MACS Recommended Service Procedures

Initial Customer Contact

It is important to obtain information from the customer identifying the problem and any previous servicing history prior to attempting repair of the system.

- Use of the MACS "*Air Conditioning & Heater Customer Questionnaire*" will help identify the problem.
- Identify service activity on MACS *"A/C – Heating – Ventilation – Cooling System Checklist."*

Identification of Type of Service

Mobile A/C systems are an integral part of the total vehicle and operation of engine cooling fan(s) and the A/C compressor can be controlled by the vehicles' computer systems resulting in a direct effect on system operation.

Cooling Operation

- Lack of cooling can be due to many reasons including:
    - Compressor operation
    - System Refrigerant Charge and Type
        - Contaminated refrigerant
        - Air in system
        - Too much oil in system
        - Sealant in system blocking/restricting controls/screens
    - System controls
        - Including temperature door movement and proper position
        - Defective/improperly operating (setting drift) thermostatic expansion valve
        - Restricted or missing orifice tube
        - Defective/improperly operating compressor clutch cycling switches
        - Defective/improperly operating evaporator temperature sensors/thermistors or thermostatic switches
        - Defective control valves (in variable displacement compressors)
    - Airflow circuits
        - Clogged evaporator core fins (or condensate screen/filter)
        - Plugged cabin air filter

- System mode door position
- System fan motor, fan clutch and electrical controls
- Condenser -- Insufficient airflow, restriction and/or capacity or improper substitute
- Cooling System – Insufficient radiator performance or coolant condition and level
- Material between radiator and condenser
- Other cooling system malfunctions such as low coolant, a stuck closed or improperly functioning thermostat, lack of or improper electric cooling fan operation, defective mechanical fan clutch, defective or incorrect pressure cap, defective or improperly operating coolant control valve, etc.

- Outside air ingestion
- Internally blocked components (such as condensers, orifice tubes, etc.)
- Replacement parts that do not meet or exceed the performance of OEM components

Heating - Defrosting Operation

The basic areas to check include:

- Internally restricted heater core, flow restrictors or hoses
- Coolant flow/coolant pump operation
- System controls
  - Including temperature door movement and proper position
  - Operation of heater engine coolant flow valve, if installed and part of system
  - Pulse Width Modulated (PWM) temperature control operation of heater coolant valve and control circuit if installed and part of system
- Airflow circuits
  - System mode door function and correct travel positions
  - System fan motor and electrical controls

Visual Inspection

Mechanical

- Inspect compressor drive belt
  - Improper compressor operation due to:
    - Excess wear – cracked – glazed

    - Incorrect tension – causing slippage
  - Compressor clutch
    - Indication of overheating or slipping
      - Due to incorrect air gap
      - Oil coating
      - Poor electrical connection or low clutch voltage
      - Poor electrical ground connection, loose, corroded
      - Wrong or improper clutch

Noise or Component Failure

- Inspect for worn – damaged – broken
  - Engine mounts
  - Check compressor mounting bolts and brackets for proper torque and attachment
  - Engine torque struts
  - Improper refrigerant or heater hose routing and mounting
  - Improper charge, refrigerant, lubricant or amount
  - OEM bulletins
  - Aftermarket sealants

Condenser

- Operation of engine cooling fan(s)
  - Improper mounting (upside down), loose or missing hardware
  - Excessive fan motor current draw
  - Broken, cracked or missing fan blades
  - Malfunctioning dual function pressure switches (fan operation & compressor cut-out)
  - Missing orifice tube
- Restricted airflow
  - Reduced airflow due to:
    - Foreign material in fins (bugs, grass, etc.)
      - Between condenser and radiator
    - Damaged condenser fins
    - Missing or misplaced airflow seals
    - Improper cooling fan(s) operation

System Airflow

To assure that the system is delivering maximum airflow the following areas should be inspected for blockage.

- Outside air operation
    - Check cowl and system air intake for restrictions
        - System air inlet location for
            - Debris
            - Plugged cabin air filter
- Recirculated air operation
    - System air inlet
        - Debris
- Plenum-Case/Duct Assembly
    - Plugged evaporator inlet filter
    - Deteriorated foam seals at ducting in plenum connections
    - Evaporator case condensate drain plugged
        - (Can result in wet vehicle carpet)

Confirm There Is Refrigerant In System

System Has Pressure

- Determine if the system has refrigerant pressure
    - To prevent damage to service equipment from possible refrigerant contamination, the system refrigerant should be checked with a refrigerant identifier and sealant detector.
- HFC-134a pressure is approximately the same as the surrounding temperature. At an area temperature of 75 degrees F. the stabilized system pressure with A/C system off will be around 75 psig.
    - If the engine compartment is hot and system is off, pressure may be slightly higher.

System Has No Pressure (15-0 PSI)

(Note: If service port valve seals are damaged, they may not allow the valve cores to depress properly, possibly making it appear that the system does not contain pressure when it actually does.)

A visual inspection for evidence of system lubricant on the refrigerant system component(s) surfaces generally indicates potential refrigerant leak points.

If the system is empty and does not have any refrigerant pressure, there are two approaches that can be used in an attempt to identify the leak point(s).

Vacuum Method

- Connect a vacuum pump to the system service ports and attempt to draw the system into a vacuum. If this is successful:
    - With vacuum pump off determine if the system will hold vacuum (at least 10 minutes)
    - Determine if there is a noise from an identifiable leak point.
- Sometimes reducing the system into a vacuum can result in the leak point becoming sealed and the leak point not found. To determine if there is a system leak the pressure method should be used.

