

## Overview

The cooling system on the Blue Bird Vision is designed to maintain the temperature of the engine within the optimum operating range, throughout the conditions for which the vehicle is intended to function.

The down-flow radiator and transmission fluid cooler are fabricated together. The engine coolant and transmission fluid radiator is assembled to the Charge Air cooler prior to installation in the chassis. The radiator is mounted at the front of the vehicle, behind the first cross-member and between the frame rails.

A 9-blade, 24 inch diameter nylon fan assists by pulling ambient air over the radiator. The operation of the fan is controlled by signals from the engine Electronic Control Module (ECM), through the Multiplex System. Control of the fan is limited to "Fully-On" or "Fully-Off" by an electromagnetic clutch arrangement.

Power to drive the fan is supplied by a polly vee fan belt, driven directly by the engine. An automatic belt tensioner helps to keep the drive belt at the proper tension for maximum drive function and service life.

The water pump provides coolant flow within the cooling system, at a level sufficient to maintain pressure of less than 10 psi. Circulation of the coolant liquid is critical to maintaining proper operating temperature. Coolant absorbs heat generated by the combustion action of the engine and by friction generated by the moving parts. The heated coolant circulates through a system of pipes and hoses to the radiator, where heat is transferred to the atmosphere by the ambient air flowing over fins in the radiator.

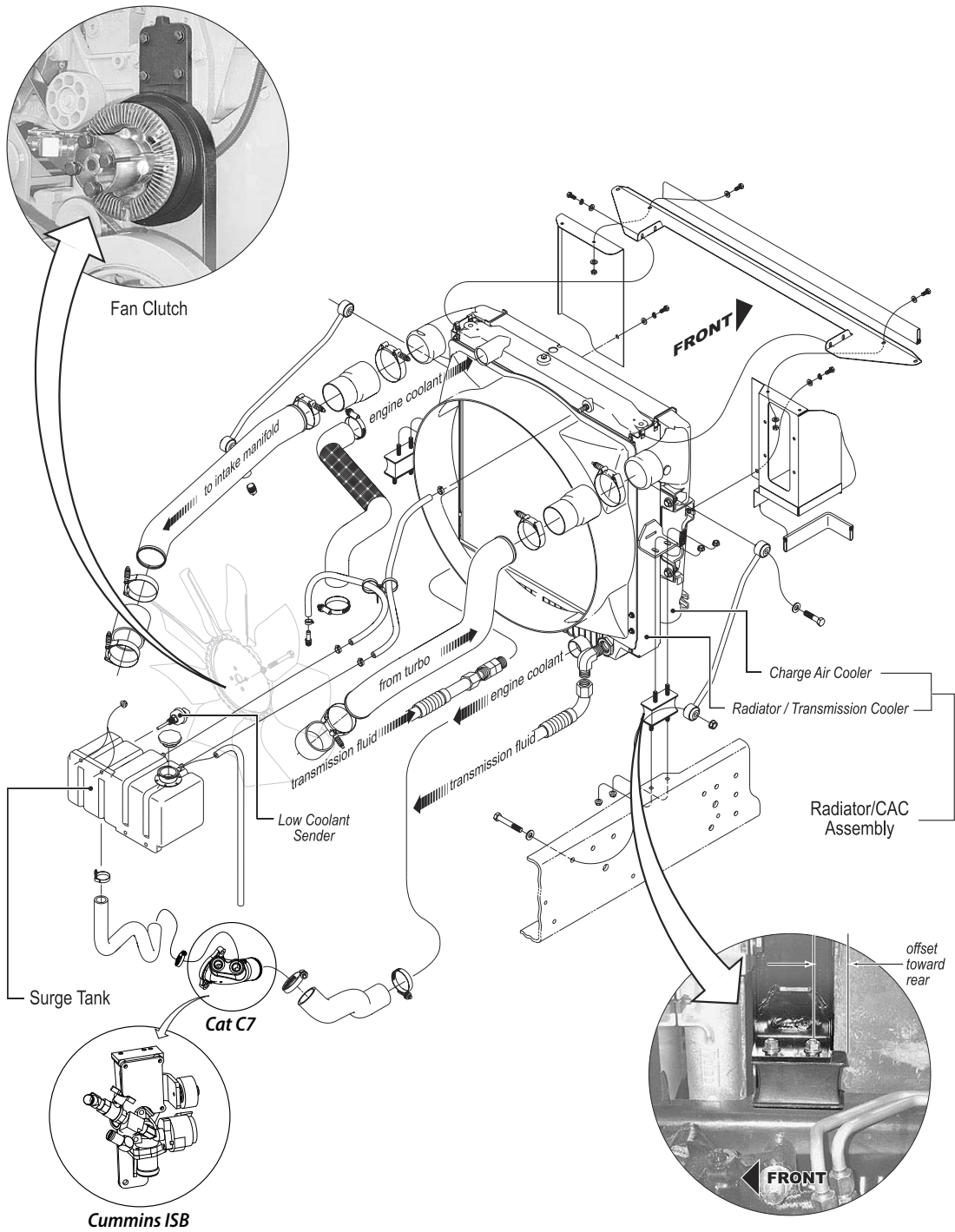
When excessively high operating temperature is observed, first check for proper fluid level in the coolant reservoir or "surge tank". If the fluid level is low and cannot be maintained without constant refill, inspect for leaks at pipe and hose connections. Also look for damaged hoses due to heat or chaffing from incorrect routing. During cold weather, the coach heater system may also be an area of leaks.

