SERVICE MANUAL SECTION

RADIATOR/COOLING SYSTEM SERVICE MANUAL – PROSTAR™

Model: ProStar

S12021

09/06/2007

Table of Contents

1. DESCRIPTION

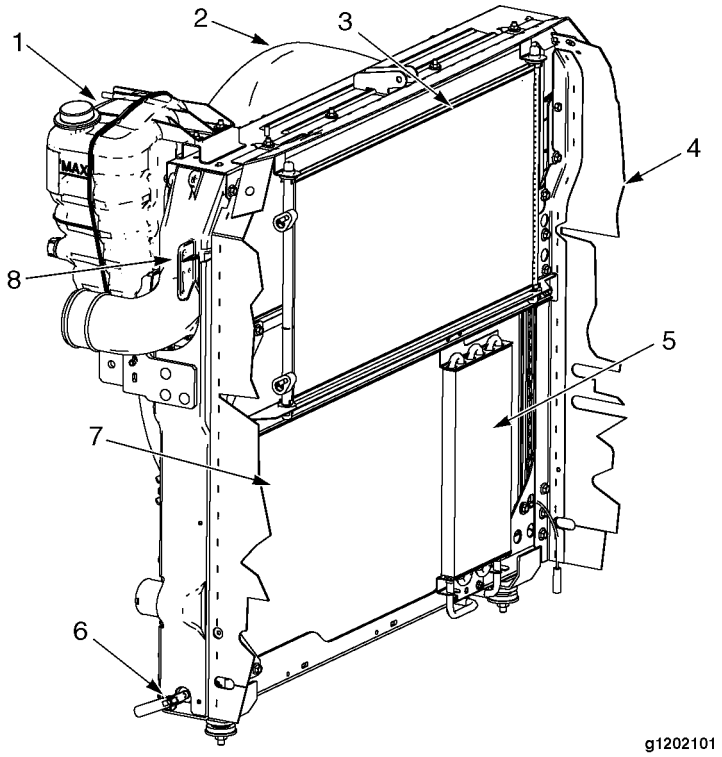

Figure 1 Coolant Package Components

1. SURGE TANK
2. FAN SHROUD
3. A/C CONDENSER
4. RECIRCULATION SEAL
5. TRANSMISSION OIL COOLER
6. DRAIN VALVE
7. RADIATOR
8. CHARGE AIR COOLER

The purpose of the cooling system is to circulate the coolant, maintain efficient operating temperature, and protect system components. About one-third of the energy produced when diesel fuel burns is converted into power by the engine. The remaining energy must be disposed of by the exhaust and cooling systems, or the engine components will be damaged by excessive heat and contamination.

The ProStar™ is equipped with a coolant package that combines all the coolant components into one forward-mounted area. This design makes service of the coolant package components easier and eliminates long periods of downtime waiting for radiator and cooling component repair.

1.1. SURGE TANK

A see-through surge tank prevents over/under filling and accurate coolant level inspections. The surge tank efficiently collects air bubbles in the engine and radiator coolant to promote longer water pump and cylinder liner life.

1.2. FAN SHROUD

The fan shroud helps in controlling the airflow through the radiator and charge air cooler. The ProStar™ is equipped with a two-piece fan shroud, top and bottom, that allows for easy removal and installation of the radiator fan and fan drive.

1.3. A/C CONDENSER

The A/C condenser is mounted on the front of the cooling package and the A/C condenser lines are routed over the top of the cooling package. This configuration creates an issue of the A/C condenser needing to be repositioned to service the radiator, charge air cooler, and bottom fan shroud. However, the A/C system does not need to be opened to service any of the cooling package components.

1.4. TRANSMISSION OIL COOLER

The transmission is normally cooled by the oil being splashed by the rotating gears. The heat is then dissipated by convection through the transmission case to the atmosphere. There are, however, several conditions such as operating in higher ambient temperatures and pulling heavy loads that require an external transmission oil cooler.

1.5. RADIATOR

The ProStar™ utilizes a radiator made with advanced aluminum alloys. The core is constructed of welded aluminum tubes and high-efficiency louvered aluminum fins. A side accessed hand-operated drain valve with drain tube is provided for quick, sanitary draining of the cooling system. There is also an optional drain fitting that is compatible with coolant extractor systems.

1.6. CHARGE AIR COOLER

The ProStar™ is equipped with a charge air cooler to improve fuel economy, increase horsepower and decrease gaseous emissions. The air-to-air charge air cooler is composed of cast aluminum inlet and outlet tanks, with a tube-and-fin structure cooler core. The core disperses heat to cool and condense the air from the turbocharger before it enters the engine air intake manifold.

1.7. FAN DRIVE

The fan drive mounts on the front of the engine with a mount hub. The fan drive works by means of a temperature switch that senses coolant temperatures to regulate an air solenoid. The air solenoid discontinues directing compressed air and engages the fan drive when the coolant reaches a predetermined temperature. When the coolant temperature has lowered, the solenoid continues directing compressed air to the fan drive, and the fan drive is disengaged.

1.8. POWER STEERING OIL COOLER

The power steering oil cooler is available as an option on the ProStar™ for trucks that are utilized in several conditions. The power steering oil cooler is a tube designed oil cooler that oil passes through and it provides an efficient way to remove heat from the power steering fluid.

2. COOLING PACKAGE COMPONENTS

WARNING – To prevent vehicle damage, personal injury, or possible death, park the vehicle on a flat level surface. Make sure the engine ignition is in the off position, and the transmission is in neutral or in the park position if the vehicle is equipped with an automatic transmission. Set the parking brake, chock the wheels, and disconnect the batteries at the negative terminal before doing any service procedures on the engine or vehicle.

WARNING – To prevent vehicle damage and/or personal injury, use care when removing or installing cooling system components with the hood in the open position. With the hood assembly in the open position, the available space to maneuver components such as the charge air cooler, air conditioning condenser, external transmission cooler (if applicable) and radiator frame and core assembly is limited, making handling of the components difficult.

IMPORTANT – Before performing any work on the coolant package components, be sure to perform these basic procedures:

1. Park the chassis on a flat level surface.
2. Place transmission in neutral (or park if automatic transmission).
3. Set the parking brake.
4. Turn off ignition.
5. Install wheel chocks.
6. Disconnect the battery.

2.1. DRAIN COOLANT

The ProStar™ radiator is equipped with a drain valve on the right, lower side of the radiator. There are two types of drain valves available for the radiator.

- Standard Drain Valve – This is a standard drain petcock with a small drain tube to help direct the coolant into a container.
- Quick Connect Drain Valve – This is an optional drain valve that can be used with a coolant fill/extraction machine or the CXI CK-500 tool kit from Dunn and Bybee Tool.

Standard Drain Valve – Draining Coolant

1. Unlatch and open the hood.

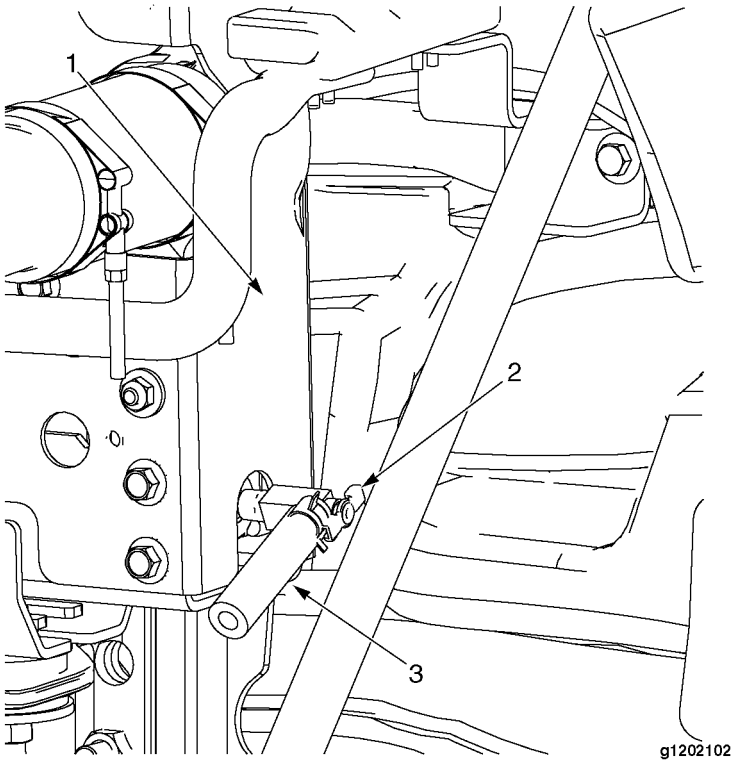

Figure 2 Radiator Drain Valve

1. RIGHT SIDE RADIATOR FRAME
2. DRAIN VALVE
3. DRAIN HOSE

2. Place tray under the radiator to collect coolant from the radiator. Open the drain valve and drain coolant.

Quick Connect Drain Valve – Draining Coolant

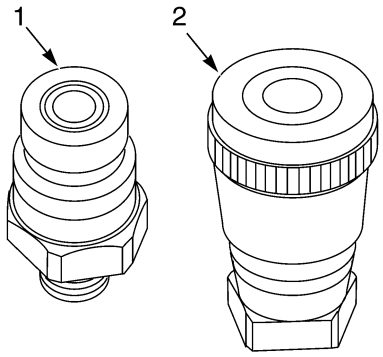

Figure 3 Quick Disconnect Fittings

1. MALE CONNECT/DISCONNECT FITTING
2. FEMALE CONNECT/DISCONNECT FITTING

The following tools are available through the parts group:

- The male fitting (3609890C1) comes as optional equipment on the ProStar™, option code 012WYZ, and is located in place of the radiator drain valve. This fitting has ¼" male NPT and can replace most existing ¼" NPT drain valves.
- The female fitting (2594109C1) also has ¼" female NPT and can be easily connected to your coolant fill/extraction machine or a drain hose.

You can obtain either of these optional quick connect/disconnects through your direct ship parts coordinator. Prices and availability can be obtained direct through the PDCs.

If you do not have a coolant fill/extraction machine, the CXI 2V-700 has been evaluated in our engineering shops with favorable results and can be purchased directly from the manufacturer. The benefits of using such a device include the following:

- Little or no mess,
- the ability to change sensors without draining the coolant, and
- quick drain/fill times.

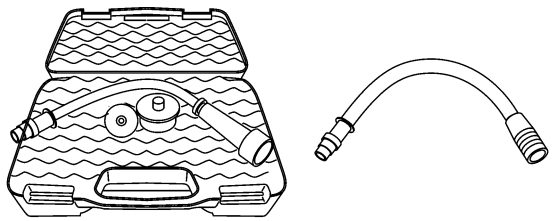

Figure 4 Retrofit Kit

The retrofit kit shown (Part number CXI CK-500) is available from Dunn and Bybee Tool.

Retrofit Kit Specs:

- 1 – Male to Female Adaptor Hose
- 3 – Radiator Cap Plugs
- 1 – ISO16028 to Volvo Style Adaptor
- 1 – Plastic Case

Use the retrofit kit to convert conventional drain valves to the quick connect/disconnect. Insert one of the rubber radiator cap plugs into the surge tank. Use the 2V-700 to create a vacuum on the vehicle's cooling system. Unscrew the drain valve and replace with a male fitting.

Visit Dunn and Bybee Tool's website (http://www.db-toolco.com/CXI/CXI.htm) for further information, or contact Charles Sams at 931-738-3611.

1. Unlatch and open the hood.

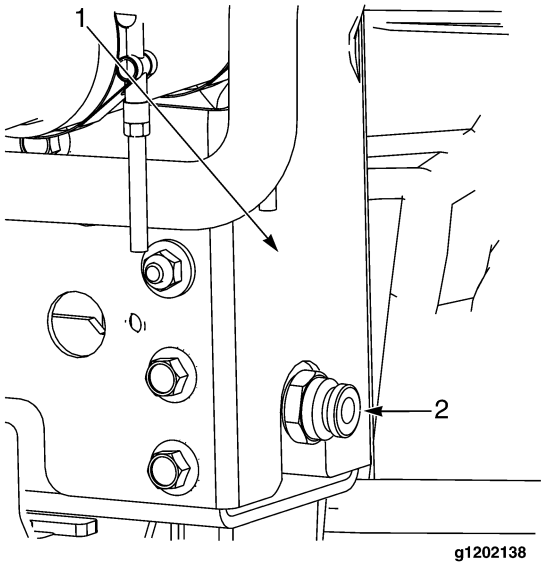

Figure 5 Male Quick Connect Fitting

1. RADIATOR
2. MALE QUICK CONNECT FITTING

2. Locate the male quick connect fitting at the lower right side of the radiator.

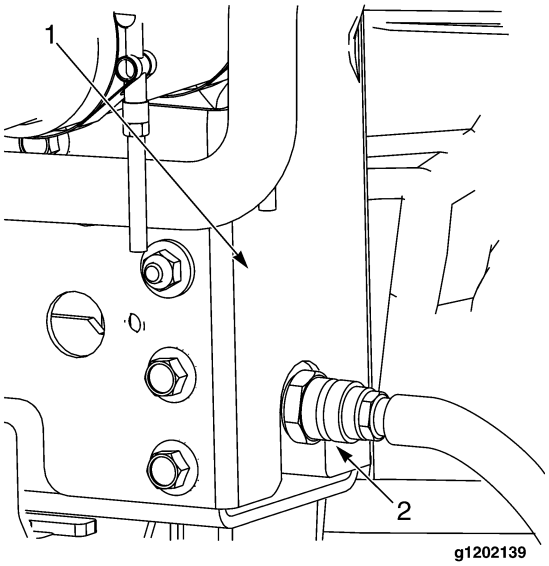

Figure 6 Female Quick Connect Fitting Hooked to Male Quick Connect Fitting

1. RADIATOR
2. FEMALE QUICK CONNECT FITTING

3. Connect the coolant fill/extraction machine by connecting the female quick disconnect fitting to the male quick disconnect fitting. Drain coolant.

2.2. SURGE TANK

Surge Tank – Removal

1. Unlatch and open the hood.

2. Drain coolant (See Drain Coolant section for proper draining procedures).

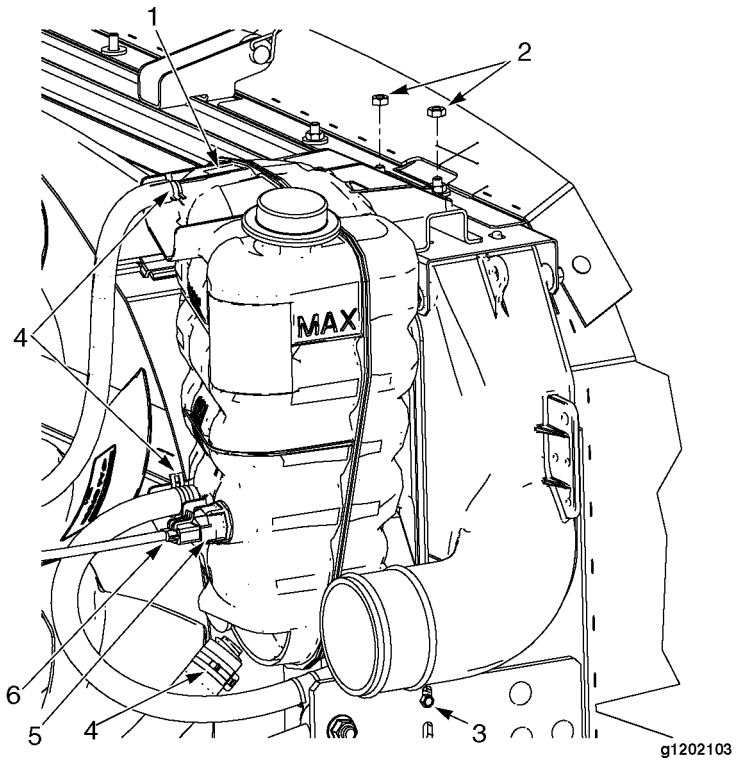

Figure 7 Surge Tank

1. SURGE TANK
2. TOP MOUNT NUTS
3. BOTTOM MOUNT BOLT
4. SURGE TANK HOSES
5. LOW COOLANT SENSOR
6. ELECTRICAL CONNECTOR

3. Disconnect electrical connector from low coolant sensor.

4. Remove three hoses from surge tank.

5. Remove bottom mount bolt from surge tank.

6. Remove two mount nuts from top of surge tank.

7. Remove surge tank from cooling package.

8. If replacement is needed, install low coolant sensor on new surge tank, by screwing low coolant sensor in hand tight and then turn two full rotations.

