

Notice

This bulletin provides an overview of information and procedures pertaining to cold weather starting and lubrication specifications for the CAT C7 engine. It is by no means intended as a substitute for the information, data and procedures contained in the CAT or Blue Bird Operations or Maintenance Manuals. If questions arise regarding any procedures or information pertaining to the C7 engine, the OEM manuals should be consulted as the authoritative source of information.

Caterpillar C-7 Cold Weather Starting

Recently with the cold weather snap and new products in service with the Caterpillar C-7 engine we have had questions arise regarding start-ability in cold weather.

Blue Bird's "Service Update #S0307", which was written to address engine cold start procedures with the "Vision" is included in this article. Please note this should also apply to Blue Bird's A3FE & A3RE units using the CAT C-7 engine.

With references made to Caterpillar's "Operation and Maintenance Manual" we have included pages directly from that manual in this article for your reference.

Several questions have arisen as to the proper viscosity of oil used in the C-7 during the colder winter months and we have included those pages pertinent to oil viscosity and ambient temperature from the Caterpillar "Operation and Maintenance Manual" to this article. If you pay close attention to table #4, you may wish to use lighter viscosity oil during our winter months to decrease the effort needed to crank the engine over, but this is dependant on the ambient temperature in your particular region of the state.

If you do not have the ability to use block heaters nor have inside storage you may wish to consider an alternative method such as a pre-heater.

Charging Issues with the Added Electrical Draw of the “Air Intake Heater”

The other issue we have heard of is the added draw on the electrical system of approximately 90-100 amps created by the “Air Intake Heater”. Information on the “Air Intake Heater” from Caterpillar’s “ELECTRICAL & ELECTRONIC APPLICATION GUIDE” is included in this article. As you can see from the information, the “Air Intake Heater” is controlled by the ECM through the combined temperatures of the ambient air and coolant. What may often times occur is that the “Air Intake Heater” will cycle on once the unit is running as the air temperature across the sensor may cool and the coolant may also cool when the thermostat of the engine opens.

It is recommended that prior to starting all additional electrical components (lights, heaters, etc.) be shut off. Additional electrical components can be turned on and operated as normal after the unit has started and approximately 2 minutes after the “Wait to Start” light has gone out. This procedure will help to eliminate the increased electrical system draw created by having electrical accessories AND the “Air Intake Heater” operating concurrently.



SERVICE UPDATE S0307

DATE: DECEMBER 18, 2003
SUBJECT: ENGINE COLD START PROCEDURES
MODELS AFFECTED: BLUE BIRD "VISION" (BBCV)

The Blue Bird Vision with Caterpillar engine has a different engine starting procedure and may differ from what your customers are accustomed to. We recommend that Caterpillar engine starting procedures be followed to maximize engine starting performance.

The starting procedures can be found in both the Caterpillar Operation and Maintenance Manual and your Blue Bird Vision Operator's Manual. Attached is a copy of two pages from the Blue Bird Vision Operator's Manual section "Starting the Engine".

This procedure has been verified on buses in 15 degree F ambient temperature without the use of engine block heater. However, wherever possible, we recommend that the engine block heater be used when the temperature is 32 degrees F or below to reduce starting time.

Questions regarding engine starting procedures should be directed to your Blue Bird field service representative.

Blue Bird Corporation
Technical Publications
S0307

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Caution

Water is corrosive at engine operating temperatures. Never add plain water to the system.

When addition of coolant is necessary, a premixed solution is required; you may premix the solution from concentrate and distilled water, or you may purchase a pre-diluted solution. Either way, it must meet the certified parameters of EC-1 and ASTM 4985 or ASTM 5345. Caterpillar ELC™ is one such product.

Please refer to the appropriate Operator's Manual from the manufacturer of the engine in your bus for complete details concerning coolant requirements (i.e., Caterpillar publication number SEBU7011-11 for the Caterpillar 3126 engine or Caterpillar publication number SEBU7766 for the Caterpillar C-7 engine). The OEM documentation will always take precedence over this publication in the event of conflicting information.

Shutters

If your bus is equipped with radiator shutters, the purpose is to help control the engine operating temperature in extremely cold weather. The shutters are automatically controlled by the operating temperature of the engine, and are effective by controlling the amount of air flowing through the radiator cooling fins.