Debris accumulation in the radiator fins or bent fins restricting airflow may also cause overheating.

The three main symptoms of trouble in the cooling system are overheating, overcooling, and loss of coolant. A cooling system should first be diagnosed by a thorough visual inspection. If this reveals no useful information, tools and test equipment will be needed to proceed.

In the case of overheating, the next step is to verify the proper operation of the thermostats. Refer to the appropriate Caterpillar publication for instructions regarding the removal and testing of the thermostats.

**WARNING** *The engine, coolant, and transmission fluid may be very hot (possibly above the boiling point at atmospheric pressure). Use caution when working with these components. Allow the system to cool to the point where you can comfortably lay your hand on the engine block and radiator before working on it. Refer to the Introduction section of this manual for advice on the environmental considerations required when working with these materials.*



**Cooling System** Major Components



## Coolant

On 2008 buses Blue Bird has implemented new engine coolants for all buses built upon Blue Bird built chassis. These include A3FE (All American Forward Engine), A3RE (All American Rear Engine), BBCV (Vision), and BCCV (EC-72).

This change results in one coolant (John Deere Cool-Gard 50/50 premix) installed across all the above listed products as standard equipment.

## Standard Equipment Coolant

John Deere Cool-Gard 50/50 premix (green in color) is installed as standard equipment across all the above listed bus products powered by Caterpillar, Cummins, or John Deere engines.

This coolant meets John Deere's specifications and requirements for extended-life coolant. It is to be considered standard-life coolant when installed in Caterpillar or Cummins engines.

## Optional Extended Life Coolant

Two optional coolants are offered as extended-life coolants for the above listed bus models when not powered by John Deere engines.

### Extended Life Coolant for Caterpillar Engines

Caterpillar ELC 50/50 premix (red in color) is installed in the above listed bus products equipped with Caterpillar engines when purchased with an option for extended-life coolant.

### Extended Life Coolant for Cummins Engines

Fleetguard ES Optimax 60/40 premix (red in color) is installed in the above listed bus products equipped with Cummins engines when purchased with an option for extended-life coolant.

## Coolant Filter

On all of the above-listed bus models equipped with an optional coolant filter, the same Wix replacement filter element cartridge is used:

*BLUE BIRD PART NUMBER: 0064641*

*WIX PART NUMBER: 24070*

The coolant filter should be replaced every 6 months or 6,000 miles, whichever occurs first.

## Coolant Decals

On all of the above-listed bus models, Blue Bird installs a decal stating:

- The type of coolant installed at the factory.
- The coolant manufacturer's part number for one gallon quantity, suitable for regular top-off and refill.
- The coolant manufacturer's part number for one gallon quantity of the concentrate version of the installed coolant, suitable for formulating stronger glycol mixture ratio.

Blue Bird also installs a second decal containing radiator warnings. Both decals are mounted near the coolant fill neck.

## Coolant Maintenance

Blue Bird advises strictly abiding by the following policy for all coolant maintenance for the life of the vehicle.

### Never Mix Coolant Types

Routine coolant addition (top-off) must match the installed coolant type and brand. Do not mix coolants of different colors, types, or brands in the same engine.

### Strictly Follow The Engine Manufacturer's Specifications

Each engine manufacturer publishes its own specific requirements for testing and maintaining coolant in their respective engines. Blue Bird recommends strictly abiding by the engine manufacturer's testing and maintenance schedules and draining, flushing, refilling procedures to maintain compliance with the engine warranty requirements. Blue Bird recommends that you maintain accurate vehicle-specific service records of all coolant system maintenance procedures performed.

For Caterpillar or Cummins engines equipped with John Deere Cool-Gard coolant, follow the engine manufacturer's maintenance schedules for standard-life coolant, not for extended-life coolant.