Surge Tank – Installation

NOTE – Check the surge tank prior to installation for any leaks and/or damage.

1. Position surge tank on cooling package.
2. Install two mount nuts on top of surge tank (Figure 7, Item 2). Torque nuts to 13 to 14 lbf-ft (18 to 19 N•m).
3. Install bottom mount bolt on surge tank (Figure 7, Item 3). Torque bolt to 13 to 14 lbf-ft (18 to 19 N•m).
4. Install three surge tank hoses (Figure 7, Item 4).
5. Connect electrical connector to low coolant sensor (Figure 7, Items 5 and 6).
6. Fill coolant system to proper level and leak test the coolant system. Special Tool number **550500INT** is recommended to fill and leak test the coolant system.
7. Close and latch the hood.

2.3. A/C CONDENSER

CAUTION – When repositioning the A/C condenser, watch for kinking or severe bending of A/C condenser lines or hose. Damage from kinking or severe bending may require replacement of the A/C condenser lines.

Perform the **A/C Condenser – Removal** procedures to reposition the A/C condenser out of the way of the cooling package and perform the **A/C Condenser – Installation** procedures to position the A/C condenser on the cooling package.

A/C Condenser – Removal

1. Unlatch and open the hood.

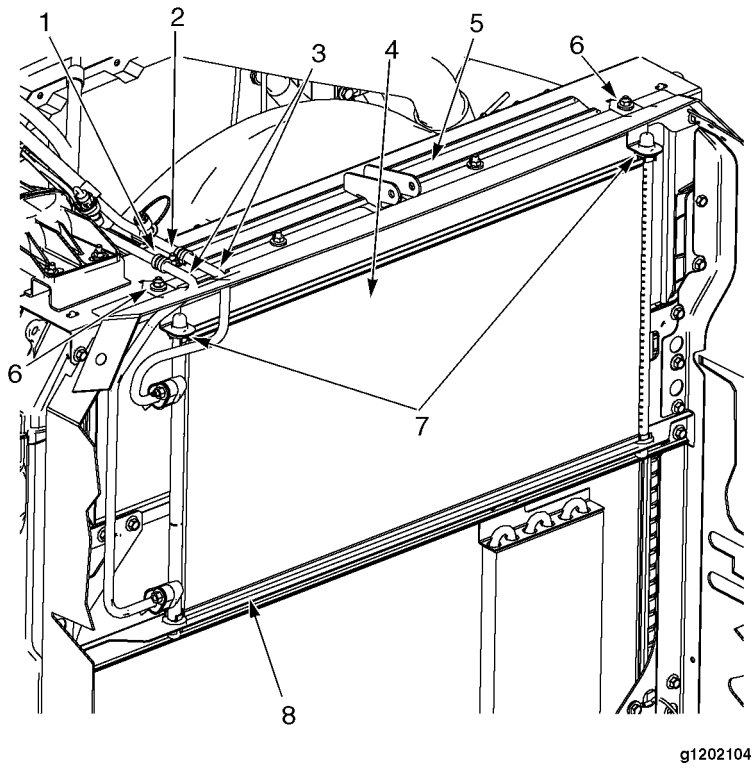

Figure 8 A/C Condenser

1. P-CLAMPS
2. P-CLAMP MOUNT NUT
3. A/C LINES
4. A/C CONDENSER
5. TOP CHANNEL PLATE
6. A/C CONDENSER MOUNT NUTS
7. TOP MOUNT BRACKETS
8. BOTTOM MOUNT BRACKET

2. Remove nut from P-clamps securing the A/C lines to the top channel plate.

3. Remove two nuts, washers, and top mount brackets from the A/C condenser.

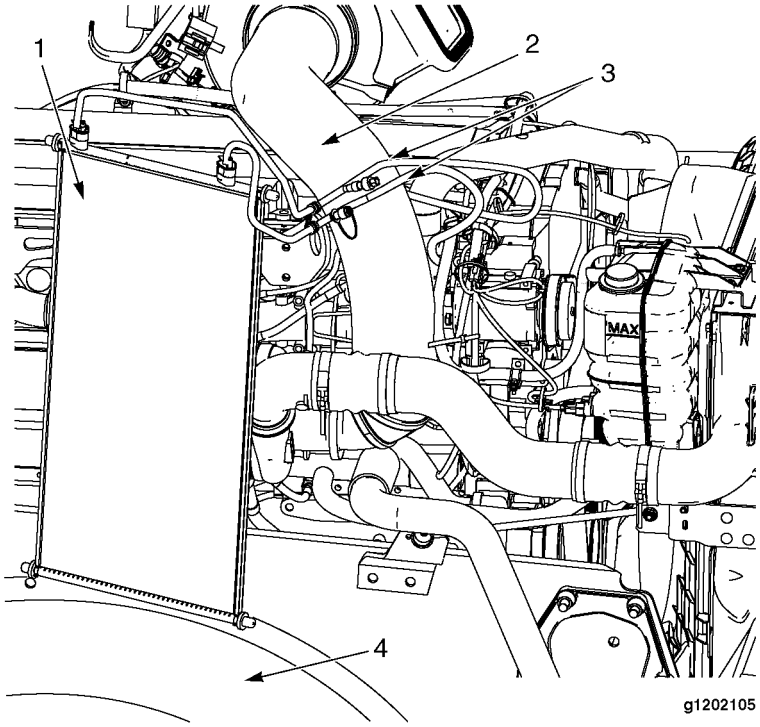

Figure 9 A/C Condenser Repositioning

1. A/C CONDENSER
2. AIR INTAKE DUCT
3. A/C CONDENSER LINES
4. RIGHT FRONT TIRE

4. Carefully remove the A/C condenser by raising the A/C condenser over the top of the cooling package. Rest the A/C condenser on the right front tire and secure the A/C condenser lines to the air intake duct.

A/C Condenser – Installation

1. Position the A/C condenser on the bottom mount bracket, make sure the A/C condenser is seated properly on the bottom mount bracket (Figure 8, Items 4 and 8).

2. Align the top mount brackets on the top channel plate and A/C condenser, secure with two washers and nuts (Figure 8, Items 6 and 7). Torque nuts to 13 to 14 lbf-ft (18 to 19 N•m).

3. Install nut on P-clamps securing the A/C lines to the top channel plate and tighten (Figure 8, Items 1 and 2).

4. Close and latch the hood.

2.4. FAN SHROUD

Fan Shroud – Removal

NOTE – The A/C condenser must be repositioned before the bottom fan shroud can be removed.

1. Unlatch and open the hood.
2. Remove nut from P-clamps securing the A/C lines to the top channel plate (Figure 8, Items 1 and 2).
3. Remove two nuts and washers from the A/C condenser top mount brackets (Figure 8, Items 6 and 7).
4. Carefully remove the A/C condenser by raising the A/C condenser over the top of the cooling package and securing the A/C condenser out of the way (Figure 9).
5. Remove two top mount nuts and one bottom mount bolt from the surge tank (Figure 7, Items 2 and 3). Secure surge tank away from fan shroud.

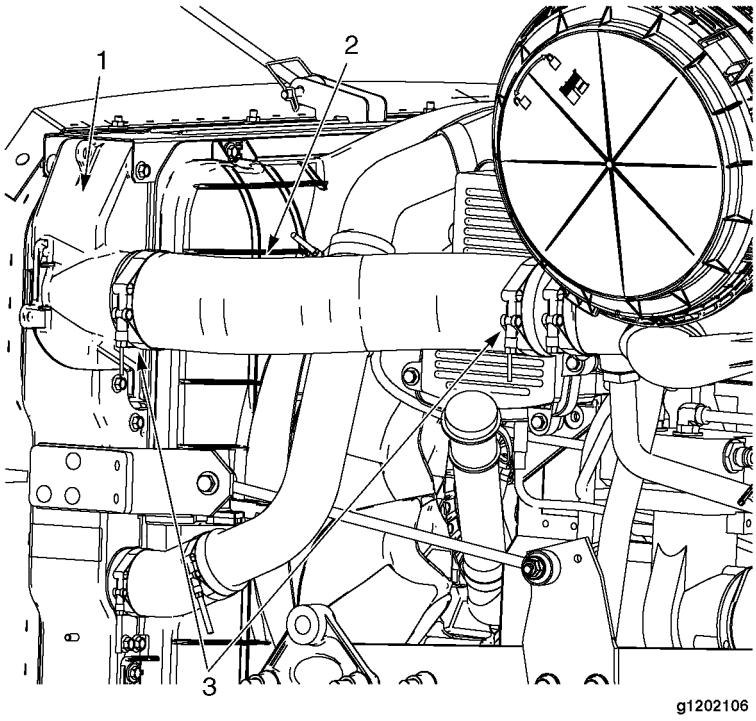

Figure 10 Left Charge Air Cooler Hose

1. CHARGE AIR COOLER
2. LEFT CHARGE AIR COOLER HOSE
3. SPRING CLAMPS

6. Loosen two spring clamps and remove the left charge air cooler hose.

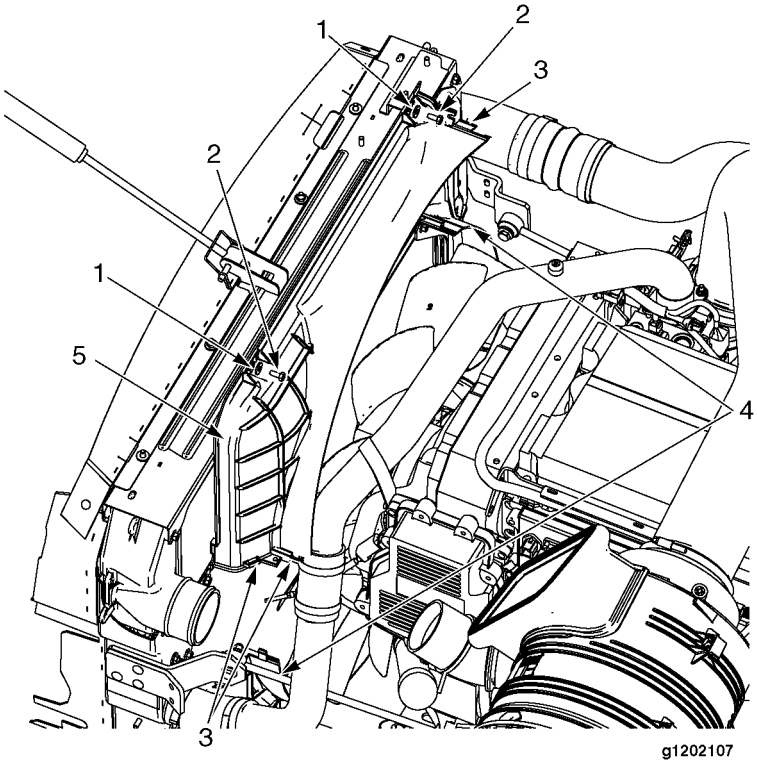

Figure 11 Top Fan Shroud

1. TOP FAN SHROUD WASHERS
2. TOP FAN SHROUD MOUNT BOLTS
3. PLASTIC HOLD TABS
4. BOTTOM FAN SHROUD
5. TOP FAN SHROUD

7. Remove two bolts and washers from the top fan shroud.

8. Beginning with the top plastic hold tab, release three plastic hold tabs and remove the top fan shroud.

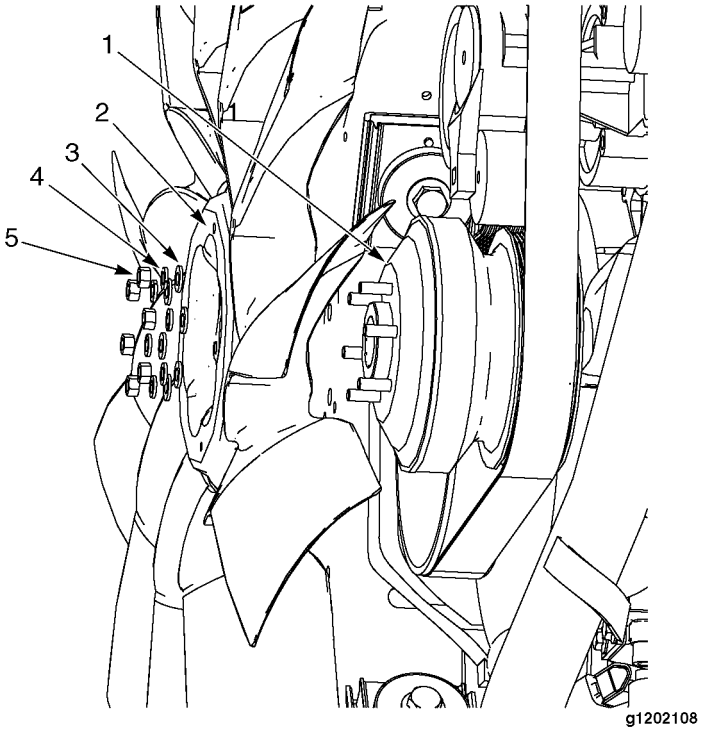

Figure 12 Radiator Fan

1. FAN DRIVE
2. RADIATOR FAN
3. WASHERS
4. LOCK WASHERS
5. RADIATOR FAN MOUNT NUTS

9. Remove six nuts, lock washers, and washers from the radiator fan.

10. Remove the radiator fan from the fan drive.

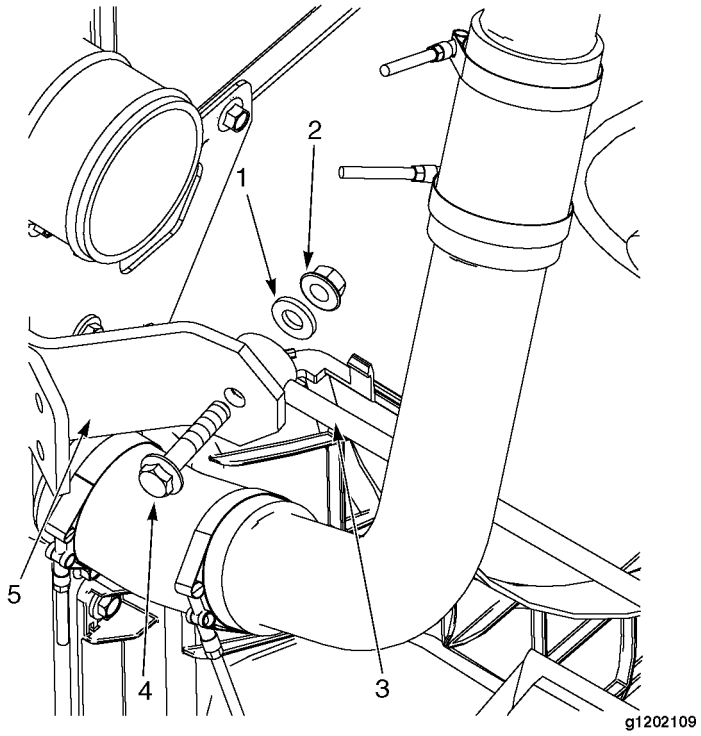

Figure 13 Left Radiator Stay Rod

1. STAY ROD WASHER
2. STAY ROD MOUNT NUT
3. STAY ROD
4. STAY ROD MOUNT BOLT
5. STAY ROD MOUNT BRACKET

11. Remove bolts, washers, and nuts from stay rods and stay rod mount brackets, on both sides of the radiator.

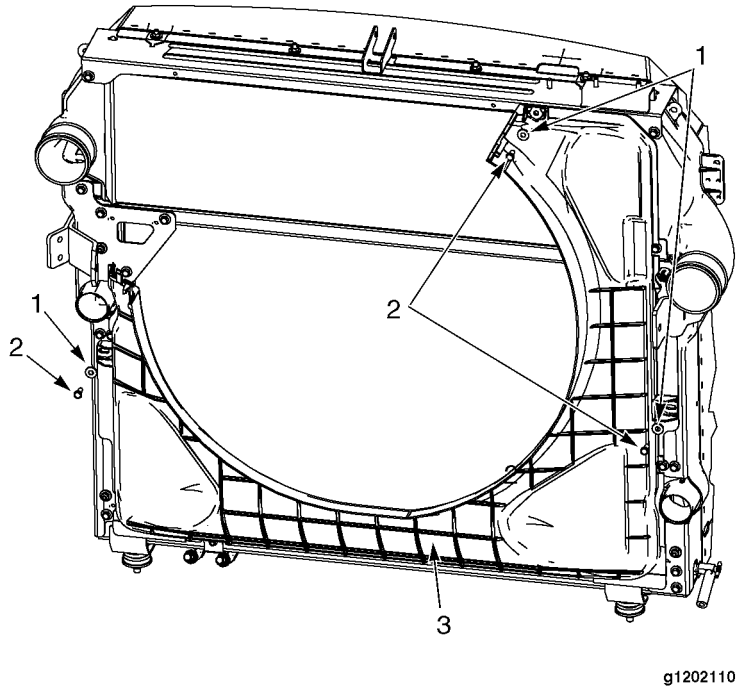

Figure 14 Bottom Fan Shroud

1. BOTTOM FAN SHROUD WASHERS
2. BOTTOM FAN SHROUD MOUNT BOLTS
3. BOTTOM FAN SHROUD

12. Remove three bolts and washers from the bottom fan shroud.

13. Remove bottom fan shroud from radiator.

Fan Shroud – Installation

1. Install the bottom fan shroud on the radiator.

2. Secure bottom fan shroud with three washers and bolts (Figure 14, Items 1 and 2). Torque bolts to 13 to 14 lbf-ft (18 to 19 N•m).

