2016

SECTION 609 TECHNICIAN TRAINING AND CERTIFICATION

GCADA

Greater Cleveland Automobile Dealers Association

CONTENTS

PROGRAM OVERVIEW

To protect the ozone layer, the land mark international environmental agreement, the Montreal Protocol on Substances that Delete the Ozone Layer, was signed in September 1987, to end the production and consumption of ozone-depleting chemicals such as chlorofluorocarbons (CFCs) and halons which were once widely used in various application as aerosols, solvents, refrigerants, and fire suppressants. The stratospheric ozone layer protects life on earth from the damaging effects of ultraviolet radiation which include skin cancer, damage to crops and aquatic ecosystems. Under the Montreal Protocol, global production of CFCs and halons, 2 types of ozone depleting substances, ended in 2010. Currently, 197 nations, representing over 95 percent of the world's consumption of CFCs are parties to the Protocol. In the U.S., the Environmental Protection Agency (EPA) is responsible for controlling these chemicals that damage the ozone layer by implementing the requirements of Title VI of the Clean Air Act, the legal framework for U.S. compliance with the Montreal Protocol and its amendments. The United States has met its commitments and deadlines under both the Montreal Protocol and Clean Air Act to support the recovery of the ozone layer.

Section 609 of the Clean Air Act (CAA) directs the U.S. Environmental Protection Agency (EPA) to establish requirements to prevent the release of refrigerants during the servicing of motor vehicle air conditioners (MVACs) and MVAC-like appliances. MVACs are defined as mechanical vapor compression refrigeration equipment used to cool the driver's or passenger's compartment of any motor vehicle. MVAC-like appliances are used to cool the driver's or passenger's compartment of off-road vehicles, including agricultural and construction vehicles. Regulations developed under Section 609 of the Clean Air Act are promulgated in 40 CFR 82 Subpart B.

Section 609 of the 1990 Clean Air Act also established an important statutory structure to control the release of refrigerants from motor vehicle air conditioners into the atmosphere. Any person repairing or servicing motor vehicle air conditioners for consideration must properly use refrigerant recycling equipment that has been approved by the EPA.

Technicians who repair or service motor vehicle air conditioners for consideration must be trained and certified by an EPA-approved technician training and certification program. Technicians who repair or service MVAC-like appliances must always be certified by an EPA-approved 609 program.

Under Section 609 of the Clean Air Act, EPA-approved technician training and certification programs provide education on the proper use of MVAC servicing equipment, the regulatory requirements of the Clean Air Act, the importance of refrigerant recovery, as well as the effects of improper handling of refrigerants on the ozone layer and climate system. To be certified, technicians must be trained by an EPA-approved program and pass a test demonstrating their knowledge in these areas. Section 609 certification is required to service any motor vehicle air conditioning system for consideration (e.g., payment or bartering), regardless of the refrigerant used in the system.

A large portion of this program used to focus on retrofitting of MVAC systems. Because retrofits are very rarely performed in 2015, most retrofitting information can be found in the appendix at the end of this program.

To obtain your certification, you must read and study the following booklet, including completing the test at the end of the booklet. The test will consist of 30 questions, and will be on the material covered in the booklet. You cannot miss more than six questions to pass. Should you have questions about the booklet, please call the Greater Cleveland Automobile Dealers' Association (440-746-1500).

BACKGROUND: WHAT IS THE OZONE LAYER

Ozone is formed when ultraviolet radiation from the sun reacts with oxygen molecules which causes them to split apart into two oxygen atoms. These separated atoms then combine with other oxygen molecules (O2) to form ozone (O3), which contains a total of three oxygen atoms. Ozone is a pungent gas that has a close chemical relationship to molecular oxygen. About 90 percent of the earth's ozone is located in a layer far above the earth's surface in a region known as the stratosphere. This natural layer acts as a shield against ultraviolet radiation. Concern about possible depletion of the ozone layer from CFC's was first raised in 1974 with publication of research which theorized that chlorine released from CFC's could migrate to the stratosphere and destroy ozone molecules. (Molina and Rowland, 1974). Some of the CFC's have an atmospheric lifetime of more than 120 years and as a result, they rise slowly to the stratosphere where the Suns radiation strikes them, releasing chlorine. Once freed, the chlorine acts as a catalyst repeatedly combining with and breaking apart ozone molecules. If ozone depletion occurs, more UV radiation penetrates the earth's surface. Moreover, because of the long atmospheric lifetimes of CFC's, it would take many decades for the ozone layer to return to past concentrations.

HOW IT EFFECTS THE ENVIRONMENT

The ozone layer shielding the earth from much of the damaging part of the sun's radiation and is a critical resource safeguarding life on this planet. Should the ozone layer be depleted, more of the sun's damaging rays would penetrate to the earth's surface. It is believed that for each one percent depletion exposure to damaging ultraviolet radiation would increase by 1.5 to 2 percent. The Environmental Protection Agency's (EPA) assessment of the risks from ozone depletion focused on the following areas:

***Increases in skin cancers**
***Suppression of the human immune response system**
***Increases in cataracts**
***Damage to crops**
***Damage to aquatic organisms**
***Increased global warming**

HOW IT EFFECTS THE HUMAN HEALTH

Under current atmospheric conditions, the greater the distance from the equator, the greater the effectiveness of the ozone layer as a shield. As a result, people who live further north are exposed to less damaging UV radiation than those residing closer to the equator. Not surprisingly, the chances of getting skin cancer follow the same gradient; the closer to the equator, the greater the risk. Three distinct types of the skin cancer would increase if the ozone layer is depleted. Basal and squamous cell skin cancers, the two most common types, affect about 500,000 people annually in the United States alone. If detected early, these cancers are treatable. Even so, approximately 1 percent of cases result in premature deaths. Malignant melanoma is far less common but substantially more harmful. Suppression of the immune system is another possible threat to human health resulting from ozone depletion.

HOW IT EFFECTS PLANT & MARINE LIFE

Crop and other land based ecosystems could also be adversely affected by increased exposure to UV radiation. In studies of the greenhouse effect, approximately 65 percent of the crops exposed to elevated levels of UV radiation proved sensitive. Certain marine organisms, particularly phytoplankton, may be

sensitive to increased exposure to UV radiation because they spend much their existence near the surface of the water.

Other Considerations:

Ground Level Ozone - Ozone depletion in the stratosphere would increase the rate of formation of ground level (tropospheric) ozone, due to higher levels of UV radiation, a major component of what is commonly called smog.

Degradation of Polymers - Ozone depletion would accelerate the breakdown (i.e. chalking, yellowing, and cracking) of plastics used in outdoor applications.

Climatic Changes - CFC's are greenhouse gases and thus would contribute to global warming and rising sea levels.

THE GLOBAL CONCERN ON THE OZONE LAYER

Unlike other environmental issues, stratospheric ozone protection is a global concern. CFC's and halons are used by most industrialized nations, and, given their long atmospheric lifetimes, they become widely distributed over time. As a result, the release of these chemicals in one country could adversely affect the stratosphere and therefore the health and welfare of other countries. Many developed and developing countries produce CFC's and halons. Most use the chemicals in a variety of different products. The United States is one of the largest consumers of the world's CFC's. Other nations are also significant users. Therefore, to protect the ozone layer from the damages that may be caused by CFC's and halons, an international solution is critical. This is one reason why technician certification in dealing with MVACs is so important and where the EPA's SNAP program comes into the picture.

PENALTIES

Failure to comply with any provision of section 609 of the Clean Air Act can result in fines of up to $27,500 per day, per violation. Further, technicians in violation could be fined individually and lose their certification.

CHOOSING AND USING ALTERNATIVE REFRIGERANTS FOR MOTOR VEHICLE AIR CONDITIONING

Background

As outlined above, scientists worldwide have concluded that CFC-12 and other chlorofluorocarbons deplete the ozone layer. As a result, over 195 countries have signed a treaty, called the Montreal Protocol, to protect the earth's ozone layer. In the US, the Protocol is implemented by the Clean Air Act, and regulations issued under the Act ended the production of CFC-12 for air conditioning and refrigeration uses on December 31, 1995.

CFC-12 (also known by the trade name Freon) was widely used in air conditioners for automobiles and trucks for over 30 years. While new vehicles no longer use CFC-12, most vehicles built before 1994 still require its use for servicing. As a result, many cars may need conversions to use an alternative refrigerant should the air conditioning develop a leak after CFC-12 is no longer available.

EPA'S SNAP PROGRAM

In recent years, motor vehicle air conditioning refrigerants have shifted from CFC-12 (used primarily through 1994) to HFC-134a (1994-2014) and now to newer climate-friendly alternatives. This is due to the EPA's Significant New Alternatives Policy (SNAP) program, under section 612 of the Clean Air Act (CAA). The SNAP program has ensured the smooth transition to alternatives that pose lower overall risk to human health and the environment. The SNAP program evaluates and finds acceptable substitutes for ozone-depleting substances. Under the SNAP program, EPA has found acceptable, subject to use conditions, three low global warming potential MVAC refrigerants: HFC-152a, hydrofluoroolefin (HFO)-1234yf, and carbon dioxide (CO2). None of these alternatives deplete the ozone layer and all have significantly lower global warming potentials than CFC-12 or HFC-134a. This training will briefly discuss servicing R-12, R-134a systems and retrofitting R-12 systems, but will focus on the use of newer, climate-friendly alternatives. As of 2014, there are cars on the road that use CFC-12, HFC-134a, and HFO-1234yf. The below table prepared by the EPA and the Intergovernmental Panel on Climate Change reviews the global warming potential of the refrigerants used in the past as well as the new alternatives:

ENVIRONMENTAL IMPACTS OF MVAC REFRIGERANTS

MVAC Refrigerant	Global Warming Potential	Ozone Depleting?
CFC-12	10,900	Yes
HFC-134a	1,430	No
HFC-152a	124	No
HFC-1234yf	4	No

CO2 (R-744)	1	No

These alternatives are discussed in more detail below. It is important to understand the meaning of "acceptable subject to use conditions." EPA believes such refrigerants, when used in accordance with the conditions, are safer for human health and the environment than CFC-12. This designation **does not mean** that the refrigerant will work in any specific system, nor does it mean that the refrigerant is perfectly safe regardless of how it is used. Finally, note that EPA does not approve or endorse any one refrigerant that is acceptable subject to use conditions over others also in that category.

Note also that EPA does not test refrigerants under the SNAP process. Rather, the EPA reviews information submitted by manufacturers and various independent testing laboratories. Therefore, it is important to use the right refrigerants, and in particular to determine what effect using a new refrigerant will have on a vehicle's warranty.

As a result of a July 2015 rulemaking, by model year 2021, the MVAC systems in newly manufactured light-duty vehicles in the United States will no longer use HFC-134a. The rule changed the status of certain HFC's now that safer alternatives are available. Under section 612 of the Clean Air Act (CAA), EPA reviews substitutes within a comparative risk framework. EPA will continue to review and update the list of acceptable substitutes as the list evolves. For a complete Fact Sheet from the EPA visit here: https://www.epa.gov/sites/production/files/2015-08/documents/snap_regulatory_factsheet_july20_2015.pdf .

