SECTION 05: COOLING SYSTEM

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1. COOLING SYSTEM

1.1 Description

A radiator and thermo-modulated fan are used to effectively dissipate the heat generated by the engine.
A centrifugal-type water pump is used to circulate the engine coolant (Fig.1).

Two full blocking-type thermostats are used in the water outlet passage to control the flow of coolant, providing fast engine warm-up and regulating coolant temperature.

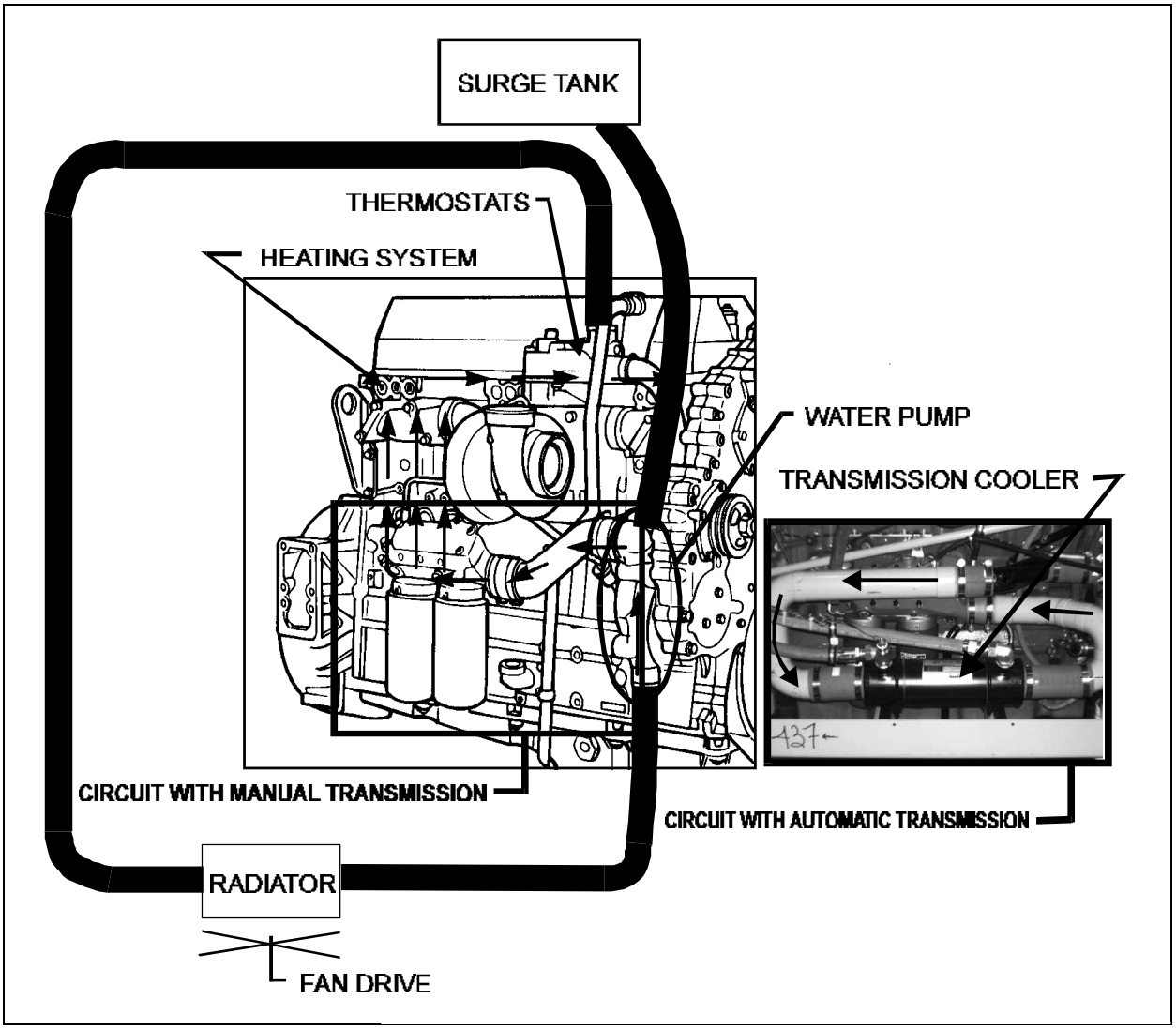


FIGURE 1: COOLING SYSTEM 05023

The engine coolant is drawn from the lower portion of the radiator by the water pump and is forced through the oil cooler and into the cylinder block. For vehicles with automatic transmissions the coolant circulates in the transmission cooler before going through the oil cooler and the cylinder block.

From the cylinder block, the coolant passes up through the cylinder head when the engine is at normal operating temperature, through the thermostat housing and into the upper portion of the radiator. Then the coolant passes through a series of tubes where the coolant temperature is lowered by air streams created by the revolving fan and the motion of the vehicle.

Upon starting a cold engine, or when the coolant is below operating temperature, the closed thermostats direct coolant flow from the thermostat housing through the by-pass tube to the water pump. Coolant is recirculated through the engine to aid engine warm-up. When the thermostat opening temperature is reached, coolant flow is divided between the radiator inlet and the by-pass tube. When the thermostats are completely open, all of the coolant flow is to the radiator inlet.

The cooling system is filled through a filler cap on the surge tank (Fig. 2). A pressure cap at right of surge tank is used to maintain pressure within the system. When the system exceeds normal pressure rating (14 psi - 96.53 kPa), the cap releases air and if necessary , coolant through the overflow tube. Two thermostats are located in the housings attached to the right side of the cylinder head.

A water temperature sensor mounted on the cylinder head (radiator side) is also supplied for engine protection purposes.

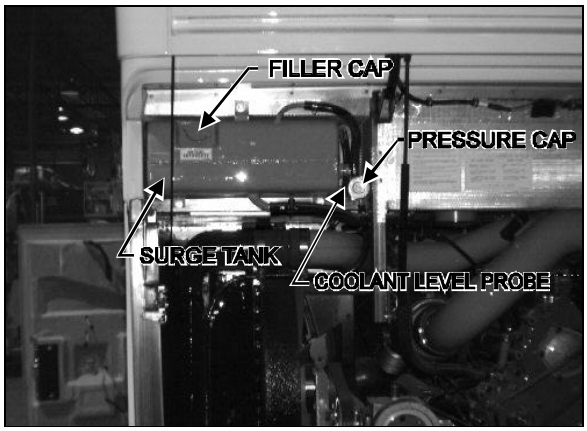


FIGURE 2: COOLING SYSTEM SURGE TANK 05024

The engine cooling system is also used to provide hot coolant for the vehicle heating system. Refer to Section 22, Heating and Air for information relating to heating system water circulation. Inspect cooling system as follows:

1.2 Maintenance

A systematic routine inspection of cooling system components is essential to ensure maximum engine and heating system efficiency.

- Check coolant level in the surge tank daily, and correct if required. Test antifreeze strength.

