VOLVO

Volvo Trucks North America
Greensboro, NC USA

Service Bulletin Trucks

Supersedes Service Bulletin 874–22, “Climate Unit Troubleshooting” (06.2003), publication no. PV776–TSP192640.

Date	Group	No.	Release	Page
5.2011	**874**	**22**	**02**	1(34)

Climate System Troubleshooting

VN, VHD VERSION2

Climate System Troubleshooting

Climate Control troubleshooting information is divided into eight symptom-based troubleshooting sections:

Climate System Troubleshooting

General A/C System Troubleshooting

This troubleshooting guide covers the majority of typical field concerns for both the front and rear climate systems. In general, the front climate unit is the primary system. The rear unit is intended only for supplementary heating and cooling in extreme driving conditions and for comfort operation when parked. If the rear unit is operated with high cooling output or especially high heating output, it can cause noticeable temperature control problems with the front ECC operation.

Troubleshooting

With the ignition on but engine off, toggle the instrument cluster menu to DIAGNOSTICS and then to CLIMATE UNIT. Note if there are any active faults or inactive faults and their SID number. These codes can help pinpoint problems quickly but are limited to the following faults on the front system only:

MID 146 **SID 2** Temperature sensor, evaporator-shorted or open circuit

MID 146 **SID 5** Stepper motor, fresh air and recirculation-short circuit only

MID 146 **SID 6** Stepper motor, air distribution-short circuit only

MID 146 **SID 9** Stepper motor, air mix-short circuit only

MID 146 **SID 11** Solenoid clutch, compressor-shorted or open circuit

MID 146 **SID 12** Solenoid valve, water distribution-(ECC only)

MID 146 **SID 13** Temperature sensor, heat exchanger-(ECC only)

MID 146 **SID 14** Circulation fan, temperature sensor, cab-(ECC only, open circuit only)

MID 146 **SID 15** Fan clutch, engine-open circuit only

MID 146 **SID 16-19** Stepper motor, phase 1-4

MID 146 **SID 22** Pressure sensor, refrigerant-out of range

MID 146 **SID 232** 5 volt supply sensors-open circuit only

MID 146 **SID 250** J1708 Information link

MID 146 **PID 170** Temperature sensor, cab-ECC only

Certain combinations of faults can indicate an intermittent or disconnected circuit. Combinations of SID 2, 13, 232 indicates an ECC climate unit connector problem. Combination of SID 2,232 indicates an MCC climate connector problem. An ECC control unit usually has a combination SID 2, 13, 232 and 170.

Review the complaint carefully and determine which troubleshooting section is most appropriate:

Front Airflow-air speed, air distribution

Front Temperature - poor heating, cooling, or cycling

Compressor Cycling-none, rapid, odd, noises

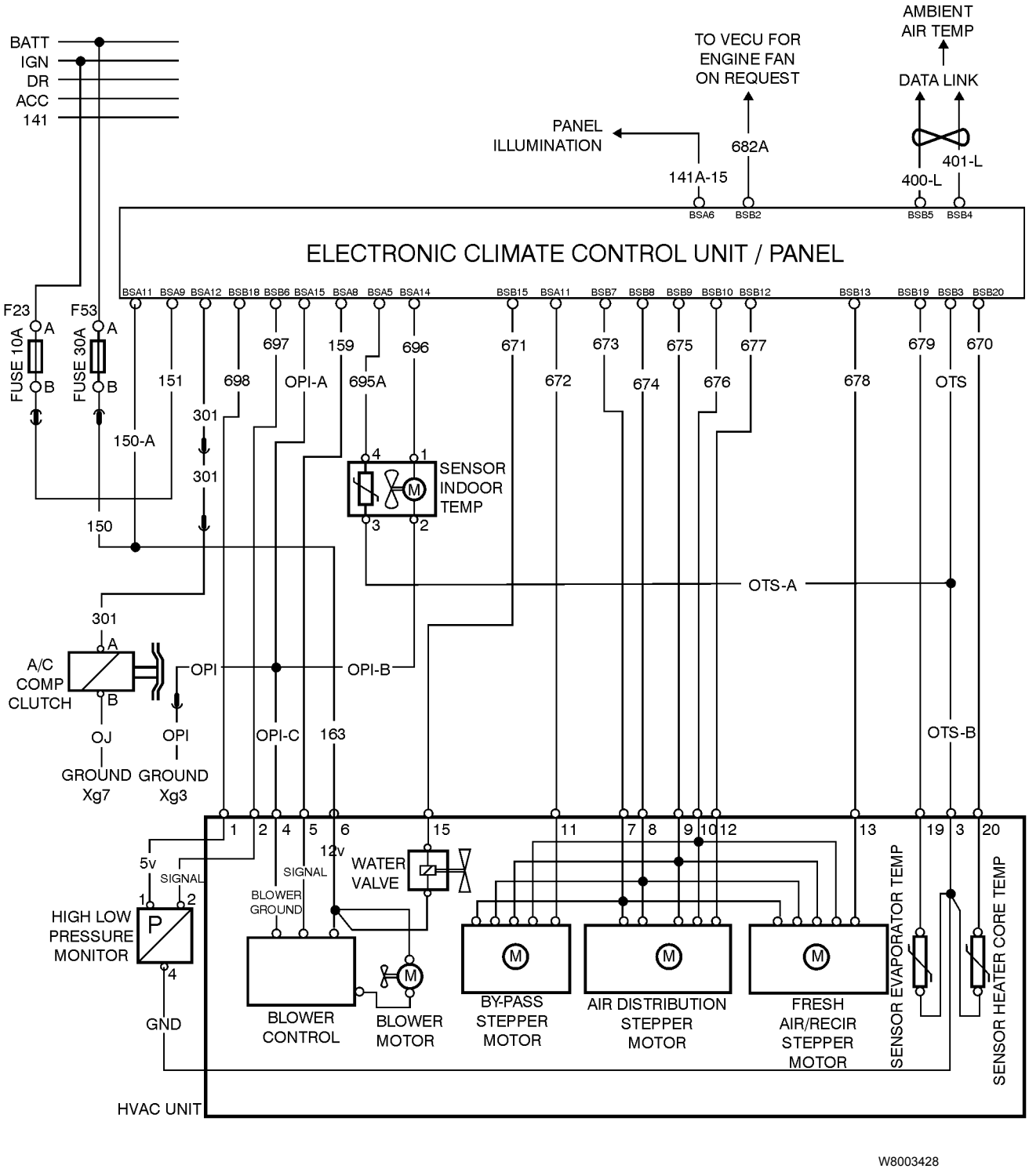
Engine Fan-none, continuous

Bunk Airflow-blower, air distribution

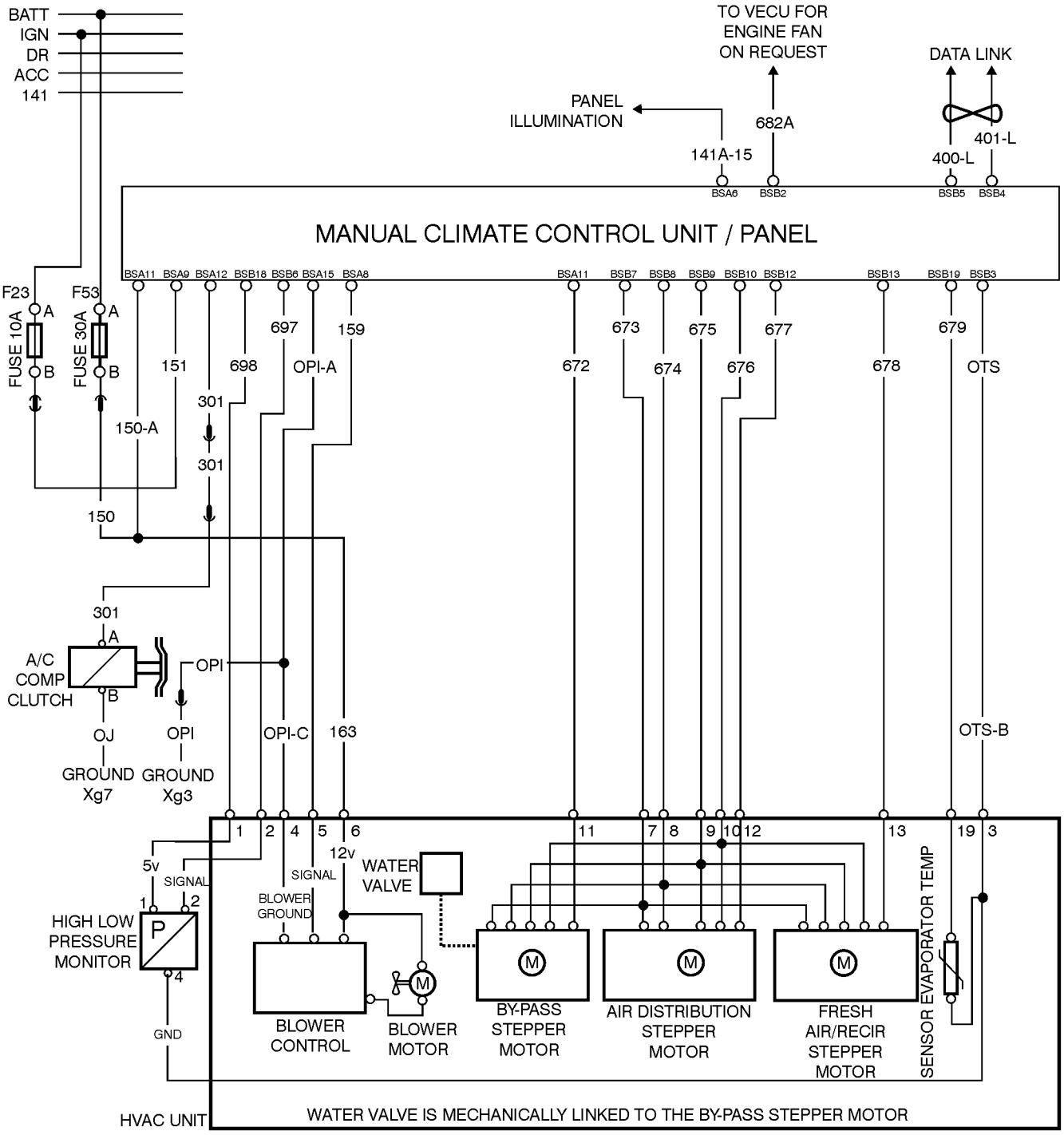
Bunk Temperature- poor heating, cooling, or cycling

