UTILIMASTER

REACH™

2012

Body Service Supplement

UTILIMASTER

DRIVING INTELLIGENT VEHICLE SOLUTIONS

Contents

Introduction

This service supplement provides *additional* servicing information for Reach vehicle bodies built by Utilimaster Corporation. See the ***Reach–Body Service Manual*** for more detailed information. This manual contains drawings and photos to aid in servicing the vehicle, and it may include maintenance information on some items installed but not manufactured by Utilimaster Corporation. Items such as chassis and drivetrain components or certain interior furnishings may be covered by separate manufacturer-supplied information. Information provided here is intended to assist Utilimaster customers and is in no way meant to replace or supersede instructions provided by other suppliers for their products.

Utilimaster Corporation attempts to provide accurate, complete, and useful information. All information contained in this manual is based on the latest product information available at the time of publication. However, because of the Utilimaster policy of continual product improvement, Utilimaster reserves the right to amend the information in this document at any time without prior notice.

Reach Customer Service
HOTLINE 574-862-3362

Monday–Friday 6:30 a.m. to 6 p.m. Eastern Standard Time Zone

Email: reach@utilimaster.com

NOTE: The information in this document is generic. Images and procedures may differ from those for vehicles you are servicing. Because Utilimaster manufactures customized vehicle bodies, this document cannot list and illustrate every possible option for every vehicle. The most common body options are described here. Use this information as a guideline.

HVAC System Components

Compressor

The compressor is a pump powered by the engine via a drive belt. It draws in low-pressure refrigerant gas and exhausts it as high-pressure gas.

Condenser

The condenser receives compressed (heated) refrigerant gas from the compressor. As the hot refrigerant gas flows through the condenser, it is cooled by air passing over the fins. The cooled, compressed refrigerant gas condenses to liquid refrigerant, which then flows into the drier.

Control Module

This driver-operated device is mounted on the dash. The control module sets the cab temperature, blower speed, and distribution of airflow for driver convenience.

Evaporator Assembly

The evaporator assembly is mounted to the right side of the dash and extends into the engine compartment. The resistor, thermostat, outside/recirculation door, heater core, and evaporator core are serviced from the vehicle interior. When servicing any of the above components, it is not necessary to remove the dash panels.

Evaporator Core

The evaporator core used is a serpentine core where liquid refrigerant flows into the expansion valve and vaporizes as it passes through the core. When the cooling system is in operation, the liquid refrigerant flows from the condenser unit through a flexible hose to the evaporator where it is allowed to evaporate at a reduced pressure, to cool the evaporator. Air is blown through the evaporator fins and is thus cooled by the evaporator.

Expansion Valve

The expansion valve releases refrigerant into the evaporator according to cooling requirements. The restrictive effect of the expansion valve, while limiting the refrigerant flow to the evaporator, results in reduced evaporator pressure. The block-type expansion valve is connected to both tubes of the evaporator.

The expansion valve is opened and closed by opposing pressures on either side of the diaphragm. The block-type expansion valve uses an internal sensing bulb located within the suction portion. As the evaporator outlet temperature rises, the refrigerant expands and exerts pressure against the diaphragm to open the valve farther and admit more refrigerant into the evaporator for increased cooling. As the evaporator outlet temperature falls, the pressure against the diaphragm is decreased. Inlet pressure on the opposite side of the diaphragm then starts closing the valve. The valve tends to seek a position to control the refrigerant flow to maintain near-maximum cooling from the evaporator.

The internal-sensing bulb measures the temperature of the refrigerant in the suction line. This temperature variation regulates the refrigerant flow to the evaporator core. When the temperature-sensing bulb senses a high temperature, the valve opens and allows refrigerant to flow into the evaporator core. When the temperature-sensing bulb senses a low temperature, the valve starts closing to reduce the refrigerant flow to the evaporator core.

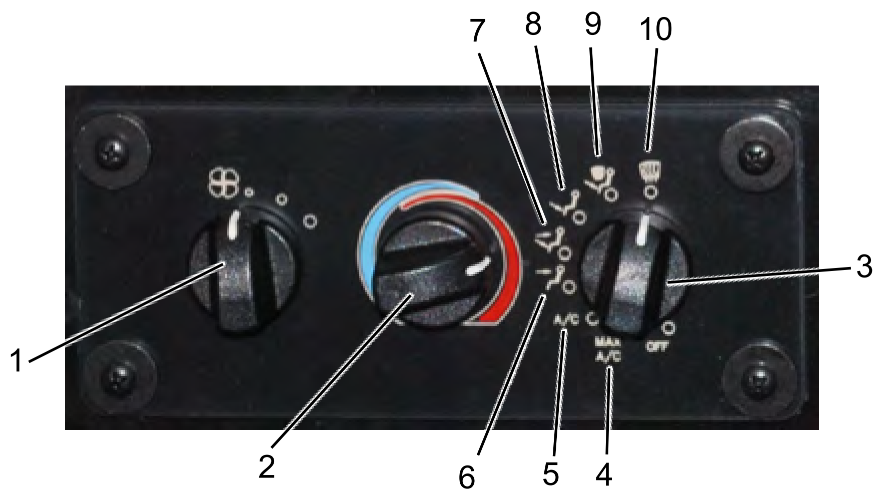
Drier Unit

The drier serves the purpose of removing any traces of moisture that may have accumulated in the system. Even one drop of moisture will cause an air-cooling unit to malfunction.