3. Install nuts, washers, and bolts in stay rods and stay rod mount brackets, on both sides of the radiator (Figure 13). The P-clamp for the surge tank hose must be secured to the bolt at the right stay rod. Torque bolts to 66 to 85 lbf-ft (90 to 115 N•m).

4. Install the radiator fan on the fan drive.

5. Install six washers, lock washers, and nuts on the radiator fan (Figure 12). Torque nuts to 25 lbf-ft (34 N•m).

6. Align the top fan shroud on the bottom fan shroud and engage the three plastic hold tabs (Figure 11, Item 3).

7. Secure the top fan shroud with two washers and bolts (Figure 11, Items 1 and 2). Torque bolts to 13 to 14 lbf-ft (18 to 19 N•m).

8. Install left charge air cooler hose and secure two spring clamps (Figure 10, Items 2 and 3). Torque spring clamps to 6 lbf-ft (8 N•m).

9. Position surge tank on cooling package and secure with two nuts and one bolt (Figure 7, Items 2 and 3). Torque nuts and bolt to 13 to 14 lbf-ft (18 to 19 N•m).

10. Position the A/C condenser on the bottom mount bracket, make sure the A/C condenser is seated properly on the bottom mount bracket (Figure 8, Items 4 and 8).

11. Align the A/C condenser top mount brackets on the top channel plate and secure with two washers and nuts (Figure 8, Items 6 and 7). Torque nuts to 13 to 14 lbf-ft (18 to 19 N•m).

12. Install nut on P-clamps securing the A/C lines to the top channel plate and tighten (Figure 8, Items 1 and 5).

13. Close and latch the hood.

2.5. RADIATOR FAN

Radiator Fan – Removal

1. Unlatch and open the hood.

2. Loosen two spring clamps and remove the left charge air cooler hose (Figure 10, Items 2 and 3).

3. Remove two bolts and washers from the top fan shroud (Figure 11, Items 1, 2, and 5).

4. Beginning with the top plastic hold tab, release three plastic hold tabs and remove the top fan shroud (Figure 11, Item 3).

5. Remove six nuts, lock washers, and washers from the radiator fan (Figure 12).

6. Remove the radiator fan from the fan drive.

Radiator Fan – Installation

NOTE – Inspect the fan for damage prior to installation. The fan should be replaced if any defects are found.

1. Install the radiator fan on the fan drive.

2. Install six washers, lock washers, and nuts on the radiator fan (Figure 12). Torque nuts to 25 lbf-ft (34 N•m).

3. Align top fan shroud on bottom fan shroud and engage three plastic hold tabs (Figure 11, Item 3).

4. Secure top fan shroud with two washers and bolts (Figure 11, Items 1 and 2). Torque bolts to 13 to 14 lbf-ft (18 to 19 N•m).

5. Install left charge air cooler hose and secure two spring clamps (Figure 10, Items 2 and 3). Torque spring clamps to 6 lbf-ft (8 N•m).

6. Close and latch the hood.

2.6. FAN BELT

Fan Belt – Removal

1. Unlatch and open the hood.

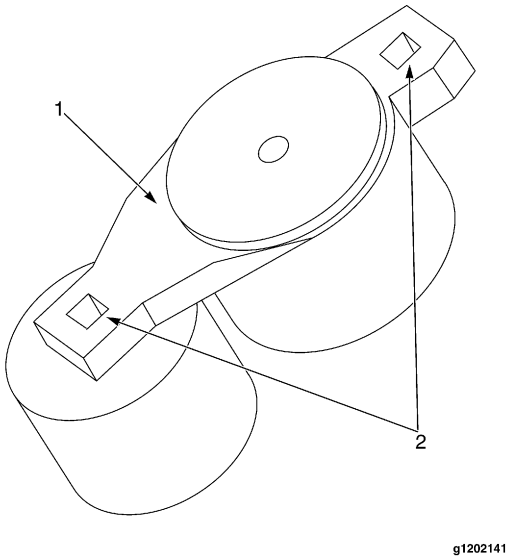

Figure 15 New Cummins Belt Tensioner

1. NEW BELT TENSIONER
2. TENSIONER RELEASE HOLE

NOTE – A new engine belt tensioner is available on the ProStar™. An extra release hole has been added in the new design to aid in service of the fan belt.

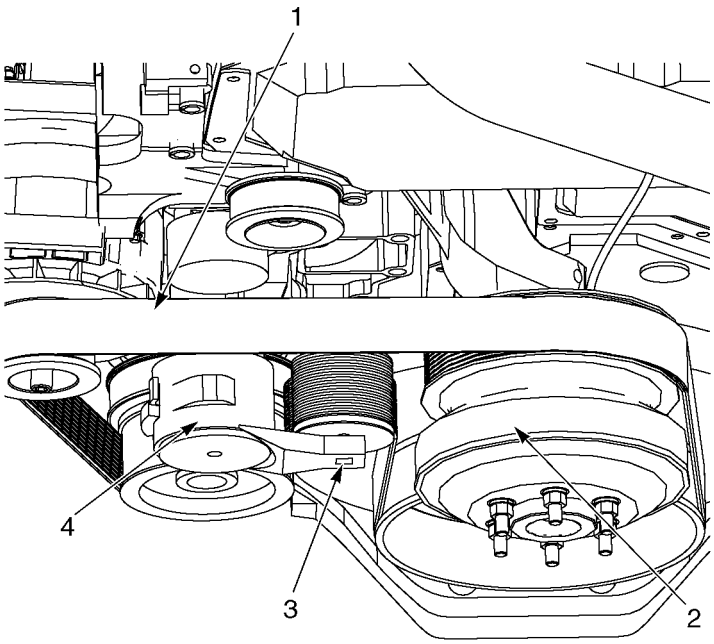

Figure 16 Fan Belt

1. FAN BELT
2. FAN DRIVE
3. TENSIONER RELEASE HOLE
4. BELT TENSIONER

2. Insert ratchet in belt tensioner release hole, relieve tension from fan belt, and remove fan belt from belt tensioner.

3. Remove fan belt from all pulleys.

4. Remove fan belt, by working the fan belt around the radiator fan.

Fan Belt – Installation

NOTE – Manual re-tensioning is not needed on belts equipped with a spring-loaded automatic belt tensioner.

NOTE – Inspect the fan belt for damage and wear prior to installation. The fan belt should be replaced if any defects are found.

1. Install fan belt, by working the fan belt around the radiator fan.
2. Position fan belt on all pulleys except belt tensioner (Figure 16).
3. Insert ratchet in belt tensioner release hole, relieve tension from tensioner, and install fan belt on belt tensioner (Figure 16, Items 1 and 3).
4. Close and latch the hood.

2.7. FAN DRIVE ASSEMBLY

Two types of fan drives are available on the ProStar™, Borg Warner and Horton. Borg Warner is the standard fan drive, and the Horton fan drive can be ordered as an option. The procedures in this service manual cover both fan drives.

Fan Drive Assembly – Removal

1. Unlatch and open the hood.
2. Loosen two spring clamps and remove the left charge air cooler hose (Figure 10, Items 2 and 3).
3. Remove two bolts and washers from the top fan shroud (Figure 11, Items 1 and 2).
4. Beginning with the top plastic hold tab, release three plastic hold tabs and remove the top fan shroud (Figure 11, Item 3).
5. Remove six nuts, lock washers, and washers from the radiator fan (Figure 12).
6. Remove the radiator fan from the fan drive.
7. Insert ratchet in belt tensioner release hole, relieve tension from fan belt, and remove fan belt (Figure 16, Items 1 and 3).

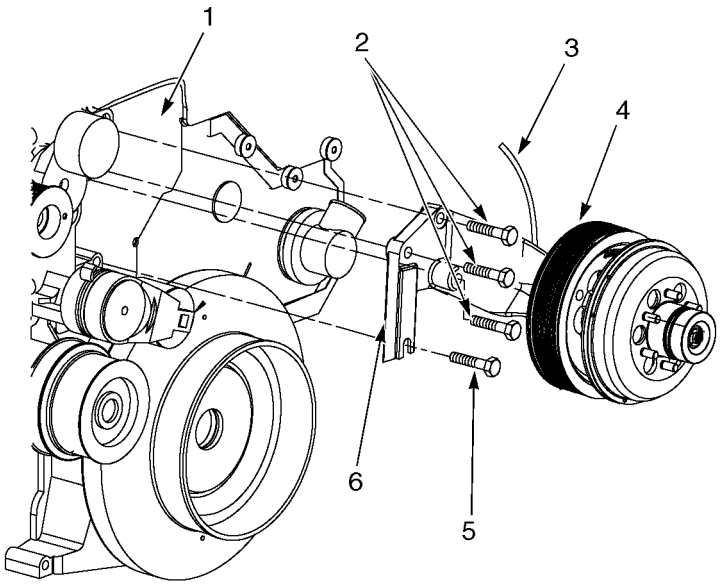

Figure 17 Borg Warner Fan Drive Assembly

1. FRONT OF ENGINE
2. FAN HUB MOUNT BOLTS
3. SUPPLY AIR LINE
4. FAN DRIVE
5. LOWER FAN HUB MOUNT BOLT
6. FAN HUB

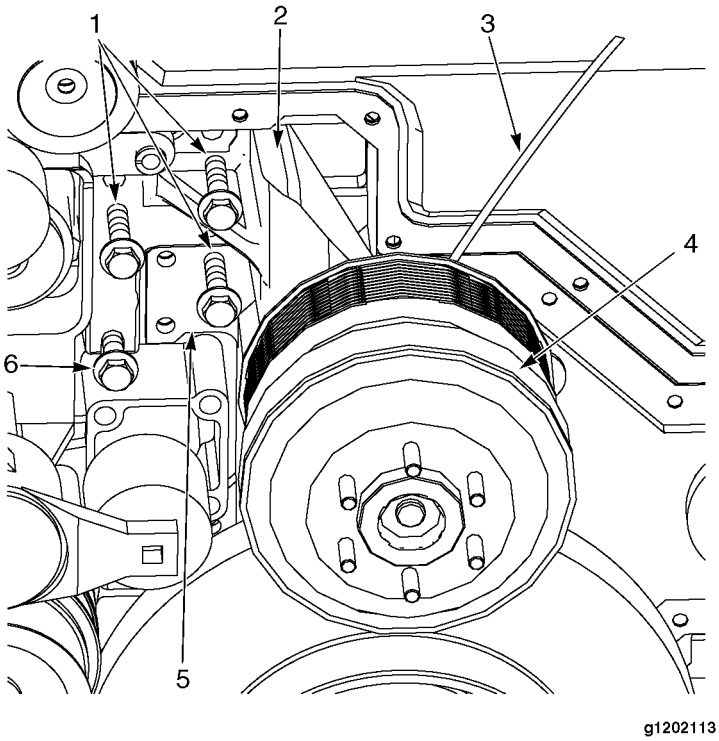

Figure 18 Horton Fan Drive Assembly

1. FAN HUB MOUNT BOLTS
2. MOUNT HUB
3. SUPPLY AIR LINE
4. FAN DRIVE
5. FRONT OF ENGINE
6. LOWER FAN HUB MOUNT BOLT

8. Disconnect the air line from the mount hub.

IMPORTANT – The bottom of the mount hub is slotted to fit over the lower mount bolt. The bottom bolt can be loosened, without being removed, and the mount hub will lift off the bolt to aid in the removal of the fan drive.

9. Suspend fan drive and mount hub with a sling.

10. Loosen, do not remove, lower mount bolt. Remove three other bolts from the mount hub.

11. Remove fan drive from front of engine.

Fan Drive Assembly – Installation

IMPORTANT – The bottom of the mount hub is slotted to fit over the lower mount bolt. The bottom bolt can be partially installed and the mount hub will slide down on the bolt to aid in the installation of the fan drive.

1. Install lower mount hub bolt in engine; turn bolt into threaded hole two full turns only (Figure 18, Item 6).
2. Using a sling, install the mount hub on the lower mount bolt (Figure 18, Items 2 and 6).
3. Install three remaining bolts in mount hub (Figure 18, Item 1).
4. Torque four mount hub bolts to 88 to 99 lbf-ft (119 to 134 N•m).
5. Connect air line to mount hub (Figure 18, Item 3).

NOTE – Inspect fan belt for damage and wear prior to installation. Fan belt should be replaced if any defects are found.

Manual re-tensioning is not needed on belts equipped with a spring-loaded automatic belt tensioner.

6. Position fan belt on all pulleys except belt tensioner (Figure 16).
7. Insert ratchet in belt tensioner release hole, relieve tension from tensioner, and install fan belt on belt tensioner (Figure 16, Items 1 and 3).
8. Install the radiator fan on the fan drive.
9. Install six washers, lock washers, and nuts on the radiator fan (Figure 12). Torque nuts to 25 lbf-ft (34 N•m).
10. Align top fan shroud on bottom fan shroud and engage three plastic hold tabs (Figure 11, Item 3).
11. Secure top fan shroud with two washers and bolts (Figure 11, Items 1 and 2). Torque bolts to 13 to 14 lbf-ft (18 to 19 N•m).
12. Install left charge air cooler hose and secure two spring clamps (Figure 10, Items 2 and 3). Torque spring clamps to 6 lbf-ft (8 N•m).
13. Close and latch the hood.

2.8. TRANSMISSION OIL COOLER

Transmission Oil Cooler – Removal

NOTE – The grille must be removed from the hood to gain access to the transmission oil cooler.

