Recreational Vehicle

Single Zone Front HVAC

Service Manual

Updated: 9/6/2023

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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Single Zone Front HVAC Owner's Manual

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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 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 regarding vehicle damage or personal injury. Additionally, Federal and any Local regulations regarding the handling and use of refrigerants should be always complied with.

NOTES:

TECHNICAL SUPPORT IS PROVIDED TO CERTIFIED TECHNICIANS ONLY. BERSTROM 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
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Rockford, IL 61109
USA

Phone:

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Website:

www.bergstrominc.com

Service

Request for Technical Support Questionnaire

Open the front service door of the coach 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

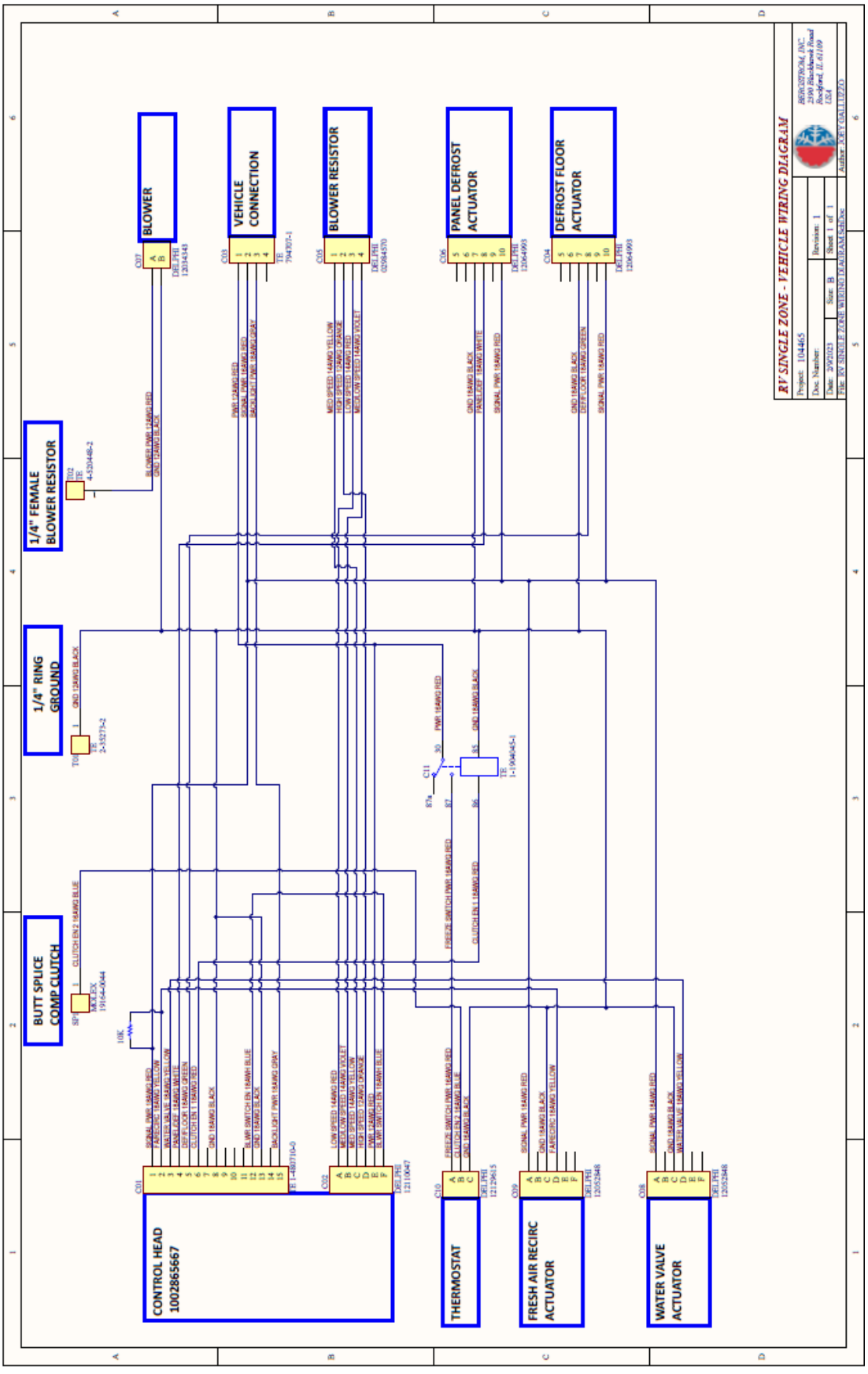
DIFFERENTIAL

Service

Comments

Electrical System

Electrical Schematics



Bergstrom

Electrical System

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 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). Two power sources are required. 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. 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. Incorrect circuit(s). 4. Faulty shutter actuator. 5. 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. 3. Correct the circuit(s) if possible or replace harness. 4. Replace the actuator if needed. 5. Replace the switch or control panel if needed.

Electrical System

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. 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 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.

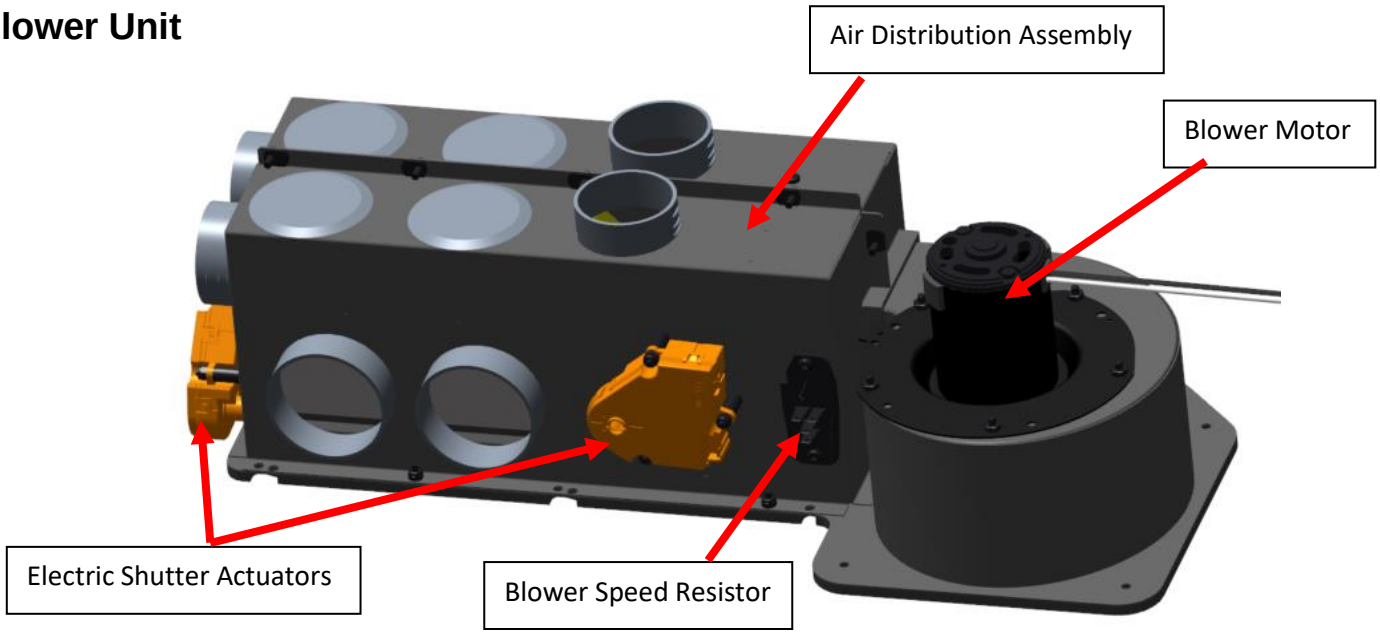
Electrical System

Problem	Possible Cause	Corrective Action
A/C Clutch does not operate	1. Blower switch is not activated.	1. AC switch receives its power source from the blower switch. Turn blower switch to any speed selection. Verify blower operation.
A/C Clutch does not operate. Blower is operating properly	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. Defective A/C thermostat. 5. Faulty A/C pressure switch (make certain adequate refrigerant is contained in system). 6. Faulty A/C clutch. 7. 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. Place a jumper across terminals of thermostat. If the clutch engages, replace the thermostat. 5. Place a jumper across terminals of vehicle's harness mating connector, if the clutch engages then replace the switch. 6. 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. 7. 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

