- the blower speed is set to the last user setting.
- the air inlet mode is set to the last user setting.
- A/C is set to the last user setting.

For moderate and warm ambient air temperatures as determined by the FCIM AUTO mode to request heat or cooling:

- the airflow mode is set to the last user setting.
- the temperature is set to the last user setting.
- the blower speed is set to the last user setting.
- the air inlet mode is set to the last user setting.
- A/C is set to the last user setting.

DESCRIPTION AND OPERATION > CLIMATE CONTROL SYSTEM - VEHICLES WITH: DUAL AUTOMATIC TEMPERATURE CONTROL (DATC) - SYSTEM OPERATION AND COMPONENT DESCRIPTION > COMPONENT DESCRIPTION

FCIM - Dual Automatic Temperature Control (DATC)

The Dual Automatic Temperature Control (DATC) system uses the FCIM as the HVAC control module. The FCIM also controls the outputs for rear window defrost and climate controlled seats. For vehicles equipped with touchscreen audio, the Dual Automatic Temperature Control (DATC) system uses voice commands or the touchscreen to control the system. For details on the FCIM communication, refer to Control System Logic in this article.

The FCIM utilizes a Field-Effect Transistor (FET) protective circuit strategy for its actuator outputs. Output load (current level) is monitored for excessive current (typically short circuits) and is shut down (turns off the voltage or ground provided by the module) when a fault event is detected. A short circuit DTC is stored at the fault event and a cumulative counter is started.

When the demand for the output is no longer present, the module resets the Field-Effect Transistor (FET) circuit protection to allow the circuit to function. The next time the driver requests a circuit to activate that has been shut down by a previous short (Field-Effect Transistor (FET) protection) and the circuit is still shorted, the Field-Effect Transistor (FET) protection shuts off the circuit again and the cumulative counter advances.

When the excessive circuit load occurs often enough, the module shuts down the output until a repair procedure is carried out. The Field-Effect Transistor (FET) protected circuit has 3 predefined levels of short circuit tolerance based on the harmful effect of each circuit fault on the Field-Effect Transistor (FET) and the ability of the Field-Effect Transistor (FET) to withstand it. A module lifetime level of fault events is established based upon the durability of the Field-Effect Transistor (FET). If the total tolerance level is determined to be 600 fault events, the 3 predefined levels would be 200, 400 and 600 fault events.

When each tolerance level is reached, the short circuit DTC that was stored on the first failure cannot be cleared by a command to clear the Diagnostic Trouble Codes (DTCs). The module does not allow the DTC to be cleared or the circuit to be restored to normal operation until a successful self-test proves

that the fault has been repaired. After the self-test has successfully completed (no on-demand Diagnostic Trouble Codes (DTCs) present), DTC U1000:00 and the associated DTC (the DTC related to the shorted circuit) automatically clears and the circuit function returns.

When each level is reached, the DTC associated with the short circuit sets along with DTC U1000:00. These Diagnostic Trouble Codes (DTCs) can be cleared using the diagnostic scan tool. The module never resets the fault event counter to zero and continues to advance the fault event counter as short circuit fault events occur.

If the number of short circuit fault events reach the third level, then Diagnostic Trouble Codes (DTCs) U1000:00 and U3000:49 set along with the associated short circuit DTC. DTC U3000:49 cannot be cleared and a new module must be installed after the repair.

The FCIM requires Programmable Module Installation (PMI) when it is replaced.

Ambient Air Temperature (AAT) Sensor

The Ambient Air Temperature (AAT) sensor contains a thermistor. The sensor varies its resistance with the temperature. As the temperature rises, the resistance falls. As the temperature falls, the resistance rises. The Ambient Air Temperature (AAT) sensor is hardwired to the PCM through separate input and return circuits. If the outside air temperature is below approximately 0 °C (32 °F), the PCM does not allow the A/C compressor clutch to engage.

The PCM sends raw ambient air temperature data to the HVAC module. The HVAC module filters the raw data, sends it to the APIM and the touchscreen displays the outside temperature.

After replacing an Ambient Air Temperature (AAT) sensor, the sensor data must be reset by either driving the vehicle at speeds consistently about 20 MPH for at least 5 minutes to update the filtered data or perform the multiple button press reset procedure to update to the current raw value.