Electrical Schematics

Electronic climate control unit

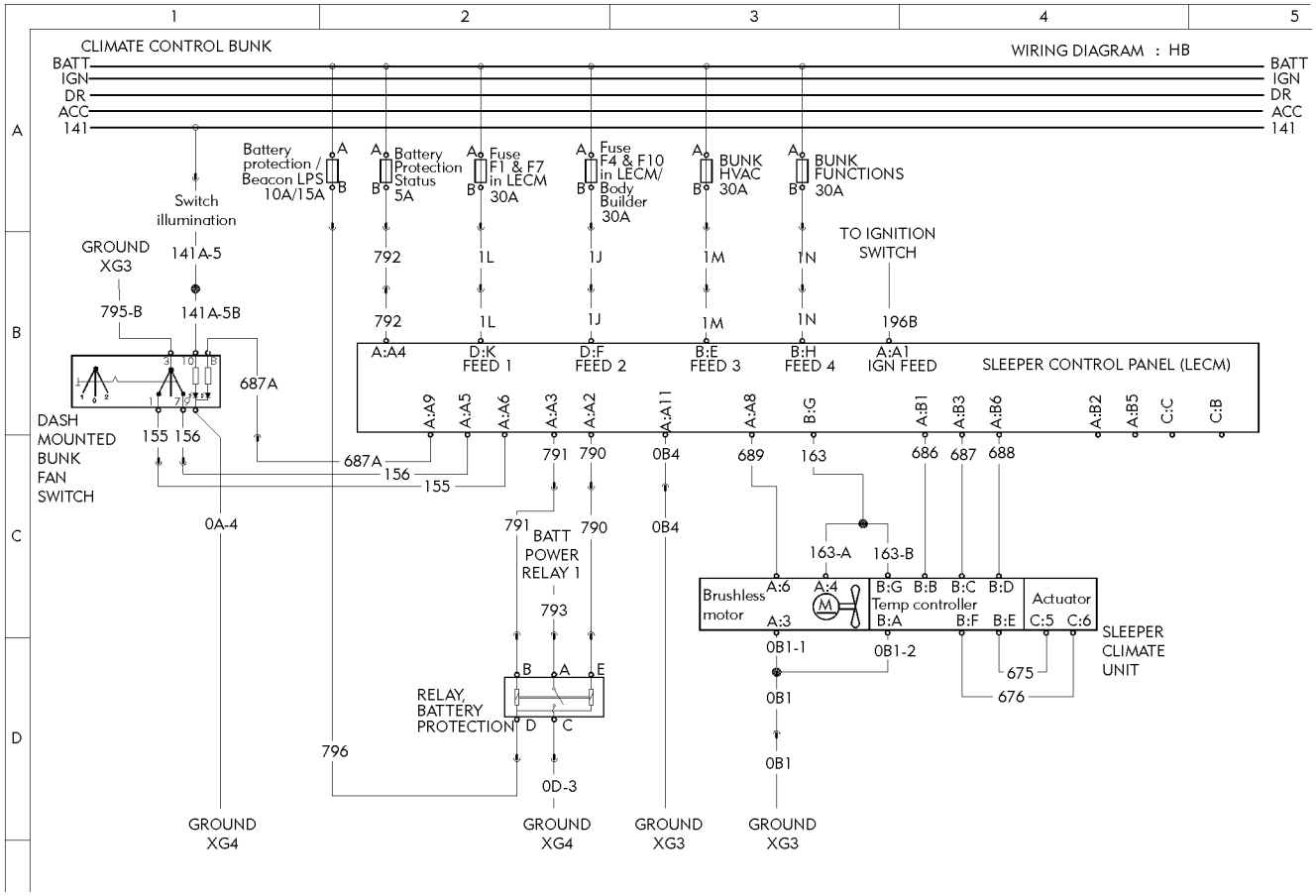


Manual climate control unit



W8003429

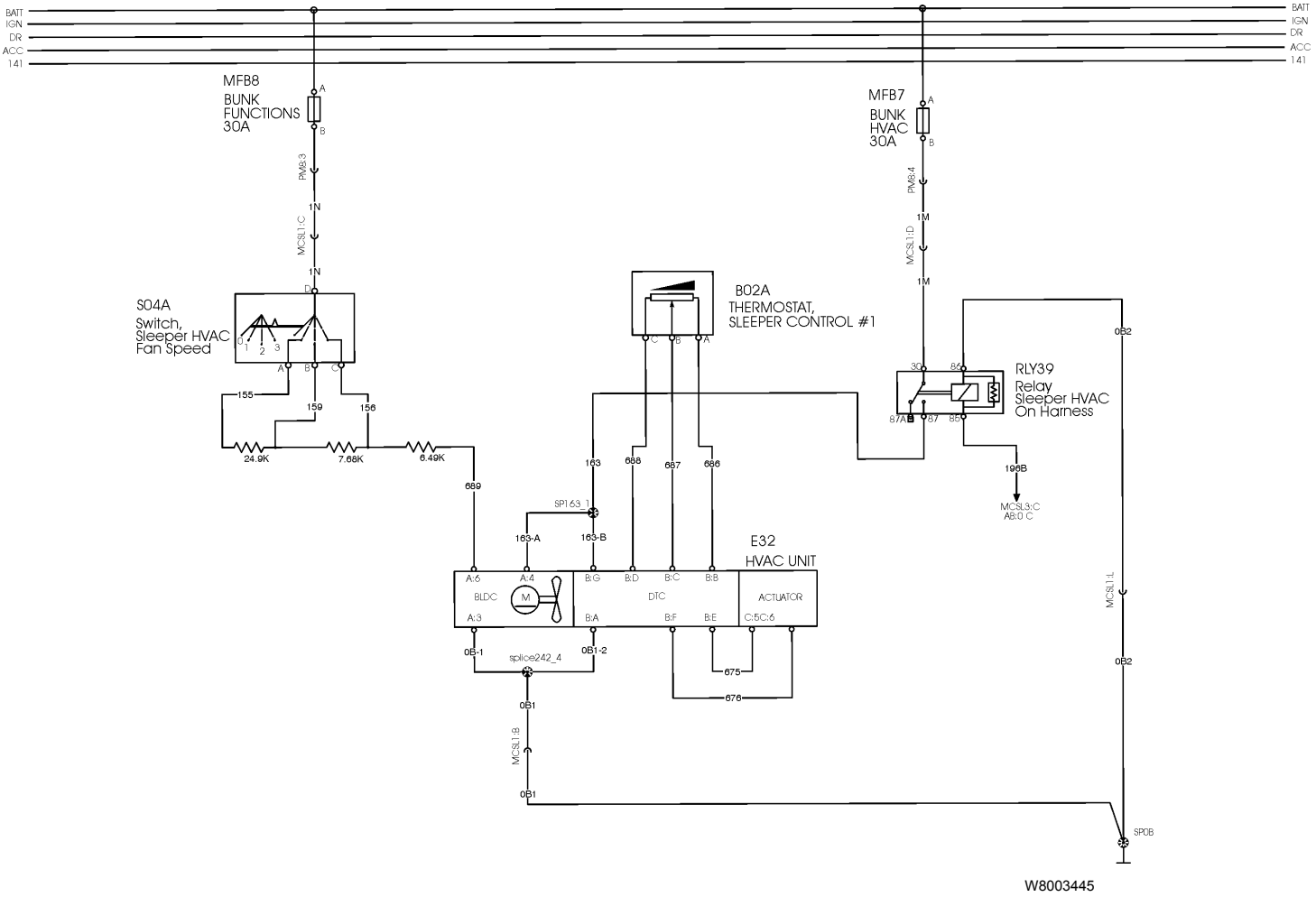
Bunk unit with LECM



W8003272

Bunk unit without LECM

SLEEPER CLIMATE CONTROL W/O LECM L3



Pressure Issues

Normal A/C System Pressures

This table lists the normal high and low pressure readings and louver (duct) temperatures for the given conditions of engine rpm, relative humidity, and ambient temperature.

Note conditions:

- Engine running at 1500 rpm
- Engine fan locked ON
- Main and bunk fans on high
- Fresh air mode
- Hood and doors open
- System properly charged
- Allow system to stabilize 10 minutes before taking readings
- Full cold A/C on

Sleeper Cab Configuration A/C Service Data

Ambient temperature °F	Relative humidity %RH	High side service port psig	Low side service port psig	Passenger side left dash louver °F	Lower bunk louver °F
110	20	220-250	25-40	58-68	48-58
100	20	185-215	20-35	52-62	43-53
90	20	150-180	15-30	45-55	37-47
80	20	100-145	20-40	47-57	40-50
70	20	80-120	20-40	45-55	42-52
100	50	195-225	25-35	60-70	50-60
90	50	125-155	20-30	50-60	40-50
80	50	155-185	15-25	43-53	35-45
70	50	80-120	20-40	45-55	40-50
90	80	160-190	25-35	57-67	47-57
80	80	130-160	15-30	50-60	40-50
70	80	80-130	15-40	45-55	37-47

Day Cab Configuration A/C Service Data

Ambient temperature °F	Relative humidity %RH	High side service port psig	Low side service port psig	Passenger side left dash louver °F	Lower bunk louver °F
110	20	195-225	15-30	53-63	NA
100	20	160-190	10-25	45-55	NA
90	20	110-150	15-45	47-57	NA
80	20	90-130	15-45	45-55	NA
70	20	70-110	15-45	43-53	NA
100	50	165-195	10-20	53-63	NA
90	50	130-160	10-20	48-58	NA
80	50	90-130	15-40	46-56	NA
70	50	70-110	15-40	44-54	NA
90	80	140-170	15-25	52-62	NA
80	80	95-135	15-40	48-58	NA
70	80	75-115	15-40	46-56	NA

Troubleshooting Abnormal Pressures

This table lists a variety of high and low system pressure conditions and the symptoms consistent with them. Included for each are general steps to correct the problem.

Refer to “Pressure Issues”, page 7 to determine normal pressure values for the conditions present during troubleshooting.

Symptoms	Low Side Pressure	High Side Pressure	Condition	Recommended Correction
1 Moisture indicator starts to turn pink 2 Slightly cool discharge air	Normal	Normal	Some moisture in refrigerant system	1 Recover refrigerant 2 Replace the receiver/dryer 3 Evacuate, recharge, and leak test system
1 Moisture indicator has turned completely pink 2 Frozen expansion valve	Normal to low	Normal	Excessive moisture in refrigerant system	1 Recover refrigerant 2 Replace the receiver/dryer 3 Evacuate, recharge, and leak test system
1 Compressor cycles at incorrect temperatures 2 Evaporator frozen causing restricted air flow	Normal	Normal	Evaporator temp sensor dislodged or defective	“Refrigerant Compressor Cycling Issues”, page 21
1 Warm discharge air 2 A/C hose temperatures appear normal	Normal	Normal	Water control valve leaking internally	1 Drain engine coolant 2 Replace water control valve and adjust 3 Refill engine coolant
1 Warm discharge air 2 A/C hose temperatures appear normal	Normal	Normal	Air bypassing evaporator core	1 Check installation to insure proper air flow through the evaporator core.
1 Slightly cool discharge air 2 Compressor cycles frequently	Low	Low	Low refrigerant charge	1 Conduct a leak test 2 Recover refrigerant 3 Repair leak 4 Check the compressor oil level 5 Evacuate, recharge, and leak test system
1 Warm discharge air 2 Compressor cycles more often or will not engage 3 Hot high side lines	Low	Low	Extremely low refrigerant charge	1 Conduct a leak test 2 Recover refrigerant 3 Repair leak 4 Check the compressor oil level 5 Evacuate, recharge, and leak test system