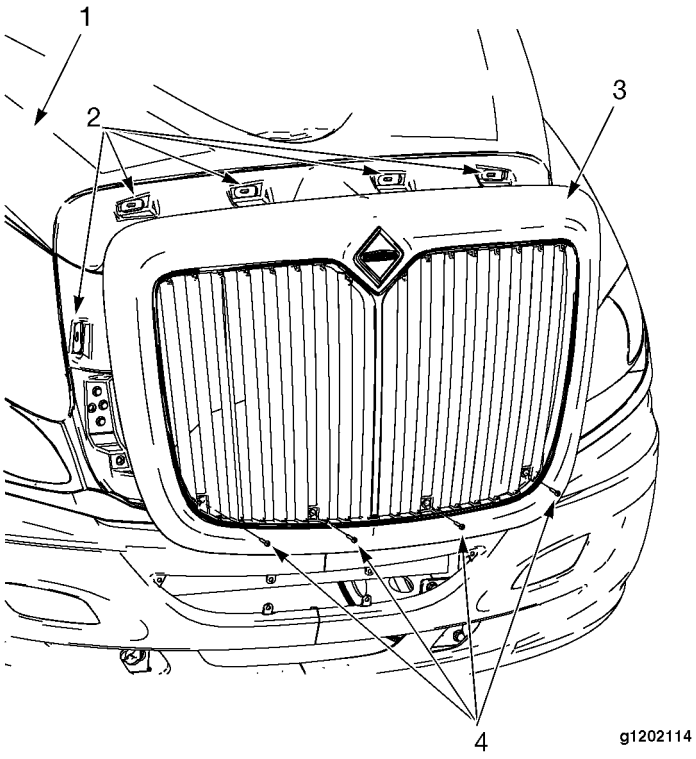

Figure 19 Grille

1. HOOD ASSEMBLY
2. TAB INSERTS
3. GRILLE
4. GRILLE MOUNT SCREWS

1. Remove four mount screws from the lower portion of the grille.
2. To remove the grille, lift the grille out to release the tabs from the tab inserts.
3. Unlatch and open the hood.
4. Release latches and lower the tilt-away bumper.

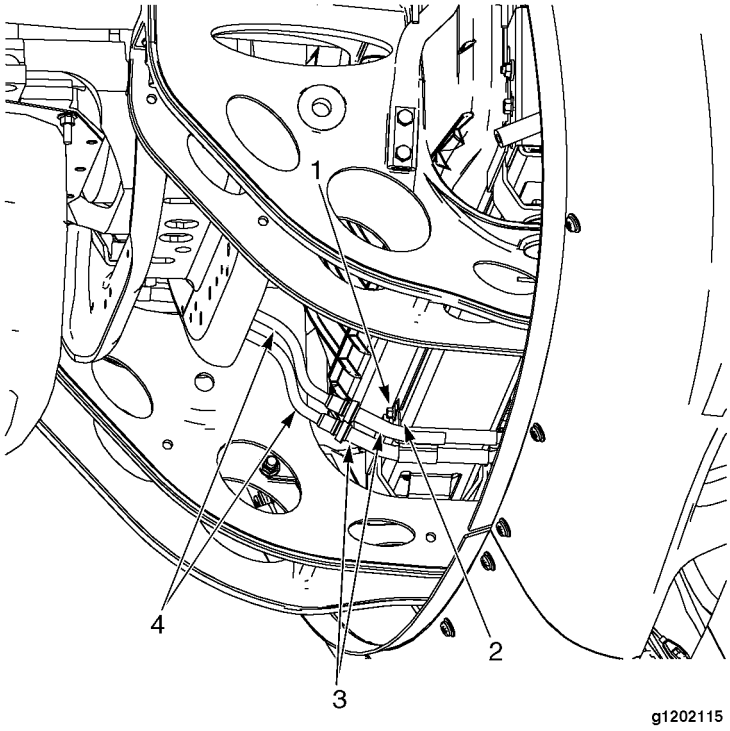

Figure 20 Transmission Oil Cooler Hoses

1. TRANSMISSION OIL COOLER TUBE BRACKET BOLT
2. TRANSMISSION OIL COOLER TUBE BRACKET
3. TRANSMISSION OIL COOLER TUBES
4. TRANSMISSION OIL COOLER HOSES

5. Place a suitable container under the transmission oil cooler hoses to catch any oil from the system.
6. Disconnect two transmission oil cooler hoses from the transmission oil cooler tubes.
7. Cap ends of the transmission oil cooler tubes and transmission oil cooler hoses.
8. Remove the transmission oil cooler tube bracket bolt.

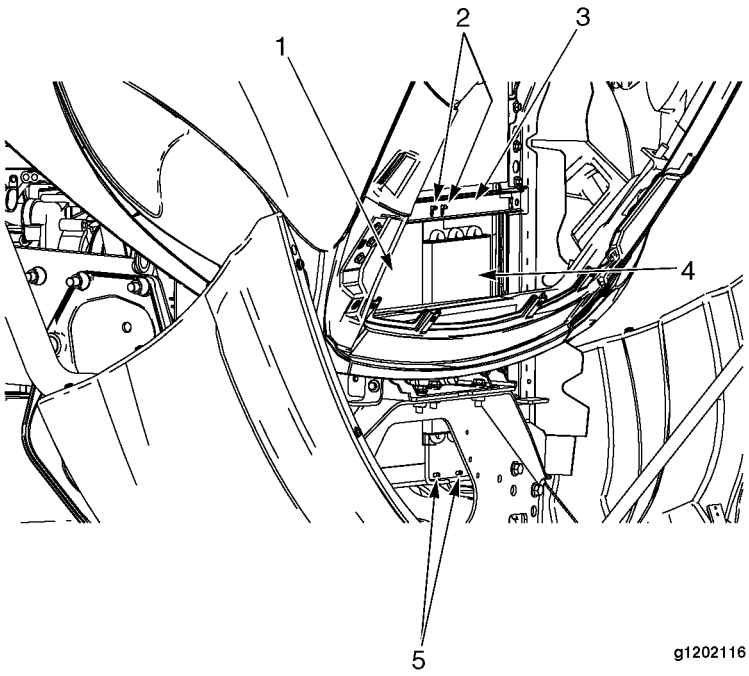

Figure 21 Transmission Oil Cooler

1. RADIATOR
2. TOP MOUNT BOLTS
3. TRANSMISSION OIL COOLER MOUNT BRACKET
4. TRANSMISSION OIL COOLER
5. BOTTOM MOUNT BOLTS

9. Remove two bottom mount bolts and two top mount bolts from the transmission oil cooler.

10. Remove the transmission oil cooler by sliding the transmission oil cooler down and rotating out of the chassis.

Transmission Oil Cooler – Installation

NOTE – Inspect the transmission oil cooler prior to installation for damage.

1. Install the transmission oil cooler on the front of the radiator by sliding the transmission oil cooler up from the bottom of the vehicle and rotating into the mounting position.

2. Install two top mount bolts and two bottom mount bolts on the transmission oil cooler (Figure 21, Items 2 and 5). Torque bolts to 33 to 40 lbf-ft (45 to 54 N•m).

3. Install the oil cooler tube bracket bolt (Figure 20, Item 1). Torque bolt to 33 to 40 lbf-ft (45 to 54 N•m).

4. Remove the capped ends from the transmission oil cooler tubes and transmission oil cooler hoses.

5. Connect two transmission oil cooler hoses to the transmission oil cooler tubes (Figure 20, Items 3 and 4).

6. Close bumper and secure latches.

NOTE – Prior to installing the grille, inspect the mounting tabs on the upper surface of the grille and the tab inserts on the hood. Insure that all tabs and tab inserts are functional and in place.

7. Align grille tabs with the hood tab insert holes (Figure 19, Item 2).

8. With the palm of your hand, press the grille at all six tab insert locations to seat grille onto the hood.

9. Install four mount screws in bottom of grille (Figure 19, Item 4). Torque screws to 4 to 5 lbf-ft (6 to 7 N•m).

10. Check and fill transmission fluid as needed. Refer to Transmission Operator's Manual for fluid type and filling instructions.

2.9. RADIATOR HOSE

The radiator hoses on the ProStar™ consist on two hoses with a coolant pipe on the right side and two hoses with two coolant pipes on the left side.

There are two types of radiator clamps that are utilized for installation of radiator hoses; spring clamps and Gates PowerGrip SB heat shrink clamps. If the radiator hoses are equipped with heat shrink clamps, be sure to follow the procedures for removal and installation of heat shrink clamps. If the radiator hoses are equipped with spring clamps, follow the procedures for removal and installation of the radiator hoses.

Heat Shrink Clamp – Removal

Figure 22 Heat Shrink Clamp Cutting Tool

The cooling system may be fitted with heat shrink clamps on the radiator connections. A special tool is required for the removal of the heat shrink clamp. The recommended tool for this application is a heavy-duty heat shrink clamp cutting tool, model number ZTSE4479, available through International Truck and Engine Corporation.

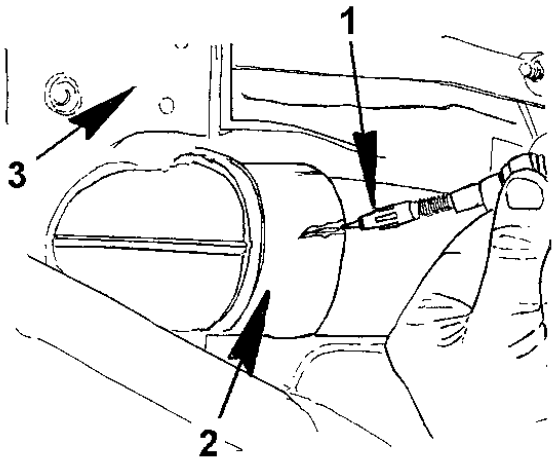

Figure 23 Heat Shrink Clamp Removal

1. HEAT SHRINK CLAMP CUTTING TOOL
2. HEAT SHRINK CLAMP
3. RADIATOR SIDE FRAME

NOTE – Use the following procedure to remove heat shrink clamps at all locations on the radiator hoses.

1. Utilizing the heat shrink clamp cutting tool, start on one side of the heat shrink clamp and work your way across the heat shrink clamp to cut the entire heat shrink clamp.

2. Move to the heat shrink clamp at the other end of the radiator hose. Cut the heat shrink clamp using the heat shrink clamp cutting tool.

3. Remove the radiator hose.

4. Slide the heat shrink clamps off the radiator hose.

Heat Shrink Clamp – Installation

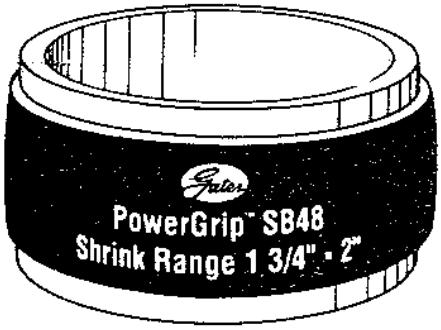

Figure 24 Heat Shrink Clamp

NOTE – Place heat shrink clamps on the radiator hose to be reconnected. Use the following procedure to install heat shrink clamps at all locations on the radiator hoses.

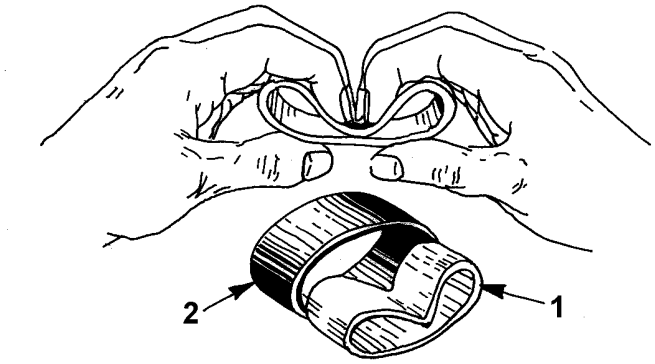

Figure 25 Preparing Heat Shrink Clamp

1. CLAMP BRACE
2. HEAT SHRINK CLAMP

1. Remove heat shrink clamp from clamp brace by squeezing heat shrink clamp to collapse the heat shrink clamp, then fold in half and remove heat shrink clamp from clamp brace.

2. Place heat shrink clamps on the radiator hose.

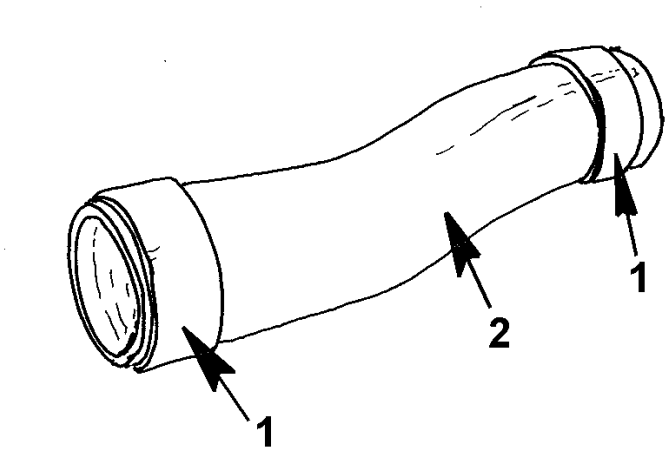

Figure 26 Radiator Hose and Heat Shrink Clamps

1. HEAT SHRINK CLAMPS
2. RADIATOR HOSE

3. Position radiator hose on the radiator, engine, and fittings as needed.

4. Slide heat shrink clamp over top of fitting bead. (Heat shrink clamps have a wider sealing surface than conventional clamps and can be positioned over a wide area including the bead without causing leaks.)

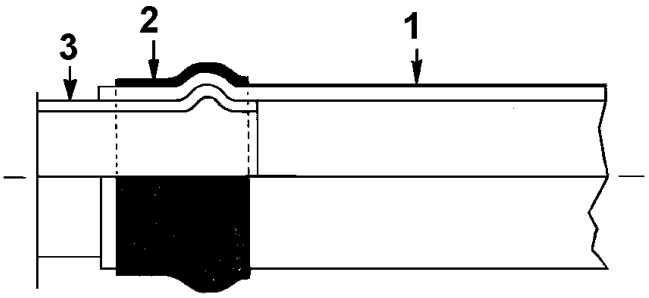

Figure 27 Cross Section Clamp and Hose

1. HOSE
2. HEAT SHRINK CLAMP
3. FITTING

CAUTION – Although heat shrink clamps are very durable, too much heat can melt them.

IMPORTANT – Be sure to position so the print on the heat shrink clamp is facing up (Figure 24) and in full view.

5. Apply heat as follows:
   a. Use standard heat gun with setting on high.
   b. Do not use open flame to apply heat.
   c. Follow heat gun manufacturer's safety procedures.
   d. Do not apply heat to one spot too long. Move gun continuously.
   e. Move heat gun continuously around as much of the heat shrink clamps surface as possible - 1/3 of the surface minimum.
   f. Continue until shrinking is complete (printed information on the heat shrink clamp will turn gray when enough heat has been applied).
   g. Remove the heat source.
6. To be sure a good seal was made, check connections by trying to turn the hose. Hose and heat shrink clamp should not turn when using **reasonable** torque.

Radiator Hose – Removal

NOTE – If the radiator hoses are mounted using heat shrink clamps, refer to Heat Shrink Clamp – Removal before attempting to remove any radiator hoses.

1. Drain coolant (See Drain Coolant section for proper draining procedures).

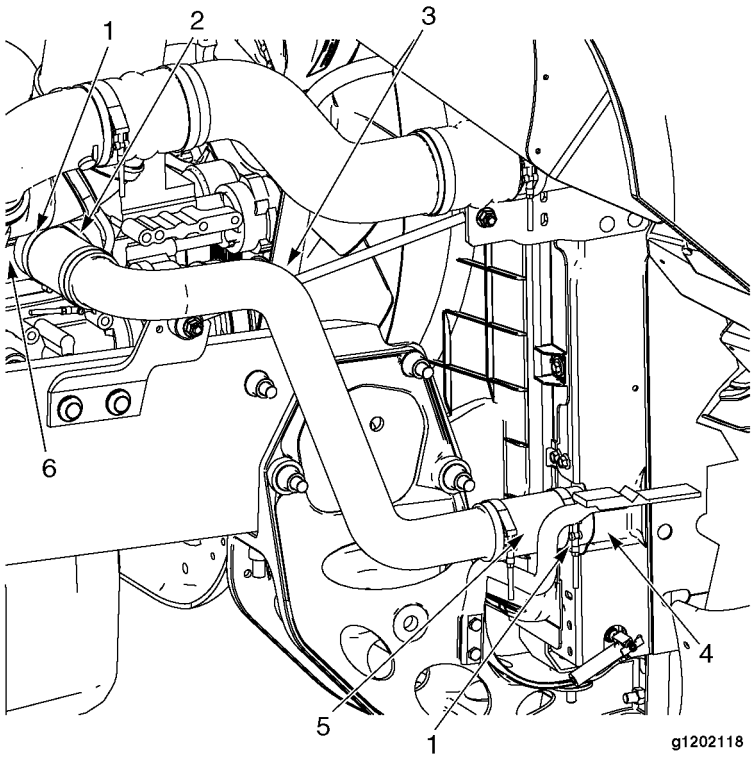

Figure 28 Right Radiator Hose, Coolant Pipe, and Coolant Hose

1. SPRING CLAMPS
2. RIGHT UPPER COOLANT HOSE
3. RIGHT COOLANT PIPE
4. RADIATOR OUTLET CONNECTION
5. RIGHT RADIATOR HOSE
6. ENGINE COOLANT INLET CONNECTION

2. Follow these procedures to remove the right coolant hoses and pipe.

   a. Loosen spring clamp securing right radiator hose to radiator outlet connection and slide spring clamp past the fitting bead on the radiator hose.

   b. Loosen spring clamp securing right upper coolant hose to engine coolant inlet connection and slide spring clamp past the fitting bead on the right upper coolant hose.

   c. Remove radiator hoses with coolant pipe from radiator outlet connection and engine coolant inlet connection.

   d. The two radiator hoses can be removed from the coolant pipe by loosening the spring clamps and sliding the radiator hoses off the coolant pipe.

