# Bobcat®

# Service Manual

# 3600

## Utility Vehicle

**S/N B3C211001 & Above**

7252955enUS (02-20) (D)

Printed in U.S.A.



D

## SAFETY INSTRUCTIONS

**Safety Alert Symbol**

**This symbol with a warning statement means: "Warning, be alert! Your safety is involved!" Carefully read the message that follows.**

**WARNING**

**Operator must have instructions before operating the utility vehicle. Untrained operators can cause injury or death.**

W-2855-0510

**IMPORTANT**

**This notice identifies procedures which must be followed to avoid damage to the utility vehicle.**

I-2317-0510

**DANGER**

**The signal word DANGER on the utility vehicle and in the manuals indicates a hazardous situation which, if not avoided, will result in death or serious injury.**

D-1022-0510

**WARNING**

**The signal word WARNING on the utility vehicle and in the manuals indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.**

W-2856-0510

The following publications provide information on the safe use and maintenance of the Bobcat utility vehicle and attachments:

- The Delivery Report is used to assure that complete instructions have been given to the new owner and that the vehicle is in safe operating condition.
- The Operation & Maintenance Manual delivered with the vehicle or attachment contains operating information as well as routine maintenance and service procedures. It is a part of the vehicle and can be stored in a container provided on the vehicle. Replacement Operation & Maintenance Manuals can be ordered from your Bobcat dealer.
- Safety signs (decals) instruct on the safe operation and care of your Bobcat utility vehicle or attachment. The signs and their locations are shown in the Operation & Maintenance Manual. Replacement signs are available from your Bobcat dealer.
- An Operator's Handbook fastened to the operator cab. It's brief instructions are convenient to the operator. The handbook is available from your dealer in an English edition or one of many other languages. See your Bobcat dealer for more information on translated versions.
- The Service Manual and Parts Manual are available from your dealer for use by mechanics to do shop-type service and repair work.
- The Utility Vehicle Operator Training Course is available through your local dealer or at **www.training.bobcat.com** or **www.bobcat.com**. This course is intended to provide rules and practices of correct operation of the utility vehicle. The course is available in English and Spanish versions.
- The Utility Vehicle Safety Video is available from your Bobcat dealer or at **www.training.bobcat.com** or **www.bobcat.com**.

SI UV-0913 SM

## LIFTING AND BLOCKING THE UTILITY VEHICLE

### Procedure

For service work under the utility vehicle, or to remove the wheels, always support the utility vehicle with jackstands or blocks of adequate capacity for weight of utility vehicle. (See Performance on Page SPEC-10-3.)

Always park the utility vehicle on a flat level surface.

Put gear selector in park. Stop the engine and put the gear selector in gear.

If removing wheel(s), loosen the wheel nuts slightly before lifting the vehicle.

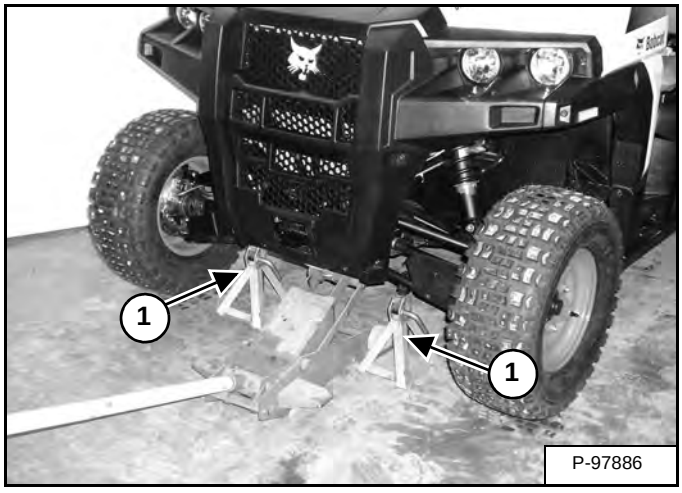
**⚠ WARNING**

**AVOID INJURY OR DEATH**

**Instructions are necessary before operating or servicing machine. Read and understand the Operation & Maintenance Manual, Operator's Handbook and signs (decals) on machine. Follow warnings and instructions in the manuals when making repairs, adjustments or servicing. Check for correct function after adjustments, repairs or service. Untrained operators and failure to follow instructions can cause injury or death.**

W-2003-0807

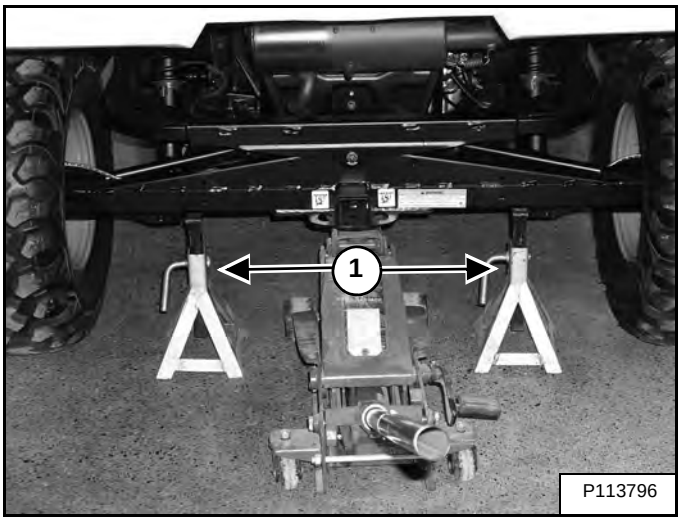
**Figure 10-10-1**




Place the jackstands (Item 1) **[Figure 10-10-1]** under the frame at the front of the utility vehicle (both sides).

**NOTE: When lifting the utility vehicle, place the jack under front frame [Figure 10-10-1].**

**Figure 10-10-2**




Place the jackstands (Item 1) **[Figure 10-10-2]** under the rear frame of the utility vehicle.

**NOTE: When lifting the utility vehicle, place the jack under the rear frame [Figure 10-10-2].**

**Maintenance Intervals (Cont'd)**

*Every 24 Months*

- **Coolant** - Replace the coolant.

*Every 300 Hours or 36 Months*

- **Spark Arrestor Muffler** - Empty the spark chamber.

*Every 1000 Hours*

- **Engine Valves** - Adjust engine valves. See your Bobcat dealer for service.

*Every 1500 Hours*

- **Engine Breather System** - Inspect the crankcase breather system. See your Bobcat dealer for service.

[1] Change yearly.
[2] Perform these procedures more often for vehicles subject to severe use.
[3] Replace lines every two years.
[4] The wheel nuts must be checked and torqued after the first eight hours of operation of a new machine and after the first eight hours of operation when the wheel(s) have been removed for service.

**Removing Air From The Fuel System**

**WARNING**

**AVOID INJURY OR DEATH**

**Always clean up spilled fuel or oil. Keep heat, flames, sparks or lighted tobacco away from fuel and oil. Failure to use care around combustibles can cause explosion or fire.**

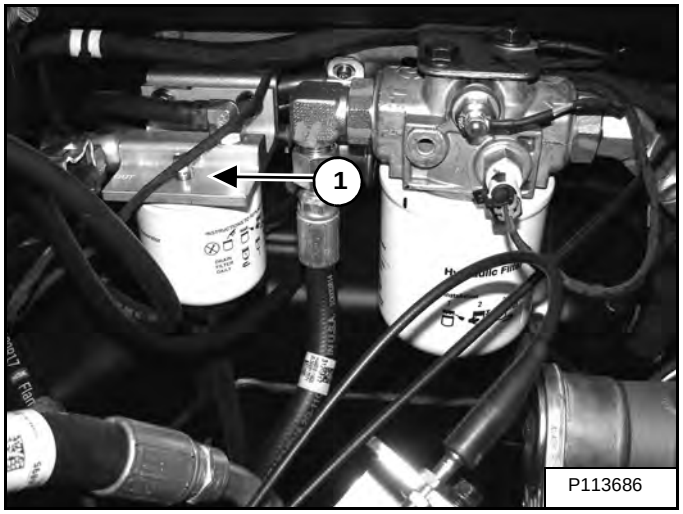
**W-2103-0508**

After replacing the filter element or when the fuel tank has run out of fuel, air must be removed from the fuel system before starting the engine.

Be sure the engine is cool.

Raise the cargo box.

**Figure 10-80-3**




With the gear selector lever in Park, turn the key to the ON position. Do Not start the engine.

The fuel pump will start pumping fuel with the key in the ON position (10 -15 seconds) and will force air out of the fuel system.

At times it may be necessary to open the valve (Item 1) **[Figure 10-80-3]** on the fuel filter housing until fuel comes from the valve with no air bubbles.

Start the engine.

Repeat until the engine starts.

**Filling A Portable Fuel Container**

Static electric spark can explosively ignite gasoline vapors when filling ungrounded portable containers.

Always put the container **ON THE GROUND** before filling.

Keep the nozzle in contact with container while filling.

NEVER fill container in the cargo box or on the utility vehicle.

**WARNING**

**FIRE AND EXPLOSION CAN CAUSE SERIOUS INJURY OR DEATH**

**Static electric spark can explosively ignite gasoline vapors when filling ungrounded portable containers.**

- **ALWAYS place the container ON THE GROUND before filling.**
- **Keep the nozzle in contact with container while filling.**
- **NEVER fill container in the cargo box, storage bins or on the machine.**

W-2801-0709

## GEARCASE

### Checking Transmission Fluid

Follow the service interval for checking the transmission fluid level. (See Maintenance Intervals on Page 10-50-1.)

Use only recommended fluid in the transmission. (See Fluid And Capacities on Page SPEC-10-5.)

Put the utility vehicle on a flat and level surface.

Move the gear selector to Park, stop the engine and exit the vehicle. (See STOPPING THE ENGINE AND LEAVING THE UTILITY VEHICLE on Page 10-150-1.)

**Figure 10-110-1**

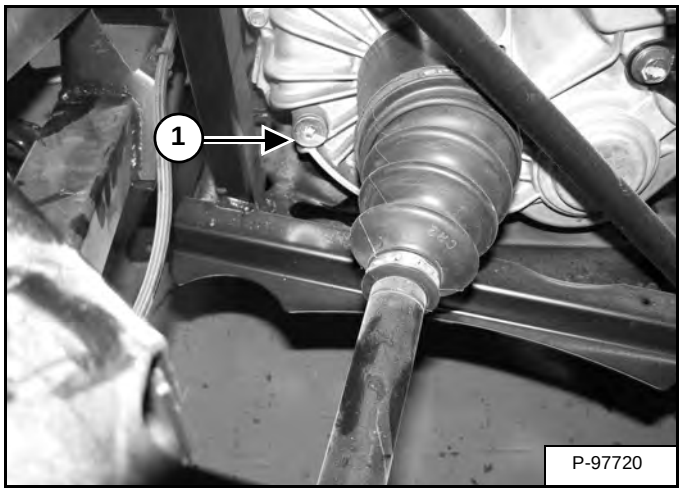
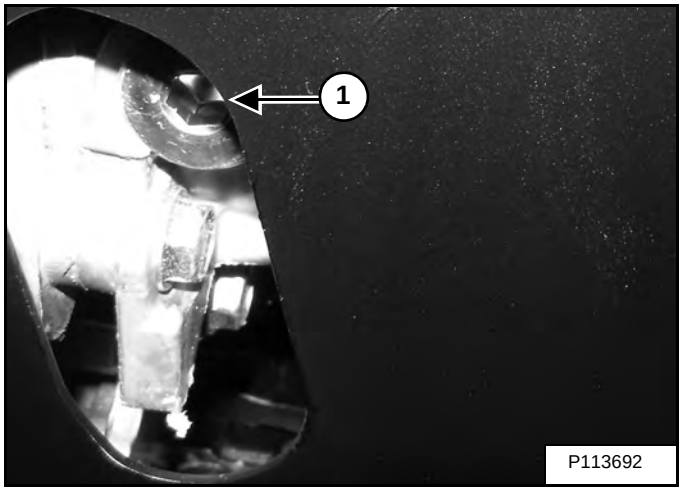



**Figure 10-110-2**




Thoroughly clean the area around the plugs before removal.

The fill / check plug (Item 1) **[Figure 10-110-1]** Is located on the side of the transmission.

The drain plug (Item 1) **[Figure 10-110-2]** is located on the bottom of the transmission and can be accessed through a hole in the bottom cover plate.

To check the fluid level, remove the plug (Item 1) **[Figure 10-110-1]**. The fluid level is correct when at the bottom edge of the fill plug.

## STOPPING THE ENGINE AND LEAVING THE UTILITY VEHICLE

**Procedure**

**WARNING**

**AVOID INJURY OR DEATH**

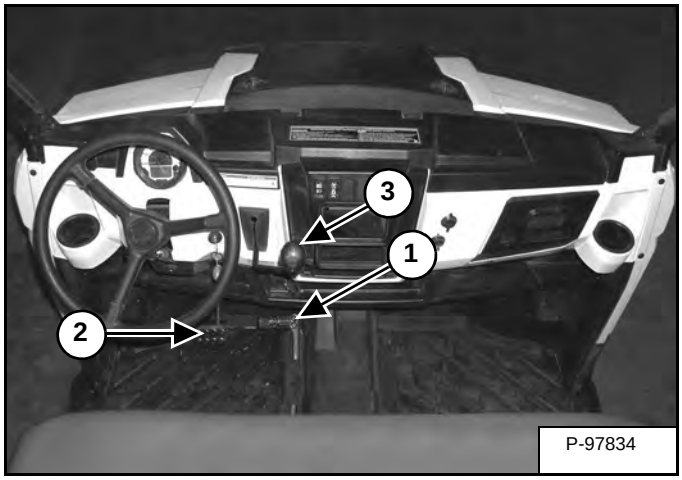
**Before you leave the operator's seat:**

- **Park on flat level ground.**
- **Press the brake pedal and move the gear selector lever to PARK.**
- **Stop the engine and remove the key.**

W-2974-1212

**Figure 10-150-1**


**Figure 10-150-2**




Gradually release pressure on the travel control pedal (Item 1) **[Figure 10-150-2]**.

Apply the brake pedal (Item 2) **[Figure 10-150-2]** until the utility vehicle comes to a complete stop.

Park the vehicle on a flat and level surface **[Figure 10-150-1]**.

Move the gear selector lever (Item 3) **[Figure 10-150-2]** to Park.

**NOTE: When parking inside an enclosed area, be sure that the structure is a well ventilated area.**

Turn the engine OFF and remove the key to prevent unauthorized use.

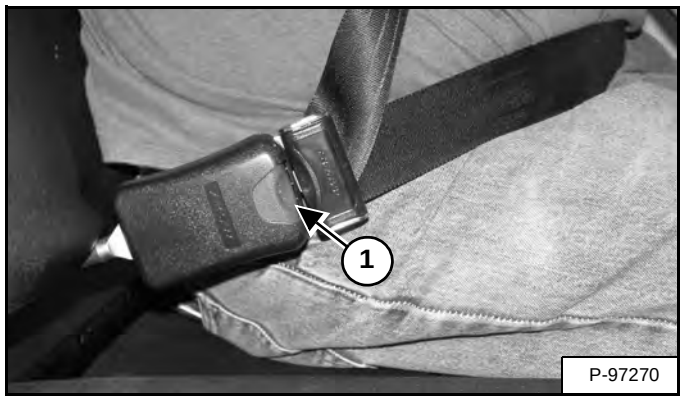
**WARNING**

**ROLLAWAY CAN CAUSE SERIOUS INJURY OR DEATH**

**Always put the gear selector lever in PARK before stopping the engine.**

W-2962-1212

**Figure 10-150-3**




Press the red release button (Item 1) **[Figure 10-150-3]** to disconnect the seat belt.

**Noise Troubleshooting**

Dirt or dust buildup on the brake pads and disc is the most common cause of brake noise (squeal caused by vibration). If cleaning does not reduce the occurrence of brake noise, Permatex™ Disc Brake Quiet can be applied to the back of the pads. Follow directions on the package. This will keep pads in contact with caliper piston(s) to reduce the chance of squeaks caused by dirt or dust.

The following troubleshooting chart is provided for assistance in locating and correcting problems. Many of the recommended procedures must be done by authorized Bobcat Service Personnel only.

**⚠ WARNING**

**Instructions are necessary before operating or servicing machine. Read and understand the Operation & Maintenance Manual and signs (decals) on machine. Follow warnings and instructions in the manuals when making repairs, adjustments or servicing. Check for correct function after adjustments, repairs or service. Untrained operators and failure to follow instructions can cause injury or death.**

**W-2408-0801**

| BRAKE NOISE TROUBLESHOOTING | |
|---|---|
| POSSIBLE CAUSE | SOLUTION |
| Dirt, dust or imbedded material on pads or disc | Spray disc and pads with CRC Brakeleen™ or an equivalent non-flammable aerosol brake cleaner. Remove pads and / or disc hub to clean imbedded material from disc or pads. |
| Pad(s) dragging on disc (noise or premature pad wear) because of improper adjustment | Adjust pad stop (front calipers) |
| Master cylinder reservoir overfilled | Set to proper level |
| Master cylinder compensating port restricted | Clean compensating port |
| Master cylinder piston not returning completely | Inspect. Repair as necessary |
| Caliper piston(s) not returning | Clean piston(s) seal |
| Operating error (riding the brake) | Educate operator |
| Loose wheel hub or bearings | Check wheel and hub for abnormal movement |
| Brake disc warped or excessively worn | Replace disc |
| Brake disc misaligned or loose | Inspect and repair as necessary |
| Noise is from other source (axle, hub, disc or wheel) | If noise does not change when brake is applied check other sources. Inspect and repair as necessary |
| Wrong pad for conditions | Change to a softer or harder pad |

## BRAKE (FRONT)

### Pad Removal

Lift and block the machine. (See LIFTING AND BLOCKING THE UTILITY VEHICLE on Page 10-10-1.)