Service Valves

These valves are similar to a tire valve. The service valve in the high-pressure line (from compressor to condenser) allows access to the high-pressure side of the system for attaching a service hose and pressure gauge. The service valve in the low-pressure line (from evaporator to compressor) allows access to the low-pressure side of the system for attaching a service hose and pressure gauge.

Control Operation



Control module with air conditioning

(1) Blower Control Switch

Low, Medium, High

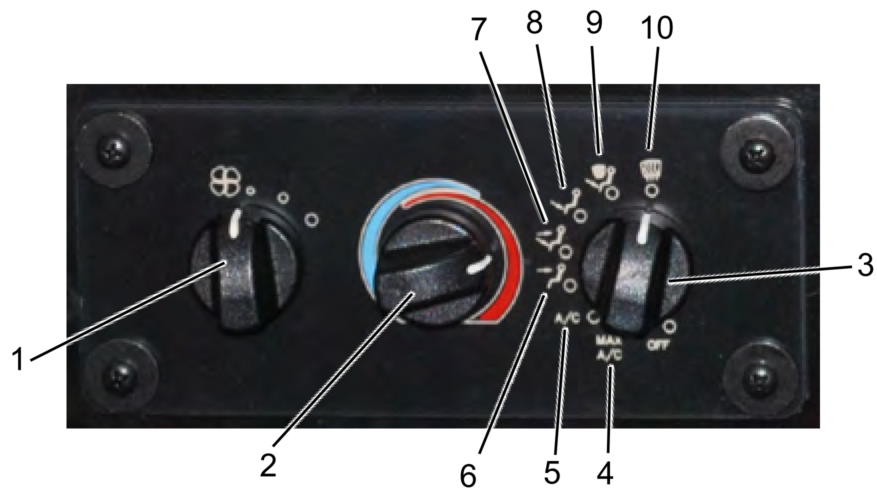
The blower motor is a variable-speed motor. The higher the voltage applied to the motor, the faster the speed.

When in Low and Medium mode, voltage is applied to the power relay, and voltage is applied to the blower switch and the blower motor resistors. When the blower switch is on Low, voltage is applied through the blower motor resistors and the power relay to the blower motor. The blower motor runs at low speed.

As the blower switch is moved to Medium, the switch bypasses part of the blower motor resistors, allowing more voltage to be applied to the blower motor which will increase its speed. When the blower motor switch is on High, voltage is applied directly to the blower motor. The blower motor runs at maximum speed.

(2) Cold/Hot (Temperature Control)

The temperature control operates the coolant valve located in the engine compartment. The coolant flow to the heater core is proportional to the setting of the control knob.



Control module with air conditioning

(3) Function Selector

The function selector actuates electric servomotors—one each for dash door, floor door, defrost door, and the outside/recirculating door. In the A/C and Defrost positions, the compressor operation is dependent upon the evaporator thermostat settings. The thermostat senses the temperature of the evaporator core; the cutout temperature is 31 F ±1.5° F [-0.6° ±0.8° C] (clutch is disengaged), and the cut in temperature is 39° F ±1.5° F [1.2° ±0.8° C] (clutch is engaged).

With the function selector in the Off position, the outside/recirculation door is in the Recirculate Air position. It is closed to outside air, and no air passes through the system. The blower motor is off.

(4) Max A/C

In the Max A/C position the outside/recirculation door is in the Recirculated Air position. All of the air discharges through the panel louvers. The AC compressor operates in this function control setting.

(5) A/C

In the A/C position the outside/recirculation door is open to the outside, and both inside and outside air is discharged through the panel louvers. The AC compressor operates at this function control setting.

(6) Panel

In the Panel position the outside/recirculation door is open to the outside, and both inside and outside air is discharged through the panel louvers.

(7) Panel/Floor

In the Panel/Floor position the outside/recirculation door is open to outside air. Both inside and outside air is discharged through the heater outlet floor ducts and panel louvers.

(8) Floor

In the Floor position the outside/recirculation door is open to outside air. Both inside and outside air is discharged through the heater outlet floor ducts.

(9) Defrost/Floor

In the Defrost/Floor position the outside/recirculation door is open to outside air. Both inside and outside air is discharged through both the windshield defroster duct and the heater outlet floor ducts. The AC compressor operates in this control setting to help dehumidify the air.

(10) Defrost

In the Defrost position the outside/recirculation door is open to outside air. Both inside and outside air is discharged through both the windshield defroster duct. The AC compressor operates in this control setting to help dehumidify the air.

Refrigerant Precautions

The most commonly used refrigerant in automotive air-conditioner systems has been Refrigerant R-134a. R-134a is nonexplosive, nonflammable, and heavier than air. Although it is classified as a safe refrigerant, certain precautions must be observed to protect the parts involved and the person who is working on the unit.

WARNING: Utilimaster recommends that a licensed automotive air-conditioning specialist work on the vehicle's air-conditioning system.

Avoid breathing air-conditioning refrigerant and lubricant vapor or mist!

If accidental system discharge occurs, ventilate work area BEFORE resuming service. Additional health and safety information may be obtained from refrigerant and lubricant manufacturers.

Always wear safety goggles when servicing any part of the refrigerant system.

Certain precautions must be observed to protect the parts involved and the person who is working on the unit.

To remove R-134a from the air-conditioning system, use service equipment certified to meet the requirements of SAE J2210 (R-134a recycling equipment).

At normal atmospheric pressures and temperatures liquid refrigerant evaporates so quickly that it has the tendency to freeze anything it contacts. For this reason, be very careful to prevent any liquid refrigerant from coming in contact with the skin and especially the eyes.