- Maintain the prescribed inhibitor strength levels as required. Coolant and inhibitor concentration must be checked at each oil change, every 12,500 miles (20 000 km) or once a year, whichever comes first to ensure inhibitor strength. For vehicles equipped with coolant filter, replace precharge element filter with a maintenance element filter. If the vehicle is not equipped with the filter, add the recommended inhibitor concentration to the antifreeze/water solution.

- Drain, flush, thoroughly cleaned and refill the system every two years or every 200,000 miles (320 000 km), whichever comes first. For vehicles equipped with coolant filter, change the precharge element filter or the existing maintenance element filter for a new maintenance element filter. If the vehicle is not equipped with the filter, add the recommended inhibitor concentration to the antifreeze/water solution.

Note: *Do not add inhibitors to the antifreeze/water solution when vehicle is equipped with a coolant filter.*

Note: *The coolant must be discarded in a environmentally safe manner.*

Vehicles without coolant filter.

Refer to Nalcool 3000 with Stabil-Aid bulletin annexed to the end of this section for preventive maintenance (at each oil change) and initial treatment instructions (each time the cooling system is drained, flushed and cleaned).

Vehicles with coolant filter.

Change the coolant precharge element filter for a maintenance element filter at each oil change (see specifications at the end of this section) and replace existing maintenance filter with a new one . Use a coolant precharge filter each time the cooling system is drained, flushed and cleaned.

- Check belts for proper tension. Adjust as necessary. Replace any frayed or badly worn belts.

- Check radiator cores for leaks. Make sure the cores are not clogged with dirt or insects. To avoid damaging the fins, clean cores with a low pressure air hose. Steam clean if required.

- Inspect the water pump operation. A leaky pump sucks in air, increasing corrosion.

- Repair all leaks promptly. Unchecked leaks can lead to trouble. Inspect and tighten radiator mounts periodically. Test and replace thermostats regularly.

Note: *In order to ensure the integrity of the system, periodically check cooling system pressure. Pressurize the cooling system to 103-138 kPa (15-20 psi) using Radiator and Cooling System Tester, J24460-1. Do not exceed 138 kPa (20 psi). Any measurable drop in pressure may indicate a leak. Whenever the oil pan is removed, check the cooling system pressure as a means of identifying any incipient coolant leaks. Make sure that the cause of the internal leak has been corrected before flushing the contaminated system.*

Leaks at the thermostat housing hose connections may be caused by deformation and rough surfaces on the castings of the hose mounting surfaces. It is recommended that *"Dow Corning RTV-102 Compound"* or any equivalent product be applied on cast surfaces prior to hose installation.

Caution*: Castings should be clean and free of oil and grease before applying compound. No other sealer should be used with RTV-102 compound.*

2. HOSES

2.1 Inspection

Rotten, swollen, and worn out hoses or loose connections are frequent causes of cooling system problems.

Serious overheating is often caused by an old hose collapsing or from rotten rubber shedding from hoses and clogging the coolant passages.

Connections should be inspected periodically and hose clamps tightened. Replace any hose found to be cracked or swollen.

When installing a new hose, clean pipe connections and apply a thin layer of a non-hardening sealing compound. Replace worn out clamps or clamps that pinch hoses.

3. CONSTANT-TORQUE HOSE CLAMPS

3.1 Description

All hose clamps of 1 3/8" I.D. and over, used on the heating and cooling systems, are of the *"constant-torque"* type. These clamps are worm-driven, made of stainless steel, and provided with a series of Belleville spring washers. They also feature an extended integral liner that covers the band slots to protect soft/silicone hoses from damage, and help maintain consistent sealing pressure.

This type of clamp is designed to automatically adjust its diameter to compensate for the normal expansion/contraction of a hose and metal connection that occurs during vehicle operation and shutdown. The constant-torque clamp virtually eliminates coolant losses due to *"cold flow"* leakage and greatly minimizes clamp maintenance.

3.2 Installation

Use torque wrench for proper installation. The recommended torque is 90 to 100 lbf•in. (10 to 11 N•m). The Belleville spring washer stacks should be nearly collapsed flat and the screw tip should extend 1/4" (6 mm) beyond the housing (Fig. 3).

Caution: The hose clamps will break if overtorqued. Do not overtighten, especially during cold weather when hose has contracted.

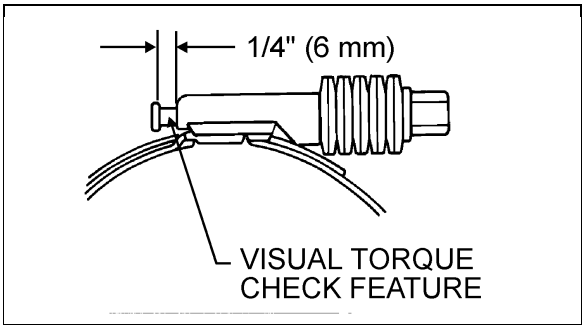


FIGURE 3: CONSTANT-TORQUE CLAMP MA3E0502

3.3 Maintenance

The constant-torque clamps contain a *"visual torque check"* feature. When the tip of the screw is extending 1/4" (6 mm) out of the housing, the clamp is properly installed and maintains a leak-proof connection (Fig. 3). Since the constant-torque clamp automatically adjusts to keep a consistent sealing pressure, there is no need to retorque hose clamps on a regular basis. During vehicle operation and shutdown, the screw tip will adjust according to the temperature and pressure changes. Proper torque installation should be checked at room temperature.

4. COOLANT

4.1 Thawing cooling System

If the cooling system becomes frozen solid, place the coach in a warm area until the ice is completely thawed. Under no circumstances should the engine be operated when the cooling system is frozen, since it will result in engine overheating due to insufficient coolant.

4.2 Coolant Level Verification

Coolant level is correct when the cold coolant is visible through the surge tank sight glass. If coolant level is low, fill cooling system (Fig. 4).

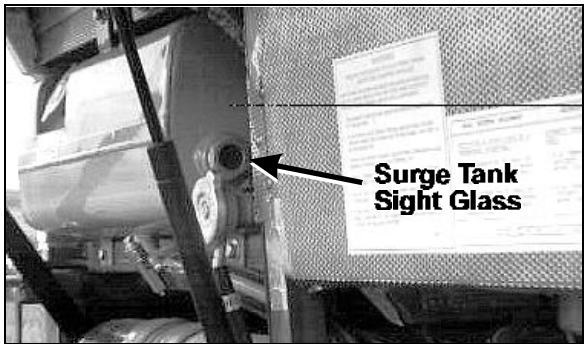


FIGURE 4: COOLANT LEVEL VERIFICATION OEH3B724

4.3 Cooling Level Sensor

The "loss of coolant warning device", consists of a level probe mounted on the surge tank and a sensor module mounted on the vehicle. The module sends a signal to the ECM to indicate coolant level. If the coolant level drops below the probe the Check Engine light flashed and diagnostic code is registered (see Section 1, Engine).

Caution: *Do not run engine with the Check Engine light flashing.*

The level probe is mounted on the R.H. side of the surge tank while the electronic module is mounted inside the rear electric junction box.