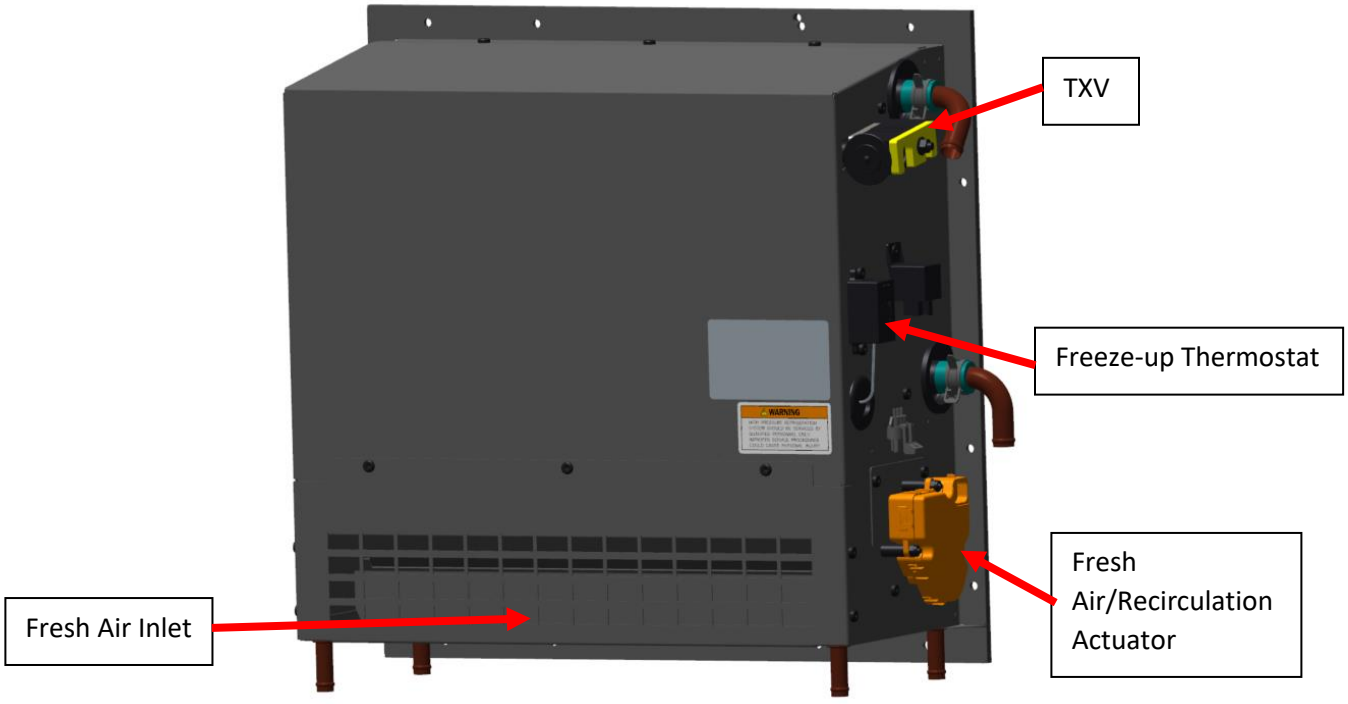
Main HVAC System Components

Blower Unit



Other designs may vary by customer need. Air outlet hole variations possible.

HVAC Unit



Other designs may vary by customer need. Air filter variations possible.

Air Flow Systems

Condenser Assembly (if applicable)

Condenser not used in all system setups. Consult kit contents or bill of material.

Heating System

HVAC Unit

HVAC Unit Removal

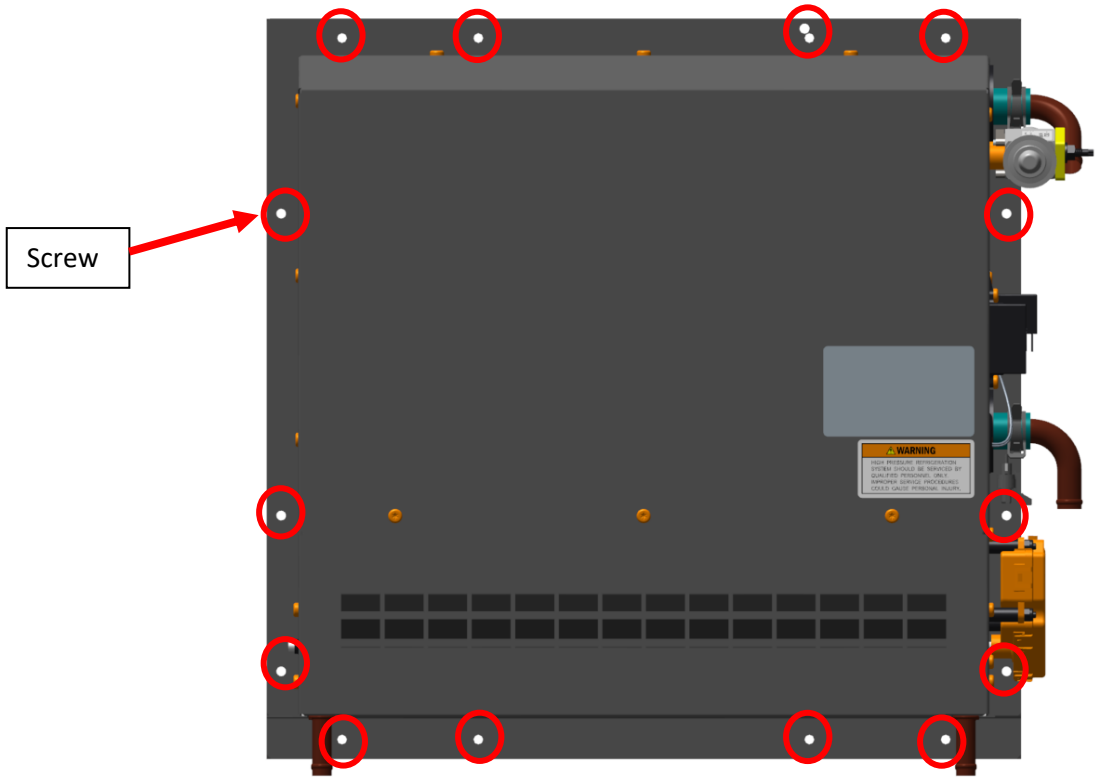
1. Discharge A/C system. Refer to SERVICE TIPS
2. Remove any hoses/fittings connected to TXV by removing front locking plate nut.
3. Drain engine coolant from heater core and connected hoses.

NOTE – Before removing heater hoses, label to ensure correct installation.

4. Remove 2 spring clamps and disconnect both heater hoses from heater core tubes.
5. Remove HVAC unit from firewall by removing 14 screws.

HVAC Unit Installation

1. Secure HVAC unit to firewall with 14 screws.
2. Secure heater hoses to HVAC unit with 2 spring clamps.
3. Refill engine coolant system with coolant.
4. Secure refrigerant fittings to TXV with front locking plate and nut.
5. Charge A/C system. Refer to REFRIGERANT CHARGE INFORMATION