Symptoms	Low Side Pressure	High Side Pressure	Condition	Recommended Correction
1 Slightly cool discharge air 2 Sweat or frost on expansion valve	Low	Low	Expansion valve clogged or stuck closed	1 Recover refrigerant 2 Replace the expansion valve 3 Replace receiver/dryer 4 Evacuate, recharge, and leak test system
1 Slightly cool discharge air 2 Sweat or frost on high side lines 3 Sweat or frost on receiver/ dryer	Low	High	Restriction in high side	1 Recover refrigerant 2 Locate and repair the restriction 3 Replace the receiver/dryer 4 Evacuate, recharge, and leak test system
1 Occasional compressor noise 2 Compressor does not turn smoothly or cannot be turned by hand	High	Low	Faulty compressor	1 Recover refrigerant 2 Replace the compressor 3 Replace the receiver/dryer 4 Evacuate, recharge, and leak test system
1 Warm discharge air 2 Very hot high side pressure hose assemblies	High	High	Condenser Air flow malfunction	1 Check for damaged fins and cleanliness of condenser, radiator, charge air cooler, or any other component that may impede airflow. Clean or straighten fins as needed. 2 Check condenser to charge air cooler clearance (approx. 1 inch). Adjust as needed. 3 Check that engine fan operates properly. See “Engine Fan Operation (HVAC Input)”, page 26.
1 Warm discharge air 2 Very hot high side pressure hose assemblies	High	High	Refrigerant overcharge	1 Recover refrigerant 2 Evacuate, recharge, and leak test system
1 Warm discharge air 2 Very hot high side lines	High	High	Expansion valve stuck open	1 Recover refrigerant 2 Replace the expansion valve 3 Replace the receiver/dryer 4 Evacuate, recharge, and leak test system
1 Warm discharge air 2 A/C hose temperatures appear normal	High - Normal	High	Air in system	1 Conduct a leak test 2 Recover refrigerant 3 Repair any leak found 4 Replace receiver/dryer

				5 Evacuate, recharge, and leak test system

Non-Condensable Gasses

To check for the presence of non-condensable gasses (air) or possible refrigerant contamination from mixing of different refrigerant types, the pressure of the R134a refrigerant should be checked. Most modern refrigerant recovery equipment have provisions to purge air from recovered refrigerants. Check the operating features of the recovery equipment used in your shop for specific features. To check for non-condensable gasses observe the following points:

- The vehicle / refrigerant container must be at a stable temperature with sufficient refrigerant to provide accurate test results.
- Connect an accurate pressure gauge to the vehicle / refrigerant container (usally the refrigerant recovery equipment gauges are adequate). Measure the temperature within 4 inches of the vehicle / refrigerant container.
- Compare the pressure on the gauge to the chart to the right. A reading significantly higher may indicate the presence of non-condensable gasses (air) or refrigerant contamination.

If non-condensable gasses are indicated, recover the refrigerant and recycle per the refrigerant recovery equipment instructions.

Temperature		**Pressure**	
°F	**°C**	**psig**	**bar**
50	10.0	45	3.10
55	12.8	51	3.49
60	15.5	57	3.92
65	18.2	63	4.38
70	21.1	71	4.87
75	23.9	78	5.40
80	26.7	88	6.09
85	29.4	95	6.55
90	32.2	104	7.18
95	35.0	114	7.86
100	37.8	124	8.57
102	38.9	129	8.86
104	40.0	133	9.16

Front Airspeed Issues

The components that effect airspeed out of the front louvers are listed below in order of air entering the cab with the last two being the electric controls:

1 Top cowl grille

2 Air inlet plenum box

3 Air inlet filter

4 Climate units fresh/recirc door

5 Evaporator Core

6 Blower motor

7 Heater Core

8 Dash ducting

9 Air outlets

10 Cab body exhausters

11 Blower speed controller, Linear Power Module (LPM)

12 Dash climate control unit

Typical Complaints and Possible Causes

The checks below are organised in components or systems. Depending on previous collected data, such as symptoms, possible error codes, and carried out tests, the starting point in the table may vary. In case of no earlier indications, system/components should be checked according to order in the table until the fault is localized.

Airflow Seems Lower than it should be for Fan Speed Selection

Component / System	Check	Service information	Reference
Airflow is restricted enroute	• Leaves, snow, or ice covering the cowl grille • wet or dirty air filter • dirt, lint, or ice in the evaporator • Climate unit air distribution doors which are closed, broken		
Blower speed controller not functioning properly	Verify the voltages in the climate unit at the blower speed controller (LPM) which is attached to the blower assembly. With ignition on, engine off, and the LPM disconnected the following voltages should be measured at the 4-way LPM wiring harness connector	Pin 1-red-(power to transistors) V ≈ B+	
		Pin 2-yellow-(speed control signal)-fan speed selected at dash 0: V ≈ Less than 0.5 V 1:V ≈ 2.3 V +/- 10% 2: V ≈ 3.4 V +/- 10% 3: V ≈ 4.4 V +/- 10% 4: V ≈ 5.9 V +/- 10%	
		Pin 3-white-(to ground) V≈ 0 V	
		Pin 4-black- (from motor) V ≈ B+	
Blower motor bearings	Listen for unusual noises, check blower current draw with engine running, fan		

Component / System	Check	Service information	Reference
restricting rotation	speed 4, recirc if drawing more than 20 A, at room temperature, replace motor		

Blower Motor Does Not Operate

Component / System	Check	Service information	Reference
Fuse blown	Look for wiring shorts to the blower motor, check current draw of blower motor with engine on, fan 4, and recirc; if over 20 amps, replace motor		
Blower disconnected	Look for disconnection on circuits 150, 163, and OP1-C		
Blower speed controller faulty or disconnected	Perform check as stated in previous section for blower speed controller not functioning properly		
Blower motor seized	Check that fan blades are not obstructed before replacing motor.		
Low battery protection device (if equipped), not supplying power to control unit	Verify battery voltage on circuits 150 and 163 when gauge cluster voltage is above 12.0V		
Battery protection (if equipped) shuts blower off	Check LECM for blinking LED - which indicates low battery voltage		

Blower Will Not Run on all Speeds

Component / System	Check	Service information	Reference
Blower speed controller faulty	Perform check as stated in earlier section for blower speed controller not functioning properly		

Air Distribution

The components that effect where the air is distributed are listed below:

1 Air distribution stepping motor

2 Air bypass stepping motor

3 Dash louvers

4 Dash climate control unit

The dash climate control unit signals the air distribution stepping motor how far to rotate based on the operators selection. The floor, panel, and defrost air doors are all linked by gearing and linkages to the stepping motor. When a new selection is made by the operator, the stepping motor may take several seconds and advance through several air modes before stopping at the selected position.

Note: On every one hundredth ignition start-up, the air distribution stepping motor has a self calibration routine where it rotates from full DEFROST to full PANEL before advancing to the selected mode on the control unit. This calibration lasts about 6-8 seconds.