4.4 Coolant Requirements

The coolant provides a medium for heat transfer and controls the internal temperature of the engine during operation. In an engine having proper coolant flow, some of the combustion heat is conveyed through the cylinder walls and the cylinder head into the coolant. Without adequate coolant, normal heat transfer cannot take place within the engine and engine temperature rapidly rises. Therefore, coolant must be carefully selected and properly maintained.

Coolant solutions must be carefully selected and properly maintained in order to meet the following basic requirements:

1. Provide adequate heat transfer.
2. Provide protection from cavitation damage.
3. Provide a corrosion/erosion-resistant environment within the cooling system.
4. Prevent formation of scale or sludge deposits in the cooling system.
5. Be compatible with the cooling system hose and seal materials.
6. Provide adequate freeze protection during cold weather operation.

The first five requirements are satisfied by combining suitable water with reliable inhibitors. When freeze protection is required, a solution of suitable water and antifreeze containing adequate inhibitors will provide a satisfactory coolant. Ethylene glycol-based antifreeze is recommended for use in Series 60 engines. The cooling system capacity is 24 US gal (91 liters).

Note: *In general, antifreeze does not contain adequate inhibitors. For this reason, supplemental coolant additives are required.*

For a complete overview of engine coolants used with Detroit Diesel Engines, see in the current DDEC III Service Manual #6SE483, refer to Section "5. COOLANT".

4.5 General Cooling System Recommendations

Always maintain cooling system at the proper coolant level. Check coolant level daily.

The cooling system must be pressurized to prevent localized boiling of coolant. The system must be kept clean and leak-free. The filler cap and pressure cap must be checked periodically for proper operation.

4.6 Coolant Recommendations

1. Always use recommended antifreeze, inhibitor and water at proper concentration levels. A 50% coolant/water solution is normally used as factory fill. Concentrations over 70% is not recommended because of poor heat transfer capability, adverse freeze protection and silicate dropout. Concentrations below 30% offers little freeze, boilover or corrosion protection.
2. Use only ethylene glycol antifreeze meeting the GM 6038-M or ASTM D 4985 formulation, or an equivalent

antifreeze with a 0.15% maximum silicate content meeting GM 1899-M performance specifications.

3. Use an antifreeze solution year-round for freeze and boil-over protection. Seasonal changing of coolant from an antifreeze solution to an inhibitor/water solution is recommended.

4. Pre-mix coolant makeup solutions at proper concentrations before adding to the cooling system.

5. Maintain the prescribed inhibitor strength levels as required.

Vehicles Without Coolant Filter

Refer to Nalcool 3000 with Stabil-Aid bulletin annexed to the end of this section for preventive maintenance (at each oil change) and initial treatment instructions (each time the cooling system is drained, flushed and cleaned).

Vehicles With Coolant Filter

Change the coolant maintenance filter at each oil change (see specifications at the end of this section). Use a coolant precharge filter each time the cooling system is drained, flushed and cleaned.

Note: *The coolant filter contain inhibitors.*

6. Do not mix different base inhibitor packages.

7. Use only non-chromate inhibitors.

Caution: *DO NOT USE THE FOLLOWING:*

Soluble oil

Chromate inhibitor

Methoxy propanol-base antifreeze

Methyl alcohol-base antifreeze

Sealer additives or antifreezes containing sealer additives

8. Distilled water is recommended.

9. Always maintain proper coolant level.

Note: *Always test the solution before adding water or antifreeze.*

10. If not at the proper protection level, mix coolant/water solution to the proper concentration before adding to the cooling system.

Warning: *Never remove fill cap while coolant is hot. When coolant is at ambient temperature, release pressure from system by turning the pressure cap counterclockwise 1/4 turn; then remove filler cap slowly. A sudden release of pressure from a heated cooling system can result in severe burns from the expulsion of hot coolant.*

4.7 Draining Cooling System

The cooling system may be completely or partially drained by using the following procedures.

The engine and related components may be drained as follows:

1. Stop engine and allow engine fin to cool. Close both heater line shutoff valves. One located in the engine compartment under the radiator fan gearbox (Fig. 5). The other heater line shutoff valve is located in the L.H. rear electric compartment (near the preheater, see Fig. 6). Refer to Section 22, Preheating System, to gain access to the preheater and the heater line shutoff valve .

Warning: *Before proceeding with the following steps, make sure that coolant has cooled down. The sudden release of pressure from a heated cooling system can result in loss of coolant and severe burns (scalding) from the hot liquid.*

2. Remove the pressure cap. Removal of the pressure cap permits air to enter the cooling passages and the coolant to drain completely from system.

3. Open the drain cock located at the right rear corner of the engine (Fig. 7).

4. Open the water pump housing inlet line drain cock (Fig. 8).

5. Open the drain cock at the bottom of the thermostat housing to drain the coolant trapped above the thermostats (Fig. 9).

6. Open the water pump drain cock (Fig. 10, if applicable).

7. Open the radiator drain cock (Fig. 5).

8. Open engine drain cock (Fig. 11).

Note: *if freezing weather is anticipated and the engine is not protected by antifreeze, drain the cooling system completely when the engine is not use. Leave the drain plugs out until the cooling system is refilled. Trapped water in the cylinder block, radiator or other engine parts may freeze and expand resulting in damage to the engine.*