Heating System

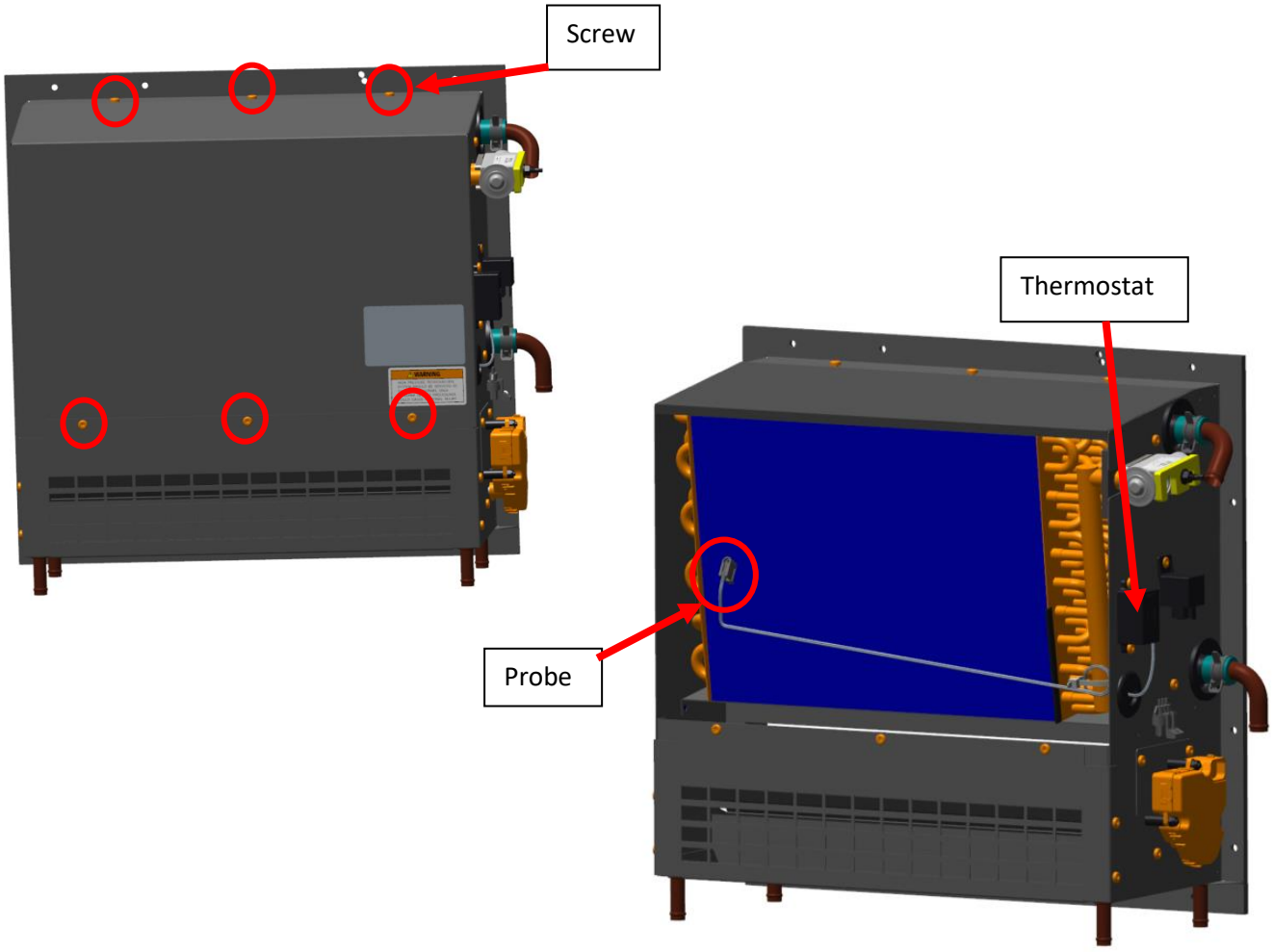
Freeze Up Thermostat

Freeze Up Thermostat Removal

1. Remove outer sheet metal cover with 6 screws.
2. Remove 2 screws holding thermostat to HVAC unit.
3. Gently pull the thermostat probe out of the face of the evaporator, noting probe depth and location of indentation left behind.
4. Remove grommet and pull probe through sheet metal hole.

Freeze Up Thermostat Installation

1. Route new probe through hole in sheet metal.
2. Gently push probe into the face of the evaporator at the same location and depth as noted during removal.
3. Secure rubber grommet and thermostat with 2 screws.
4. Install outer sheet metal cover with 6 screws.



Heating System

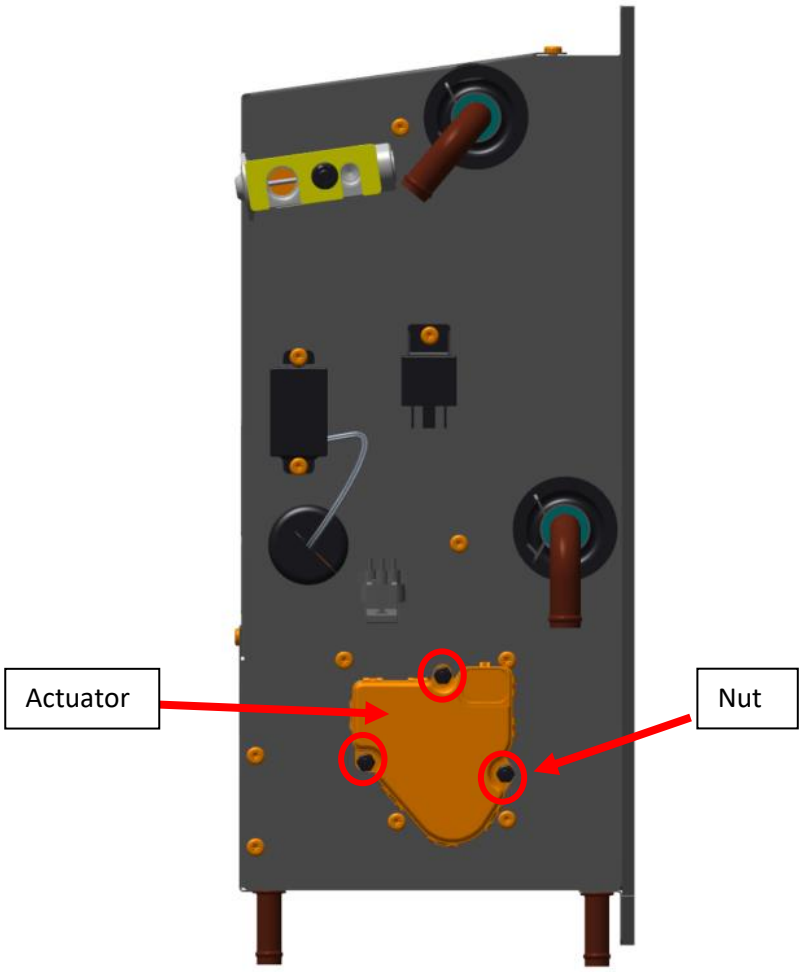
Actuator

Actuator Removal

1. Depending on actuator location, removal of the HVAC unit or blower mode box may be necessary.
2. Disconnect electrical connector from actuator.
3. Remove 3 nuts.
4. Pull actuator out making sure the spacers remain on mounting bolts.

Actuator Installation

1. Verify 3 spacers are in place on mounting bolts and secure actuator with 3 nuts.
2. Connect electrical connector to actuator.
3. Installation of HVAC unit of blower mode box may be necessary.



Thermostatic Expansion Valve (TXV)

TXV Removal

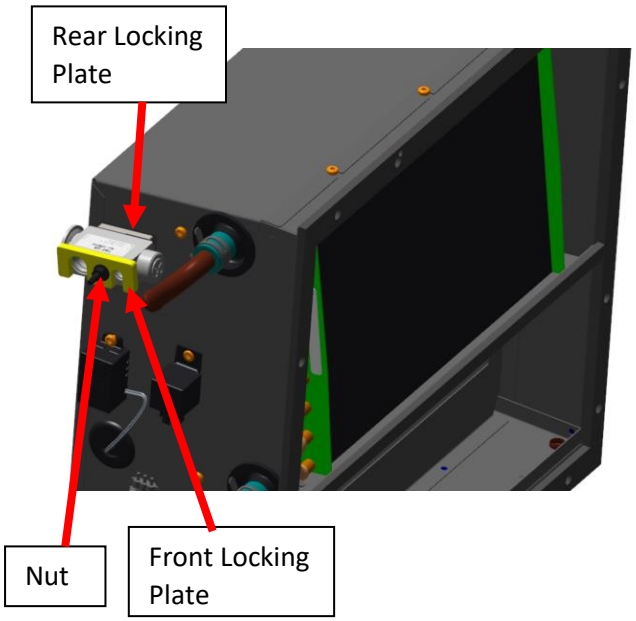
1. Discharge A/C system. Refer to SERVICE TIPS
2. Remove any attached hoses/fittings connected to TXV and front mounting plate by removing 1 nut.
3. Remove 2 Allen screws from the expansion valve body. Remove and retain rear locking plate.
4. Remove TXV.