Refrigerant is readily absorbed by most types of oil. It is therefore recommended that a bottle of sterile mineral oil and a quantity of weak boric acid solution be kept nearby when servicing the air-conditioning system.

Should any liquid refrigerant get into the eyes, immediately use a few drops of mineral oil to wash them out, then wash the eyes clean with a weak boric acid solution. Seek a doctor's aid immediately even though irritation may have stopped.

The refrigerant in the system is always under pressure. Because the system is tightly sealed, heat applied to any part would cause this pressure to build up excessively.

To avoid a dangerous explosion, never weld, use a blow torch, solder, steam clean, bake body finishes, or use an excessive amount of heat on or in the immediate area of any part of the air-cooling system or refrigerant supply tank while they are closed to the atmosphere, whether filled with refrigerant or not.

The liquid refrigerant evaporates so rapidly that the resulting refrigerant gas will displace the air surrounding the area where it is released. The refrigerant will displace the oxygen, so always work in well-ventilated areas to prevent suffocation.

The discharge of refrigerant gas near open flame can produce a very poisonous gas. This gas will also attack all bright metal surfaces. This poisonous gas is generated when a flame-type leak detector is used. Avoid inhaling the fumes from the leak detector.

Never heat a refrigerant container with an open flame. If the container must be warmed, place the bottom of the container in a pail of warm water.

Never intentionally drop, puncture, or incinerate refrigerant containers.

Never store or heat refrigerant containers above 125° F [52° C].

If it is necessary to carry a container of refrigerant in a vehicle, do not carry it in the passenger compartment.

Always replace the metal screw cap to protect the valve and safety plug of the refrigerant container from damage when not in use.

CAUTION: Use only Refrigerant R-134a. Do NOT use refrigerant canned for pressure-operated accessories (such as boat air horns). This type is not pure 134a and will cause a malfunction.

R-12 refrigerant and R-134a refrigerant must never be mixed even in the smallest of amounts. They are incompatible with each other. If the refrigerants are mixed, compressor failure is likely to occur.

Use only specified lubricants and components in the air-conditioning system. If lubricants other than those specified are used, compressor failure is likely to occur. All fittings and O-ring seals should be coated with clean mineral oil to provide a leakproof seal and aid assembly and disassembly.

Do NOT introduce compressed air to any refrigerant container or refrigerant component, because contamination will occur.

Lines and Fittings Precautions

WARNING: Before opening the refrigerant system, make sure the work area is well-ventilated. Welding or steam-cleaning operations should not be done on or near refrigeration system lines or other air-conditioning parts on the vehicle.

WARNING: When disconnecting any fitting in the refrigerant system, the system must be discharged of all refrigerant. However, proceed very cautiously, regardless of the gauge readings. Open fittings very slowly, keeping your face and hands away so that no injury can occur. If pressure is noticed when a fitting is loosened, allow it to bleed off slowly.

CAUTION: All metal tubing lines should be free of dents or kinks to prevent loss of system capacity due to line restriction. Do NOT let the connection become kinked, crushed, or cross-threaded.

Never bend flexible hose lines to a radius of less than four times the diameter of the hose.

Do NOT allow flexible hose lines to come within a distance of 2.5" [6.5 mm] of the exhaust manifold.

Inspect flexible hose lines regularly for leaks or brittleness and replace with new lines if deterioration or leaking is found.

Alcohol should never be used in the refrigeration system in an attempt to remove moisture. Damage to system components could occur.

If any refrigerant line is opened to the atmosphere, cap immediately to prevent the entrance of moisture and dirt. Moisture and dirt can cause internal compressor wear or plugged lines in the condenser and evaporator core, expansion (orifice) tubes, or compressor inlet screens.

Remove sealing caps from subassemblies just before making connections for final assembly. Use a small a mount of clean mineral oil on all tube and hose joints. Use new O-ring seals dipped in mineral oil when assembling joints. The oil will aid in assembly and help provide a leakproof joint. O-ring seals and seats must be in perfect condition because a burr or a piece of dirt can cause a refrigerant leak.

It is important to use the proper wrenches when making connections on O-ring seal fittings. The use of improper wrenches may damage the connection. The opposing fitting should always be backed up with a wrench to prevent distortion of connecting lines or components. When connecting the flexible hose connections, it is important that the crimped fitting and flare nut, as well as the coupling to which it is attached, be held at the same time using two different wrenches to prevent turning the fitting and damaging the seat. Tighten tubing connections to the specified torque.

The life and efficient operation of the air conditioning system depends upon the chemical stability of the refrigeration system. When foreign materials, such as dirt or moisture, contaminate the refrigeration system, they change the stability of the refrigerant and polyalkaline glycol (PAG) refrigerant oil or ester refrigerant oil. They also affect the pressure/temperature relationship, reduce efficiency, and could cause internal corrosion and abnormal wear of moving parts. The following general practices should be followed to ensure chemical stability in the system:

CAUTION: Whenever it becomes necessary to disconnect a hose connection, wipe away any dirt or oil at or near the connection to eliminate the possibility of dirt entering the system. Both sides of the connection should be capped, plugged, or taped as soon as possible to prevent the entrance of dirt and moisture. Remember that all air contains moisture. Air that enters any part of the refrigeration system will carry moisture with it, and the exposed surfaces will collect the moisture quickly.

Keep tools clean and dry. This includes the manifold gauge set and all replacement parts.

When adding polyalkaline glycol (PAG) refrigerant oil, the container/transfer tube through which the oil will flow should be exceptionally clean and dry. Refrigerant oil must be as moisture-free as possible.

