Recreational Vehicle
Thor

HVAC "All-In-One" Unit
Service Manual

Updated: 5/18/2023

Note (Not applicable for hard copies):

1. Phrases in blue are "**hyperlinks**" that allow user to jump directly to the respective section. Hold "**ctrl**" and click the link to use.
2. All section titles are "**hyperlinks**" allowing the user to jump back to the top of the document.

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Service

Disclaimer:

WARNING!!

The technical information, provided in this service guide, is intended for use by properly trained HVAC service personnel, who can ensure a safe and properly operating system. It is assumed that the user of this guide is trained and experienced in basic refrigeration principles, in addition to being familiar with Bergstrom HVAC systems installed on Recreational Vehicles. Technicians who repair or service motor vehicle A/C systems must be certified by Section 609 (MACS) approved by the EPA.

Before any air conditioning service is started, it is the technician's responsibility to determine what type of refrigerant is contained in the system. Component marking and/or service port peculiarities are good places to start in an effort to identify the contents.

Bergstrom advises that the usual precautions associated, with servicing a motor vehicle, be exercised when servicing the HVAC system and assumes no liability with regard to vehicle damage or personal injury. Additionally, Federal and any Local regulations regarding the handling and use of refrigerants should be complied with at all times.

NOTES:

TECHNICAL SUPPORT IS PROVIDED TO CERTIFIED TECHNICIANS ONLY. BERGSTROM DOESN'T SUPPLY TECHNICAL SUPPORT TO RV OWNERS.

THE AIR CONDITIONING SYSTEM CONTAINS REFRIGERANT R134A, UNDER HIGH PRESSURE, AND SHOULD BE SERVICED BY ONLY QUALIFIED PERSONNEL.

REPAIRS THAT ALTER THE DESIGN OF THE BERGSTROM SYSTEM, INCLUDING USE OF NON-BERGSTROM SUPPLIED PARTS, WILL VOID THE WARRANTY AND ANY BERGSTROM LIABILITY FOR THE HVAC SYSTEM.

THE BERGSTROM HVAC SYSTEM SHOULD BE SERVICED BY A FULLY TRAINED AND ENVIRONMENTALLY LICENSED TECHNICIAN. FAILURE TO AGREE TO ALL STATEMENTS COULD RESULT IN SERIOUS INJURIES, FINES AND POSSIBLE VOIDING OF ANY WARRANTIES.

Picture Symbol 

Caution: If installation care is not taken, damage to HVAC unit could occur. Please read all directions carefully!

Service

Contact Information

Address:

Bergstrom HQ
2390 Blackhawk Road
Rockford, IL 61109
USA

Phone Numbers:

(866) 204-8570

Web Site: www.bergstrominc.com

Service

REQUEST FOR TECHNICAL SUPPORT QUESTIONNAIRE

Open the front service door of the vehicle and verify if you are servicing a Bergstrom HVAC system by checking the base unit mounted on the front firewall. Verify customer complaint by operating the vehicle. ***(Print this page for reference).***

DESCRIPTION OF COMPLAINT:

_____

_____

_____

DEALER:

_____

CONTACT/TECH:_____PHONE #: _____

CHASSIS:_____MODEL YR:_____MODEL: _____

COACH MANUFACTURER:_____

CONDENSER TYPE & LOCATION:_____

PRESSURE GAUGE READINGS:

LOW_____PSIG @ 1500 RPM, HIGH BLOWER SPEED

HIGH_____PSIG @ 1500 RPM, HIGH BLOWER SPEED

R134A REFRIGERANT CHARGE WEIGHT:

_____POUNDS

AIR TEMPERATURE & HUMIDITY READINGS:

HUMIDITY LEVEL:_____%RH

RECIRCULATION INLET AIR TEMPERATURE:_____ºF

DISCHARGE AIR TEMPERATURE (VENT CLOSEST TO BASE UNIT):_____ºF

SUBTRACT THE TWO AIR TEMPERATURES =_____ºF

DIFFERENTIAL

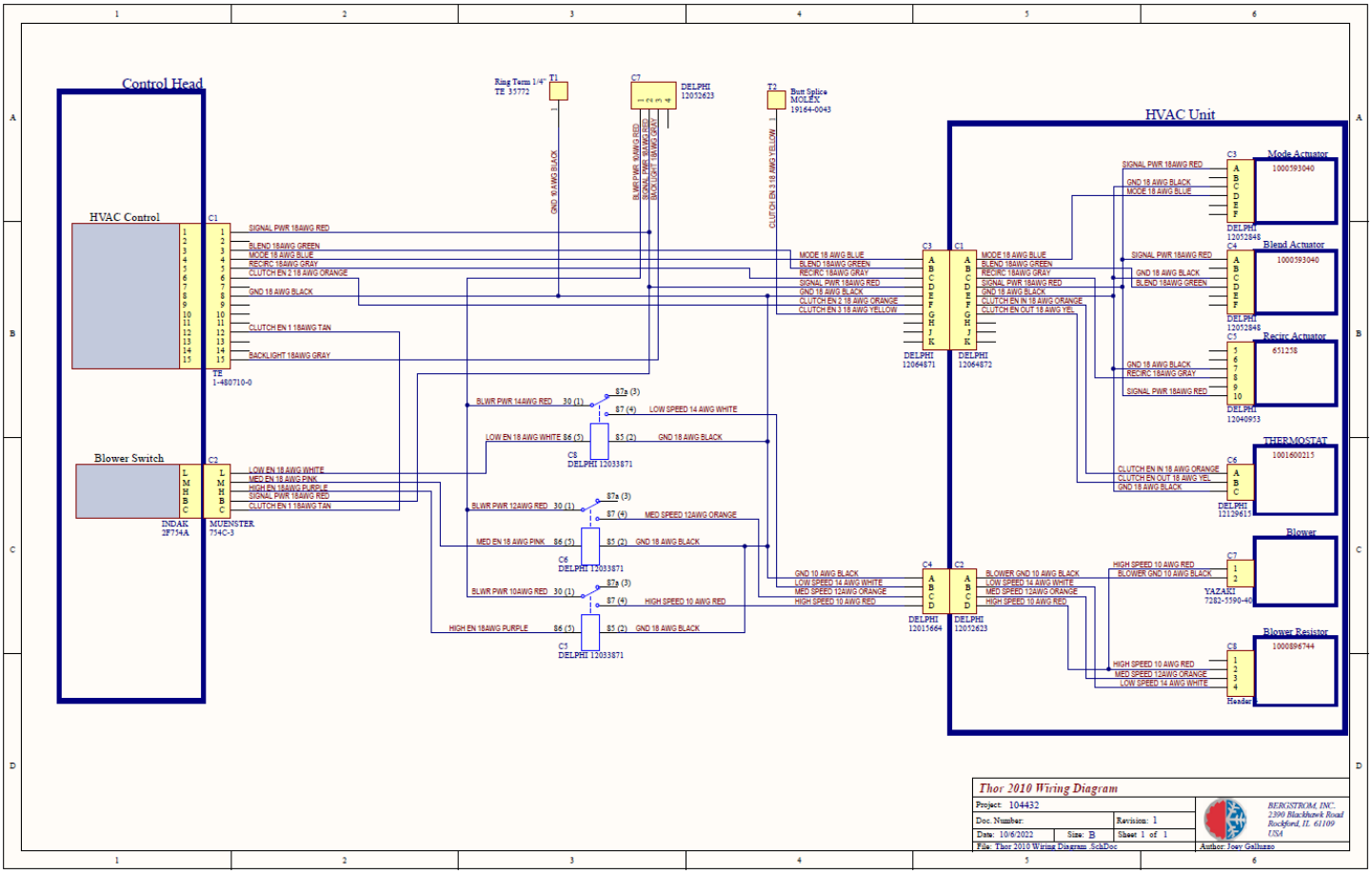
Service

Comments:

Electrical Systems

Electrical Schematics

Thor “All-In-One” Unit



Expected Voltages

All voltages are ratios relative to applied voltage. Use wiring diagram for pinout.

BLEND	
STEP	VOLTAGE RATIO
1(COLD)	100%
2	88%
3	77%
4	66%
5	55%
6	44%
7	33%
8	22%
9	11%
10(HOT)	0%

MODE	
STEP	VOLTAGE RATIO
PANEL	100%
BI-LEVEL	68%
FLOOR	47%
MIX	33%
DEFROST	0%

RECIRC/FA	
STEP	VOLTAGE RATIO
RECIRC	100%
FA	65%

Diagnostics Guide

Problem	Possible Cause	Corrective Action
Control Panel is not functional	1. Vehicle ignition switch isn't activated. 2. Loss of power supply. 3. Open circuit between vehicle ignition and control panel. Open circuit between ground source and control panel. 4. Loose or wrong connection(s) at the control panel. 5. Failed control panel.	1. Activate vehicle ignition switch. 2. Examine the chassis' HVAC circuit's protection device for failure (i.e. fuse or circuit breaker). 3. Check primary connections at power source, ground source, and the control panel. Verify vehicle voltage at each connection. Repair or replace harness if necessary. 4. Ensure all connections are mated properly. Ensure correct pinout via wiring diagram. 5. Replace control panel.
Controller knob is rotating beyond its defined positions	1. Knob is damaged. 2. Control device is damaged.	1. Replace knob. 2. Internal stop has been broken. If control device can be rotated through more than designed positions, replace control device.
Discharge and/or inlet air systems are not functioning properly. Blower is operating properly.	1. Loss of power supply. 2. Open circuit between vehicle ignition and control panel. Open circuit between ground source and control panel. 3. Faulty mode actuator. 4. Faulty ventilation mode, or recirculated air push button switch.	1. Examine the chassis' HVAC circuit's protection device for failure (i.e. fuse or circuit breaker). Separate source from the blower motor circuit. 2. Verify vehicle voltage at each connection. Perform continuity test between the control panel and shutter actuator(s) connections. Repair or replace harness if necessary. Refer to EXPECTED VOLTAGES 3. Replace the actuator if needed. Refer to MODE DOOR ACTUATOR 4. Replace the switch or control panel if needed.

Diagnostics Guide (cont.)

