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SURFACE VEHICLE RECOMMENDED PRACTICE

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Procedure Retrofitting CFC-12 (R-12) Mobile Air-Conditioning Systems to HFC-134a (R-134a)

1. *Scope*—The purpose of this SAE Recommended Practice is to provide a service procedure for retrofitting a CFC-12 (R-12) system to HFC-134a (R-134a) while preserving performance and integrity of the air-conditioning (A/C) system. The steps outlined in this procedure are complete when combined with good service practices and the vehicle manufacturer's recommendations (if available) for retrofitting their models.

Separate service equipment, for CFC-12 (R-12) and HFC-134a (R-134a), including refrigerant recovery/recycle (R/R), service manifolds, vacuum pumps, and charging equipment shall be used to preserve the purity of the refrigerants and the mobile A/C systems. This procedure will minimize release of refrigerant to the atmosphere, and will preserve the integrity of the recycled CFC-12 (R-12) and HFC-134a (R-134a) supplies.

This document applies to A/C systems used to cool the passenger compartment of automobiles, light trucks, and other vehicles with similar CFC-12 (R-12) systems. Due to technical advancements in recent years, this procedure is recommended for common vehicle platforms produced in the mid-1980s and later. Vehicles produced before this time period may require additional retrofit requirements. A/C systems used on mobile vehicles for refrigerated cargo that have hermetically sealed systems are not covered by this document.

This document is only complete when combined with the requirements of SAE J1657 "Selection Criteria for Retrofit Refrigerants to Replace CFC-12 (R-12) in Mobile Air-conditioning Systems."

2. *References*

2.1 Applicable Publications—The following publications form a part of the specification to the extent specified herein. Unless otherwise indicated, the latest revision of SAE publications shall apply.

2.1.1 SAE PUBLICATIONS—Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

SAE J639—Safety and Containment of Refrigerant for Mechanical Vapor Compression Systems Used for Mobile Air-Conditioning Systems

SAE J1628—Technical Procedure for Using Electronic Refrigerant Leak Detectors for Service of Mobile Air-Conditioning Systems

SAE J1657—Selection Criteria for Retrofit Refrigerants to Replace CFC-12 (R-12) in Mobile Air-Conditioning Systems

SAE J1660—Fittings and Labels for Retrofit of CFC-12 (R-12) Mobile Air-Conditioning Systems to HFC-134a (R-134a)

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SAE J1771—Criteria for Refrigerant Identification Equipment for Use With Mobile Air-Conditioning Systems
SAE J1989—Recommended Service Procedure for the Containment of CFC-12 (R-12)
SAE J1990—Extraction and Recycle Equipment for Mobile Air-Conditioning Systems CFC-12 (R-12)
SAE J1991—Standard of Purity for Use in Mobile Air-Conditioning Systems CFC-12 (R-12)
SAE J2084—Air-Conditioning Hose Requirements for HFC-134a (R-134a)
SAE J2099—Standard of Purity for Recycled HFC-134a (R-134a) for Use in Mobile Air-Conditioning Systems
SAE J2196—Service Hoses for Automotive Air Conditioning
SAE J2197—HFC-134a (R-134a) Service Hose Fittings for Automotive Air-Conditioning Service Equipment
SAE J2209—CFC-12 (R-12) Extraction Equipment for Mobile Air-Conditioning Systems
SAE J2210—HFC-134a (R-134a) Recycling Equipment for Mobile Air-Conditioning Systems
SAE J2211—Recommended Service Practice for the Containment of HFC-134a (R-134a)

3. Air-Conditioning System Preparation Prior to Retrofit

3.1 Determine that the vehicle A/C system has not been previously retrofitted. Talk to the customer and obtain the service history of the A/C system.

3.1.1 Since the A/C system may contain another refrigerant, a combination of refrigerants, or excess noncondensables (NCG's), the system's contents should be identified before removing the refrigerant. Not identifying the refrigerant type prior to removal can result in contamination of R/R equipment. Use of refrigerant identification equipment certified to SAE J1771 should be used to determine what refrigerant is in the mobile A/C system about to be recovered.

3.1.2 Check the engine compartment area for a system label to determine the existing system identification and/or if a retrofit label has been installed.

3.1.3 Determine that CFC-12 (R-12) service ports are on the A/C system. CFC-12 (R-12) high and low side ports. (SAE 3/8 in-24 and 7/16 in-20 refrigeration flares as defined in SAE J639).

3.1.4 Check all service ports and identify the usage (e.g., switches). Refer to 5.3 for retrofit fitting and label requirements.

3.2 Determine possible refrigerant leaks and system performance.

3.2.1 Connect the CFC-12 (R-12) manifold set including service hoses that meet SAE J2196 to the system. During initial inspection and service, use CFC-12 (R-12) refrigerant recovery/recycle (CFC-12 (R-12) R/R) equipment meeting SAE J1990 or SAE J2209.

3.2.2 With the engine off, check the A/C system pressure. If the system does not have pressure, inspect the system for possible leak points. Follow SAE J1628 Leak Check procedure by adding refrigerant CFC-12 (R-12) to determine if the system has any leaks. System components that are found to be leaking shall be repaired or replaced in a manner compatible with the retrofit.