MOTOR VEHICLE AIR CONDITIONING REFRIGERANT TRANSITION & ENVIRONMENTAL IMPACTS

As stated above, the most common refrigerant used in motor vehicle air conditioner (MVAC) systems has been hydrofluorocarbon (HFC)-134a. HFCs are intentionally-made fluorinated greenhouse gases used in the same applications where ozone-depleting substances have been used: air conditioning, refrigeration, foam-blowing, fire retardants, solvents, and aerosols. Below is a discussion of some of the climate-friendly alternative refrigerants to which motor vehicle manufacturers are transitioning.

HFC-134a: a Potent Greenhouse Gas

HFC-134a has remained the most common refrigerant used in MVAC since the 1990s. Although HFC-134a does not deplete the ozone, it is a potent greenhouse gas (GHG) with a global warming potential that is 1,430 times greater than CO2. In the United States, emissions of HFCs are increasing more quickly than those of any other greenhouse gas, and globally they are increasing 10-15% annually. At that rate, emissions are projected to double by 2020 and triple by 2030. HFC-134a is the most abundant HFC in the atmosphere. Its use to motor vehicle air conditioners accounts for an estimated 24% of total global HFC consumption.

HFC-134a does not contain chlorine and therefore does not contribute to ozone depletion, although like other HFCs, it contributes to global warming. ARI, an A/C and refrigeration manufacturers' trade association, develops standards for the industry. ARI's 700 standard specifies acceptable levels of refrigerant purity for fluorocarbon refrigerants including R-134a. The purpose of the 700 standard is to enable reclaimers to evaluate and accept or reject refrigerants, whether virgin, reclaimed or repackaged. Reclamation of these refrigerants in both the motor vehicle and stationary/commercial sectors must follow the 700 standard.

NEW CLIMATE-FRIENDLY ALTERNATIVE REFRIGERANTS AND SERVICING CONSIDERATIONS

As discussed above, EPA's Significant New Alternatives Policy (SNAP) Program ensures the smooth transition from ozone depleting substances to alternatives that pose lower overall risk to human health and the environment. Under SNAP, EPA recently listed three low global warming potential (GWP) MVAC refrigerants as acceptable subject to use conditions: hydrofluoroolefin (HFO)-1234yf, carbon dioxide, and HFC-152a. None of these alternatives deplete the ozone layer and all have significantly lower impacts to the climate system than CFC-12 or HFC-134a. All 3 low-GWP refrigerants are "acceptable subject to use conditions" under SNAP. Also, all 3 should be used in a well-ventilated area, especially CO2.

In the United States and globally, many automobile manufacturers are transitioning to these low-GWP alternatives. It is important for both consumers and technicians to be aware of these alternative refrigerants, their properties, and proper servicing procedures. The Society of Automotive Engineers (SAE) International has developed SAE Ground Vehicle Standards on these alternative refrigerants. These standards, also known as SAE J Standards, are discussed throughout this training and available in full at http://standards.sae.org.

SAEJ639 provides design standards and safety requirements for MVAC systems. Also included are cautionary statements for the mobile air conditioning service industry to alert service technicians to the inadvisability and the possible health and safety effects associated with venting refrigerant during service. This standard contains a recommended practice restricted to mechanical vapor compression refrigerant systems that provide cooling for the occupants compartment. SAEJ639 provides guidelines for refrigerant containment and safety for a mobile air-conditioning system. It is not intended to restrict the use of, or further development of, other types of refrigeration systems for passenger compartment cooling. SAEJ639 addresses CFC-12 (R-12) and HFC-134a (R-134a) refrigerants. To prevent mobile A/C system refrigerant contamination, all other alternate refrigerants considered for automotive use require unique service fittings. Technicians should check state and local regulations regarding compliance with SAEJ639.

HFO-1234yf (R-1234yf)

R-1234yf Systems:

As outlined above, R-1234yf is an acceptable refrigerant subject to use conditions for new passenger cars and light-duty trucks only; final rule published March 29, 2011 (76 FR 17488). HFO-1234yf is mildly flammable (ASHRAE A2L), but can be used safely. HFO-1234yf is increasingly being adopted by automobile manufacturers. It has an extremely low GWP of 4 and an ODP of zero. Below are more specifics:

- Acceptable subject to use conditions for new passenger cars and light-duty trucks only; final rule published March 29, 2011 (76 FR 17488)
- HFO-1234yf is mildly flammable (ASHRAE A2L), but can be used safely
- There are cars on the road using HFO-1234yf and it is increasingly being adopted by automobile manufacturers
- Under the 2011 SNAP listing, EPA established the following conditions for use:
    - HFO-1234yf MVAC systems must adhere to all of the safety requirements of SAE J639 (adopted 2011), including requirements for a flammable refrigerant warning label, high-pressure compressor cutoff switch and pressure relief devices, and unique fittings. For connections with refrigerant containers for use in professional servicing, use fittings must be consistent with SAE J2844 (revised October 2011).

- Manufacturers must conduct Failure Mode and Effect Analysis (FMEA) as provided in SAE J1739 (adopted 2009). Manufacturers must keep the FMEA on file for at least three years from the date of creation.

Carbon Dioxide (CO2, R-744)

CO2 can be used as a refrigerant and is also known as R744. CO2 systems are more fuel-efficient and can increase cooling performance over R134a systems. The EPA has established conditions of use for these systems. R744 has a boiling point of -78/-109. While not yet available, an R744 system will likely have a much higher pressure level than an R134a system.

Under Section 608 of the Clean Air Act, intentional release (venting) of any refrigerant is illegal unless the refrigerant is specifically exempted from the prohibition. CO2 is exempted under 608 meaning that it can be legally vented. Although CO2 may legally be vented, section 609 still requires that all MVAC systems be serviced through the proper use of EPA-certified refrigerant handling equipment. This requirement applies regardless of the refrigerant used in the MVAC system. This means that anyone servicing an MVAC system that uses CO2 as the refrigerant would need to properly use EPA-certified refrigerant handling equipment.

R744 is not considered flammable. However, exposure to fire may cause containers of R744 to rupture/explode. Should a R744 related fire take place, all known extinguishants can be used. Where possible, a technician should stop flow of the product and move away from the container and cool with water from a protected position.

When storing, R744 should be kept in a firmly secured container below 50°C in a well ventilated place. In handling, the sucking back of water into the container must be prevented. Further, backfeed must not be allowed into the container. Below are more specifics:

- GWP of 1
- Acceptable subject to use conditions for new vehicles only; final rule published June 6, 2012 (77 FR 33315)
- Operates at 5 to 10 times higher pressure than other MVAC systems
- Under development by several foreign automobile manufacturers
- Although CO2 is exempt from the Section 608 venting prohibition, CO2 is not exempt from the Section 609 requirement to properly use certified refrigerant handling equipment.
- Under the 2012 SNAP listing, EPA established the following conditions of use:
    - Engineering strategies and/or mitigation devices shall be incorporated such that in the event of refrigerant leaks the resulting CO2 concentrations do not exceed the STEL of 30,000 ppm averaged over 15 minutes in the passenger free space and the ceiling limit of 40,000 ppm in the passenger breathing zone.
    - OEMs must keep records of the tests performed for a minimum period of three years demonstrating that CO2 refrigerant levels do not exceed the STEL of 30,000 ppm averaged over 15 minutes in the passenger free space, and the ceiling limit of 40,000 ppm in the breathing zone.
    - The use of CO2 in MVAC systems must adhere to the standard conditions identified in SAE Standard J639 (EPA 2012b).

HFC-152a (R-152a)

R-152a is also known as difluoroethane and is also suggested as a replacement for R-134a. R152a has similar characteristics to that of R134a but has a much lower GWP than R134a. They also use substantially less energy to produce the same cooling.

R-152a has a boiling point of -25/-13. It is a halogenated aliphatic composed of carbon, hydrogen, and fluorine ($C_2H_4F_2$) with a relatively low global warming potential.

In handling, it is important to note that R-152a is a flammable under certain circumstances. EPA relies on ASHRAE designations. 152a is classified as A2 and 1234yf is classified as an A2L. .

Further, R-152a can produce hydrofluoric acid when exposed to moisture, flames, or extreme heat. Thus, it is important to keep R-152a systems moisture free so that acid does not eat the systems evaporator. Below are more specifics:

- GWP of 124
- SNAP listed as acceptable subject to use conditions for new vehicles only; final rule published June 12, 2008 (73 FR 33304)
- HFC-152a is moderately flammable (ASHRAE A2), but can be used safely
- May be pursued by automobile manufacturers in the future
- Under the 2008 SNAP listing, EPA established the following conditions for use:
    - Engineering strategies and/or devices shall be incorporated into the system such that foreseeable leaks into the passenger compartment do not result in R-152a concentrations of 3.7% v/v or above in any part of the free space1 inside the passenger compartment for more than 15 seconds when the car ignition is on
    - Manufacturers must adhere to all the safety requirements listed in the SAE Standard J639, including unique fittings and a flammable refrigerant warning label as well as SAE Standard J2773, "Refrigerant Guidelines for Safety and Risk Analysis for Use in Mobile Air Conditioning Systems."

EPA REGULATORY REQUIREMENTS FOR SERVICING OF MVACS

APPROVED REFRIGERANT HANDLING EQUIPMENT

Technicians must use certified refrigerant handling equipment to repair or service MVACs and MVAC-like appliances. EPA requires that MVAC refrigerant handling equipment be certified by the Administrator or an independent standards testing organization approved by the Administrator to meet the standards in 40 CFR 82 subpart B. Intertek (formerly ETL Testing Laboratories, Inc.) and Underwriters Laboratory (UL) are approved independent standards testing organizations. A list of approved recover/recycle and recover-only equipment is available at https://www.epa.gov/mvac/section-609-certified-equipment.

Certified refrigerant handling equipment must be used to remove refrigerant prior to servicing or repairing an MVAC, or conducting any other service on a vehicle during which discharge of refrigerant can reasonably be expected. Recovered refrigerant must be either recycled or reclaimed before it can be recharged it into an MVAC or MVAC-like appliance, even if the refrigerant is being returned to the system from which it was removed. Recovered refrigerant can either be recycled on-site using approved equipment designed to both recover and recycle refrigerant, or sent off-site to a reclamation facility to be purified according to ARI Standard 700. Recycling removes impurities and oil, while reclamation returns the refrigerant to virgin specifications. Refrigerant sent off-sight must be sent to an EPA-certified refrigerant reclaimer.

CERTIFICATION REQUIREMENTS FOR REFRIGERANT HANDLING EQUIPMENT

Service shops must certify to EPA that they have acquired and are properly using approved refrigerant recovery handling equipment, and that each person using the equipment has been properly trained and certified. A certification form (PDF) must be submitted to the appropriate EPA Regional Office.

Note that this certification is a one-time requirement. If a shop purchased a piece of CFC-12 or HFC-134a refrigerant handling equipment in the past, and sent the certification to EPA, the shop does not need to send a second certification to EPA when it purchases another piece of equipment, no matter what refrigerant that equipment is designed to handle.

Equipment must be certified by an independent standards testing organization approved by the administration, both Underwriters Laboratories (UL) and Intertek are approved, under the regulations. Equipment purchased before the proposal of regulations (1991 for R-12 equipment and 1996 for R-134a equipment) will be considered approved if the administration (EPA) determines that the equipment is substantially identical to the equipment certified under the previous paragraph.