When it is necessary to "open" an air-conditioning system to the atmosphere, have everything needed ready so that as little time as possible will be required to perform the operation. Do NOT leave the air-conditioning system open any longer than necessary.

Anytime the air-conditioning system has been "opened," it should properly evacuated before recharging.

Diagnosis and Testing

Overview Refrigerant System

Diagnosis of the refrigerant system must be done by analyzing the system's high- and low-pressure readings.

Attaching the Manifold Gauge Set

Test equipment **must** be connected to the refrigerant system when performing any of the various tests. If charge-station type of equipment is used, follow the instructions of the manufacturer. To attach a manifold gauge set to the service access gauge port valves, proceed as follows:

1. Turn both manifold gauges set valves fully clockwise to close the high- and low-pressure hoses at the gauge. Remove the caps from the high- and low-pressure service (Schrader) access gauge port valves in the high- and low-pressure lines.
2. Connect the high- and low-pressure refrigerant hoses with adapters containing depressing pins to the respective high- and low-pressure service access gauge port valves.
3. Connect the hoses attached to the manifold center fitting to refrigerant supply tank and vacuum pump valves.

Electronic Leak Detector

The battery-operated electronic refrigerant leak detector is an instrument that will locate a much smaller type of refrigerant leak than can be detected by the flame-type leak detector. Follow the directions with the leak detector to ensure absolute accuracy.

Checking for Leaks

1. Attach the manifold gauge set. Leave both manifold gauge set valves at the maximum clockwise position. Both gauges should show approximately 60–80 PSI [414–551 kPa] 75° F [23.9° C] with the engine not running.
2. If very little or no pressure is indicated, leave the vacuum pump valve closed, open the refrigerant tank valve, and turn the low-pressure (suction) manifold gauge set valve to the counterclockwise position. This opens the system to tank pressure.
3. Check all connections, the compressor head gasket, oil filter plug, and the shaft seal for leaks.

   NOTE: Use compressed air to blow off excessive oil from the shaft seal area to reduce the possibility of an erroneous detection of refrigerant retained in the refrigerant oil.

Expansion Valve Test

In the properly operating standard refrigerant system, the expansion valve will maintain the refrigerant flow required for maximum refrigerant system efficiency. Corrosion of the polished metal surfaces of the internal valve seat or valve stem in the expansion valve can cause erratic compressor suction and discharge pressures. This would be seen as a sudden increase in the discharge (high) pressure and, at the same time, the suction (low) pressure will suddenly decrease. The reverse might also happen—a sudden decrease in discharge (high) pressure combined with a sudden increase in the suction (low) pressure. Refrigerant system contamination in the form of sludge or moisture may also cause a similar compressor suction and discharge-pressure reaction. The blocking action of sludge in the valve seat will cause an increase in the compressor discharge pressure and a reduction of the suction pressure. When the sludge clears the valve seat opening, the discharge pressure will suddenly reduce, and the suction pressure will suddenly increase. Moisture, on the other hand, may cause the valve to stick in any position. When the valve is stuck closed, the higher compressor discharge pressure and temperature will soon thaw the frozen area and release the refrigerant, causing a sudden drop in compressor discharge pressure and increase in suction pressure. When the valve is stuck open, the increase in evaporator (suction) pressure and temperature aids in the thawing of the frozen area, and the expansion valve begins to function again.

To test the expansion valve:

Expansion valve and manifold tube assembly

1. Start the engine and run at fast idle (approximately 1500 RPM) in Max A/C mode and blower speed on High for approximately 10 minutes.
2. Check gauge reading.
   - If a low/low side gauge reading or shows a vacuum this indicates the expansion valve is stuck shut.
   - If a high/low side pressure gauge reading and with a low/high side pressure gauge reading this indicates the expansion valve is stuck open.

3. Check the temperature of hoses attached to the manifold.
   - If the temperature of the hoses are different, the expansion valve is working.
   - If the temperature of the hoses are the same, the expansion valve is NOT working.

The compressor pressures high side should be smooth and deliberate. If at any time during the pressure changing period you see a hesitation followed by a jump in the pressure-gauge readings, the system may be contaminated and require cleaning. Corrosion of the valve stem may also be interfering with proper valve operation.

Measuring Temperature

This guide was developed to assist in evaluating air-conditioning systems. The information given is the result of extensive testing in laboratory conditions. Actual results may vary by as much as ±4° F [±2.2° C] due to variances in installation technique or chassis manufacturer.

The moisture content of the ambient air plays an important role in air-conditioner performance. Warmer air can contain more moisture than cooler air. In the cooling process, air often reaches "saturation" temperature, at which point no additional cooling can occur without a corresponding drop in moisture content. As relative humidity of the air to be cooled increases, a greater percentage of the system's refrigeration capacity is needed to extract the moisture, and less is available for actual cooling.

In the process of removing moisture, it is important that ice not be allowed to form and block the flow of air through the evaporator coil. The system is equipped with a thermostat that will turn off the compressor clutch when the evaporator coil drops to a temperature at which ice could form. The discharge air temperature will be approximately 37° F [2.8° C] when the thermostat cycles the system off.

When testing the system it is important that the air entering the evaporator coil be the same temperature as the ambient air surrounding the coach. **Set the air-conditioner control to the NORMAL A/C position (not Max A/C).**

Measuring Pressure

Dash outlet temperature and pressures developed on the high-pressure (discharge) and low-pressure (suction) side of the compressor indicate whether or not the system is operating properly.