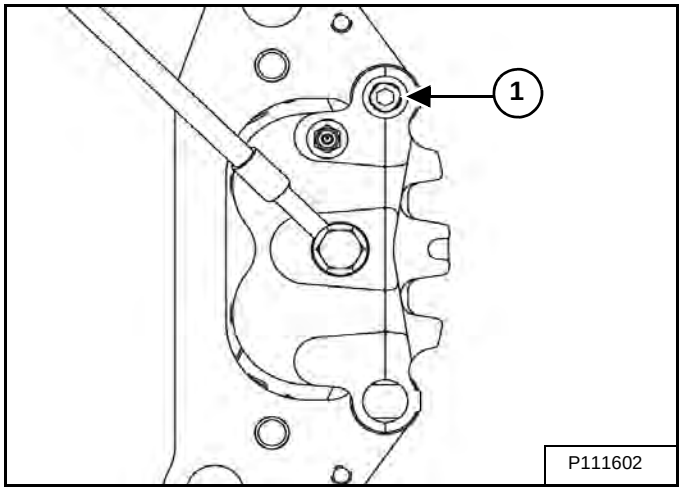
**⚠ WARNING**

**Use care when supporting vehicle so that it does not tip or fall. Severe injury may occur if machine tips or falls.**

**W-2848-0510**

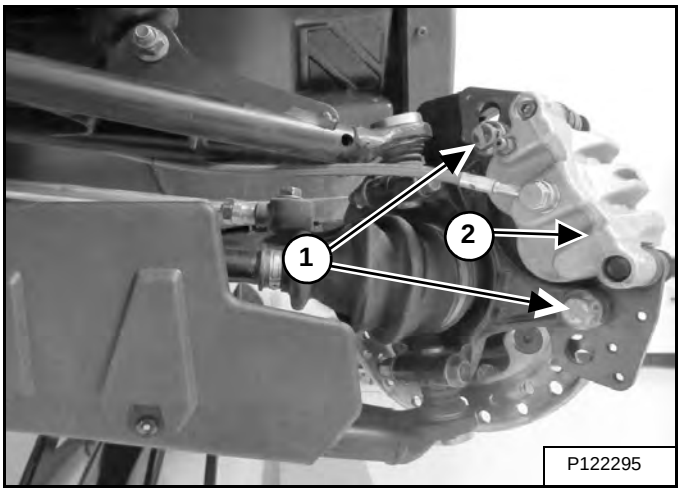
Remove the tire assembly. (See Wheel Removal And Installation on Page 10-120-1.)

**Figure 20-11-1**




Loosen the pad adjuster screw (Item 1) **[Figure 20-11-1]** 2 - 3 turns.

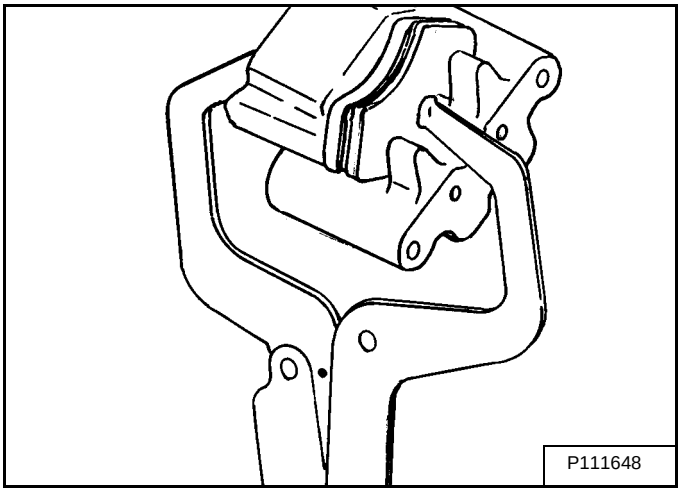
**Figure 20-11-2**




Remove the upper and lower caliper mounting bolts, lock washers and washers (Item 1) and remove the caliper (Item 2) **[Figure 20-11-2]** from the front hub.

**NOTE: When removing caliper, use care not to damage brake line. Support caliper to avoid kinking or bending brake line.**

**Figure 20-11-3**




Push caliper piston into caliper bore slowly using a C-clamp or locking pliers with pads installed **[Figure 20-11-3]**.

## BRAKE (REAR)

### Pad Removal

Lift and block the machine. (See LIFTING AND BLOCKING THE UTILITY VEHICLE on Page 10-10-1.)

**⚠ WARNING**

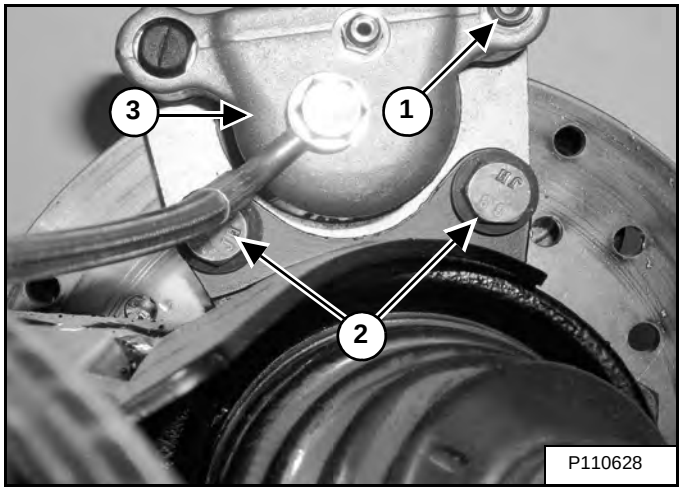
**Use care when supporting vehicle so that it does not tip or fall. Severe injury may occur if machine tips or falls.**

**W-2848-0510**

Remove the tire assembly. (See Wheel Removal And Installation on Page 10-120-1.)

Clean the caliper area before removal.

**Figure 20-12-1**

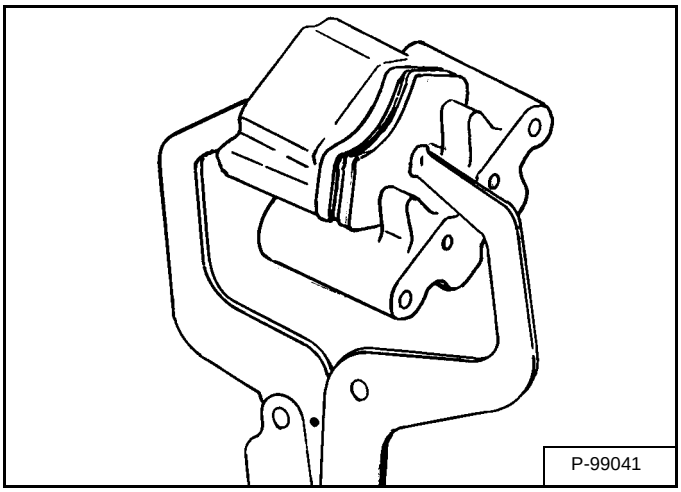



Loosen the pad adjuster screw (Item 1) **[Figure 20-12-1]** 2 - 3 turns.

Remove the caliper mounting bolts (Item 2) and remove the caliper (Item 3) **[Figure 20-12-1]** off the disc.

**NOTE: When removing caliper, use care not to damage brake line. Support caliper to avoid kinking or bending brake line.**

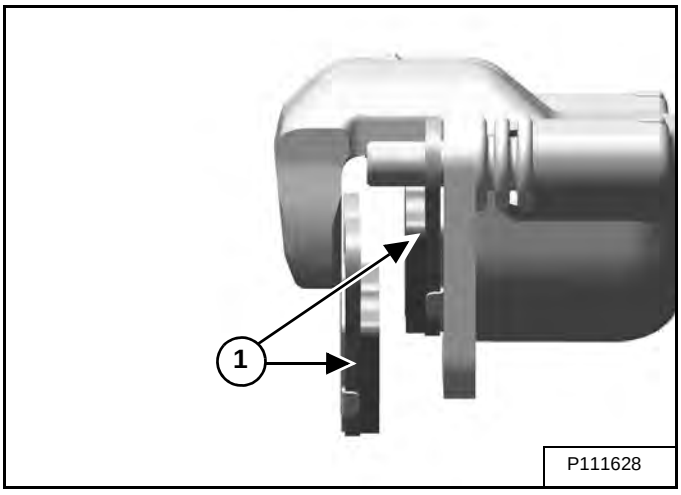
**Figure 20-12-2**




Push caliper piston into caliper bore slowly using a C-clamp or locking pliers with pads installed **[Figure 20-12-2]**.

**NOTE: Brake fluid will be forced through the compensating port into master cylinder fluid reservoir when piston is pushed back into caliper. Remove excess fluid from reservoir as required.**

**Figure 20-12-3**

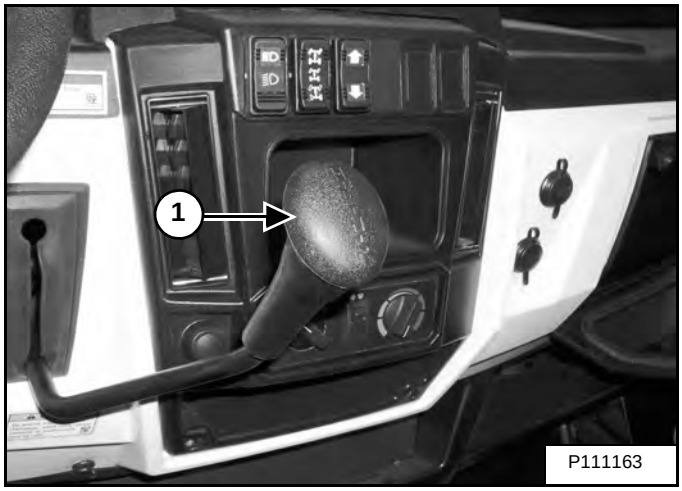



Remove the brake pads (Item 1) **[Figure 20-12-3]** from the caliper.

## Shift Lever Removal And Installation

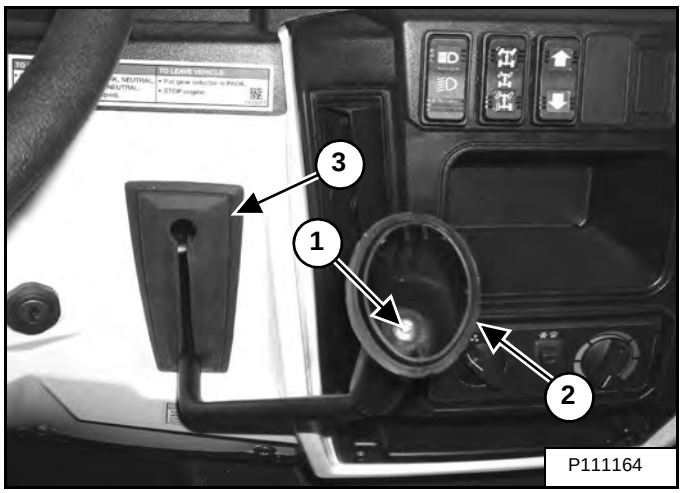
Remove the upper dash. (See Upper Dash Panel Removal And Installation on Page 30-30-1.)

**Figure 20-20-1**




Remove the shift knob cover (Item 1) **[Figure 20-20-1]**.

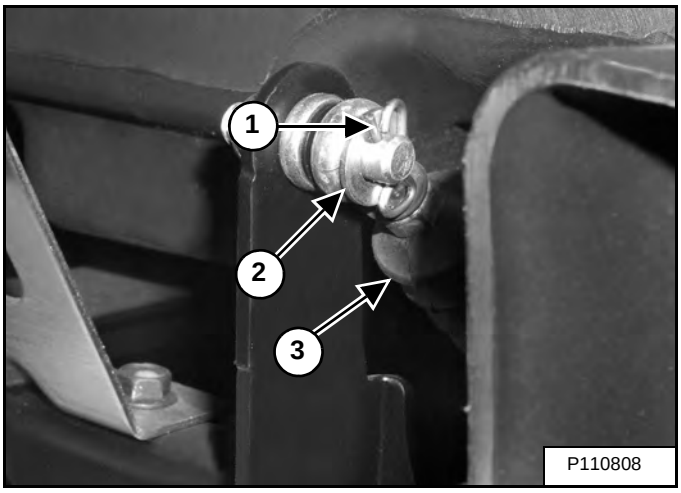
**Figure 20-20-2**




Remove the screw (Item 1) and shift knob (Item 2) **[Figure 20-20-2]** from the shift lever.

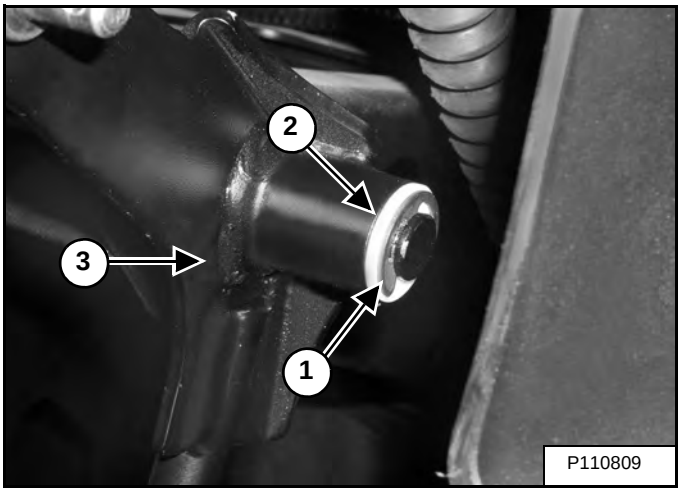
Remove the rubber grommet (Item 3) **[Figure 20-20-2]** from the dash.

**Figure 20-20-3**




Remove the clip (Item 1), washer (Item 2) and cable (Item 3) **[Figure 20-20-3]** from the lever.

**Figure 20-20-4**

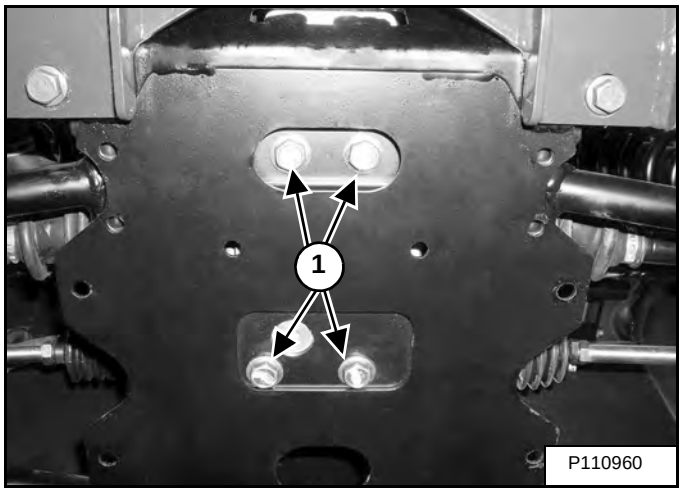



Remove the clip (Item 1) **[Figure 20-20-4]**.

Remove both bushings (Item 2) and shift lever (Item 3) **[Figure 20-20-4]** from the vehicle.

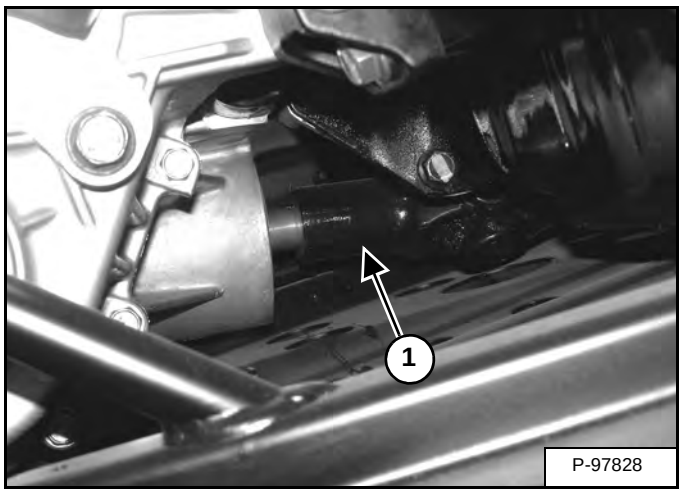
**Removal And Installation (Cont'd)**

**Figure 20-20-35**




Remove the bolts (Item 1) **[Figure 20-20-35]** from the front gear box. Slide the gear box towards the front of the vehicle allowing the drive shaft to slide off the splined shaft.

**Figure 20-20-36**

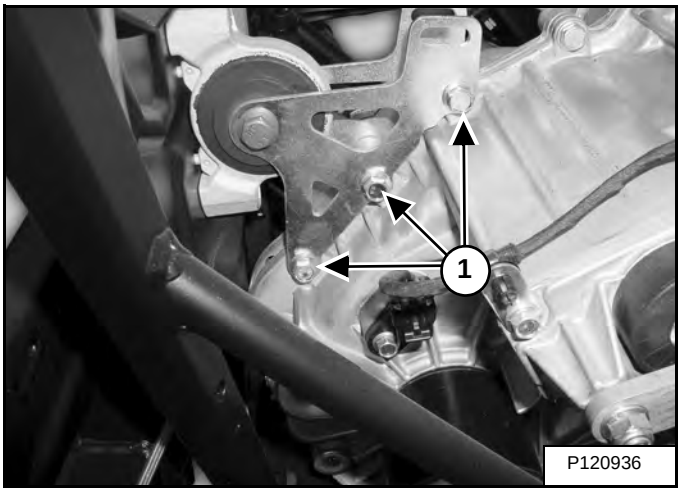



Slide the drive shaft (Item 1) **[Figure 20-20-36]** off the transmission output shaft.