The multiple button reset for the Ambient Air Temperature (AAT) sensor is as follows:

- On the HVAC panel controls, press the A/C and Recirc buttons simultaneously, then, release both.
- Within 2 seconds press the A/C button again.

Blower Motor

The blower motor pulls air from the air inlet and forces it into the heater core and evaporator core housing and the plenum chamber where it is mixed and distributed.

Blower Motor Speed Control

The blower motor speed control uses a PWM signal from the FCIM to determine the desired blower speed and varies the ground feed for the blower motor to control the speed.

Compressor Clutch Assembly

When battery voltage is applied to the A/C compressor clutch field coil, the clutch disc and hub assembly is drawn toward the A/C clutch pulley. The magnetic force locks the clutch disc and hub assembly and the A/C clutch pulley together as one unit, causing the compressor shaft to rotate with the engine. When battery voltage is removed from the A/C compressor clutch field coil, springs in the clutch disc and hub assembly move the clutch disc away from the A/C clutch pulley.

An A/C clutch diode is integrated into the coil for A/C clutch field coil circuit spike suppression.

Evaporator Core

The evaporator core is an aluminum plate/fin type and is located in the climate control housing. A mixture of liquid refrigerant and oil enters the evaporator through the evaporator inlet tube and continues out of the evaporator through the evaporator outlet tube as a vapor. During A/C compressor operation, airflow from the blower motor is cooled and dehumidified as it flows through the evaporator fins.

Heater Core

The heater core consists of fins and tubes arranged to extract heat from the engine coolant and transfer it to air passing through the heater core.

Climate Control Housing

The climate control housing directs airflow from the blower motor through the evaporator core and heater core. All airflow from the blower motor passes through the evaporator core. The airflow is directed through or around the heater core by the temperature doors. Airflow is then distributed to the selected outlet by the airflow mode doors.

Air Distribution Door Actuator

The air distribution door actuator contains a reversible electric motor and a potentiometer. The potentiometer allows the FCIM to monitor the position of the airflow mode door.

Air Inlet Door Actuator

The air inlet door actuator contains a reversible electric motor and a potentiometer. The potentiometer allows the FCIM to monitor the position of the air inlet door. The FCIM may adjust the air inlet door depending on the humidity measured by the in-vehicle temperature and humidity sensor. If the vehicle cabin becomes too humid, and recirculated air is not selected, the FCIM adjusts the air inlet door to allow more fresh air. When the humidity level drops, it may adjust back to partial recirculated air. Additionally, when recirculated air is not selected, the FCIM may also adjust the system based on the in-vehicle and outside ambient temperatures to reduce loading on the compressor when required.

Driver Side Temperature Door Actuator

The driver side temperature door actuator contains a reversible electric motor and potentiometer. The potentiometer allows the FCIM to monitor the position of the temperature blend door.

Passenger Side Temperature Door Actuator

The passenger side temperature door actuator contains a reversible electric motor and potentiometer. The potentiometer allows the FCIM to monitor the position of the temperature blend door.

Air Conditioning (A/C) Pressure Transducer

The PCM monitors the discharge pressure measured by the A/C pressure transducer. As the refrigerant pressure changes, the resistance of the A/C pressure transducer changes. It is not necessary to recover the refrigerant before removing the A/C pressure transducer.

In-Vehicle Temperature And Humidity Sensor

The in-vehicle temperature and humidity sensor contains a thermistor and a sensing element which separately measures the in-vehicle air temperature and the humidity, then sends those readings to the FCIM. The in-vehicle temperature and humidity sensor has an electric fan within the sensor that draws in-vehicle air across the two sensing elements. The FCIM may adjust the air inlet door based on the in-vehicle temperature and humidity sensor information to maintain the desired humidity of the passenger cabin air.

Autolamp/Sunload Sensor

The autolamp/sunload sensor supplies information to the FCIM indicating the intensity of the sun on the vehicle. The FCIM compensates high sun load with higher blower and reduced discharge temperatures.