For Caterpillar engines using Caterpillar ELC extended life coolant, perform testing at a qualified coolant laboratory per the Caterpillar Operation and Maintenance Manual. Label sample as Extended-Life coolant.

For Cummins engines using Fleetguard ES Optimax extended-life coolant, send coolant samples to Fleetguard for Monitor C testing, as specified in the Cummins Operator's Manual. Label sample as Extended-Life coolant.

For Caterpillar, Cummins, or John Deere engines using John Deere Cool-Gard coolant, send coolant samples to a John Deere lab for Cool Scan testing; or test manually using a John Deere Three-Way test strip, supplied in John Deere 3-Way Heavy Duty Coolant Test Kit TY6175.

### Always Mix Concentrate With Premix Coolant, Not Water

If concentrated coolant is added in order to raise the glycol ratio, use only the concentrate version of the same premix coolant type and brand as installed. Do not mix the concentrate with water. Instead, mix the concentrate with the premix version of the same coolant.

### Only Add Tap Water In Emergency Situations

A regularly-scheduled bus inspection and maintenance program should be followed to prevent coolant losses due to damaged or worn hoses, loose clamps, etc.

If coolant is lost while the bus is in use, and roadside emergency measures are called for, replenish the coolant with the same premix type and brand if possible. If the proper coolant is not available, and water must be used, use only de-ionized water if possible. Ordinary tap water should only be used if proper coolant or de-ionized water are not available.

Whenever tap water alone has been added, the bus should be taken to a service facility and the entire cooling system should be completely drained, flushed, and refilled with premix coolant.

### Heater Cut Off Valves

The Blue Bird Vision is equipped with two cutoff valves which can be used to isolate the heaters portion of the coolant circuit from the engine portion. These valves may be used to minimize spillage when performing maintenance tasks between coolant changes, such as replacing a damaged coolant hose. Both valves must be open when bleeding air from the heater circuit.

*Heater Cut Offs*



*Lower right side of engine*



*Top right side of engine*

### John Deere Cool-Gard

*Green in color. Standard equipment coolant in all A3FE, A3RE, BBCV, BCCV.  
Qualifies as extended-life coolant in John Deere engines.  
Considered standard-life coolant in Caterpillar and Cummins engines.  
Concentrate version may be mixed with the pre-mix version to lower freezing point.*

50/50 Premix	BLUE BIRD NUMBER	JOHN DEERE NUMBER
1 Gallon Container	0109179	TY25081
2 1/2 Gallon Container		TY16036
55 Gallon Drum		TY16037
330 Gallon Tote		TY24504
<b>Concentrate</b>		
1 Gallon Container		TY16034

### Caterpillar ELC

*Red in color. Optional coolant in A3FE, A3RE, BBCV, BCCV with Caterpillar engines.  
Qualifies as extended-life coolant in Caterpillar engines.  
Blue Bird installs 50/50 premix, which is available in one gallon and larger (listed) containers.  
The 50/50 premix may be mixed with the concentrate version per Caterpillar's instructions to achieve 60/40 ratio.  
Concentrate version may be mixed with the pre-mix version to lower freezing point.*

50/50 Premix	BLUE BIRD NUMBER	CATERPILLAR NUMBER
1 Gallon Container		101-2844
Case of six 1 Gallon Containers	0113986	
55 Gallon Drum		101-2845
275 Gallon Tote		222-1534
<b>Concentrate</b>		
1 Gallon Container	0113987	119-9150