**Figure 20-20-37**


Support the rear of the transmission **[Figure 20-20-37]**.

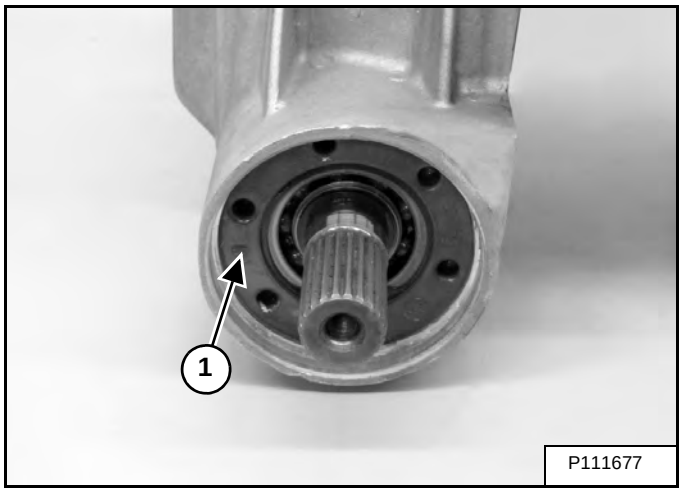
**Figure 20-20-38**




Remove the bolts (Item 1) **[Figure 20-20-38]** from the rear transmission mount.

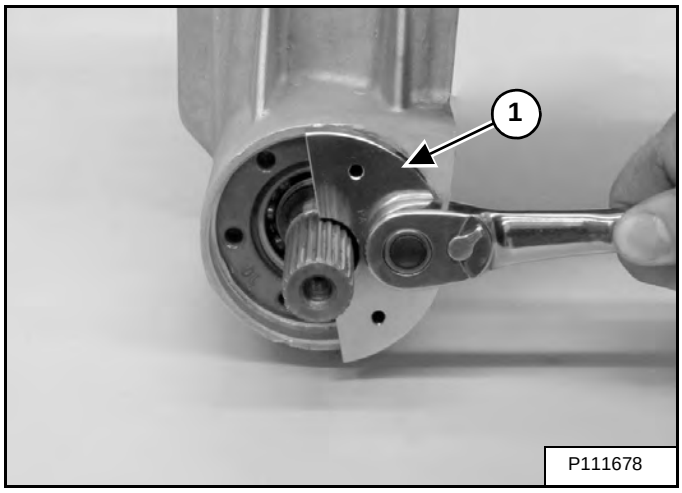
**Snorkel Shaft Removal / Disassembly**

**Figure 20-20-57**



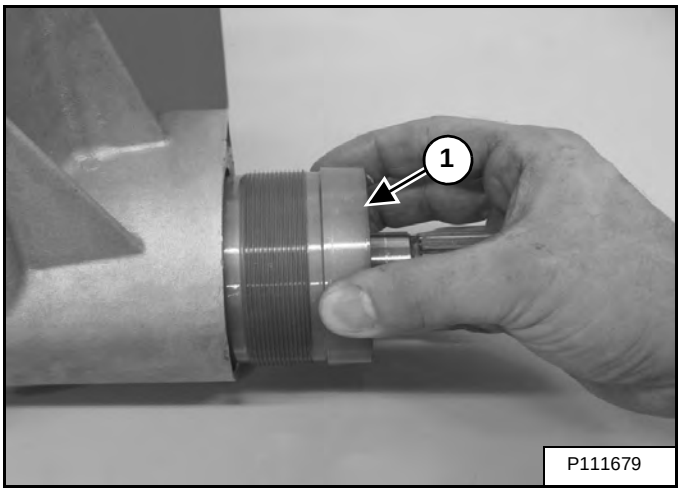

Extract the seal (Item 1) **[Figure 20-20-57]** from the snorkel shaft to access the snorkel tube.

**Figure 20-20-58**



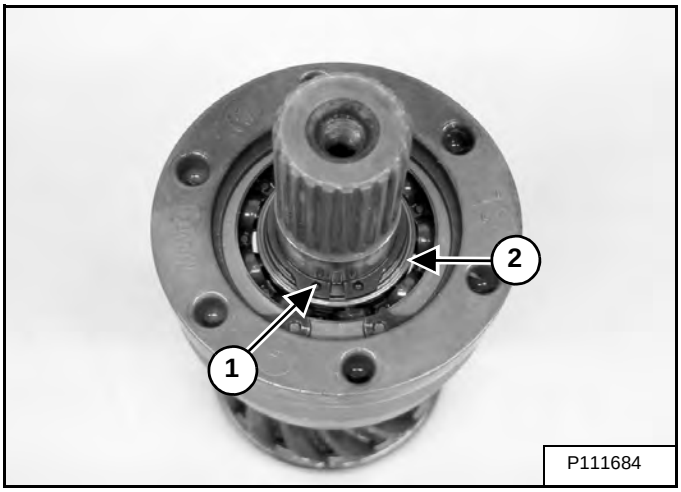

Using the Snorkel Tool (PA-50231) (Item 1) **[Figure 20-20-58]**, fully loosen the snorkel tube.

**Figure 20-20-59**




Remove the snorkel tube and shaft assembly (Item 1) **[Figure 20-20-59]** from the transmission case.

**Figure 20-20-60**

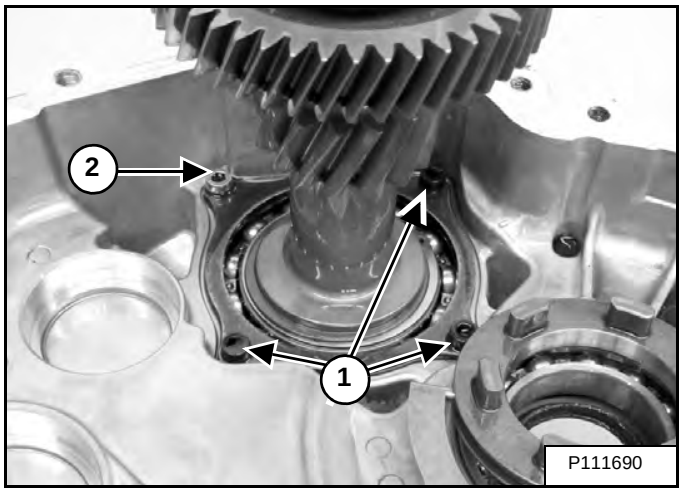



Remove the snap ring (Item 1) and shim (Item 2) **[Figure 20-20-60]** from the snorkel shaft.

Use an arbor press to remove the snorkel tube from the snorkel shaft.

**Snorkel Gear Backlash (Cont'd)**

**Figure 20-20-89**




Apply Loctite® 242 to the threads of the bearing cover retaining screws.

Install only the three screws (Item 1) **[Figure 20-20-89]** that secure the pinion shaft assembly as shown. Leave the longer locking screw (Item 2) **[Figure 20-20-89]** out at this point.

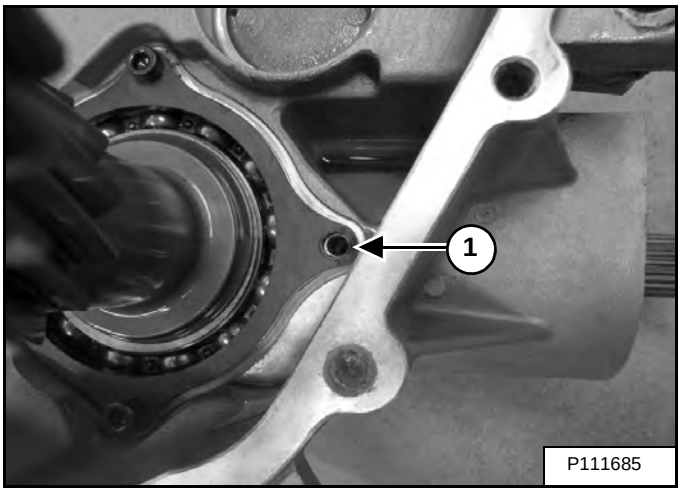
Tighten the screws to 11 - 14 N•m (8 - 10 ft-lb) torque.

Rotate the snorkel tube counterclockwise using the snorkel tool (PA-50231) until the snorkel gear and pinion gear have 'zero' backlash.

Look down into the transmission housing to see the snorkel locking screw hole opening to reference your starting point.

**NOTE: If you have a hard time seeing into the hole, insert a small Allen wrench, punch or screwdriver into the hole to feel when the notch is aligned with the hole.**

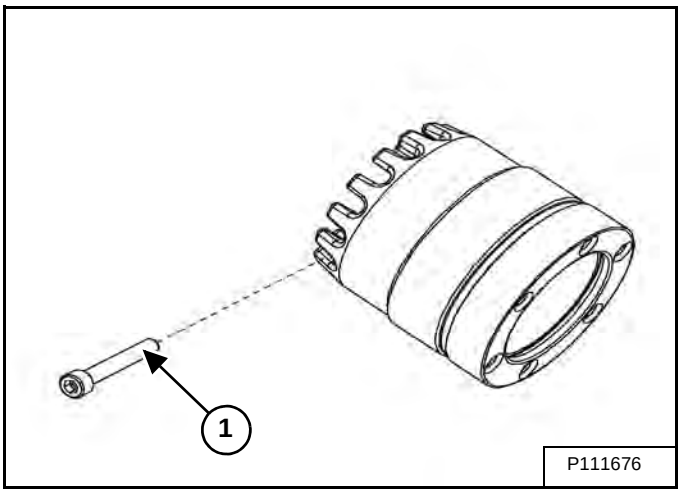
**Figure 20-20-90**




Slowly rotate the snorkel tube clockwise while counting the number of notches passing through the hole opening (Item 1) **[Figure 20-20-90]** as you rotate the tube. Rotate the snorkel tube to the 3rd notch from the 'zero' backlash position earlier obtained.

Check the pinion shaft gear backlash again by feel. If the pinion shaft gear lash appears to be too tight, rotate the snorkel shaft clockwise to the next notch (4th notch).

**Figure 20-20-91**




Once the backlash is set, apply Loctite® 242 to the threads and install the locking screw (Item 1) **[Figure 20-20-91]** to secure the snorkel tube.

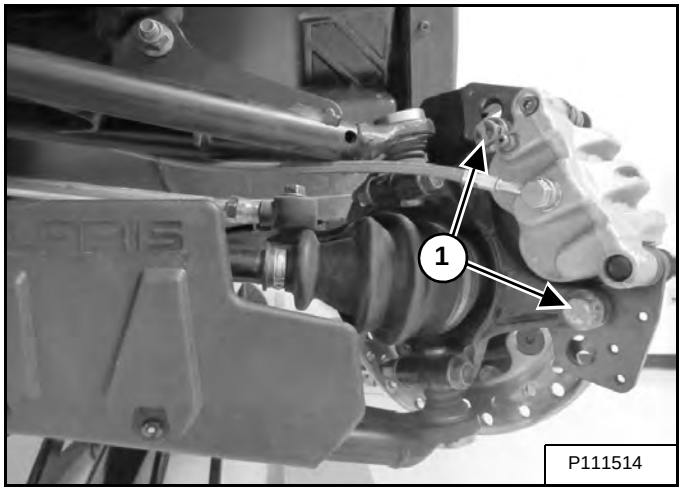
**Bearing Carrier Installation (Cont'd)**

# IMPORTANT

**New bolts have a pre-applied locking agent which is destroyed upon removal. Always use new brake caliper mounting bolts upon assembly.**

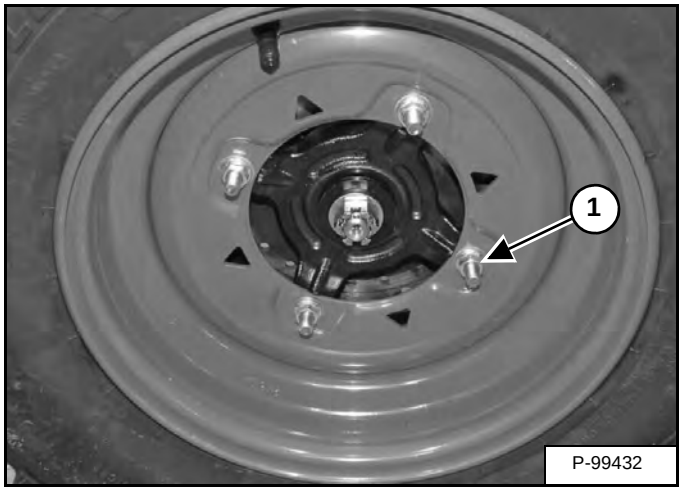
I-2326-0510

**Figure 20-30-14**



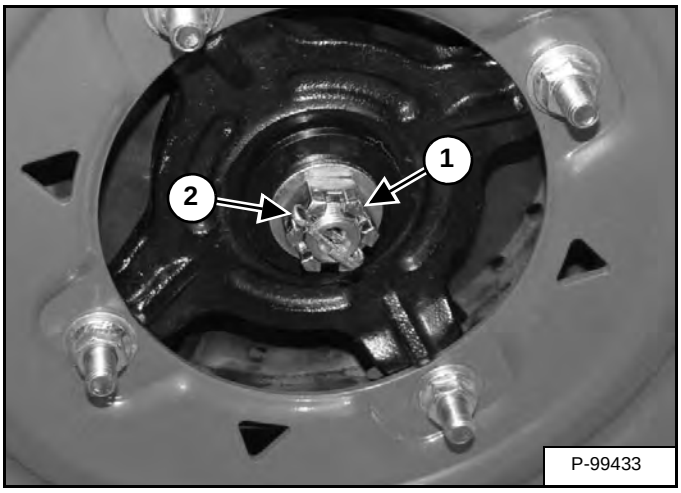

Install the brake caliper using new bolts (Item 1) **[Figure 20-30-14]**. Tighten the bolts to 41 N•m (30 ft-lb) torque.

**Figure 20-30-15**




Install the wheel, washers and wheel nuts (Item 1) **[Figure 20-30-15]**. Tighten the nuts evenly in a criss-cross pattern to 81 N•m (60 ft-lb) torque.

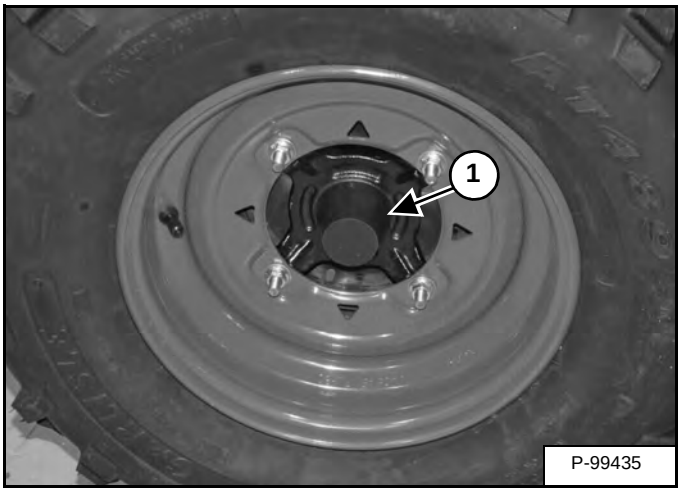
**Figure 20-30-16**




Lower the vehicle and tighten the front spindle nut (Item 1) **[Figure 20-30-16]** to 102 N•m (75 ft-lb) torque.

Install a new cotter pin (Item 2) **[Figure 20-30-16]**.

**Figure 20-30-17**




Rotate wheel and check for smooth operation. There should not be any binding, rough spots or side play.

Install the hub dust cap (Item 1) **[Figure 20-30-17]**.

**Inner Plunging Joint And Boot Removal And Installation (Cont'd)**

# IMPORTANT

**The grease provided in the replacement kit is specially formulated for wear resistance and durability. DO NOT use substitues or mix with other lubricants.**

I-2328-0510

**NOTE: The amount of grease that's provided is pre-measured, so use all the grease.**

*Boot Replacement Grease Requirements:*

| | |
|---|---|
| Outer CV Joint Capacity | 150 g |

**Figure 20-30-45**


Fully compress the joint and push the drive shaft firmly into the inner race.

Align the circlip with the lead-in chamfer.

Use a soft-faced hammer to tap the joint onto the drive shaft until you reach the end of the splines and the joint locks in place **[Figure 20-30-45]**.

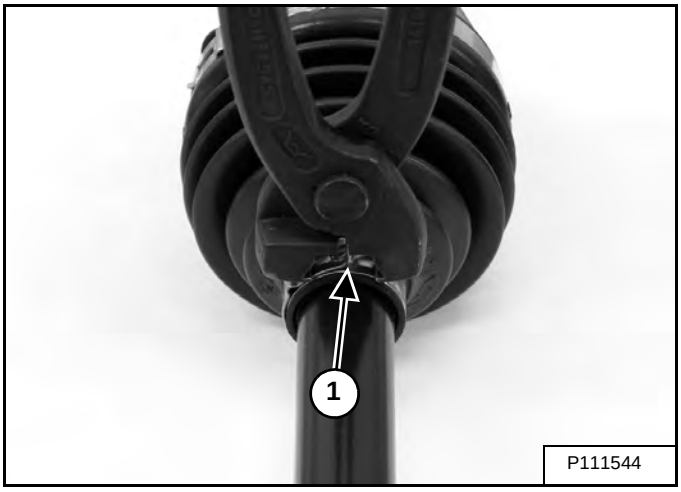
Slide the joint onto the drive shaft splines and align the circlip with the lead-in chamfer on the inner race of the joint.

Use a soft-faced hammer to tap the joint onto the drive shaft until it locks into place.

Pull on the joint to test that the circlip is seated and that the joint is securely fastened to the shaft.

Remove excess grease from the plunging joint's external surfaces and place the excess grease in the boot.