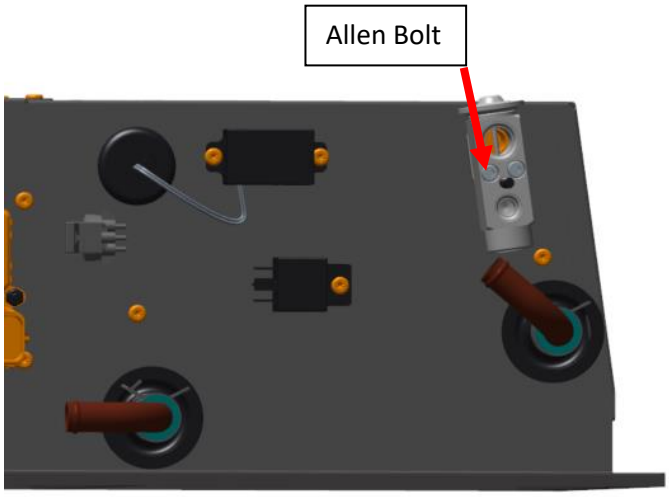
TXV Installation

1. If A/C system is to be flushed, perform that operation before reassembling the TXV. Refer to SERVICE TIPS

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

2. Ensure that newly lubricated O-rings are installed on all lines being connected to TXV.
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 screws (5.65 Nm Torque).
5. Install refrigerant fittings to TXV using the front locking plate and 1 nut.
6. Recharge A/C system. Refer to REFRIGERANT CHARGE INFORMATION





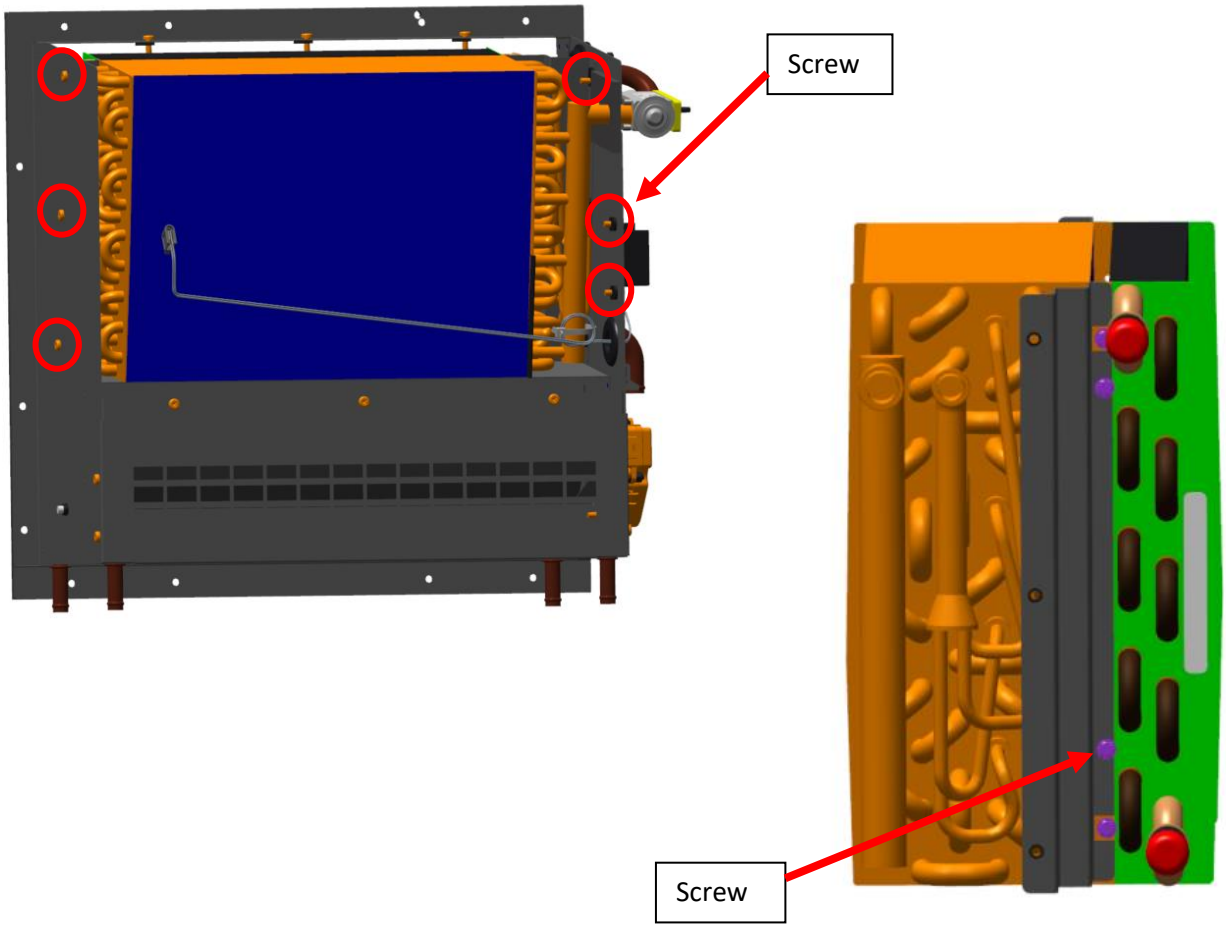
Evaporator Coil & Heater Core

Evaporator Coil & Heater Core Removal

1. Remove HVAC unit. Refer to HVAC UNIT
2. Remove freeze up thermostat. Refer to FREEZE UP THERMOSTAT
3. Remove 6 screws holding interior coil brackets to sheet metal.
4. Slide out both evaporator and heater core together.
5. Remove 8 screws to separate the two coils.

Evaporator Coil & Heater Core Installation

1. Secure evaporator and heater core together with 8 screws.
2. Slide assembly into sheet metal.
3. Secure coil assembly to sheet metal with 6 screws.
4. Install freeze up thermostat. Refer to FREEZE UP THERMOSTAT
5. Install HVAC unit. Refer to HVAC UNIT



Heating System

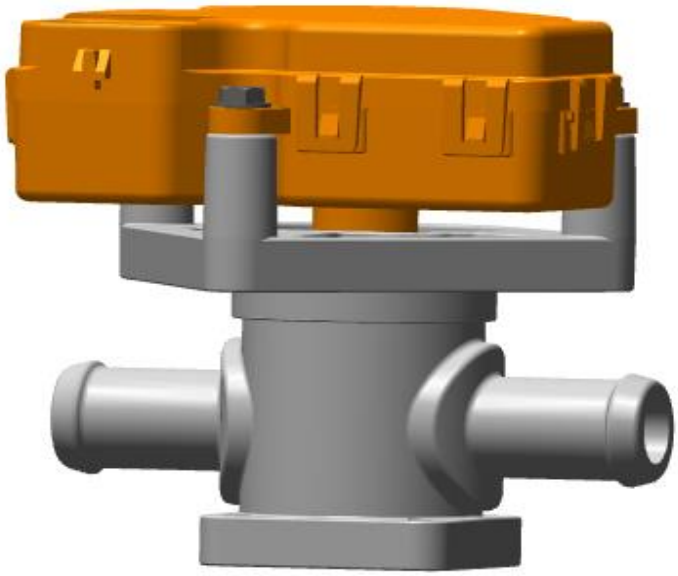
Water Valve

Water Valve Removal

1. Clamp off coolant hoses (both sides) of water valve.
2. Disconnect valve electrical connector.
3. Loosen hose clamps on both sides and drain any remaining coolant.
4. Remove valve noting the arrow direction for new installation.

Water Valve Installation

1. Insert valve into coolant hoses with hose clamps, using direction previously noted.
2. Tighten hose clamps.
3. Connect electrical connector.
4. Release coolant hose clamps and fill with additional coolant if necessary.



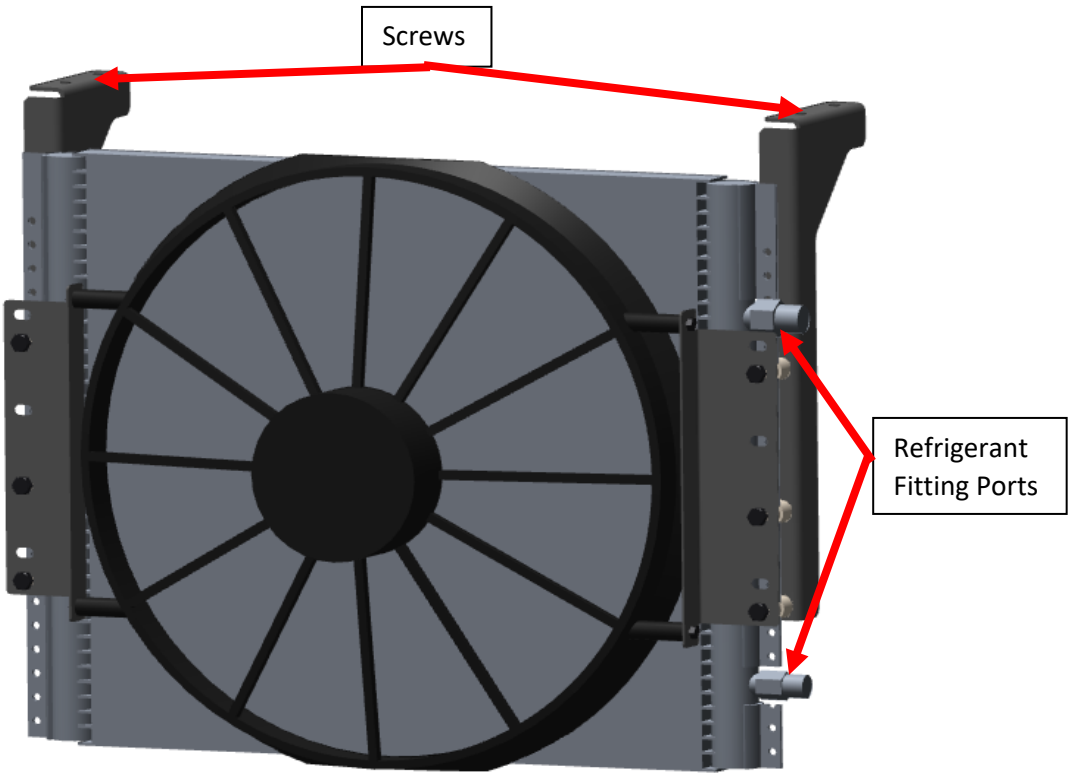
Condenser Assembly

Condenser Assembly Removal

1. Evacuate system A/C refrigerant. Refer to SERVICE TIPS
2. Remove refrigerant fittings from condenser.
3. Remove 4 screws that secure the condenser assembly brackets to vehicle.