1. To test the system, attach the manifold gauge set with both gauge valves at the maximum clockwise, or closed, position. It will not be necessary to attach the refrigerant tank.
2. Check the system pressures with the engine running at 1500 RPM, all controls set for maximum cooling, and the front of the vehicle at least 5 feet from any wall. Use a large fan in front of the condenser to simulate vehicle motion. Operate the system under these conditions for 5–10 minutes in order for pressures to stabilize.
3. The actual pressures indicated on the gauges will depend on the temperature of the surrounding air and the humidity. Higher air temperatures along with high humidity will give higher system pressures. The pressure switch turns on at 185 psi and will shut-off at 385 psi.
4. Measure the ambient (outside) air temperature with a thermometer held in front of the condenser.

   NOTE: Relative humidity of the air affects air-conditioner performance. As humidity increases, air-conditioning performance decreases.

5. If the pressures are within or near the specified limits, but the cooling performance is poor, the problem may be related to the heater control valve. The evaporator/heater unit is a “stacked coil” design in which the conditioned air passes through both the evaporator and heater coils. The smallest amount of hot engine coolant in the heater coil will affect AC performance. Both the inlet and outlet heater lines at the unit should be cool if the heater control valve is functioning properly. Proceed to the Voltage Test.

6. If the discharge (High Side) or suction (Low Side) pressures are not within the specified limits, see the possible causes chart below.

NOTE: These numbers are estimated and will vary with environment conditions.

Condition	Low Side		High Side	
Normal Operation	Normal pressure	30–31psig	Normal Pressure	204–210 psig
Ice on evaporator due to defective thermostat	Low pressure	12 psig	Normal to slightly low pressure	208 psig
Moisture in system causing ice in expansion valve	Low pressure	12 psig	Normal to slightly low pressure	208 psig
Low refrigerant charge	Moderately low pressure	15 psig	Low pressure	139–144 psig
Expansion valve stuck closed	Very low pressure (possibly in a vacuum)	0–10 psig	Low pressure	139–144 psig
Collapsed hose on the high side	Low pressure	20 psig	High to extremely high pressure	281 psig
Clogged drier	Low pressure	20 psig	Moderately high pressure	235 psig
Inoperative or defective compressor	High pressure	43 psig	Low pressure	150 psig
Expansion valve stuck open	High pressure	38 psig	Normal	184 psig
Overcharge (excess) of refrigerant	High pressure	37 psig	High to extremely high pressure	263 psig
Defective condenser fan	High pressure	37 psig	Moderately high pressure	235 psig
Clogged condenser fan	High pressure	37 psig	Moderately high pressure	235 psig
Contaminants in the system	High pressure	37 psig	High to extremely high pressure	263 psig

Drier Test

1. Operate the air conditioner for about 5 minutes.
2. Slowly move your hand across the length of the unit from one end to the other. There should be no noticeable difference in temperature.
3. If cold spots are felt, it indicates that the unit is restricting the refrigerant flow, and the drier must be replaced.

Magnetic Clutch Test

1. If the magnetic clutch on the compressor does not pull in as it should, the battery should be checked for operation voltage (11 volts minimum).
2. If the operating voltage is within specifications, disconnect the electrical connector at the clutch coil.
3. Apply battery voltage to the coil feed wire. If the clutch engages, the clutch is OK, and the electrical problem is elsewhere in the system. If the clutch does not engage, replace the clutch.

Excess Moisture

One of the characteristics of an air conditioner is that it will remove moisture from air passing through the cooled evaporator core. This moisture condenses, runs off the evaporator core, and is drained from the evaporator case. Because the AC system is a push-through design (blower upstream of the evaporator core), the primary cause of condensation dripping or blowing into the passenger compartment is air being pushed through the drain tube, housing seals, holes or cracks in the housing, or other air-leak paths, thereby inhibiting condensation drainage. In some instances, due to environmental conditions (leaves or other foreign material plugging the drain) and sometimes mechanical conditions (damaged or kinked drain tube), the condensation is prevented from draining from the evaporator case. If either of these conditions exist, condensation may drip from the blower housing or be blown from the instrument panel registers.

Performing the following inspection and corrections can best eliminate the cause of insufficient evaporator case drainage or leaks.

1. Inspect the vehicle for missing grommets, plugs, kazoo valve, or seals. Replace any missing grommets, plugs, kazoo valve, or seals.
2. Inspect for correct sealing of the evaporator case-to-plenum gasket. Tighten the evaporator case-to-dash retaining nuts to correct a seal leak between the evaporator case and the cowl panel.
3. Inspect for possible air leaks around the refrigerant lines at the evaporator case. Seal any leaks around the refrigerant lines with Motorcraft® Insulating Tape YZ-1, Caulking Cord D6AZ-19560-A, or equivalent.

Voltage Tests (Temperature Control)

Overview

The temperature is controlled by adjusting the center knob on the control head.

With the control set to the Max Cold position, the output of the dash potentiometer will be more than 11 volts. This voltage is fed to Pin D of the coolant valve motor. The motor is then driven to the Max Cold position. As the dash control is turned to the Max Hot position, the voltage is decreased, and the coolant valve is driven to match the voltage set at Pin D (Red/Black wire) of the coolant valve. At the Max Hot position the output of the dash potentiometer will be less than 0.75 volts.

Blower Motor Power

Blower motor power is supplied from the blower motor power relay.

Blower motor power relay supplies ignition switch power to the coil on Pin 86 (Red wire) of the relay. A Gray wire from Pin 85 of the relay to Pin 20 of the controller is grounded through the controller in any position except Off, closing the relay contacts and energizing the blower motor.

Blower Control

The blower motor is a variable-speed motor. The higher the voltage applied to the motor, the faster the speed.