**Figure 20-30-46**

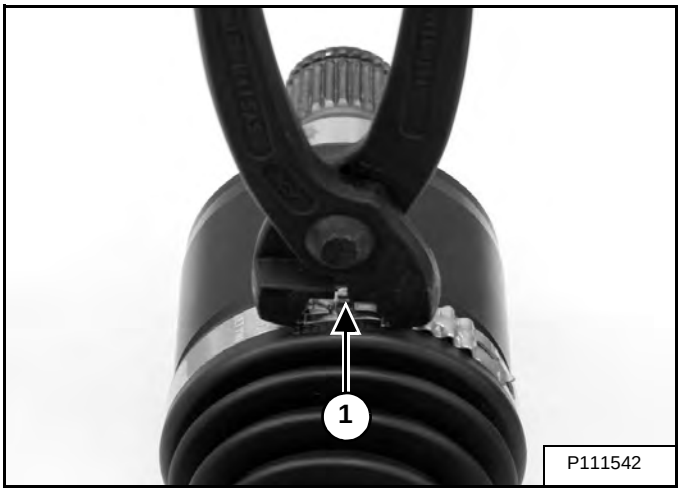



Pull the boot over the joint and position the boot lips into the grooves on the joint housing and shaft. Make sure the boot is not dimpled or collapsed.

Install and tighten the small clamp (Item 1) **[Figure 20-30-46]**.

Pull out on drive shaft to center joint in the housing. Slide a straight O-ring pick or a small slotted screw driver between the large end of the boot and the joint housing and lift up to equalize air pressure in the boot.

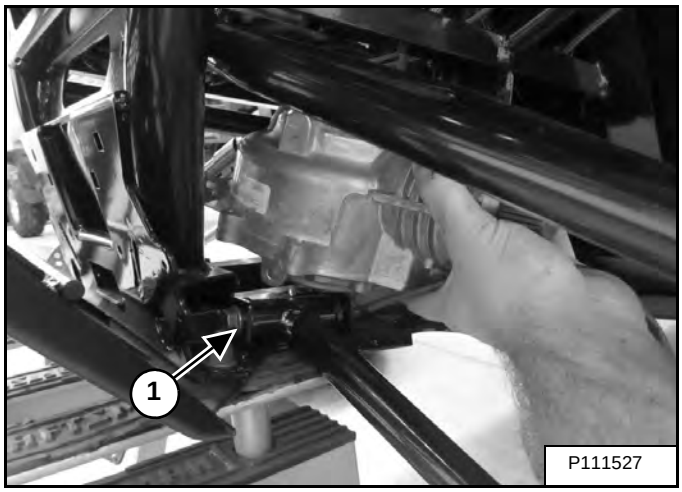
**Figure 20-30-47**




Position the boot lip in its groove. Install and tighten the large clamp (Item 1) **[Figure 20-30-47]** using the appropriate clamp tool.

**Front Gearcase Removal And Installation (Cont'd)**

**Figure 20-30-72**




Remove the front gearcase (Item 1) **[Figure 20-30-72]** from the vehicle.

***Installation:*** Add proper lubricant to the front gearcase. (See Fluid And Capacities on Page SPEC-10-5.)

## TRAVEL CONTROL PEDAL

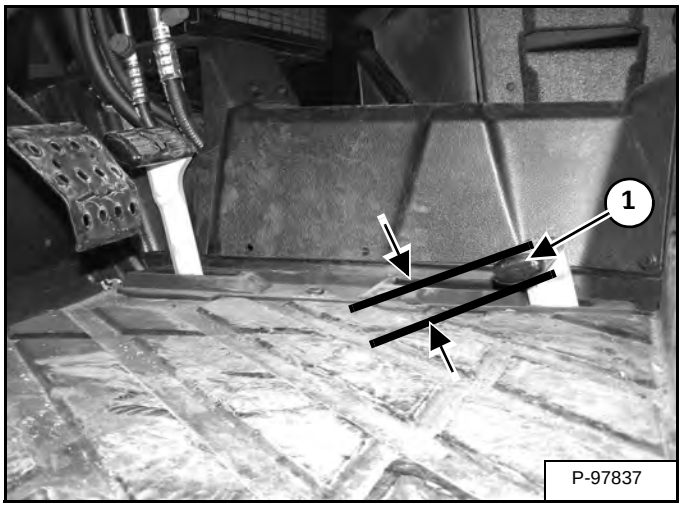
### Description

The travel control pedal is used to control the forward and backward movement of the utility vehicle. The farther the pedal is pressed, the faster the travel speed.

### Inspection

Position the utility vehicle on a flat level surface. Put the gear selector lever in Park and stop the engine. Exit the utility vehicle.

**Figure 20-40-1**



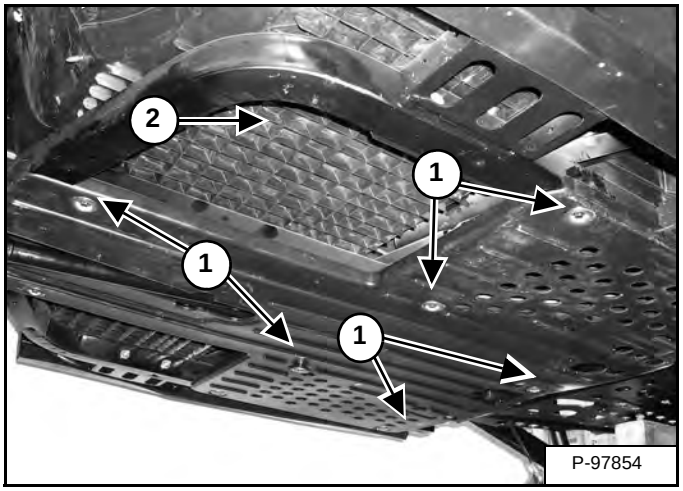

Check the travel control pedal (Item 1) **[Figure 20-40-1]** for excessive freeplay.

The correct amount of total free travel on the travel control pedal is 7,6 mm (0.30 in) **[Figure 20-40-1]**.

When on flat ground, with the travel control pedal in neutral, move the gear select lever to low and move the engine speed control lever to high idle. If any vehicle movement is detect, travel control adjustments must be made. (See Hydrostatic Travel Control Adjustments on Page 70-40-11.)

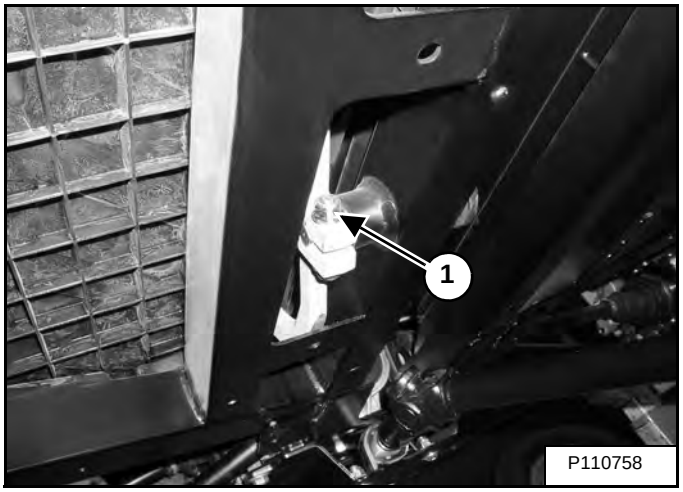
### Removal And Installation

**Figure 20-40-2**




Remove the bolts (Item 1) and skid plate (Item 2) **[Figure 20-40-2]**.

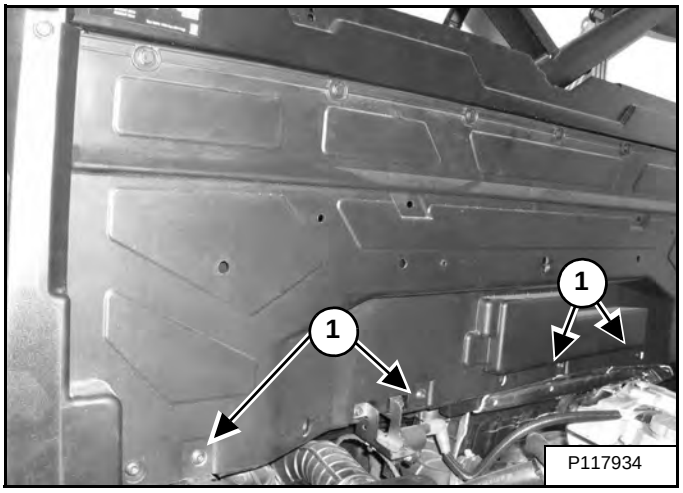
**Figure 20-40-3**




Remove the nut (Item 1) **[Figure 20-40-3]** and slide the pedal off the shaft.

**Removal And Installation (Cont'd)**

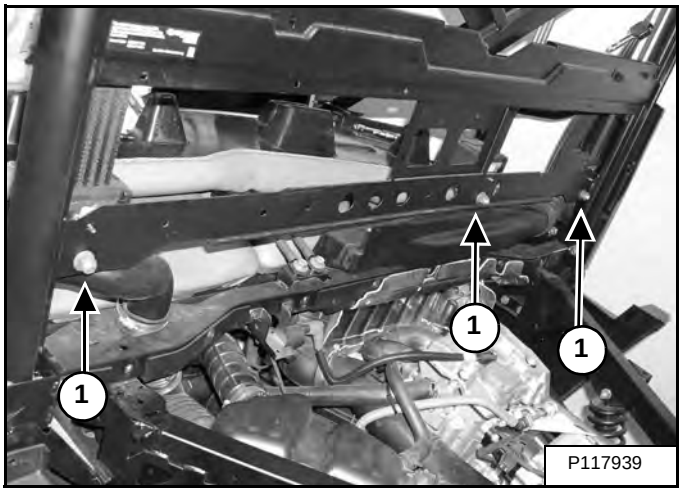
**Figure 30-10-17**




Remove the screws (Item 1) **[Figure 30-10-17]** securing the rear panel to the cab frame.

Remove the rear panel.

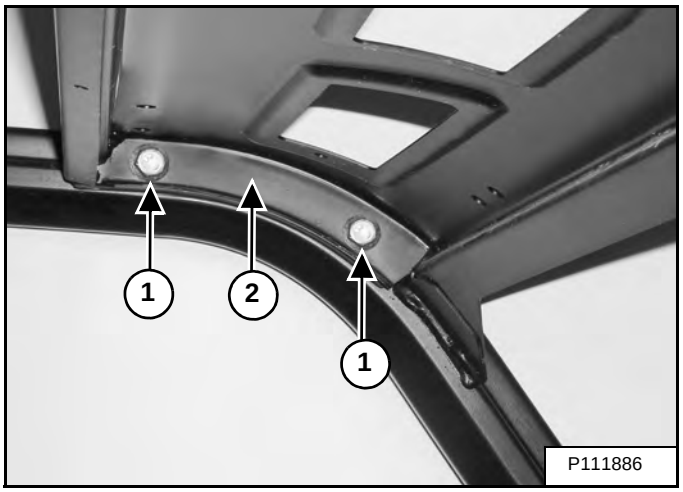
**Figure 30-10-18**




Remove the nut (Item 1) **[Figure 30-10-18]** securing the seat belt base to the cab frame.

*Earlier Models*

**Figure 30-10-19**




Remove the two bolts (Item 1) (both sides) and upper windshield mount (Item 2) **[Figure 30-10-19]**.

**NOTE: Do not tighten any structure bolts until all parts are loosely installed. Starting with the top of the cab frame and working down, torque all bolts to 40,7 N•m (30 ft-lb) torque.**

Installation: Tighten the bolts to 40,7 N•m (30 ft-lb) torque.

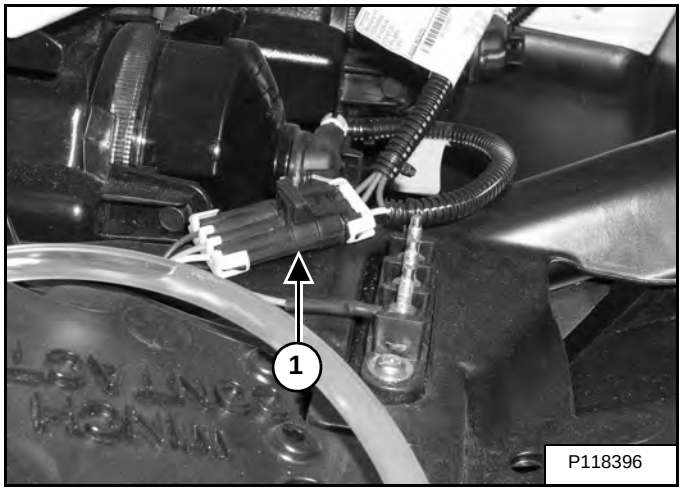
## BUMPER COVER

### Removal And Installation

Remove the front access cover. (See Front Access Cover Removal And Installation on Page 30-30-1.)

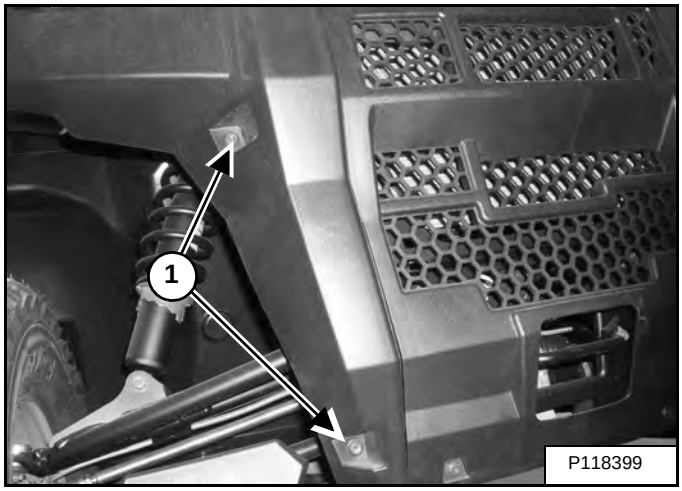
Remove the fenders. (See Removal And Installation (Front) on Page 30-140-1.)

**Figure 30-40-1**



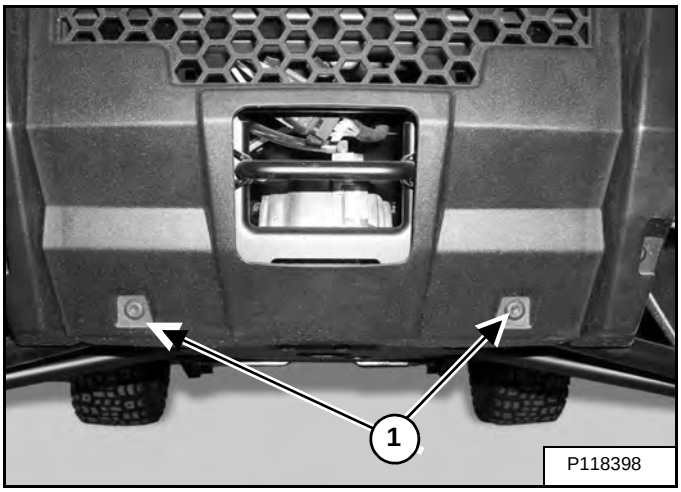

Disconnect the light wire harness (Item 1) **[Figure 30-40-1]** (both sides).

**Figure 30-40-2**



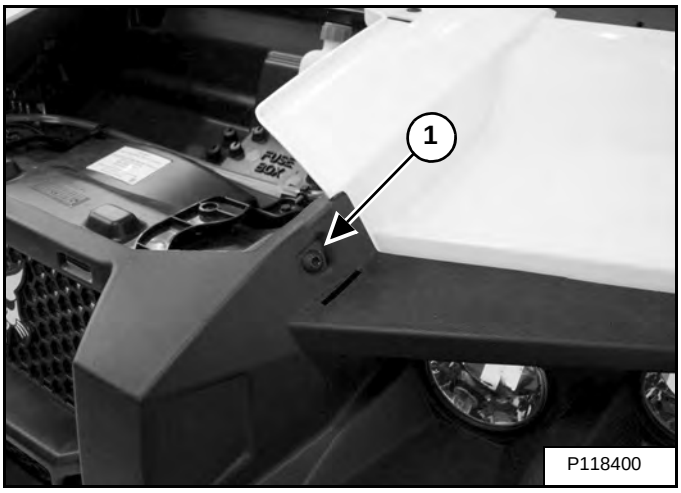

Remove the bolts (Item 1) **[Figure 30-40-2]** (both sides).

**Figure 30-40-3**




Remove the bolts (Item 1) **[Figure 30-40-3]**.

**Figure 30-40-4**




Remove the bolts (Item 1) **[Figure 30-40-4]** (both sides).

**Steering Wheel Removal And Installation**

Remove the upper steering shaft and steering wheel as an assembly before attempting to remove the steering wheel. (See Steering Wheel / Upper Steering Shaft Removal And Installation on Page 30-60-4.)

