amount of cost involved. The refrigerant is extremely expensive when compared to other refrigerants.

The equipment using these refrigerants is typically specialty, extremely low- and high-temperature systems, which are fairly expensive. The technicians who work on these systems are highly trained and this is a valuable asset.

The recovery equipment must be specially designed in order to handle high-pressure refrigerants and must obtain ARI certification requirements; thus, they are more expensive than more basic recycle-recovery units.

It is important to note that there is a significant amount of investment involved in the refrigerant, refrigeration system, and personnel, so take the time to consider your options when selecting very-high-pressure recovery units.

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Very High Pressure Refrigerant Recovery System

for R-503, R-13, R-23, R-13B1 & SUVA-95



- Portable
- 100% Recovery
- Microprocessor Controlled
- Fully Automatic
- Only 110 lbs
- 120V
- ARI Certified
- Dimensions:
 - Height: 21"
 - Width: 13"
 - Depth: 21"

Special Features:

- Designed to recover very high pressure refrigerants used in cascade systems and environmental test chambers
- Will fill any size high pressure refrigerant cylinder to specified capacity without aid of additional equipment, such as large air compressor, auxiliary refrigerant chamber, or dry ice bath.

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Company Profile

Redi Controls manufactures equipment used with:

- Industrial Process Cooling Chillers • Commercial & Industrial HVACR Chillers • Cascade Systems & Environmental Test Chambers.

OUR SPECIALTIES:

- Oil, Acid & Moisture Removal from Chiller's Refrigerant Charge • Oil Separation & Refrigerant Cleaning from Chiller's Refrigerant • Purgers for Both Low- and High-Pressure Chillers • Safety Relief Valves for Low-Pressure Chillers • Refrigerant Recovery & Reclamation Equipment • Chiller Controllers • Refrigerant-Monitoring Equipment • Additional New Products Coming Soon!

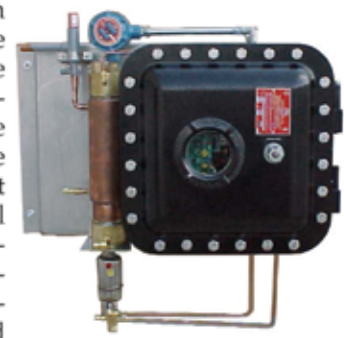
"OAM-Purger™" is a revolutionary new patented system designed to remove oil, acid and moisture from a chiller's refrigerant charge (removing oil and automatically returning it to chiller's oil sump where it belongs). Oil finds its way into the evaporator (regular operation oil migration occurs, running low capacity/low load leads to low lift and thus increased oil migration) where it degrades system efficiency and capacity. The evaporator tubes become coated with oil, and heat transfer is retarded which drastically reduces cooling effect and significantly increases energy consumption. The OAM-Purger regains chiller capacity and saves thousands of dollars per year in energy savings (paying for itself). The OAM-Purger is an environmentally conscious product as it also increases the life of the refrigerant and oil charge by keeping them clean of acid and moisture while assisting in decreasing fossil fuel consumption (decreased pollutants) as it saves energy. Contact us for OAM-Purger models for various system applications (low- and high-pressure centrifugal chillers, high-pressure screw chillers, other systems with liquid-filled receivers and more).



"Redi-Purge™" series of ultra high-efficiency noncondensable purges for low-pressure chiller (R-11, 113, 114 & 123) and high-pressure chiller (R-12, 22, 134a, etc.) system applications. Models for commercial and industrial applications are available (including units for hazardous area applications requiring ATEX Certification). "Redi-Purge™" Portable Service Purge units for low- and high-pressure refrigerant applications are also available.



Refrigerant Containment: "RuptureSeal™" backup safety relief valves for low-pressure centrifugal chiller applications minimize refrigerant loss due to chiller overpressurization and burst rupture disks. RS series can be installed over the existing carbon rupture disk and installed while the chiller is running. NRS series comes with a reverse buckling metal nonfragmenting rupture disk. **SavAll™ & SavAll-II™** refrigerant charge protection systems for centrifugal chillers (all refrigerants) prevent catastrophic refrigerant loss due to chiller overpressurization. These products save thousands of dollars in valuable refrigerant and protect the environment.



"Refrigerant Mizer™" is an ARI-certified very-high-pressure refrigerant recovery system for (R-503, 13, 23, 508B, Suva-95, etc.) cascade system and environmental chamber refrigerant recovery applications.

More products available!!!



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Refer to our **NEW UPDATED** webpage for information on Low-Pressure Chiller (R-11, R-113, R-114 & R-123), High-Pressure Chiller (R-12, R-22, R-134a, etc.) and Very High-Pressure Refrigerant (R-503, R-13, R-23, Suva95, etc.) Product applications.