Pressure Method

To provide system refrigerant pressure for leak detection, only a partial system refrigerant charge is required. Generally an amount equal to 20% of the total system charge will result in a saturated system pressure reading. Once the system contains both liquid and vapor refrigerant the system pressure will not increase by adding more refrigerant. (See Figure 1) The refrigerant can be added without evacuating the system since upon its removal the recycling equipment will remove the air during the recycling process. Adding refrigerant to a system that did not have pressure will result in a slightly higher pressure as compared to pure refrigerant in the system.

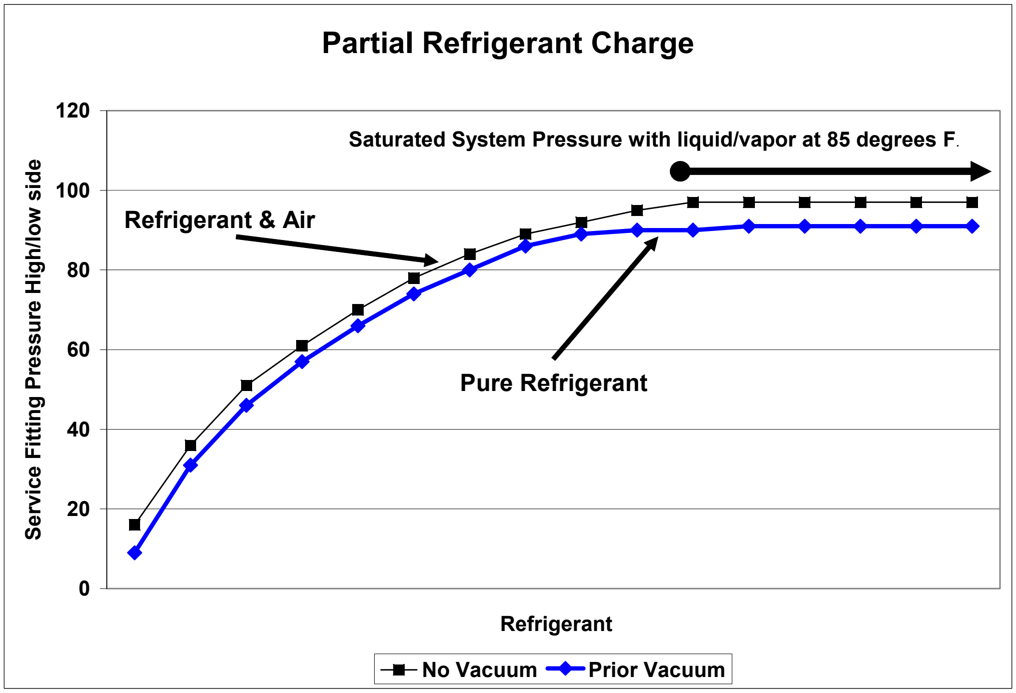

Figure 1

- With at least 50-psig system pressure perform the leak checking process.
- If the refrigerant system is to be operated, install the full factory charge amount.

Performance Testing

Upon completion of the initial visual inspection and determination as to whether or not the system has pressure, it would be best at this time to conduct a system performance test. Running a performance test can offer an opportunity to see if the system will cool properly after repair(s) have been performed. It may also help eliminate possible future concerns and questions.

If it has been determined that the system has a functioning or somewhat functioning compressor, a sufficient charge of refrigerant should be added to enable the compressor to operate to complete a performance test of the system.

The performance test may also allow the technician to note if the compressor is functioning properly, if the compressor is noisy, if the expansion valve is functioning, if there is the expected temperature drop at the condenser, if there may be air blend door issues, or if the system may have any additional cooling issues. Having a sufficient charge of refrigerant in the system will also ensure the system contains adequate internal pressure for use of an electronic leak detector.

If fluorescent dye is to be used in a leak detection process, it may also be added at this time.

System Refrigerant Leakage

System refrigerant leaks can occur in many locations where they may be difficult to visually pinpoint.

Visual inspection for evidence of system lubricant generally indicates potential refrigerant leak points. When a point is identified, use an SAE certified leak detector to verify the leak. Except for compressor shaft seals, surfaces that have evidence of lubricant generally indicate the presence of a refrigerant leak.

In some cases, even though there may be a sign of lubricant leakage at a compressor shaft seal, the leak may be too small to result in a sufficient release of refrigerant which could be identified with a leak detector.

The condenser, evaporator and rigid pipes/tubing, unless physically damaged, will not usually experience leakage. However, these components can be susceptible to corrosion, which could result in leakage.

In general, operational leakage or mis-assembly of the following system components can result in system leak points.

- Coupled flexible hose(s)
    - At hose and metal coupling connection
    - At quick connect points if moved
- Compressor
    - Shaft seal
    - Porous casting/shell case seals
    - Pressure switches and/or o-rings
    - Pressure relief valve
- System service ports due to:
    - Missing or lost service caps
    - Leaking/damaged core valves

- All refrigerant coupling points
  - O-Rings
    - Cut/damaged
    - Wrong size O-ring (diameter, thickness)
    - Residual flush material, sealants, alternate refrigerants
  - Flat surface seals – gaskets
    - Cut/damaged
    - Incorrect torque of connections
    - Residual flush material, sealants, alternate refrigerants

Identification of System Refrigerant Leakage
Identification of a small system refrigerant leak may require a combination of leak detection methods.

If a system has at least 50-psig pressure, the system can be checked with an electronic leak detector. It should be noted that there is a major difference between the capabilities of electronic refrigerant leak detectors to find small leaks even though they are certified to the SAE standard.

Increasing System Refrigerant Pressure for Leak Detection
Elevating the temperature (warming) of all the A/C system components will help increase the system pressure for leak detection. (It is preferred to work on vehicles when the ambient temperature is above 70 degrees F.)