The EPA maintains a list of approved equipment by manufacturer and model. GCADA will maintain a list of approved Freon recovery /recycling equipment. Should you have any question about approved equipment, please contact GCADA.

REQUIRED EQUIPMENT

There are two types of equipment that have been approved by the EPA. Recover/recycle equipment removes the refrigerant from the vehicle and cleans the refrigerant. Recover only equipment removes the refrigerant into an EPA approved container which is sent away for reclamation. Both types may only be used for the refrigerant for which it was designed.

Recover/Recycle Equipment

Recover/recycle equipment must be certified by an EPA approved testing organization as outlined above. SAEJ1990 sets forth the standard for dealing with CFC-12 and SAEJ2788 for HFC-134a. Both address specifications for hardware items like hoses and filters. These standards also state that service hoses must have shutoff valves located within 12 inches of the hose ends to prevent unnecessary release of refrigerant when they are disconnected. SAEJ2788 replaced J2210 and set a recharge accuracy standard of 0.5 ounces and requires 95% recovery of refrigerant from an MVAC system within 30 minutes.

SAEJ1770 outlines procedures for dealing with equipment where CFC-12 and HFC-134a share a common refrigerant circuit. SAEJ1770 ensures that special features are in place to prevent cross-contamination in the refrigerant circuit.

Recover Only Equipment

Recovery of alternative refrigerants under the EPA's SNAP program requires a dedicated piece of equipment. They may not be recovered using the same equipment used for CFC-12 and HFC-134a. These alternatives may not be recycled and thus must be sent to a certified reclaiming facility.

If you are working with a refrigerant which you are unsure about it is recommended that you obtain a refrigerant identifier. Once the refrigerant is recovered it must be properly stored or sent to a reclaiming facility.

SAE J2810 establishes the standard for HFC-134a (R-134a) recovery for only equipment used in conjunction with the on-site recovery/recycling equipment used at service facilities for off-site refrigerant reclamation or other environmentally legal use. The standard provides equipment specifications, safety requirements, operating instructions, as well as a description of the equipment function and testing procedures. All technicians should be familiar with and prepared to comply with this standard.

J2843 applies to equipment to be used with R-1234yf refrigerant only. It establishes requirements for equipment used to recharge R-1234yf to an accuracy level that meets purity levels outlined in this standard as well as SAEJ2099. Refrigerant service equipment is required to ensure adequate refrigerant recovery to reduce emissions and provide for accurate recharging of mobile air conditioning systems. Equipment shall be certified to meet all performance requirements outlined in this document and international/regional construction and safety requirements outlined in this standard. All technicians should be familiar with and prepared to comply with this standard.

Recovery Cylinders

Recovery cylinders are where the refrigerant ends up after being recovered. They are specifically designed to be refilled and have at least two ports (one vapor and one liquid). EPA standards set forth that such a cylinder must not be filled above 80% of its capacity by weight and that the safe filling level must be controlled by either an electronic shut-off valve or weight control. Before any refrigerant is transferred to a cylinder the cylinder must be evacuated to at least 27 in. HG of vacuum. Cylinders must also be UL or DOT approved, tested and date stamped every 5 years. If using a disposable cylinder, all refrigerant MUST be recovered prior to disposal. It must be reduced from a pressure to a vacuum and marked as empty. Should a recovery cylinder be shipping, there are strict DOT and EPA shipping requirements that must be adhered too. Check your local office for details.

HFC-134A SYSTEMS

As stated, HFC-134a systems have unique service ports designed to prevent HFC-134a from being mixed with other refrigerants. Accordingly, separate equipment should be used when servicing any HFC-134a system. It is also important to remember that replacement hoses must meet J2064's standard for permeability. Under this standard the hose must minimize permeation of HFC-134a, any permeation of the system, and be functional within a temperature range of -22 F to 257 F.

RECYCLING REQUIREMENTS

Approved recycling equipment must meet the same criteria as recovery only. Recycling equipment must also clean any used refrigerant to the minimum purity level required in the SAE standards. The SAE J2099 standard establishes the necessary level of purity for recycled HFC-134a refrigerant for use in mobile A/C systems, which has been directly removed from automotive A/C systems, shall not exceed the following levels of contamination:

- Moisture: 50 PPM (Parts per million) by weight
- Refrigerant Oil: 500 PPM by weight
- Non-condensable Gases (air): 150 PPM by weight

By comparison, the SAE J1991 standard establishes the necessary level of purity for CFC-12 refrigerant for use in mobile A/C systems, which has been directly removed from automotive A/C systems, shall not exceed the following levels of contamination:

- Moisture: 15 PPM (Parts per million) by weight
- Refrigerant Oil: 4000 PPM by weight
- Non-condensable Gases (air): 330 PPM by weight

LEAK TESTING

J1628 outlines technician procedures for refrigerant leak detection in service of mobile air conditioning systems. This standard applies to the use of generally available leak detection methods to service motor vehicle passenger compartment air conditioning systems. Some considerations in leak testing:

- Perform a visual inspection first, remove excess dirt and always leak test with the engine off.
- Follow manufacturer requirements.
- Only use a small amount of refrigerant when leak testing. A psi of 50 is all that is required.
- Maintain a distance of 3/8 inch between the detector probe and the surface being checked
- Test the evaporator core by operating the AC system blower on the high setting for a minimum of 15 seconds. Turn off blower and wait 15 minutes to ensure no leaks.
- Fluorescent dye kits may also be used in accordance with J2297. Dye kits are available from manufacturers and include the dye, a tool to inject the dye, and a UV light to detect leaks. J2298 and J2299 should also be reviewed when using leak detection dye kits.
- In accordance with J2298 before injecting any dye, check the engine compartment for a sticker indicating that dye has already been installed. Add dye as outlined in manufacturer instructions.
- Place the identification label from the dye manufacturer in a prominent place in the engine compartment.

- Operate the system for 15 minutes to circulate the dye and inspect with a UV lamp once engine is turned off. Trace the entire refrigerant system for leaks.
- If no leak present, remove fluorescent residue using a cleaner approved by the vehicle or MVAC system manufacturer.

VENTING PROHIBITION

Another section of the Clean Air Act, Section 608, prohibits the intentional release (venting) of refrigerants, ozone-depleting and their substitutes, while maintaining, servicing, repairing, or disposing of air conditioning or refrigeration equipment. Currently, only one refrigerant approved for use in MVAC, carbon dioxide (CO2), is exempt from the venting prohibition.

MISLEADING USE OF "DROP-IN" TO DESCRIBE REFRIGERANTS

Many companies use the term "drop-in" to mean that a substitute refrigerant will perform identically to CFC-12, that no modifications need to be made to the system, and that the alternative can be used alone or mixed with CFC-12. However, the EPA believes the term confuses and obscures several important regulatory and technical points. **First**, charging one refrigerant into a system before extracting the old refrigerant is a violation of the SNAP use conditions and is, therefore, illegal. **Second**, certain components may be required by law, such as hoses and compressor shutoff switches. If these components are not present, they must be installed. See the section below on use conditions for more information on these points. **Third**, it is impossible to test a refrigerant in the thousands of air conditioning systems in existence to demonstrate identical performance. **In addition**, system performance is strongly affected by outside temperature, humidity, driving conditions, etc., and it is impossible to ensure equal performance under all of these conditions. **Finally**, it is very difficult to demonstrate that system components will last as long as they would have if CFC-12 were used. For all of these reasons, EPA does not use the term "drop-in" to describe any alternative refrigerant.

RECORDKEEPING REQUIREMENTS

Service shops must maintain records of the name and address of any facility to which refrigerant they recover is sent. Service shops are also required to maintain records (on-site) showing that all service technicians are properly certified.

SALES RESTRICTIONS

The sale or distribution of any class I or class II substance, such as CFC-12 or refrigerant blends that include HCFCs, is restricted to technicians certified under section 608 or section 609 of the CAA. The sale or distribution of any class I or class II substance suitable for use in an MVAC that is in a container of less than 20 pounds may only be sold to technicians certified under section 609. Any person who sells or distributes CFC-12 for use as a refrigerant in a motor vehicle air conditioner and that is in a container of less than 20 pounds must verify that the purchaser has obtained certification by an EPA-approved section 609 technician training and certification program.

The only exception to these requirements is if the purchaser is purchasing the small containers for resale only. In this case, the seller must obtain a written statement from the purchaser that the containers are for resale only and indicate the purchasers name and business address. Records must be maintained for 3 years.

There is currently a Proposed Rulemaking which would Update to the Refrigerant Management Requirements under Section 608 of the Clean Air Act. Among the proposed changes is allowing the purchase of cans containing two pounds or less of non-ODS refrigerant for motor vehicle air conditioner (MVAC) servicing without technician certification so long as the small cans have a self-sealing valve to reduce refrigerant releases. To view a fact sheet on the proposed rulemaking visit here: https://www.epa.gov/sites/production/files/2015-11/documents/608factsheet.pdf .

UNIQUE FITTINGS:

Regardless of which refrigerant you are using, any new refrigerant must be used with a unique set of fittings to prevent the accidental mixing of different refrigerants. These fittings are attachment points on the car itself, on all recovery and recycling equipment, on can taps and other charging equipment, and on all refrigerant containers. If the car is being retrofitted, any service fittings not converted to the new refrigerant must be permanently disabled. Unique fittings help protect the consumer by ensuring that only one type of refrigerant is used in each car. They also help protect the purity of the recycled supply of CFC-12, which means it will last longer, so fewer retrofits will be necessary nationwide.

These fittings and labels must be used with alternative refrigerants when used in motor vehicle air conditioning systems. For more details, see EPA's fact sheet Choosing and Using Alternative Refrigerants for Motor Vehicle Air Conditioning.