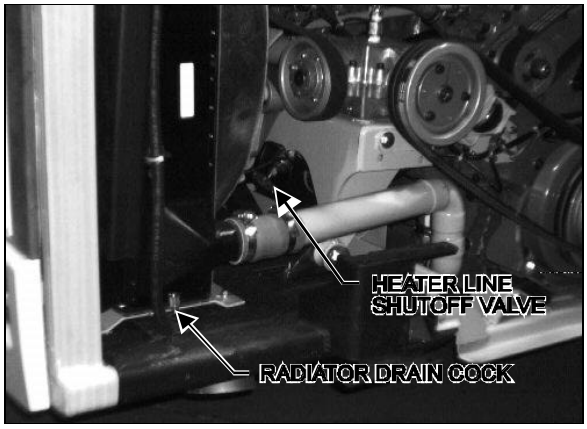


FIGURE 5: ENGINE COMPARTMENT 05025

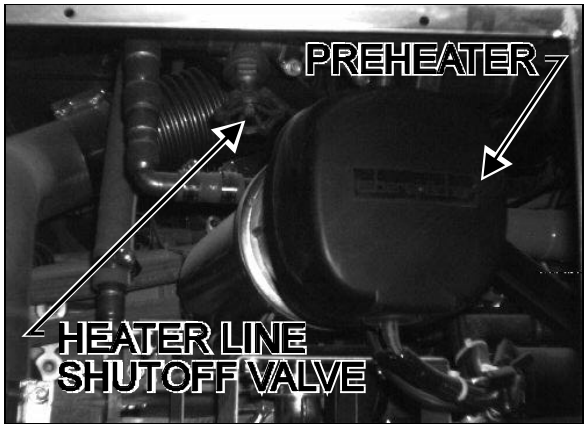


FIGURE 6: REAR ELECTRIC COMPARTMENT 05026

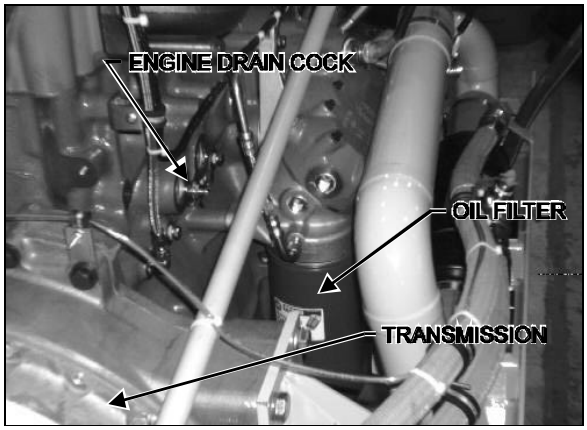


FIGURE 7: RIGHT REAR CORNER OF ENGINE 05027

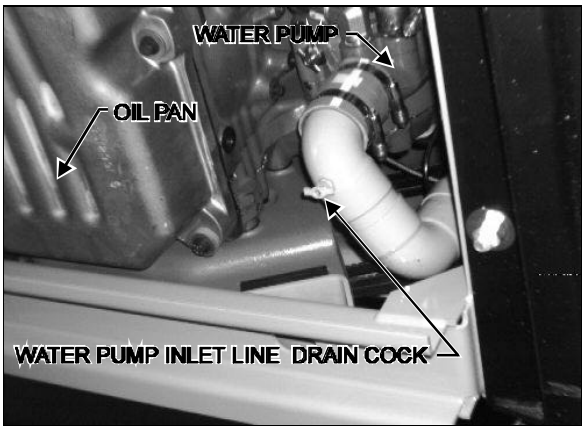


FIGURE 8: VIEW FROM UNDER THE VEHICLE 05028

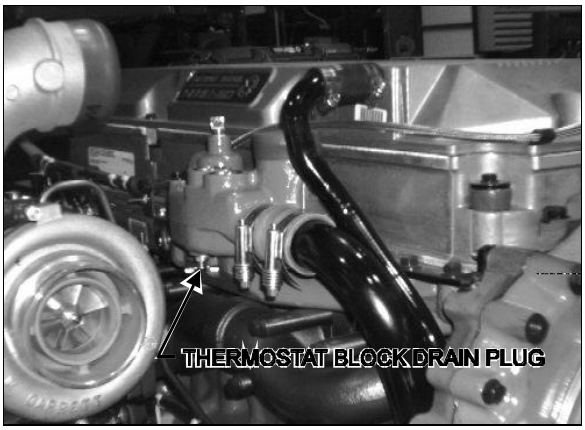


FIGURE 9: THERMOSTAT BLOCK DRAIN PLUG 05029

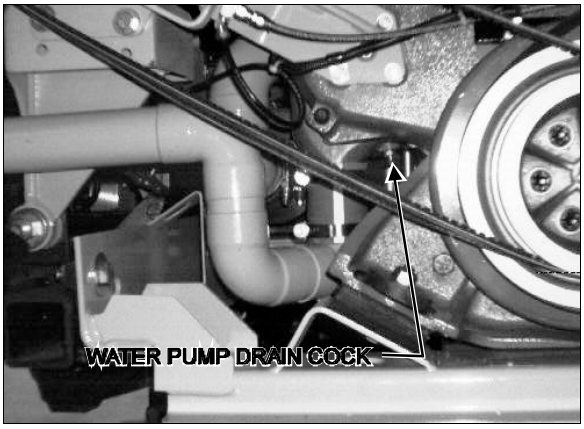


FIGURE 10: WATER PUMP DRAIN COCK 05030

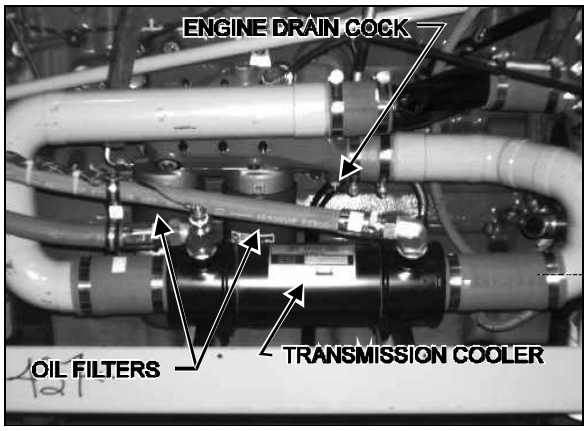


FIGURE 11: ENGINE DRAIN COCK 05031

To drain the entire system, repeat the previous steps while maintaining the shutoff valves in their open position. Follow the procedure under the heading "11.2 DRAINING HEATING SYSTEM" in Section 22, to simultaneously drain the heating units.

4.8 Refilling Cooling system

If only the engine and related components have been drained, place the two heater line shutoff valves in their closed position, then proceed as follows:

1. Close all drain cocks. Refer to the draining cooling system procedure for the location of draining points.

2. From the surge tank filler cap inlet, refill cooling system with a recommended ethylene glycol-base antifreeze and water solution with the required concentration. Add required Detroit Diesel selected product cooling system inhibitors.

Note: *The coolant level should remain within two inches of the surge tank filler neck.*

Note: *Make sure that the vent line from the top of the thermostat housing is properly connected and not obstructed. The vent line (thermostat housing dome to radiator top tank) is required to ensure complete engine fill and proper venting of air in the system.*

3. Install the filler and pressure caps. Start the engine and run it at fast idle until normal operating temperature is reached (check for leaks).

Note: *If for any reason, the coolant level drops below the surge tank level probe, the Check Engine light will flash.*

4. Stop engine and let cool.

Caution*: Never pour cold coolant into a hot engine. The sudden change in temperature may crack the cylinder heads or block.*

5. Open the two heater line shutoff valves. Check the coolant level in the surge tank. Add coolant as required.

If the entire system has been drained, repeat the previous steps while keeping the two heater line shutoff valves in the "Open" position. With engine running, activate the driver's and central heating systems to permit coolant circulation. Bleed the heater cores as explained in Section 22, under heading "11.4 BLEEDING HEATING SYSTEM".

4.9 Flushing

If the cooling system is contaminated, flush the cooling system as follows:

1. Drain the coolant from the engine.

2. Refill with soft clean water.

Note: *If the engine is hot, fill slowly to prevent rapid cooling and distortion of the engine castings.*

3. Start the engine and operate it for 15 minutes after the thermostats have opened to thoroughly circulate the water.

4. Drain the unit completely.

5. Refill with clean water and operate for 15 minutes after the thermostats have opened.

6. Drain the unit completely.

7. Fill with 50/50 antifreeze and water solution. Add required inhibitors. Change the coolant filter (if applicable) for a precharge filter. In this case, do not mix inhibitors with antifreeze/water solution.

4.10 Cooling System Cleaners

If the engine overheats, and the fan belt tension, water level, and thermostat operation have been found to be satisfactory, it may be necessary to clean and flush the entire cooling system.

Remove scale formation by using a reputable and safe descaling solvent. Immediately after using the descaling solvent, neutralize the system with the neutralizer. It is important that the directions printed on the container of the descaler be thoroughly read and followed.