Increase System Refrigerant Pressure Procedure (Using Engine Heat)

- A/C System Controls
  - Turn compressor off so it will not operate. *(Note: On some vehicles, particularly those equipped with Automatic Temperature Control systems, this may not be possible. It may be necessary to electrically disable the clutch by removing the clutch control relay, disconnecting the clutch field coil's electrical connector, removing a fuse, etc. Also, some vehicles are equipped with clutchless compressors. Clutchless compressors operate any time the engine is running. If a vehicle is equipped with a clutchless compressor, refer to the vehicle manufacturer's service information to see if a procedure exists to operate the engine without the compressor also operating.)*

- Set panel system controls
  - Outside air (not max or recirculated)
  - High fan speed
  - Airflow from panel outlets
  - Temperature position max cold
- Vehicle hood open to allow warm engine air to enter cowl inlet to A/C system
- Operate engine idle condition
  - Neutral (park) with parking brake applied
    - Depending on engine compartment temperature
    - Run engine to warm up A/C system components for 15 minutes
      - After idling engine for 15 minutes (hot condition)
      - Shut engine and A/C fan off and start the leak detection process

Other Leak Detection Methods

Soap Bubbles

Using soap bubbles to detect a leak will only identify a large leak. A leak rate producing 1 bubble per second results in a loss of over 50 ounces per year. Since most mobile systems contain only one half of that amount, they will lose cooling capability within days. As noted in figure 2 the typical R134a single evaporator system charge is 25.6 ounces.

The information found in figure 2 compares the detection rate of an SAE leak detector of 0.5 ounces per year with water and soap bubble detection methods of 45 to 55 ounces per year.

The use of soap bubbles may help in verifying the location of **large leaks** in tight and hard to access places or near multiple refrigerant connections. Unless the system has a large refrigerant leak, using soap bubbles for leak detection is an ineffective method when servicing mobile A/C systems.

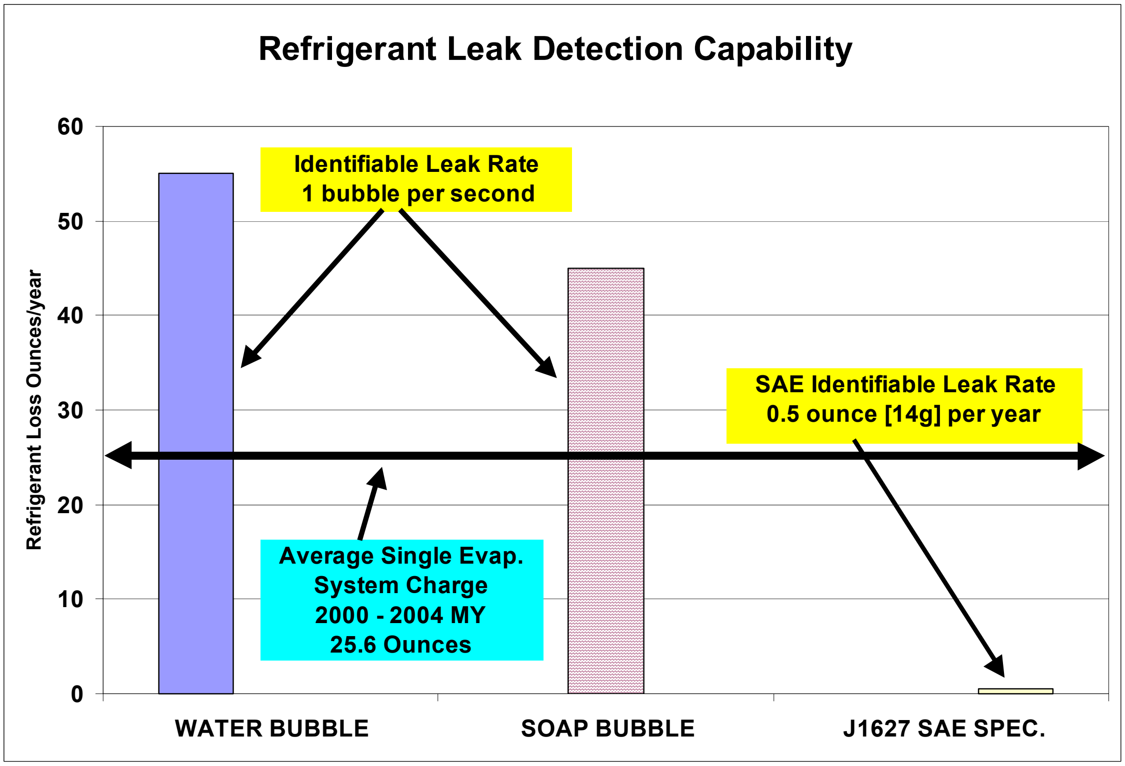

Figure 2

Using Nitrogen

Using nitrogen for leak checking is a questionable method due to a lack of nitrogen detection equipment and nitrogen's high pressure. For example, if an evaporator core is subjected to over 300 PSI, it may burst. As the components age, they may fail at pressure less than 300 PSI.

Nitrogen and soap bubbles have been used in the commercial refrigerant industry on large systems that are prone to high leakage rates. Using nitrogen and soap bubbles for locating small leaks in mobile A/C systems is of questionable value.

Using Other Refrigerants

The use of R22 or other chemicals having higher pressure can result in system damage. Use of R22 for leak checking can result in chemical damage to the system over time (especially to seals). The R22 cannot be completely removed from the system after leak checking.

The R22 remaining in the system's lubricant may over time chemically damage hose and seal material resulting in a potential later system failure. Using R22 is never recommended for use for leak checking. Check system and/or component manufacturers' policy on using other refrigerants.

Using Trace Dye

When trace dye is installed in the system it requires that the lubricant carry it to the leak point. This may not be an immediate action and may require hours of system operation, depending upon the system's use, before the dye will be visible when using a test lamp. Dye installed in the system may not be visible depending upon its original expected lifetime and its visibility can be reduced after being exposed to air (point of leak) and may not be identifiable the next season. If too much dye is added to the system, it can affect compressor durability by changing the lubricating ability of the system's oil and restricting oil flow through the refrigerant system.