3.2.3 With the refrigerant system properly charged, operate the A/C system and observe the high and low pressures, panel outlet discharge temperature, and other parameters recommended by the vehicle manufacturer.

3.2.4 Determine necessary repairs and component replacements in addition to those required for retrofitting the vehicle A/C system. Refer to 5.2.1 for repairs.

3.3 Using CFC-12 (R-12) refrigerant recovery/recycle equipment (CFC-12 (R-12) R/R equipment) meeting SAE J1990 or J2209, recover the refrigerant according to the service procedure in SAE J1989. During refrigerant recovery, observe A/C system components (e.g., accumulator) for frosting. If frosting has occurred or if the low side pressure rises above atmospheric pressure within 2 min, additional refrigerant is in the system and it shall be removed. Gently applying heat to the frosted components will reduce the time for the refrigerant recovery process. An open flame or torch should not be used.

3.3.1 To assure recovery of CFC-12 (R-12) refrigerant during system processing as defined in 3.3 or after flushing as defined in 4.2, the SAE J1989 procedure shall be used. SAE J1989 states, "Start the recovery process and remove the refrigerant from the vehicle A/C 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 min, determine that there is no refrigerant remaining in the vehicle A/C system. If the vehicle system has pressure, additional recovery operation is required to remove the remaining refrigerant. Repeat the operation until the vehicle A/C system vacuum level remains stable for 2 min."

3.4 Evaluate the retrofit requirements which will vary by vehicle and model year.

3.4.1 Improper retrofit procedures may affect performance or result in damage to the A/C system. Carefully read the vehicle manufacturer's requirements, if available, for retrofitting the particular vehicle A/C system to HFC-134a (R-134a).

3.4.2 Determine the suitable lubricant type to be used with the HFC-134a (R-134a) retrofit refrigerant. Refer to the manufacturer's procedure, if available, to determine which components need inspection, cleaning, or replacement. Affected components may include hoses, seals, expansion devices, accumulators, receiver driers, and possibly other components depending on system design.

4. System Cleanup Procedure

4.1 CFC-12 (R-12) Removal—To protect the integrity of the HFC-134a (R-134a) recycled refrigerant supply, CFC-12 (R-12) must be removed from the A/C system before charging with HFC-134a (R-134a) at the end of the retrofit procedure. Service procedures shall reduce the CFC-12 (R-12) content in the retrofitted system. Excess CFC-12 (R-12) levels may cause system chemical contamination and system damage. Procedures in 3.3.1 and/or 4.1 and 4.2 when followed, will provide proper HFC-134a (R-134a) purity.

The importance of evacuation per 6.3 in removing CFC-12 (R-12) must be emphasized. SAE and industry conducted a survey on residual CFC-12 (R-12) levels in refrigerants sampled from retrofitted A/C systems. System cleanup procedures were reviewed to determine their effect on CFC-12 (R-12) levels. System evacuation after completing the retrofit procedure is the most effective procedure in achieving low CFC-12 (R-12) levels.

4.2 Lubricant Removal—Depending on the retrofit lubricant choice and the particular A/C system, part or all of the mineral oil may need to be removed. Draining oil from components, replacing components, or flushing can be used for this purpose. It is essential to follow the manufacturer's recommendations (if available) for removing and replacing lubricant (see 5.2.2).

4.3 Vehicle Manufacturer's Recommended Cleanup Procedure (Procedure 1)

4.3.1 Consult vehicle manufacturer's recommendations, if available. The vehicle manufacturer's recommended service procedures shall meet the HFC-134a (R-134a) purity level, of less than 2.0% CFC-12 (R-12) in 4.1. These procedures will likely emphasize evacuation for a period of time not less than called for in 6.3.

4.4 Flush the A/C System with CFC-12 (R-12) Refrigerant (Procedure 2)

4.4.1 The CFC-12 (R-12) mobile A/C system components can be flushed using refrigerant CFC-12 (R-12) charging equipment and recovery/recycling equipment. Adapter fittings and hoses are attached to the A/C component to be flushed. Prepared for flushing by opening the A/C system to provide a flushing inlet and an outlet to the A/C system or component being flushed. Consult, if available, the vehicle manufacturer's recommended procedure to determine the flushing connections and which components to leave in during the flushing procedure.

4.4.2 Attach the refrigerant charging equipment to the inlet of the component to be flushed.

4.4.2.1 Depending upon the selected direction for flushing, the inlet hose should be attached to the component to be flushed. If backward circuit flushing is being performed, the inlet hose should be attached to the normal outlet flow connection.

4.4.3 Connect the R/R equipment to the other end of the component being flushed. This hose should have an in-line filter to collect any foreign material that may be removed during the flushing process.

4.4.3.1 It is advisable to periodically replace the in-line filter after the flushing procedure is complete.

4.4.4 Check all connections to be sure they are leak free. For systems which have an A/C compressor that is designed to retain oil in the crankcase, consult the manufacturer's procedures to drain oil from the compressor.