The shutters must be maintained and kept free of foreign material that would prevent them from operating. It is a good idea to inspect them for obstruction on a routine schedule, such as when checking the engine oil level. Remove any debris and, if necessary, seek technical assistance to determine whether the shutters operate properly.

Prior to Starting the Engine

For the most complete engine starting details, refer to the Operator's Handbook from the engine manufacturer. A copy of this manual is provided in the material shipped with your new Blue Bird Vision. The information and/or instructions in the manufacturer's handbook will take precedence over the limited information in this manual.

Your Blue Bird Vision may be equipped with an engine alarm system, designed to help prevent major damage due to high coolant temperature and/or low engine oil pressure. If so equipped, when the engine coolant temperature exceeds 210° F (99° C) and/or the engine lubricating oil pressure falls below 6 psig, an alarm will sound.

Caution

The engine must be shut down immediately when the alarm sounds to avoid costly engine damage.

Warning

Engine exhaust contains products of combustion that may be harmful to your health. Always start and operate the bus in a well-ventilated area. If the engine must be operated in an enclosed area, vent the exhaust to the outside.

Perform the required, daily, under-the-hood inspection and maintenance. Also perform any other periodic maintenance prior to starting the engine. This routine can help avoid costly major repairs later.

Caution

Engage parking brake for safety purposes.

1. Look for obvious oil leaks, coolant leaks, loose belts and trash build-up.
2. Remove trash build up and arrange for any necessary repairs as a result of your inspection.
3. Look for cracks in the coolant hoses that may not be leaking yet.
4. Look for cracks in the drive belts and check that they are tight enough to drive the accessories.
5. Check the wiring for loose connections and obvious breaks in the insulation or frayed wires.
6. Check the oil level.
7. Check the fuel supply. Drain water from the separator, if equipped. Ensure the fuel supply valve is open.
8. Check the coolant level.
9. Check the air intake service indicator.

Starting the Engine

Warning

Never use ether as an aid in trying to start the engine.

1. Engage the parking brake and place the transmission in neutral.
2. Turn the keyed ignition switch to the "ON" position.

Caution

Wait until the "Wait to Start" light is no longer illuminated before turning the ignition to the "Start" position.

3. Once the "Wait to Start" light is no longer illuminated, turn the key to "START", to crank the engine.

Note

If the engine does not start after 15 to 20 seconds of cranking, release the key start switch.

Note

The air inlet heater will turn on if the sum of the coolant temperature and the air inlet temperature is less than 109° F (25° C). The "Wait to Start" indicator time may vary somewhat depending upon the temperature. Colder temperatures may increase the time the "Wait to Start" indicator illuminates.

Caution

The switch should be held in the "Start" position for a maximum of 30 seconds. If the engine has not started in 30 seconds, the operator should not try to start the engine again for at least 2 minutes, in order to allow the starter (cranking motor) time to cool.

Note

If the ignition fails to make a connection, check the vandal lock(s) to ensure it/they is/are not engaged.

4. The "CHECK ENGINE" lamp will flash while the engine is cranking. This lamp will extinguish after the engine starts and achieves proper oil pressure.
- If the lamp fails to flash during cranking, have qualified service personnel correct the problem.
- If the lamp continues to flash after the engine is running, refer to qualified service personnel.

Note

The "AIR INLET HEATER" indicator lamp will flash for a minimum of 2 seconds, regardless of the coolant temperature. If the "AIR INLET HEATER" flashes for more than 2 seconds, wait until the lamp stops flashing before attempting to start the engine.

Caution

Do not engage the cranking motor when the flywheel is turning. Do not attempt to start the engine under load.

Caution

The oil pressure should rise within 15 seconds after the engine starts. Do not increase engine speed until the oil pressure gauge indicates normal. If oil pressure is not indicated on the gauge in 15 seconds, do not operate the bus. Stop the engine and refer to qualified service personnel.

5. Release the key switch and allow it to return to the "ON" (or run) position immediately after the engine starts. After the engine starts, ensure that the transmission is still in the neutral position. Once a normal engine oil pressure and air pressure are established, the vehicle may be operated at a light load and speed.
6. After the engine has started, the air inlet heater may continue to run in a "continuous" mode or intermittently. The air inlet heater will automatically turn off when the sum of the engine coolant temperature and the air inlet temperature exceeds 127° F (35° C).
7. If the engine is operated at a light load and low speed, it will reach normal operating temperature more quickly than if it idles at no load. When idling in cold weather, increase the engine idle speed to a maximum of 1200 revolutions per minute (RPM); this is the "HIGH IDLE" function. Do not exceed the no-load recommended RPM during the warm up process. Limit unnecessary idle time to 10 minutes.