After the solvent and neutralizer have been used, completely drain the engine and radiator and reverse flush before filling the system.

4.11 Reverse Flushing

After the engine and radiator have been thoroughly cleaned, reverse flush the system. The water pump should be removed and the radiator and engine reverse flushed separately to prevent dirt and scale deposits clogging the radiator tubes or being forced through the pump. Reverse flushing is accomplished by hot water, under pressure, being forced through the cooling system in a direction opposite to the normal flow of coolant, loosening and forcing deposits out.

Radiator Reverse Flushing

The radiator is reverse flushed as follows:

1. Remove the radiator inlet and outlet hoses. Replace the radiator cap.

2. Attach a hose to the top of the radiator to lead water away from the engine.

3. Attach a hose at the bottom of the radiator. Insert a flushing gun in the hose.

4. Connect the water hose of the gun to the water outlet and the air hose to the compressed air outlet.

5. Turn on the water. When the radiator is full, turn on the air in short blasts, allowing the radiator to fill between blasts.

6. Continue flushing until only clean water is expelled from the radiator.

Cylinder Head and Cylinder Reverse Flushing

The cylinder block and cylinder head water passages are reverse flushed as follows:

1. Remove the thermostats and the water pump.

2. Attach a hose to the water inlet of oil cooler housing to drain water away from engine.

3. Attach a hose to the water outlet at the top of the cylinder head (thermostat housing). Insert the flushing gun in the hose.

Caution: *Apply air gradually. Do not exert more than 138 kPa (20 psi) air pressure. Too great a pressure may rupture a radiator tube.*

4. Turn on the water. When the jackets are filled, turn on the air in short blasts, allowing the engine to fill with water between air blasts.

5. Continue flushing until the water from the engine runs clean.

If scale deposits in the radiator cannot be removed by chemical cleaners reverse flushing as outlined above, it may be necessary to remove the upper tank and clean out the individual radiator tubes with flat steel rods. Circulate the water through the radiator core from the bottom to the top during this operation.

5. Coolant Filter (Spin-on Type) (if applicable)

5.1 Description

The engine cooling system filter is used to: eliminate the adding of inhibitors in the antifreeze/water solution; and filter impurities such as scale or sand from the coolant. The filter is available as optional equipment. It is mounted to the engine cradle (close to the engine water pump, Fig. 12).

The precharge element filter lasts for 12,500 miles (20 000km) or a year, whichever comes first. Replace the precharge element filter with a maintenance element filter, which lasts for 200,000 miles (320 000 km) or every two years, whichever comes first. Every time the cooling system is flushed, drained and cleaned, you must first install a precharge element filter for its required lifespan; then install a maintenance element filter. Both filters must be changed at specified intervals.

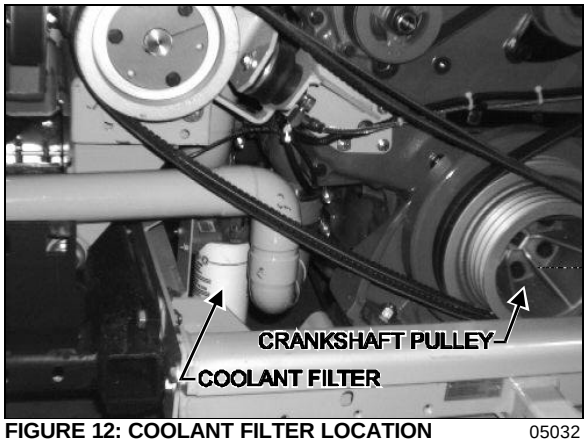


FIGURE 12: COOLANT FILTER LOCATION 05032

Note: *If a coolant system filter and conditioner is to be installed on an engine which has been in service, drain and flush the cooling system prior to installation of the filter.*

To replace a filter:

1. Close the two shutoff cocks at the filter mounting heads. Unscrew the old filters from under the vehicle.

2. Remove and discard the filter.

3. Clean the filter adapter with a clean, lint-free cloth.
4. Coat surface of gasket with oil. Tighten 2/3 to 1 turn after gasket contacts base.
5. Open the two shutoff cocks at filter.
6. Start engine and check for leaks.

Caution: *Do not exceed recommended service intervals.*

6. RADIATOR

The radiator is mounted at the L.H. side of engine compartment. The radiator is designed to reduce the temperature of the coolant under all operating conditions. It is essential that the radiator core be kept free from corrosion and scale at all times.

6.1 Maintenance

Inspect the exterior of the radiator core every 25,000 miles (40 000 km) or once a year, whichever comes first. Clean radiator with a quality grease solvent, such as a mineral spirits and dry with compressed air. Do not use fuel oil, kerosene or gasoline. It may be necessary to clean the radiator more frequently if the engine is being operated in extremely dusty or dirty areas.

7. RADIATOR VARIABLE SPEED FAN

7.1 Description

The two fan speeds are thermostatically controlled by ECM. The ECM compares input data from engine temperature, coolant temperature and air inlet temperature sensors to a set of calibration data. After comparing the input data with the calibrations data, the ECM sends electric current to the electromagnetic fan drive clutch.

An electric current regulates speeds by activating one magnetic coil for the first speed and two magnetic coils for the second speed.

The coolant temperature settings are:

- 196°F (91°C) First speed
- 203°F (95°C) Second speed

Also, for vehicle equipped with an automatic transmission and a retarder. The first speed is activate as soon as the retarder is in operation, then the second speed after a delay of approximately 7 seconds.

Caution: *<u>Mechanical locking device.</u> In case of an electrical power failure: unscrew the bolt from the end of the shaft and screw it into the locking plate. This procedure will prevent engine overheating (Fig. 13).*

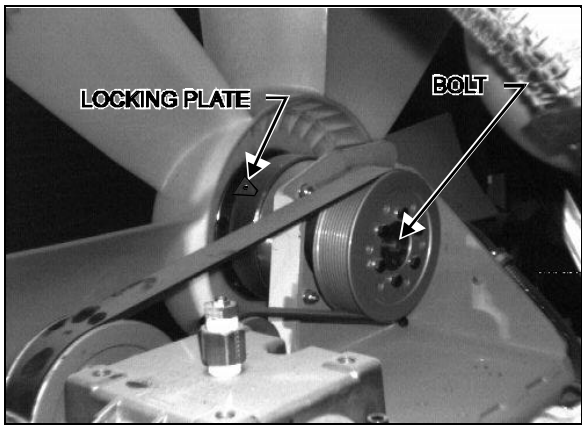


FIGURE 13: MECHANICAL LOCKING DEVICE 05033

7.2 Maintenance

1. Clean the fan and related parts with clean fuel oil. Dry with compressed air. Do not clean with steam or high pressure jet.
2. Check the fan blades for cracks or other damage. Replace the fan if the blades are cracked or deformed.
3. Remove any rust or rough spots in the grooves of the fan pulley. If the grooves are damaged or severely worn, replace the pulleys.
4. Do not add any fluids or lubricants to the fan drive.