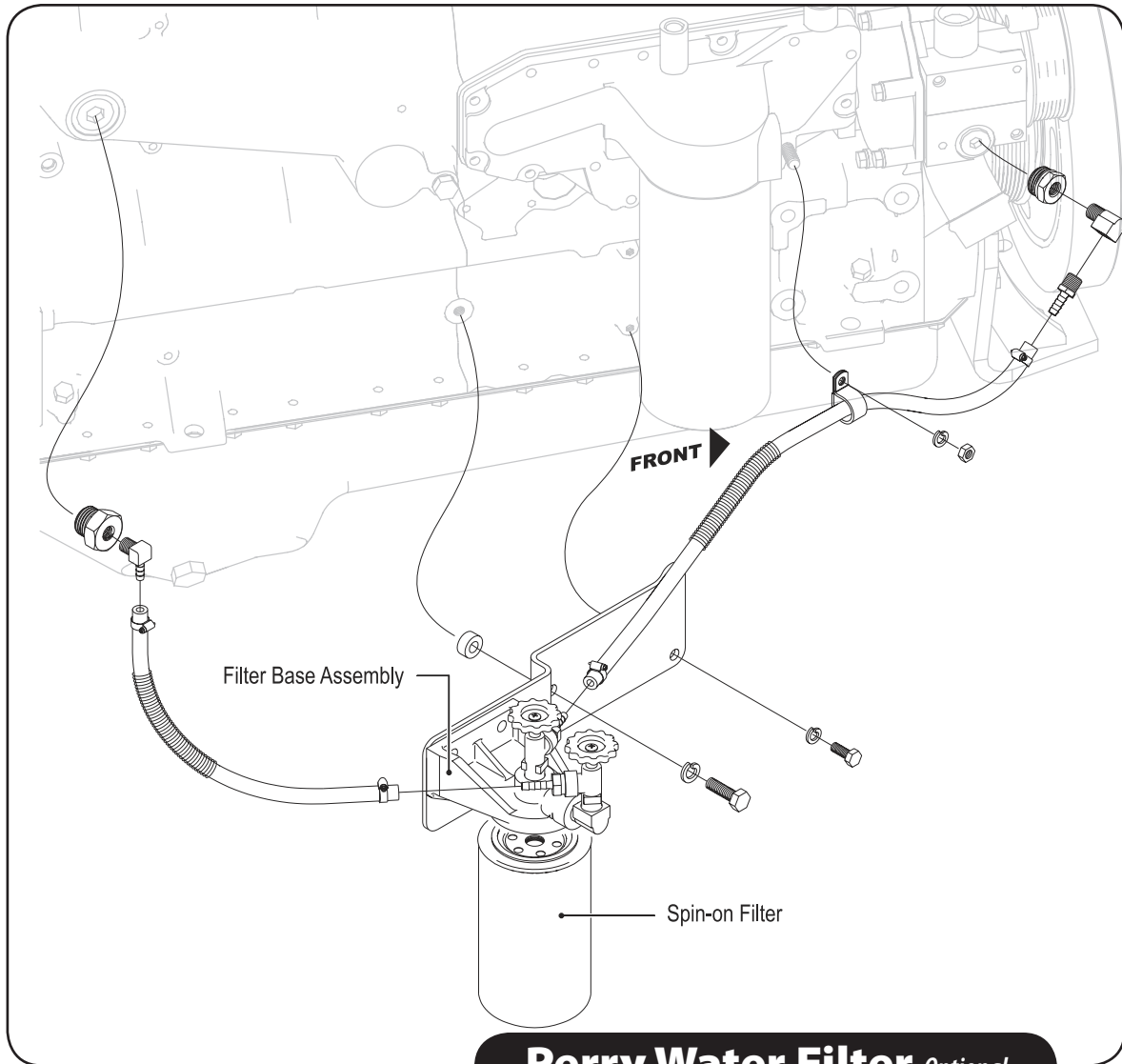
### Fleetguard ES Optimax

*Red in color. Optional coolant in A3FE, A3RE, BBCV, BCCV with Cummins engines.  
Qualifies as extended-life coolant in Cummins engines.  
Blue Bird installs 60/40 premix, which is not available in one gallon containers, but is available in larger containers (listed).  
The 50/50 premix may be mixed with the concentrate version per Fleetguard's instructions to achieve 60/40 ratio.  
Concentrate version may be mixed with the pre-mix version to lower freezing point.*

50/50 Premix	BLUE BIRD NUMBER	FLEETGUARD NUMBER
1 Gallon Container	0109178	CC2785/2785X
<b>60/40 Premix</b>		
55 Gallon Drum		CC2770/2770X
275 Gallon Tote		CC2790/2790X
<b>Concentrate</b>		
1 Gallon Container	0109552	CC2780/2780X

## Coolant Filter

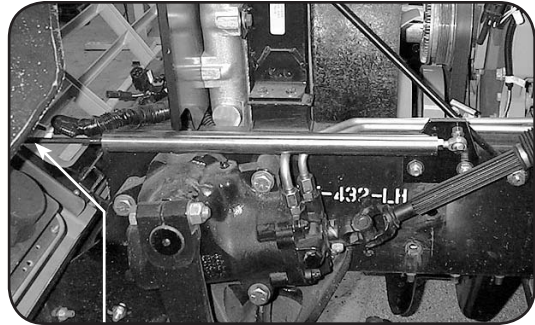
If the unit under repair is equipped with a water filter, the paper cartridge must be replaced at 1,000 hour/6 month intervals. Use Wix p/n 24070 or equivalent. Do not use filter cartridges with Supplemental Cooling Additives (SCAs).