Problem	Possible Cause	Corrective Action
Blower does not operate at all speeds	1. Loss of power source 2. Open circuit in harness between the circuit protection and control panel. 3. Faulty blower switch. 4. Open circuit in harness between the control panel and blower resistor. 5. Faulty blower resistor. 6. Faulty blower motor.	1. Examine the chassis' HVAC circuit's protection device for failure (i.e. fuse or breaker). 2. Verify vehicle voltage at each blower switch connection. Perform continuity test between connections. Repair or replace harness if necessary. 3. With vehicle ignition ON, rotate blower switch through all its positions, check for voltage at all terminals. If no voltage is measured, replace switch or control panel if needed. 4. Rotate the blower switch to LOW speed. Verify vehicle voltage at LOW speed connection of the blower resistor. Perform continuity test between connections. Repair or replace harness if necessary. 5. Measure the voltage at the connection that feeds the motor lead. If no voltage is measured, replace blower resistor. Refer to RESISTOR 6. Rotate the blower switch to HIGH speed. Check for voltage at the motor connection. If no voltage is measured, replace blower motor. Perform continuity test between connections if necessary.
Blower does not operate at a specific speed	1. Faulty blower switch. 2. Open circuit in harness between the control panel and blower resistor. 3. Faulty blower resistor	1. With vehicle ignition ON, rotate blower switch to its inoperative speed position. Check for voltage at the controller's speed setting terminal. If no voltage is measured, replace switch or control panel if needed. 2. Verify vehicle voltage at each speed connection on the blower resistor. Perform continuity test between connections. Repair or replace harness if necessary. 3. Measure the voltage at the connection that feeds the motor lead. If no voltage is measured, replace blower resistor.

Diagnostics Guide (cont.)

Problem	Possible Cause	Corrective Action
A/C Clutch does not operate.	1. A/C switch is not activated. 2. Faulty A/C switch 3. Open circuit between A/C switch and A/C thermostat, or thermostat to clutch. 4. Faulty A/C clutch. 5. Faulty chassis circuitry.	1. Verify A/C switch is depressed and operating correctly. 2. Replace control panel. 3. Check primary connections at the control panel. Perform continuity test between AC switch connection and A/C thermostat. Repair or replace harness if necessary. 4. With the engine OFF apply a separate 12V+ supply directly to clutch terminals and listen for clutch engagement. Replace clutch if there is no engagement. 5. If voltage is read at pressure switch, and the clutch is working as noted above, the problem is originating in the chassis wiring. Refer to the chassis manufacturer service manual.

Air Flow Systems

Basic Description

The Bergstrom “All-In-One” HVAC unit consists of components designed to provide air that has been conditioned to the occupants of the vehicle. The unit is mounted under the dash. The evaporator core, expansion valve, heater core, fresh/recirculate door and actuator, temperature door and actuator, mode door and actuator, blower motor, and recirculation air filters are located within the unit.

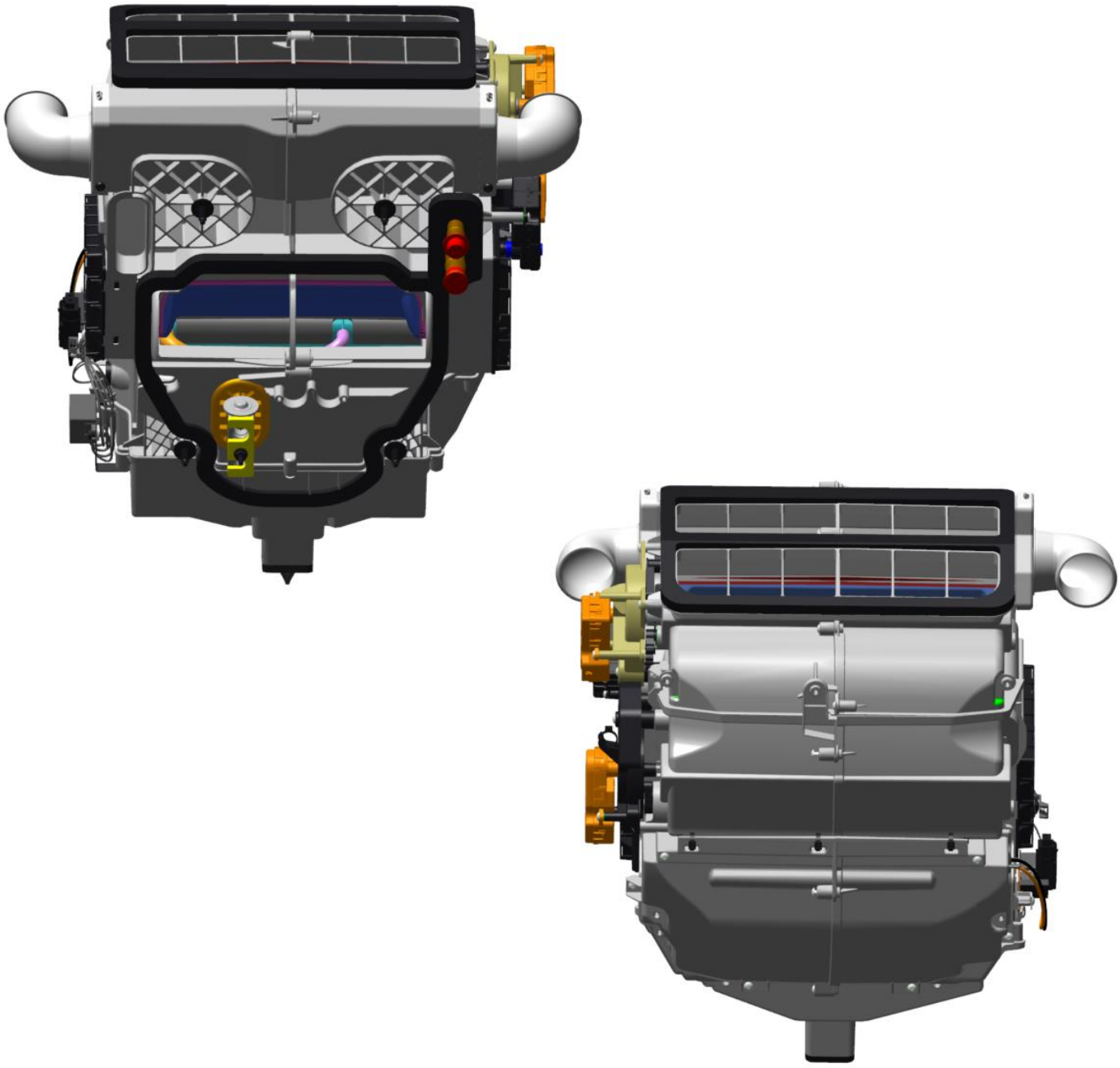


Figure 1: HVAC Unit

System Operation Description

Air Distribution (General)

The electrically actuated fresh/recirculate air door is controlled by the mode control knob on the HVAC control panel. When the door is in the recirculate position, outside air is blocked from entering the unit. Recirculated air enters the HVAC unit through recirculation filters located on each side of the HVAC unit. When the fresh/recirculate air door is in the fresh air position, fresh air from outside of the vehicle enters the HVAC unit. The air enters the evaporator, flows through the blower assembly and then, is distributed through the air distribution system.

The electrically actuated temperature blend door is controlled by the temperature control knob on the HVAC control located on the instrument panel. The electrically actuated temperature blend door distributes air from the blower assembly, either through the heater core for full heat, partially through the heater core or around it for A/C, depending on the temperature selected from the HVAC control. With a blend system, engine coolant always flows through the heater core.

There are two electrically actuated mode doors that are controlled by the mode control knob on the HVAC control panel. The doors are located at the top of the HVAC unit and are controlled through a set of gears and a cam (kinematics). These mode doors distribute air to the air outlets (floor vents, panel vents, and/or defrost vents) based on the mode selected.

The speed of the blower motor, which controls the volume of air moving through the system, is selected by the blower speed control knob on the HVAC control panel.