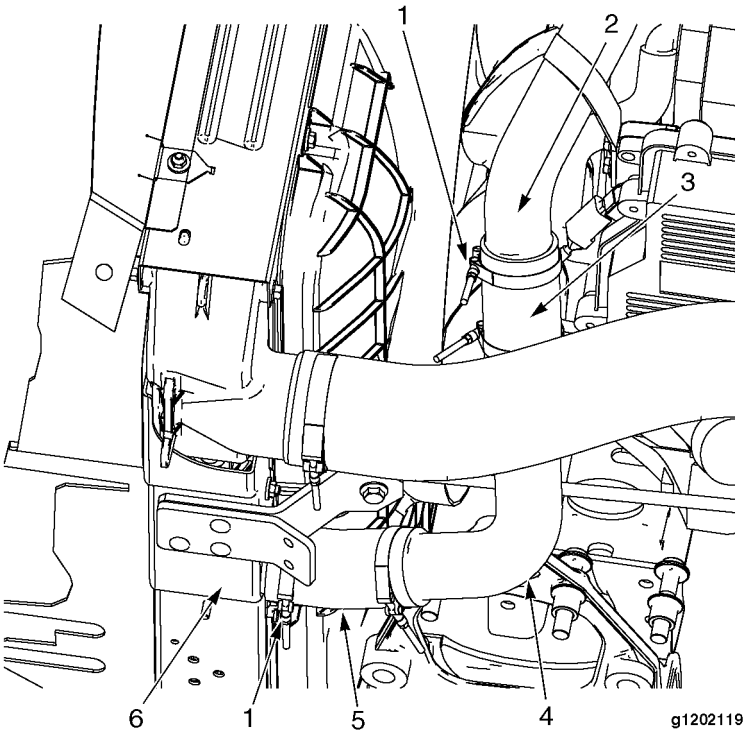

Figure 29 Left Radiator Hose, Upper Coolant Hose, and Lower Coolant Pipe

1. SPRING CLAMPS
2. UPPER COOLANT PIPE
3. UPPER COOLANT HOSE
4. LOWER COOLANT PIPE
5. LEFT RADIATOR HOSE
6. RADIATOR INLET CONNECTION

3. Follow these procedures to remove the left lower coolant hoses and pipe.

    a. Loosen spring clamp securing radiator hose to radiator inlet connection and slide spring clamp past the fitting bead on the radiator hose.

    b. Loosen spring clamp securing left radiator hose to upper coolant pipe and slide spring clamp past the fitting bead on the left radiator hose.

    c. Remove left radiator hose with lower coolant pipe and upper coolant hose from radiator inlet connection and upper coolant pipe.

    d. The two radiator hoses can be removed from the lower coolant pipe by loosening the spring clamps and sliding the left radiator hose and upper coolant hose off the lower coolant pipe.

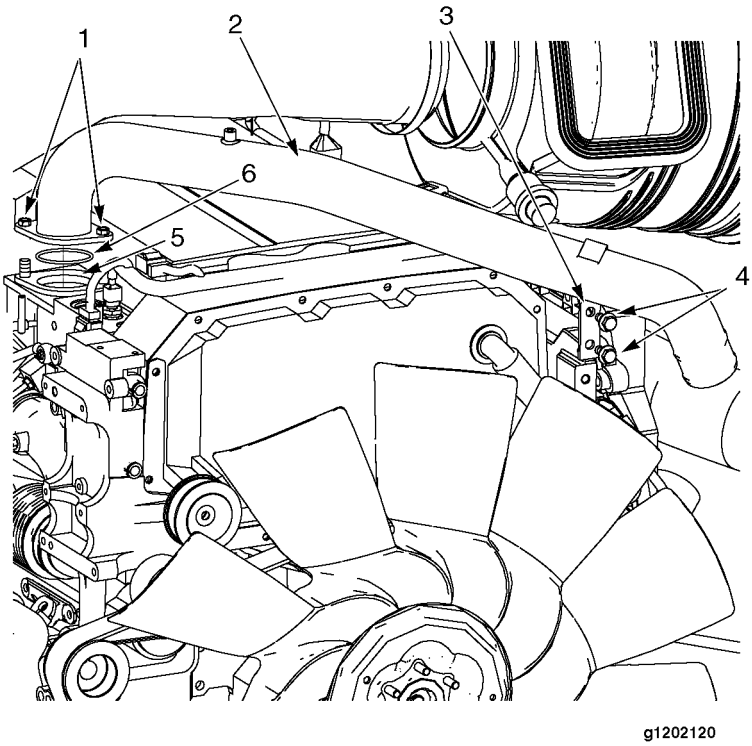

Figure 30 Left Upper Coolant Pipe

1. MOUNT NUTS
2. UPPER COOLANT PIPE
3. UPPER COOLANT PIPE MOUNT BRACKET
4. MOUNT BOLTS
5. THERMOSTAT HOUSING
6. COOLANT PIPE O-RING

4. Follow these procedures to remove the left upper coolant pipe.

    a. Remove two nuts from upper coolant pipe and thermostat housing.

    b. Remove two bolts from upper coolant pipe mount bracket.

    c. Remove upper coolant pipe and O-ring from engine.

Radiator Hose – Installation

NOTE – If the radiator hoses are to be mounted using heat shrink clamps, refer to Heat Shrink Clamp – Installation before attempting to install any radiator hoses.

NOTE – Inspect radiator hoses and coolant pipes for damage and wear prior to installation. Any radiator hose or coolant pipe with defects should be replaced.

1. Follow these procedures to install the left upper coolant pipe.
    a. Install a new O-ring and upper coolant pipe on thermostat housing mount studs (Figure 30, Items 2 and 6).
    b. Install two bolts on upper coolant pipe mount bracket (Figure 30, Item 4). **DO NOT** tighten these bolts at this point.
    c. Install two nuts on upper coolant pipe and thermostat housing (Figure 30, Items 1 and 2). Torque nuts to 21 to 24 lbf-ft (29 to 33 N•m).
    d. Torque two bolts on upper coolant pipe mount bracket (Figure 30, Item 4). Torque bolts to 35 to 43 lbf-ft (47 to 58 N•m).
2. Follow these procedures to install the left lower coolant hoses and pipe.
    a. Position left radiator hose and upper coolant hose on lower coolant pipe and secure spring clamps (Figure 29). Torque spring clamps to 6 lbf-ft (8 N•m).
    b. Slide spring clamps on left radiator hose and upper coolant hose. Install left radiator hose, upper coolant hose, and lower coolant pipe on radiator inlet connection and upper coolant pipe (Figure 29).
    c. Position spring clamps on fitting bead of radiator inlet connection and upper coolant pipe (Figure 29, Item 1). Torque spring clamps to 6 lbf-ft (8 N•m).
3. Follow these procedures to install the right coolant hoses and pipe.
    a. Position right radiator hose and right upper coolant hose on right coolant pipe and secure spring clamps (Figure 28). Torque spring clamps to 6 lbf-ft (8 N•m).
    b. Slide spring clamps on right radiator hose and right upper coolant hose. Install right radiator hose, right upper coolant hose, right coolant pipe on radiator outlet connection and coolant inlet adapter (Figure 28).
    c. Position spring clamps on fitting bead of radiator outlet connection and coolant inlet adapter (Figure 28, Item 1). Torque spring clamps to 6 lbf-ft (8 N•m).
4. Inspect all hose connections prior to filling coolant system by trying to turn each hose. Hose and clamp should not turn when using reasonable torque.
5. Fill coolant system to proper level and leak test the coolant system. Special Tool number **550500INT** is recommended to fill and leak test the coolant system.

2.10. CHARGE AIR COOLER

CAUTION – Protect all open ports in the charge air cooler system during removal and installation procedures. Dirt or foreign particles in charge air cooling piping or cooling system components could cause internal damage to engine parts.

Charge Air Cooler – Removal

NOTE – The grille must be removed from the hood to gain access to the charge air cooler.

1. Remove four screws from the lower portion of the grille (Figure 19, Item 2).
2. To remove the grille, lift the grille out to release the tabs from the tab inserts (Figure 19).
3. Remove nut from P-clamps securing the A/C lines to the top channel plate (Figure 8, Items 1 and 2).
4. Remove two nuts from the A/C condenser top mount brackets (Figure 8, Items 6 and 7).
5. Carefully remove the A/C condenser by raising the A/C condenser over the top of the cooling package and securing the A/C condenser out of the way (Figure 9).
6. Remove two mount nuts and one bottom mount bolt from the surge tank (Figure 7, Items 2 and 3). Secure surge tank away from fan shroud.
7. Loosen two spring clamps and remove the left charge air cooler hose (Figure 10, Items 2 and 3).
8. Remove two bolts and washers from the top fan shroud (Figure 11, Items 1 and 2).
9. Beginning with the top plastic hold tab, release three plastic hold tabs and remove the top fan shroud (Figure 11, Item 3).
10. Remove three bolts and washers from the bottom fan shroud (Figure 14, Items 1 and 2).
11. Position bottom fan shroud away from coolant package.

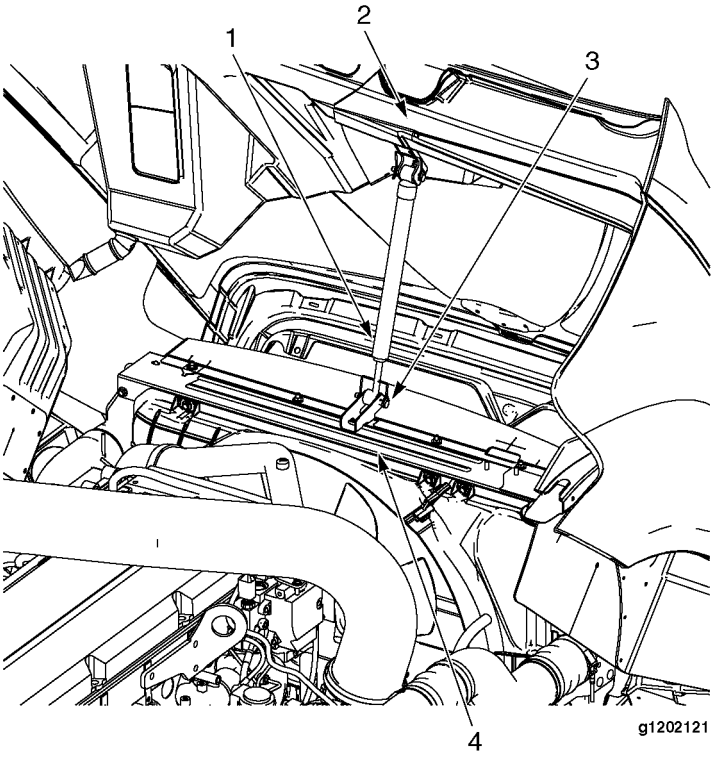

Figure 31 Tilt Assist Cylinder

1. HOOD TILT ASSIST CYLINDER
2. HOOD ASSEMBLY
3. RETAINER PIN
4. TOP CHANNEL PLATE

CAUTION – Prior to disconnecting the tilt assist cylinder, position a padded support under the hood.

12. With the aid of an assistant, remove retainer pin and disconnect the hood tilt assist cylinder from the top channel plate.

13. Gently lower the hood onto a padded support.

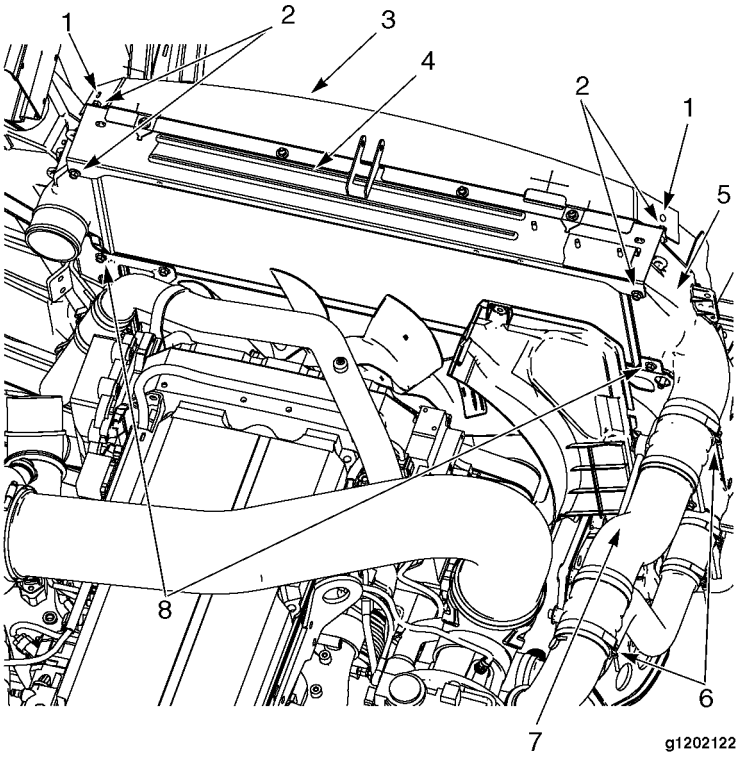

Figure 32 Charge Air Cooler

1. BUTTON SNAPS
2. TOP CHANNEL MOUNT BOLTS
3. TOP RECIRCULATION SEAL
4. TOP CHANNEL PLATE
5. CHARGE AIR COOLER
6. SPRING CLAMPS
7. RIGHT CHARGE AIR COOLER PIPE
8. CHARGE AIR COOLER MOUNT BOLTS

14. Loosen two spring clamps and remove right charge air cooler pipe with hoses.

NOTE – The button snaps may not be reusable, new button snaps may be needed for proper installation of the recirculation seals.