High Idle Function

The high idle control positions the throttle at high idle. This allows the engine to warm up faster than at the normal low idle position. High idle is limited to 1000 to 1200 revolutions per minute (RPM) to avoid engine damage. High idle can be activated by a switch in the driver's area. With the transmission in the neutral position and the park brake set, move the toggle switch to the "HIGH IDLE" position to maintain a constant engine RPM above the normal idle speed.

Caution

Do not move the toggle switch to the high idle position unless the transmission is in Neutral and the park brake is engaged.

Starting Problems

For more detailed instructions, refer to the engine manufacturer's Operator's Manual or Handbook.

One or more of the following items may cause an occasional starting problem:

- Low battery charge.
- A malfunctioning cranking motor.
- Problems with the wiring harness or connections.
- A lack of fuel.

If the fuel system has been run dry, fill the fuel tank and prime the fuel system.

Transmission

Your Blue Bird Vision is fitted with an Allison™ 2000 series transmission. The shifter lever is mounted on the dash to the driver's right. Gear selection is straightforward; only brief instruction is required to master the shift possibilities on the Vision.

The information in this Operator's Manual is intended to assist the driver in selecting the proper gear for the circumstances. It is accurate to Blue Bird's knowledge, based upon the information available at the time of printing. However, you must remember, Allison has intimate knowledge of its product(s) and, for this reason, the appropriate Allison Operator's Manual will take precedence over this publication. Please refer to Allison publication number OM3063EN. (Please note that this publication number was valid at the time of this manual's publication, but may be subject to change. For clarification, please contact Allison Transmission.)

Warning

Each time you park the bus or leave the driver's seat while the engine is running:

Cold Weather Starting

Starting the engine and operation in cold weather is dependent on the type of fuel used, the oil viscosity, and other optional starting aids. For more information, refer to the Operation and Maintenance Manual, “Cold Weather Operation” topic (Operation Section).

Air Inlet Heater

DO NOT USE ETHER (starting fluids) unless specifically instructed to do so. If the engine is equipped with an Air Inlet Heater (electrically or fuel ignited manifold heater), DO NOT use ether (starting fluids) at any time. Their use could result in engine damage and/or personal injury.

Note: There will be an indicator lamp on the dashboard of the vehicle that is marked “AIR INLET HEATER”. For detailed information on the operation of the Air Inlet Heater, refer to System Operation, “Air Inlet and Exhaust”.

Use the following procedure in order to start the engine:

1. Engage the parking brake. Place the transmission in NEUTRAL. If the vehicle is equipped with a manual transmission, depress the clutch pedal to disengage the clutch. This reduces transmission drag and prevents movement of the vehicle. Depressing the clutch helps to reduce the battery drain. In cold weather, this can mean the difference between starting or not starting the engine. The “CHECK ENGINE/DIAGNOSTIC” lamp will flash while the engine is cranking. The lamp should turn off after proper engine oil pressure is achieved. If the lamp fails to flash, notify your authorized Caterpillar dealer. If the lamp continues to flash, the ECM has detected a problem in the system. Refer to the Operation and Maintenance Manual, “Engine Diagnostics” topic (Operation Section).
2. Turn the key switch to the ON position. The air inlet heater can preheat the system in order to improve cold weather starting.

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Engine Starting

Note: The “AIR INLET HEATER” indicator lamp will flash for a minimum of two seconds regardless of the coolant temperature. If the “AIR INLET HEATER” indicator lamp flashes for more than two seconds, wait until the indicator lamp stops flashing (approximately 30 seconds) before attempting to start the engine. If the indicator lamp continues to flash, the ECM will control the air inlet heater during a restart of the engine. Restarting the engine at this point can cause excessive white smoke.

Note: A buzz may be heard while the air inlet heater is engaged. This is the sound of the fuel injectors that are being exercised in preparation for starting.

NOTICE

Do not engage the starting motor when flywheel is turning. Do not start the engine under load. If the engine fails to start within 30 seconds, release the starter switch or button and wait two minutes to allow the starting motor to cool before attempting to start the engine again.