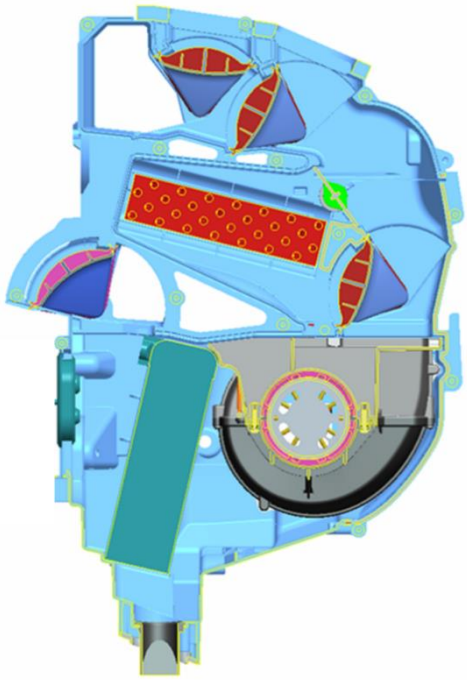


Figure 2: Cross-Section of HVAC Unit

Air Flow Systems

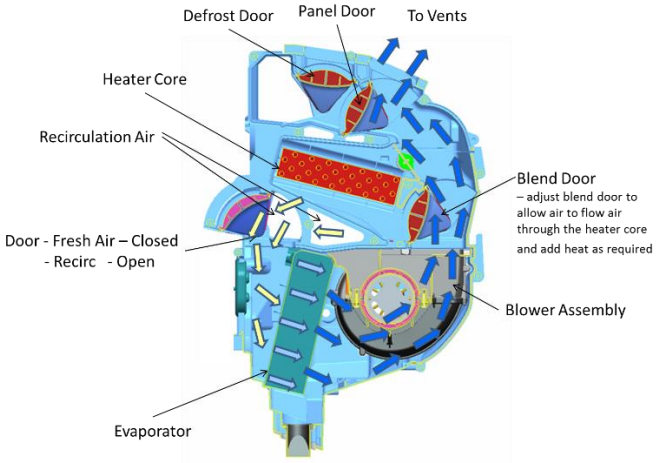


Figure 3: Max A/C. Recirculation Mode, Panel

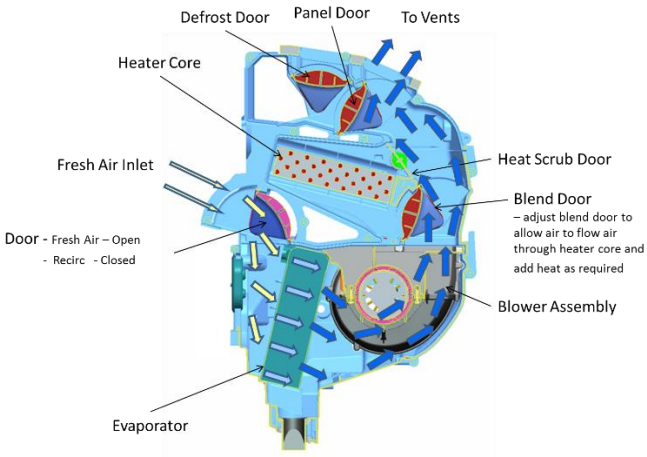


Figure 4: Panel A/C. Fresh Air, Panel

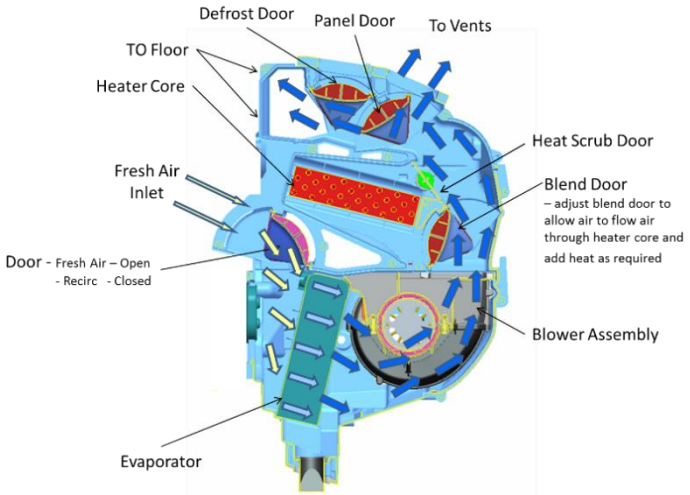


Figure 5: Normal A/C, Fresh Air, Floor/Panel

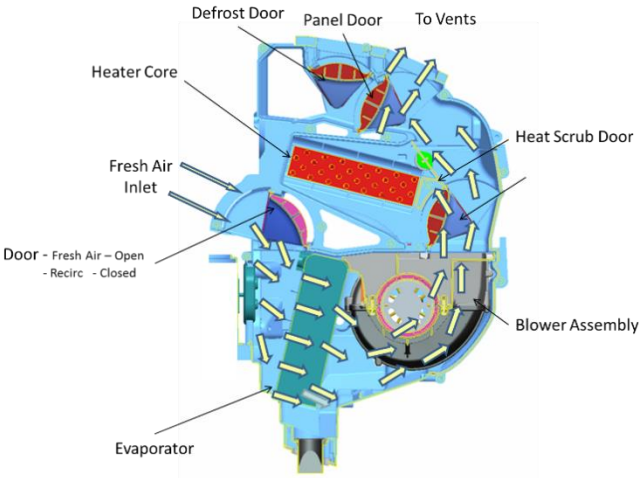


Figure 6: Fresh Air, Panel

Air Flow Systems

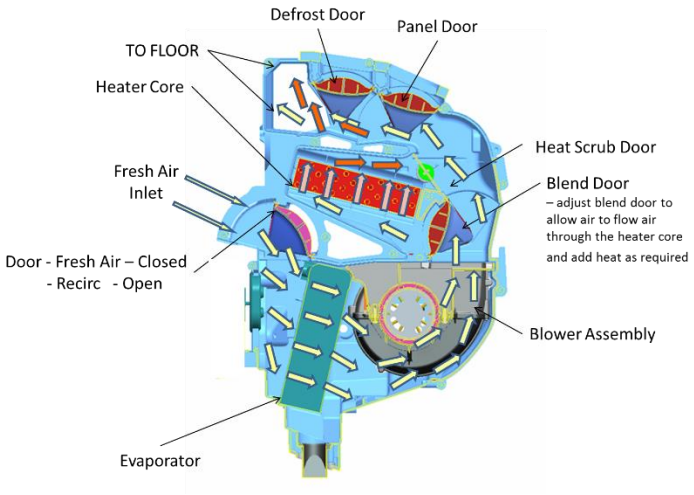


Figure 7: Fresh Air, Floor

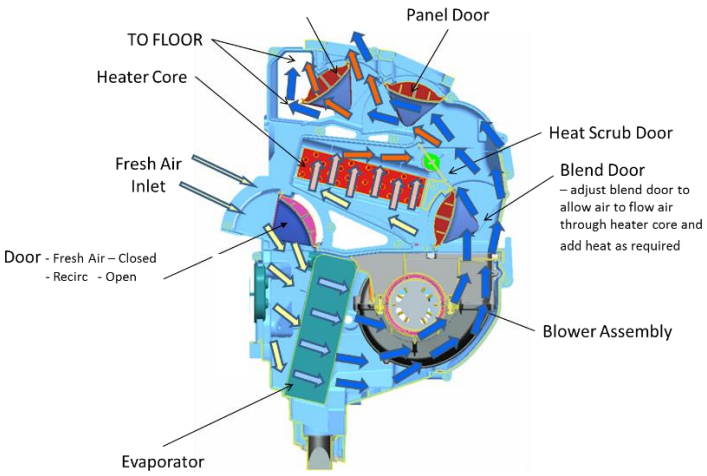


Figure 8: Fresh Air, Defrost/Floor

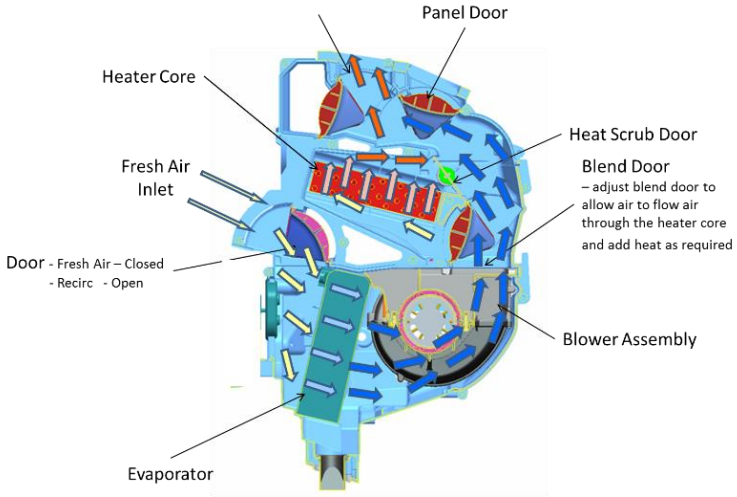


Figure 9: Fresh Air, Defrost

Air Flow Systems

Air Distribution(cont.)

Air Conditioning:

Figure 3 illustrates the system airflow when operating in the **PANEL A/C mode** with recirculate button pressed**.** In this mode, the fresh/recirculated air door is in the recirculated position. Recirculated air (REC), from the cab, enters the HVAC unit through the recirculation filters, located on each side of the HVAC unit. The air is pulled by the blower assembly through the evaporator core and is pushed through the rest of the HVAC unit. The temperature blend air door diverts air around the heater core for full A/C operation. Although the temperature control is operational while in the A/C modes, the temperature control is generally set to direct all the air around the heater core. The air proceeds to the mode door area which directs all the air to the panel vents.

Figure 4 illustrates the system airflow when operating in the **PANEL A/C mode** with fresh air intake. In the PANEL A/C mode, the fresh/recirculated air door is in the fresh air position by default. Fresh outside air enters the top of the fresh air module via an air duct. The remainder of PANEL A/C operation is identical to the previous PANEL A/C operation.

Figure 5 illustrates the system airflow when operating in the **BI-LEVEL A/C mode**. The BI-LEVEL A/C mode operation is identical to PANEL A/C operation; except, the mode doors direct the output air to both the floor ducts, and the panel vents.

Heating & Ventilation:

Figure 6 illustrates the system airflow when operating in the Heat & Vent modes. In this mode, the fresh/recirculate air door is in the fresh air position. Fresh outside air enters the top of the fresh air module via an air duct. The air is pulled into the HVAC unit, through the evaporator core, by the dual scroll blower assembly. The blower then pushes the air through the remainder of the HVAC unit. The temperature blend air door directs air either through the heater core or past it depending on the temperature selected for the outlet air. The temperature blended air proceeds to the mode doors where all the air is directed to the panel vents. All the air can bypass the heater core if the temperature control is set at full cold. (The A/C button in the control panel is disengaged at this point)

Figure 7 illustrates the system airflow when operating in the Heat and Vent **FLOOR mode.** The Heat and Vent Floor mode is identical to the Heat and Vent mode; except the mode doors direct all the output air to the floor ducts.

Air Distribution(cont.)

Defrost:

Figure 8 illustrates the system airflow when operating in the **BI-LEVEL DEFROST/HEAT mode**. In the Bi-Level Defrost/Heat mode the fresh/recirculate air door is in the fresh air position. Fresh outside air enters the top of the fresh air module. The air is pulled into the unit, through the evaporator core, by the dual scroll blower assembly. The blower then pushes the air through the remainder of the HVAC module. The temperature blend air door diverts air either through the heater core or past it depending on the temperature selected for the outlet air. The air proceeds to the mode doors where the doors direct the output air to both the defrost duct and the floor ducts.

Figure 9 illustrates the system airflow when operating in the **DEFROST mode**. The Defrost mode is identical to the Bi-Level Defrost/Heat mode; except, the mode doors direct all the output air to the defrost ducts.

Air Flow Systems

HVAC Unit Components

Thermostatic Expansion Valve (TXV)

The thermostatic expansion valve (TXV) regulates the amount of liquid refrigerant that enters the evaporator. The TXV is connected to both the input and output lines of the evaporator core. By sensing the temperature of the refrigerant at the output of the evaporator, the valve determines the amount of refrigerant needed to the evaporator to keep the evaporator within the correct parameters.

Temperature Switch

The temperature switch is located in the fins of the evaporator coil and is used to measure the temperature so as to prevent the evaporator from freezing up. The probe is located in the coldest spot of the evaporator and should **not** be inserted anywhere else in the unit.

Motor Speed Resistor

The motor speed resistor is mounted on the blower scroll housing located in the cab. The resistor establishes the blower speed based on the setting of the blower speed control knob. As the blower speed control is turned, the voltage across the blower motor will increase.

Recirculation Filter

The recirculation filters are installed in front of the recirculation inlets, on both sides of the HVAC unit. The filters trap particles during recirculation mode that could damage or reduce the performance of any of the HVAC unit components.

Heater Core

The heater core is a heating assembly made of copper tube and aluminum construction, with inlet and outlet fittings for connecting the heater hoses from the engine cooling system. The inlet and outlet fittings protrude from the HVAC unit. Engine coolant always flows through the heater core. The temperature of the air output by the heating/air conditioning system is determined by regulation more or less of the input air through the heater core. The heater core is serviced from inside the vehicle.

Blower Assembly

The blower assembly is located in the blower scroll housing. The blower assembly consists of a permanent magnet motor and cage style blower wheel both housed in a housing assembly designed to maximize the airflow and reduce noise. The motor speed is controlled by the left knob on the HVAC control panel on the instrument panel. The blower provides air circulation through the heater core and evaporator, and delivery of the treated air throughout the vehicle interior.

Evaporator Core

The evaporator core is a cooling assembly made of aluminum plate and fin construction, with “C-plate” block-style inlet and outlet fittings. Drain valves for both condensate and rainwater are incorporated in the bottom of the HVAC unit below the evaporator.