Using Vacuum Decay

Using a vacuum decay method will only confirm you have a leak. Unless very large, it does not give the location. You may also have a leak in your measuring equipment. In addition, using a vacuum decay method may not find some leaks, because when the system is under vacuum the leak point (o-ring – seal – hose) may seal and leak only when under pressure.

Electronic Detector Component Leak Checking

- Leak test with the engine off
    - Do not contaminate the detector probe tip with dirt, grease or expose it to a direct stream of refrigerant.
    - If component being checked is dirty*,* wipe it off with a clean shop towel or blow off with dry shop air.
        - Do not use cleaners or solvents.
            - Detectors may react to their chemical composition.
        - Leak test the entire refrigerant system, testing all lines, fittings and components.
            - If a leak is found, continue to test the remainder of the system for potential additional system leaks.
        - Move the probe around the location, at a rate no more than 25 to 50 mm/second (1 to 2 in/second),

        - Hold the sensing probe no more than 5 mm (1/4 in) from the surface completely around the area being checked.
            - Moving the sensing probe slowly and as close as possible to the component improves the chance of finding a leak.
        - Confirm the leak by blowing shop air into the area of the suspected leak to disperse any refrigerant that may not be due to the suspected leak.
            - Repeat if necessary.
            - Blowing out the area with shop air often helps locate the exact position of large leaks.
- Leak testing of evaporator core
    - Run the air conditioning blower on high speed for 15 seconds minimum.
        - Turn blower off, wait 5 minutes for the refrigerant to accumulate in the case.
            - Insert the leak detector probe into the
                - Blower resistor block opening or
                - Evaporator case drain hole if there is no condensation, or
                - Since refrigerant is heaver than air, locate the lowest point in the duct system. Do not rely on an indication of a leak with the probe located in panel outlet.
                - Into the closest opening in the heating/ventilation/air conditioning case to the evaporator.
                    - If the detector alarms, an evaporator leak has apparently been found.
                    - *(Note: On R12 systems there will be a covering of oil and dirt on the evaporator. On R134a systems there may not be since the lubricant is water soluble. Therefore check condensate drain for dye products.)*

Leak Detectors Meeting SAE J1627

Depending upon the technology used for a leak detector, false triggering may occur from foam seals and adhesives used around the evaporator. Some detectors meeting J1627 are calibrated to detect only R12 and R134a refrigerants, thus eliminating the possibility of false leak identification.

System Lubricant Charge

There is no effective way in the field to determine the amount of lubricant that is in a system. Systems with too much oil can result in reduced cooling capacity. Excessive lubricant results in the internal coating of the evaporator or condenser resulting in less heat transfer.

Only the A/C system and component manufacturer's recommended lubricant type, viscosity and amount should be used to provide the maximum cooling performance and compressor durability.

To establish the correct amount of lubricant in a system, each component must be drained or liquid flushed (using approved chemicals and procedures) and the manufacturer's recommended lubricant amount for the specific system be added.

System Refrigerant Charge

The system pressure cannot be used to determine the amount of refrigerant in a system. To assure that the system is operating properly, the refrigerant should be recovered from the system and the correct amount installed with properly calibrated charge equipment. "Top Off" service procedures will result in improper refrigerant charge amounts and is not considered professional servicing.

Establishing System Refrigerant Charge Amount

Mobile A/C systems are operated over a great variation of system loads, from low loads to hot weather soak and cooldown conditions. To assure that a continuous source of liquid refrigerant is supplied to the expansion device, the vehicle manufacturer establishes the charge amount for high load conditions. When the system refrigerant charge amount is determined, several factors are included in the selection of the charge value to ensure system performance. These factors include small losses from servicing procedures and lubricant circulation in the system.

Mobile A/C system refrigerant charging should not be attempted by using high and low side pressure readings. Using high and low side pressure readings are commonplace for charging commercial systems, since they generally operate under constant load conditions. Unlike commercial A/C systems, on any given day, a mobile A/C system could be required to operate from hot vehicle soak and cooldown to reduced stabilized highway cooling demand conditions. Under all these conditions, an adequate amount of liquid refrigerant must be available to provide maximum system cooling performance.

TXV System

A typical expansion valve system can be found in figure 3. The TXV can either be a separate in-line device or a block valve located near the evaporator.