5. Do not restrict fan rotation during engine operation for any reason.

6. Do not operate fan drive with a damaged fan assembly. Replace a damaged fan as soon as a fault is found.

7. Immediately investigate and correct any operator complaint involving drive or cooling system performance.

8. When questions arise, obtain answers before proceeding. Assistance is available through the authorized Field Sales distributor serving your area.

7.3 Inspection

Inspect as follows:

Warning: *Set the starter selector switch in the engine compartment to the "OFF" position to prevent accidental starting of the engine.*

- Check security of fasteners holding fan blade assembly to fan drive.
- Check coupling installation to gearbox.
- Visually inspect fan drive, fan blade assembly, shroud, radiator, and surrounding area for evidence of contact between rotating and non-rotating parts.
- Check fan transfer belt for fraying, cracking, and proper tension.
- Turn fan through at least 360° of rotation. It should turn smoothly, and be free of resistance.

7.4 Thermostat Operation

The temperature of the engine coolant is controlled by two blocking-type thermostats located in a housing attached to the right side of the cylinder head (Fig. 14).

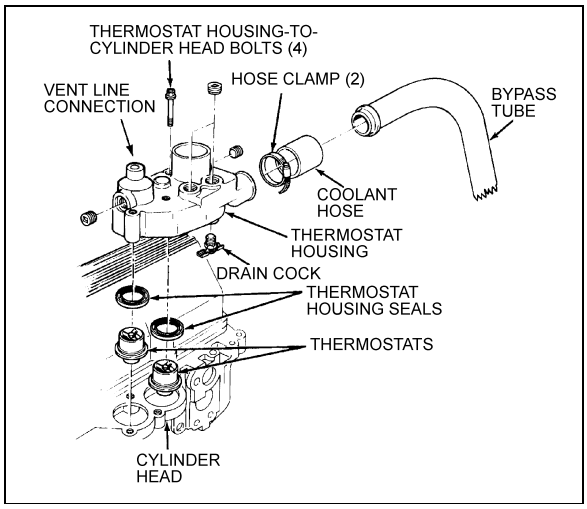


FIGURE 14: THERMOSTAT AND RELATED PARTS 05034

At coolant temperature below approximately 190°F (88°C), the thermostat valves remain closed and block the flow of coolant from the engine to the radiator. During this period, all of the coolant in the system is recirculated through the engine and directed back to suction side of the water pump via a bypass tube. As the coolant temperature rises above 190°F (88°C) the thermostat valves start to open, restricting the bypass system, and allowing a portion of the coolant to circulate through the radiator. When the coolant temperature reaches approximately 205-207°F (96-97°C) thermostat valves are fully open, the bypass system is blocked off, and the coolant is directed through the radiator.

8. FAN GEARBOX

8.1 Description

The radiator fan is belt driven from the engine crankshaft pulley through a gearbox standard assembly which is provided with two output shafts.

8.2 Maintenance

Break-in the gearbox oil at 3 000 miles (4 800 km) and subsequently every 50,000 miles (80 000 km) or once a year, whichever comes first.

8.3 Oil Change

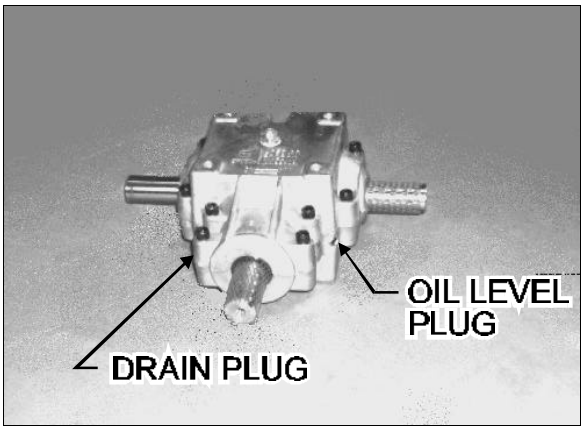


FIGURE 15: FAN GEARBOX 05008

1. Stop engine and make sure that all engine safety precautions have been observed.
2. Unscrew the air vent tube to permit the air to enter (Fig. 15).
3. Remove the drain plug located at the gearbox base.
4. Drain the gearbox.
5. Replace the drain plug.
6. Remove the level plug located on the middle side of the gearbox, near the air bellow tensioner.
7. Fill the gearbox with synthetic oil (Esso imperial mobil SHC 634, Prévost #682268) until the oil runs out of the plug.
8. Install plugs on the side of the gearbox and the air vent tube.

9. RADIATOR FAN BELT REPLACEMENT AND AIR BELLOWS BELT TENSIONER

Locate the belt tensioner control valve (Fig. 16). To release belt tension, turn handle counterclockwise in order to reverse pressure in belt tensioner air bellows.

1. Remove old belts (3 V belts and 1 Poly) from fan assembly. Install new belt.
2. Turn the two-way control valve clockwise, to its initial position, to apply tension on the new belt.
3. For proper operation of the belt, adjust the air bellow tensioner pressure regulating valve to 50 psi (345 kPa).

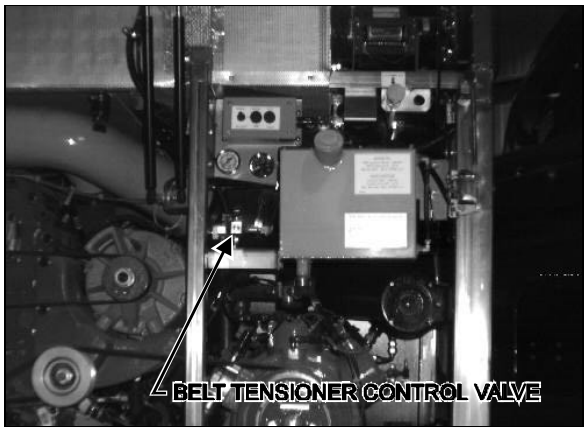


FIGURE 16: ENGINE COMPARTMENT 05035

10. FAN DRIVE ALIGNMENT

1. Install both attachment assembly plates (48, Fig. 17) through lower plating. Secure with four spring nuts (70, Fig. 17). Install one spacer (49, Fig. 17) on spring nuts at both anchoring locations.
2. Center seat assembly in the fan shroud using the horizontal displacement of the fan drive installation. Center with the slots in the floor at anchoring angle support (on some vehicles only). The vertical displacement of the fan clutch is made possible by slots at the base of the fan clutch (on some vehicles only) or by shimming with additional spacers at anchoring locations. Temporarily secure assembly with two temp. nuts (74, Fig. 17), 7/16-20, Prévost # 500709 at both anchoring locations.

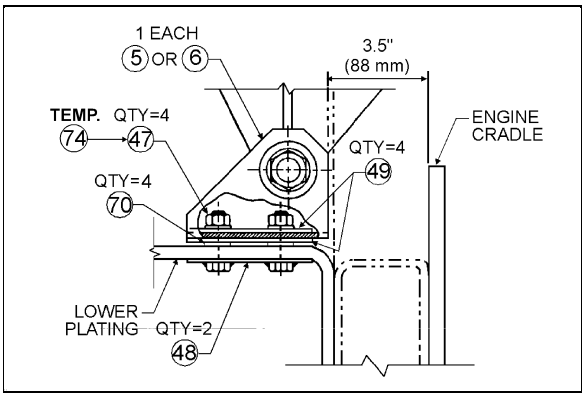


FIGURE 17: ANGLE SUPPORT 05014

Caution: *Tilt fan and check for clearance.*

3. Using a straight edge, align the 3"V" pulley on gearbox central shaft pulley with engine pulley, while taking pulleys outer edge thickness under consideration. That is, the 3 "V" pulley's outer edge is thicker than the engine pulley's outer edge (Fig. 18).