Component Servicing

Temperature Switch

Temperature Switch Removal

1. Remove blower scroll housing. Refer to BLOWER SCROLL HOUSING
2. Remove 2 screws holding temperature switch electrical.
3. Gently pull the temperature probe out of the face of the evaporator – Note the location and depth of the probe upon removal.
4. Pull grommet through interior module and pull out the temperature switch probe.

Temperature Switch Installation

1. Remove blower scroll housing. Refer to BLOWER SCROLL HOUSING
2. Push the temperature switch probe through interior module and seat grommet in place.
3. Gently push temperature probe into the face of the evaporator at the location and to the depth noted during removal.
4. Secure temperature switch electrical in place with 2 screws and make sure harness connector is in place.
5. Connect temperature switch electrical connector and secure with wire ties as necessary.
6. Install blower scroll housing. Refer to BLOWER SCROLL HOUSING

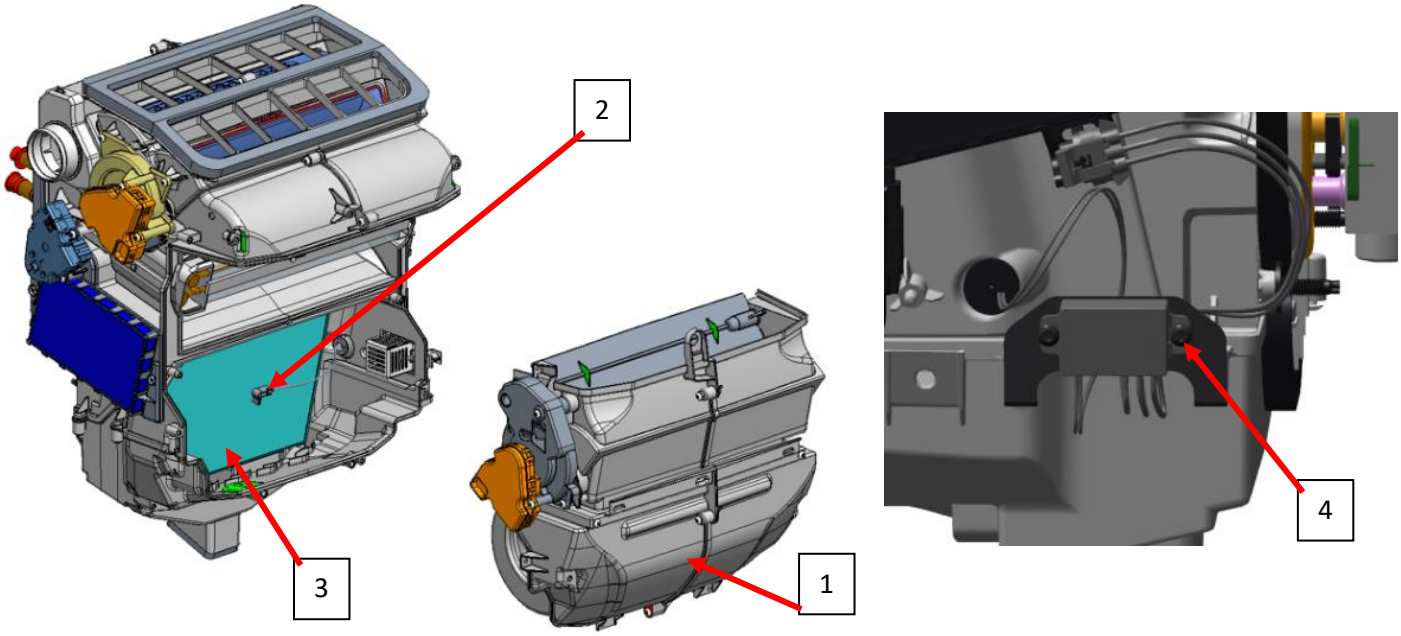


Figure 10: HVAC Unit w/ Separated Blower Scroll Housing

1. Blower Scroll Housing	3. Evaporator Coil
2. Temperature Switch	4. Screw

Component Servicing

Thermostatic Expansion Valve

TXV Removal

1. Discharge A/C system. Refer to REFRIGERANT CHARGE INFORMATION
2. Remove any attached tubes or fittings connected to the TXV.
3. With front locking plate removed from expansion valve, remove 2 Allen head screws from expansion valve body. Remove and retain rear locking plate.
4. Remove expansion valve (TXV).

TXV Installation

1. If A/C system is to be flushed, perform that operation before reassembling the system. Refer to REFRIGERANT CHARGE INFORMATION

NOTE – During installation always lubricate O-rings on fittings with mineral-based oil.

2. Ensure that new lubricated O-rings are installed on all lines being connected to expansion valve.
3. Position rear locking plate over evaporator inlet and outlet lines.
4. Install expansion valve on rear locking plate over the inlet and outlet lines and secure expansion valve with 2 Allen head screws (5.65 Nm Torque).
5. Install refrigerant fittings to TXV using front locking plate (10 Nm Torque).
6. Recharge A/C system. Refer to REFRIGERANT CHARGE INFORMATION

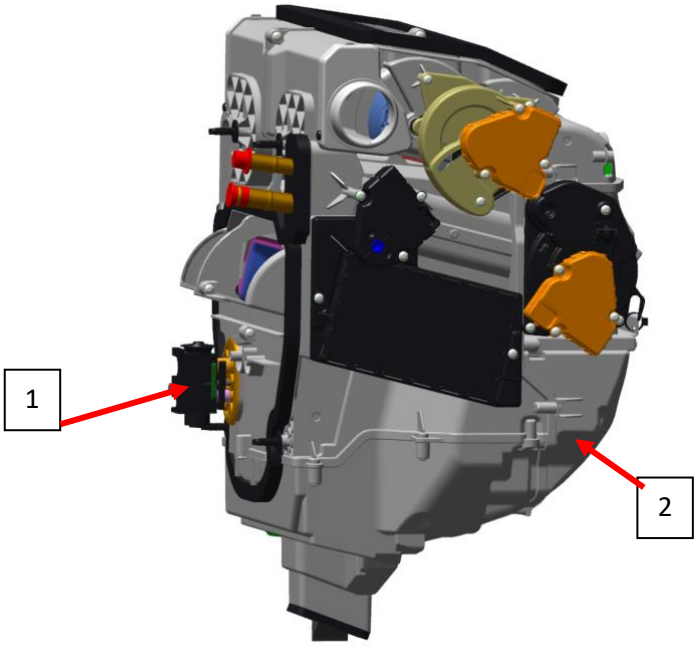


Figure 11: HVAC Unit, TXV View

1. TXV	2. HVAC Unit

Component Servicing

Fresh/Recirculate Door Actuator

Fresh/Recirculate Door Actuator Removal

1. Disconnect electrical connector from fresh/recirculate door actuator.
2. Remove 3 screws from fresh/recirculate door actuator and remove fresh/recirculate door actuator.

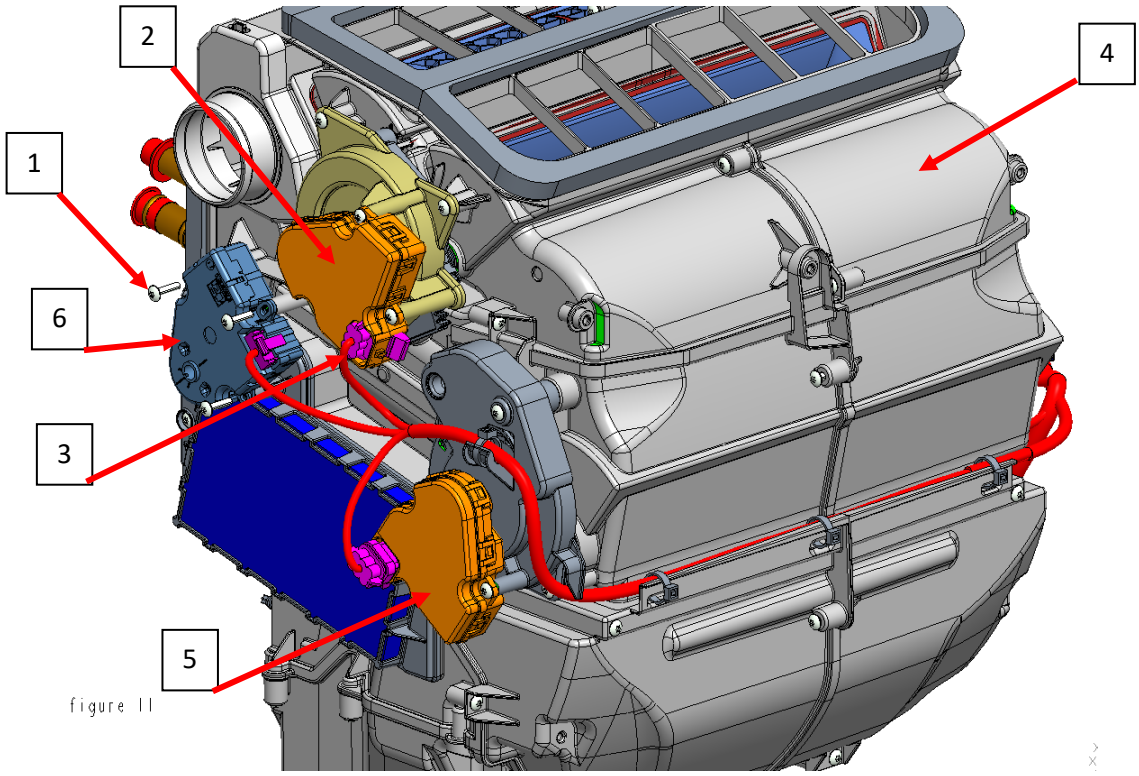


Figure 12: Fresh/Recirc, Mode, and Blend Door Actuators

1. Screw (3 per actuator)	4. HVAC Module
2. Mode Door Actuator	5. Blend Air Door Actuator
3. Connector	6. Fresh/Recirc Door Actuator

Fresh/Recirculate Door Actuator Installation

1. Secure fresh/recirculate door actuator to interior module using 3 screws.
2. Connect electrical connector to fresh/recirculate door actuator.

Component Servicing

Blend Door Actuator

Blend Door Actuator Removal

1. Disconnect electrical connector from blend door actuator.
2. Remove 3 screws from blend door actuator and remove blend door actuator.

Blend Door Actuator Installation

1. Install blend door actuator by rotating door until flats on door shaft align with blend door actuator drive collar, if possible, then carefully slip the blend door actuator onto end of door shaft so that mounting holes are properly aligned.
2. Secure blend door actuator to interior module using 3 screws.
3. Connect electrical connector to blend door actuator.