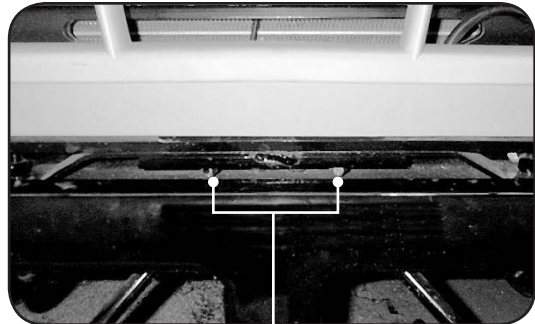
## Radiator

### Removal

1. Disconnect the headlight wiring harnesses.
  2. Remove the gas springs from each side of the hood.
  3. Remove 2 bolts at the center of the hood, just above the bumper. (Remove the holding bracket, hinges and hood as an assembly.)
  4. Remove the drain plug from the transmission to drain the fluid into a suitable container.
  5. Remove the transmission cooler hoses at the transmission to drain the fluid into a suitable container, observing all applicable local, state and federal laws concerning disposal of hazardous fluids. If the adapter fittings are removed from the bottom of the radiator, mark the orientation to aid at assembly.
  6. Remove the transmission cooler hoses from the radiator.
  7. Using the petcock at the lower left-hand (driver's) side of the radiator, drain the engine and radiator of coolant into a suitable container.
  8. Remove the 4 nuts and bolts from the engine air intake grille.
  9. Remove the air intake piping completely or ensure that it is secured out of the way.
- CAUTION** Cover all openings in the engine, transmission, and radiator as they are opened. Plug all removed tubing, hoses and piping to prevent contamination.
10. After removing all the hoses and piping, remove 2 capscrews from each corner of the fan shroud assembly.
  11. Pull the shroud as far rearward (over the fan) as possible. Allow the shroud to hang over the fan blades. If the vehicle is equipped with shutters, see the instructions for their removal below.
  12. Remove the capscrew from each side of the radiator.



Disconnect front ends of gas springs.



Hinge mount bolts



13. Remove and discard the locknut at each support assembly, where it attaches to the frame rail. Store the support out of the way.
14. Remove and discard 2 locknuts from the isolator at each side of the radiator.
15. Carefully lift the radiator clear of the frame rails. Ensure the fins on the radiator and charge air are protected.

### Reinstallation

Both baffles must be in position and their respective seals in place for the cooling system to perform correctly.

When installing the radiator isolators, exercise care to orient the 20 mm edge distance toward the front of the bus. If the 35 mm edge is installed toward the front, there will not be space for the fan shroud and shutters.

When installing the fan, use 4 new split-ring lock washers. Torque the capscrews to 33–58 ft. lbs. (44.74–78.64 Nm). Ensure the fan blades are oriented to produce air flow through the radiator and toward the engine when rotated counter clockwise.

1. Position the fan shroud over the fan as far as possible.
2. Centering the assembly, carefully position the radiator onto the isolators at each frame rail. Torque new locknuts to 29–33 ft lb (39.32–44.74 Nm), at 4 places.
3. Position and install the radiator braces (14). Torque all 4 fasteners to 70–80 ft lb (94.91–108.47 Nm). Use new Grade 8 locknuts at the frame rail.
4. Position and install the transmission fluid cooler hoses to the bottom of the radiator. Ensure the hoses are in the proper position. The left (driver's) side transmission hose connects to the driver's side of the radiator. Ensure that the protective loom is installed on the transmission lines. The threads in the bottom of the radiator are National Pipe Threads (NPT). These threads require the application of Loctite 557™ pipe sealant with Teflon™. Follow the directions and warnings on the package. Start the fitting 1 thread into the proper location, and then apply the sealant. Torque to 70–77 ft lb (94.91–104.40 Nm).
5. Install the transmission drain plug. Torque to 22–30 ft lb (30–40 Nm).
6. If so equipped, position the shutter assembly onto the radiator.
7. Position the shroud onto the radiator and shutter assembly.
8. Loosely install 2 capscrews at each corner.

9. Turn the fan blades by hand. Ensure that the blades are centered in the shroud and do not touch at any point.
10. When the fan blades are centered in the shroud, torque the 8 fasteners to 30–38 ft lb (40.67–51.52 Nm).
11. Install the bottom coolant hose. Torque clamps to 5 ft lb (6.8 Nm).
12. Install the upper coolant hose; torque the clamp to 5 ft lb (6.78 Nm). Ensure the protective loom is installed on the top radiator hose.
13. Route the intake charge air tube over the radiator hose and install to charge air cooler. Torque clamp to 5 ft lb (6.78 Nm).
14. Install the charge air tube from the turbo outlet to the curb side charge air cooler fitting. Torque the clamps to 5 ft lb (6.8 Nm).
15. It is important that the baffles and their seals are properly positioned. Torque fasteners to 5–6 ft lb (6.78–8.13 Nm).
16. Install the hood in the reverse order of its removal. Torque the hinge fasteners to 25–37 ft lb (33.90–50.17 Nm).
17. Torque the gas assist spring fasteners to 16–18 ft. lbs. (21.69–24.40 Nm).