When the heater and AC control head is in the Off position, no voltage is applied to the power relay. The relay is Off, and no voltage is applied to the blower motor.

When in any other mode except Off, voltage is applied to the power relay, and voltage is applied to the blower switch and the blower motor resistors.

When the blower switch is in Low, voltage is applied though the power relay and blower motor resistors to the blower motor. The blower motor runs at low speed.

As the blower switch is moved to Medium, the switch bypasses part of the blower motor resistors, allowing more voltage to be applied to the blower motor. This will increase its speed.

When the blower motor switch is moved to High, voltage is applied to the coil of the power relay. The power relay is energized, removing the blower motor resistors from the circuit. Battery voltage is applied directly to the blower motor though the power relay contacts. The blower motor runs at maximum speed.

Air Conditioning Clutch Control

The air conditioning clutch is energized in Max A/C, A/C, in defrost mode and defrost/floor to aid in defogging the windshield.

The air conditioning clutch is supplied power to the coil on Pin 86 of the relay (Yellow wire). Current then flows to the thermostat switch on the Black/White wire. The switch closes above 35° F [1.7° C], allowing current to flow to the control module, grounding the relay and allowing the contacts to close. Current flows to the relay on Pin 30 through the closed contacts out Pin 87 on the Green wire to the high-pressure switch mounted on the drier. From the trinary-pressure switch the current flows to the low-pressure switch located on the inlet fitting of the evaporator. Then, via the Green wire, current flows to the AC clutch.

Control Module Switch Test

1. Disconnect wire harness from the Control Module.
2. Using a DVOM (Digital Voltmeter), measure the resistance from Pin 1 (Black wire) of the control module connector to Pin 2 (Purple wire) with the control switch in the Off position.

   If less than 2 ohms, go to the next step. If more than 2 ohms, check for an open circuit in the Black or Purple wire. If wires are OK, replace the control module switch.
3. Using a DVOM, measure the resistance from Pin 1 (Black wire) of the control module connector to Pin 3 (Blue wire) with the control switch in the Max AC position.

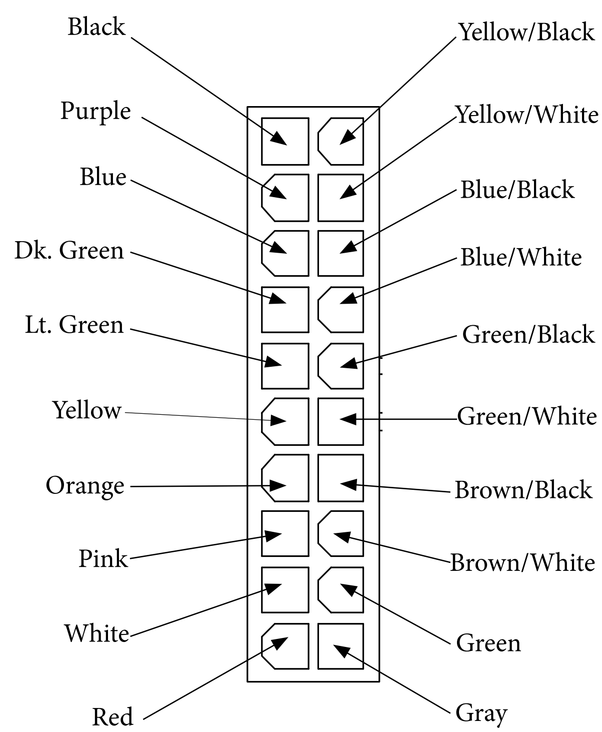
   If less than 2 ohms, go to the next step. If more than 2 ohms, check for an open circuit in the Black or Blue wire. If wires are OK, replace the control module switch.
4. Using a DVOM, measure the resistance from Pin 1 (Black wire) of the control module connector to Pin 4 (Dark Green wire) with the control switch in the AC position.

   If less than 2 ohms, go to the next step. If more than 2 ohms, check for an open circuit in the Black or Dark Green wire. If wires are OK, replace the control module switch.
5. Using a DVOM, measure the resistance from Pin 1 (Black wire) of the control module connector to Pin 5 (Light Green wire) with the control switch in the Panel position.

   If less than 2 ohms, go to the next step. If more than 2 ohms, check for an open circuit in the Black or Light Green wire. If wires are OK, replace the control module switch.
6. Using a DVOM, measure the resistance from Pin 1 (Black wire) of the control module connector to Pin 6 (Yellow wire) with the control switch in the Floor/Panel position.

   If less than 2 ohms, go to the next step. If more than 2 ohms, check for an open circuit in the Black or Yellow wire. If wires are OK, replace the control module switch.
7. Using a DVOM, measure the resistance from Pin 1 (Black wire) of the control module connector to Pin 7 (Orange wire) with the control switch in the Floor position.

   If less than 2 ohms, go to the next step. If more than 2 ohms, check for an open circuit in the Black or Orange wire. If wires are OK, replace the control module switch.



Control module connector

8. Using a DVOM, measure the resistance from Pin 1 (Black wire) of the control module connector to Pin 8 (Pink wire) with the control switch in the Floor/Defrost position.

   If less than 2 ohms, go to the next step. If more than 2 ohms, check for an open circuit in the Black or Pink wire. If wires are OK, replace the control module switch.

9. Using a DVOM, measure the resistance from Pin 1 (Black wire) of the control module connector to Pin 9 (White wire) with the control switch in the Defrost position.

   If more than 2 ohms, check for an open circuit in the Black or White wire. If wires are OK, replace the control module switch.