Mode Door Actuator

Mode Door Actuator Removal

1. Disconnect electrical connector from mode door actuator.
2. Remove 3 screws securing mode door actuator to interior module and pull mode door actuator straight off mode door shaft.

Mode Door Actuator Installation

1. Secure mode door actuator to interior module using 3 screws.
2. Connect electrical connector to mode door actuator.

Component Servicing

Recirculation Filters

Recirculation Filters Removal

1. Carefully pull right recirculation filter out of recirculation filter holder.
2. Carefully pull left recirculation filter out of recirculation filter holder.

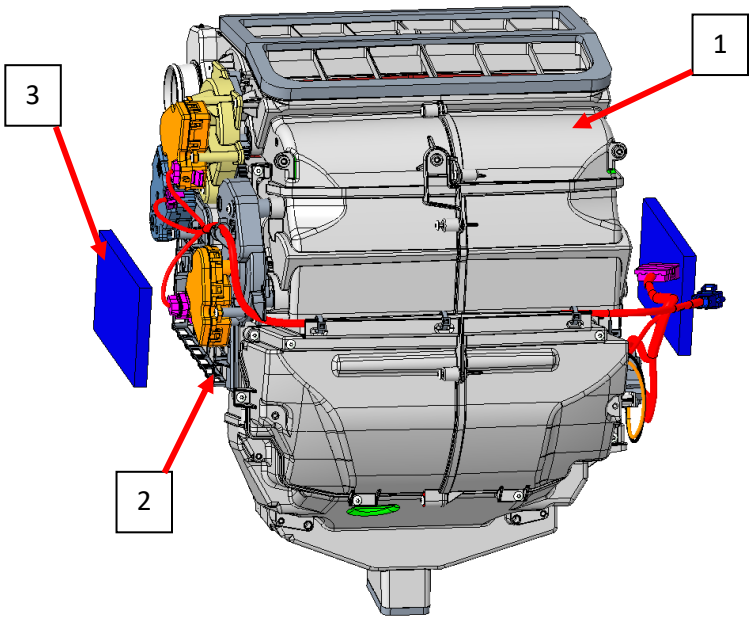


Figure 13: Recirculation Filters

1. HVAC Unit	3. Recirc Filter
2. Recirc Filter Holder	

Recirculation Filters Installation

1. Carefully press left recirculation filter into recirculation filter holder, making sure not to damage filter. Ensure recirculation filter goes all the way in, so recirculation filter cage secures filter in place.
2. Carefully press right recirculation filter into recirculation filter cage, making sure not to damage filter. Ensure recirculation filter goes all the way in, so recirculation filter cage secures filter in place.

Component Servicing

Motor Speed Control (Resistor)

Resistor Assembly Removal

1. Locate Resistor assembly on interior module and disconnect the electrical connector.
2. Remove 2 screws on the resistor assembly.
3. Remove the resistor assembly from the HVAC unit.

Resistor Assembly Installation

1. Install resistor/cage assembly to interior module and secure with 2 screws.

NOTE: Resistor must be inserted in correct orientation. Correct and incorrect orientation is shown in figure 15. Corner notch should be in bottom left corner relative to orientation shown.

2. Connect electrical connector to resistor.

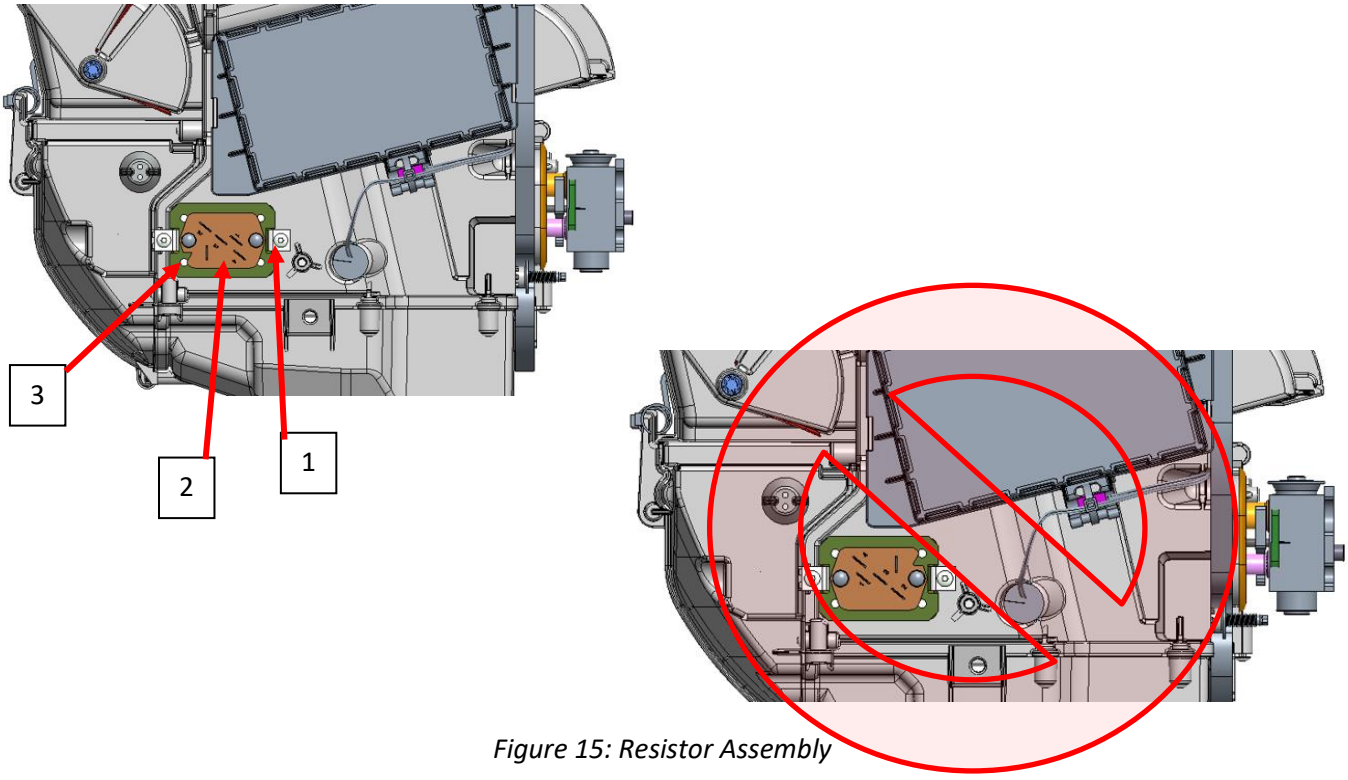


Figure 15: Resistor Assembly

1. Screw	3. Corner Notch
2. Resistor Assembly	

Blower Scroll Housing

Blower Scroll Housing Removal

1. Remove electrical connector to mode and fresh air actuator (main HVAC section).
2. Remove 8 screws (figure 16, item 2 – circled in blue).
3. Separate the blower subassembly from the rest of the HVAC unit (includes the blend actuator, doors, and blower).

Blower Scroll Housing Installation

1. Insert the separated subassembly back into place with the rest of the HVAC unit.
2. Secure with the 8 screws (figure 16, item 2 – circled in blue).
3. Connect mode and fresh air actuator electrical connectors.

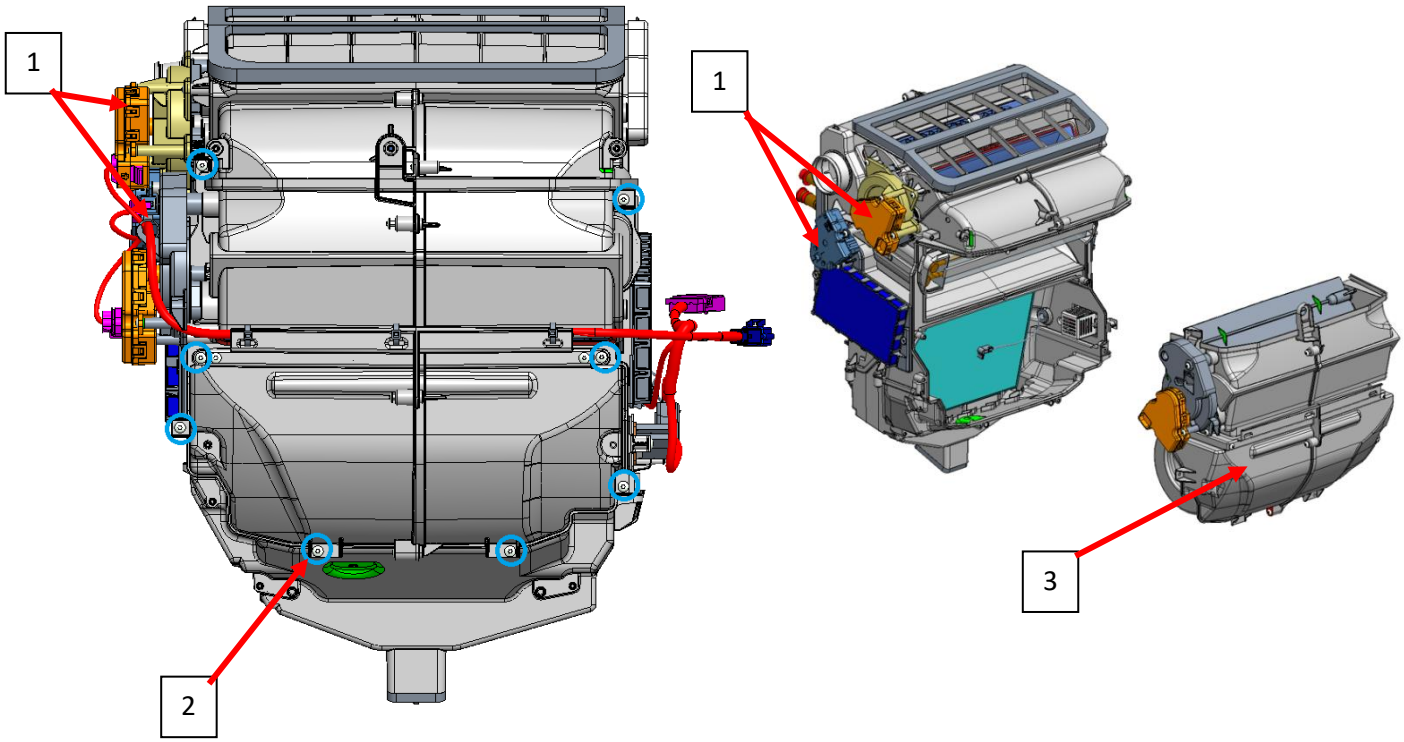


Figure 16: HVAC Unit with Separated Blower Scroll Housing

1. Mode and Fresh Air Actuators
2. Screw
3. Separate Blower Subassembly

Blower Assembly

Blower Assembly Removal

1. Remove blower scroll housing. Refer to BLOWER SCROLL HOUSING
2. Remove 4 screws holding the blower assembly to blower scroll housing – 2 in rear and 2 in front.
3. Carefully pull grommet and electrical connector through blower scroll housing.
4. Pull blower assembly away from blower scroll housing.

