YELLOW JACKET® | VOLUME 1, ISSUE 1 UPDATE

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A Guide to Effective Refrigerant Recovery

An overview of the latest in refrigerant recovery technology includes a step-by-step guide to applying the three most commonly used recovery methods

BY RALPH A. VERGARA

Technology has changed considerably since refrigerant recovery was first required in 1987. Manufacturers of refrigerant recovery equipment have since been trying to make your life easier with an array of new products that are now on the market.

Refrigerant recovery became required in September 1987 as a result of the Montreal Protocol, an agreement between 30 nations and the United States to control the release of ozone-depleting substances, including CFCs and HCFCs.

Starting July 1,1992, section 608 of the Clean Air Act prohibited individuals from knowingly venting ozone-depleting compounds into the atmosphere. Since then all service personnel have been required to recover and recycle refrigerant, and if necessary, reclaim the refrigerant to U.S. EPA standards.

There are a few exceptions for venting refrigerant that you should know. De minimis venting, which is probably the most well-known exception, simply means refrigerant that is released in "good faith" during recovering, recycling or disposing of refrigerant. The other exceptions are as follows:

• Refrigerants that are emitted in the course of normal operation of hvac equipment (EPA does require the repair of all substantial leaks).

• Mixtures of nitrogen and R-22 that are used as holding charges or as leak test gases.

• Small releases of refrigerant that are the result of purging hoses or from disconnecting hoses after a charge or service of equipment.

Section 608 of the Clean Air Act also requires that all refrigerant recovery equipment be certified by an EPA-approved testing organization to assure that the equipment meets EPA standards. The only two EPA-approved testing organizations are Underwriters Laboratories and Intertek, which conducts testing for ARI. All certified refrigerant recovery equipment must be tested by one of these organizations.

Contact information for both of these organizations and their websites is listed at the end of this article. Both organizations offer information on approved refrigerant recovery equipment, refrigerant recovery rates and refrigerant types for which the equipment is approved.

Features in a good machine

Refrigerant recovery equipment has changed quite a bit since 1992. Recovery equipment has evolved from very complex, heavy and slow to very user-friendly, light and fast.

Most machines today use oil-less compressors rather than the hermetic compressors of the past. Oil-less compressor technology has evolved with the growth of the recovery market and offers many benefits: improved recovery rates, direct liquid recovery, elimination of oil maintenance and multiple refrigerant capabilities.

Here are some features to consider when you purchase your next recovery machine:

• **Large condenser:** Condenses refrigerant and keeps tank temperatures cool, increasing recovery rates.

• **Large fan:** Keeps compressor cool, and will increase airflow, which helps condensing in high-ambient conditions.
• **Compact size:** Makes it more portable.
• **Purge feature:** Allows for multiple refrigerant applications and eliminates cross contamination.
• **High-pressure refrigerant capabilities:** With R-410A becoming more prevalent in today's market, service technicians will be servicing more R-410A units in years to come.
• **Constant pressure regulator (CPR) valve:** Manufacturers are starting to incorporate CPR valves in equipment to automatically regulate the refrigerant flow into the equipment, which prevents costly damage due to liquid slugging of compressor.
• **Oil-less compressor:** Very reliable and eliminates compressor maintenance.
• **Warranty:** Manufacturers offer more than just a standard one-year warranty.
• **Serviceability:** Make sure that the unit is easy to work on and parts are readily available. Most units can be field serviced, which helps avoid down time.

Recovery equipment has evolved from very complex, heavy and slow to very user-friendly, light and fast.

Recovery basics

The basics of refrigerant recovery begin with having the proper equipment. You will need manifold gauges, safety glasses, gloves, a refrigerant recovery cylinder, scale, approved refrigerant recovery unit and the proper hoses (including hoses with low-loss fittings) to connect to the discharge side of your recovery equipment.

Safety is always a concern when recovering refrigerant. Always wear safety glasses and gloves to keep debris from getting into your eyes and to prevent frostbite. Never recover refrigerant near an open flame because it will decompose into phosgene gas. Breathing phosgene gas can be fatal.

When recovering refrigerant always use a scale to prevent overfilling the recovery tank. Overfilling the recovery tank can cause it to rupture and severely damage equipment, a potentially fatal situation for service technicians and others in the area.

Some recovery equipment is available with an 80 percent overfill sensor or tank overfill sensor (TOS). A TOS is a cable that will interface with a liquid-level switch on the recovery cylinder and shut off the power supply to the unit if the tank reaches 80 percent of its capacity.