Note: For ECC units in AUT mode, the ECC programming has special features to control the distribution. Perform air distribution checks in the manual override modes.

Typical Complaints and Possible Causes

The checks below are organized in components or systems. Depending on previous collected data, such as symptoms, possible error codes, and carried out tests, the starting point in the table may vary. In case of no earlier indications, system/components should be checked according to order in the table until the fault is localized.

Air Distribution

Component / System	Check	Service information	Reference
Will not change mode when different air distribution is selected	Air distribution stepping motor electrical connection is loose	See fault code manual under group 87	
	Air distribution door linkages and gearing broken	Inspect driver side upper housing of climate unit	
	Air distribution doors jammed or obstructed	Inspect doors at top of climate unit	
	Climate control unit faulty	Ignition on, defrost mode selected, fan speed 4 BSB12 at rear of dash control unit V ≈ 5 V	
	Air distribution stepping motor faulty	See fault code manual under group 87	

Control Unit Selection does not Match Location of Airflow (AUT mode excluded)

Note: The panel door on the climate unit will always allow some air to the dash louvers even in floor or defrost mode to compensate for heat rise.

Note: When full floor mode is selected, a small amount of air will flow from the defrost louvers. If cooling the cab, change the selection to panel / floor which will eliminate all airflow to the windshield and possible misting.

Component / System	Check	Service information	Reference
Dash control unit not recalibrating correctly	Place control knob to full panel (dash louvers) position and a high fan speed while engine is running. Turn engine off. Turn engine back on after about 20 seconds and let the control unit self-calibrate for about 8-10 seconds. At the end of this time, if noticeable airflow can be felt from defrost or floor, but the doors rotate OK, replace the control unit.	See fault code manual under group 87	

Front Temperature Control Issues

A properly working Manual A/C unit provides a 14°C to 17°C (25°F to 30°F) difference between ambient and duct temperatures. In extremely hot climates, this temperature drop may not feel sufficient to some drivers, even though the air conditioning is working properly. The Electronic (ECC) unit should provide the same cooling as the manual in hot climates, however in milder climates or as the temperature in the cab gets close to the selected temperature, the outlet air temperature will automatically warm slightly for a more comfortable feel.

Note: During cold start-up in the winter, ECC units will not allow the blower to reach full fan speed until the engine coolant temperature reaches at least 30°C (86°F) to prevent high speed, cold air from hitting the driver.

Note: When switching from the max cold or max hot (blue and red dots) on ECC units to any other temperature selections, the ECC unit will do whatever is required to get the interior cab temperature to the newly selected temperature.
An example: A driver starts a truck in the winter, selects defrost and max heat (red dot) and then walks off. After 15 minutes the driver gets into the cab where the interior temperature has risen to 45°C (113°F) and selects 76°F at the control unit. ECC will change to cold air (running the a/c compressor if possible) to get the interior temperature down to 76°F as quickly as possible rather than reducing heat gradually.

Note: All climate units have air bypass doors which allow a small portion of air to bypass the heater core and flow to the dash louvers when heating is selected. As more heat is selected, the amount of bypass is greater. This feature provides cooler air to the dash louvers to help offset the hotter air rising from the floor or defrost so the drivers and passengers head area will remain comfortable.

Typical Complaints and Possible Causes

The checks below are organized in components or systems. Depending on previous collected data, such as symptoms, possible error codes, and carried out tests, the starting point in the table may vary. In case of no earlier indications, system/components should be checked according to order in the table until the fault is localized.

Poor or Insufficient Heat out of the Front Louvers

Component / System	Check	Service information	Reference
Restricted coolant flow through the climate unit heater circuit	Pipes or hoses bent		With engine running, control unit in max heat, check for coolant flow on the climate unit return hose (look for possible restrictions).
	Pipes plumbed in reverse causing no flow (supply to top port of climate unit)		
	Water valve clogged or stuck closed		
	For ECC, 0V to solenoid valve opens it. If plumbing is correct and no flow is noticed through disconnected solenoid, replace valve		
	For MCC, valve is controlled by linkage. If plumbing is correct and no flow is noticed when manipulating valve with linkage off, replace valve.		
Faulty ambient temperature or cab air sensors (ECC only)	With ignition on, toggle dash display and verify outside temperature reading is correct. If not, check sensor near lower radiator		
	For cab air sensor and the sensor fan	See fault code manual under “group 87”	
Duct leakage	Verify outlet ducts at top of climate unit are sealed		
Faulty engine thermostat	With engine running, verify coolant temperature reaches thermostat opening temperature		
Faulty heat control stepping motor		See fault code manual under “group 87”	

Poor or Insufficient Cold Air out of Front Louvers

Component / System	Check	Service information	Reference
Fault in refrigerant circuit		See, “Troubleshooting Abnormal Pressures”, page 9	
Compressor not cycling		See compressor troubleshooting section	
Heat leakage in climate unit	Verify no coolant flow through water valve by applying 12V to ECC solenoid valve or manually adjusting MCC water valve (linkage disconnected)		
	Heat exchanger temperature sensor, see fault code manual under “group 87”		
Faulty ambient air or cab temperature sensor (ECC only)	With ignition on, toggle dash display and verify outside temperature reading is correct. If not, check sensor near lower radiator.		
	For cab air sensor and the sensor fan, see fault code manual under “group 87”		
Faulty evaporator sensor	In max cold (blue dot on ECC) with a/c running, measure the voltage on circuit 679 (pin BSB19 at control unit) while the compressor cycles	Compressor off for freeze protection at 2.9-3.1V	If compressor is cycling outside these values in max cold, see fault code manual under “group 87”
		Compressor back on at 2.5-2.7V	
Incorrect Control Unit Installed	If an ECC control unit is replaced with an MCC control unit, Maximum heating will result due to an open water control valve. This will lead to unfavorable cooling. Check part number of ECU for correct vehicle installation.		

Poor Control of Set Temperature, Fluctuates too Much

Component / System	Check	Service information	Reference
Bunk climate unit effecting front cab temperature sensor	Operate front system without bunk unit.		Typically ECC works best when the bunk unit is operating in fan speed level 2 or less and a moderate temperature selected.
Faulty ambient air or cab temperature sensor (ECC only)	With ignition on, toggle dash display and verify outside temperature reading is correct. If not, check sensor near lower radiator		
	For cab air sensor and the sensor fan, see fault code manual under “group 87”		
Compressor cycling erratic		“Refrigerant Compressor Cycling Issues”, page 21	
Evaporator temperature sensor disconnected-defaults to compressor on for 20 seconds and off for 60 seconds		See fault code manual under “group 87”	
Heat leakage in climate unit while trying to cool	Verify no coolant flow through water valve by applying 12V to ECC solenoid valve or manually adjusting MCC water valve (linkage disconnected)		
	Heat exchanger temperature sensor	See fault code manual under “group 87”	
Incorrect Control Unit Installed	If an MCC control unit is replaced with an ECC control unit, unfavorable heating/cooling will result. This is due to missing temperature sensor information for the cab and heat exchanger. Check part number of ECU for correct vehicle installation.	See fault code manual under “group 87”	

Refrigerant Compressor Cycling Issues

The dash hvac control unit supplies power to the compressor clutch under the following conditions, for all vehicles:

1 The engine is running

2 A fan speed other than 0 is selected

3 The pressure transducer measures a refrigerant pressure between the minimum and maximum allowed
Minimum-2 bar (about 29 psig) or 0.8V on circuit 697 (pin BSB6 at control unit)
Maximum-30 bar (about 435 psig) or 4.5V on circuit 697 (pin BSB6 at control unit)

4 The evaporator air sensor measures a temperature indicating no icing above 3 °C (37 °F) or a voltage less than 3.1 V on circuit 679 (pin BSB19 at control unit)

5 The electrical circuitry to and from the pressure transducer is good

6 The supply lead to the compressor clutch and the ground lead back to the bulkhead stud are good

7 The resistance of the compressor clutch is good

8 The climate control unit has at least 11.5 volts at ignition start-up on both the 150-A circuit (pin BSA11) and the 151 circuit (pin BSA 9).