## Fan Clutch

The cooling fan is not mounted to an engine shaft, but to a Horton magnetic fan clutch which engages only when the Vision's Multiplex system provides it 12 volt current. The outer housing of the clutch assembly is driven by the fan belt and therefore rotates whenever the engine is running. When the stator coil inside the fan clutch assembly becomes energized by 12 volt DC from the Multiplex system, the clutch engages the rotating outer housing with the inner hub to which the fan blade is mounted.

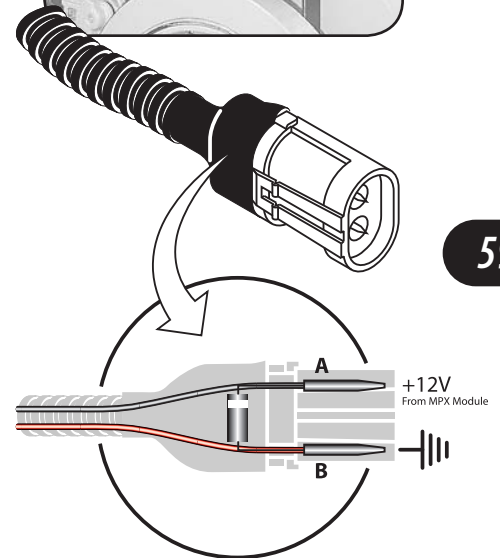
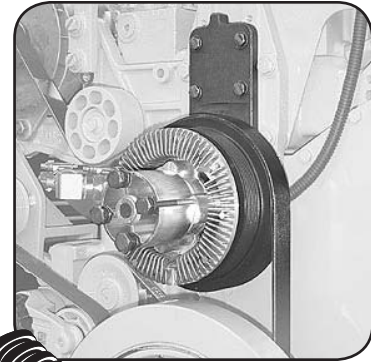
The engine ECM monitors engine temperature and provides a Cooling Fan Disable signal as an Active Input to the Multiplex system's central component, the MPX Module. When engine temperature is high enough to require additional cooling, the ECU stops the Input signal (the Input becomes Inactive). The absence of this signal is one of two conditions (the other being an Active Ignition Switch Input) which the logic of the MPX Module requires in order for it to provide an Active Fan Control Power Output (12 DC).

When the fan clutch is de-energized, the collapsing magnetic field momentarily induces a current with reversed polarity in the stator. The electrical connector of the fan clutch contains a diode which provides the induced current a low-resistance path to ground, to protect other circuits from being affected.

## Troubleshooting

Because the fan clutch circuit is part of the Multiplex System, the first step in investigating an inoperative fan is to perform Multiplex diagnostics.

1. Refer to the Multiplex Output Table to find out which Port/Pin (B2-03) and which Output LED (B2-002) pertain to the Fan Control Power Output. The chart also shows which Ladder Logic Line (#11) describes the logic of the circuit.
2. Use the Diagnostic Switch to cycle the MPX Module to the appropriate Diagnostic Mode (Showing B2 Outputs). Check the LED to see if it is Active. If the Output LED is Inactive, refer to the Ladder Logic line to systematically verify that each requirement for an Active Output is true. (See the Multiplex chapter for information on how to troubleshoot a Multiplex circuit.) If the Output is Active, but the fan clutch is not engaged, verify the 12 V Output at Pin B2-03 on the MPX Module, and/or at the fan clutch harness connector.
3. If, the fan clutch fails to engage after having determined it is receiving 12 volt power, replace the fan clutch.



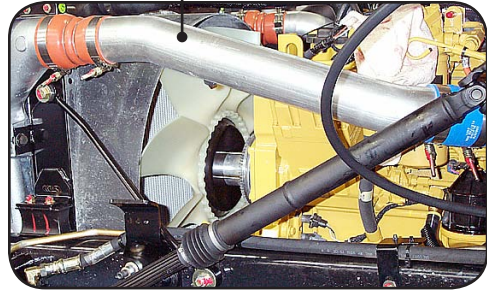
*A diode installed inside the fan clutch's connector plug provides induced current a low-resistance path to ground to prevent other circuits being affected by the momentary current induced when the fan clutch is de-energized.*

**Removal**

The fan clutch is assembled to a mounting bracket which bolts to the front of the engine. The fan clutch can usually be removed with the fan still attached, by removal of the Charged Air Intake tube on the left side of the engine compartment and unbolting the fan clutch mounting bracket from the engine. This avoids having to drain coolant and remove the radiator and/or remove the radiator shroud in order to service the fan clutch.