15. Remove two button snaps from recirculation seals.

16. Remove four bolts and top channel plate from charge air cooler.

17. Remove two mount bolts from the charge air cooler.

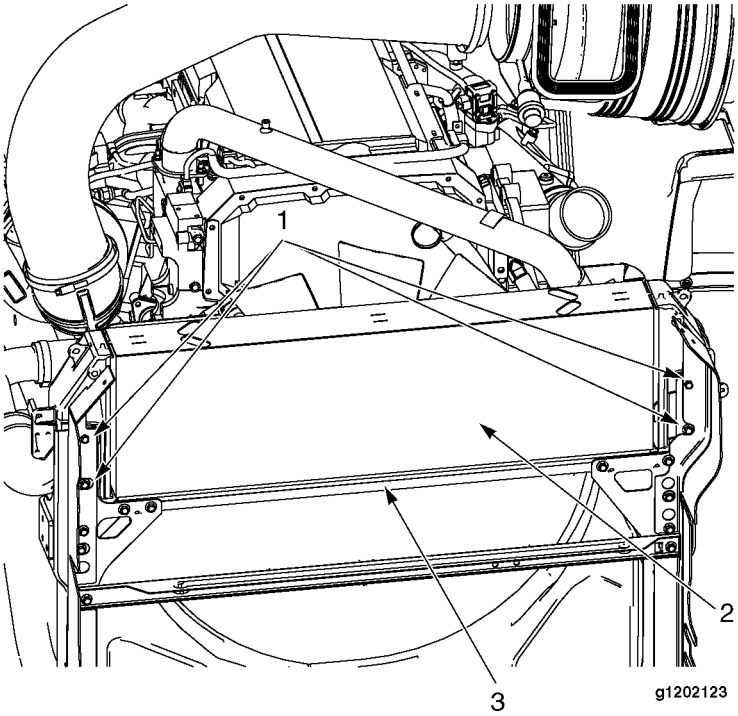

Figure 33 Charge Air Cooler Mount Bolts

1. CHARGE AIR COOLER MOUNT BOLTS
2. CHARGE AIR COOLER
3. RADIATOR UPPER FRAME PLATE

18. Remove four mount bolts from the charge air cooler.

19. With aid of an assistant, remove the charge air cooler from the radiator upper frame plate.

20. Secure the charge air cooler in a safely supported position on the floor or work bench.

Charge Air Cooler – Installation

NOTE – Prior to installation of charge air cooler hoses and pipes, inspect for dirt or particles. Remove any dirt or particles.

1. With aid of an assistant, position charge air cooler on the radiator upper frame plate (Figure 33, Items 2 and 3).

2. Install four bolts on the front of the charge air cooler (Figure 33, Item 1). Torque bolts to 52 to 59 lbf-ft (71 to 80 N•m).

3. Install two mount bolts on the back of the charge air cooler (Figure 32, Item 8). Torque bolts to 52 to 59 lbf-ft (71 to 80 N•m).

4. Align top channel plate on charge air cooler and secure with four bolts (Figure 32, Items 2 and 4). Torque bolts to 52 to 59 lbf-ft (71 to 80 N•m).

5. Install two button snaps on recirculation seals (Figure 32, Items 1 and 3).

6. Install right charge air cooler pipe with hoses and secure with two spring clamps (Figure 32, Items 6 and 7). Torque spring clamps to 6 lbf-ft (8 N•m).

7. With the aid of an assistant, install the hood tilt assist cylinder and secure retainer pin (Figure 31, Items 1 and 3).

8. Install the bottom fan shroud on the radiator.

9. Secure bottom fan shroud with three washers and bolts (Figure 14, Items 1 and 2). Torque bolts to 13 to 14 lbf-ft (18 to 19 N•m).

10. Align the top fan shroud on the bottom fan shroud and engage the three plastic hold tabs (Figure 11, Item 3).

11. Secure the top fan shroud with two washers and bolts (Figure 11, Items 1 and 2). Torque bolts to 13 to 14 lbf-ft (18 to 19 N•m).

12. Install left charge air cooler hose and secure with two spring clamps (Figure 10, Items 2 and 3). Torque spring clamps to 6 lbf-ft (8 N•m).

13. Position surge tank on cooling package and secure with two nuts and one bolt (Figure 7, Items 2 and 3). Torque nuts and bolt to 13 to 14 lbf-ft (18 to 19 N•m).

14. Position the A/C condenser on the bottom mount bracket, make sure the A/C condenser is seated properly on the bottom mount bracket (Figure 8, Items 4 and 8).

15. Align the A/C condenser top mount brackets on the top channel plate and secure with two washers and nuts (Figure 8, Items 6 and 7). Torque nuts to 13 to 14 lbf-ft (18 to 19 N•m).

16. Install nut on P-clamps securing the A/C lines to the top channel plate and tighten (Figure 8, Items 1 and 2).

17. Close and latch the hood.

NOTE – Prior to installing the grille, inspect the mounting tabs on the upper surface of the grille and the tab inserts on the hood. Insure that all tabs and tab inserts are functional and in place.

18. Align grille insert tabs with the hood insert holes (Figure 19, Item 2).

19. With the palm of your hand, press the grille at all six insert tab locations to seat grille onto the hood.

20. Install four mount screws in bottom of grille (Figure 19, Item 4). Torque screws to 4 to 5 lbf-ft (6 to 7 N•m).

2.11. RADIATOR ASSEMBLY

Radiator Assembly – Removal

NOTE – The grille must be removed from the hood to gain access to the radiator assembly.

1. Remove four screws from the lower portion of the grille (Figure 19, Item 4).
2. To remove the grille, lift the grille out to release the tabs from the tab inserts (Figure 19).
3. Remove nut from P-clamps securing the A/C lines to the top channel plate (Figure 8, Items 1 and 2).
4. Remove two nuts from the A/C condenser top mount brackets (Figure 8, Items 6 and 7).
5. Carefully remove the A/C condenser by raising the A/C condenser over the top of the cooling package and securing the A/C condenser out of the way (Figure 9).
6. Remove two mount nuts and one bottom mount bolt from the surge tank (Figure 7, Items 2 and 3). Secure surge tank away from fan shroud.
7. Loosen two spring clamps and remove the left charge air cooler hose (Figure 10, Items 2 and 3).
8. Remove two bolts and washers from the top fan shroud (Figure 11, Items 1 and 2).
9. Beginning with the top plastic hold tab, release three plastic hold tabs and remove the top fan shroud (Figure 11, Item 3).
10. Remove six nuts, lock washers, and washers from the radiator fan (Figure 12).
11. Remove the radiator fan from the fan drive.
12. Remove three bolts and washers from the bottom fan shroud (Figure 14, Items 1 and 2).
13. Remove bottom fan shroud from radiator.

> **CAUTION – Prior to disconnecting the tilt assist cylinder, position a padded support under the hood.**

14. With the aid of an assistant, remove retainer pin and disconnect the hood tilt assist cylinder from the top channel plate (Figure 31).
15. Gently lower the hood onto a padded support.
16. Loosen two spring clamps and remove right charge air cooler pipe with hoses (Figure 32, Items 6 and 7).

NOTE – The button snaps may not be reusable, new button snaps may be needed for proper installation of the recirculation seals.

17. Remove two button snaps from recirculation seals (Figure 32, Items 1 and 3).
18. Remove four bolts and top channel bracket from charge air cooler (Figure 32, Items 2 and 4).

19. Remove two bolts from the charge air cooler (Figure 32, Item 8).

20. Remove four bolts from the charge air cooler (Figure 33, Item 1).

21. With aid of an assistant, remove the charge air cooler from the radiator upper frame plate (Figure 33, Items 2 and 3).

22. Locate the radiator drain valve, prior to removal of the radiator assembly. Place tray under the radiator to collect coolant from radiator. Open drain valve and drain coolant.

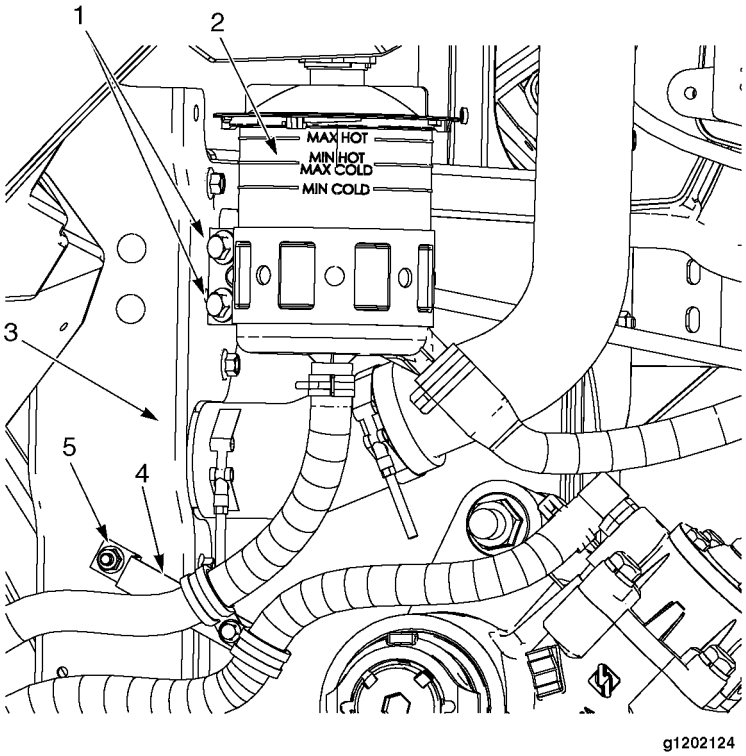

Figure 34 Power Steering Reservoir

1. MOUNT BOLTS
2. POWER STEERING RESERVOIR
3. LEFT RADIATOR FRAME
4. STEERING HOSE MOUNT BRACKET
5. MOUNT BRACKET NUT

23. Remove mount bracket nut securing power steering hoses on the left radiator frame.

24. Remove two bolts from the power steering reservoir and secure power steering reservoir out of the way.

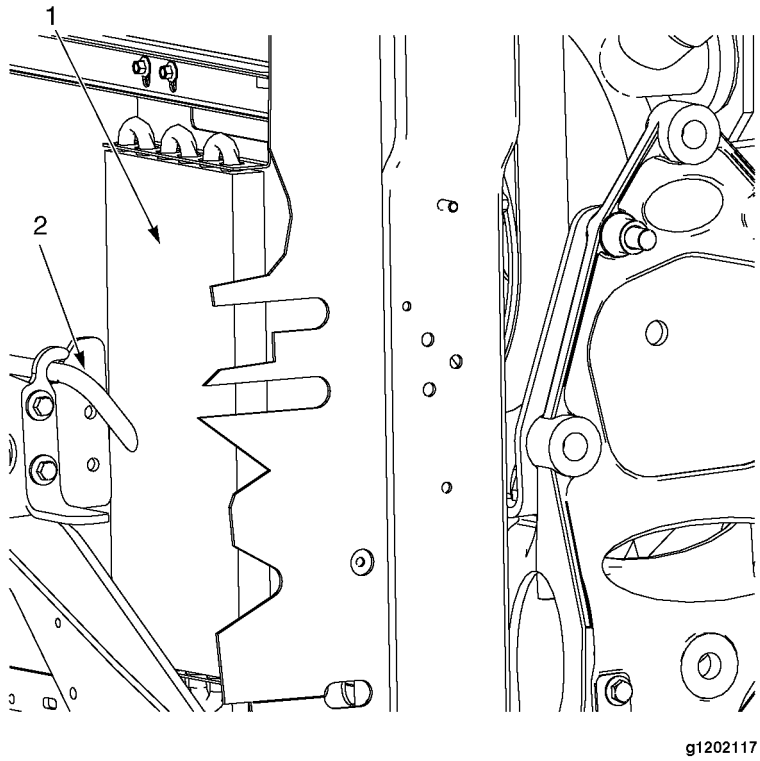

Figure 35 Torsion Bar Interference

1. TRANSMISSION OIL COOLER
2. TORSION BAR

CAUTION – Exercise care when removing the transmission oil cooler as there is minimal clearance between the hood torsion bar and the transmission oil cooler. Failure to comply could result in damage to the transmission oil cooler.

25. Cover the end of the hood torsion bar with cardboard or a similar material to protect the transmission oil cooler from damage.

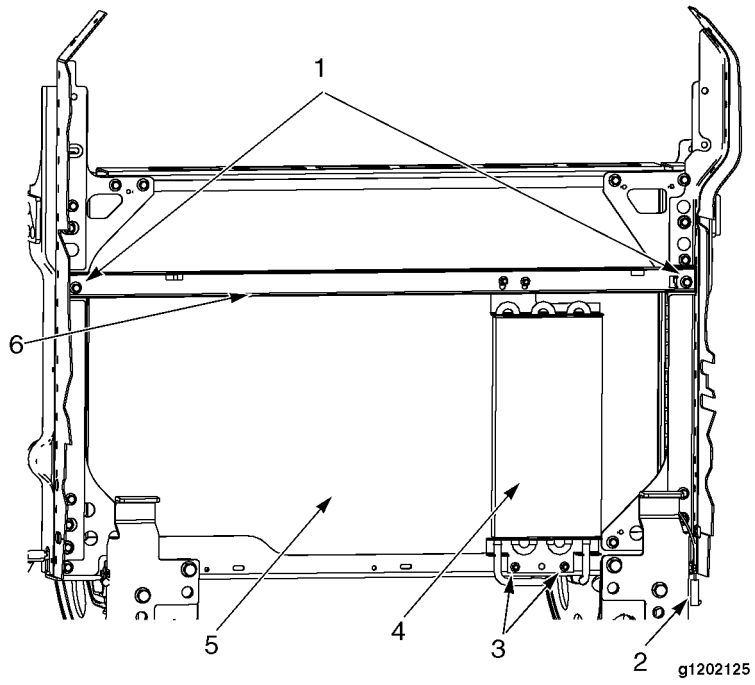

Figure 36 Transmission Oil Cooler Mounting

1. TRANSMISSION OIL COOLER MOUNT BRACKET BOLTS
2. RADIATOR GROUND WIRE
3. OIL COOLER BOTTOM MOUNT BOLTS
4. TRANSMISSION OIL COOLER
5. RADIATOR
6. TRANSMISSION OIL COOLER MOUNT BRACKET

26. Disconnect radiator ground wire.

27. Remove rear transmission oil cooler tube bracket bolt (Figure 37, Item 6).

28. Remove two bolts from bottom of the transmission oil cooler.

29. Remove two bolts from transmission oil cooler mount bracket and secure transmission oil cooler out of the way.

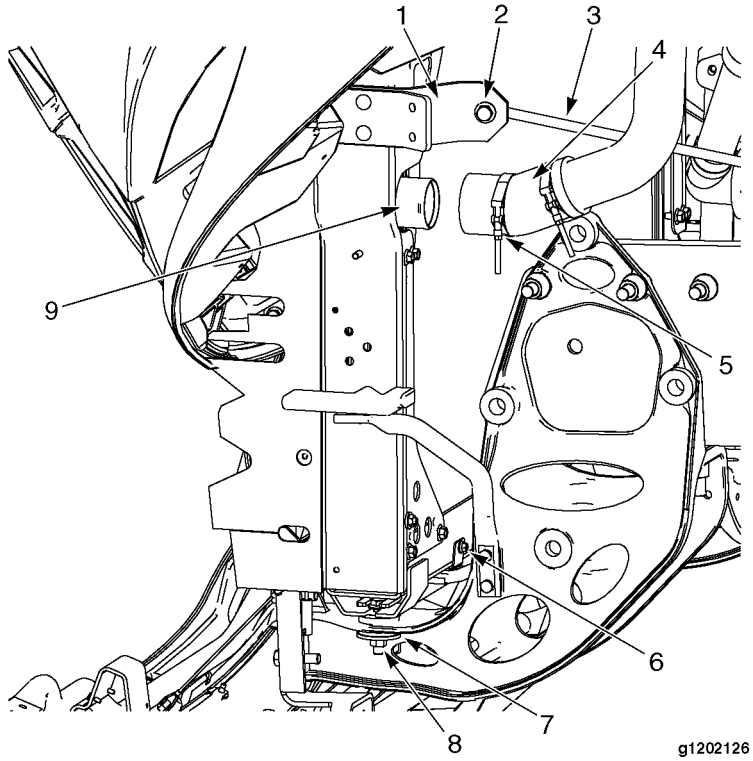

Figure 37 Left-Side Radiator Components

1. STAY ROD MOUNT BRACKET
2. STAY ROD BOLT
3. LEFT STAY ROD
4. LEFT RADIATOR HOSE
5. SPRING CLAMP
6. TRANSMISSION OIL COOLER BRACKET BOLT
7. LOWER MOUNT BUSHING
8. MOUNT NUT
9. RADIATOR INLET CONNECTION

30. Loosen spring clamp on left radiator hose, slide spring clamp past fitting bead on left radiator hose, and remove left radiator hose from radiator.