Blower Assembly Installation

1. Insert blower assembly into blower scroll housing and secure with 4 screws.
2. Pull electrical connector through blower scroll housing.
3. Secure grommet in the blower scroll housing.
4. Install blower scroll housing. Refer to BLOWER SCROLL HOUSING

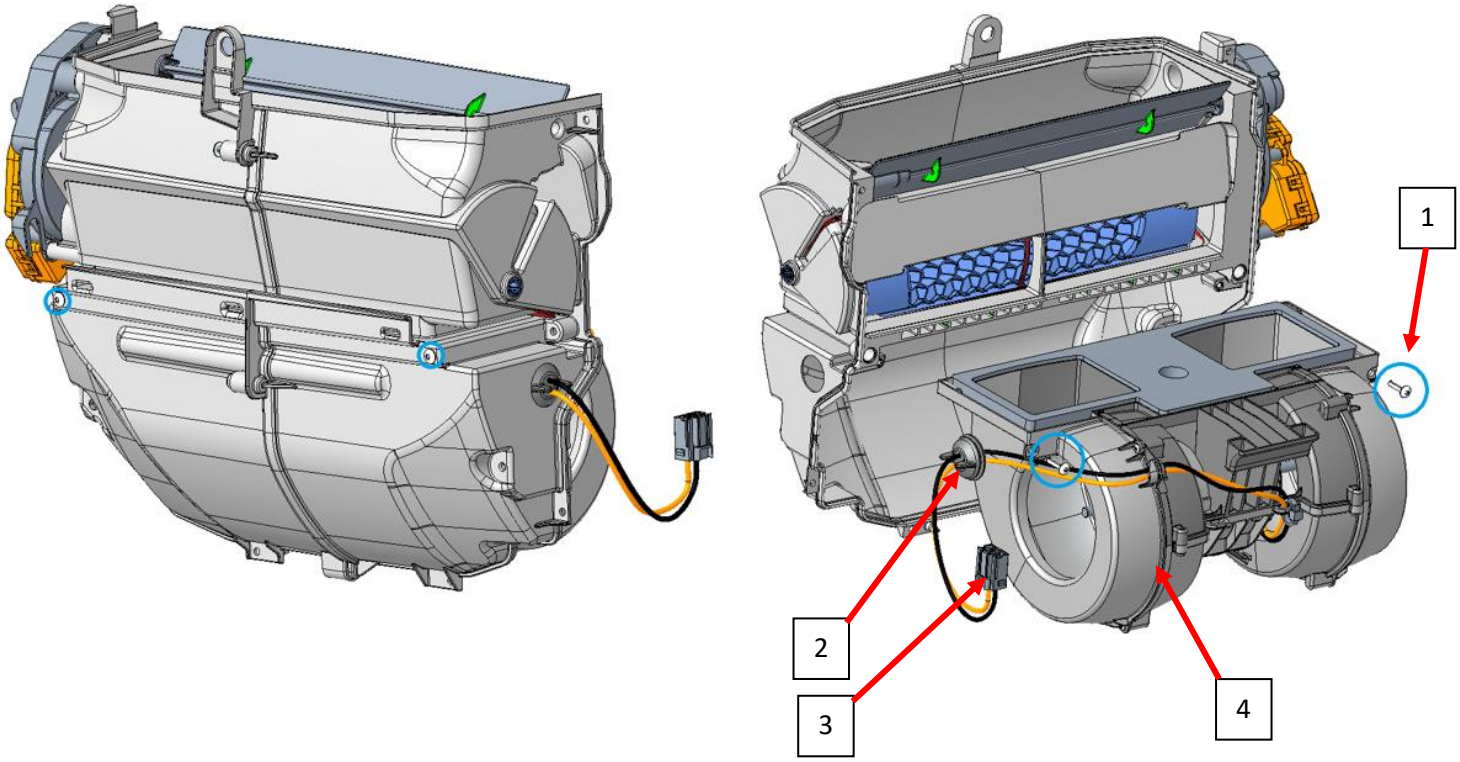


Figure 17: Blower Assembly Separated from Blower Scroll Housing

1. Screw	3. Electrical Connector
2. Grommet	4. Blower Assembly

Heater Core

NOTE – To access the heater hoses, you may require the removal of other assemblies.

Heater Core Removal

1. Drain engine coolant from heater core and connected heater hoses.

NOTE – Before removing heater hoses in the following step, label hoses to ensure correct installation.

2. Remove 2 spring clamps and disconnect both heater hoses from heater core tubes on engine side of cowl.
3. From inside cab, remove blower scroll housing. Refer to BLOWER SCROLL HOUSING

NOTE – The heater core is mounted at a slight angle and therefore retains a small amount of coolant in the core. Be careful to keep the core in a n upright position until the coolant can be drained.

4. Pull heater core out of interior module.

Heater Core Installation

NOTE – In the following step, ensure that the interior module seal that surrounds the heater core tubes does not become dislodged while installing the heater core.

1. From inside cab, carefully position heater core in interior module so that tube ends of core protrude through dash panel seal.
2. Install blower scroll housing. Refer to BLOWER SCROLL HOUSING

NOTE – In the following step, position the heater hose clamps to allow easy access for their next removal.

3. Install heater hose and clamps.
4. Fill cooling system with coolant.

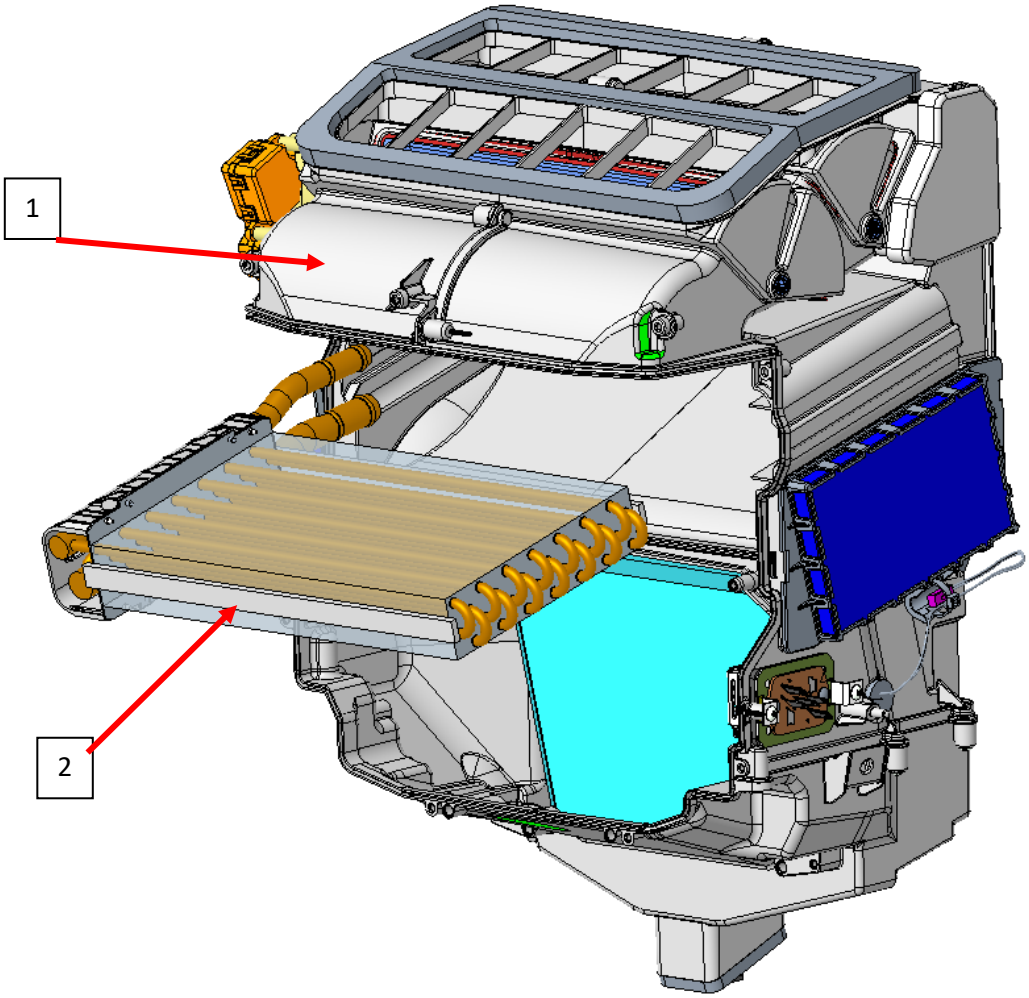


Figure 18: Heater Core

1. HVAC Unit	2. Heater Core

Evaporator

Evaporator Removal

1. Discharge A/C system.
2. Remove blower scroll housing. Refer to BLOWER SCROLL HOUSING
3. Remove expansion valve. Refer to THERMOSTATIC EXPANSION VALVE (TXV)
4. Carefully press evaporator tube grommet through interior module housing. It may be helpful to use a flat tip screwdriver to work grommet seal off.
5. Carefully maneuver evaporator out of interior module, using caution not to damage evaporator tubes or the evaporator itself.
6. Once evaporator is out of the interior module, remove the grommet from the evaporator tubes.

Evaporator Installation

1. Install grommet onto evaporator tubes (figure 19, items 1 and 2).
2. Installation may require additional personnel to aid with grommet installation while the evaporator is being installed.
3. Lubrication may be required when installing the grommet.
4. Install evaporator into interior module, while guiding the evaporator tubes and grommet through outside the vehicle. Ensure grommet seats properly.
5. Install expansion valve. Refer to THERMOSTATIC EXPANSION VALVE (TXV)
6. Install blower scroll housing. Refer to BLOWER SCROLL HOUSING

NOTE: If a refrigerant leak is present in the system and is not present at the TXV connection, replace the evaporator coil. Do not search for a leak in the coil.