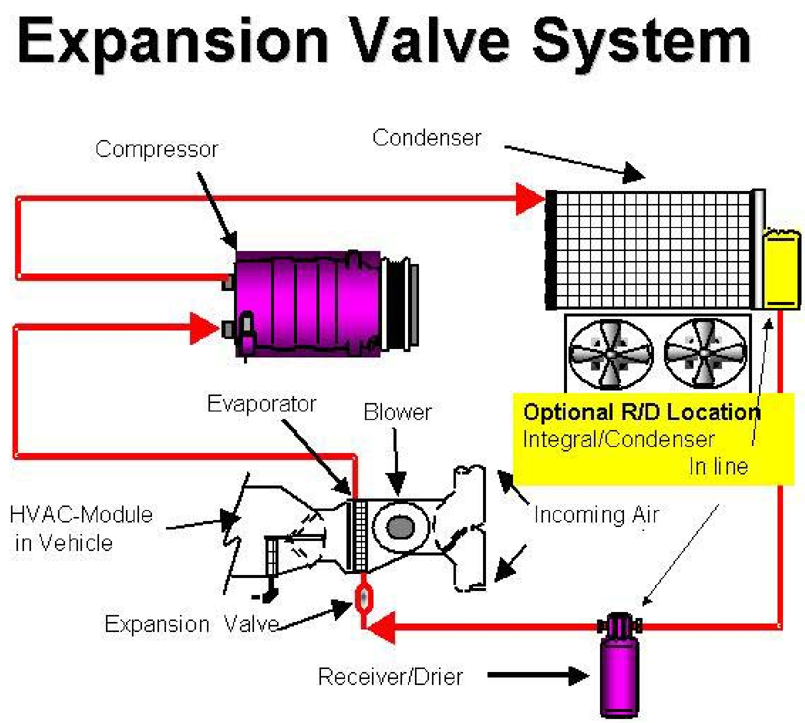

Figure 3

The charge curve identified in figure 4 shows the variation in system pressure under high load conditions for a production system. The factory system charge was established at 28 ounces. For this condition the system pressure change between 22 to 28 ounces of refrigerant in the system was 5-psig on the high side and 4-psig on the low side. Depending upon the temperature in the service bay and the load on the A/C system, it is impossible to duplicate charging conditions that rely upon pressure reading for every type of mobile A/C system serviced.

Using the pressure values identified on the left side of the flat portion charge curve, charging to 295-psig high side and 22-psig low side could be in the range of 22 ounces. With only a slight system refrigerant loss the system would have reduced cooling performance and the potential for inadequate system lubricant circulation. Charging to the right side of the charge in the 30 to 32 ounce range could result in the system being shut off on a hot day in city traffic. Since the capacity of the receiver-drier limits the amount of excess refrigerant that can be added to the system, systems that incorporate the integral receiver-drier/condenser design have less internal refrigerant storage capability as compared to a separate RD system. The correct factory refrigerant charge is required to avoid overcharging the system.

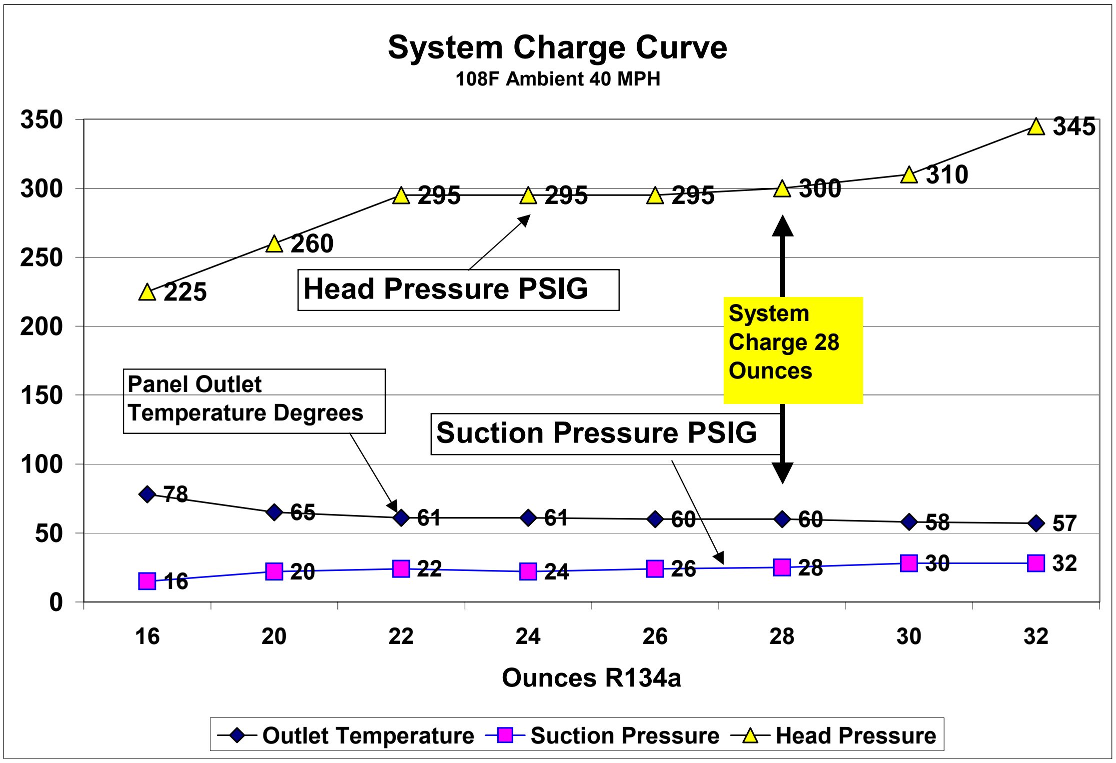

Figure 4

Refrigerant Overcharge Symptoms

A typical system overcharge problem may not be evident on a cool morning or in the service bay during low heat load conditions. Excess refrigerant will result in increased high side system pressure, when the system is operated during high heat load conditions. The excessive pressure will cause the high side pressure switch to shut off the compressor when conditions such as idle and stop and go driving are encountered. Although an electric or mechanically engine driven fan should be operating during low speed operation, the amount of airflow may not be enough to handle the heat load. Considering that most passenger cars and light trucks have electric engine cooling fan(s), during idle conditions, the effect of wind can influence airflow through the condenser. Side or tail wind during city traffic and idle conditions can result in loss of A/C system cooling due to the pressure discharge (PD) switch shutting off the compressor. At road speeds, increased airflow over the condenser allows the compressor to re-engage, but may still result in higher discharge pressures, causing warmer outlet air temperatures.

Orifice Tube System

A typical orifice tube system can be found in figure 5.