Condenser Assembly Installation

1. Secure the condenser assembly to the vehicle with condenser assembly brackets and 4 screws.
2. Attach refrigerant fittings to condenser.
3. Charge system A/C refrigerant. Refer to REFRIGERANT CHARGE INFORMATION

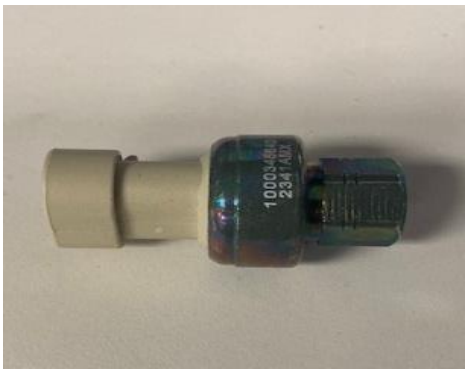


Heating System

Other Serviceable Items

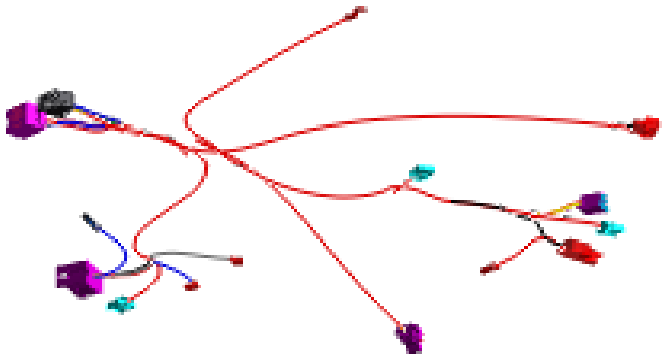
HVAC Control

Binary Pressure Switch



Receiver Dryer

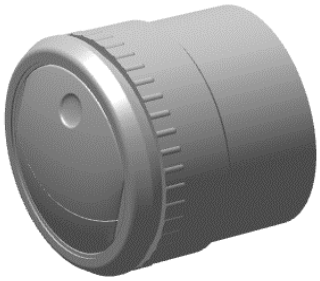
Electrical Harness

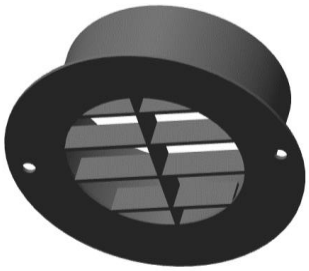


Heating System

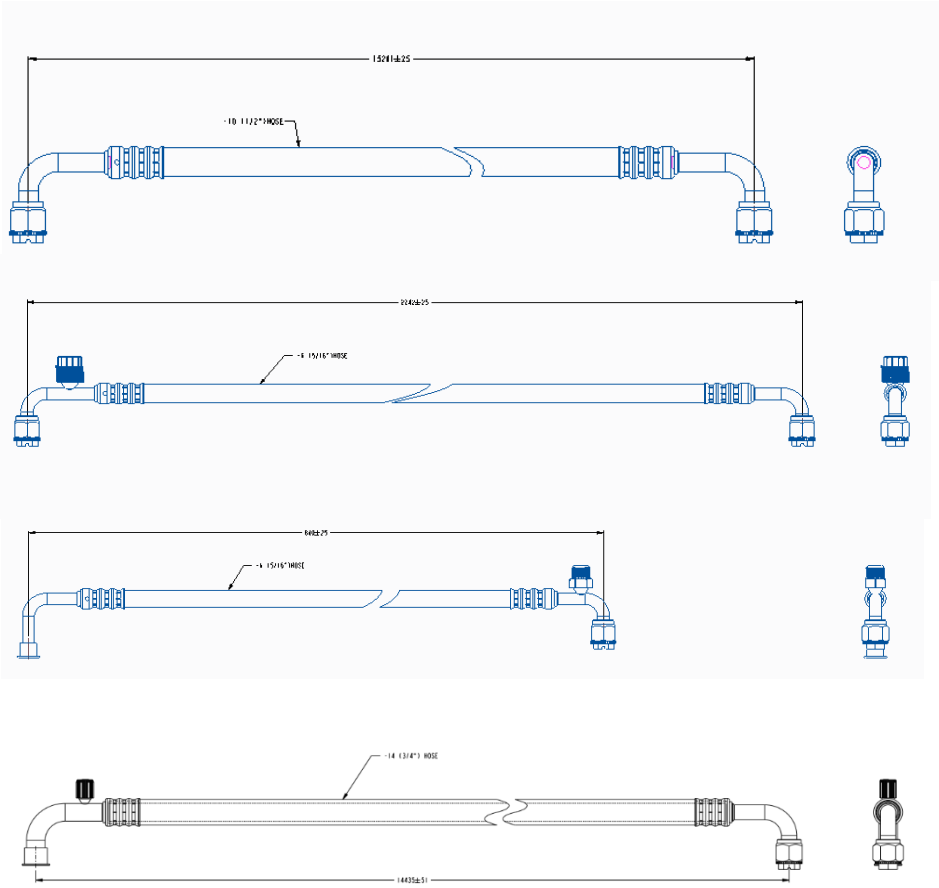
Drain Hose

Louver





Hose Assembly



Heating System

Safety Precautions & Warnings

Servicing Engine Coolant Systems:

1. Always wear the proper protective eyewear and clothing before working on any engine coolant system. Remember engine coolant systems can reach temperatures over 180 degrees F. If coolant gets in your eye, **immediately** flush eyes with running water for at least 15 minutes, keeping eyelids open. Seek medical attention.
2. Always wear work gloves whenever you're working with heating coils and hoses. 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 moments' warning.

Warning:

Never remove the radiator cap on a vehicle while the engine is still hot or warm. Severe scalding can occur.

Heating System

Engine Coolant System

ANTIFREEZE / COOLANT

The main function of the Cooling System is to carry heat away from the engine and maintain the desired operating temperature. This is accomplished by circulating antifreeze/coolant through the engine, where heat is generated, and carrying it to the radiator to be cooled.

Modern recreational vehicles operate in a wide variety of ambient temperatures, from well below freezing to well over 100 F. The fluid used to cool the engine must have a very low freezing point, a high boiling point, and it must have the ability to transfer heat.

An adequate amount of an antifreeze/coolant and water mixture is necessary to reduce the possibility of engine overheating and freezing and contain additives to prevent rust and corrosion in the cooling system.

Water is one of the most effective fluids for holding heat, but water freezes at too high a temperature to be used in automobile engines alone.

The fluid used in most recreational vehicles is a mixture of water and ethylene glycol, also known as "antifreeze" or "coolant". By adding antifreeze / coolant to water, the boiling and freezing points are improved significantly.

The temperature of the coolant can sometimes reach 250 to 275 F (121 to 135 C). Even with antifreeze added, these temperatures would boil the coolant. To prevent this, the cooling system is pressurized, which further raises the boiling point of the coolant. Most systems have around 14 to 15 pounds per square inch (psi), which raises the boiling point approximately 45ºF so the coolant can endure the high temperatures produced in the engine.

ENGINE COOLANT HOSES

The radiator hoses and heater hoses are easily accessed by opening the hood, at the engine location, and inspecting. You want to be sure that the hoses show no visible signs of cracking or splitting and that there is no bulging or swelling at the ends.