Control Module Tests

Mode Switch	Rec Motor	Defrost Motor	Panel Motor	Floor Motor	AC Clutch
Off	Closed	Closed	Closed	Closed	Off
Max AC	Closed	Closed	Open	Closed	On
AC	Open	Closed	Open	Closed	On
Panel	Open	Closed	Open	Closed	Off
Floor/Panel	Open	Closed	Open	Open	Off
Floor	Open	Closed	Closed	Open	Off
Floor/Defrost	Open	Open	Closed	Open	On
Defrost	Open	Open	Closed	Closed	On

Off

In the Off position the current flows from the control module on the Purple wire to the mode switch to the control module ground. The power relay is de-energized, and all mode doors are driven closed. The motors are driven to position for 25 seconds after the mode is selected, and then all motor inputs de-energize high (+12 V to ground).

Mode Switch	Defrost Motor		Panel Motor		Floor Motor	
	Green/White	Green/Black	Blue/White	Blue/Black	Yellow/White	Yellow/Black
Off	+12 V	0 V	+12 V	0 V	+12 V	0 V
Off 25 seconds after switched	0 V	0 V	0 V	0 V	0 V	0 V

Mode Switch	Rec Motor		AC Relay	Power Relay	Condenser Relay
	Brown/White	Brown/Black	Green	Yellow	Orange
Off	+12 V	0 V	0 V	0 V	0 V
Off 25 seconds after switched	0 V	0 V			

Max A/C

In the Max A/C position the current flows from the control module on the Blue wire to the mode switch to the control module ground. The power relay is energized. The panel door is driven open, the rec door is driven closed to outside air, and the AC clutch relay is energized. Defrost and floor doors are driven closed. The motors are driven to position for 25 seconds after the mode is selected, and then all motor inputs de-energize (+12 V to ground).

Mode Switch	Defrost Motor		Panel Motor		Floor Motor	
	Green/White	Green/Black	Blue/White	Blue/Black	Yellow/White	Yellow/Black
Off	+12 V	0 V	0 V	+12 V	+12 V	0 V
Off 25 seconds after switched	0 V	0 V	0 V	0 V	0 V	0 V

Mode Switch	Rec Motor		AC Relay	Power Relay	Condenser Relay
	Brown/White	Brown/Black	Green	Yellow	Orange
Off	+12 V	0 V	+12 V	+12 V	+12 V
Off 25 seconds after switched	0 V	0 V			

A/C

In the A/C position the current flows from the control module on the Green/Red wire to the mode switch to the control module ground. The power relay is energized. The panel door is driven open, the Rec door is driven open to all air, and the AC clutch relay is energized. Defrost and floor doors are driven closed. The motors are driven to position for 25 seconds after the mode is selected, and then all motor inputs de-energize (+12 V to ground).

Mode Switch	Defrost Motor		Panel Motor		Floor Motor	
	Green/White	Green/Black	Blue/White	Blue/Black	Yellow/White	Yellow/Black
Off	+12 V	0 V	0 V	+12 V	+12 V	0 V
Off 25 seconds after switched	0 V	0 V	0 V	0 V	0 V	0 V

Mode Switch	Rec Motor		AC Relay	Power Relay	Condenser Relay
	Brown/White	Brown/Black	Green	Yellow	Orange
Off	0 V	+12 V	+12 V	+12 V	+12 V
Off 25 seconds after switched	0 V	0 V			

Panel

In the Panel position the current flows from the control module on the Light Green/White wire to the mode switch to the control module ground. The panel door is driven open and the rec door is driven open to all air. Defrost and floor doors are driven closed and the power relay is energized. The AC clutch relay is de-energized. The motors are driven to position for 25 seconds after the mode is selected, and then all motor inputs de-energize (+12 V to ground).

Mode Switch	Defrost Motor		Panel Motor		Floor Motor	
	Green/White	Green/Black	Blue/White	Blue/Black	Yellow/White	Yellow/Black
Off	+12 V	0 V	0 V	+12 V	+12 V	0 V
Off 25 seconds after switched	0 V	0 V	0 V	0 V	0 V	0 V

Mode Switch	Rec Motor		AC Relay	Power Relay	Condenser Relay
	Brown/White	Brown/Black	Green	Yellow	Orange
Off	0 V	+12 V	0 V	+12 V	0 V
Off 25 seconds after switched	0 V	0 V			

Panel/Floor

In the Panel/Floor position the current flows from the control module on the Yellow wire to the mode switch to the control module ground. The system power relay is energized. The panel and floor outlet doors are driven open. Defrost door is driven closed and the rec door is driven open to all air. The motors are driven to position for 25 seconds after the mode is selected and then all motor inputs de-energize. The AC clutch is de-energized.

Mode Switch	Defrost Motor		Panel Motor		Floor Motor	
	Green/White	Green/Black	Blue/White	Blue/Black	Yellow/White	Yellow/Black
Off	+12 V	0 V	0 V	+12 V	0 V	+12 V
Off 25 seconds after switched	0 V	0 V	0 V	0 V	0 V	0 V

Mode Switch	Rec Motor		AC Relay	Power Relay	Condenser Relay
	Brown/White	Brown/Black	Green	Yellow	Orange
Off	0 V	+12 V	0 V	+12 V	0 V
Off 25 seconds after switched	0 V	0 V			

Floor

In the Floor position the current flows from the control module on the Orange wire to the mode switch to the control module ground. The system power relay is energized. The floor outlet door is driven open, and the panel door is driven closed. Defrost door is driven closed and the Rec door is driven open to all air. The motors are driven to position for 25 seconds after the mode is selected, and then all motor inputs de-energize (+12 V to ground). The AC clutch is de-energized.