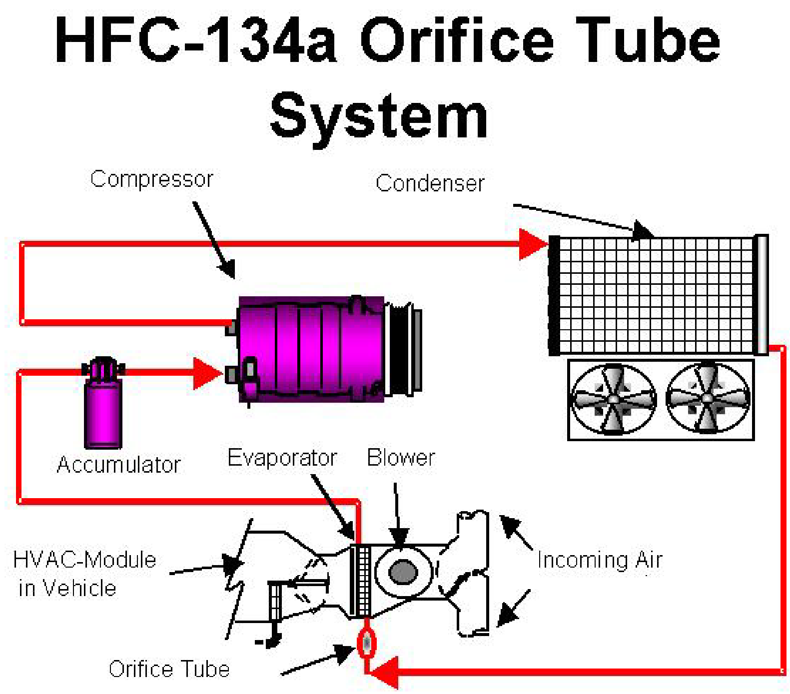

Figure 5

The charge curve in figure 6 is for an orifice tube system having a factory refrigerant charge of 26 ounces. As compared to the TXV system, the high side curve is more gradual as additional refrigerant is added. This is due to the refrigerant being stored in the accumulator on the low side of the system.

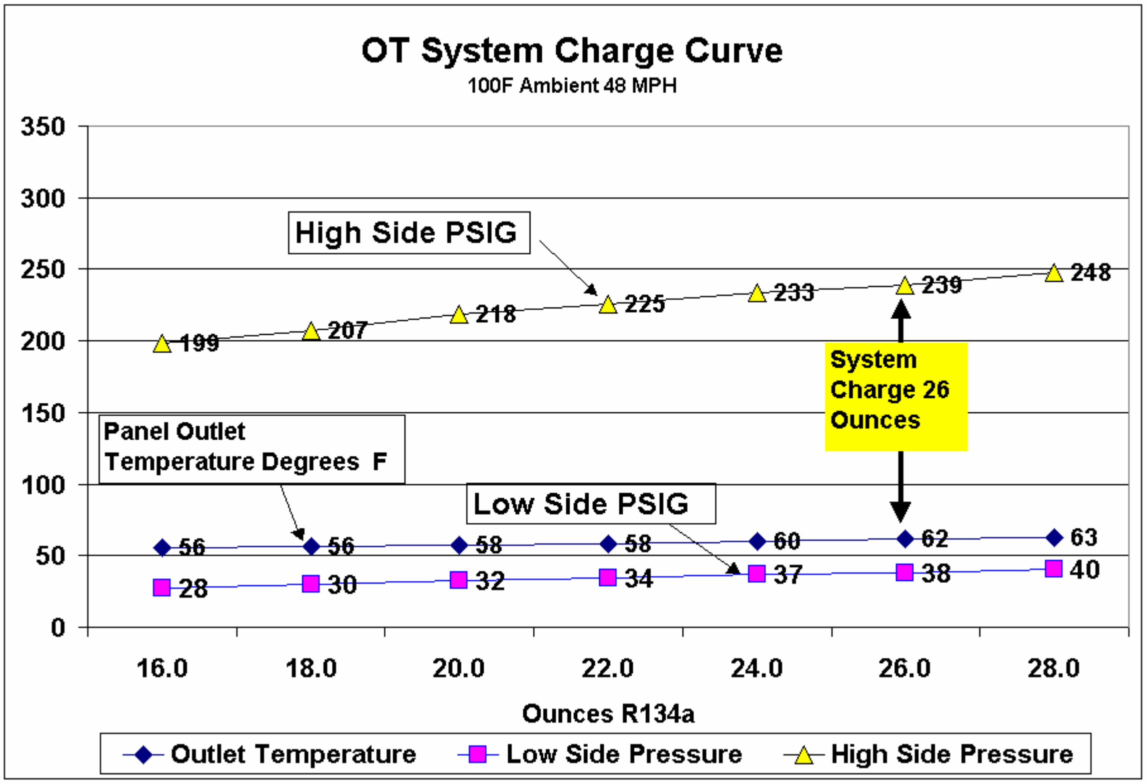

Figure 6

With professional service equipment, less time will be consumed installing the correct system refrigerant charge, ensuring the proper operation of the A/C system as compared to charging by questionable gauge pressure readings. Not being able to identify how much refrigerant is in the system results in the potential for improper system operation. Systems that are overcharged become an environmental concern due to the potential release of the excess refrigerant. Systems not having the correct refrigerant charge may result in many unseen problems.

Low refrigerant charge can result in:
Poor system performance; evaporator core refrigerant distribution problems can result in temperature spread across panel outlets and localized core icing (freeze up), reducing system airflow. Reduced cooling performance will occur due to a lack of solid flow of liquid refrigerant (partial vapor) being supplied to the evaporator under high loads.

Since lubricant circulation in the system relies upon a proper system refrigerant charge, inadequate refrigerant and lubricant will result in increased compressor operating temperature and potential compressor failure. In addition, the excess temperature can result in damage to the lubricant, flexible hoses and seals. Not all lubrications are compatible with a mobile A/C system. There are some lubricants which will not be transported in sufficient quantities to service the compressor.