Evaporator Temperature Sensor

The evaporator temperature sensor contains a thermistor. The sensor varies its resistance with the temperature. As the temperature rises, the resistance falls. As the temperature falls, the resistance rises. The evaporator temperature sensor is an input to the FCIM and the information is relayed to the PCM over the CAN. If the evaporator temperature is below approximately 1 °C (33.8 °F), the PCM does not allow the A/C compressor to operate.

Air Discharge Temperature Sensors

There are 2 air discharge temperature sensors in the Dual Automatic Temperature Control (DATC) system:

- Center register air discharge temperature sensor
- Footwell air discharge temperature sensor

The air discharge temperature sensors contain a thermistor and are inputs to the FCIM. The sensors vary their resistance with the temperature. As the temperature rises, the resistance falls. As the temperature falls, the resistance rises. The FCIM uses the sensor information to maintain the desired temperature of the passenger cabin air.

Externally Controlled Variable Displacement A/C Compressor (2.3L)

> *NOTE: Proper Air Conditioning (A/C) system diagnosis on a vehicle's compressor is dependent on correct refrigerant system charge and tested in ambient temperatures above 21.1 °C (70 °F).*

The externally controlled variable displacement compressor has:

- a non-serviceable shaft seal.
- a serviceable pressure relief valve installed in the rear of the compressor to protect the refrigerant system against excessively high refrigerant pressures.
- a serviceable A/C clutch and field coil.
- Uses Motorcraft ® PAG Refrigerant Compressor Oil YN-12-D. This oil contains special additives required for the A/C compressor. The oil may have some slightly dark-colored streaks while maintaining normal oil viscosity. This is normal for this A/C compressor because of break-in wear that can discolor the oil.

Variable displacement compressors have a swash plate that rotates to reciprocate pistons, which compresses refrigerant. Variable displacement compressors change the swash plate angle to change the refrigerant displacement. The externally controlled variable displacement compressor changes the swash plate angle in accordance with an electrical signal from the PCM. Externally controlled variable displacement compressor manages displacement by controlling refrigerant differential pressure before and after a throttle at the discharge side; achieving precise cooling capability control in accordance with cabin environment and driving conditions.

The PCM sends a PWM signal to the solenoid in the compressor to control the compressor displacement based upon the:

- Evaporator temperature
- Ambient air temperature
- Engine RPM
- Vehicle speed
- A/C high side pressure
- Intake air temperature

Fixed Displacement A/C Compressor (3.7L, 5.0L and 5.2L)

> *NOTE: Proper Air Conditioning (A/C) system diagnosis on a vehicle's compressor is dependent on correct refrigerant system charge and tested in ambient temperatures above 21.1 °C (70 °F).*

The fixed displacement compressor has:

- a non-serviceable shaft seal.
- a serviceable pressure relief valve installed in the rear of the compressor to protect the refrigerant system against excessively high refrigerant pressures.
- a serviceable A/C clutch and field coil.
- Uses Motorcraft ® PAG Refrigerant Compressor Oil YN-12-D. This oil contains special additives required for the A/C compressor. The oil may have some slightly dark-colored streaks while maintaining normal oil viscosity. This is normal for this A/C compressor because of break-in wear that can discolor the oil.

Fixed displacement A/C compressors are always at 100% displacement. The pistons are placed around an angled plate (swash plate) and are pushed back and forth as the plate rotates. Cooling performance is controlled by switching the compressor clutch on or off depending upon the evaporator temperature.

Condenser

The A/C condenser is an aluminum fin-and-tube design heat exchanger. It cools compressed refrigerant gas by allowing air to pass over fins and tubes to extract heat, and condenses gas to liquid refrigerant as it is cooled. The receiver drier is mounted on the left side of the condenser.