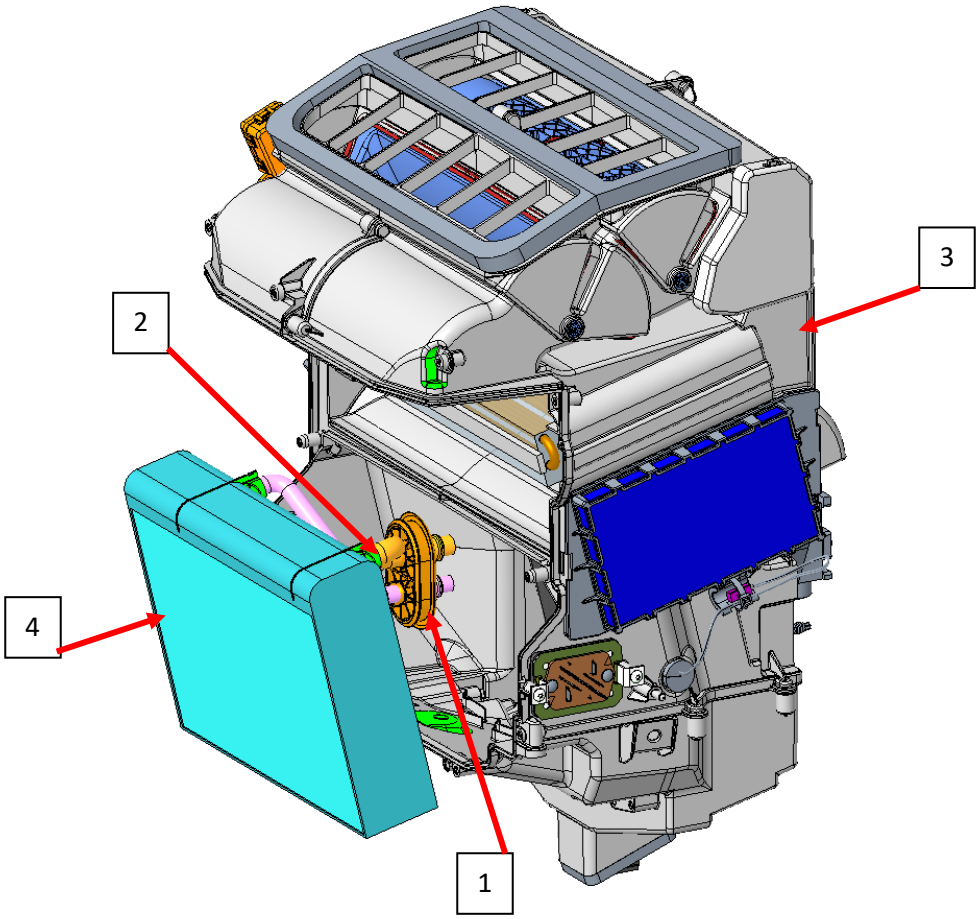


Figure 19: Evaporator

1. Grommet	3. HVAC Unit
2. Evaporator Tubes	4. Evaporator

Air Conditioning System

Safety Precautions & Warnings

SERVICING REFRIGERANT SYSTEMS:

1. Always wear the proper protective eyewear and clothing before working on any refrigeration system. Remember, refrigerant in the air conditioning system can reach pressures of over 500 PSI – if one of those lines bursts while you're working on the system, it can cause serious injury. If refrigerant gets in your eye, it can freeze your eyeball, causing permanent damage or blindness.

2. Always wear work gloves whenever you're working with condensers or evaporators. The aluminum edges are sharp and can cause serious cuts.

3. Always stay clear of the belts and fan blade and be careful revving the engine on a vehicle with a flex fan – damaged blades have been known to come flying off without a moment's warning.

4. Always use a DOT-approved tank for storing used and recycled refrigerants. Look for the Department of Transportation stamp: DOT 4BW or DOT 4BA.

5. Always provide plenty of ventilation when using any electrical testing, recycling, or recovery equipment. Avoid breathing any refrigerant vapor, lubricant vapor, or mist. Exposure to these (particularly PAG oil mist) may irritate your eyes, nose, and throat.

6. Always follow the instructions for your recycling equipment; failure to follow those directions could end up causing personal injury or damaging your equipment. Never perform any maintenance or service on your recycling equipment while the unit is plugged in (unless directed to do so) or without first consulting with authorized service personnel. Removing internal fittings and filters can release pressurized refrigerant. Use care and always wear appropriate safety wear.

7. Never use compressed air to leak test or pressure test an R-134a system or R-134a service equipment. Under certain conditions, pressurized mixtures of R-134a and air can be combustible. Always follow the proper procedures to prevent any safety hazards. In addition, shop air injects moisture into the system, and a pressure surge could damage the evaporator.

8. Microprocessors and computers are susceptible to damage from electrostatic discharge. Always use a static strap when working with these components, and always take the necessary precautions to prevent damage to electronic components.

Note:
To prevent cross contamination between refrigerants, verify that the A/C system has the correct label and unique service fittings designed for R134a refrigerant. If you're ever in doubt, check the system with a refrigerant identifier.

Air Conditioning System

Diagnostic Guide

Problem	Possible Causes	Corrective Action
Inadequate Cooling (Discharge air from A/C vents is only slightly cool or neutral)	1. Incorrect refrigerant charge. 2. Blend door actuator electrical or mechanical issue. 3. Restriction in the TXV resulting in a starved evaporator.	1. Refer to REFRIGERANT CHARGE INFORMATION. 2. Blend door actuator should move with rotation of hot/cold potentiometer on control module. Refer to BLEND DOOR ACTUATOR. Replace if necessary. 3. Verify system has the proper refrigerant charge amount. Perform TXV FUNCTION TEST. Replace TXV if necessary. Refer to TXV
Compressor clutch cycles too rapidly or discharge air temperature increased excessively during compressor clutch "OFF" cycle.	1. Defective temperature probe.	4. Replace probe. Refer to FREEZE PROBE

Air Conditioning System

A/C System Operation Check

The following is an A/C system **"Field Test" and Evaluation Procedure** to be used by service personnel. This procedure can be used to determine if a Bergstrom A/C system is performing properly and contains the correct refrigerant charge. The performance guidelines shown are approximate, and subject to many operational variables. Ambient temperature must be 50 deg F or above to accurately test for A/C performance.

1. Park the vehicle and set the engine speed at 1500 RPM.

2. Set the HVAC controls to AC on, recirculation inlet air, blower at HIGH speed, and the temperature control dial to the coldest setting.

3. Visually verify that the A/C compressor clutch is engaged, and the compressor is operating. Verify that the heater coolant valve is closed, and the heater coil tubes are neutral or cool to the touch.

4. The suction hose fitting (at the evaporator outlet) should be cold to the touch. This fitting may sweat or even frost slightly. The liquid hose fitting (at the evaporator inlet) should be warm to the touch.

5. Chilled air should be discharged from the supply louvers in the dash. After 3-5 minutes of A/C operation the system should begin to cool.

6. Air inlet / outlet temperature differentials are greatly affected by ambient temperature and relative humidity. In cool ambient conditions, differentials smaller than 30 degrees may be seen. Air can only be chilled to a certain level, and then the A/C compressor will cycle off to prevent evaporator freeze-up. High humidity may also result in smaller differentials; a large amount of cooling capacity is required to dehumidify the air, as well as cool it.

7. Measure and record the inlet air to the HVAC unit (near front passenger foot area) and vent discharge air temperature closest to the unit (usually center vent on the front passenger side) and calculate the differential of the two values. Record the humidity value for the day.

8. Measure and record the suction and discharge refrigerant pressures.

9. Refer to EXPECTED A/C PERFORMANCE

10. If the values fall within the guidelines, then the system is functioning properly. If the values don't meet the guidelines, then troubleshooting will be required

Expected A/C Performance

The following performance guidelines are based on test conditions outlined under A/C SYSTEM OPERATION CHECK. Variables such as engine speed, condenser airflow, sun load, blower motor speed, and chassis voltage will all affect A/C system performance.

Air Temperature (F) Entering A/C Unit FRESH OR RECIRCULATED	Inlet - Outlet Air Temperature Differential**	
	LOW HUMIDITY	HIGH HUMIDITY
50	5-10	5-10
60	10-20	10-15
70	20-25	15-20
80	25-30	20-25
90	25-35	20-30
100	30-35	25-30
110	35-40	30-35

** The outlet louver closest to the A/C unit usually discharges the coldest air. The warmest inlet air temperature (fresh or recirculated) should also be used for the Differential calculation.

A/C System Operating Pressures		
Ambient Air Temp (F) Entering Condenser	Suction Pressure (PSIG) @ Evaporator Outlet	Discharge Pressure (PSIG) @ Compressor Outlet
50	5-15	75-125
60	5-15	100-150
70	10-20	125-175
80	10-20	150-225
90	15-25	175-250
100	15-25	200-275
110	15-30	225-325

Thermostatic Expansion Valve (TXV) Function Test

TXV OPERATION:

The Thermostatic Expansion Valve or TXV is an interactive device that senses pressure and temperature then adjusts refrigerant flow to maintain a given superheat. Do not replace this device unless its function has been properly tested.

Perform the A/C SYSTEM OPERATION CHECK first to ensure that there aren't any other possible restrictions to refrigerant flow. Look for frost, potentially caused by a restriction, on components such as the Evaporator, Receiver/Drier, Condenser and adjoining refrigerant hoses.

TXV FUNCTION TEST:

1) A/C system is fully charged.
2) Blower motor set for high speed.
3) Engage compressor and allow A/C system to stabilize.
4) After 5 - 10 minutes observe low side refrigerant operating pressures and record.
5) Change the blower motor speed to low and continue to watch the low side pressure. The pressure should drop ~ 3 – 4 psig depending on the heat load in ~ 1 – 2 minutes.
6) Repeat this procedure 2 – 3 more times.
7) If the low side pressure can be influenced by changing the blower motor fan speed, then the TXV is responding in the changing of the evaporator's heat load as designed.

Air Conditioning System

Refrigerant Charge Information – R134a

A correct refrigerant charge is necessary to achieve optimum performance from an air conditioning system. This is very important with the vehicle A/C systems designed for R-134a refrigerant. When servicing the refrigerant system, ***the only way to be certain of an exact charge is to fill an empty system with the specified amount of R-134a.*** If the A/C system is operating and the amount (charge) of refrigerant within the system is not known, some simple checks can be performed to determine if the operating charge is adequate:

1. Compressor clutch engaged, and compressor operating.
2. Suction hose fitting (at evaporator outlet) cold to the touch. This fitting may sweat or even frost lightly.
3. Chilled discharge air at the dash louvers, when the temperature control is set at the coolest setting (water valve completely closed).