3. Turn the key switch to the START position in order to crank the engine. The air inlet heater will turn ON if the sum of the coolant temperature and the inlet air temperature is less than 25 °C (77 °F). ***Do not push the throttle or do not hold the throttle downward while the engine is cranked. The system will automatically provide the correct amount of fuel in order to start the engine.*** If the engine does not start after 15 to 20 seconds of cranking, release the key switch. If the sum of the coolant temperature and the inlet air temperature is less than 25 °C (77 °F), the preheat for the air inlet heater will restart. Turn the key switch to the OFF position. Allow the starting motor to cool for two minutes. Repeat Steps 2 and 3.

NOTICE

Oil pressure should rise within 15 seconds after the engine starts. Do not increase engine speed until the oil pressure gauge indicates normal. If oil pressure is not indicated on the gauge within 15 seconds, DO NOT operate the engine. STOP the engine, investigate and correct the cause.

4. Release the key switch to the ON or RUN position immediately after the engine starts. After the engine starts, check in order to ensure that the transmission is still in the NEUTRAL position and release the clutch pedal (manual transmission). Once a normal engine oil pressure and air pressure are reached, the vehicle may be operated at a light load and speed. After the engine has started, the air inlet heater may continue to operate in a “Continuous” mode and/or an “Intermittent” mode. The air inlet heater will turn OFF when the sum of the coolant temperature and the air inlet temperature exceeds 35 °C (95 °F). The engine will reach normal operating temperature sooner if it is operated with a low load rather than idling with no load. When the engine is idled in cold weather, increase the engine rpm to approximately 1000 to 1200 rpm. This will warm up the engine more quickly. Do not exceed the recommended rpm in order to increase the speed of the warm-up. Limit unnecessary idle time to ten minutes.

Starting Problems

An occasional starting problem may be caused by one of the following items:

- Low battery charge
- Lack of fuel
- Problem with the wiring harness

If the engine fuel system has been run dry, fill the fuel tank and prime the fuel system. Refer to the Operation and Maintenance Manual, “Fuel System - Prime” topic (Maintenance Section).

If the other problems are suspected, perform the appropriate procedure in order to start the engine.

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Lubricant Specifications

NOTICE

Operating Direct Injection (DI) diesel engines with fuel sulfur levels over 1.0 percent may require shortened oil change intervals in order to help maintain adequate wear protection.

Lubricant Viscosity Recommendations for Direct Injection (DI) Diesel Engines

The proper SAE viscosity grade of oil is determined by the minimum ambient temperature during cold engine start-up, and the maximum ambient temperature during engine operation.

Refer to Table 4 (minimum temperature) in order to determine the required oil viscosity for starting a cold engine.

Refer to Table 4 (maximum temperature) in order to select the oil viscosity for engine operation at the highest ambient temperature that is anticipated.

Note: Generally, use the highest oil viscosity that is available to meet the requirement for the temperature at start-up.

If ambient temperature conditions at engine start-up require the use of multigrade SAE 0W oil, SAE 0W-40 viscosity grade is preferred over SAE 0W-20 or SAE 0W-30.

Note: SAE 10W-30 is the preferred viscosity grade for the following diesel engines when the ambient temperature is above -18°C (0°F).

- C7
- C9
- 3116
- 3126

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Table 4

Engine Oil Viscosities for Ambient Temperatures (1)		
	Ambient Temperature	
Viscosity Grade	Minimum	Maximum
SAE 0W-20	-40 C (-40 F)	10 C (50 F)
SAE 0W-30	-40 C (-40 F)	30 C (86 F)
SAE 0W-40	-40 C (-40 F)	40 C (104 F)
SAE 5W-30	-30 C (-22 F)	30 C (86 F)
SAE 5W-40	-30 C (-22 F)	50 C (122 F)
SAE 10W-30(2)	-18 C (0 F)	40 C (104 F)
SAE 10W-40	-18 C (0 F)	50 C (122 F)
SAE 15W-40	-9.5 C (15 F)	50 C (122 F)

(1) Refer to this publication, “Engine Oil (Recommendations)” for recommendations of diesel engine oil type.

(2) SAE 10W-30 is the preferred viscosity grade for the 3116, 3126, C7, and C9 diesel engines when the ambient temperature is above -18°C (0°F).