4.4.5 Evacuate the portion or component of the A/C system with the R/R equipment which was open to the atmosphere while making the flushing connections. This will prevent air from being introduced into the CFC-12 (R-12) equipment. Shut the R/R equipment off. Be sure that the refrigerant flow valves are closed.

4.4.6 Using the refrigerant charging equipment, charge the component being flushed so that it becomes filled with liquid refrigerant. When the pressure has equalized, shut the refrigerant charging equipment off. Be sure that the refrigerant flow valves are closed.

4.4.7 Completely recover the CFC-12 (R-12) refrigerant by using the recovery/recycling equipment. Since the A/C system or component will be completely filled with liquid CFC-12 (R-12), the recovery process should be monitored for frosting of components to assure that all the refrigerant has been removed. Gently apply heat to components which have become frosted during the recovery process. Lubricant removed during the flushing process will be collected in the R/R equipment storage lubricant container. At the end of the flushing procedure, the recovered refrigerant shall be recycled to SAE J1991 purity before beginning the next flushing operation.

4.4.8 This flushing procedure should only be used when CFC-12 (R-12) is the flushing solution. The use of other flushing solutions, with this procedure may contaminate the A/C system and equipment.

5. Retrofit to HFC-134a (R-134a) Procedure

5.1 Remove all CFC-12 (R-12) service equipment. Disconnect the CFC-12 (R-12) manifold and CFC-12 (R-12) R/R equipment from the system. Evacuation and charging will be accomplished with HFC-134a (R-134a) service equipment using fittings per SAE J2197.

5.2 Repair and Retrofit System

5.2.1 If required, repair or replace the necessary system parts. Fix any problems noted in 3.2.4 to assure proper system operation as defined in 6.6.

5.2.2 Charge lubricant type in the amount, location, and manner recommended by the vehicle manufacturer. If the A/C system has been flushed, lubricant shall be charged directly into the compressor or the low side near the compressor to provide lubricant to the compressor at first start-up.

5.2.3 Retrofit and reassemble the A/C system using the recommended procedures and OEM or equivalent components in 3.4.

5.3 Change service ports and apply labels as defined in SAE J1660. Use only fittings and labels meeting SAE J1660 installed in the manner prescribed in SAE J1660.

6. R-134a Evacuation and Charging Procedure

6.1 Cautionary Statements

6.1.1 CAUTION—Avoid breathing A/C refrigerant and lubricant vapor or mist. Exposure may irritate eyes, nose, and throat. To remove HFC-134a (R-134a) from the A/C system, use service equipment certified to meet the requirements of SAE J2210 (HFC-134a (R-134a) R/R equipment). Additional health and safety information may be obtained from refrigerant and lubricant manufacturers.

6.1.2 CAUTION—Do not pressure test or leak test HFC-134a (R-134a) service equipment and/or vehicle A/C systems with compressed air. Some mixtures of air and HFC-134a (R-134a) have been shown to be combustible at elevated pressures. These mixtures, if ignited, may cause injury or property damage. Additional health and safety information may be obtained from refrigerant manufacturers.

6.1.3 CAUTION—Lubricants used with HFC-134a (R-134a) refrigerant for mobile A/C systems may damage the appearance of painted surfaces and plastic parts.

6.2 Connect hoses from the manifold gauge set or the HFC-134a (R-134a) charging equipment to the A/C system service ports.

6.3 Evacuation—Using an HFC-134a (R-134a) vacuum pump, having fittings defined in SAE J2197, evacuate the A/C system for a minimum of 30 min to remove air and trace CFC-12 (R-12) from the system. Vehicles equipped with front and rear evaporators evacuate the system for at least 45 min. The vacuum pump shall be capable of a vacuum level of 3 kPa (29 in of mercury below atmospheric adjusted to altitude). The vacuum pump may be part of the HFC-134a (R-134a) service equipment. System manufacturers may recommend longer evacuation time for specific systems.

6.3.1 It is important to obtain a deep system vacuum removing any remaining CFC-12 (R-12) refrigerant and NCG (air). System contamination levels in excess of 2% caused by another refrigerant or NCG's may result in system operating problems, including reduced cooling performance, improper refrigeration control calibration, and higher operating pressures.

6.4 With the vacuum pump isolated from the system, check for loss of vacuum as an indication of a system leak. If loss of vacuum occurs, determine if the leak source can be identified and repaired. Repair the leak and evacuate the system for an additional 15 min.

6.5 Charge the A/C system with HFC-134a (R-134a) in the amount and manner recommended by the system manufacturer. Be sure that the lubricant has been installed as defined in 5.2.2.

6.6 Operate the A/C system to assure that the system is properly operating.

6.6.1 Shut the vehicle off and remove all the service equipment and replace the caps and secondary seals on all service ports.

6.7 Perform a final leak check as defined in SAE J1628 to assure that the system is leak-free.

7. Notes

7.1 **Marginal Indicia—**The change bar (l) located in the left margin is for the convenience of the user in locating areas where technical revisions have been made to the previous issue of the report. An (R) symbol to the left of the document title indicates a complete revision of the report.

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