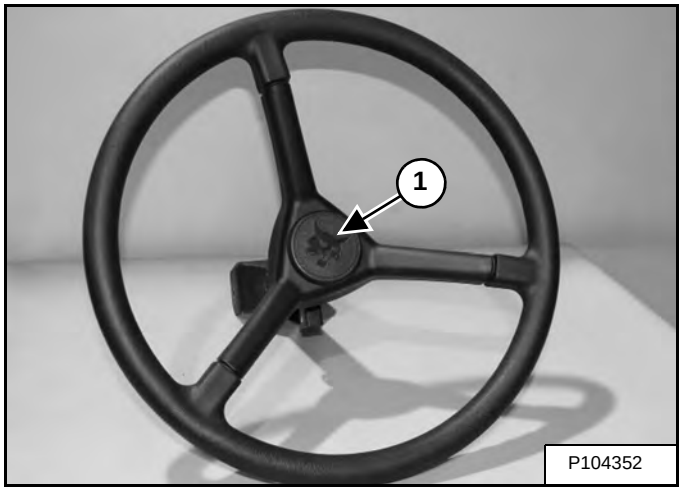
# IMPORTANT

**Striking the steering wheel or steering shaft while still connected to the steering unit can permanently damage the power steering unit and cause a power steering fault.**

I-2349-0811

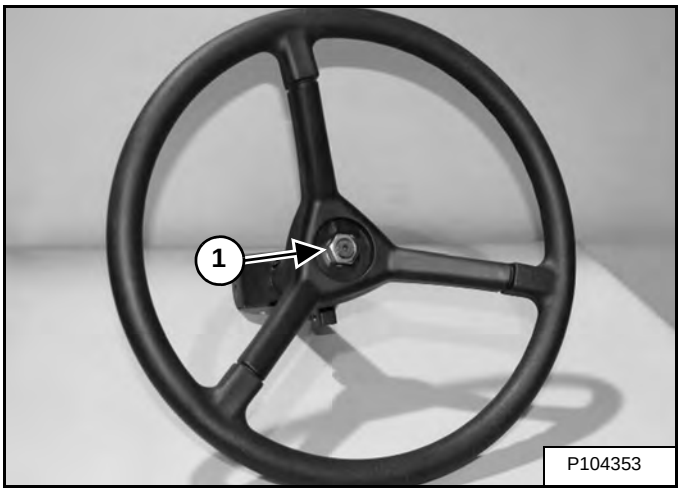
**NOTE: The upper steering shaft and steering wheel must be removed from the vehicle as an assembly before the steering wheel can be removed or damage to the power steering unit can result.**

**Figure 30-60-3**



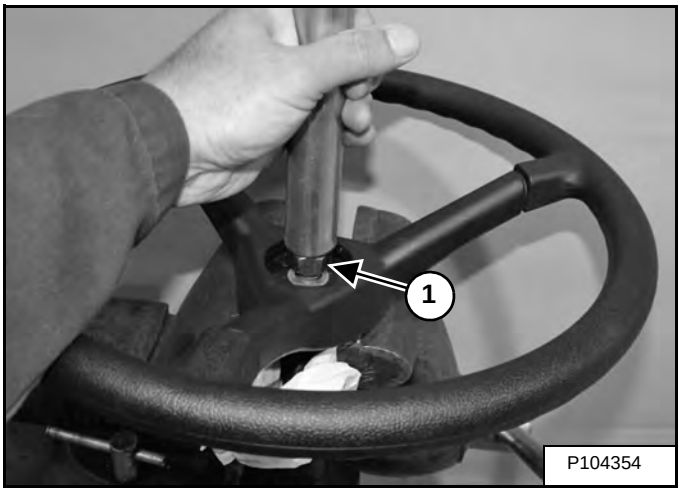

Remove the steering wheel cap (Item 1) **[Figure 30-60-3]**.

**Figure 30-60-4**




Loosen the nut (Item 1) **[Figure 30-60-4]** and back it half way off the steering shaft.

**Figure 30-60-5**




Place the assembly in a vise.

Using a large bronze drift and hammer, strike the steering shaft nut (Item 1) **[Figure 30-60-5]** to pop the steering wheel off the shaft taper.

Once the steering wheel pops loose, completely remove the nut (Item 1) **[Figure 30-60-5]** and remove the steering wheel from the shaft.

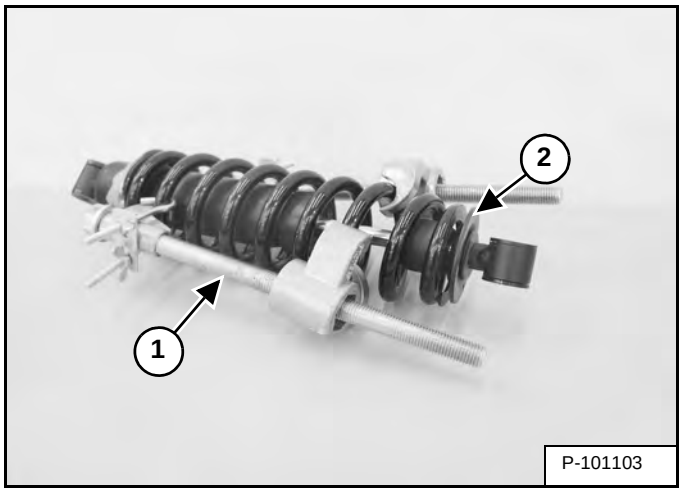
***Installation:*** Be sure wheels are facing straight forward and align as needed. Apply Loctite® and tighten the nut to 88 N•m (65 ft-lb) torque.

**Shock Spring Removal And Installation**

Remove the shock. (See Rear Shock Removal And Installation on Page 30-90-1.) or (See Front Shock Removal And Installation on Page 30-90-2.)

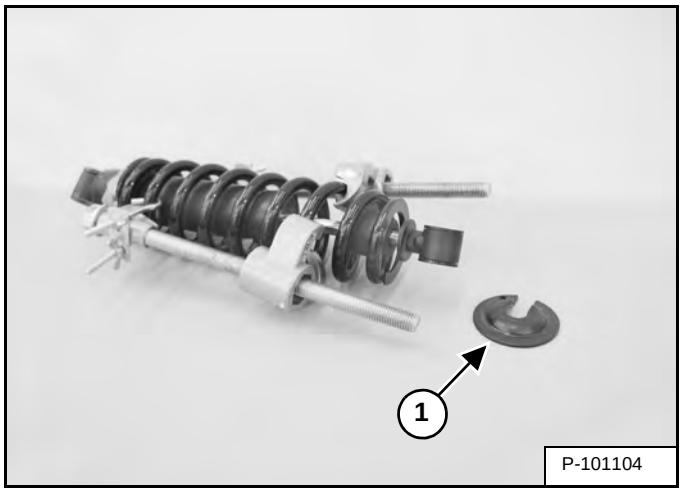
Note the spring preload cam setting for reinstallation.

**Figure 30-90-7**



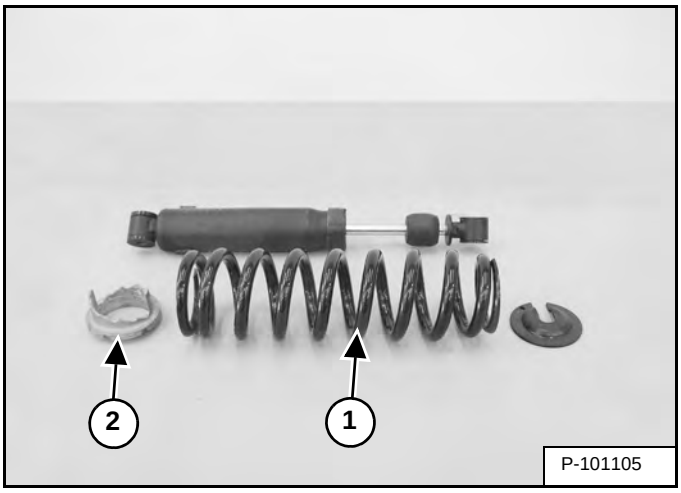

Using a spring compression (Item 1), compress the shock spring far enough to remove the spring retainer (Item 2) **[Figure 30-90-7]**.

**Figure 30-90-8**




Remove the spring retainer (Item 1) **[Figure 30-90-8]**.

**Figure 30-90-9**




Remove the spring (Item 1) and adjusting cam (Item 2) **[Figure 30-90-9]**.

## TIE ROD

### Description

The tie rods are the adjustable connection that links the steering cylinder shaft to the spindle. The tie rods provide a method of adjusting the “toe” position of the wheels.

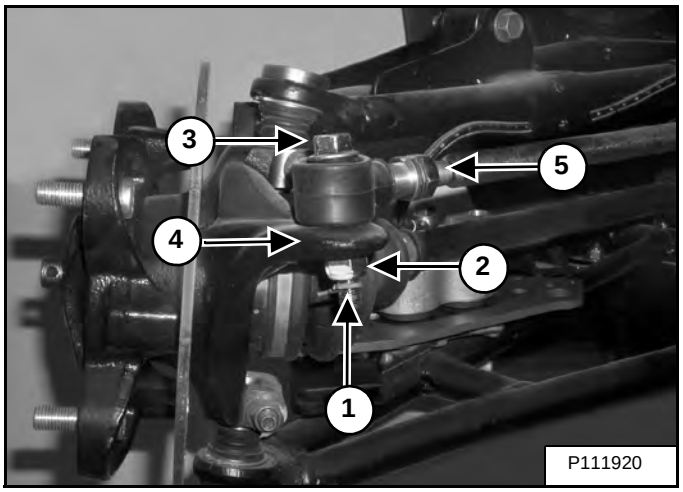
### Removal And Installation

Lift and block the machine. (See Procedure on Page 10-10-1.)

Remove the tire assembly. (See TIRE MAINTENANCE on Page 10-120-1.)

**NOTE: The tie rod end and boot are serviceable, when replacing a tie rod, the tie rod must be replaced as a complete unit. After the tie rod is replaced, the wheel alignment for toe position must be checked.**

**Figure 30-110-1**

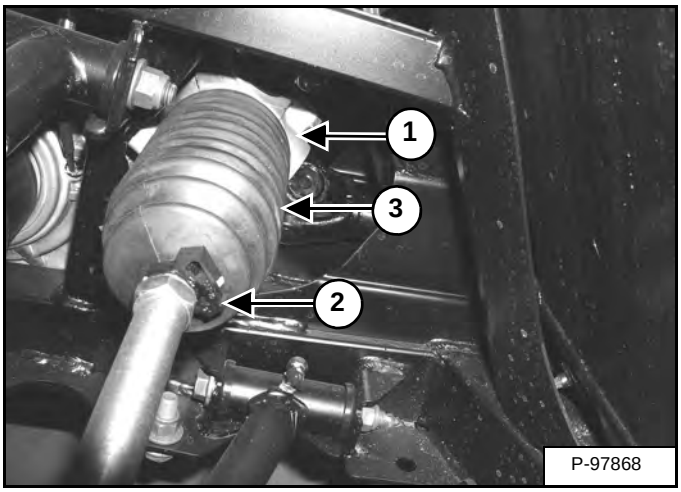



Remove the cotter pin (Item 1), nut (Item 2), bolt (Item 3) and separate the outer tie rod end from the spindle (Item 4) **[Figure 30-110-1]**. Tighten the nut to 16 - 19 N•m (12 - 14 ft-lb) torque.

Loosen the nut (Item 5) **[Figure 30-110-1]** and turn the tie rod end off of the tie rod. Count the number of turns it takes to remove the tie rod end.

***Installation:*** Turn the new tie rod end onto the tie rod the same number of turns it took to remove the old tie rod end.

**Figure 30-110-2**




Remove the strap (Item 1) **[Figure 30-110-2]** securing the steering box side of the boot.

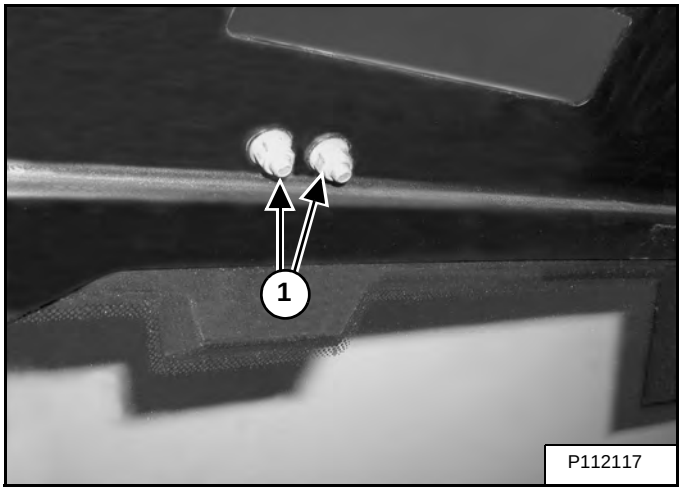
Remove the clamp (Item 2) and slide the boot (Item 3) **[Figure 30-110-2]** towards the spindle.

## FRONT WINDOW

### Removal And Installation

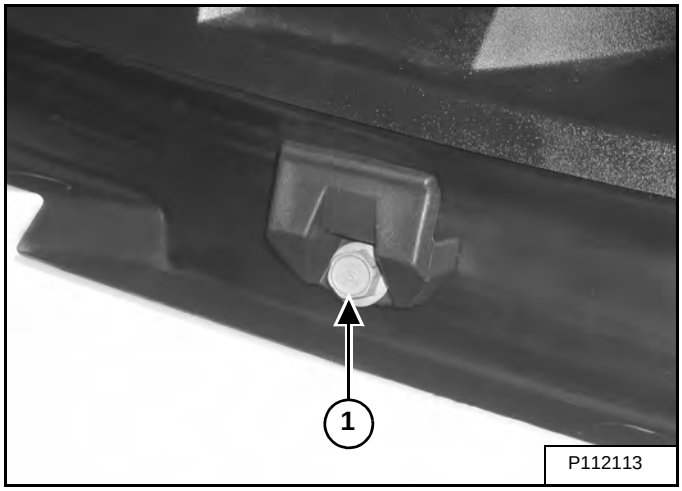
Remove the roof.

**Figure 30-150-1**



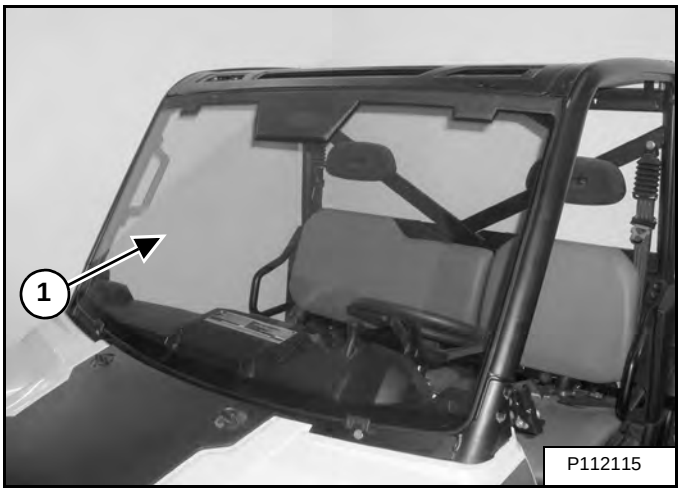

If equipped with a front window, remove the upper mounting bracket bolts (Item 1) **[Figure 30-150-1]** (both sides).

**Figure 30-150-2**




Loosen the bottom mount bolt (Item 1) **[Figure 30-150-2]** (both sides).

**Figure 30-150-3**




With the help of an assistant, remove the windshield (Item 1) **[Figure 30-150-3]** from the windshield frame.

# ELECTRICAL SYSTEM AND ANALYSIS

## Description

The utility vehicle has a 12 volt, negative ground, alternator charging system. The electrical system is protected by fuses and relays. The fuses will protect the electrical system when there is an electrical overload. The reason for the overload must be found before starting the engine again.

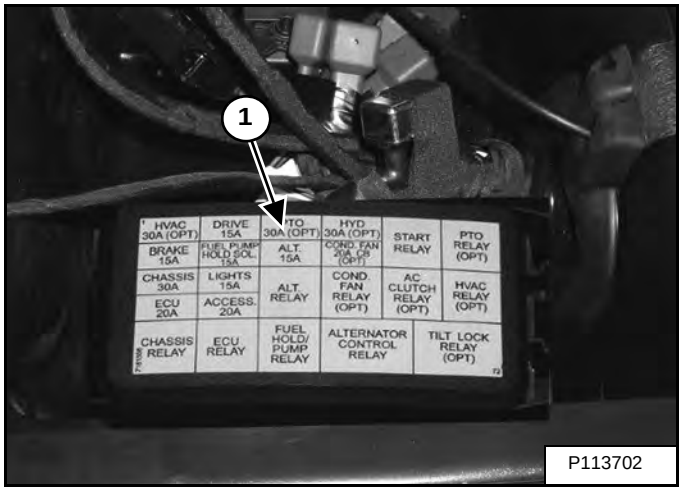
## Fuse And Relay Location

The fuses and relays are located below the center of the seat.

**Figure 40-10-1**

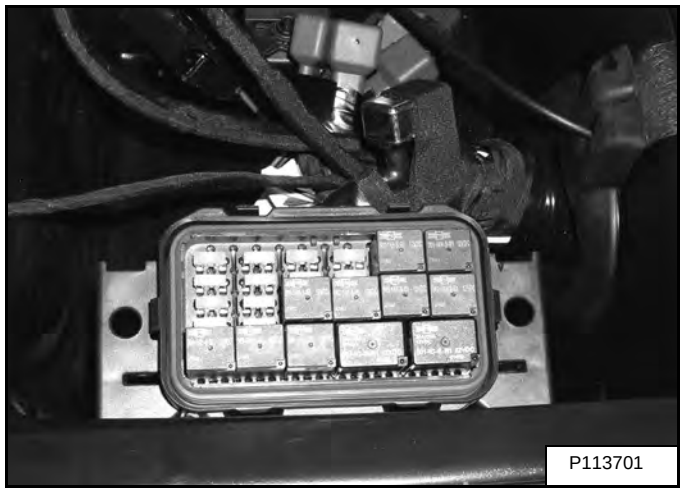

Remove the passenger seat (Item 1) **[Figure 40-10-1]**.

**Figure 40-10-2**




Remove the fuse and relay cover (Item 1) **[Figure 40-10-2]**.