9 Additional for MCC:
1) the A/C ON button must be depressed
Additional for ECC:
1) the A/C OFF button is NOT depressed
2) The ambient temperature from the data bus is above freezing.

In general the compressor cycling will be very different between a vehicle with MCC and with ECC although both prevent compressor cycling more than once every 30 seconds. Under normal operation, MCC will keep the compressor on until the evaporator sensor measures a temperature just above freezing and then will keep the compressor off until the temperature off the evaporator rises about 8-9°F. Under normal operation, ECC will operate very similar to MCC when the ambient temperatures are high. However, as the ambient temperature lowers nearer typical room temperature, the ECC control unit will cut the compressor off at higher evaporator temperatures so the air temperature out of the louvers remain near constant. Even when the ambient temperatures are cooler than the selected temperature, ECC will operate short de-humidification compressor cycling without defrost being selected.

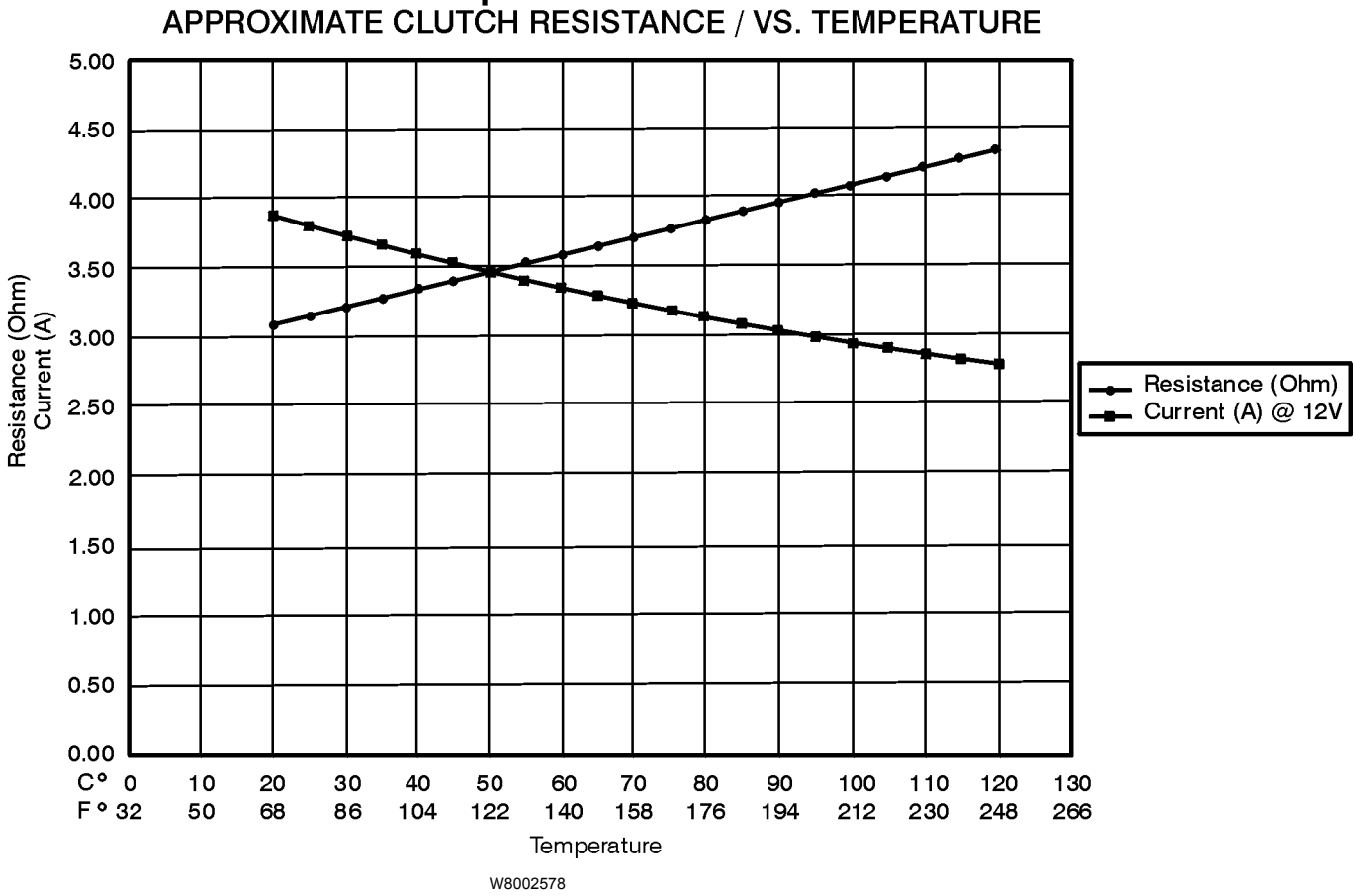
Typical Complaints and Possible Causes

The checks below are organized in components or systems. Depending on previous collected data, such as symptoms, possible error codes, and carried out tests, the starting point in the table may vary. In case of no earlier indications, system/components should be checked according to order in the table until the fault is localized.

Compressor does not Engage

Component / System	Check	Service information	Reference
No signal from control unit	Verify that all requirements for compressor clutch activation listed at the beginning of this section are met. If yes, replace control unit		
Compressor clutch circuitry bad	With compressor lead disconnected, measure the resistance of the clutch. At shop temperature, the resistance should be about 3.1-3.7 Ω. For other clutch temperatures use the chart on “Clutch Resistance vs. Temperature”, page 23. If resistance is out of range, replace compressor clutch.		
Excessive gap between armature plate and rotor	Measure gap with feeler gauges	0.4-0.8 mm (.016-.031 in)	
Internal compressor lock-up	With engine off, rotate the compressor clutch plate by hand. Rotation should be some resistance and smooth. If noises can be heard or if rotation is hard, replace compressor.		

Clutch Resistance vs. Temperature



Compressor Rapid Cycles

Component / System	Check	Service information	Reference
Chattering wire or connector to the compressor clutch or ground stud	A SID 11 fault in the dash diagnostics display with the compressor still occasionally cycling or rapid cycling is a good indication of a chattering wire or connector. If running a wire directly to the compressor from pin BSA 11 at the control unit and then a ground wire directly to a bulkhead stud eliminates the cycling problems, check the vehicle compressor wiring circuit, pass-thrus, and connectors for a chaffed wire, broken wire, or bad contact.		
Control unit faulty	Check pin BSA 11 at control unit for rapid switching of the compressor. If voltage switching (12V>0>12V) is less than 30 seconds for the entire cycle, replace control unit.		