This list includes all refrigerants found acceptable subject to use conditions in motor vehicle air conditioning as of March 29, 2011. The list is available in an EPA fact sheet titled "Fitting Sizes and Label Colors for Motor Vehicle Refrigerants" and is found here:

Fitting Sizes

Refrigerant	High Side Service Port			Low Side Service Port			30-lb. Cylinders			Small Cans		
	Diameter (inches)	Pitch (threads/inch)	Thread Direction	Diameter (inches)	Pitch (threads/inch)	Thread Direction	Diameter (inches)	Pitch (threads/inch)	Thread Direction	Diameter (inches)	Pitch (threads/inch)	Thread Direction
CFC-12 (post-1987)	6/16	24	Right	7/16	20	Right	7/16	20	Right	7/16	20	Right
HFC-134a	quick-connect			quick-connect			8/16	16 Acme	Right	8/16	16 Acme	Right
Freeze 12	7/16	14	Left	8/16	18	Right	8/16	18	Right	6/16	24	Right
Free Zone / HCFC Blend Delta	8/16	13	Right	9/16	18	Right	9/16	18	Right	6/16	24	Left
R-414B/HCFC Blend	10/16	18	Left	10/16	18	Right	10/16	18	Right	5/16	24	Right

Refrigerant	High Side Service Port			Low Side Service Port			30-lb. Cylinders			Small Cans		
Omicron/Hot Shot												
R-414A/GHG-X4/HCFC Blend Xi/McCool Chill It	.305	32	Right	.368	26	Right	.368	26	Right	14mm	1.25mm spacing	Left
	6/16	24	Left	7/16	20	Left						
GHG-X5/Autofrost X5	8/16	20	Left	9/16	18	Left	9/16	18	Left	not sold in small cans		
R-406A/GHG-12/GHG-X3/McCool	.305	32	Left	.368	26	Left	.368	26	Left	8/16	20	Left
R-416A/FRIGC FR-12/HCFC Blend Beta	quick-connect, different from HFC-134a			quick-connect, different from HFC-134a			8/16	20	Left	7/16	20	Left
SP34E	7/16	14	Right	8/16	18	Left	8/16	18	Left	5/16	24	Left
R-426A (RS-24, new formulation)	Quick connect, different from HFC-134a and FRIGC FR-12			Quick connect, different from HFC-134a and FRIGC FR-12			Quick connect, different from HFC-134a and FRIGC FR-12			Quick connect, different from HFC-134a and FRIGC FR-12		
R-420A	0.5625 (9/16)	18	Right	0.5625 (9/16)	18	Left	0.5625 (9/16)	18	Left	0.5625 (9/16)	18	Right
HFO-1234yf	Outside diameter 17 +0/-0.2mm			Outside diameter 14 +0/-0.2mm			8/16	16	Left^	Not yet developed; additional information must be submitted to EPA.*		
	Quick connect consistent with J639 (2011 version)			Quick connect consistent with J639 (2011 version)			Consistent with SAE J2844 (Oct 2011 version)					
HFC-152a	Outside diameter 15 +0/-0.2mm +			Outside diameter 14.1 +0/-0.2mm +			not yet developed*			not yet developed*		
	Quick connect consistent with			Quick connect consistent with								

Refrigerant	High Side Service Port	Low Side Service Port	30-lb. Cylinders	Small Cans
	J639 (2011 version)	**J639 (2011 version)**		
R-744 (CO2)	**Outside diameter 18.1 +0/-0.2 mm** [+]	**Outside diameter 16.6 +0/-0.2 mm** [+]	**20.955 +0/-0.127 mm and right-hand thread direction**	**Not yet developed; additional information must be submitted to EPA.***
	Quick connect consistent with J639 (2011 version)	**Quick connect consistent with J639 (2011 version)**		

LABEL COLORS

Historically, EPA established a specific label colors for each refrigerant as part of its SNAP approval. The table below includes only those refrigerants for which EPA required use of a specific label color as part of the listing decision. This table does not include all MVAC refrigerants, such as those for which labeling was never developed. Also, the use conditions for HFC-152a, R-744 (CO_2) and HFO-1234yf require compliance with SAE J639, which specifies the markings required on labels, but not unique label colors. These refrigerants are not included in the table below and must be labeled in accordance with SAE J639. The information required for each label is listed in EPA's fact sheet Choosing and Using Alternative Refrigerants for Motor Vehicle Air Conditioning and is available here:

Refrigerant	Label Color
CFC-12	White
HFC-134a	Sky Blue
Freeze 12	Yellow
Free Zone / HCFC Blend Delta	Light Green
R-414B/HCFC Blend Omicron/Hot Shot	Medium Blue
R-414/GHG-X4/HCFC Blend Xi	Red
R-406A/GHG-12/GHG-X3	Black
GHG-X5/Autofrost X5	Orange
R-416A/FRIGC FR-12/HCFC Blend Beta	Grey
SP34E	Tan
R-426A (RS-24, new formulation)	Gold
R-420A	Dark green (PMS #347)

APPLICABILITY TO MANIFOLD GAUGES AND REFRIGERANT IDENTIFIERS

Manifold gauges allow technicians to diagnose system problems and to charge, recover, and/or recycle refrigerant. A standard fitting may be used at the end of the hoses attached to the manifold gauges, but as outlined above unique fittings must be permanently attached at the ends of the hoses that attach to vehicle air conditioning systems and recovery or recycling equipment. Similarly, refrigerant identifiers may be used with

multiple refrigerants. The connection between the identifier or similar service equipment and the service hose may be standardized and work with multiple hoses. For each refrigerant, however, the technician must attach a hose to the identifier that has a fitting unique to that refrigerant permanently attached to the end going to the vehicle. Adapters for one refrigerant may not be attached to end 2 and then removed and replaced with the fitting for a different refrigerant. *The guiding principle is that once attached to a hose, the fitting is permanent and is not removed.*

MVAC SERVICING CONSIDERATIONS

REMOVE ORIGINAL REFRIGERANT:

The original CFC-12 must be removed from the system prior to charging with the new refrigerant. This procedure will prevent the contamination of one refrigerant with another. Refrigerants mixed within a system probably won't work and could damage the system. As mentioned above, this requirement means that no alternative can be used as a "drop-in."

BARRIER HOSES:

HCFC-22, a component in some blends, can seep out through traditional hoses. Therefore, when using these blends, a technician must ensure that new, less permeable "barrier" hoses are used. These hoses must be installed if the system currently uses old, non-barrier hoses. The table of refrigerants below notes this additional requirement where appropriate.

COMPRESSOR SHUTOFF SWITCH:

Some systems have a device that automatically releases refrigerant to the atmosphere to prevent extremely high pressures. When retrofitting any system with such a device to use a new refrigerant, the technician must also install a high-pressure shutoff switch. This switch will prevent the compressor from increasing the pressure to the point where the refrigerant is vented.

RECOVERING REFRIGERANT

J1989 (R-12) and J2211 (R-134a) outline guidelines for recovering refrigerant. These standards require that all service technicians ensure refrigerant containment during mobile air-conditioning system repair. This standard provides guidelines for technicians for servicing mobile A/C systems and operating refrigerant recycling equipment designed for R-12 and R-134a. Refrigerant containment should be ensured by following the procedures set forth in the standard at each phase of servicing and repair. Under these guidelines a technician should ensure the following:

- Verify the system has a refrigerant charge before recovery.
- Equipment hoses must have shutoff valves within 12 inches of the service ends. Connect the hoses to the vehicle's air conditioning service fittings with both valves closed.
- Follow the equipment manufacturer's recommended procedures. Recover the refrigerant until the vehicle's system shows vacuum instead of pressure. Turn off the recovery unit and repeat if pressure still exists in the system. Continue this process until the vehicle holds a stable vacuum for two minutes.
- Close all valves and disconnect from the service fittings. As stated above, make sure any automatic shutoff valves are working.
- After refrigerant is completely recovered, measure and replace any recovered oil.

PROPER CHARGING AND RECHARGING OF MVACS

Once an MVAC system has been evacuated the system can be charged with a replacement (new or recycled) refrigerant. To operate correctly, the system must be correctly charged. A refrigerants'

critical charge level is typically found on the specification decal under the system's hood or in the vehicle service manual.

Incorrectly charging a system drastically affects the systems efficiency and the comfort. An undercharged system will not cool properly and could shut down the system. An overcharged system could result in high pressures, system failure, and potentially venting.

To charge a system to its critical charge you must weigh the refrigerant into the system. Any scales should be verified for accuracy and recalibrated per manufacturer requirements.

ALTERNATIVE REFRIGERANTS

The table below summarizes the following information about refrigerants reviewed under EPA's SNAP program for use in motor vehicle air conditioning systems. Note that "air conditioning" means cooling vehicle passenger compartments, not cargo areas, so refrigeration units on trucks and rail cars are not covered by this list.

- Name: Many refrigerants are sold under various names. All known trade names are listed, separated by slashes.
- Status:
  - *acceptable subject to use conditions:* May be used in any car or truck air conditioning system, provided the technician meets the conditions described above. Note that EPA cannot guarantee that any refrigerant will work in a specific system.
  - *unacceptable*: Illegal to use as a substitute for CFC-12 in motor vehicle air conditioners.
  - *proposed acceptable subject to use conditions:* May be used legally. EPA will accept public comment on these refrigerants and then make a final ruling. There is no formal EPA position until then, and it is inappropriate for advertising to imply that EPA has found the product acceptable.
  - *not submitted:* Illegal to use **or sell** as a substitute for CFC-12 in motor vehicle air conditioning systems.
- Date of ruling: The date either a final rule or a proposed listing was published in the Federal Register. Note that proposed listings are not final and may change because of public comment.
- Manufacturer name and contact phone number: Call for more information on testing, performance, system compatibility, etc.
- Composition: Every refrigerant other than HFC-134a is a blend of two or more components.

Motor Vehicle Air Conditioning Substitutes for CFC-12 Reviewed Under EPA's SNAP Program as of July 20, 2015

Substitute	Trade Name	Retrofit/New	ODP	GWP	ASHRAE	SNAP Listing Date	Use Conditions
Evaporative Cooling		**N**	**0**	**N/A**	**N/A**	**March 18, 1994**	

Substitute	Trade Name	Retrofit/New	ODP	GWP	ASHRAE	SNAP Listing Date	Use Conditions
Free Zone (HCFC Blend Delta)	Free Zone / RB-276	R/N	0.013	1,592	A1	May 22, 1996; July 20, 2015	Unacceptable in New Light-Duty Systems as of MY 2017. Detailed conditions apply - see Rule.
Freeze 12	Freeze 12	R/N	0.013	1,606	A1	October 16, 1996; July 20, 2015	Unacceptable in New Light-Duty Systems as of MY 2017. Detailed conditions apply - see Rule.
GHG-HP (HCFC Blend Lambda)	GHG-HP	R/N	0.056	1,893	A1	October 16, 1996; July 20, 2015	Unacceptable in New Light-Duty Systems as of MY 2017. Detailed conditions apply - see Rule.
GHG-X5	GHG-X5	R/N	0.032	2,377	A1	June 3, 1997; July 20, 2015	Unacceptable in New Light-Duty Systems as of MY 2017. Detailed conditions apply - see Notice.
HFC-134a	134a	R/N	0	1,430	A1	March 18, 1994; July 20, 2015	Unacceptable in New Light-Duty Systems as of Model Year (MY) 2021, except where allowed under a narrowed use limit through MY 2025. Acceptable, subject to narrowed use limits, for vehicles exported to countries with insufficient servicing infrastructure to support other alternatives, for MY 2021 through MY 2025. Unacceptable for all newly manufactured vehicles as of MY 2026. Detailed conditions apply - see Rule.
HFC-152a		N	0	124	A2	June 12, 2008	Detailed conditions apply - see Rule
HFO-1234yf		N	0	4	A2L	March 29, 2011	Detailed conditions apply - see Rule
Ikon A	Ikon-12, Blend Zeta	R/N	0	N/A	A1	May 22, 1996	Detailed conditions apply - see Rule

Substitute	Trade Name	Retrofit/New	ODP	GWP	ASHRAE	SNAP Listing Date	Use Conditions
R-401C		R/N	0	933	A1	June 13, 1995	
R-406A	GHG	R/N	0.057	1,900	A2	October 16, 1996; July 20, 2015	Unacceptable in New Light-Duty Systems as of MY 2017. Detailed conditions apply - see Rule.
R-414A	GHG-X4, HCFC Blend Xi, Autofrost, Chill-it	R	0.045	1,478	A1	October 16, 1996; July 20, 2015	Unacceptable in New Light-Duty Systems as of MY 2017. Detailed conditions apply - see Rule.
R-414B	Hot Shot, Kar Kool	R/N	0.098	3,337	A1	October 16, 1996; July 20, 2015	Unacceptable in New Light-Duty Systems as of MY 2017. Detailed conditions apply - see Rule.
R-416A	FRIGC FR-12, HCFC Blend Beta	R/N	0.009	1,081	A1	June 13, 1995; July 20, 2015	Unacceptable in New Light-Duty Systems as of MY 2017. Detailed conditions apply - see Rule.
R-426A	RS-24	R/N	0	1,510	A1	September 28, 2006; July 20, 2015	Unacceptable in New Light-Duty Systems as of MY 2017. Detailed conditions apply - see Notice.
R-744 (Carbon Dioxide, CO2)		N	0	1	A1	June 6, 2012	Detailed conditions apply - see Rule
RS-24 (2002 formulation)		R/N	0	1,510	A1	December 20, 2002	Detailed conditions apply - see Notice
Small auxiliary power units that include an engine, electrical alternator, water pump, air conditioning compressor and a		R/N	0	N/A	N/A	June 19, 2000	

Substitute	Trade Name	Retrofit/New	ODP	GWP	ASHRAE	SNAP Listing Date	Use Conditions
heat exchanger used in tractor trailers in conjunction with passenger compartment climate control systems that already use an acceptable substitute refrigerant.							
SP34E	**SP34E**	**R/N**	**0**	**<1,470**	**A1**	**December 18, 2000; May 23, 2001; July 20, 2015**	**Unacceptable in New Light-Duty Systems as of MY 2017. Detailed conditions apply - see Notice; Use of new fittings for small refrigerant cans required.**
Stirling Cycle		**N**	**0**	**N/A**	**N/A**	**March 18, 1994**	

For More Information

Visit www.epa/gov/mvac. The following fact sheets discuss various issues related to motor vehicle air conditioning and ozone depletion.