**Figure 40-10-3**



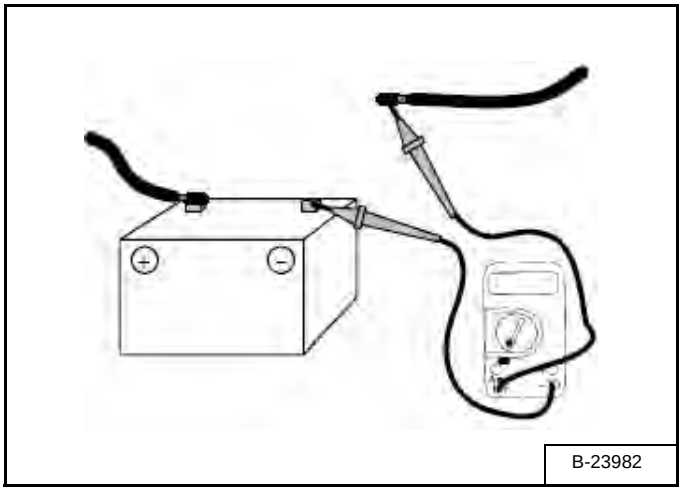

Under the cover (Item 1) **[Figure 40-10-2]** are the fuses and relays **[Figure 40-10-3]**.

## CHARGING SYSTEM

### Current Draw - Key OFF

Remove the seat base. (See Seat Base Removal And Installation on Page 30-20-1.)

**Figure 40-30-1**




If the charging system malfunctions check the following:

Check the electrolyte level in the battery. Add distilled water as needed. (Does not apply to maintenance free batteries.)

Verify the charge of the battery. Make sure battery is fully charged.

Disconnect the battery cables (negative first, then positive). Inspect the cable clamps and battery posts for corrosion. Remove acid or corrosion from the battery and cables with a sodium bicarbonate and water solution. Put grease on the cable ends and battery terminals to prevent corrosion. Reconnect the cable to the positive terminal.

With the key off, connect an ammeter in series with the negative battery post and the disconnected negative cable clamp **[Figure 40-30-1]**.

1. With the key OFF, current draw should not be more than 0.01 DCA (10 MA).

2. If the draw is excessive, there is a short (drain) in the electrical system of the utility work machine. The short must be repaired before the charging system can be checked

3. Disconnect loads one by one until the draw is isolated. Check component wiring as well as components for shorts to ground.

**⚠ WARNING**

**AVOID INJURY OR DEATH**

**Batteries contain acid which burns eyes and skin on contact. Wear goggles, protective clothing and rubber gloves to keep acid off body.**

**In case of acid contact, wash immediately with water. In case of eye contact get prompt medical attention and wash eye with clean, cool water for at least 15 minutes.**

**If electrolyte is taken internally drink large quantities of water or milk! DO NOT induce vomiting. Get prompt medical attention.**

W-2065-0807

### Break Even Test

Remove the seat base. (See Seat Base Removal And Installation on Page 30-20-1.)

The “break even” point of the charging system is the point at which the alternator overcomes all system loads (lights, etc.) and begins to charge the battery. Depending on battery condition and system load, the bread even point may vary slightly. The battery should be fully charged before performing this test.

Connect a tachometer to the engine.

Using an inductive amperage metering device, (set to DC amp) connect to the negative battery cable.

With engine off and the key switch and lights in the ON position, the ammeter should read negative amp (battery discharge). Reverse meter lead if a positive reading is indicated.

Shift transmission to park and start the engine. With the engine running at idle, observe meter readings.

Increase engine rpm while observing ammeter and tachometer.

Note rpm at which the battery starts to charge (ammeter indication is positive).

With lights and other electrical loads off, the “break even” point should occur just above idle rpm.

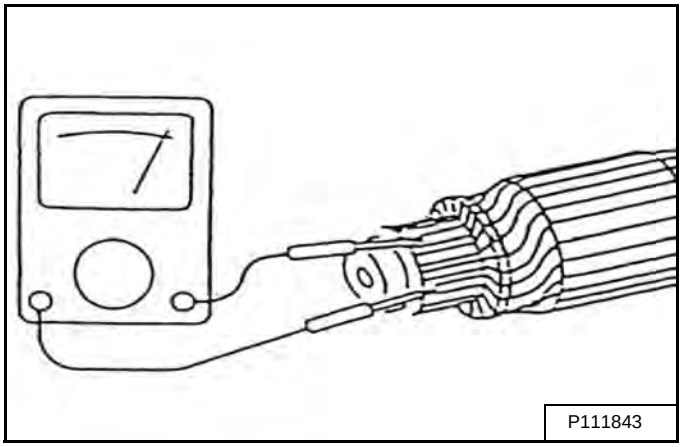
With the engine running, turn the lights on and engage the brake to keep brake light on.

Repeat test, observing ammeter and tachometer. With lights on, charging should occur at or below 2000 rpm.

**Starter Motor Testing**

*Armature Coil Continuity Test*

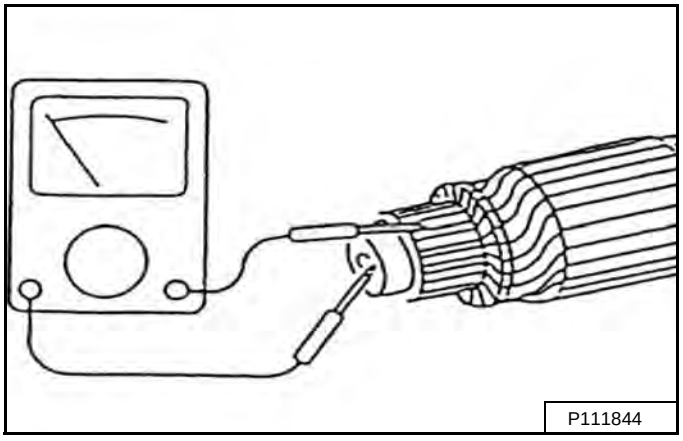
**Figure 40-40-11**




Check for continuity between the commutator segments using a multimeter. There should be continuity present between any two segments. If the continuity is present, replace the armature **[Figure 40-40-11]**.

*Armature Coil Insulation Test*

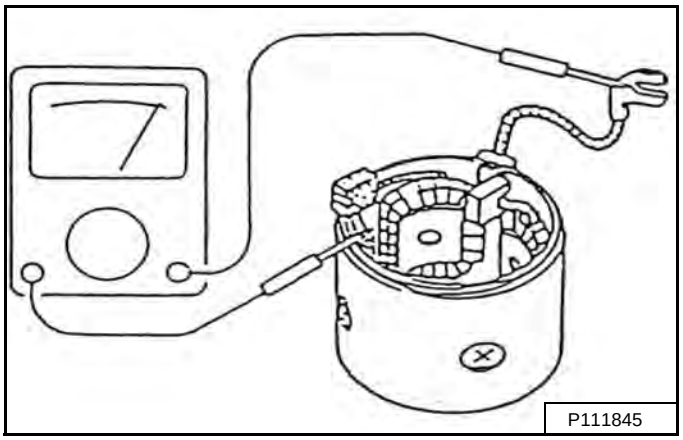
**Figure 40-40-12**




Check for continuity between a commutator segment and the shaft or armature using a multimeter. The multimeter should not indicate continuity. If there is continuity present, replace the armature **[Figure 40-40-12]**.

*Field Coil Continuity Test*

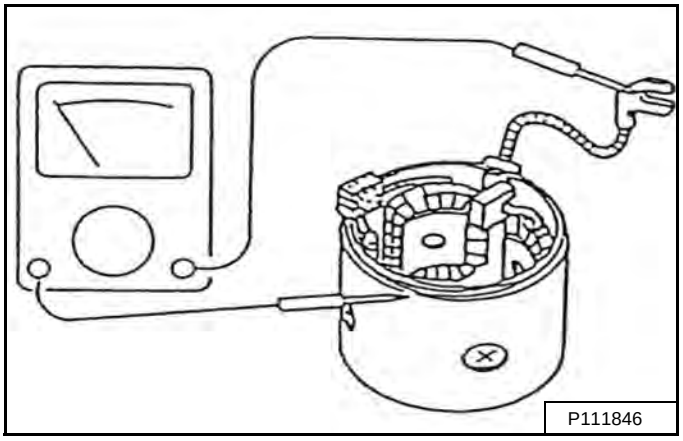
**Figure 40-40-13**




Check for continuity between the field coil terminals using a multimeter. There should be continuity present. If there is not continuity, replace the field coil assembly **[Figure 40-40-13]**.

*Field Coil Insulation Test*

**Figure 40-40-14**




Check for continuity between either field coil terminal and the yoke using a multimeter. There should not be continuity present. If there is continuity, replace the field coil assembly **[Figure 40-40-14]**.

## SPEED SENSORS

### Engine Speed Sensor

#### *Description*

The Engine Speed Sensor is used to provide the ECU with engine speed for AWD operation.

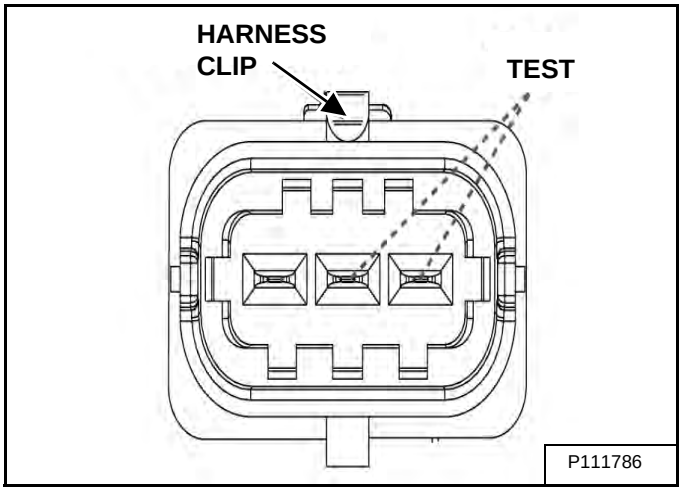
#### *Location*

The speed sensor is located on the ride side of the transmission, accessed through the right rear wheel well.

#### *Testing*

Disconnect the main harness (Item 1) **[Figure 40-80-2]** from the sensor harness pigtail.

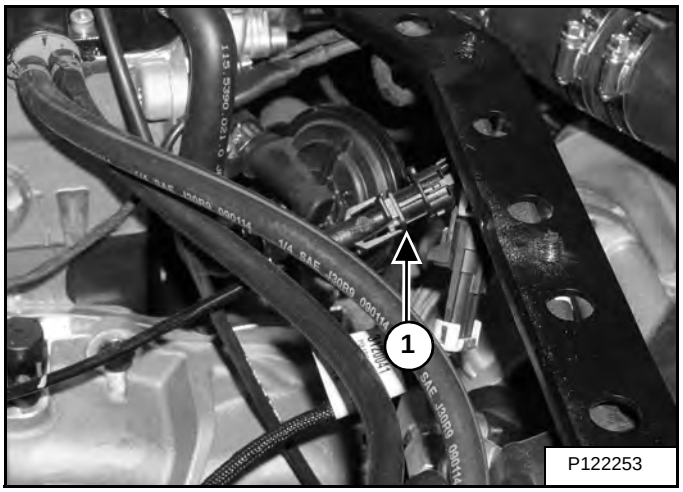
**Figure 40-80-1**




Connect an ohmmeter between the sensor pin terminals shown in **[Figure 40-80-1]**. The reading should be 1000 ohm ± 10% and taken at room temperature.

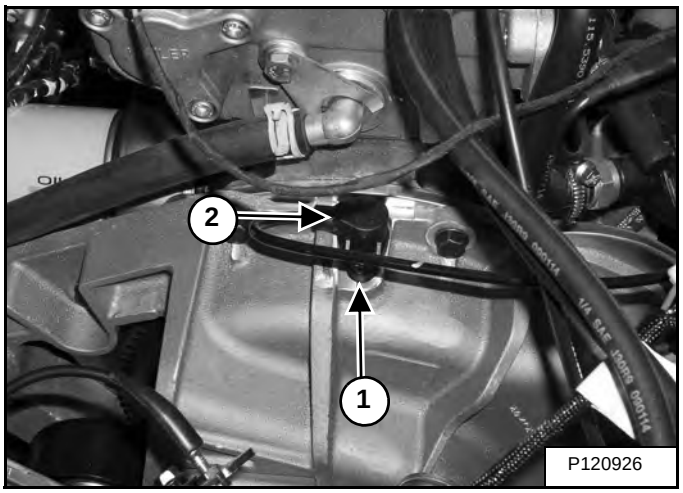
*Removal And Installation*

**Figure 40-80-2**




Disconnect the harness (Item 1) **[Figure 40-80-2]**.

**Figure 40-80-3**




Remove the bolt (Item 1) and sensor (Item 2) **[Figure 40-80-3]**.

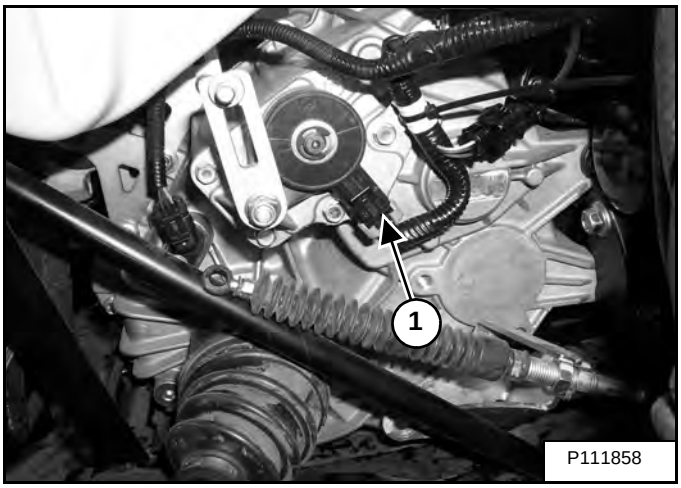
## SWITCH (GEAR SELECTOR)

### Location

The gear selector switch is located on the right side of the transmission. The switch can be accessed through the right rear wheel well opening.

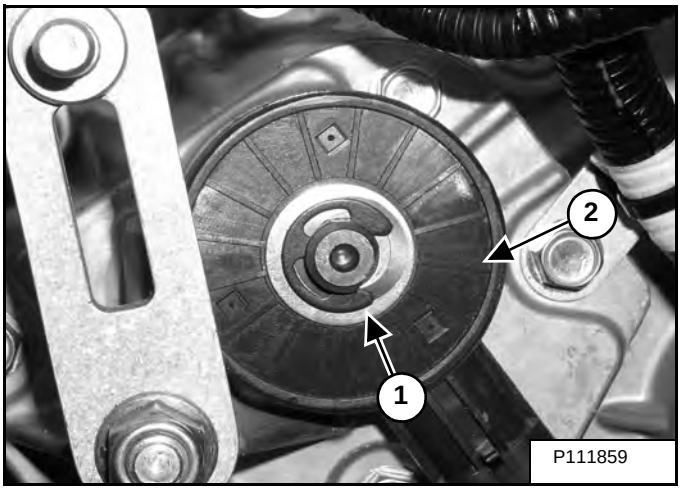
### Removal And Installation

**Figure 40-94-1**




Disconnect the harness (Item 1) **[Figure 40-94-1]**.

**Figure 40-94-2**




Remove the retaining clip (Item 1) and switch (Item 2) **[Figure 40-94-2]**.

**NOTE: The gear selector switch is not adjustable. If the indicator lights do not match the gear selected adjust the shift cable.**

Verify shift cable is adjusted correctly. (See Shift Cable Adjustment on Page 20-20-2.)

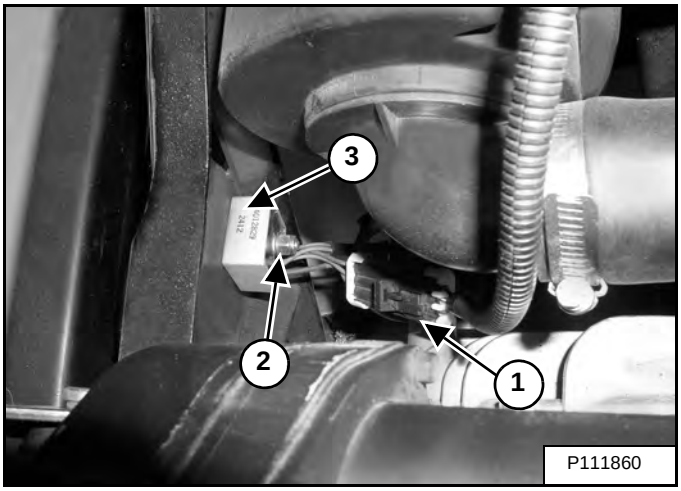
## DIFFERENTIAL SOLENOID (REAR RELAY)

### Description

The rear differential solenoid relay is attached to the rear portion of the main frame and can be accessed by tilting the rear cargo box.

### Removal And Installation

**Figure 40-121-1**



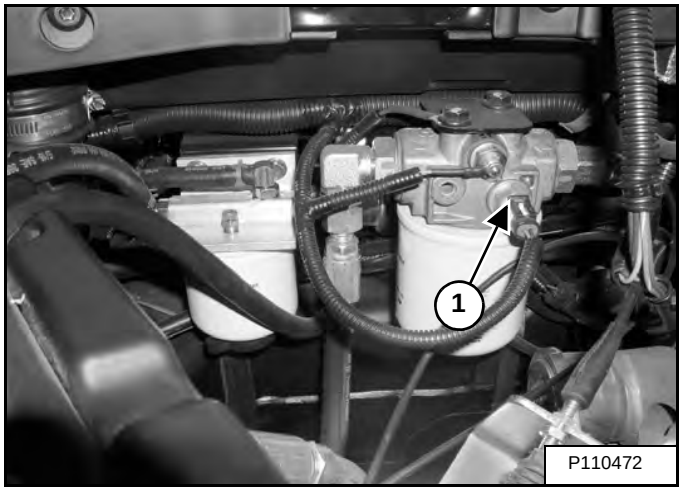

Disconnect the harness (Item 1) **[Figure 40-121-1]**.