1. Loosen the clamps at each end of the Charge Air Intake Tube and remove the Charge Air Intake Tube. Cover the open ends to prevent contamination.
2. Insert a 1/2-inch socket drive handle into the square socket of the idler pulley arm. Lift upward to release tension from the fan belt. Slide the fan belt off of the fan clutch pulley.
3. Remove the four bolts which mount the fan clutch bracket to the engine.
4. Carefully maneuver the fan, with clutch and bracket attached, outward toward the driver's side of the engine compartment.
5. To remove the fan from the clutch assembly, acquire assistance in holding the fan at several places while removing the four bolts which fasten it to the inner hub. To avoid damage to the fan, do not rely upon pressure against only one fan blade.
6. To remove the fan clutch from its mounting bracket, secure the bracket in a bench vise. Insert a 1/2 inch socket drive extension into the square socket of the journal shaft in the center of the clutch hub and turn counter clockwise.

*On most units, removing the Charge Air Intake Tube provides clearance for removal of the fan & fan clutch as a unit.*



*Turning the tensioner to allow belt removal.*



## Reinstallation

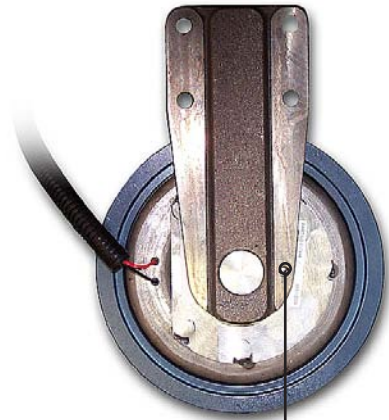
Reinstall in reverse order of the removal procedure, observing these requirements:

1. If the fan clutch assembly has been removed from the mounting bracket, be sure to align the anti-rotation boss on the mounting side of the fan clutch with the hole on the bracket:
2. Use these torque values when reassembling:

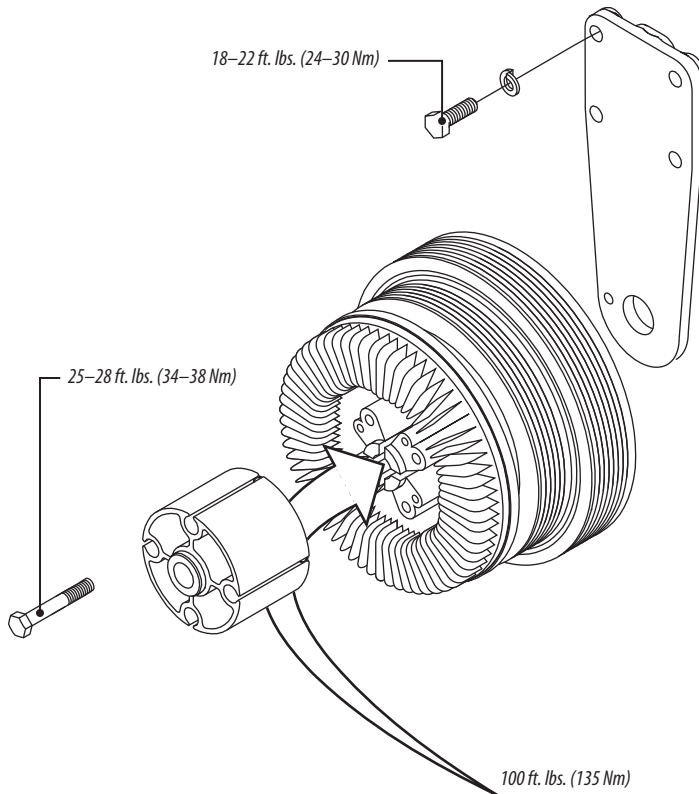
**Journal Shaft to mounting bracket:** 100 ft. lbs. (135 Nm.)