- Fitting Sizes and Label Colors for Motor Vehicle Refrigerants
- Questions to Ask Before You Purchase an Alternative Refrigerant
- The Facts Behind the Phaseout (ozone depletion science)
- Qs & As on Ozone-Depleting Refrigerants and Their Alternatives

THE ABC'S OF HANDLING CONTAMINATED AND UNFAMILIAR AUTOMOTIVE REFRIGERANTS

This document also discusses what a tech should do with a substitute refrigerant that he has chosen not to work with or is unfamiliar to him. EPA intends to update this document whenever the Agency receives new information about potential solutions to the problems relating to contaminated or unfamiliar refrigerants.

IDENTIFYING REFRIGERANTS

EPA requires that when any vehicle is retrofitted from R-12, a label identifying the new refrigerant in the system must be placed under the hood, and new fittings that are unique to that refrigerant must be attached to the high-and-low-side service ports of the A/C systems. (For a complete discussion of these and other requirements, see the EPA fact sheet "Choosing and Using Alternative Refrigerants.") These EPA requirements obviously don't solve the entire refrigerant identification problem. Your shop could encounter a vehicle that has been retrofitted to another refrigerant but has not been properly relabeled, or a vehicle that has the right label, but highly contaminated refrigerant.

Checking refrigerant pressures does not guarantee that you will recognize that refrigerant is contaminated or is a brand that is unfamiliar to you. Unusual head pressures may tip you off that a system labeled to indicate that it has pure R-12 or R-134a in it actually is highly contaminated or contains another refrigerant altogether. However, you may also encounter a contaminated system, or a system that contains a blend refrigerant, that indicates pressures similar to those of pure R-12 or R-134a.

Purchasing a refrigerant identifier unit can help pinpoint many refrigerant identification problems, and EPA strongly recommends (but does not require) that techs obtain this equipment. You can use the identifier to confirm that the refrigerant your supplier is sending you is exactly what he says it is pure and uncontaminated. The equipment you choose will depend on what you plan to do once you discover that refrigerant in a vehicle is not pure R-12 or R-134a. If for example, you decide to turn the customer with a contaminated system away, then a less-expensive identifier that simply tells you whether refrigerant is pure R-12 or R134a ("go/no-go") may be sufficient for you.

However, a unit that can help you identify the chemical composition of the refrigerant more specifically can be an important diagnostic tool, so that the extra cost may be well worth it. Some models can identify flammable substances, which require special care and safe handling (see section B below). Some models can tell you how much air is in recycled refrigerant, so that you can use these models to determine whether the air purge cycle feature on your R-12 or R134a recycling equipment is functioning properly. Excess air in an A/C system can lead to false readings in electronic low charge indications in some vehicles; rapid clutch cycling and potential clutch failures; and noisy compressor operation. Finally, using this tool may build your customers' confidence in your diagnostic abilities.

Keep in mind that even the most sophisticated diagnostic units on the market today cannot properly identify all combinations of chemicals used in blend refrigerants. Diagnostic identifiers being sold today may be able to identify potential R-12 and R134a contaminants such as air, R-22, and hydrocarbons, but were not designed to identify R-124 and R-142b (chemicals that are components in many of the new substitutes), or to recognize particular chemical combinations as specific patented, marketed blend refrigerants. In the future, equipment manufacturers may develop equipment designed to identify all of the substitute refrigerants that are being marketed today.

Whether you are interested in purchasing a "go/no-go" unit or a diagnostic unit, check that the unit meets the SAE J1771 standard, which is an indication that the unit accurately identifies refrigerants. When claiming to

meet this standard, manufacturers of identifier equipment are required to label the unit stating its level of accuracy.

If you are reluctant to invest in another piece of equipment, consider making an arrangement to borrow an identifier from a nearby service facility that has purchased one. That facility may agree to make its identifier available to you for a reasonable fee.

USED REFRIGERANT FROM NON-MOBILE SOURCES:

R12 and R134a recovered from non-MVAC appliances should not be used in MVAC appliances because the MVAC is not stationary operating equipment. Because of the makeup of the MVAC system it is unable to extract the contaminants present in these refrigerants from non-mobile sources.

If a refrigerant that is extracted from an MVAC or an MVAC-like appliance (as that term is defined in §82.152) bound for disposal and located at a motor vehicle disposal facility may not be subsequently used to charge or recharge an MVAC or MVAC-like appliance, unless, prior to such charging or recharging, the refrigerant is either:

> (i) Recovered, and reclaimed in accordance with the regulations promulgated under §82.32(e)(2) of this subpart B; or
>
> (ii) (A) Recovered using approved refrigerant recycling equipment dedicated for use with MVACs and MVAC-like appliances, either by a technician certified under paragraph (a)(2) of this section, or by an employee, owner, or operator of, or contractor to, the disposal facility; and
>
> (B) Subsequently recycled by the facility that charges or recharges the refrigerant into an MVAC or MVAC-like appliance, properly using approved refrigerant recycling equipment in accordance with any applicable recommended service procedures set forth in the appendices to this subpart B.

RECOVERING AND RECYCLING CONTAMINATED OR UNFAMILIAR REFRIGERANTS

You may not wish to turn away a good customer who comes to the shop with contaminated R-12 or R-134a, or with a substitute refrigerant for which you have no dedicated recovery or recycling equipment. What do you do?

Recovering refrigerant. As a first step, the contaminated or unfamiliar refrigerant must be recovered. EPA prohibits venting any automotive refrigerants (including "unacceptable" refrigerants), no matter what combination of chemicals is in the refrigerant. The best way today that a tech can recover contaminated or unfamiliar refrigerant is to dedicate a recover-only unit to anything that is not pure R-12 or pure R-134a. SAEJ2851 outlines requirements for recovery-only stations specifically designed to remove these refrigerants.

If the refrigerant you extract into a recovery unit contains a high level of flammable substances such as propane and butane, a fire hazard may result if the refrigerant comes into contact with an ignition source within the equipment. Whether you are purchasing a new piece of equipment to handle your contaminated and unfamiliar refrigerants, or you are converting a piece of existing equipment for this purpose, make sure you talk to your sales representative about what features have been incorporated into the equipment to guard against risks of ignition.

Refrigerant should be recovered into the standard DOT-certified, gray-with-yellow-top recovery tank, and if the tank is not equipped with a float valve (which serves as overfill protection), make sure it never gets filled

beyond 60 % of its gross weighted capacity, as specified in the SAE J1989 and J2211 standards. It should also be noted that while 60% is the SAE liquid fill limit, 40 CFR 82.42 Appendix A section 7.1, requires a liquid fill limit of 80%.

If A/C service is n*o*t a large percentage of your business, then you may be reluctant to invest in another piece of recovery equipment. If this is the case, consider calling a local A/C specialty shop that may have the equipment necessary to service contaminated refrigerants or refrigerants that are unknown to you.

Recycling refrigerant. Once recovered, refrigerant should not be recycled on-site unless uncontaminated R-12 or R-134a. Recovering contaminated R-12 or R-134a refrigerant into recycling equipment may damage the equipments. In addition, EPA regulations currently prohibit technicians from recycling blend substitute refrigerants (contaminated or not).

STORAGE AND DISPOSITION OF CONTAMINATED OR UNFAMILIAR REFRIGERANTS

Once the refrigerant has been recovered, if you can't recycle it, what do you do with it? The answer, naturally, is that it depends.

Storage. If the refrigerant in your "junk" tank contains significant amounts of flammable substances, it may be considered hazardous and you should make sure you follow any local ordinances that govern the storage of combustible mixtures. In addition, if your shop generates over 100 kilograms (220 pounds) of hazardous wastes per month (including used coolant, and battery acids), then your shop must meet certain storage and transportation requirements under the Resource, Conservation and Recovery Act (RCRA). For more details, call the RCRA Hotline at (800) 424-9346 and ask for EPA publication 530-K-95-001, the 1996 update of "Understanding the Hazardous Waste Rules – A Handbook for Small Business." You may also wish to check out the site of the Coordinating Committee for Automotive Repair at www.ccar-greenlink.org.

Disposition. If the refrigerant in your "junk" recovery tank is a chemical "soup" – either contaminated R-12 and R-134a, or a mixture of those contaminated refrigerants and some blend refrigerants that you are unfamiliar with—then the contents should be reclaimed or destroyed. You should investigate all your options and pick the one that makes the most economic sense for you.

If you have a contract in place with a waste hauler, contact the hauler to see if they can handle the material. Waste haulers may require that the contents be identified first and any charge you for this identification procedure. They are most likely to send the tank to an incinerator for destruction. You may also want to contact one or more reclaimers, who will send the refrigerant off-site either for destruction, or for reclamation, which involves breaking it up into its chemical components and purifying each of the components.

Some reclaimers can handle tanks sent to them from anywhere in the nation. A reclaimer does not necessarily have to be located in your area.

Due to the expense involved in reclaiming, some reclaimers may not accept less than 500 or 1000 pounds of contaminated or mixed refrigerant. In addition, you should be aware that not all reclaimers have the technology to handle all contaminated or mixed refrigerants. However, if one tells you that he is not interested in receiving your tank, don't necessarily assume that the next reclaimer you call will say the same thing.

Before you enter into any agreement with either your waste hauler or a reclaimer, make sure you understand all of the costs involved; there may be separate charges for identifying the material, transporting it and

destroying it. If you are responsible for shipping the tank, make sure that the hauler or reclaimer explains to you how to comply with any applicable DOT, state and local requirements relating to shipping.

If you have questions about disposing of specific blend refrigerants, call the refrigerant manufacturer. Most manufacturers of blend refrigerants have made arrangements with specific reclaimers to handle their used refrigerant. For a list of these telephone numbers, visit the EPA reclamation web site at https://www.epa.gov/section608/stationary-refrigeration-refrigerant-reclamation-requirements.