Note: Supplemental heat is recommended below the minimum recommended ambient temperature.

Synthetic Base Stock Oils

SMCS Code: 1300; 1348; 7581

Synthetic base oils are acceptable for use in Caterpillar engines if these oils meet the performance requirements that are specified for the engine compartment.

Synthetic base oils generally perform better than conventional oils in the following two areas:

- Synthetic base oils have improved flow at low temperatures especially in arctic conditions.
- Synthetic base oils have improved oxidation stability especially at high operating temperatures.

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Lubricant Specifications

Some synthetic base oils have performance characteristics that enhance the service life of the oil. However, Caterpillar does not recommend the automatic extension of oil change intervals for any type of oil. Oil change intervals for Caterpillar engines can only be adjusted after an oil analysis program that contains the following tests: oil condition and wear metal analysis (Caterpillar's S-O-S oil analysis), trend analysis, fuel consumption, and oil consumption.

Re-refined Base Stock Oils

SMCS Code: 1300; 7581

Re-refined base stock oils are acceptable for use in Caterpillar engines if these oils meet the performance requirements that are specified by Caterpillar. Re-refined base stock oils can be used exclusively in finished oil or in a combination with new base stock oils. The US military specifications and the specifications of other heavy equipment manufacturers also allow the use of re-refined base stock oils that meet the same criteria. The process that is used to make re-refined base stock oil should adequately remove all wear metals that are in the used oil and all additives that are in the used oil. The process that is used to make re-refined base stock oil generally involves the processes of vacuum distillation and hydro treating the used oil. Filtering is inadequate for the production of high quality re-refined base stock oils from used oil.

Cold Weather Lubricants

SMCS Code: 1300; 1348; 7581

When an engine is started and an engine is operated in ambient temperatures below -20°C (-4°F), use multi grade oils that are capable of flowing in low temperatures. These oils have lubricant viscosity grades of SAE 0W or SAE 5W. When an engine is started and operated in ambient temperatures below -30°C (-22°F), use a synthetic base stock multi grade oil with a 0W viscosity grade or with a 5W viscosity grade. Use an oil with a pour point that is lower than -50°C (-58°F).

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Lubricant Specifications

The number of acceptable lubricants is limited in cold weather conditions. Caterpillar recommends the following lubricants for use in cold weather conditions:

First Choice – Use one of the following oils that is licensed by API: CI-4 and CH-4. Global DHD-1 is also acceptable. The lubricant viscosity grade must be one of the following grades: SAE 0W-20, SAE 0W-30, SAE 0W-40, SAE 5W-30, and SAE 5W-40.

Second Choice – Use a CG-4 oil that is licensed by the API. The lubricant viscosity grade should be one of the following grades: SAE 0W20, SAE 0W30, SAE 0W40, SAE 5W30, and SAE 5W40.

Aftermarket Oil Additives

SMCS Code: 1300; 1348; 7581

Caterpillar does not recommend the use of aftermarket additives in oil. It is not necessary to use aftermarket additives in order to achieve the engine's maximum service life or rated performance. Fully formulated, finished oils consist of base oils and of commercial additive packages. These additive packages are blended into the base oils at precise percentages in order to help provide finished oils with performance characteristics that meet industry standards. There are no industry

standard tests that evaluate the performance or the compatibility of aftermarket additives in finished oil. Aftermarket additives may not be compatible with the finished oil's additive package, which could lower the performance of the finished oil. The aftermarket additive could fail to mix with the finished oil. This could produce sludge in the crankcase. Caterpillar discourages the use of aftermarket additives in finished oils.

To achieve the best performance from a Caterpillar engine, conform to the following guidelines:

- Select the proper Caterpillar oil or commercial oil that meets the “EMA Recommended Guideline on Diesel Engine Oil” or the recommended API classification.
- See the appropriate “Lubricant Viscosities” table in order to find the correct oil viscosity grade for your engine.