Mode Switch	Defrost Motor		Panel Motor		Floor Motor	
	Green/White	Green/Black	Blue/White	Blue/Black	Yellow/White	Yellow/Black
Off	+12 V	0 V	+12 V	0 V	0 V	+12 V
Off 25 seconds after switched	0 V	0 V	0 V	0 V	0 V	0 V

Mode Switch	Rec Motor		AC Relay	Power Relay	Condenser Relay
	Brown/White	Brown/Black	Green	Yellow	Orange
Off	0 V	+12 V	0 V	+12 V	0 V
Off 25 seconds after switched	0 V	0 V			

Floor/Defrost

In the Floor/Defrost position the current flows from the control module on the Pink wire to the mode switch to the control module ground. The system power relay is energized. The floor and defrost outlet doors are driven open. Vent door is driven closed and the rec door is driven to all air. The motors are driven to position for 25 seconds after the mode is selected, and then all motor inputs go high (+12 V to ground). The AC clutch is energized.

Mode Switch	Defrost Motor		Panel Motor		Floor Motor	
	Green/White	Green/Black	Blue/White	Blue/Black	Yellow/White	Yellow/Black
Off	0 V	+12 V	+12 V	0 V	0 V	+12 V
Off 25 seconds after switched	0 V	0 V	0 V	0 V	0 V	0 V

Mode Switch	Rec Motor		AC Relay	Power Relay	Condenser Relay
	Brown/White	Brown/Black	Green	Yellow	Orange
Off	0 V	+12 V	+12 V	+12 V	+12 V
Off 25 seconds after switched	0 V	0 V			

Defrost

In the Defrost position the current flows from the control module on the White wire to the mode switch to the control module ground. The system power relay is energized. The defrost outlet door is driven open, and the floor door is driven closed. Vent door is driven closed and the Rec door is driven open to all air. The motors are driven to position for 25 seconds after the mode is selected, and then all motor inputs de-energize (+12 V to ground). The AC clutch is energized.

Mode Switch	Defrost Motor		Panel Motor		Floor Motor	
	Green/White	Green/Black	Blue/White	Blue/Black	Yellow/White	Yellow/Black
Off	0 V	+12 V	+12 V	0 V	+12 V	0 V
Off 25 seconds after switched	0 V	0 V	0 V	0 V	0 V	0 V

Mode Switch	Rec Motor		AC Relay	Power Relay	Condenser Relay
	Brown/White	Brown/Black	Green	Yellow	Orange
Off	0 V	+12 V	+12 V	+12 V	+12 V
Off 25 seconds after switched	0 V	0 V			

Torque and Voltage Specifications

NOTE: This vehicle was designed using English (S.A.E.) measurements. Utilimaster provides metric conversion equivalents as a courtesy if metric tools must be used, but Utilimaster does not warrant metric values given in this manual.

Torque Specifications

Description	N•m	Ft•lbs
Expansion Valve to Evaporator Core	21–27	15–20
Liquid Line to Expansion Valve	14–20	10–15
Liquid Line to Drier Suction Line to Evaporator Core	41–47	30–35
Suction Line to Compressor	34	25
Discharge to Compressor	22	18
Compressor Fitting Tube-O	41	30
Compressor to Manifold Hold Down Clamp Bolt	35	26
Hose Clamp, Worm Screw	3.9–5.1	(35–45 in•lbs)
T-Bolt	7.3–8.5	(65–75 in•lbs)
Pressure Switches	5	(44 in•lbs)
Plenum to Cowl 1/4" Studs	27	20
Plenum to Cowl 3/8" Studs	43	32
Evaporator to Cowl	27	20

Line Fittings Torque Specifications

Metal Tube Outside Diameter	Thread and Fitting Size	Steel Tubing Torque	Aluminum or Copper Tubing Torque	Nominal Torque Wrench Span
1/4"	7/16"	13 ft•lbs	71 in•lbs	5/8"
3/8"	5/8"	32 ft•lbs	12 ft•lbs	3/4"
1/2"	3/4"	32 ft•lbs	17 ft•lbs	7/8"
5/8"	7/8"	32 ft•lbs	24 ft•lbs	1-1/16"
3/4"	11/16"	32 ft•lbs	30 ft•lbs	1-1/4"

NOTE: Use Steel Tubing Torque Specifications when mate is steel-to-steel. If steel connection is made to aluminum or copper tube fittings, use appropriate Aluminum or Copper Tubing Torque Specifications.

Blower Voltage Chart

Blower Speed	Current	Blower Voltage
Low	7.0 A	8.8 V
Medium	9.42 A	10.4 V
High	11.9 A	12.0 A

NOTE: The measurements listed reflect bench load test at circuit 530A on wire harness 16515182. Current draw in actual field conditions may very slightly.

Contacting Utilimaster

Browse our web site for more information about Utilimaster and its products, or contact Utilimaster Customer Service by using one of the following methods:

- Call 574-862-3362.
- Fax to 574-862-7637.
- Email to **reach@utilimaster.com**
- Mail to the following address:

Utilimaster
Attn: Customer Service Department
65528 State Road 19
P.O. Box 585
Wakarusa, IN 46573-0585
U.S.A.

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Reach Customer Service
HOTLINE 574-862-3362
Monday—Friday 8 a.m. to 5 p.m. Eastern Standard Time Zone

Email: reach@utilimaster.com

Reach

2012 Body Service Supplement

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