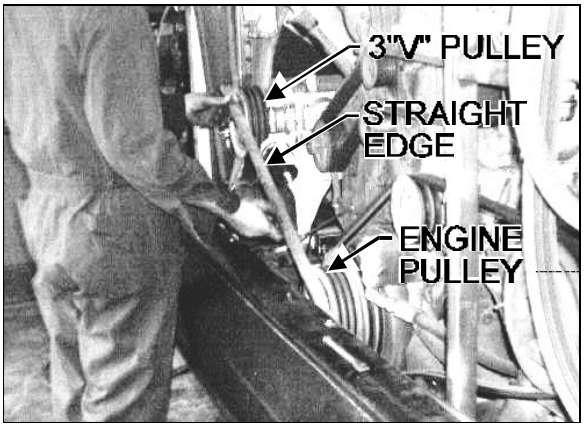
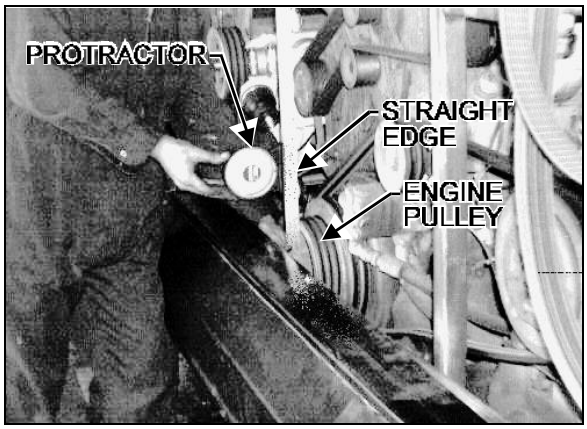


FIGURE 18: PULLEY ALIGNMENT 05015

4. Using a universal protractor, check 3 "V" pulley's vertical angle with that of engine pulley's. If angles do not correspond, raise seat assembly by shimming with additional spacers (49, Fig. 17).

Note: *Use a straight edge to measure engine pulley's vertical angle. (Fig. 19)*



05016

FIGURE 19: MEASURING ENGINE PULLEY VERTICAL ANGLE

5. Recheck alignment (steps 3, 4 and 5). Replace temporary anchoring nuts (74, Fig. 17) with four nuts (47, Fig. 17), Prévost # 500714. Tighten with wrench.

6. Align Multi"V" Pulley with Fan Pulley. Adjust the depth of the pulley on the gearbox shaft.

Caution*: In order for tensioning system to work properly, the distance between the inside faces of "tensioning arm to engine" bellow brackets should be between 2 3/8" (60 mm) and 2 1/2" (64 mm); if not, release tension on system and readjust distance using bolts securing upper tensioning bracket (Fig. 20).*

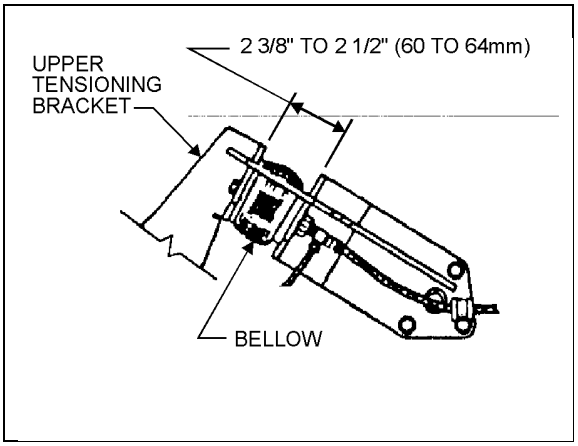
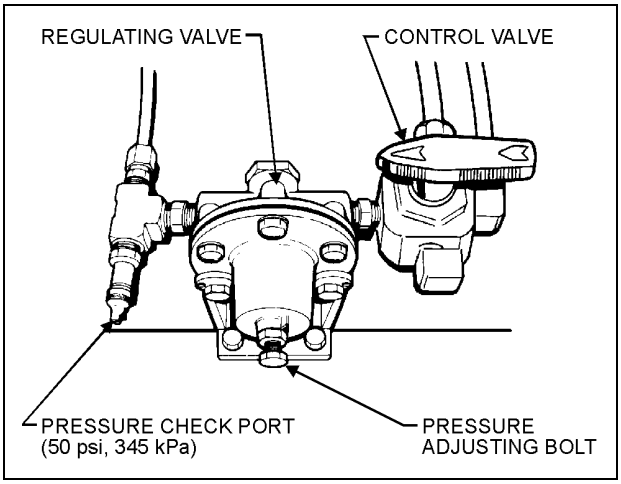


FIGURE 20: UPPER TENSIONING BRACKET 12017

7. Reset belt tensioning pressure control valve to 50 psi (345 kPa) for vehicles with series 60 engine in accordance with Section 12, Brake (Fig. 21).



12018

FIGURE 21: BELT TENSIONING PRESSURE CONTROL VALVE

11. SPECIFICATIONS

Cooling System Capacity (Approx.)
Includes heating system ..... 24 US gal (91 liters)

Thermostat
Number used 2
Start to open ..... (186-193 °F) 86-89 °C
Fully open ..... 207 °F (97 °C)

Radiator
Make ..... Long
Location ..... Rear L.H. side
H3-41" & H3-45" Coaches
Supplier number 7601-8317-1
Prevost number 550687
H3-45 VIP
Supplier number 7601-8336
Prevost number 550689

Surge Tank Filler Cap
Make ..... Stant
Model R3
Prevost number 530191

Pressure Cap
Make ..... Stant
Pressure setting ..... 14 psi (96.53 kPa)
Supplier number R12
Prevost number 550606

Fan Clutch
Make ..... Linnig
Type ..... 3 speeds
Supplier number LA1.2.024Y
Prevost number 550634
Note: ***The fan clutch is controlled by ECM (not by thermoswitch).***

Fan Gearbox
Make ..... Superior Gearbox
Ratio 1:1
Supplier number 411ACF-097-6
Prevost number 550688

Fan Belt (gearbox-fan)

Make ..... Dayco
Type ..... Poly
Qty 1
All H3'S
Supplier number 5100495
Prevost number 506663

Fan Belt (gearbox-motor)

Make ..... Dayco
Type ..... V belt
Qty 3
H3-45 Coaches & VIP
Supplier number AX73
Prevost number 50-6691
H3-41 Coaches
Supplier number AX74
Prevost number 506690