If there are any signs of problems, the hose should be replaced with the correct part number for the year, make, model and engine of the vehicle.

Never use a universal hose unless it is an emergency, and a proper molded hose is not available.

For either the radiator hoses or the heater hoses, make sure that you route the replacement hose in the same way that the original hose was running. Position the hose away from any obstruction that can possibly damage it and always use new hose clamps.

After the cooling system is refilled with the proper coolant mixture, a pressure test should be performed to ensure that there are no leaks.

Heating System

BELTS

On older recreational vehicles, the water pump is driven by either a “V” belt or serpentine belt on the front of the engine that is also responsible for driving the alternator, power steering pump and air conditioner compressor. These types of belts are easy to inspect and replace if they are worn.

Check for dry cracking on the inside surface of the belt.

On newer vehicles, the water pump is often driven by the timing belt. This belt usually has a specific life expectancy at which time it must be replaced to ensure that it does not fail. Since the timing belt is inside the engine and will require partial engine disassembly to inspect, it is very important to replace the timing belt at the scheduled interval.

ITEMS OF CONCERN

- Check antifreeze/coolant level monthly. Only use a 50/50 solution of anti-freeze/coolant and water.
- Water quality plays an important role in protecting the cooling system. A high mineral content may cause scaling or corrosion. De-ionized or distilled water should be used in 50/50 solution.
- CAUTION: Do not remove the radiator pressure cap when the engine is HOT.
- Inspect belts monthly. Replace belts that are worn, frayed, or glazed. Adjust belts when more than 1/2 inch can be depressed between the pulleys.
- Belts with spring-loaded tensioners do not require manual adjustments.
- Replace bulging, rotten, or brittle hoses and tighten hose clamps. If a hose looks bad or feels too soft or too hard, it should be replaced.

Heating System

Diagnostics Guide

Problem	Possible Causes	Corrective Action
Inadequate or no heat (Discharge air only slightly warm, or neutral)	1. Engine coolant system's fluid is low. 2. Excessive air leaks around the HVAC coil unit connection to the fire wall or the interior blower motor assembly. 3. Pinched heater hose(s) or other restrictions in the engine coolant system. 4. Engine running cold. Thermostat is stuck open. 5. Hot water valve is not operating properly.	1. Check engine coolant level per chassis manufacturers recommendation. Add coolant as required. 2. Locate and seal leaks as required. 3. Examine heater hoses from the engine cooling system to the heater core for pinches and kinks. 4. Check engine coolant temperature specifications according to the chassis manufacturer's recommendations. 5. Refer to the "HOT WATER VALVE DIAGNOSTIC GUIDE".

Hot Water Valve Diagnostic Guide

Systems Check

Before attempting to troubleshoot, verify that the HVAC system (other than temperature control) is operating correctly. With the vehicle running, test-operate the system and check the following:

- Blower motor is operating at all speeds.
- Ventilation modes are all operating correctly.
- A/C system is operating correctly (engine-driven compressor, refrigerant system, etc.).

1. Attach refrigerant manifold gauge set to the service ports. Clamp the heater inlet and outlet hoses to eliminate coolant flow through the heating valve.
2. Start the vehicle, set blower speed to high, depress the A/C switch, rotate the temperature dial to full cool (far left), and rotate the ventilation mode dial to dash/floor position.
3. Test the A/C performance according to the A/C SYSTEMS OPERATION CHECK and EXPECTED A/C PERFORMANCE.
4. If the system isn't operating correctly, reference the DIAGNOSTIC GUIDE.
5. If the A/C system is operating correctly then remove the heater hose clamps from the coolant hoses. If a significant loss in cooling capacity in the A/C system occurs with notable rise in discharge air temperature, after the clamps have been removed, then turn the vehicles ignition switch off. This confirms flow of high temperature coolant through the water valve.
6. Carefully follow the step-by-step directions listed below for troubleshooting the coolant flow control system. If a problem is found, repair and correct the fault before proceeding to the next step.
7. When troubleshooting electric components, care must be taken to prevent component damage while inspecting, using a test meter, light, etc. If questions or concerns arise during the troubleshooting process, contact Bergstrom Inc. for phone assistance before proceeding any further. Refer to SERVICE section.

Component Testing

1. The temperature controller is located in the center of the HVAC system control panel. Rotate the potentiometer knob to verify smooth operation. The knob should rotate freely from the cool stop (blue) to the warm stop (red). Do not force the knob to rotate past the cool or warm stops. Doing so will cause irreparable damage to the potentiometer control. If the knob can be rotated past the internal stop at the full cool and full heat positions, the potentiometer must be replaced before any further valve diagnostics are done.

   Locate the electronic coolant valve assembly near the Bergstrom heater-evaporator base unit (mounted on the dash sheet/bulkhead). The electrical connector is located on the top of the actuator housing.

2. Verify that the port on the outlet side of the valve is connected to the inlet tube on the heater coil. A flow direction indication is located on the side of the valve to help distinguish inlet and outlet ports. Also, the inlet side of the valve is always on the same side as the harness connector. New valves also have tape wrapped arounds the inlet port that clearly identifies the inlet port. The coolant supply hose from the engine connects to the inlet side of the valve.

   NOTE

   The electronic coolant calve is a “directional” valve and must be correctly installed or it will not function properly. Coolant calves installed with the coolant flow reversed will leak coolant past the valve cylinder resulting in poor A/C system performance. Valves that have been installed backwards should be replaced because of seal damage that can occur.

   CAUTION

   Removal of the coolant valve should not be performed when the engine is cold. Attempting to remove the valve when the engine is hot could result in burns and/or serious injury due to extremely hot coolant escaping under pressure. Do not start the engine while the coolant lines are disconnected as the engine will quickly pump the system dry, which could result in damage to the engine.

3. Verify that the heater supply hose (connected to the coolant valve) is the hose coming from the supply port on the engine. The supply port is usually on, or near, the engine thermostat housing. To positively identify the supply line, remove the valve from the coolant lines and place both ends of the lines into a container to capture escaping fluid. Have an assistant “turn over” the engine while you observe the coolant lines. The line that discharges coolant when the engine is turned over is the supply line for the HVAC system.

   NOTE

   This procedure will not be useful for systems with a bypass or “H” fitting. Correct plumbing will have to be checked at “H” fitting in this case. Reference your chassis manual for systems with “H” bypass fittings in the coolant lines.

Heating System

Electrical Testing

1. Verify positing electrical connections at the coolant valve.

2. Unplug the wire harness connector from the coolant valve connector. Check the socket terminals for damage. Inspect the pin terminals on the coolant valve connector for damage. If any pins in the valve connector are loose or broken, replace the valve. Refer to ELECTRICAL SCHEMATICS for correct pin locations and wire colors.

Temperature Control Potentiometer

1. Use a DV voltage test meter and find a good vehicle ground for the negative prove. Do not use the negative connection on the wire harness.

2. Insert the positive probe from the meter into the black wire terminal on the wire harness valve connector. The voltage value should always read 0 VDC because this is the ground connection for the hot water valve. If voltage is detected here, the entire harness should be inspected for damaged, incomplete, or misaligned connections. Do not proceed until this has been resolved.

3. Insert the positive probe from the meter into the red wire terminal of the wire harness calve connector. The voltage value should always read near the vehicle's regulated voltage (11-13 VDC). If not, there is an issue with the wire harness or fuse.

   NOTE

   Low system voltage could be the cause of numerous issues and will cause the valve to fail to operate. Do not proceed with testing until a low voltage issue has been resolved.

4. Insert the positive probe from the meter into the yellow wire terminal of the wire harness valve connector. Rotate the temperature control knob in the control panel to the far left (blue) position. The voltage value should always read near the vehicle's regulated voltage (11-13 VDC) when the potentiometer is in the closed (blue) position.

5. Rotate the temperature control knob to the far right (red) and measure the yellow wire connection. The voltage value should always read 0 VDC when the potentiometer is in the open (red) position.

6. If the proper voltage readings are not measured at either valve position and all other electrical issues have been resolved, replace the temperature control potentiometer or control panel.

Electronic Valve Testing

1. If the issue still exits after testing the components and electrical, carefully plug the connector back into the valve and remove the HVAC control panel to gain access to the temperature control potentiometer connector.

2. Remove the connector from the potentiometer and install a jumper wire on the connector from the red wire terminal to the yellow wire terminal. This will apply full vehicle voltage to the valve and force the valve to fully close. Look into the valve coolant inlet port to visually verify that the valve is completely closed.