BEST SERVICING PRACTICES

- In addition to the environmental benefits, keeping systems properly charged and leak-free will improve the energy efficiency of the unit, save the owner additional costs of refrigerant, and help maintain the reliability and longevity of the system.
- The EPA encourages technicians to find and fix leaks rather than repeatedly topping off with refrigerant.
- Do not add more refrigerant than necessary, as this can cause system damage and decrease system performance.
- There is no "drop-in" replacement for any refrigerant. Refrigerants should never be mixed or used in systems designed for other refrigerants.
- Refrigerant containers and systems have unique fittings to prevent the mixing of refrigerants. Adapters should not be used to convert a fitting.
- Beware of contaminated refrigerants as they EPA understands that in some cases they are falsely packaged. Consider purchasing certified refrigerant identification equipment.
- Wear safety glasses and insulated gloves at all times when dealing with refrigerants and avoid direct contact of refrigerant with skin.
- Work in a well-ventilated area as acute exposure to any refrigerant can lead to asphyxiation.

APPENDIX A: RELEVANT SAE STANDARDS FOR MVAC SERVICING AND REPAIR

Mobile air-conditioning systems must be certified to meet SAE standards for performance. Further, all technicians engaging in the service or repair of MVAC systems must be familiar with and compliant with the following SAE standards for MVAC servicing and repair. The applicable SAE standards are briefly summarized below and some relevant items from these standards are contained throughout the study guide. To obtain a complete copy of the standard, you may contact the Society for Automotive Engineering or visit them online at www.sae.org . GCADA recommends all technicians review these standards in their entirety.

SAEJ639

This document provides design standards and safety requirements for MAC systems. Also included are cautionary statements for the mobile air conditioning service industry to alert service technicians to the inadvisability and the possible health and safety effects associated with venting refrigerant during service. This standard contains a recommended practice restricted to mechanical vapor compression refrigerant systems that provide cooling for the occupants' compartment. SAEJ639 provides guidelines for refrigerant containment and safety for a mobile air-conditioning system. It is not intended to restrict the use of, or further development of, other types of refrigeration systems for passenger compartment cooling. SAEJ639 addresses CFC-12 (R-12) and HFC-134a (R-134a) refrigerants. To prevent mobile A/C system refrigerant contamination, all other alternate refrigerants considered for automotive use require unique service fittings. Technicians should check state and local regulations regarding compliance with SAEJ639.

SAEJ1628

Standard outlines technician procedures for refrigerant leak detection in service of mobile air conditioning systems. Applies to the use of generally available leak detection methods to service motor vehicle passenger compartment air conditioning systems.

SAEJ1770

Equipment that recovers and recycles CFC-12 and HFC-134a must meet SAE Standard SAEJ1770.

SAE J1989

SAE standard J1989 states that all technicians should ensure containment of R-12 refrigerant during the service of mobile air-conditioning systems. Accordingly, all vehicle repairs should be performed in compliance with the service guidelines outlined in the SAE J1990 standard. When external portable containers are used for transfer, the container must be evacuated to at least 27 inches of vacuum (75 mm Hg absolute pressure) prior to transfer of the recycled refrigerant. External portable containers must meet DOT and UL standards. To prevent on-site over filling when transferring to external containers, the safe filling level must be controlled by weight and must not exceed 60% of container gross weight rating.

Under SAE J1989, the refrigerant recovery procedure is as follows: 1) Connect the recovery unit service hoses, which shall have shut off valves within 12 inches (30 cm) of the service ends, to the vehicle air-conditioning system service ports. 2) Operate the recovery equipment as covered by the equipment manufacturers recommended procedure. 3) Start the recovery process and remove the refrigerant from the vehicle AC system. Operate the recovery unit until the vehicle system has been reduced from a pressure to a vacuum. With the recovery unit shut off for at least 5 minutes, determine that there is no refrigerant remaining in the vehicle AC system. If the vehicle system has pressure, additional recovery operation is required to remove the remaining refrigerant. Repeat the operation until the vehicle AC system vacuum level remains

stable for 2 minutes. 4) Close the valves in the service lines and then remove the service lines from the vehicle system. Proceed with the repair/service. If the recovery equipment has automatic closing valves, be sure they are properly operating.

SAE J1990

SAE standard J1990 establishes that all equipment used for CFC-12 (R-12) recycling and/or recovery or recharging systems must comply with the equipment specifications set forth in SAE J1990. The SAE J1990 standard applies to equipment used to service automobiles, light trucks, and other vehicles with similar CFC-12 systems, but does not cover mobile vehicles with hermetically sealed systems for refrigerated cargo. Under SAE J1990, the equipment shall incorporate an in-line filter that will trap particulates of 15 UM spherical diameter or greater

SAE J1991

All refrigerant used in mobile air-conditioning systems should comply with the standard of purity set forth in SAE J1991. The contaminants in R-12 should be limited to 15 ppm by weight for moisture; 4000 ppm by weight for refrigerant oil; and 330 ppm by weight for noncondensable gases. These standards apply to refrigerant used to service automobiles, light trucks, and other vehicles with similar CFC-12 systems.

SAE J2064

Hose assembly requirements should meet or exceed the SAE J2064 standard. The SAE J2064 standard requires that the hose shall be designed to minimize permeation of R134a refrigerant, contamination of the system, and to be functional over a temperature range of -30° to 125°C. Specific construction details are to be agreed upon between user and supplier. A hose marked "J2064" signifies that it has been coupled, tested, and has met the requirements of SAE J2064.

SAEJ2099

As discussed earlier in the guide, SAE J2099 standard establishes the necessary level of purity for recycled HFC-134a and HFO-1234 yf refrigerant for use in mobile A/C systems, which has been directly removed from automotive A/C systems.

SAEJ2196

SAEJ2196 sets forth the standard for service hoses used in MVAC systems. All flexible hoses must meet the standard except that fittings shall be unique to the applicable refrigerant. Service hoses must have shutoff devices located within 30 cm of the connection point to the system being serviced to minimize introduction of noncondensable gases into the recovery equipment during connection and the release of the refrigerant during disconnection. The equipment must also be able to separate the lubricant from the recovered refrigerant and accurately indicate the amount removed from the simulated automotive system during processing in 30 mL units.

SAE J2197

The purpose of this SAE Standard is to establish specific but unique fittings for service equipment used in maintaining HFC-134a (R-134a) systems. This is necessary to avoid cross mixing of refrigerant and lubricants from CFC based systems. SAE J2197 establishes procedures to avoid the cross mixing of refrigerant and lubricants from CFC based systems, all service equipment used in maintaining HFC-134a (R-134a) systems should comply with the unique fitting standards set forth in SAE

standard J2197. It is important to note that CFC-12 and HFC-134a recovery/recycling equipment do not use the same type of hose fittings.

SAE J2209

SAE J2209 covers the equipment certification for the removal of CFC-12 from mobile air-conditioning systems that are being sent off site for process to meet ARI 700 purity level. Under SAE J2209, the container assembly shall be marked to indicate the first retest date, which shall be 5 years after date of manufacture. The marking shall indicate that retest must be performed every subsequent 5 years. The marking shall be in letters at least 6 mm high. The container must be stored at a temperature of 18.3 C (65 F) or above for at least 12 hours, protected from direct sunlight.

SAE J2211

SAE standard J2211 requires that all service technicians ensure refrigerant containment during mobile air-conditioning system repair. This standard provides guidelines for technicians for servicing mobile A/C systems and operating refrigerant recycling equipment designed for HFC-134a (R-134a). Refrigerant containment should be ensured by following the procedures set forth in the standard at each phase of servicing and repair.

SAE J2219

SAE J2219 addresses concerns to the mobile air-conditioning industry that all repair and service technician should be aware of when servicing or repairing MVAC units. All technicians should be familiar with these issues and MVAC recycling equipment must be certified to meet the standards set forth by SAE.

SAEJ2296

Standard provides a procedure to inspect a refrigerant cylinder used in equipment servicing mobile air-conditioning (A/C) systems. This includes the pressure cylinder used for refrigerant recovery/recycling and charging equipment.

SAEJ2297

This SAE Standard applies to dyes intended to be introduced into a mobile air-conditioning system refrigerant circuit for the purpose of allowing the application of ultraviolet leak detection. In order to label any product(s) they shall meet SAE J2297, and the certification process as described in SAE J2911 must be followed and the documentation described in the appendix shall be submitted to SAE.

SAEJ2298

Standard outlines the appropriate application of ultraviolet refrigerant leak detection dyes to service mobile air conditioning systems.

SAEJ2299

Standard applies to fluorescent refrigerant leak detection dye injection equipment for use in ultraviolet leak detection when servicing mobile air-conditioning systems as previously outlined in this guide.

SAEJ2670

This SAE standard applies to any and all additives and chemical solutions intended for aftermarket use in the refrigerant circuit of vehicle air-conditioning systems with belt-driven compressors, except as noted below. This standard provides testing and acceptance criteria for determining the stability and compatibility of additives and flushing materials (solutions) with A/C system materials and components, that may be intended for use in servicing or operation of vehicle air conditioning systems. This standard does not provide test criteria for additive, compressor lubricant, or flushing solution effectiveness; such testing is the responsibility of the additive and/or solution manufacturer/supplier. This standard does not cover additives or flushing materials for electrically driven compressors. The use of additives with electrically driven compressors might cause electrical shorting and compressor failure. It is not the intent of this document to identify the requirements for ultraviolet leak detection dyes. Such dyes must meet the requirements of SAE J2297 for the intended refrigerant. Additives for mobile air conditioning systems are not tested under this standard for system enhancement or performance. This standard only indicates if the additive is chemically compatible with materials used in the system components. Flushing solvents, when used, completely fill the component/system being flushed and, hence, should not harm system components at 100% concentration. They are not intended to remain in the system, either as a solvent or as an additive, but, because it is not possible to remove all of the flushing solvent, an indeterminate amount remains. The residual remaining in the system depends on many factors, including system/component configuration, component blind spots where liquid cannot be removed, the volatility of the solvent, the procedure(s) used to remove the solvent, and evacuation capability and procedure. No means exists to identify and/or specify the amount of residual solvent that either can, or will, remain in any given system after the procedure(s) have been followed. This standard does not address the flushing solvent procedure or its effectiveness at removing residual flushing agent.

SAEJ2683

Standard applies to Carbon Dioxide R-744 refrigerant used to service motor vehicle passenger air-conditioning systems designed to use CO2 (R-744). Carbon dioxide (R-744) when used as a refrigerant in mobile air conditioning systems shall contain an odorant as an identification of refrigerant leaking from the system.

SAEJ2776

SAEJ2776 applies to new refrigerant used in motor vehicle passenger air conditioning systems designed to use HFC-134a.

SAE J2788

SAE J2788 provides the specific minimum equipment requirements for the recovery/recycling of HFC-134a that has been directly removed from and intended for reuse in mobile air-conditioning systems, as well as recovery/recycling and system recharging of recycled HFC-134a. These specifications are aimed at ensuring the system will be able to provide the same level of performance and durability with recycled refrigerant as new refrigerant. Recycled refrigerant for recharging and transfer shall be taken from the liquid phase only. All technicians should be familiar with the requirements set forth by SAE in this standard.