The information found in figure 7 compares a reduced system refrigerant charge's effect on the compressor discharge temperature. This is something that is not identifiable by just looking at the system operating pressures. The production charge for this system is 26 ounces. By reducing the charge by 6 ounces (to 20 ounces) the high side pressure was reduced by 21 psig (from 239 to 218) and the low side pressure was 6 psig lower (from 38 to 32). Panel outlet temperature is four degrees cooler with the 6 ounce reduced charge (58 vs. 62). Unfortunately, when charging the system by using the pressure and panel outlet temperature**,** a reduced system charge could occur. The undetectable temperature problem is the compressor outlet temperature, which increased from 150 F to 182 F for the reduced 6-ounce charge, and with a reduced charge of 8 ounces was 204 degrees F.

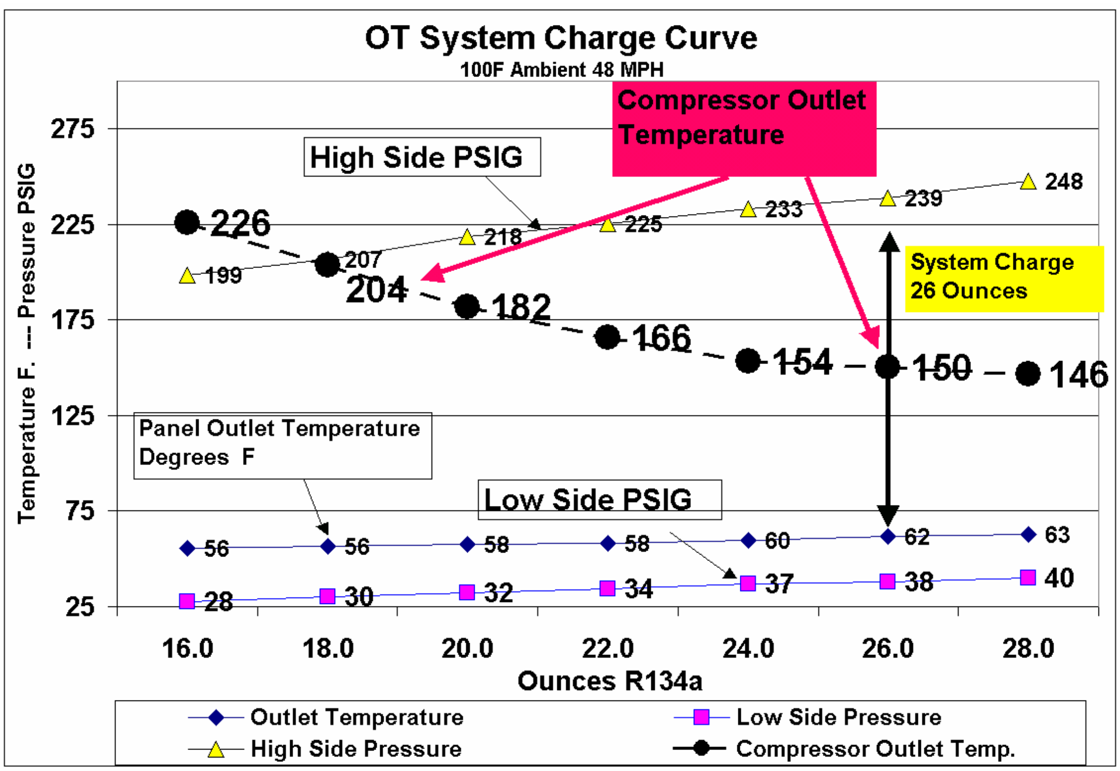

Figure 7

Compressor Failure

Should a system experience an internal compressor failure, it may not be possible to completely clean the system of the debris from the failure. Since heat exchangers (evaporator/condenser) have very small multiple internal passages and internal baffles, flushing may not clean all passes returning the heat exchanger to its expected level of performance. Replacement of an orifice tube or replacing the expansion valve must be done to assure maximum performance. Replacement of the accumulator or receiver dryer is necessary when an internal compressor failure has occurred. Flushing of flexible hoses and refrigerant lines is may be required as well as the installation of auxiliary filters or compressor screens. Hose assemblies having inline mufflers should be replaced, since flushing may not remove all the debris from the failure. Liquid lines that contain permanent orifice tubes must be replaced. Installation of non-restrictive in-line filters minimizes the chances of the re-circulation of any foreign material remaining in the system. Movement of debris can reverse flow from the system high side to low side when the system is shut off and equalizes, resulting in the contamination of low side components (the accumulator and evaporator).

Refrigerant Removal

It is extremely difficult to completely remove all refrigerant from the system. When the system is being evacuated*,* the refrigerant boiling (changing from liquid to vapor state) results in cooling of the system components. The lubricant also adsorbs the refrigerant and the evacuation process is slow in removing the refrigerant from the lubricant.

Raising the temperature (warming) of all the A/C system components and reducing the system to at least 20 inches of vacuum, will help recover the maximum amount of the refrigerant in the shortest period of time.

Removal Procedure

- Turn off the compressor so it will not operate. *(Note: On some vehicles, particularly those equipped with Automatic Temperature Control systems, this may not be possible. It may be necessary to electrically disable the clutch by removing the clutch control relay, disconnecting the clutch field coil's electrical connector, removing a fuse, etc. Also, some vehicles are equipped with clutchless compressors. Clutchless compressors operate any time the engine is running. If a vehicle is equipped with a clutchless* *compressor, refer to the vehicle manufacturer's service information to see if a procedure exists to operate the engine without the compressor also operating.)*

- Set panel system controls
  - Outside air (not max or recirculated)
  - High fan speed
  - Airflow from panel outlets
- Vehicle hood open to allow warm engine air to enter cowl inlet to A/C system
- Operate engine idle condition
  - Neutral (park) with parking brake applied
    - Depending on engine compartment temperature
      - Run engine to warm up A/C system components for 15 minutes
      - After idling engine for 15 minutes (hot condition)
      - With engine idling and A/C fan high, system on outside air, start refrigerant recovery process
      - When refrigerant recovery is completed, including the required 5 minute recheck for system pressure (system refrigerant out gassing), shut vehicle and equipment off.