31. Remove bolt, nut, and washer from left radiator stay rod and stay rod mount bracket.

32. Remove mount nut and lower mount bushing from left radiator mount bolt.

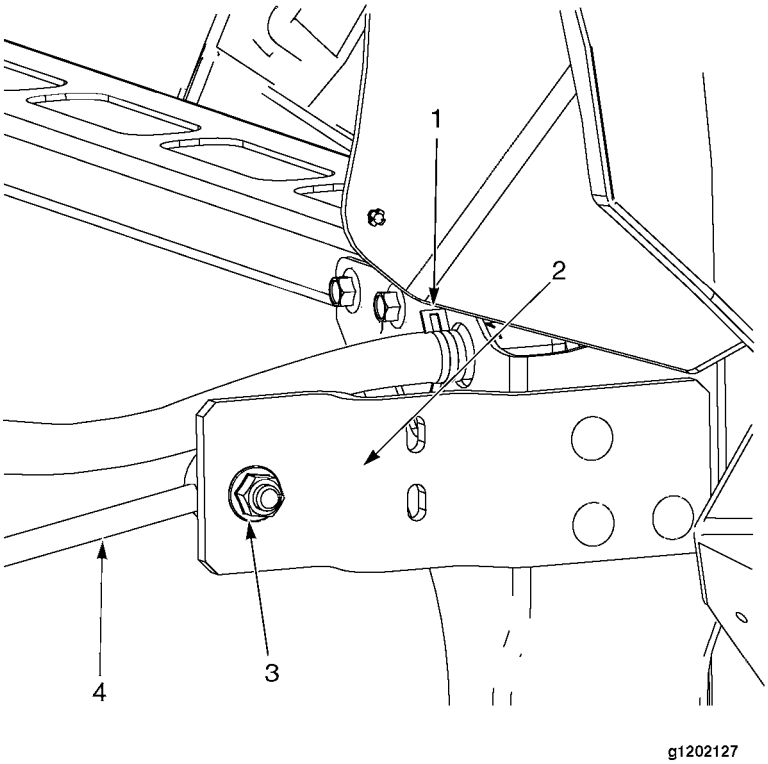

Figure 38 Right-Side Stay Rod

1. RADIATOR TO SURGE TANK HOSE
2. STAY ROD MOUNT BRACKET
3. STAY ROD BOLT
4. STAY ROD

33. Remove radiator to surge tank hose.

34. Remove bolt, nut, and washer from right radiator stay rod and stay rod mount bracket.

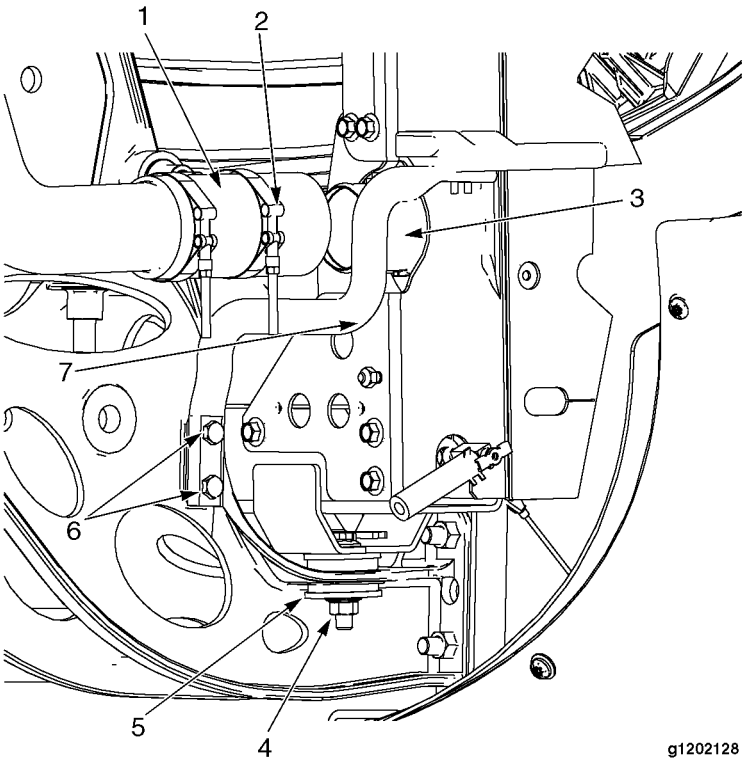

Figure 39 Right Side Radiator Components

1. RIGHT RADIATOR HOSE
2. SPRING CLAMP
3. RADIATOR OUTLET CONNECTION
4. MOUNT NUT
5. LOWER MOUNT BUSHING
6. LATCH BRACKET BOLTS
7. BUMPER LATCH BRACKET

35. Loosen spring clamp on right radiator hose, slide spring clamp past fitting bead on radiator hose, and remove right radiator hose from radiator outlet connection.

36. Remove two bolts and right bumper latch bracket from mega bracket.

37. Remove mount nut and lower mount bushing from right radiator mount bolt.

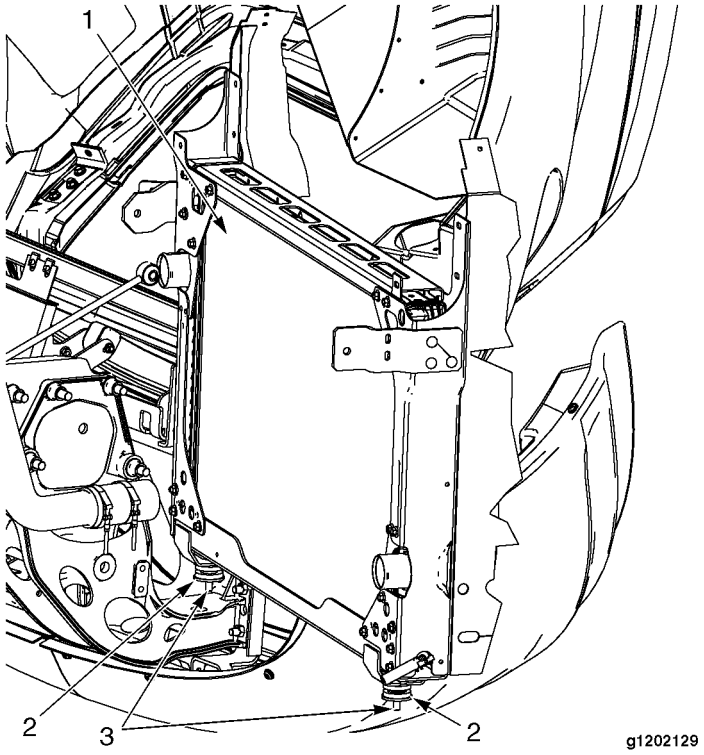

Figure 40 Radiator Assembly

1. RADIATOR ASSEMBLY
2. UPPER MOUNT BUSHINGS
3. RADIATOR MOUNT BOLTS

38. With the aid of an assistant, remove the radiator assembly from the right side of chassis.

39. Remove two radiator mount bolts and upper mount bushings from the bottom of the radiator assembly.

40. Secure the radiator assembly in a safely supported position on the floor or workbench.

Radiator Assembly – Installation

1. With the aid of an assistant, place radiator assembly in vehicle from the right side of chassis (Figure 40).

2. Install two radiator mount bolts and upper mount bushings on the bottom of the radiator assembly (Figure 40, Items 2 and 3).

3. Install two nuts and bushings on bottom of radiator assembly and ensure mount bolts and bushings are aligned properly (Figure 39, Items 4 and 5) (Figure 37, Items 6 and 7). Torque nuts to 65 to 79 lbf-ft (88 to 107 N•m).

4. Install two bolts and right bumper latch bracket on mega bracket (Figure 39, Items 6 and 7).

5. Install right radiator hose on radiator outlet connection and secure with spring clamp (Figure 39, Items 1, 2, and 3). Torque spring clamp to 6 lbf-ft (8 N•m).

6. Install bolt, washer, and nut on right radiator stay rod and stay rod mount bracket (Figure 38, Items 2 and 4). Torque bolt to 66 to 85 lbf-ft (90 to 115 N•m).

7. Connect radiator to surge tank hose (Figure 38, Item 1).

8. Install bolt, washer, and nut on left radiator stay rod and stay rod mount bracket (Figure 37, Items 1, 2, and 3). Torque bolt to 66 to 85 lbf-ft (90 to 115 N•m).

9. Install left radiator hose on radiator inlet connection and secure with spring clamp (Figure 37, Items 4 and 9). Torque spring clamp to 6 lbf-ft (8 N•m).

10. Align transmission oil cooler mount bracket on radiator frame and secure with two bolts (Figure 36, Items 1 and 6). Torque bolts to 33 to 40 lbf-ft (45 to 54 N•m).

11. Install two bolts in bottom of transmission oil cooler (Figure 36, Item 3). Torque bolts to 33 to 40 lbf-ft (45 to 54 N•m).

12. Install bolt in rear transmission oil cooler tube bracket (Figure 37, Item 6).

13. Connect radiator ground wire.

14. Align the power steering reservoir on the left side of the radiator and secure with two bolts (Figure 34, Items 1 and 2). Torque bolts to 41 to 50 lbf-ft (56 to 68 N•m).

15. Install nut on mount bracket securing power steering hoses on the left radiator frame (Figure 34, Items 4 and 5).

16. With aid of an assistant, position charge air cooler on the radiator upper frame plate (Figure 33, Items 2 and 3).

17. Install four bolts on the front of the charge air cooler (Figure 33, Item 1). Torque bolts to 52 to 59 lbf-ft (71 to 80 N•m).

18. Install two mount bolts on the back of the charge air cooler (Figure 32, Item 8). Torque bolts to 52 to 59 lbf-ft (71 to 80 N•m).

19. Align top channel plate on charge air cooler and secure with four bolts (Figure 32, Items 2 and 4). Torque bolts to 52 to 59 lbf-ft (71 to 80 N•m).

20. Install two button snaps on recirculation seals (Figure 32, Items 1 and 3).

21. Install right charge air cooler pipe with hoses and secure with two spring clamps (Figure 32, Items 6 and 7). Torque spring clamps to 6 lbf-ft (8 N•m).

22. With the aid of an assistant, install the hood tilt assist cylinder and secure retainer pin (Figure 31).

23. Install the bottom fan shroud on the radiator.

24. Secure bottom fan shroud with three washers and bolts (Figure 14, Items 1 and 2). Torque bolts to 13 to 14 lbf-ft (18 to 19 N•m).

25. Install the radiator fan on the fan drive.

26. Install six washers, lock washers, and nuts on the radiator fan (Figure 12). Torque nuts to 25 lbf-ft (34 N•m).

27. Align the top fan shroud on the bottom fan shroud and engage the three plastic hold tabs (Figure 11, Item 3).

28. Secure the top fan shroud with two washers and bolts (Figure 11, Items 1 and 2). Torque bolts to 13 to 14 lbf-ft (18 to 19 N•m).

29. Install left charge air cooler hose and secure with two spring clamps (Figure 10, Items 2 and 3). Torque spring clamps to 6 lbf-ft (8 N•m).

30. Position surge tank on cooling package and secure with two nuts and one bolt (Figure 7, Items 2 and 3). Torque nuts and bolt to 13 to 14 lbf-ft (18 to 19 N•m).

31. Position the A/C condenser on the bottom mount bracket, make sure the A/C condenser is seated properly on the bottom mount bracket (Figure 8, Items 4 and 8).

32. Align the A/C condenser top mount brackets on the top channel plate and secure with two washers and nuts (Figure 8, Items 6 and 7). Torque nuts to 13 to 14 lbf-ft (18 to 19 N•m).

33. Install nut on P-clamps securing the A/C lines to the top channel plate and tighten (Figure 8, Items 1 and 2).

NOTE – Prior to installing the grille, inspect the mounting tabs on the upper surface of the grille and the tab inserts on the hood. Insure that all tabs and tab inserts are functional and in place.

34. Align grille insert tabs with the hood insert holes (Figure 19, Item 2).

35. With the palm of your hand, press the grille at all six insert tab locations to seat grille onto the hood.

36. Install four mount screws in bottom of grille (Figure 19, Item 4). Torque screws to 4 to 5 lbf-ft (6 to 7 N•m).

37. Fill coolant system to proper level and leak test the system. Special Tool number **550500INT** is preferred to fill and leak test the coolant system.

2.12. RADIATOR CORE

The radiator core is a replaceable component only. If replacing the radiator core, use only authorized International® parts and assemblies.

Radiator Core – Removal

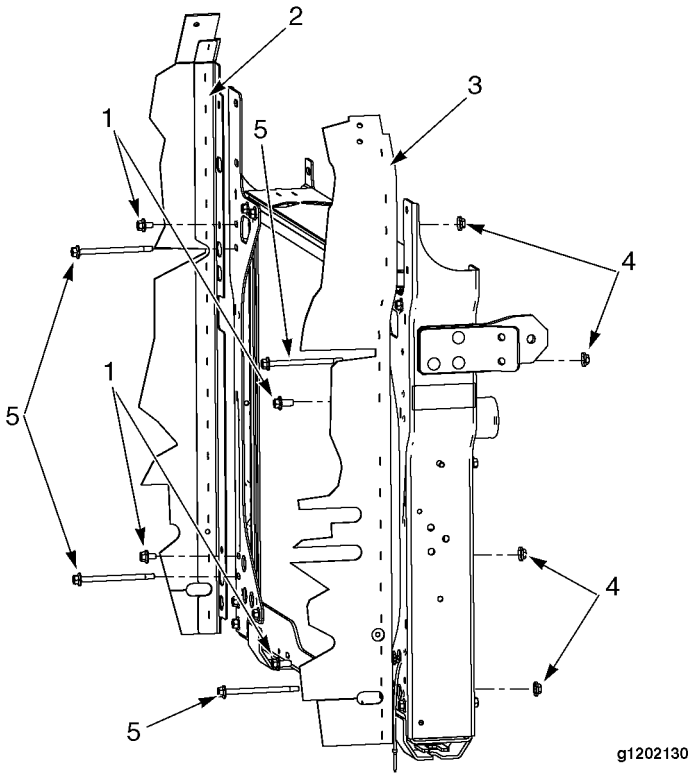

Figure 41 Recirculation Seals

1. RECIRCULATION SEAL MOUNT BOLTS
2. RIGHT RECIRCULATION SEAL
3. LEFT RECIRCULATION SEAL
4. RADIATOR CORE MOUNT NUTS
5. RADIATOR CORE MOUNT BOLTS

1. Remove two bolts and the right recirculation seal from right radiator frame.
2. Remove two bolts and the left recirculation seal from left radiator frame.
3. Remove four mount nuts and bolts securing radiator core to right radiator frame and left radiator frame.