Remove the nut (Item 2) and relay (Item 3) **[Figure 40-121-1]**.

## HYDRAULIC TEMPERATURE SENSOR

### Location

**Figure 40-160-1**




The hydraulic temperature sensor (Item 1) **[Figure 40-160-1]** is located on the hydraulic filter housing under the driver's seat between the cargo box and the cab.

### Testing

Disconnect the vehicle harness from the hydraulic temperature sensor.

Using an ohmmeter, place one lead on a pin on the sensor. Compare readings to the chart.

| Function | Temperature |
|---|---|
| Hydraulic Lamp On Solid | 90°C (194°F) |
| Hydraulic Lamp Off | 85°C (185°F) |
| Hydraulic Lamp Starts Blinking | 94°C (201°F) |
| Hydraulic Lamp Stops Blinking | 91°C (196°F) |
| Cooling Fan On | 80°C (176°F) |
| Cooling Fan Off | 76°C (169°F) |
| Engine Shutdown (when temp is sustained for 60 sec) | 96°C (205°F) |

| Temperature | Resistance |
|---|---|
| 0°C (32°F) | ~1700 Ω |
| 25°C (77°F) | ~1000 Ω |
| 25°C (77°F) | ~815 Ω |

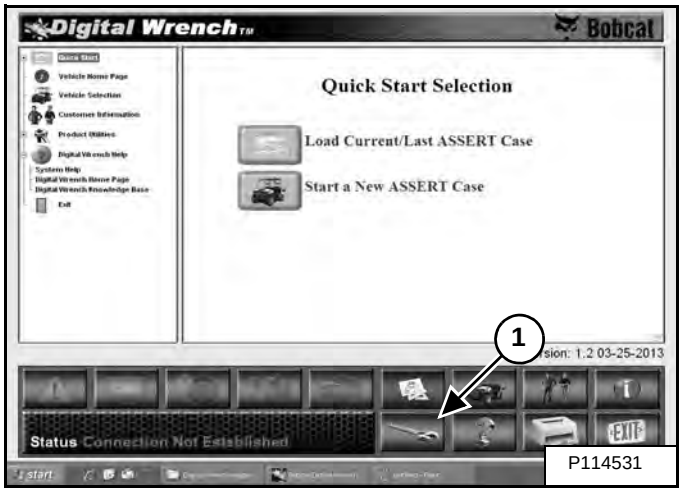
## Diagnostic Trouble Codes

| COMPONENT | CONDITION | SPN | FMI | DIGITAL WRENCH P-CODE |
|---|---|---|---|---|
| Vehicle Speed Signal | Data Erratic or Intermittent (or missing) | 84 | 2 | P0503 |
| | Received Vehicle Speed Has Error | | 19 | C1069 |
| Engine Temperature Sender (ETC) | Voltage Too High | 110 | 3 | P0118 |
| | Voltage Too Low | | 4 | P0117 |
| | Temperature Too High | | 16 | P0217 |
| System Power (Battery Potential / Power input) | Voltage Too High | 168 | 3 | P0563 |
| | Voltage Too Low | | 4 | P0562 |
| Engine Speed (This is applicable when the EPS module gets the engine speed from the ECM) | Error in Engine Speed Computation | 190 | 31 | P121C |
| | Received Engine Speed Has Error | | 19 | C1066 |
| Engine Speed | Error in Engine Speed Computation | 400 | 31 | P121D |
| Gear Sensor Signal | Voltage Too Low | 523 | 4 | P0217 |
| ECU Memory | EEPROM: Read/Write Failure | 628 | 12 | C1073 |
| Calibration | Checksum/CRC Error | 630 | 13 | C1074 |
| Crankshaft Position Sensor (CPS) | Plausibility Fault | 636 | 2 | P0335 |
| Rear Differential Output | Driver Circuit Open / Grounded | 746 | 5 | P1691 |
| | Driver Circuit Short To B+ | | 3 | P1692 |
| | Driver Circuit Grounded | | 4 | P1693 |
| Fan Relay Driver Circuit | Driver Circuit Open / Grounded | 1071 | 5 | P1481 |
| | Driver Circuit Short To B+ | | 3 | P1482 |
| | Driver Circuit Grounded | | 4 | P1483 |
| Fuel Pump Driver Circuit | Driver Circuit Open / Grounded | 1347 | 5 | P0230 |
| | Driver Circuit Short To B+ | | 3 | P0232 |
| | Driver Circuit Grounded | | 4 | P0231 |
| PTO Solenoid Driver Circuit (Not used for this model) | Driver Circuit Open / Grounded | 1888 | 5 | P1310 |
| | Driver Circuit Short To B+ | | 3 | P1311 |
| | Driver Circuit Grounded | | 4 | P1312 |
| Hydraulic Oil temperature Sensor | Temperature Too High | 5536 | 16 | P1218 |
| | Hydraulic Over Temperature Shutdown | | 0 | P121A |
| | Temperature Too High | | 19 | P121B |
| ECU 3.3V Output Supply Voltage | Voltage Too High | 3597 | 3 | P16A2 |
| | Voltage Too Low | | 4 | P16A1 |
| ECU 5V Output Supply Voltage | Voltage Too High | 3598 | 3 | P16A9 |
| | Voltage Too Low | | 4 | P16A8 |
| ECU Output Supply Voltage 3 | Voltage Too High | 3599 | 3 | P17AA |
| | Voltage Too Low | | 4 | P17AB |
| All Wheel Drive Control Circuit (AWD) | Driver Circuit Open / Grounded | 520207 | 5 | P1836 |
| | Driver Circuit Short To B+ | | 3 | P1835 |
| | Driver Circuit Grounded | | 4 | P1834 |
| Steering Over Current Shut Down | Current Above Normal or Grounded | 520221 | 6 | C1050 |
| Steering Excessive Current Error | Current Above Normal or Grounded | 520222 | 6 | C1051 |
| Steering Torque Partial Failure | Condition Exists | 520223 | 31 | C1052 |
| Steering Torque Full Failure | Condition Exists | 520224 | 31 | C1053 |

***Diagnostic codes subject to change without notice.***

### Digital Wrench™ Serial Number Location

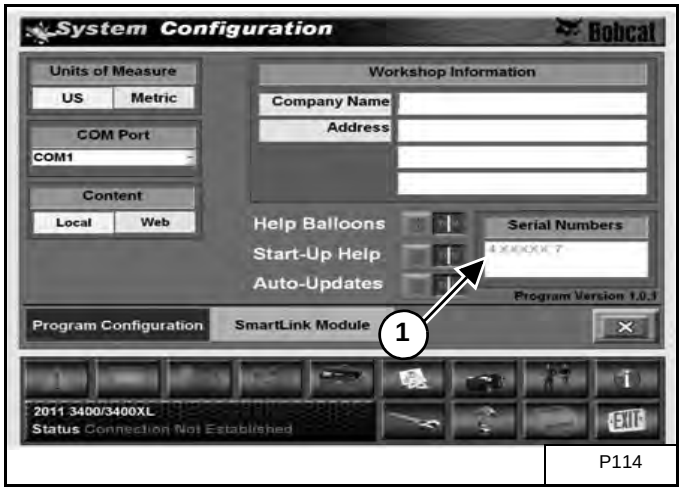
**Figure 40-200-3**




Open the Digital Wrench™ software **[Figure 40-200-3]**.

Open the configuration screen by clicking on the "wrench" icon (Item 1) **[Figure 40-200-3]**.

**Figure 40-200-4**




The serial number (Item 1) **[Figure 40-200-4]** is located on the right side of the screen.

### Version And Update ID

**Figure 40-200-5**


Open the Digital Wrench™ software. Locate the version ID (Item 1) **[Figure 40-200-5]** shown on the lower right side of the Digital wrench™ startup screen.

In this case, the version number is 1.2 with a 03/25/2013 revision **[Figure 40-200-5]**.

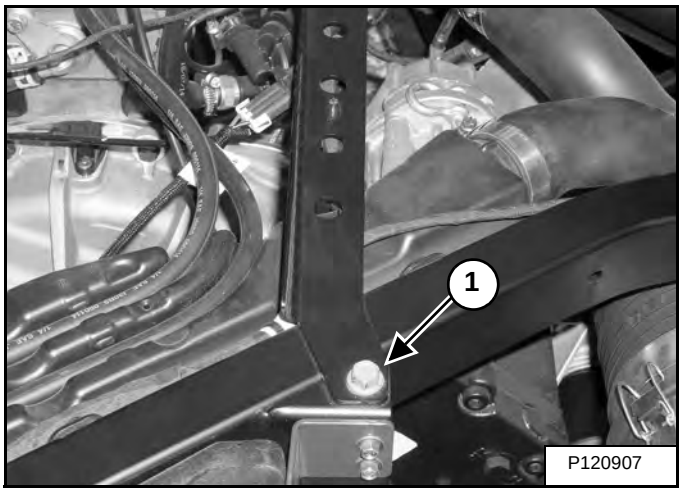
# ENGINE SERVICE

**Troubleshooting**

| TROUBLE SYMPTOM | | | | CAUSE: Engine System — Improper Intake / Exhaust Valve Clearance | Compression Leakage From Valve Seat | Intake / Exhaust Valve Seizure | Cylinder Head Gasket Blowout | Seized Or Broken Piston Ring | Worn Piston Ring, Piston Or Cylinder | Seized Crankpin Metal Or Bearing | Improper Arrangement Of Piston Ring Gaps |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Starting **Troubleshooting** ting Problem | Engine Does Not Start | | | ■ | | ■ | | ■ | ■ | ■ | |
| | Engine Starts But Stops Soon | Exhaust Smoke | None | ■ | | | | | | ■ | ■ |
| | | | Little | | | | | | | | |
| | | | Much | | | ■ | | ■ | ■ | | |
| Insufficient Engine Output | Exhaust Color | Ordinary | | ■ | ■ | ■ | ■ | | | | |
| | | White | | | | | | ■ | ■ | | ■ |
| | | Black | | | ■ | ■ | | | | | |
| Poor Exhaust Color | During Work | White | | | | | | ■ | ■ | | |
| | | Black | | | ■ | ■ | | | | | |
| High Knocking Sound During Combustion | | | | | | | | | | | |
| Abnormal Engine Sound | | | | ■ | ■ | ■ | | ■ | | ■ | |
| Uneven Combustion Sound | | | | | | | | | | | |
| Engine Surging | During Idling | | | | | | | ■ | | ■ | |
| | During Work Operation | | | | | ■ | | | | ■ | |
| Excessive Engine Vibration | | | | | | ■ | | ■ | | ■ | |
| Difficulty In Returning To Low Speed | | | | | | | | | | | |
| Excessive Fuel Consumption | | | | | ■ | | | | | | |
| Engine Oil | Excessive Oil Consumption | | | | | | | ■ | ■ | | ■ |
| | Dilution By Diesel Fuel | | | | | ■ | | ■ | ■ | | |
| | Oil With Water | | | | | | ■ | | | | |
| | Low Oil Pressure | | | | | | | | | | |
| Excessive Blow-by Gas | | | | | ■ | ■ | | ■ | ■ | ■ | ■ |
| Engine Coolant | Overheat | | | | | | ■ | ■ | | | |
| | Low Coolant Temperature | | | | | | | | | | |
| Air Intake | Pressure Drop | | | ■ | ■ | ■ | | | | | |
| | Pressure Rise | | | | | | | | | | |
| Exhaust Temperature Rise | | | | ■ | ■ | | | ■ | | | |
| Corrective Action | | | | Adjust the Valve Clearance. | Lap the Valve Seat. | Correct or Replace Intake / Exhaust Valve. | Replace the Gasket. | Replace the Piston Ring. | Perform Honing and Use Oversize Parts. | Repair or Replace. | Correct the Ring Joint Positions. |

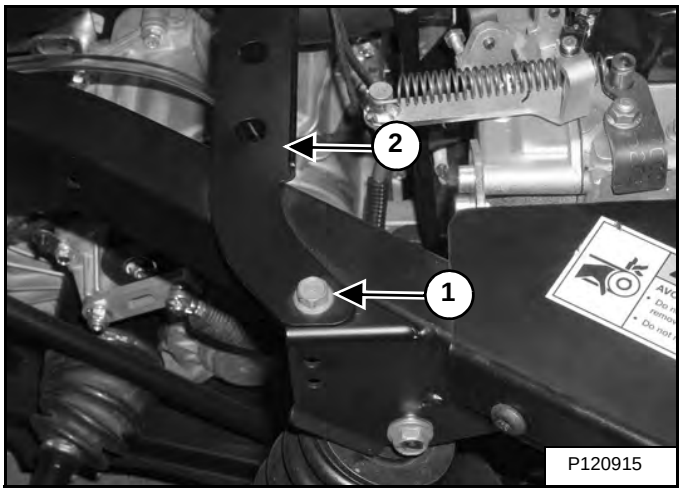
**Engine Removal And Installation (Cont'd)**

**Figure 50-10-8**



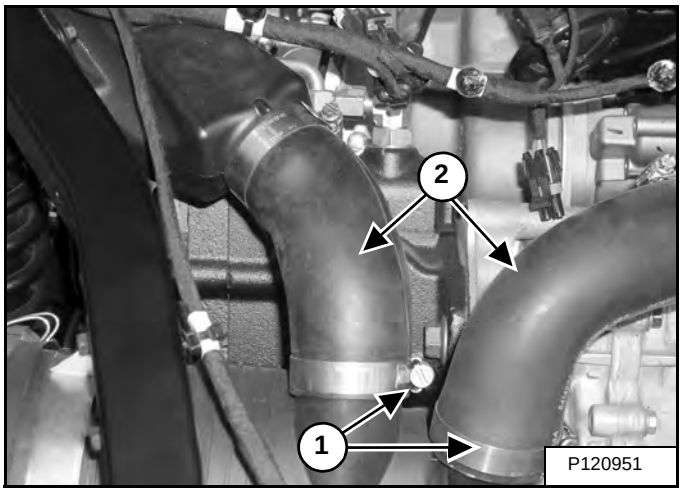

Remove the bolt (Item 1) **[Figure 50-10-8]** from the crossmember.

**Figure 50-10-9**



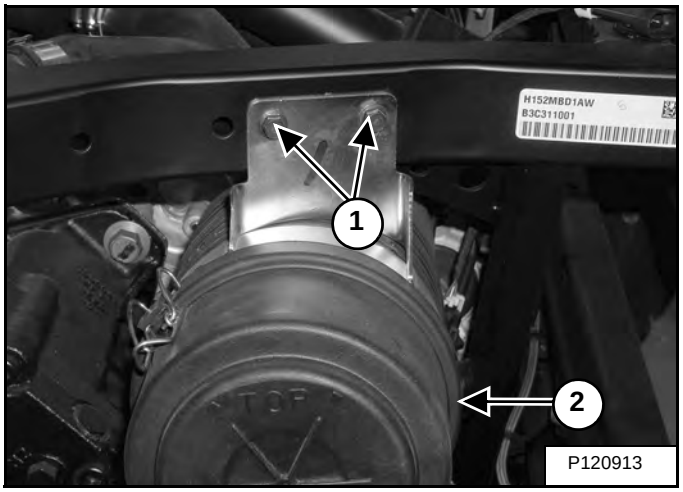

Remove the bolt (Item 1) and crossmember (Item 2) **[Figure 50-10-9]**.

**Figure 50-10-10**




Loosen the clamps (Item 1) and remove the hoses (Item 2) **[Figure 50-10-10]** from the air filter.

**Figure 50-10-11**



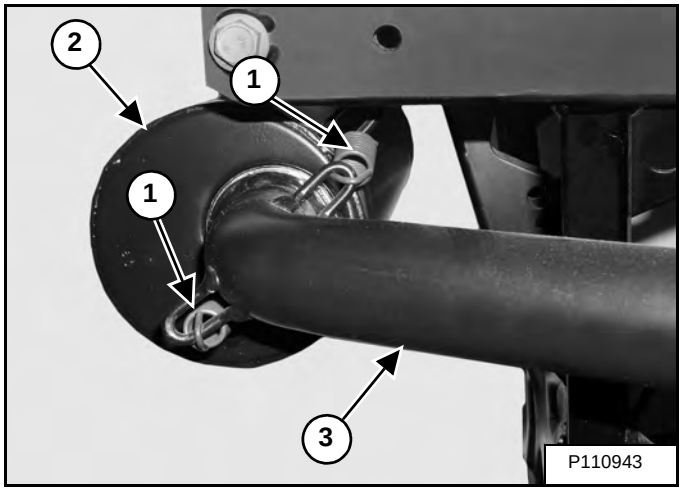

Remove the bolts (Item 1) and air filter (Item 2) **[Figure 50-10-11]**.

## MUFFLER

### Removal And Installation

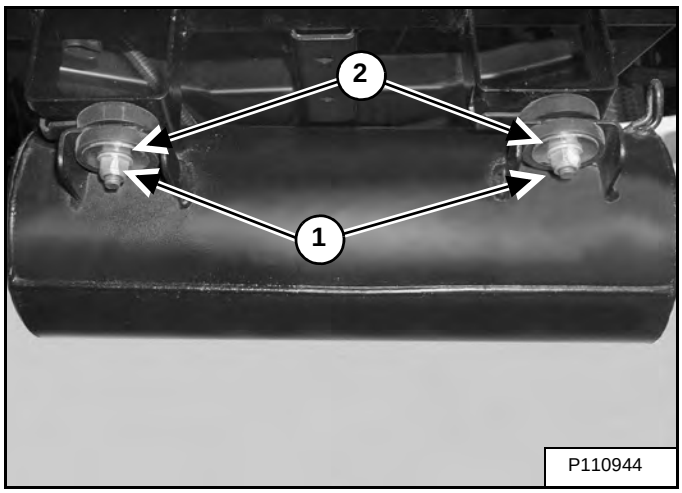
Raise the cargo box.