Desiccant Replacement

The purpose of desiccant in a mobile air conditioning system is to absorb and hold moisture. Moisture in a system (above an acceptable level) can lead to corrosion and degradation of the lubricant. The general industry recommended desiccant replacement service guidelines are found in table1.

Desiccant material is located in the refrigerant circuit. Servicing of the desiccant will depend upon its location. The location may not allow the replacement of only the desiccant material, resulting in the replacement of an accumulator, or a receiver drier assembly. Systems having an integral receiver drier condenser assembly may have the service feature that allows replacement of the desiccant pack.

Table 1 Recommended Guidelines for Replacement of Desiccant

Service Operation Replace RD/Accl or Desiccant Pack	Yes
w/Replace Compressor (Ref System contains foreign material)	X
w/Replace Evaporator (Ref System contains foreign material)	X
w/Replace Condenser (Ref System contains foreign material)	X
w/Replace refrigerant line or hose (Ref System contains foreign material)	X
w/Replace Refrigerant Control OT/TXV (Ref System contains foreign material)	X
w/System has open line(s) more that 24 hours	X
w/System has operated over 5 years without desiccant replacement in high humidity area	X
w/System has operated over 10 years without desiccant replacement	X

Desiccant Replacement Guidelines

Desiccant replacement guidelines vary among vehicle manufacturers and system, component and parts suppliers. To maintain the warranty on purchased parts, desiccant must be replaced as specified by the particular supplier whose parts are being installed.

Flushing Systems

Flushing of the mobile A/C system may not completely remove all potential foreign material from the system. Proper use of flushing solvents is important to accomplish the desired results. It is necessary to purge all residual flush material from the system when servicing. Any residual flush left behind will contaminate and dilute the A/C system oil charge.

SAE standard J2670 provides testing and acceptance criteria for stability and compatibility of chemicals, including flushing materials and additives intended for use in R134a vehicle air conditioning systems. Use of non-compatible chemicals may result in future (extended time) failure of A/C system materials.

Flushing Material

R134a is commonly used as a flushing solvent in conjunction with equipment capable of handling the refrigerant in such a manner. Because R134a can act as both the refrigerant and a flushing solvent, R134a is deemed to meet all the requirements set forth in the J2670 specification. Keep ion mind that R134a should only be used to flush lubricant and loose debris from an A/C system. R134a will not remove any particulate matter that has attached itself to the inner tube walls.

Some A/C system and component manufacturers have developed flushing solvents and equipment for removal of foreign material from the system.

In general, flushing provides a method of removing:
– Lubricant
– Residual materials found in the system
– Foreign material

Removal of some foreign debris may not be achievable in heat exchangers due to the multi-path circuits and the potential for the flushing procedure to bypass the plugged refrigerant flow path. To achieve the original level of performance, replacement of the heat exchanger may be required.

In flushing a contaminated system, follow the procedures provided by the system or component manufacturer and by using the recommend flushing material and equipment.

Evaporator Freeze Protection

Loss of system cooling performance can occur if the system has an incorrect evaporator freeze protection setting. This condition can occur when the system has been operated for an extended period of time. When the evaporator fin surface is operated below 32 degrees F, the collected condensate water will turn to ice. This will then result in loss of system airflow as the frozen water blocks the air passages and the icing condition continues to spread over the core area.

With an incorrect control setting, this loss of cooling can occur on systems that use a fixed displacement or variable displacement compressor. There are many options on how evaporator freeze protection is achieved. Some of the control methods include pressure control devices in the compressor body or attached to other refrigerant system components. Other options include electronic sensors or thermal switches controlling compressor operation by sensing refrigerant component surface or outlet air temperature.

It is important to identify how the system manufacturer controls evaporator freeze protection and that the correct pressure or temperature settings are used when servicing the system.

AIR CONDITIONING & HEATING CUSTOMER QUESTIONNAIRE

CUSTOMER
Name____________________________ **Phone**___________________ **Date**___________

Address__________________________ **City**_______________ **State**_____ **Zip**________

VEHICLE
Year_____________ **Make**_____________ **Model**_____________ **Color**_____________

A/C System Type – ❐ Manual ❐ Auto. Temp. Control ❐ Dual / Rear Auxiliary Unit

PROBLEM / SYMPTOM

❑ No A/C	❑ No Heat	❑ No Defrost	❑ Poor Cooling	❑ Poor Heating
❑ Improper Fan/Blower Operation	❑ Air From Wrong Outlet(s)	❑ No Temperature Control	❑ Noise Inside Car	❑ Noise Under Hood
❑ Interior Water Leak	❑ Engine Coolant Leak	❑ Warning Light(s) On	❑ Odor	❑ Other* (See Below)

WHEN DOES THE PROBLEM OCCUR?

❑ Always	❑ Intermittent	❑ When Hot	❑ When Cold	❑ At Start Up
❑ During Warm Up	❑ At Idle	❑ High Engine Speeds	❑ Driving Away From Stop	❑ At Road Speeds

Have there been any previous attempts to repair this problem? ❐ No ❐ Yes
If there were previous repair attempts, what was done? (What parts were installed, etc.)

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Did previous repairs help the problem? ❐ No ❐ Some ❐ A lot ❐ At first, but not now.
Have repairs or service of any kind been recently performed to the vehicle? ❐ No ❐ Yes
If so, exactly what was done?

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***FURTHER DESCRIPTION OF THE PROBLEM**

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