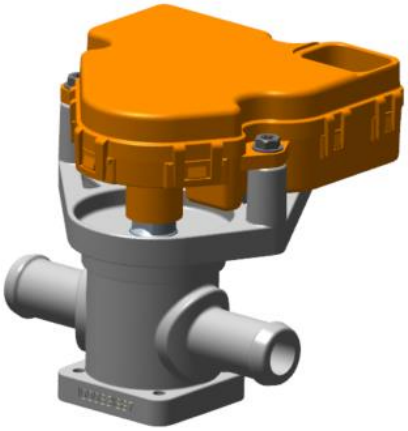
3. Change the jumper from the red wire terminal to the black wire terminal so that the jumper connects the yellow wire terminal to the black wire terminal. This will ground the control wire of the actuator and the valve should be completely open. Visually verify again.

   NOTE

   By nature of design of the valve, when the coolant valve gate is fully open, half of the valve port opening appears to be blocked. At no time will the valve port appear to be empty.

4. If the valve does not visually open or close completely, then replace it. Re-attach the coolant hoses and secure assembly for proper operation.

5. Proceed to SYSTEM VERIFICATION TEST to determine if repair is complete. Keep in mind that if heated coolant has traveled through the heater core prior to these tests, it will take several minutes before the core cools and proper valve operation can be verified. Operating the A/C system for a few minutes will speed up the process of cooling the heater core.



Heating System

System Verification Test

1. Attach both coolant hoses to the correct valve ports, reinstall the control panel, and secure the vehicle for operation.

2. Set the controller for high blower speed and panel ventalation mode.

3. Rotate the temperature control knob to full cold (blue).

4. Start the engine and set the engine speed to approx. 1500 rpm if possible. Remember to have the vehcile transmission in Park or neutral gear with the parking brake ON.

5. Measure the fresh air inlet temperature and the dash vent air temperature (passenger side dash louver) and record the values. Repeat these measurments at 5 minute increments until the engine has reached normal operating temperatures.

6. If the inlet and outlet air temperature difference does not vary significantly as the engine warms the coolant, then the valve can be considered completely closed. If the temperature difference increases significantly, the valve is leaking coolant through the heater core. Replace the valve assembly.

7. Rotate the temperature control to full heat; an immediete and significant temperature change should occur between the inlet and outlet temperature readings.

8. Rotate the temperature control back to full cool and monitor the temperature differential. The change will be slower, but the outlet temperature should drop to where no significant difference is detected between inlet and outlet temperatures. If the temperature difference does not stabilize, the valve is leaking coolant through the heater core. Replace the valve assembly.

9. Once the faulty component has been identified, the new replacement permanetly installed, and everything is buttoned back up, perform an actual function test for warm and cool air with the vehicle running. Test A/C performance using the A/C SYSTEMS OPERATIONAL check and ESTIMATED A/C PERFORMANCE.

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.

Diagnostic Guide

Problem	Possible Causes	Corrective Action
Inadequate Cooling (Discharge air from A/C vents is only slightly cool or neutral)	1. Leaking valve (Cooling may be diminished at engine idle. Increased engine and compressor speed will improve A/C cooling). 2. Condenser clogged with road debris or condenser fan inoperative. 3. Incorrect refrigerant charge in system. If charge is excessively low or high, the compressor clutch will not engage or remain engaged. 4. Restriction in the TXV resulting in a starved evaporator.	1. Refer to the "ELECTRONIC VALVE TROUBLESHOOTING GUIDE". 2. Examine fin region of the condenser for debris and bent fins. Clean and straiten as required. Repair and/or replace the condenser fan components as required. Install a manifold gauge set onto the high and low side charge ports and operate the A/C. Observe for low pressures. If low pressures are observed, check all A/C components for leaks as required. If excessive oil is suspected, check oil level in compressor by evacuating the system and recharging. Refer to REFRIGERANT CHARGE INFORMATION 3. If low pressure readings are excessively low and/or the liquid line at the expansion valve is cool to the touch or showing signs of sweating or frosting, recover the refrigerant. Evacuate and recharge the system with the proper refrigerant amount. Perform the "TXV FUNCTION TEST". If symptoms repeat, then replace the TXV following the same service procedure.

Air Conditioning System

Problem	Possible Causes	Corrective Action
Inadequate Cooling (cont.)	5. Restriction in receiver/drier resulting in a starved evaporator. 6. Defective, worn, or leaking compressor.	4. If low side readings are excessively low and/or the liquid line at the expansion valve is cool to the touch and showing signs of sweating or frosting, discharge then recover the refrigerant. Replace the receiver-drier. Add 2 ounces of recommended PAG oil, to replace oil removed from the old receiver/drier. Evacuate and recharge the system with the proper refrigerant amount. 5. Low side gauge reading too high and high side gauge reading too low. Recover refrigerant. Perform "COMPRESSOR FUNCTION TEST". Remove and replace new or rebuilt compressor and replace receiver/drier. Add 2 ounces of oil, to replace oil removed with the old receiver/drier, evacuate and recharge. (Check compressor for factory oil charge).
Inadequate cooling during hot part of the day	1. Excessive moisture in system which can cause the expansion valve to frost and restrict refrigerant flow.	1. Recover refrigerant. Replace receiver/drier, add 2 ounces of oil, evacuate the system, and recharge.
Gradual loss of cooling and air flow over time of A/C operation	1. Defective thermostat causing continuous operation of the compressor and potentially freezing condensate within the evaporator coil.	1. Place a jumper across terminals of thermostat. If the clutch engages then replace thermostat.
Compressor clutch cycles too rapidly or discharge air temperature increased excessively during compressor clutch "OFF" cycle.	1. Defective thermostat.	1. Replace thermostat.

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 degrees 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.

Air Conditioning System

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	Inlet - Outlet Air Temperature Differential**	
FRESH OR RECIRCULATED	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

Compressor Function Test

A/C Compressor Operation

The A/C compressor is the heart of the system since it produces the refrigerant flow. Check to see if the compressor's clutch is engaged or rotating and the compressor is operating by producing low and high side pressure ratios listed in the "Estimated A/C Performance Chart".

Compressor and engine fan belts should be in good condition and tightened to the correct tension. Check the belts when the engine is off and the belt is still warm. Do not replace the compressor unless its function has been properly tested.

These are general guidelines to check the compressor function as part of the AC system, consult the chassis manufacturer or the compressor supplier before any repair or replacements to the compressor. Bergstrom does not supply the compressor for RV A/C systems.

A/C Compressor Function Test

1. Restrict inlet airflow to the condenser with a piece of cardboard to increaser the high side refrigerant pressure.
2. Monitor high side pressure gauge to see if the pressure rises to approx. 300-500 psig. If the pressure does not rise to this level, then remove the cardboard.
3. This is a quick and simple test to see if the compressor has the capacity to build pressure and pump refrigerant. If it does not achieve the high-pressure range, check the items below.
    a. Low refrigerant charge.
    b. High side refrigerant blockage.
    c. Ambient temperature is below 50 degrees F.
    d. Clutch slippage or low voltage.
    e. Inspect compressor front seal and pressure relief valve for leaks.
    f. Clutch voltage should be approx. 11.5 VDC. Clutch coil resistance between 2.2 and 4.4 ohms.
    g. Check compressor rotation for smoothness.

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 evaporator, receiver/dryer, condenser, or 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 to the changing of the evaporator's heat load as designed.

Air Conditioning System

Refrigerant Charge Information

A correct refrigerant charge is necessary to achieve optimum performance from an A/C system. 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 refrigerant. If the A/C system is operating and the amount 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 running.
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.

Refer to the chart on the next page to select the correct refrigerant charge level for your vehicle.

Air Conditioning System

Recommended R134a Charge Chart

1. Need to know chassis make, model, year, and engine location.
2. Need to know condenser type and location.

FRONT ENGINE CHASSIS	CHARGE
GM (Chevy) P-30, L-19, L-29, L-65	2.75 Lbs.
GM (Chevy) P-12 w/Parallel-Flow Condenser	2.00 Lbs.
Workhorse before '05 model except W-24	2.75 Lbs. (1)
Workhorse - all models with black Behr condenser and two fans	2.00 Lbs.
Workhorse W22/W24 w/Multi-flow Condenser and no fans	1.50 Lbs.
Ford E-33 w/Serpentine Condenser	2.25 Lbs.
Ford F-53 w/Black Fin & Tube Condenser	2.75 Lbs.
Ford F-53 w/Silver Multi-flow Condenser(starting with MY2012)	2.13 Lbs
Ford F-53 w/Silver Multi-flow Condenser(starting with MY2016)	2.75 Lbs
Ford V-10 Super Duty w/6mm Condenser	2.75 Lbs.
FTL Front Engine Diesel w/Parallel-Flow Condenser	1.5 Lbs.
FTL Front Engine Diesel w/remote mounted condenser and fan	2.25 Lbs.