Corrosion Inhibitor and Coolant Stabilizer

Supplier number ..... Detroit D. 23507857
Supplier number ..... Nalco DD3000-15

Coolant Filter

Number used 1
Make ..... Nalco
Type ..... Spin-on
MAINTENANCE ELEMENT FILTER
Supplier number. .... Detroit Diesel 23507545
Supplier number ..... Nalco DDF3000
Prevost number 550630
PRECHARGE ELEMENT FILTER
Supplier number. .... Detroit Diesel 23507189
Supplier number ..... Nalco DDF60
Prevost number 550629

Temperature Gage (in engine compartment)

Make ..... VDO Yazaki
Operating range ..... 100-265 °F (40-130 °C)
Supplier number 1 131 015 015B
Prevost number 562331

Temperature Gage (on instrument panel)

Make ..... Datcon
Type ..... Electrical
Operating range ..... 100-280 °F (38-138 °C)
Supplier number 07718-40
Prevost number 562214

NALCO

Dosage - Cont'd

hours unless there is an unusual water Iosa. For systems larger than 76 L capacity, add 0.473 L for ovary 76 L at each sertvice interval. When NALCOOL 3000 with STABIL-AID is used at each maintenance interval, both corrosion protection and coolant stability are maintained in your engine system.

Handing

Handle like any alkali. Avoid contact with eyes. Avoid prolonged or repeated contact with skin. Do not take internally. May cause eye or skin irritation. May be harmful or fatal is swallowed. Product my be stored up to one year. NALCOOL 3000 with STABIL-AID becomes "mushy" at -9°C (15°F), but is satisfactory for use after complete thawing.

shipping

NALCOOL 3000 with STABILL-AID is supplied in cases containing twelve 0.473-L (16 fluid oz.) bottles, in 23-L pails, 115-L and 210 L non returnable drums.

Instructions for Use

Protect your coding system against deposit formation caused by unstable engine coolant. In addition, protect your cooling system against corrosion, cavitation-erosion, mineral scale deposits and electrolysis. Use NALCOOL 3000 with STABIL-AID for total cooling system protection.

1. **Before Treatment** — The ingredient STABIL-AID will not dissolve gel once it has formed. For proper use, drain coolant and clean with NALCO NALPREP 2001 Cooling System Cleaner (add 1.89 L of NALPREP 2001 for each 30 L of cooling system capacity). Run your engine for a minimum of two hours eith the NALPREP/water mixture. Allow engine to cool and flush with fresh water. NOTE: If gel has already dried or your radiator is completely blocked, we recommend ultrasonic cleaning.

2. **Initial NALCOOL 3000with STABIL-AID Treatment** - See chart below for the number of tlitres of NALCOOL 3000 with STABIL-AID required to bring the coolin system up to full protection at initial fill.

Cooling System Capacity

4 - 15 L (1-4 USG)	Add 0.473 L (1 pint)
19 - 30 L (5-8 USG)	0.946 L (2 pints)
34 - 45 L (9-12 USG)	1.419 L (3 pints)
49 - 61 L (13-16 USG)	1.892 L (4 pints)
64 - 76 L (17-20 USG)	2.365 L (5 pints)
79 - 91 L (21-24 USG)	2.838 L (6 pints)
95 - 106 L (25-28 USG)	3.311 L (7 pints)
Over 106 (over 28 USG)	0.473 L (1 pints) per 15 L

When freeze protection is desired, use only ethylene glycol based antifreeze.

3 . Preventive Maintenance with NALCOOL 3000 with STABIL-AID

A . Line-Haut (High Mieagel Trucks - At every routine "B" service (typically 16,000 to 19.000 km)

System Capacity 76 L or less - Add 0.473 L

System Capacity over 76 L - Add 0.473 L for every 76 L or fraction thereof (e.g. 114 L- add 0.946 L)

B. **P&D (Low Mileage) Trucks, Stationary and Marine Units - At every 250 operating hours.**

System Capacity 76 L of less - Add 0.473 L

System Capacity over 76 L - Add 0.473 for every 76 L or fraction thereof (e.g. 114 L - add 0.946 L)

Quality

Nalco Canada certifies that all received batches of NALCOOL 3000 meet or exceed all in-process and finished product quality standards set for this product.

Remarks

For **Transportation Emergencies** involving Nalco products call: 1-800-463-3216.

For **Medical Emergencies** involving Nalco products call 416-632-8791 (24-hr. response).

Transportation Chemicals **Product Bulletin**

NALCOOL 3000® with STABIL-AID

COOLING SYSTEM CORROSION INHIBITOR AND COOLANT STABILIZER

Product Benefits

- Stabilizes engine coolants helping prevent the formation of abrasive gel-like deposits that can form from overconcentrations of:
  - coolant additives
  - hard wster salts
  - corrosion products
  - antifreeze products (particularty high silicate antifreeze formulations)
- Helps condition cooling system water by neutralizing hard water salts, preventing them from forming scale deposits on heat transfer surfaces
- Helps protect all metals in engine cooling systems from corrosive Helps protect against liner pitting and cavitation-erosion
- Lubricates water pump
- Helps keep engines free from heat-absorbing sludge and minerai scale deposits — prevents overheating
- Helps extend antifreeze life
- Comes in liquid form for simple supplication —add directly to the engine radiator or coding system
- Does not affect gaskets and hoses

Principal Uses

NALCOOL 3000 with STABIL-AID is a new advanced cooling system treatment formulation that helps prevent gel-like deposits from feting in cooling system passages. Hard water salts can combine with coolant additives, corrosion products and antifreeze to form gel-like deposits that can plug cooling system passages solid. Further, this abrasive gel can cause excessive wear damage to water pump seals and other coding system components. NALCOOL 3000 with STABiL-AID helps block the chemical formation of this coding system gel. It allows the safe use of current antifreeze formulations and coolant additive products in hard water without the occurrence of gelation problems. In addition, this new formulation helps prevent hard water salts from forming scale deposits on heat transfer surfaces. NALCOOL 3000 with STABIL-AID also helps provide superior film forming corrosion protection for all metals found in engine cooling systems. It helps keep angina coding systems clean and free from corrosive attack and the harmful effecte of mineral scale deposits. This allows for maintained design hoot transfer efficiencies and long engine life.

General Description

NALCOOL 3000 with STABIL-AID has the following typical characteristics:

Colour	red
Odour	none
Re;ative density at (15"CI	1.14
pH(± 0.1)	11.6
Solubility in water	soluble in all porportions

Dosage

Initial Treatment - New Engines: To assure a clean system, free from both corrosion and scale deposits, add 0.473 L of NALCOOL 3000 with STABIL-AID to the radiator for ovary 15 L of angina cooling system capacity.

Note: Engines Already in Service: It is recommended that engines be cleaned with NALPREP 2001 Engine Cooling System Cleaner to remove existing gel deposits before starting a NALCOOL 3000 with STABIL-AID program.

Maintenance Dosage: All Engines: A maka-up dosage of 0.473 L of NALCOOL 3000 with STABIL-AID should be added at every routine "B" service interval (oil change), typically every 16,000 to 19,000 km or 250

Continued on reverse

NALCO CANADA INC.

1055 TRUMAN STREET ❑ P.O. BOX 5002 BURLINGTON, ONTARIO L7R 3Y9