Working with high-pressure refrigerants has unique safety issues. R-410A probably is the most commonly used high-pressure refrigerant today. Recovering it requires the use of different tanks, hoses, manifolds and recovery equipment.

For example, a standard 350 Department of Transportation (DOT) recovery cylinder will not work for high-pressure refrigerants. Instead, you must use a 400 DOT recovery cylinder. Unfortunately, there are no distinct markings indicating a 350 from a 400 DOT cylinder. Both are yellow on top and gray on the bottom. Always make sure to check the top of the cylinder to confirm that the cylinder is a 400 DOT.

The gauges used on a traditional manifold set do not read the level of pressures you will encounter with the high-pressure refrigerants. When working with high-pressure refrigerants, make sure you use a manifold set with a low-side gauge that reads pressures up to at least 500 psig and a high-side gauge that reads up to at least 800 psig. Make sure that you use hose assemblies that are rated by UL for high-pressure use.

When purchasing new recovery equipment look for recovery equipment that can be used on high-pressure refrigerants. They are the wave of the future, and if you are not working with them now, you will in the near future.

Refrigerant recovery methods

The three different recovery methods are: vapor recovery, which is the most common; the push-pull method; and the liquid recovery method, which is gaining in popularity.

Always remember to use a filter-dryer or particulate filter on your refrigerant recovery unit. It is also important to us an acid core dryer when recovering from a burned-out system. Acid and particulate matter will cause damage to your refrigerant recovery system. If you use the appropriate filter on every job, your refrigerant recovery equipment should give you many years of trouble-free service.

The following information describes the most common recovery configurations. Remember, your system configuration may vary. Check your operation manual to find the proper configuration for your unit.

Vapor recovery method

The following describes the 10 steps for proper use of the vapor recovery method:

Connect a hose with a low-loss fitting on both ends to the discharge side of the recovery equipment. Connect the other end of this hose to the tank liquid port on the recovery cylinder.

1. Place the recovery cylinder on a scale.
2. Connect a hose from the low-side service port of the hvac system.
3. Connect the other end of this hose to the center (charging) port of your manifold set.
4. Connect a hose to the low-side of your manifold set.
5. Connect the other end of this hose to the suction side of the recovery equipment.
6. Connect a hose from the tank vapor port to the high gauge on the manifold set. This will allow you to monitor the tank pressure.
7. Close valves on manifold set.
8. Open vapor and liquid valves on the recovery cylinder. Start the recovery system.
9. Allow unit to pull into the appropriate vacuum based on refrigerant type.
10. Close all valves and disconnect from the hvac system or begin purge cycle.

Recovery Tips From The Author

1. Always use shortest hoses possible.
2. Using 3/8" hose will greatly increase your recovery rates.
3. Remove valve cores from system when possible.
4. Use heat gun to get refrigerant to boil off.
5. Use Liquid recovery when possible.
6. When comparing performance on UL or ARI websites remember that vapor recovery is approximately 75 to 80% of the recovery process. It is very important to use a recovery machine with a high vapor recovery rate. Liquid recovery is 20-25% of the recovery process. A refrigerant unit with the ability to recover liquid will speed up the first (liquid) part of the recovery process.

Push-pull recovery method

It is not recommended to use this method unless you have first checked the system configuration of the system being serviced. Here are a few questions to ask:

- Are less than 10 pounds of refrigerant in the system?
- Is the system a heat pump or one with a reversing valve?
- Will the system allow a solid column of liquid to form?
- Does the system have an accumulator?

If the answer is yes to any of these questions, refer to either the vapor or liquid recovery methods. Otherwise, here are 10 steps to using the push-pull recovery method:

1. Connect a hose from the tank vapor port to the center port of the manifold set.
2. Connect a hose from the low side of the manifold set to the suction side of the refrigerant recovery unit.
3. Connect a low-loss hose from the discharge side of the recovery unit to the low-side service port.
4. Connect the low-loss hose from the high-side service port to the tank liquid valve.
5. Place the tank on a scale.
6. Open valves on recovery cylinder.
7. Start refrigerant recovery machine.
8. Open the low-side valve on the manifold set.
9. Monitor the scale.
10. Switch the unit over to vapor recovery once the scale stops picking up weight.