(1) For W22 without an aux condenser, charge would be 1.75 lbs. and performance would be reduced.

DIESEL ENGINE CHASSIS BUILT PRIOR TO 2015	CHARGE
Front-mounted Step well Parallel-Flow Condenser	2.00 Lbs.
Spartan (Fleetwood Heritage only)	5.25 Lbs.
Spartan Rear-Side Mounted Condenser (>500 HP)	4.50 Lbs.
Spartan Rear-Side Mounted Condenser (<500HP)	3.00 Lbs.
Spartan Rear-Side Mounted Condenser (Full cover -2011 or later)	5.50 Lbs
Spartan Rear Std Center Mounted Condenser	3.00 Lbs.
Spartan Front Mounted Evans Fin & Tube Condenser	3.50 Lbs.
Spartan Mid-Engine Chassis	2.50 Lbs.
Spartan Front Mounted Parallel Flow Condenser	2.50 Lbs.
FTL Rear Mounted Evans Fin & Tube Condenser	4.50 Lbs.
FTL Remote Mounted Parallel Flow Condenser w/12" Elec. Fan	2.75 Lbs.
FTL Rear Mtd Large Parallel Flow Cond. w/Side Radiator w/No Elec. Fan	4.00 Lbs.
FTL Front Mounted Evans Fin & Tube Condenser	3.50 Lbs.
Workhorse Pusher Front Mounted Fin & Tube Condenser	3.00 Lbs.
Road Master (Monaco/Holiday Rambler) Rear Condenser	4.00 Lbs
DIESEL ENGINE CHASSIS BUILT IN 2015, 2016 & 2017	**CHARGE**
FTL Remote Mounted Parallel Flow Condenser w/ 12" Electric Fan,	2.25 Lbs.
FTL Rear Mounted Serpentine Condenser Below Side Radiator w/ No Elect. Fan, >=450	
Spartan Rear Mounted Fin & Tube Condenser, Side Radiator w/ No Elect. Fan, 450 Hp,	7 Lbs
Spartan Rear Mounted Fin & Tube Condenser, Side Radiator w/ No Elect. Fan, >=450 Hp,	8 Lbs.
Spartan Rear Mounted Multi-flow, Side Radiator w/ No Elect. Fan, 600 Hp	4.5 Lbs

Air Conditioning System

Service Tips

1. Use only virgin (new, not reclaimed) R134a refrigerant.
2. Reclaiming refrigerant, evacuating the A/C system, and charging with the proper amount of refrigerant resolved many A/C issues.
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 prof system nearly impossible.
4. Bergstrom does not recommend or endorse the use of "Stop Leak" or "Leak Sealing" products.

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

Bergstrom Inc.

Single Zone A/C Heater

Owner's Manual

Operating Instructions

For additional owner and operator information visit us at

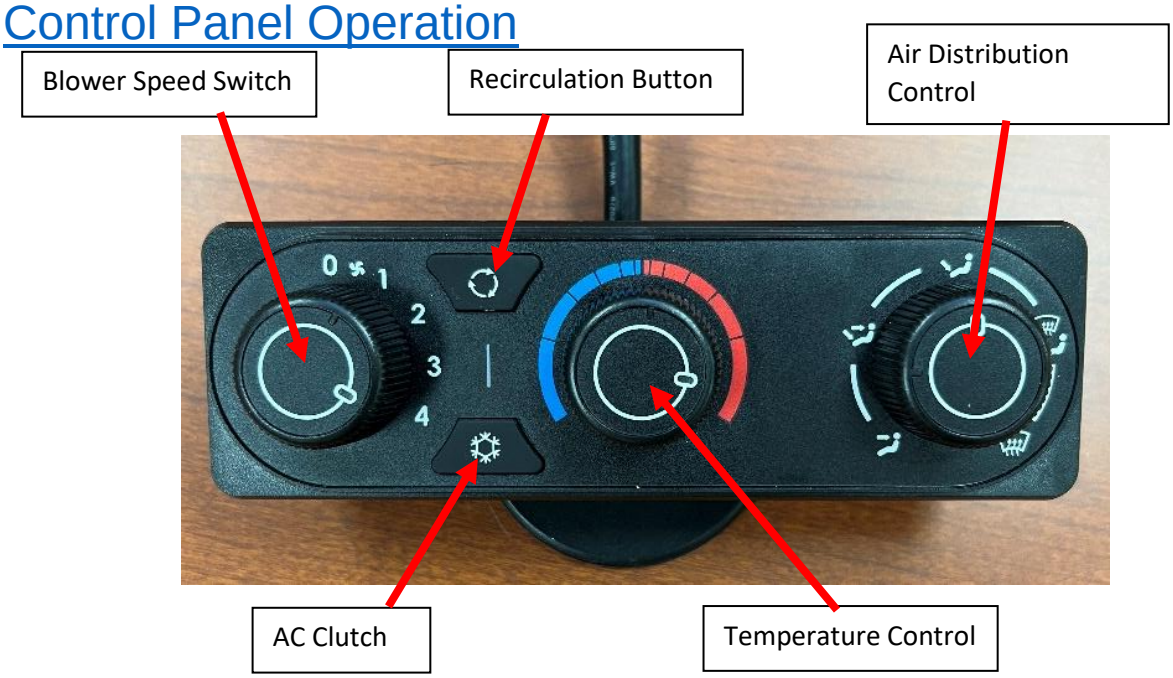
www.bergstrominc.com

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.

2390 Blackhawk Road ● P.O. Box 6007 ● Rockford, IL 61125 ● www.bergstrom.com ● 1-866-204-8570

Control Panel Operation



Blower Speed Switch

One of the best ways of controlling temperature is by changing the speed of the blower. The blower switch controls the system on/off and provides several different speeds in any mode.

Temperature Control

The temperature control dial controls only the heat content of the discharge air. The temperature control dial will also control the overall temperature of the discharge air if the AC system is operating. Turn the knob to the right (red area) for warmer air, and to the left (blue area) for cooler air. Use of the temperature control will also moderate the discharge temperature when the cooling system is engaged.

A/C Clutch

Illuminates when compressor clutch is engaged. This means the compressor is on and discharging refrigerant.

Recirculation

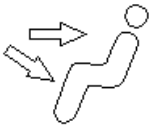
Your driver/passenger heater and air conditioning system is designed to operate in fresh air mode by default. The recirculating air feature is primarily used for faster passenger area cool downs during the summer and warmups during the winter by closing off the fresh air source and recirculating the passenger compartment air. Pressing this switch will place your system in the recirculated air mode.

NOTE: Prolonged use of this feature can cause stale air quality and moisture to form on the windows.

Air Distribution

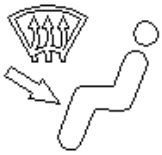
To achieve the maximum comfort in your vehicle, the air must be directed where it is needed. The mode switch (right of center) gives the user the ability to select where the air will flow.

Panel Mode – Air is drawn into the system and discharged through the dash louvers only.



Bi-level – Air is drawn into the system and discharged through the dash louvers and floor outlets.

Floor – Air is drawn into the system and discharged through the floor outlets.



Mix – Air is drawn into the system and discharged through the floor outlets and defrost outlets.

Defrost – Air is drawn into the system and discharged through the defrost and demist outlets.

Operating Features

The A/C system is designed to operate in all air distribution modes. This provides significant moisture, dust, and pollen removal for enhanced passenger comfort.

The Bergstrom vehicle A/C system will not function if the outside temperature is below approximately 40 degrees F. For cool air circulation during low temperatures, it is suggested the operator utilize fresh air mode.

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, set the system air intake to FRESH AIR by disengaging the RECIRC button, adjust the temperature and fan control to maintain comfort, position 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 recirculation switch is engaged.
- 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 seals lubricated.
- Periodically inspect the belts and hoses for wear and proper tension.
- Periodically check the proper coolant levels.

Warranty/Service

Warning

The A/C 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 the use of non-Bergstrom supplied parts will void the warranty and any Bergstrom liability for the system.

If repairs are required contact your dealer or RV manufacturer for warranty period and details. If traveling and service is required, you can contact you RV manufacturer for the nearest dealer or contact Bergstrom by phone or email.