Compressor Cycles at Odd Intervals

Component / System	Check	Service information	Reference
Fault in refrigerant circuit		Pressure / Temperature Diagnostics Guide	
Ambient sensor or in-cab sensor faulty (ECC only)	With ignition on, toggle dash display and verify outside temperature reading is correct. If not, check sensor near lower radiator		
	For cab air sensor and the sensor fan, see fault code manual under “group 87”		
Chattering wire or connector to the compressor clutch or ground stud	A SID 11 fault in the dash diagnostics display with the compressor still occasionally cycling or rapid cycling is a good indication of a chattering wire or connector. If running a wire directly to the compressor from pin BSA 11 at the control unit and then a ground wire directly to a bulkhead stud eliminates the cycling problems, check the vehicle compressor wiring circuit, pass-thrus, and connectors for a chaffed wire, broken wire, or bad contact.		
Evaporator temp sensor dislodged or defective.	Inspect temp sensor mounting. Verify voltage of sensor on circuit 679 (BSB19). In max cold, (blue dot-ECC)	Compressor off for freeze protection at 2.9-3.1 V Compressor on at 2.5-2.9 V	

Compressor Makes Unusual Noises

Component / System	Check	Service information	Reference
Belt slippage	Measure compressor belt tension and verify within specification		
Improper air gap between armature and rotor	Measure gap with feeler gauge and verify within specification	0.4-0.8 mm (.016-.031 in).	
Clutch defective	With engine off, rotate the compressor clutch plate by hand. Rotation should be some resistance and smooth. If noises can be heard or if rotation is hard, replace compressor.		
Compressor mounting loose	Visible inspection		
Improper oil charge in refrigerant circuit	Follow oil level check procedure in service procedures section		

Compressor Runs Continuously

Component / System	Check	Service information	Reference
Note: Extremely high heat load outside.	Operate system inside shop bay: Recirc. mode High idle Max cold Fan speed 3	Compressor should cycle within 30 minutes.	
Low charge	Verify correct charge is in system		
Temp Evaporator sensor dislodged	Verify sensor is correct mounted and unobstructed-check sensor in troubleshooting guide		
Defective control unit	Verify compressor operation/cycling using the “AC on” or “AC off” buttons		

Engine Fan Operation (HVAC Input)

Engine fan operation is controlled by the Vehicle Electronic Control Unit or VECU. The VECU watches for inputs from engine coolant temperature, transmission temperature, and the dash HVAC control unit to activate the fan solenoid (on / off fans) or electro-viscous clutch.

The dash HVAC control unit grounds a signal from the VECU under normal operation (no fan request) and breaks the ground when the HVAC pressure transducer senses a pressure in the refrigerant circuit that is above about 300 psig.

Electro-viscous fans are pre-programmed (Engine ECU) to operate at certain rpms based on inputs like ambient temperature, vehicle speed, engine speed, and HVAC compressor operation (supplied over the data bus from the HVAC control unit). The ECU will still operate the electro-viscous fan at max speed if the HVAC control unit breaks the ground from the VECU signaling the refrigerant pressure is too high.

Typical Complaints and Possible Causes

The checks below are organized in components or systems. Depending on previous collected data, such as symptoms, possible error codes, and carried out tests, the starting point in the table may vary. In case of no earlier indications, system/components should be checked according to order in the table until the fault is localized.

Engine Fan Does Not Engage when the A/C Pressure Reaches about 300 psig

Component / System	Check	Service information	Reference
VECU not accepting hvac requests for fan operation	With the engine running, disconnect the hvac control unit from the main cab harness. The engine fan should immediately engage. If not, verify the VECU programming HVAC input is on.		
Fan solenoid faulty	1. Check air supply to solenoid. 2. Check electrical signal input to solenoid.	See Vehicle ECU and Engine ECU troubleshooting information.	
Pressure transducer faulty	Compare pressure transducer reading on circuit 697 (pin BSB 6) to gauges attached to the high pressure service port. The following are sample voltages for various pressures (the transducer has a linear output, so other pressures can be calculated from the data to the right):	2 bar (about 29 psig) ≈ 0.8 V 6 bar (about 87 psig) ≈ 1.3 V 16 bar (about 232 psig) ≈ 2.6 V 22 bar (about 320 psig) ≈ 3.4 V Since refrigeration gauges are generally not precise the values above from the transducer should be compared with discretion. However, if there is a large discrepancy, see the transducer section in the fault code manual under “group 87”	
Refrigerant blockage between compressor and transducer location		“Troubleshooting Abnormal Pressures”, page 9	

Engine Fan Runs Continuously

Component / System	Check	Service information	Reference
Fan solenoid faulty	1. Check air supply to solenoid. 2. Check electrical signal input to solenoid.	See Vehicle ECU and Engine ECU troubleshooting information.	
HVAC control unit disconnected from main cab harness	Remove top right dash panel and check connections.		
Refrigerant system faulty, pressure too high		See, “Troubleshooting Abnormal Pressures”, page 9	
Engine fan on request is generated from EECU systen and not related to HVAC	Check coolant transducer.	See Engine ECU troubleshooting information.	

Bunk Unit Airflow Issues

In general, the bunk unit blower forces all air through the evaporator core but will decide how much of that air to route additionally through the heater core based on the temperature selection made at the control unit. Therefore, the maximum airflow when full heat is selected will be noticeably less than in max cold, because the air will pass through both the evaporator and heater core in max heat versus just the evaporator core in max cold.

Note: The brushless motor has an internal start-up mode which may take about 3 seconds to reach the fan speed selected.

Airspeed Issues:
The components that effect airspeed out of the bunk louvers are listed below in order of air entering the bunk unit with the last two being the electric controls:

1 Bunk inlet grille

2 Bunk inlet filter

3 Brushless blower motor

4 Evaporator Core

5 Air bypass door

6 Heater core (if heat is selected)

7 Outlet ducting

8 Bunk louvers

9 Bunk wall control module

10 Dash-fan speed override switch

Typical Complaints and Possible Causes

The checks below are organized in components or systems. Depending on previous collected data, such as symptoms, possible error codes, and carried out tests, the starting point in the table may vary. In case of no earlier indications, system/components should be checked according to order in the table until the fault is localized.

Airflow Seems Lower than it should be for Fan Speed Selection

Component / System	Check	Service information	Reference
Airflow is restricted enroute	Dirty air filter		
	Dirt, lint, or ice in the evaporator core (visible with blower motor removed)		
	Louvers which are closed, broken		
Supply voltage to blower below minimum (8.5 volts) to operate	Ground wire, OB1-1, for excessive voltage drop	Combination of ground and supply losses cause voltage at blower to be less than 8.5 V	
	Supply voltage, 163-A, for excessive voltage drop	Combination of ground and supply losses cause voltage at blower to be less than 8.5 V	
	Vehicle voltage levels		
Outlet duct is leaking			
Blower speed signal faulty	Disconnect the blower motor connection and measure the voltage on circuit 689 relative to cab ground	fan speed 0 ≈ less than 0.5 volts L1 ≈ 1.6 volts +/- 10% L2 ≈ 2.2 volts +/- 10% L3 ≈ 3.0 volts +/- 10% L4 ≈ 5.0 volts +/- 10% If the voltage falls outside these ranges, check for faulty bunk control unit. If voltage is within above ranges, recheck the voltages with blower connected, the engine running, and fan level 4. If the voltage falls outside the ranges, check for insufficient ground wiring.	