Liquid recovery method

Until recently it was unheard of to recover direct liquid. But with the use of oil-less compressors and constant pressure regulator valves, it is the preferred method of recovery by most recovery equipment manufacturers.

As you know it is impossible to compress a liquid. Oil-less recovery equipment has an internal device to flash off the refrigerant. Oil-less compressors will tolerate liquid only if metered through a device like a CPR valve. Do not attempt to use the liquid recovery method unless your unit is designed to recover liquid.

Liquid recovery is performed the same way as standard vapor recovery. The only difference is that you will connect to the high side of the system. Recovering liquid is ideal for recovering large amounts of refrigerant like refrigerant transfer or if the system you are servicing will allow you to recover liquid.

For more information on refrigerant recovery and equipment, contact UL Laboratories, 333 Pfingsten Road, Northbrook, IL 60062–2096; call 847-272-8800; fax 847-272–8129; or visit www.ul.com/refrigeration/performance.html. You also can contact the Air-Conditioning and Refrigeration Institute (ARI), 4301 N. Fairfax Drive-Suite 425, Arlington, VA 22203; call 703-524-8800; fax 703-528-3816; or visit www.ari.org.◆

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Frequently Asked Questions

1. Why should I purchase a YELLOW JACKET® Recovery System?

With the YELLOW JACKET® name on a hose, you know you've got the genuine item for performance backed by more than 50 years. Now, you'll also find the name on refrigerant recovery systems that are based on RRTI and RST proven designs. RRTI was one of the original recovery companies and helped DuPont design and manufacture its original unit. With the purchase of RST in 1998, Ritchie Engineering combined YELLOW JACKET standards of manufacturing and testing with the RST track record of tough reliability.

2. Is ARI the only testing agency?

No. ARI is only a certifying agency that hires another agency to perform the actual testing. UL is a testing and certifying agency for EPA. YELLOW JACKET Systems are UL tested for performance. Some YELLOW JACKET Systems are also tested to CUL, CE, and TUV safety standards which go beyond the ARI performance standards.

3. Can I compare systems by comparing their ARI or UL ratings?

Yes. ARI and UL test standards are the same. And remember that manufacturers can change the conditions under which they test their own machines to give the appearance of enhanced performance. Only ARI and UL test results provide consistent benchmarks and controls on which to make objective comparisons.

4. How dependable are YELLOW JACKET Refrigerant Recovery Systems?

YELLOW JACKET Recovery Systems get pushed to the limits: day-in and day-out in dirty conditions, on roof tops, and sometimes on 40°F days or high ambient temperatures. YELLOW JACKET equipment has been tested at thousands of cycles, and are backed with the experience of over 125,000 units in the field since 1992.

5. Can I service a YELLOW JACKET System in the field?

Yes and repairs are easy. Although YELLOW JACKET Systems feature either a full one or optional no-cost two year warranty, there are times when a unit will need a tune-up. The service manual with every unit includes a wide variety of information such as tips to speed recovery, troubleshooting guides, and parts listings. On the side of every unit, you'll find hook-up instructions, a quick start guide, and simple tips for troubleshooting. And if ever in doubt, just call 1-800-769-8370, Ext. 216.

All service and repair parts are readily available through your nearest YELLOW JACKET wholesaler.

6. Are there any recovery systems certified for R-410A?

ARI 740-98 has been written but not yet enacted by the EPA. The YELLOW JACKET R70a series has been UL tested and certified for high-pressure gases such as R-410A that are covered under ARI 740-98.

7. What features should I demand in a system to be used for R-410A?

Look for the following three features as a minimum:

A) High volume air flow through an oversized condenser to keep the unit running cooler and help eliminate cut-outs in high ambient temperatures.

B) Single automatic internal pressure switch for simple operation and safety is not operator dependent.

C) CPR valve rated to 600 psi to eliminate the need to monitor and regulate the unit during recovery.

8. Are all recovery units approved for R-410a?

No, only a few recovery units are rated and approved for use with R-410a and other high-pressure refrigerants. You should always check the ARI and UL sources to make sure that you are purchasing an approved unit.

9. What is the most common type of refrigerant recovery method used in "real world" applications?

Vapor recovery is the most common type of refrigerant recovery. Most refrigerant recovery units will tell you the liquid recovery rate, not the vapor recovery rate. Make sure you check out vapor recovery rates on the (www.ul.com/refrigeration/performance.html) or ARI (www.ari.org) websites.

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Printed in U. S. A. CP-03/02