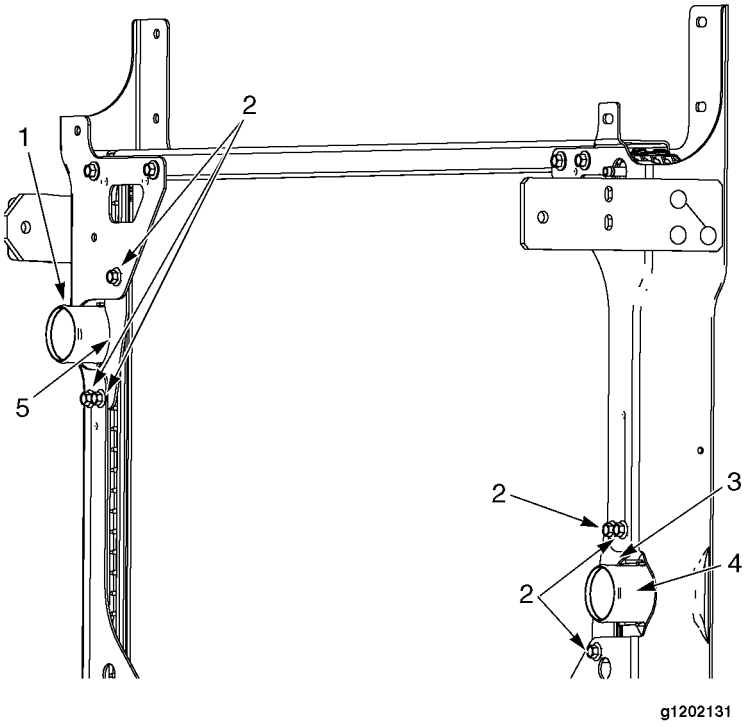

Figure 42 Gusset Plates

1. RADIATOR INLET CONNECTION
2. GUSSET PLATE MOUNT BOLTS
3. RIGHT GUSSET PLATE
4. RADIATOR OUTLET CONNECTION
5. LEFT GUSSET PLATE

4. Remove three bolts and left gusset plate from the radiator inlet connection.

5. Remove three bolts and right gusset plate from the radiator outlet connection.

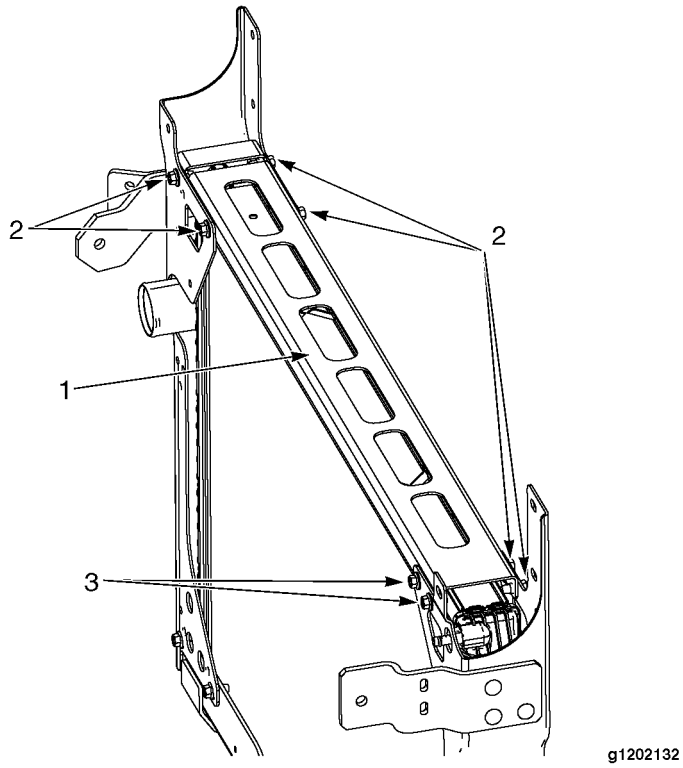

Figure 43 Top Frame Plate

1. UPPER FRAME PLATE
2. TOP FRAME PLATE MOUNT BOLTS
3. RADIATOR CORE

6. Remove eight bolts, four bolts on each side, and upper frame plate from both side radiator frames.

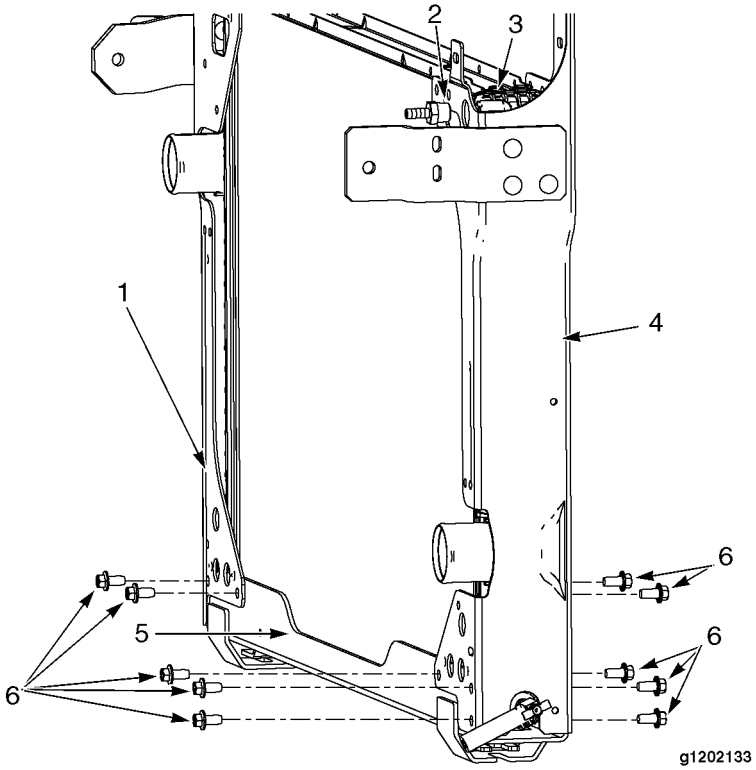

Figure 44 Bottom Frame Plate

1. LEFT RADIATOR FRAME
2. COOLANT HOSE FITTING
3. RADIATOR CORE
4. RIGHT RADIATOR FRAME
5. LOWER FRAME PLATE
6. FRAME MOUNT BOLTS

7. Remove coolant hose fitting from radiator core.

8. Remove 10 bolts from the lower frame plate and both side radiator frames.

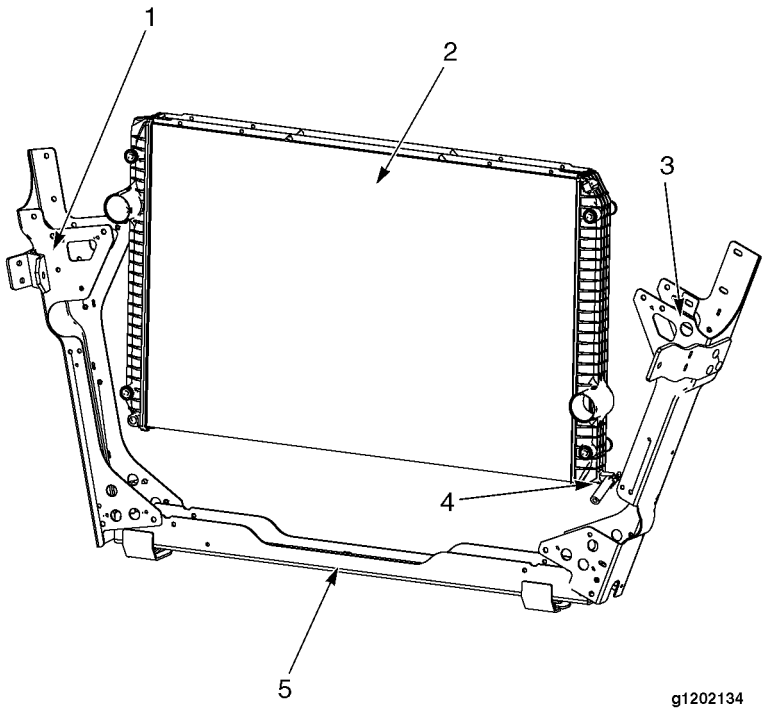

Figure 45 Radiator Core

1. LEFT RADIATOR FRAME
2. RADIATOR CORE
3. RIGHT RADIATOR FRAME
4. DRAIN VALVE
5. BOTTOM FRAME PLATE

9. Support radiator core and spread the radiator frame apart. Carefully lift and remove radiator core from the bottom frame.

10. Transfer ground wire and drain valve to new replacement core (if applicable).

Radiator Core – Installation

1. Support radiator frame and spread the radiator frame apart. Carefully install radiator core (Figure 45).

2. Install 10 bolts on the lower frame plate and both side radiator frames (Figure 44, Items 5 and 6). Torque bolts to 52 to 59 lbf-ft (71 to 80 N•m).

3. Install coolant hose fitting on radiator core (Figure 44, Items 2 and 3).

4. Align radiator core on both side radiator frames and secure with four mount nuts and bolts (Figure 41, Items 4 and 5). Torque bolts to 33 to 40 lbf-ft (45 to 54 N•m).

5. Install upper frame plate on both side radiator frames and secure with eight bolts, four bolts on each side (Figure 43, Items 1 and 2). Torque bolts to 52 to 59 lbf-ft (71 to 80 N•m).

6. Install left gusset plate at the radiator inlet connection with three bolts (Figure 42, Items 2 and 5). Torque bolts to 33 to 40 lbf-ft (45 to 54 N•m).

7. Install right gusset plate at the radiator outlet connection with three bolts (Figure 42, Items 2 and 3). Torque bolts to 33 to 40 lbf-ft (45 to 54 N•m).

8. Install two bolts and the left recirculation seal on the left side radiator frame (Figure 41, Items 1 and 3).

9. Install two bolts and the right recirculation seal on the right side radiator frame (Figure 41, Items 1 and 2).

10. Install radiator assembly into chassis. Refer to **Radiator Assembly – Installation** procedures in this manual.

2.13. POWER STEERING OIL COOLER

The power steering oil cooler is secured to the back of the hood crossmember and can be accessed from under the chassis with the tilt-away bumper in the raised position.

Power Steering Oil Cooler – Removal

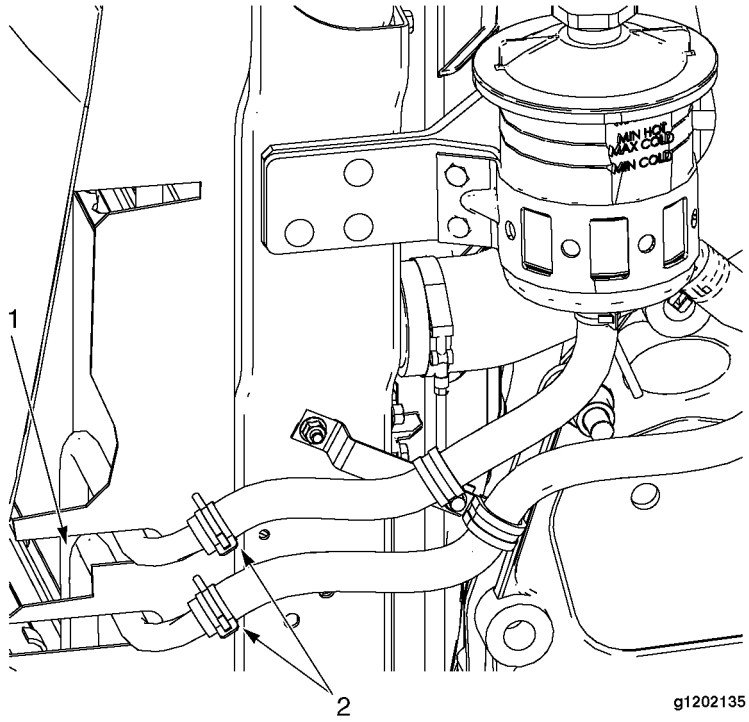

Figure 46 Power Steering Hoses

1. POWER STEERING OIL COOLER
2. POWER STEERING HOSES

1. Place a suitable container under the power steering oil cooler hoses to catch any oil from the system.
2. Disconnect two power steering hoses at the power steering oil cooler.
3. Cap ends of power steering hoses and power steering oil cooler.

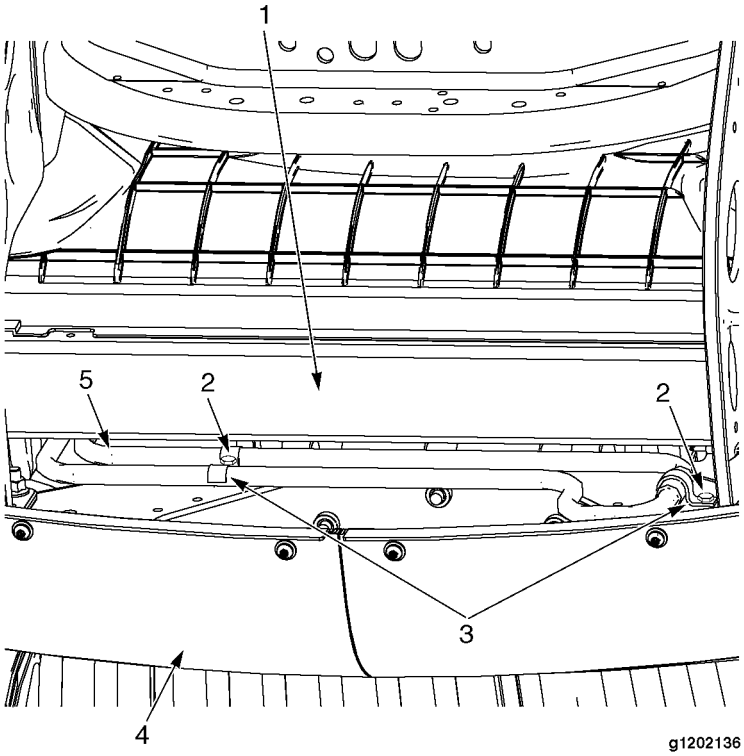

Figure 47 Power Steering Oil Cooler

1. LOWER RADIATOR FRAME
2. MOUNT BOLTS
3. P-CLAMPS
4. TILT-AWAY BUMPER
5. POWER STEERING OIL COOLER

4. Remove two bolts from P-clamps at front crossmember.

5. Remove power steering oil cooler from under the vehicle.

Power Steering Oil Cooler – Installation

NOTE – Inspect the power steering oil cooler prior to installation for damage.

1. Install power steering oil cooler on front crossmember and secure P-clamps with two bolts (Figure 47, Items 2 and 3).

2. Remove the capped ends from the power steering hoses and power steering oil cooler.

3. Connect two power steering hoses to the power steering oil cooler (Figure 46, Items 1 and 2).

4. Fill the power steering reservoir and check for leaks.

TORQUE

Table 1 Torque Chart

Figure No. (Item No.)	Location	Lbf-ft/in	N•m
Figure 7 (Item 2)	Surge Tank Mount Nuts	13 to 14	18 to 19
Figure 7 (Item 3)	Surge Tank Mount Bolt	13 to 14	18 to 19
Figure 8 (Item 6)	A/C Condenser Top Mount Bracket Nuts	13 to 14	18 to 19
Figure 10 (Item 3) Figure 32 (Item 6)	Charge Air Cooler Hose Spring Clamps	6/72	8
Figure 11 (Item 2) Figure 14 (Item 2)	Fan Shroud Bolts	13 to 14	18 to 19
Figure 12 (Item 3)	Radiator Fan Nuts	25	34
Figure 13 (Item 4) Figure 37 (Item 2) Figure 38 (Item 3)	Stay Rod Bolts	66 to 85	90 to 115
Figure 16 (Items 2 and 5) Figure 25 (Item 3)	Transmission Oil Cooler Mount Bolts	33 to 40	45 to 54
Figure 17 (Item 2) Figure 18 (Item 1)	Fan Mount Hub Bolts	88 to 99	119 to 134
Figure 19 (Item 4)	Grille Mount Screws	4 to 5	6 to 7
Figure 21 (Item 1) Figure 36 (Item 6)	Transmission Oil Cooler Tube Bracket Bolt	33 to 40	45 to 54
Figure 28 (Item 1) Figure 29 (Item 1) Figure 37 (Item 5) Figure 39 (Item 2)	Radiator Hose Spring Clamps	6/72	8
Figure 30 (Item 4)	Upper Coolant Pipe Mount Bolts	35 to 43	47 to 58
Figure 30 (Item 1)	Upper Coolant Pipe Mount Nuts	21 to 24	29 to 33
Figure 32 (Item 8) Figure 33 (Item 1)	Charge Air Cooler Mount Bolts	52 to 59	71 to 80
Figure 32 (Item 2)	Top Channel Plate Bolts	52 to 59	71 to 80
Figure 34 (Item 1)	Power Steering Reservoir Mount Bolts	41 to 50	56 to 68
Figure 34 (Item 5)	Power Steering Hose P-clamp Nut	19 to 23	26 to 31
Figure 36 (Item 1)	Transmission Oil Cooler Mount Bracket Bolts	33 to 40	45 to 54
Figure 37 (Item 8) Figure 39 (Item 4)	Radiator Assembly Mount Nuts	65 to 79	88 to 107
Figure 41 (Item 1)	Recirculation Seal Mount Bolts	33 to 40	45 to 54
Figure 41 (Item 5)	Radiator Core Mount Bolts	33 to 40	45 to 54
Figure 42 (Item 2)	Radiator Gusset Plate Bolts	33 to 40	45 to 54
Figure 43 (Item 2) Figure 44 (Item 6)	Radiator Frame Bolts	52 to 59	71 to 80