SAEJ2791

This SAE Standard provides testing and functional requirements to meet specified minimum performance criteria for electronic probe-type leak detectors. So they will identify smaller refrigerant leaks when servicing all motor vehicle air conditioning systems, including those engineered with improved sealing and smaller

refrigerant charges to address environmental concerns and increase system efficiency. This document does not address any safety issues concerning their design or use.

SAE J2810

SAE J2810 establishes the standard for HFC-134a (R-134a) recovery for only equipment used in conjunction with the on-site recovery/recycling equipment used at service facilities for off-site refrigerant reclamation or other environmentally legal use. The standard provides equipment specifications, safety requirements, operating instructions, as well as a description of the equipment function and testing procedures. All technicians should be familiar with and prepared to comply with this standard.

SAEJ2842

This standard is intended to minimize any unnecessary exposure to persons, during normal use or servicing of a mobile air conditioning system using toxic or flammable refrigerants. The intent of this standard is to establish a framework to assure that all evaporators for R-744 and R-1234yf mobile air conditioning (MAC) systems meet appropriate testing and labeling requirements. SAE J639 requires vehicle manufacturers to perform assessments to minimize reasonable risks in production MAC systems. The evaporator (as designed and manufactured) shall be part of that risk assessment and it is the responsibility of the vehicle manufacturer to assure all relevant aspects of the evaporator are included. It is the responsibility of all vehicle or evaporator manufacturers to comply with the standards of this document at a minimum. (Substitution of specific test procedures by vehicle manufactures that correlate well to field return data is acceptable.) As appropriate, this standard can be used as a guide to support risk assessments. With regard to certification, most vehicle manufacturers have established formal production part approval processes (PPAP) where compliance certification is established and formally documented. For an evaporator manufacturer of non-original equipment parts (or a vehicle manufacturer that does not have a formal part compliance certification process) then the certification described in this standard is the requirement to which those evaporators shall comply. In this case, the evaporator manufacturer or an independent institution shall complete the evaporator certification according to SAE J2911. An example of the latter would be the completion of witness testing by the evaporator manufacturer with the submission of certification documents by the witness organization.

SAEJ2843

Standard applies to equipment to be used with R-1234yf refrigerant only. It establishes requirements for equipment used to recharge R-1234yf to an accuracy level that meets purity levels outlined in this standard as well as SAEJ2099. Refrigerant service equipment is required to ensure adequate refrigerant recovery to reduce emissions and provide for accurate recharging of mobile air conditioning systems. Equipment shall be certified to meet all performance requirements outlined in this document and international/regional construction and safety requirements outlined in this standard. All technicians should be familiar with and prepared to comply with this standard.

SAEJ2844

Standard applies to new refrigerant used in motor vehicle passenger air conditioning systems designed to use R-1234yf, including belt and electrically driven compressors. The purpose of this SAE Standard is to establish the minimum level of purity required and container specifications for HFO-1234yf refrigerant used in mobile air-conditioning (A/C) systems. The refrigerant shall meet all purity requirements as identified in this Standard and shall follow the sampling and analytical methods of testing described in AHRI Standard 700-2006 and in future AHRI-700 Standards that include HFO-1234yf.

SAEJ2845

Includes unique requirements and recommended procedures for servicing and repairing Mobile Air Conditioning systems using R-744 and/or R-1234yf. Technicians are trained to recognize which refrigerant is being handled, how to handle it safely and be equipped with the essential information, proper equipment and tools, which are unique to these refrigerants. Goal of the training is to provide information to technicians about safely handling these refrigerants. All technicians should be familiar with and prepared to comply with this standard.

SAEJ2851

This standard examines equipment used to remove contaminated refrigerant from Mobile Air conditioning systems. The purpose of this SAE Standard is to provide minimum performance and operating feature requirements for the recovery of HFO-1234yf refrigerant to be returned to a refrigerant reclamation facility that will process it to the appropriate ARI 700 Standard or allow for recycling of the recovered refrigerant by using SAE J2843 certified equipment. Technicians should ensure that any equipment being used for removal of contaminated refrigerant is included in this standard.

SAEJ2888

This SAE Standard covers fittings, couplers, and hoses intended for connecting service hoses from mobile air-conditioning Systems to service equipment such as charging, recovery and recycling equipment. (Figure 1) This specification covers service hose fittings and couplers for MAC service equipment service hoses, per SAE J2843 and SAE J2851, from mobile air-conditioning systems to service equipment such as manifold gauges, vacuum pumps, and air-conditioning charging, recovery and recycling equipment. This is necessary to avoid cross mixing of refrigerant and lubricants from other refrigerant systems. This standard applies only to systems specifically designed to use HFO-1234yf.

SAEJ2912

This SAE Standard applies to refrigerant identification equipment to be used for identifying refrigerant HFC-134a (R-134a) and HFO-1234yf (R-1234yf) refrigerant when servicing a mobile A/C system or for identifying refrigerant in a container to be used to charge a mobile A/C system. The purpose of this SAE Standard is to establish criteria for refrigerant identification equipment intended for use with or without recycling equipment when removing refrigerant from Mobile Air-Conditioning (A/C) Systems or from refrigerant containers prior to charging a mobile A/C system.

SAEJ3030

This SAE Standard establishes the specific minimum equipment requirements for recovery/recycling/recharge equipment intended for use with both R-1234yf and R-134a in a common refrigerant circuit that has been directly removed from, and is intended for reuse in, mobile air-conditioning (A/C) systems. This document does not apply to equipment used for R-1234yf and R-134a having a common enclosure with separate circuits for each refrigerant, although some amount of separate circuitry for each refrigerant could be used.

APPENDIX B: GUIDANCE ON RETROFITTING A/C SYSTEM TO R-134A

The term "retrofit" decries special procedures required to convert an R-12 system to use an alternative refrigerant. This document will describe some facts about aftermarket options and procedures for retrofitting a vehicle's a/c system to R-134a. In 2015, this process is used sparingly.

Automakers worldwide chose R-134a to be the long-term replacement for R-12 in automotive A/C systems, both in new vehicles and in retrofit applications. If information becomes available, EPA may develop similar guidelines in the future for retrofitting to refrigerants other than R-134a. At this time however, wide- scale performance testing has not been performed on vehicles retrofitted to these refrigerants. Should you have questions about retrofitting to an alternative refrigerant, consult the refrigerant's manufacturer. You may also want to review the EPA publication "Choosing and Using Alternative Refrigerants in Motor Vehicle Air Conditioning" available electronically at www.epa.gov/ozone/title6/snap/macssubs.

The Society of Automotive Engineers (SAE) provides guidelines for A/C retrofit in their publication J1661. Several refrigerant and lubricant procedures have published their own recommendations. EPA is compiling a list of organizations that offer either classroom or home-study (videotape/workbook) retrofit training. Foe EPA's current list; see "Resources for Retrofit Training" at the end of this document.

Retrofitting CFC-12 MVACs

The retrofitting of CFC-12 vehicles is also regulated under EPA's SNAP program. SNAP requires that when retrofitting a CFC-12 vehicle for use with another refrigerant, the technician must extract the CFC-12, must cover the CFC-12 label with a label that indicates the new refrigerant in the system and other information, and must affix new fittings unique to that refrigerant. The label must include the name and address of the technician and the company performing the retrofit; the date of the retrofit; the trade name, charge amount, and, when applicable, the ASHRAE refrigerant numerical designation of the refrigerant; and the type, manufacturer, and amount of lubricant used. If the refrigerant is or contains an ozone-depleting substance, the label must state "ozone depleter", and if the refrigerant is flammable, it must include the statement "This refrigerant is FLAMMABLE. Take appropriate precautions." The label must be large enough to be easily read, must be permanent, and must be affixed to the system over information related to the previous refrigerant, in a location not normally replaced during vehicle repair. If information on the previous refrigerant cannot be covered by the new label, the original label must be permanently rendered unreadable. Lastly, the background color of the label must be unique to the refrigerant. This information is needed so that subsequent technicians working on the MVAC system will be able to service the system properly, decreasing the likelihood of significant refrigerant emissions, cross-contamination and potential failure of air conditioning systems and refrigerant recovery/recycling equipment.

CFC-12 vehicles may only be retrofitted with alternatives approved under SNAP for use as retrofits. HFC-134a is the primary refrigerant currently used to retrofit CFC-12 systems. There are no alternatives approved to retrofit HFC-134a systems.

RETROFITTING VEHICLES TO ALTERNATE REFRIGERANTS

Although section 609 of that Act does not govern retrofitting, section 612 of the Act, which describes the Agency's Significant New Alternatives Policy (SNAP) program, does require that when retrofitting a CFC-12 vehicle for use with another refrigerant, the technician must first extract the CFC-12, must cover CFC-12 label with a label(see below) that indicates that new refrigerant in the system and other information, must

affix new fitting unique to that refrigerant. In addition, if a technician is retrofitting a vehicle to a refrigerant that contains R-22, the technician must ensure that only barrier hoses are used in the A/C system. Finally, if the system includes a pressure relief device, the technician must install a high-pressure compressor shutoff switch to prevent the compressor from increasing pressure until the refrigerant is vented.

Much more information about the SNAP program and about retrofitting procedures is available in a fact sheet called “Choosing and Using Alternative Refrigerants” through the website listed above.

EPA REQUIREMENTS FOR RETROFIT

According to EPA regulations, the use of any alternative refrigerant to replace R-12 requires at a minimum that:

- Unique service fittings be used in order to minimize the risk of cross-contamination of either the air-conditioning system or the service facility’s recycling equipment;
- The new refrigerant be identified by a uniquely-colored label in order to identify the refrigerant in the system:
- All R-12 be properly removed from the system before filling the system with an alternative refrigerant;
- In order to prevent release of refrigerant to the atmosphere, a high-pressure compressor shutoff switch be installed on any system equipped with a pressure relief device; and
- Separate, dedicated EPA-approved equipment be used to recover the R-12 from the system.

In addition, alternative refrigerant blends that contain R-22 must be used with barrier hoses. Finally, when retrofitting any system that has a pressure release device, the technician must install a high-pressure shutoff switch on the compressor if the system is not already equipped with a switch.