11.0 Inlet Air Heater, Lamp and Relay Operation

The Inlet Air Heater (IAH) is used to improve cold start capability of the engine and to reduce white smoke. The ECM controls the Inlet Air Heater Grid and Inlet Air Heater Lamp through the Inlet Air Heater Relay. The heater and relay are installed on the engine at Caterpillar. The Inlet Air Heater operation is determined at three different times: Power Up/Preheat, Engine Cranking and Engine Running. This operation is based on measured engine temperatures and affected by operational conditions including vehicle speed and service brake pedal position. If there is an active vehicle speed sensor fault the ECM will assume that the vehicle speed is above 5 mph and will disable the Intake air Heater when the Service Brake is applied.

11.1 Inlet Air Heater Relay Electrical Specifications

The OEM is responsible for connecting the contact side of the Inlet air heater relay to battery voltage. Recommended circuit protection for this connection is 130 Amps with a circuit load of 100 Amps continuous. The Inlet Air Heater Relay has a maximum ‘On’ time of 7 minutes. Minimum required wire size is 4 AWG.

11.4 ECM Power Up and Preheat Cycle

If the SUM of the Coolant Temperature and Inlet Manifold Air Temperature is less than 136°F or 40°C and the engine is being operated below 5500 feet (1678 meters) of elevation, the ECM will turn the Inlet Air Heater relay output ON for 30 seconds as a preheat cycle. If the engine is being operated at elevations higher than 5500 feet (1678 meters) the sum of the Coolant Temperature and Inlet Manifold Air Temperature must only be less than 160°F or 53°C in order to compensate for the extreme altitude operation.

NOTE: DO NOT convert the sum of the temperatures!!! The temperatures MUST be converted before summing!

The ECM adds Coolant Temperature and Inlet Manifold Air Temperature as measured in centigrade. In order to get the correct conversion of the summed value in Fahrenheit, each temperature must first be converted to Fahrenheit and then added together as follows:

$$([\text{Coolant Temperature } ^\circ\text{C}] \times 1.8 + 32) + ([\text{Inlet Manifold Air Temperature } ^\circ\text{C}] \times 1.8 + 32) = \text{sum in Fahrenheit.}$$

The Heater and Heater Lamp will turn ON, and then turn OFF when the cycle is complete. If the operator attempts to start the engine before the 30 second preheat cycle ends, the ECM will continue to control the Heater during engine cranking.

11.5 Engine Cranking Cycle

When the engine is cranking, the Heater will turn ON if the SUM of the Coolant Temperature and Inlet Manifold Air Temperature is less than 136°F or 40°C at elevations below 5500 feet (1678 meters), and stay ON while cranking. If the engine fails to start the Heater will activate for 30 seconds (preheat cycle is restarted). At elevations above 5500 feet (1678 meters) the SUM of the Coolant Temperature and Inlet Manifold Air Temperature must only be less than 160°F or 53°C in order to compensate for the extreme altitude operation.

11.6 Engine Running Cycle

After the engine has started, the Inlet Air Heater operation is determined by the same combination of both the Inlet Manifold Air Temperature and Coolant Temperature. The Engine Running Cycle has two segments, a continuous mode followed by an On/Off cycling mode. The Continuous ON mode lasts for a maximum of seven minutes. The On/Off cycle mode can last for a maximum of 13 minutes. During the On/Off cycle mode, the Heater is cycled ON and OFF for ten seconds. The Inlet Air Heater will turn OFF anytime the SUM of the Inlet Manifold Air Temperature and Coolant Temperature exceeds 126°F or 40°C if the engine is being operated below 5500 feet (1678 meters) of elevation. If the engine is being operated at elevations higher than 5500 feet (1678 meters), the Heater will turn OFF anytime the SUM of the Inlet Manifold Air Temperature and Coolant Temperature exceeds 178°F or 63°C.

11.7 IAH and Active Engine Diagnostics

Whenever there is an Active Open or Short Circuit Diagnostic Code for the Coolant Temperature Sensor, the Heater will activate if the Inlet Manifold Air Temperature is less than 50°F (10°C). For an Active Inlet Manifold Air Temperature Sensor Diagnostic, the Heater will activate if Coolant Temperature is less than 104°F (40°C).

2.8 IAH and Starting Aid Interaction

At key switch On, the Inlet Air Heater will not be activated if the Starting Aid Output is programmed to Automatic and the inlet air temperature is below 0 Deg C. The Inlet Air Heater will not be activated if the Starting Aid circuit is activated. When the Starting Aid Output is programmed to Automatic, the Inlet Air Heater will not be activated until the engine is running and the starting Aid output has been turned off for 5 seconds.