Blower Motor Does Not Operate

Note: Blower has internal protection which shuts down for the entire ignition cycle, so checks must be done after cycling the ignition

Component / System	Check	Service information	Reference
Supply voltage to blower below minimum (8.5 volts) to operate	• Ground wire, OB1-1, for excessive voltage drop • Supply voltage, 163-A, for excessive voltage drop • Vehicle voltage levels	Combination of ground and supply losses cause voltage at blower to be less than 8.5 V	
Fuse blown	Look for wiring shorts to the blower motor, check current draw of blower motor with engine on and max fan speed; if over 24 amps, replace motor		
Bunk blower disconnected	Look for disconnection on circuits 163-A, 689, and OB1-1	See schematic page “Electrical Schematics”, page 3	
Bunk blower speed controller faulty or disconnected	Disconnect the blower motor connection and measure the voltage on circuit 689 relative to cab ground fan speed 0 ≈ less than 0.5 volts L1 ≈ 1.6 volts +/- 10% L2 ≈ 2.2 volts +/- 10% L3 ≈ 3.0 volts +/- 10% L4 ≈ 5.0 volts +/- 10% If the voltage falls outside these ranges, check for faulty bunk control unit. If voltage is within above ranges, recheck the voltages with blower connected, the engine running, and fan level 4. If the voltage falls outside the ranges, check for insufficient ground wiring.		
Blower motor seized	If blower does not operate with 12V supplied to circuit 163-A, circuit OB1-1wired to a known good ground, and 5V is supplied to circuit 689, replace blower		

Bunk Unit Temperature Control Issues

The bunk unit is a blend air system which mixes cold air with varying amounts of warm air to reach a desired air outlet temperature. To accomplish this, a diverter door located downstream of the evaporator core rotates forcing a portion of the air through the heater core which later remixes with the main airstream. A sensor near the units air outlet measures the mixed airstream temperature and compares it to the selected temperature at the bunk control panel to re-adjust the diverter door position if necessary. This simple temperature control is isolated from the bunk blower circuits and comprises the following components:

Note: The bunk unit evaporator only receives refrigerant to cool when the a/c compressor is running. The dash climate and dash control unit operate the compressor, the bunk unit has no control.

1 Temperature selection potentiometer (bunk control unit)

2 Air temperature sensor/comparator

3 Diverter door actuator

4 Diverter door

5 Evaporator core

6 Evaporator expansion valve

7 Heater core

Typical Complaints and Possible Causes

The checks below are organized in components or systems. Depending on previous collected data, such as symptoms, possible error codes, and carried out tests, the starting point in the table may vary. In case of no earlier indications, system/components should be checked according to order in the table until the fault is localized.

Poor Heating while Front Climate System Works Normally

Component / System	Check	Service information	Reference
Engine coolant flow is restricted	Inspect rear heater lines for damage or blocked		
Diverter door not opening	Measure voltage at door actuator connector when wall temperature controller is rotated from hot to cold to hot.	Circuit 675 (pin 5 at actuator) should have a 8-12 V signal for the duration of the actuator rotation when max cold is selected. Circuit 676 (pin 6 at actuator) should have a similar signal when max hot is selected.	
		If these signals are present: • But the actuator does not rotate when connected, remove actuator and verify diverter door can be easily rotated. If door can be rotated, replace faulty actuator. • And the actuator rotates in the current direction, check diverter door seals and mounting.	
		If these signals are not present: • Disconnect the temperature controller. With ignition on, verify that battery voltage is on circuit 163-B (pin G) and ground OB-1 (pin A) has connection to ground. Repair if necessary. Verify that the resistance between circuits 686 (pin B) and 688 (pin D) is approximately 9-11 kΩ. Also verify that the resistance between circuits 686 (pin B) and 687 (pin C) and between 687 (pin C) and 688 (pin D) vary in resistance, from about 0 kΩ to 10 kΩ as the temperature control is rotated from full cold to full hot. Check wiring, connectors and LECM. If resistances are not correct-replace temperature controller.	

Poor Cooling while Front Climate System Works Normally

Component / System	Check	Service information	Reference
Refrigerant flow is restricted or blocked.	Inspect rear a/c lines for damage.		
Diverter door not closing off heat	Measure voltage at door actuator connector when wall temperature controller is rotated from hot to cold to hot.	Circuit 675 (pin 5 at actuator) should have a 8-12 V signal for the duration of the actuator rotation when max cold is selected. Circuit 676 (pin 6 at actuator) should have a similar signal when max hot is selected.	
		If these signals are present: • But the actuator does not rotate when connected, remove actuator and verify diverter door can be easily rotatded. If door can be rotated, replace faulty actuator. • And the actuator rotates in the current direction, check diverter door seals and mounting.	
		If these signals are not present: • Disconnect the temperature controller. With ignition on, verify that battery voltage is on circuit 163-B (pin G) and ground OB-1 (pin A) has connection to ground. Repair if necessary. Verify that the resistance between circuits 686 (pin B) and 688 (pin D) is approximately 9-11 kΩ. Also verify that the resistanse between circuits 686 (pin B) and 687 (pin C) and between 687 (pin C) and 688 (pin D) vary in resistance, from about 0 kΩ to 10 kΩ as the temperature control is rotated from full cold to full hot.Check wiring, connectors and LECM. If resistances are not correct-replace temperature controller.	
Evaporator is iced over	If condition has occurred, it can be detected by an unusually large quantity of water leaving the drainage tube after the a/c is cut-off and an increase in airflow. Most rear evaporator freezes occur when the operator has windows open while running the rear a/c. Slightly increasing the fan speed during use can decrease the chances of freeze-up.	See, “Compressor Runs Continuously”, page 25	

Poor Control of Set Temperature, Fluctuates too Much

Note: The rear climate unit can not control compressor cycling and will have increased fluctuations in louver temperatures if the compressor cycles quickly

Component / System	Check	Service information	Reference
Diverter door faulty	Measure voltage at door actuator connector when wall temperature controller is rotated from hot to cold to hot.	Circuit 675 (pin 5 at actuator) should have a 8-12 V signal for the duration of the actuator rotation when max cold is selected. Circuit 676 (pin 6 at actuator) should have a similar signal when max hot is selected.	
		If these signals are present: • But the actuator does not rotate when connected, remove actuator and verify diverter door can be easily rotatded. If door can be rotated, replace faulty actuator. • And the actuator rotates in the current direction, check diverter door seals and mounting.	
		If these signals are not present: • Disconnect the temperature controller. With ignition on, verify that battery voltage is on circuit 163-B (pin G) and ground OB-1 (pin A) has connection to ground. Repair if necessary. Verify that the resistance between circuits 686 (pin B) and 688 (pin D) is approximately 9-11 kΩ. Also verify that the resistanse between circuits 686 (pin B) and 687 (pin C) and between 687 (pin C) and 688 (pin D) vary in resistance, from about 0 kΩ to 10 kΩ as the temperature control is rotated from full cold to full hot.Check wiring, connectors and LECM. If resistances are not correct-replace temperature controller.	
Temperature sensor / comparator faulty	With engine running, the front hvac controls set to max cold, fan speed 2 or above, and rear climate controls set to a mild temperature and at least fan level 2, the rear louver temperature fluctuation should not exceed 8C (14.4 F). If over, replace temperature sensor/comparator.		