Receiver Drier

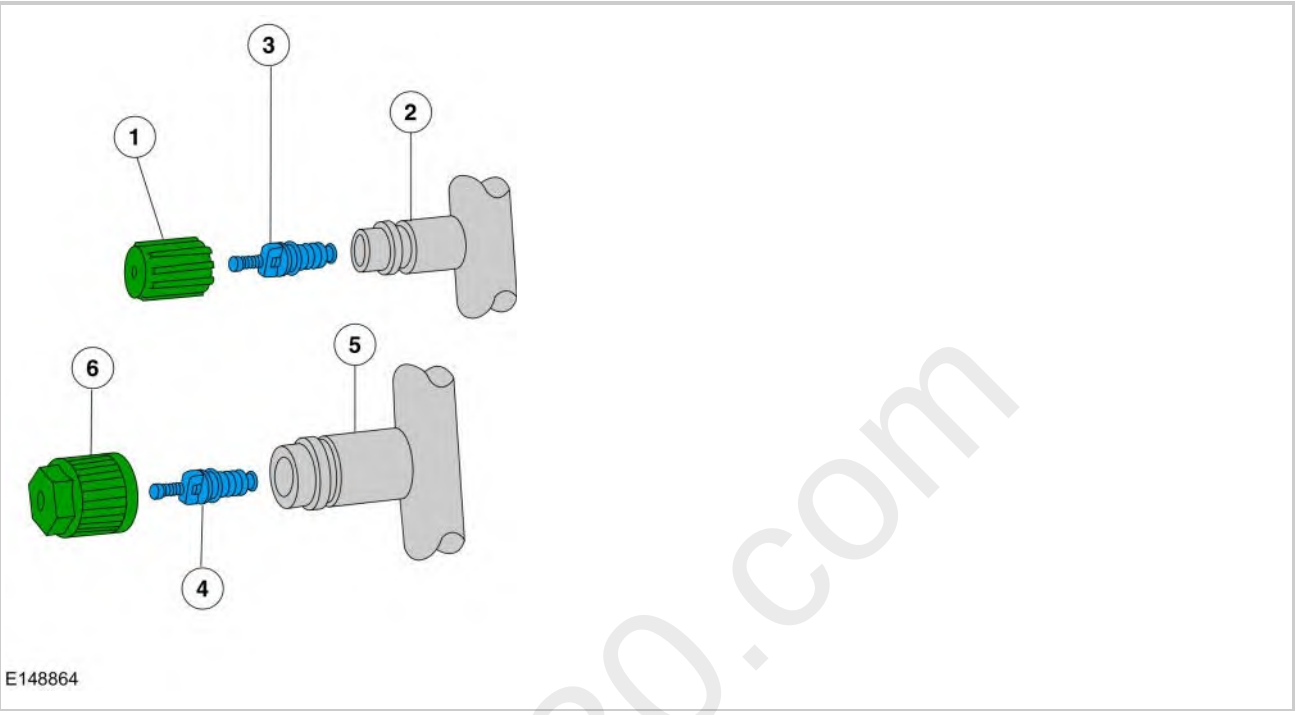
The receiver drier stores high-pressure liquid. The desiccant bag mounted inside the receiver drier removes any retained moisture from the refrigerant.

Thermostatic Expansion Valve (TXV)

The Thermostatic Expansion Valve (TXV) is located at the evaporator core inlet and outlet tubes at the center rear of the engine compartment. The TXV provides a restriction to the refrigerant flow and separates the low-pressure and high-pressure sides of the refrigerant system. Refrigerant entering and

exiting the evaporator core passes through the TXV through 2 separate flow paths. An internal temperature sensing bulb senses the temperature of the refrigerant flowing out of the evaporator core and adjusts an internal pin-type valve to meter the refrigerant flow into the evaporator core. The internal pin-type valve decreases the amount of refrigerant entering the evaporator core at lower temperatures and increases the amount of refrigerant entering the evaporator core at higher temperatures.

Service Gauge Port Valves



Item	Description	Torque
1	Low-pressure service gauge port valve cap	0.8 Nm (7 lb-in)
2	Low-pressure service gauge port valve	-
3	Low-pressure Schrader-type valve	2.26 Nm (20 lb-in)
4	High-pressure Schrader-type valve	3.4 Nm (30 lb-in)
5	High-pressure service gauge port valve	-
6	High-pressure service gauge port valve cap	0.8 Nm (7 lb-in)

The service gauge port fitting is an integral part of the refrigerant line or component.

- Prior to leak testing, blow air over the service gauge port valves to ensure an accurate test.
- Special couplings are required for both the high-side and low-side service gauge ports.
- A very small amount of leakage around the Schrader-type valve with the service gauge port valve cap removed is considered normal. Install a new Schrader-type valve core if the seal leaks excessively.