Labeling

In accordance with 40 CFR Subpart G, Appendix D when a retrofit is performed, a label must be used as follows:

Whether a car is originally designed to use a new refrigerant or is retrofitted, the technician must apply a detailed label giving specific information about the alternative. The label's background color is chosen by the manufacturer to be unique. The label shows:

- the name and address of the technician and the company performing the retrofit;
- the date of the retrofit;
- the trade name, charge amount, and, when applicable, the ASHRAE numerical designation of the refrigerant;
- the type, manufacturer, and amount of lubricant used; and
- if the refrigerant is or contains an ozone-depleting substance, the phrase "ozone depleter"

This label covers up information about the old refrigerant, and provides valuable details on the alternative and how it was used. It also tells the owner who performed the retrofit. For more details on the retrofit process please visit the EPA’s website here: https://www.epa.gov/mvac/choosing-and-using-retrofit-refrigerant-cfc-12-motor-vehicle-air-conditioner-mvac

APPENDIX C: OTHER IMPORTANT INFORMATION

- Technicians should stay abreast of updates to any state and local regulations regarding compliance with this section.
- The EPA has materials available almost all of the topics discussed in this guide. For more information, visit:
    - http://www.epa/gov/mvac
    - https://www.epa.gov/snap

APPENDIX D: FIXING REFRIGERANT LEAKS:

Fixing leaks in MVAC systems is not required by the EPA where the appliance does not have a charge of at least 50 (fifty) pounds of refrigerant. EPA regulations do require that all commercial and industrial process refrigeration containing more than 50 lbs. of ODS refrigerant MUST be repaired when the annual leak rate exceeds 35%. However, when servicing an MVAC System, leaks should be repaired whenever possible. This is because adding refrigerant to a leaking system is not only wasteful and potentially illegal, but also harmful to the environment

In detecting a leak, a manufacturer's instructions should be followed when using an electronic leak detector. In addition, a technician should always leak test when the engine is off. Next, only a small amount of refrigerant is required to perform a leak test (50psig is all that is needed). Further, all dirt should be removed from suspected leak areas. Carefully look for signs of leakage, damage, and corrosion on all lines, hoses, and components. To verify an apparent leak, detection dye may be used. When the dye escapes, it leaves a colored deposit at the point of the leak. After completing each step, repeat the leak check. If a technician chooses to fix a leak, compliance with the leak repair requirements requires calculating both the full charge of the appliance and the leak rate.

Where a leak exists, a technician should: (A) isolate leaking from non-leaking components wherever possible; (B) evacuate non-leaking components to be opened to the levels in owner's manual; and (C) evacuate leaking components to be opened to the lowest level that can be attained without substantially contaminating the refrigerant. In no case shall this level exceed 0 psig.

To prevent leakage, manifold hoses must have shut off valves within 12 inches of the ends of each line. Further, if a refrigerant recovery cylinder is being used it must be approved. Approved refrigerant recovery cylinders have yellow tops and gray bodies. Hose assembly requirements should meet or exceed the SAE J2064 standard. The SAE J2064 standard requires that the hose shall be designed to minimize permeation of R134a refrigerant, contamination of the system, and to be functional over a temperature range of -30° to 125°C. Specific construction details are to be agreed upon between user and supplier. A hose marked "J2064" signifies that it has been coupled, tested, and has met the requirements of SAE J2064.

When repairing an MVAC systems there are several risks in handling or coming in contact with refrigerant, which may result in skin or eye irritation or frostbite. Inhalation of concentrated refrigerant fumes is dangerous and can result in death; cases of fatal cardiac arrhythmia have been reported in people accidentally subjected to high levels of refrigerant. Some early symptoms include loss of concentration and drowsiness.

YOU HAVE NOW COMPLETED THE SELF-STUDY PORTION OF THE CERTIFICATION.

CERTIFICATION TEST

TO BECOME CERTIFIED, YOU MUST COMPLETE THE ENCLOSED CERTIFICATION TEST ON PAGES 40 THROUGH 43. YOU MUST CORRECTLY ANSWER 28 QUESTIONS TO PASS. YOU MAY USE YOUR SELF-STUDY BOOKLET DURING THE TEST.

BE SURE TO COMPLETE ALL THE INFORMATION ON PAGE 44. IF IT'S INCOMPLETE, YOU WILL NOT RECEIVE YOUR CERTIFICATION. PLEASE CALL THE GREATER CLEVELAND AUTOMOBILE DEALERS ASSOCIATION WITH ANY QUESTIONS (440-746-1500).

GOOD LUCK.

1. If the ozone layer is depleted, more of the sun’s damaging rays would not penetrate the earth's surface?

A. TRUE B. FALSE

2. When storing, R744 should be kept in a firmly secured container below 50°C in a well ventilated place.

A. TRUE B. FALSE

3. Using the wrong refrigerants during "top off" service activities will not cause system damage to the air conditioner?

A. TRUE B. FALSE

4. CO_2 can be used as a refrigerant and is also known as R744.

A. TRUE B. FALSE

5. The recovery equipment service hoses must have shut off valves within 12 inches of the service ends, to the vehicle air-conditioning system service ports.

A. TRUE B. FALSE

6. Under the EPA SNAP Program, the EPA examines alternatives to CFC-12 for their:

A. Ozone Depleting
B. Global Warming
C. Flammability
D. Toxicity Characteristics
E. All of the above

7. During the HFC-134a recycling process, the use of refrigerant with excess air may cause damage to an A/C system?

A. TRUE B. FALSE

8. Use of improper refrigerant can cause leakage in the air-conditioner's hoses and seals?

A. TRUE B. FALSE

9. EPA standards set forth that such a cylinder must not be filled above ___% of its capacity by weight

A. 80
B. 95
C. 75%
D. 50

10. Equipment that recovers and recycles CFC-12 and HFC-134a must meet SAE Standards?

A. SAE J2211
B. SAE J1989
C. SAE J1770
D. SAE J 2211 and SAE J1989

11. HFC-134a does not contain chlorine and therefore _____, however it _____.

A. contributes to ozone depletion; does not contribute to global warming.
B. does not contribute to ozone depletion; does contribute to global warming.
C. None of the above.

12. If a vehicle's air conditioning system is retrofitted from CFC-12 to HFC 134a, the technician?

A. Needs to Inform the U.S. EPA B. Needs to Do Nothing
C. Must Place a Label Under the Hood Identifying the New Refrigerant and New Fittings That Are Unique to the Refrigerant Must Be Attached to the High-and-Low Side Service Ports of the A/C System

13. Under SAE J2064 the hose must minimize permeation of HFC-134a, any permeation of the system, and be functional within a temperature range of _____ t0 _____.

A. -44 F to 212 F B. 0 F to 112 F
C. 32 F to 257 F D. -22 F to 257 F

14. To properly charge a system to its critical charge a technician must weigh the refrigerant into the system.

A. TRUE B. FALSE

15. Service shops are also required to maintain records (on-site) showing that all service technicians are properly certified.

A. TRUE B. FALSE

16. HFC-134a is an unacceptable refrigerant starting with model year (MY) 2021.

A. TRUE B. FALSE

17. According to SAE Standards, when transferring refrigerant to an external container, a safe filling level must be controlled by weight and must not exceed?

A. 60% Of Containers Gross Weight B. 75% OF Containers Gross Weight
C. 80% Of Containers Gross Weight D. 90% OF Containers Gross Weight

18. It is legal to sell containers of Class I and Class II refrigerant in small cans only to individuals that are properly trained and certified to operate approved refrigerant recycling equipment under the Clean Air Act.

A. TRUE B. FALSE

19. R-152a is also known as difluoroethane and is also suggested as a replacement for R-134a.
A. TRUE B. FALSE

20. The contaminates in the recycled refrigerant shall be limited to ?

A. Anti-Freeze B. Engine Oil
C. Both A & B D. the refrigerant only.

21. The DOT or UL approved container must be retested?

A. Every Year B. Every Two Years
C. Every Ten Years D. Every Five Years

22. HFO-1234yf is yet to be adopted by automobile manufacturers.

A. TRUE B. FALSE

23. Recycled refrigerant, for recharging and transfer shall be taken from the?

A. Gas Phase Only B. Liquid Phase Only
C. Gas or Liquid Phase D. None of the Above

24. R-152a has remained the most common refrigerant used in MVAC since the 1990s.

A. TRUE B. FALSE

25. During the process of refrigerant recovery, the technician should:

A. Operate The Recovery Unit Until the System Has Been Reduced from A Pressure to A Vacuum; Then Immediately Close the Valves in The Service Lines and Remove the Lines from the Vehicle.

B. After Shutting the Recovery Unit Off for 2 Minutes, Determine That the System Has No Pressure; If It Still Has Pressure, Perform More Recovery Until the Vacuum Level Remains Stable for 5 Minutes.

C. After Shutting the Recovery Unit Off for 5 Minutes, Determine That the System Has No Pressure; If It Still Has Pressure, Perform More Recovery Until the Vacuum Level Remains Stable for 2 Minutes.

D. First Connect the Recovery Equipment's Service Hoses, Which Must Have Shut Off Valves Within 4 Inches (10CM) Of The Service Ends.

26. A CO2 system 0perates at _ to __ times higher pressure than other MVAC systems

A. 5 to10 times higher pressure B. 1 to 2 times higher pressure
C. Three to four times less pressure D. 45 to50 times less pressure

27. R-141b is an acceptable substitute refrigerant for use in motor vehicles.

A. TRUE B. FALSE

28. Under SAE J2788, equipment shall be capable of removing a minimum of _____ of the refrigerant from the test system in 30 minutes or less.

A. 50% B. 75%
C. 95% D. 100%

29. SAE J2810 establishes the standard for HFC-134a (R-134a) recovery for only equipment used in conjunction with the on-site recovery/recycling equipment used at service facilities for off-site refrigerant reclamation or other environmentally legal use.

A. TRUE B. FALSE

30. The SAE J2099 standard of purity for recycled HFC-134a refrigerant for use in mobile A/C systems, which has been directly removed from automotive A/C systems, shall not exceed the following levels of contamination:

A. Moisture: 50 PPM (Parts per million) by weight
B. Refrigerant Oil: 500 PPM by weight
C. Non-condensable Gases (air): 150 PPM by weight
D. All of the Above

31. Adding more refrigerant than necessary can cause system damage and decrease system performance.

A. TRUE B. FALSE

32. Topping off a refrigerant is recommended over finding and fixing leaks.

A. TRUE B. FALSE

33.In order to avoid the mixing of refrigerants, refrigerant containers and systems have unique fittings.

A. TRUE B. FALSE

34.Which SAE standard covers recommended service procedures for the containment of HFC-134a (R-134a)?

A. SAE J639 B. SAE J2064
C. SAE J2211 D. SAE J2845

35. As outlined in SAE J2298, the appropriate application of ultraviolet refrigerant leak detection _____ can be used to service mobile air conditioning systems.

A. Tape B. Dyes
C. Chalk D. Fluid

PLEASE COMPLETE THE FOLLOWING REQUIRED INFORMATION: (please print)

NAME: _____

PLACE OF EMPLOYMENT:_____

ADDRESS:_____

CITY:_____ STATE:_____ ZIP:_____

WORK PHONE:_____-_____-_____

HOME ADDRESS:_____

CITY:_____ STATE:_____ ZIP:_____

HOME PHONE:_____-_____-_____

SOCIAL SECURITY NUMBER:_____-_____-_____

I CERTIFY THAT THE ABOVE INFORMATION IS CORRECT AND THAT I COMPLETED THE TEST OF MY OWN ABILITY.

X_____ _____
Signature Date

ALL INFORMATION MUST BE COMPLETED BEFORE A CERTIFICATE WILL BE ISSUED.

A CERTIFICATE WILL FOLLOW IN THE MAIL. ALL CERTIFICATES MUST BE KEPT AT YOUR PLACE OF EMPLOYMENT.

BE SURE TO MAKE A COPY OF THE COMPLETED TEST FOR YOUR RECORDS BEFORE YOU SEND IT FOR GRADING.

SHOULD YOU HAVE ANY QUESTIONS ABOUT THE CERTIFICATION BOOKLET, PLEASE FEEL FREE TO CALL. THANK YOU.

RETURN THE ENCLOSED TEST TO:

KAREN FORD
GCADA/FREON
10100 Brecksville Road
Brecksville, OH 44141