**Fan mounting bolts to clutch hub:** 25-28 ft. lbs. (34-38 Nm.)

**Mounting bracket bolts to engine:** 18-22 ft. lbs. (24-30 Nm.)



*Be sure the anti-rotation boss aligns with the hole in the mounting bracket.*



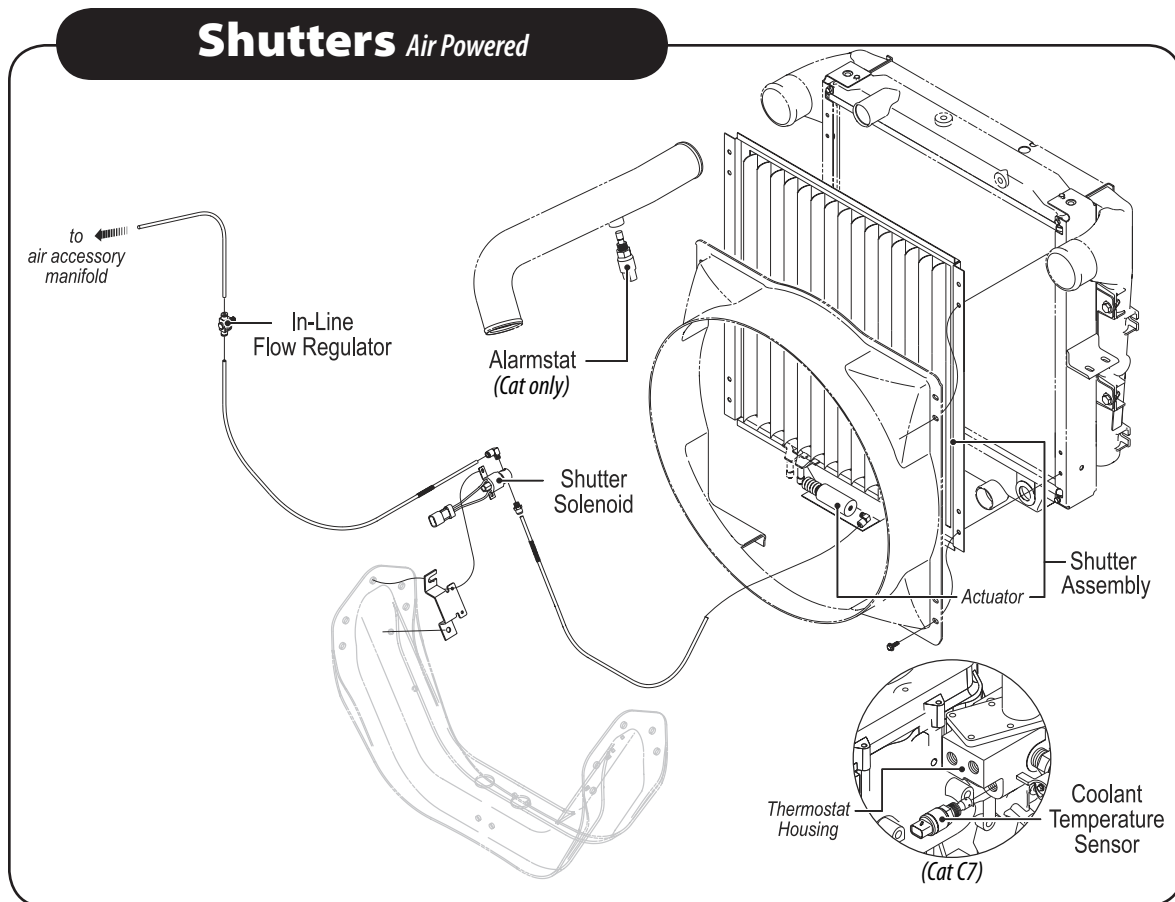
## Shutters

Your Blue Bird Vision may be equipped with a shutter system to help with temperature control in colder climates. The shutters are spring-loaded and are normally open. When the operating temperature of the engine falls below the recommended range, the shutters close to prevent air flow through the fins of the radiator. Shutters may be hydraulically operated or pneumatically operated.

The shutter system requires little maintenance, but should be lubricated and checked routinely for smooth operation. If debris or corrosion is allowed to collect in the mechanism, it can bind or jam the shutters, preventing them from opening, and leading to engine overheating.

The shutter assembly is installed between the radiator and the shroud and the 8 bolts that attach the shroud fasten it. The actuator assembly is located at the bottom center of the shutter assembly and is controlled by a valve located on the frame rail inside the front deep-U cross member. This valve is controlled by 185° Alarmstat controls located in the Charge Air (CA) pipe, between the CA cooler and the engine intake, and in the thermostat housing on the engine. There is no practical method to check the operation of the Alarmstats. If they are suspected of malfunctioning, substitution is the method of testing.

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## Removal

1. Remove the actuator supply tube from the shutter actuator.
2. If necessary, remove the top radiator hose.
3. Remove the 2 capscrews from each corner of the shroud/shutters assembly.
4. Carefully lift the shutters assembly from the unit.

Shutter installation is accomplished in the reverse order of the removal instructions.

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