*Recommend charge level is **2.5 lbs. R-134a** virgin refrigerant.*

Refrigerant System Leak

If the HVAC system has a refrigerant leak:

1. Leak test using nitrogen or a small amount of refrigerant and test the TXV connection for leaks.
2. If a leak is found at the TXV, repair or replace the TXV.
3. If no leak is found at the TXV, **DO NOT SEARCH FOR A LEAK ELSEWHERE**! Immediately replace the evaporator coil. Refer to EVAPORATOR COIL
4. **Bergstrom only authorizes 0.5 hours repair time at the TXV connection for refrigerant leaks.**

Air Conditioning System

Service Tips

1. **USE ONLY VIRGIN OR NEW R134A REFRIGERANT.**

2. RECLAIMING REFRIGERANT, EVACUATING THE A/C SYSTEM AND CHARGING WITH PROPER AMOUNT OF REFRIGERANT RESOLVES MANY A/C COMPLAINTS.

3. SOME REFRIGERANT LOSS WILL OCCUR IN ONE YEAR'S TIME AND THIS IS RECOGNIZED AS NORMAL. VIBRATION, HOSE POROSITY AND GENERAL CONSTRUCTION OF THE SYSTEM MAKE A LEAK PROOF SYSTEM NEARLY IMPOSSIBLE.

4. **BERGSTROM DOES NOT RECOMMEND OR ENDORSE THE USE OF "STOP LEAK" OR "LEAK SEALING" PRODUCTS**.

Air Conditioning System

R134a Temperature / Pressure Chart

Pressure	Temp		Pressure	Temp		Pressure	Temp		Pressure	Temp		Pressure	Temp		Pressure	Temp
psig/Hg"	Deg F		psig	Deg F		psig	Deg F		psig	Deg F		psig	Deg F		psig	Deg F
22	-62.38		13	11.77		37	42		61	62.75		145	109.4		265	150.6
20	-55.02		14	13.38		38	43		62	63.5		150	111.5		270	152
18	-48.85		15	14.94		39	43.98		63	64.24		155	113.6		275	153.4
16	-43.5		16	16.46		40	44.95		64	64.98		160	115.6		280	154.7
14	-38.76		17	17.95		41	45.91		65	65.71		165	117.6		285	156.1
12	-34.49		18	19.4		42	46.85		66	66.43		170	119.6		290	157.4
10	-30.6		19	20.81		43	47.78		67	67.14		175	121.5		295	158.7
8	-27.02		20	22.19		44	48.7		68	67.85		180	123.3		300	160
6	-23.7		21	23.55		45	49.61		69	68.55		185	125.2		305	161.3
4	-20.59		22	24.87		46	50.51		70	69.24		190	126.9		310	162.5
2	-17.67		23	26.16		47	51.39		75	72.62		195	128.7		315	163.8
0	-14.92		24	27.43		48	52.26		80	75.86		200	130.4		320	165
1	-12.31		25	28.68		49	53.13		85	78.98		205	132.1		325	166.2
2	-9.84		26	29.9		50	53.98		90	81.97		210	133.8		330	167.4
3	-7.47		27	31.1		51	54.82		95	84.87		215	135.5		335	168.6
4	-5.21		28	32.27		52	55.65		100	86.66		220	137.1		340	169.8
5	-3.04		29	33.43		53	56.48		105	90.37		225	138.7		345	171
6	-0.95		30	34.56		54	57.29		110	92.99		230	140.2		350	172.1
7	1.05		31	35.68		55	58.1		115	95.53		235	141.8		355	173.3
8	2.99		32	36.77		56	58.89		120	98		240	143.3		360	174.4
9	4.86		33	37.85		57	59.68		125	100.4		245	144.8		365	175.4
10	6.67		34	38.91		58	60.46		130	102.7		250	146.3		370	176.3
11	8.42		35	39.96		59	61.23		135	105		255	147.7		375	177.3
12	10.12		36	40.99		60	62		140	107.2		260	149.2		380	178.2

The numbers above represent the boiling points for R134a

HVAC Unit

Owner's Manual Operating Instructions

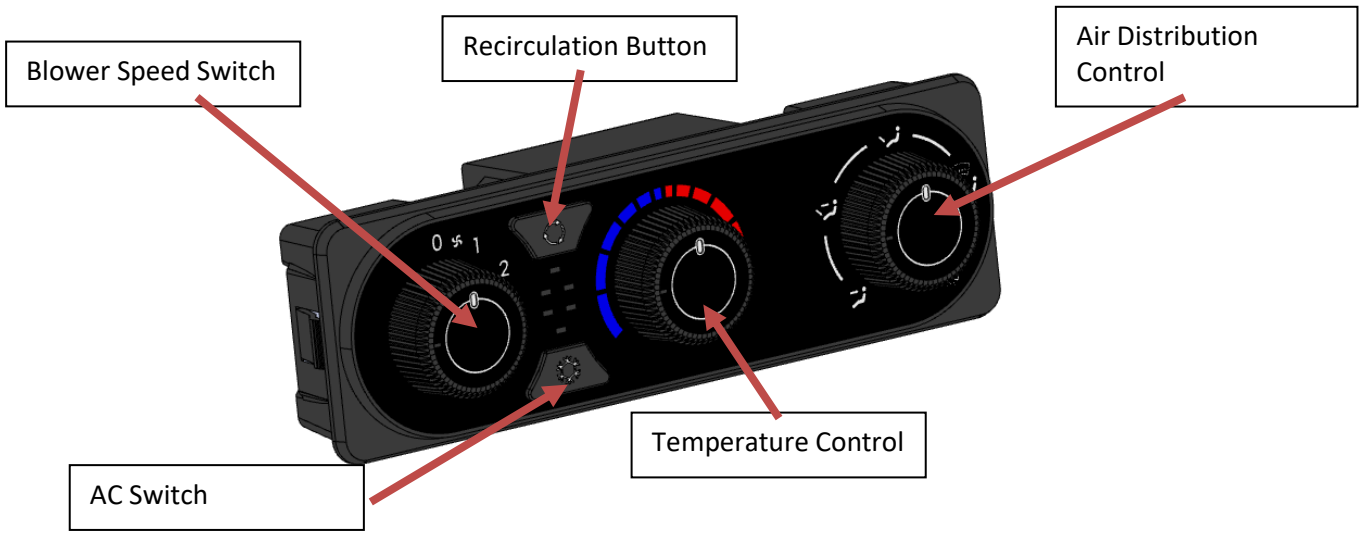
For additional owner and operator information visit us on the web at

www.bergstrominc.com

WARNING
This heater / air conditioner should be serviced by a fully trained and environmentally licensed technician. Failure to do the above could result in serious injuries, fines, and possible voiding of any warranties.

Control Panel Operation

The control panel enables the driver to control the temperature, volume, and direction of the air discharged from the heating/air conditioning system.



TYPICAL CONTROL PANEL

NOTE – The following descriptions cover the 'heater/air conditioner' version of the system. Operation of the 'heater only' system (available on some models) is nearly identical, except all air conditioning information can be ignored.

Blower Fan Speed Control

This control regulates the amount of air provided to the vents in any mode you select. Turn the knob clockwise to increase fan speed. Turning the control to the OFF position will shut off the fan but does not prevent outside air from entering the vehicle. Turning off the fan speed control prevents the A/C compressor from operating.

Temperature Control

This control regulates the temperature of the air discharged from the vents. The blue area of the control indicates cooler temperatures while the red area indicates warmer temperatures. This control operates the blend door that determines what portion of the air flowing through the system is regulated through the heater core. As the temperature control is rotated clockwise, more air is regulated through the heater core, increasing the temperature of the air in the vehicle.

Mode Control

This control selects the operating mode of the system (HEAT, VENT, DEFROST, and A/C) and controls which outlets are used to distribute the air. This is accomplished by electronically controlling the A/C compressor clutch, as well as three air doors located in the in-cab interior module.

Air Distribution

To achieve the maximum comfort in your motor home, the air must be directed where it is needed. The mode switch (right of center) gives the driver the ability to select where the air will flow.

CONTROL KNOB POSITION		AIRFLOW		
Air Conditioner Systems	**Heater Only Systems**	**Panel**	**Floor**	**Windshield**
NORM A/C 	N/A	100%		
BI-LEVEL 	N/A	75%	25%	
FLOOR 	N/A		100%	
MIX 	N/A		50%	50%
DEFROST 	N/A			100%

Panel A/C Mode

In this mode, all airflow is directed to the panel air outlets. In the PANEL A/C mode, the fresh/recirculate air door is in the fresh position. Use the recirculate button to activate recirculation air intake. Use this feature to block out any outside odors, smoke, or dust and to cool the interior rapidly upon startup.

Bi-Level A/C Mode

In this mode, 75% of the airflow is directed to the panel air outlets, 25% is directed to the floor air outlets. Fresh (outside) air is used to cool the vehicle.

Floor Mode

In this mode, all airflow is directed to the floor air outlets and fresh (outside) air is used to cool the vehicle.

MIX Mode

In this mode, 50% of the airflow is directed to the defrost outlets and side demist air outlets and 50% of the airflow is directed to the floor air outlets. Fresh (outside) air is used to cool the vehicle.

Defrost Mode

In this mode, all the airflow is directed to the defrost air outlets and side demist air outlets. Fresh (outside) air is used to cool the vehicle.

IMPORTANT OPERATING FEATURES AND TIPS

Window Fogging

In mild, but rainy or humid weather, windows may fog on the inside. To clear the fog of all driver area windows, turn on the air conditioning, and set the mode control to DEFROST.

Winter Operation

- Remove snow and ice from windshields and system air intakes if applicable.
- The discharge air will heat up faster if the blower is operated on lower speeds until the engine is hot and the RECIRC switch engaged (illuminated).
- For windshield de-icing, use **DEFROST** mode.
- Ensure the air intake is free of ice and slush.

Summer Operation

Air-conditioned vehicles must be protected with a high-quality antifreeze coolant during summer to provide corrosion protection and to raise the boiling point of the coolant for protection against overheating. A 50% concentration is recommended.

- Use Recirculated air control for a quick cool down.
- Close all windows and vents to hot humid outside air.
- Close all curtains which do not obstruct the driver's vision.

CARE AND SERVICE

- Keep the condenser and radiator free of bugs and debris.
- During periods of little use, operate the A/C system monthly to keep the compressor and seals lubricated.
- Periodically inspect the belts and hoses for wear and proper tension.
- Periodically check for proper coolant levels.

WARRANTY / SERVICE WARNING:
THE AIR CONDITIONING SYSTEM CONTAINS REFRIGERANT 134a UNDER HIGH PRESSURE AND SHOULD BE SERVICED BY QUALIFIED PERSONNEL ONLY.

REPAIRS THAT ALTER THE DESIGN OF THE BERGSTROM SYSTEM INCLUDING USE OF NON-BERGSTROM SUPPLIED PARTS WILL VOID THE WARRANTY AND ANY BERGSTROM LIABILITY FOR THE SYSTEM.