**Figure 50-20-1**




Remove the springs (Item 1) that secure the muffler (Item 2) to the exhaust pipe (Item 3) **[Figure 50-20-1]**.

**Figure 50-20-2**




Remove the nuts (Item 1) washers (Item 2) **[Figure 50-20-2]** and bolts.

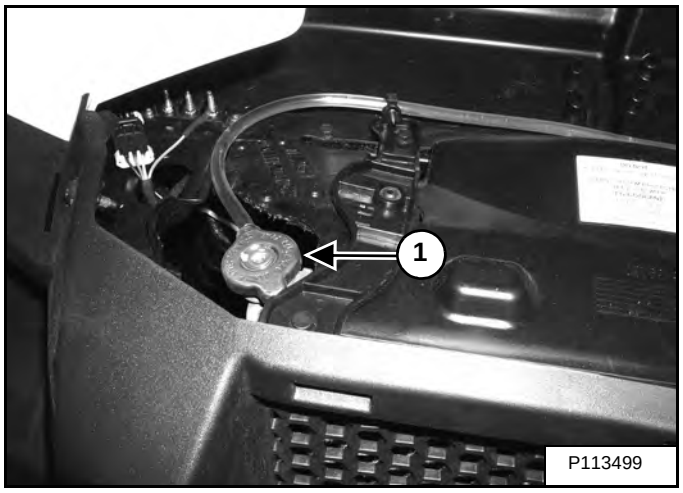
Remove the muffler.

**Thermostat Removal And Installation**

Remove the front access cover. (See Front Access Cover Removal And Installation on Page 30-30-1.)

Raise the cargo box.

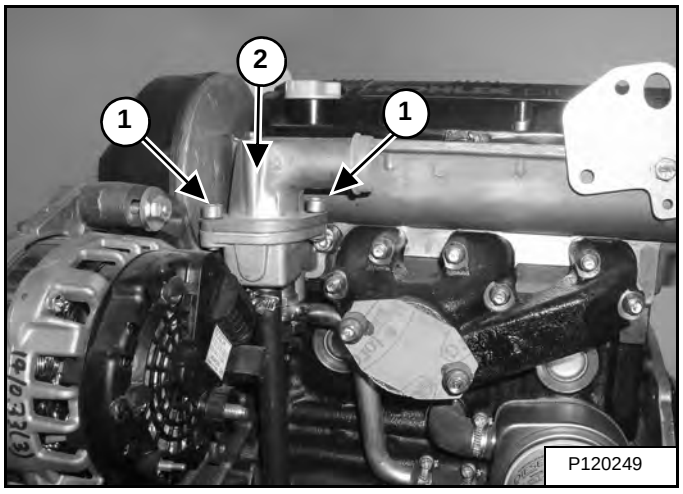
**Figure 50-40-14**




Remove the radiator cap (Item 1) **[Figure 50-40-14]** to relieve any system pressure.

Drain coolant to a level thats below the thermostat housing.

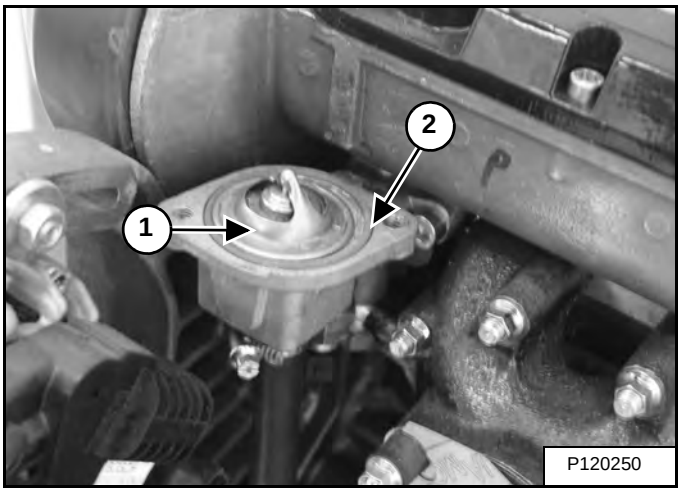
**Figure 50-40-15**




Remove the bolts (Item 1) and the thermostat cover (Item 2) **[Figure 50-40-15]**.

***Installation:*** Tighten the bolts to 25 N•m (18 ft-lb) torque.

**Figure 50-40-16**




Remove the thermostat (Item 1) and seal (Item 2) **[Figure 50-40-16]**

**Fuel Tank Removal**

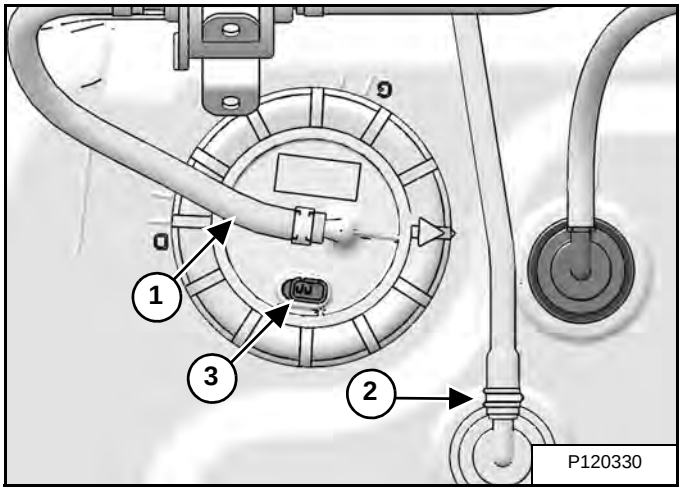
Remove the driver and passenger seat base and storage bins.

Disconnect the negative (-) battery cable from the battery.

Remove the main floor.

**NOTE: Siphon as much fuel from the tank as possible before attempting to remove it from the vehicle.**

**Figure 50-60-2**



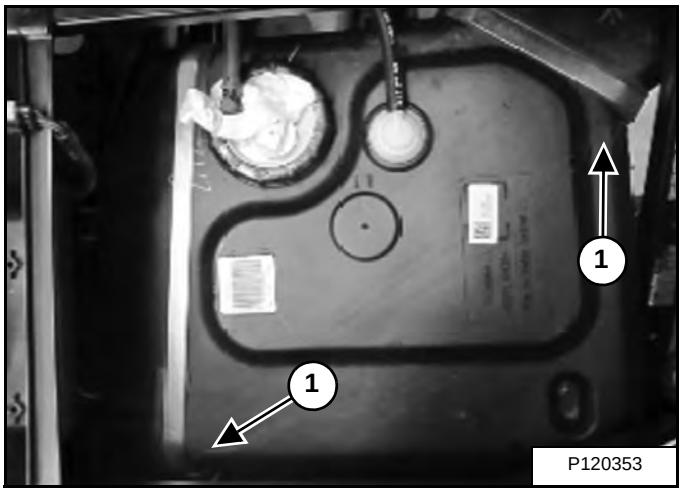

While holding a shop towel over the fuel line connectors, remove the fuel line (Item 1) **[Figure 50-60-2]** from the fuel sender.

**NOTE: A small amount of fuel may come out of the fuel lines or pump fitting. Properly drain fuel into a suitable container.**

Remove the fuel tank return line (Item 2) **[Figure 50-60-2]**.

Disconnect the fuel sender harness (Item 3) **[Figure 50-60-2]**.

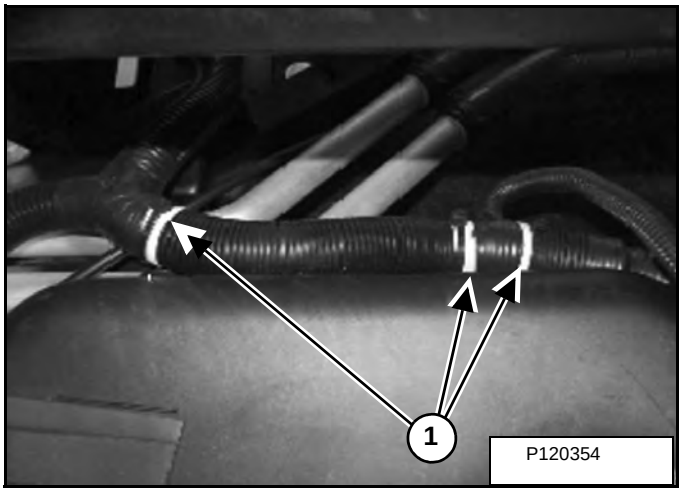
**Figure 50-60-3**




Remove the fuel tank bracket bolts (Item 1) **[Figure 50-60-3]** retaining the fuel tank to the chassis.

Swing the tank brackets clear of the fuel tank for removal.

**Figure 50-60-4**




Remove the tie straps (Item 1) **[Figure 50-60-4]** retaining the main wire harness to the fuel tank.

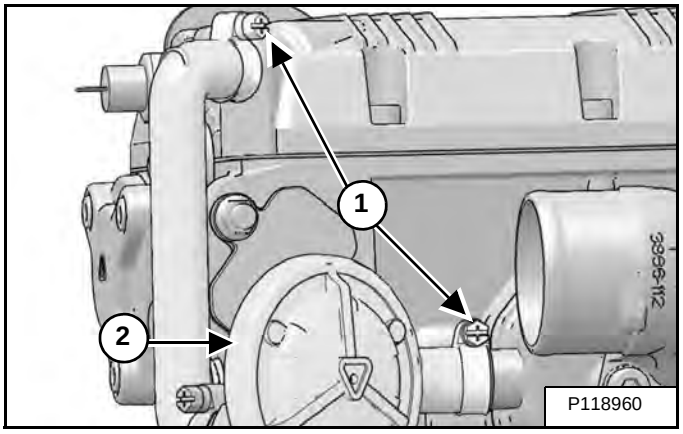
Slide the fuel tank towards the front of the vehicle and remove.

## ENGINE DISASSEMBLY AND INSPECTION

### Crankcase Vacuum Regulator Valve Removal

The vacuum relief valve is an engine safety device. Its function is that of limiting the vacuum whenever it tends to increase. Without this, should the air filter be clogged, the oil contained in the cover may be sucked back into the intake manifold causing the condition for engine runaway. The vacuum relief valve fails closed.

**Figure 50-70-1**

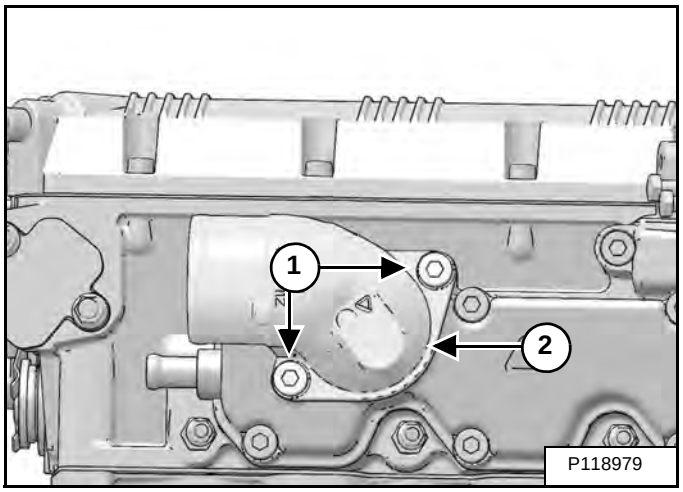



Loosen the clamps (Item 1) and remove the valve (Item 2) **[Figure 50-70-1]**.

Inspect the valve for any oil in the hose to the intake manifold.

### Intake Manifold Removal

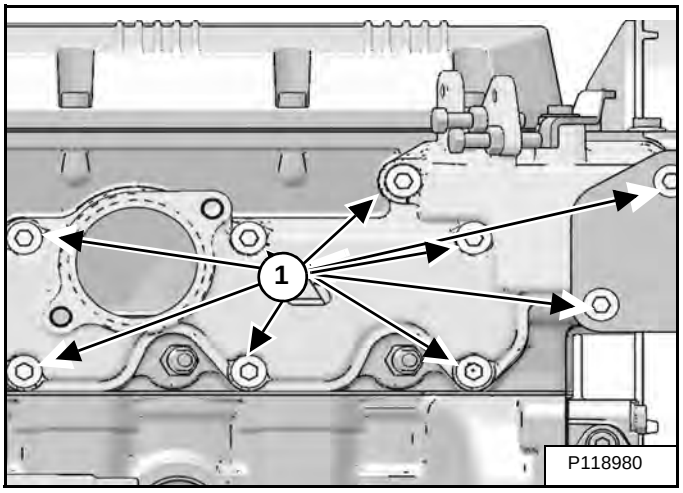
**Figure 50-70-2**




Remove the bolts (Item 1) and intake duct (Item 2) **[Figure 50-70-2]**.

Discard the gasket.

**Figure 50-70-3**



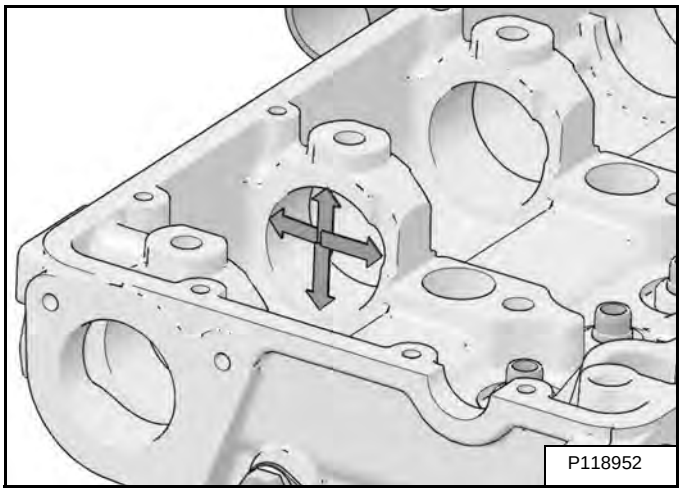

Remove the manifold bolts (Item 1) **[Figure 50-70-3]**.

Lift the intake manifold and remove the throttle cable.

Inspect the manifold for cracks and breaks. Discard the gasket.

### Camshaft Inspection

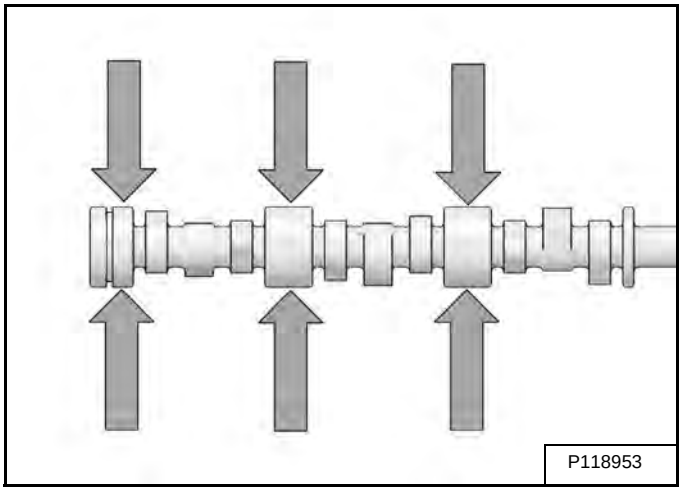
**Figure 50-70-32**




Use a commonly available inside micrometer, measure camshaft housing diameters **[Figure 50-70-32]**.

| | |
|---|---|
| Camshaft Housing Diameter | 37,035 - 37,060 mm (1.458 - 1.459 in) |

**Figure 50-70-33**




Use a commonly available outside micrometer, measure camshaft journal diameter. **[Figure 50-70-33]**.

| | |
|---|---|
| Camshaft Journal Diameter | 36,975 - 37,000 mm (1.456 - 1.457 in) |

Subtract the camshaft housing diameter minus the camshaft journal diameter. Replace the camshaft if any clearance is out of specification.

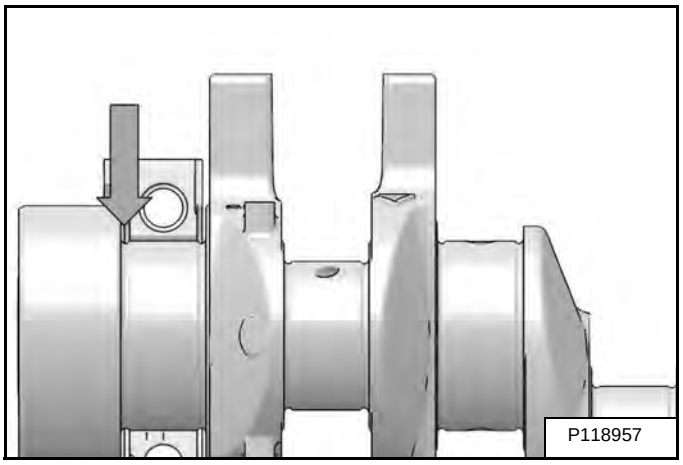
| | |
|---|---|
| Camshaft Journal To Housing Clearance (Max) | 0,170 mm (0.0067 in) |

The camshaft will wear on the cam lobe where the follower rides. Measure the lobe height in two spots, one where the follower rides and one where it does not. Replace the camshaft if the cam is above the wear limit specified.

| | |
|---|---|
| Camshaft Lobe Wear Limit | 0,10 mm (0.039 in) |

### Crankshaft Inspection

**Figure 50-70-59**




Either before removal or after installation, use a feeler gauge to measure the axial clearance between the crankshaft flywheel side shoulder and the mainbearing half rings **[Figure 50-70-59]**.

| | |
|---|---|
| Crankshaft Axial Clearance | 0,130 - 0,313 mm (0.0051 - 0.0123 in) |

**Figure 50-70-60**

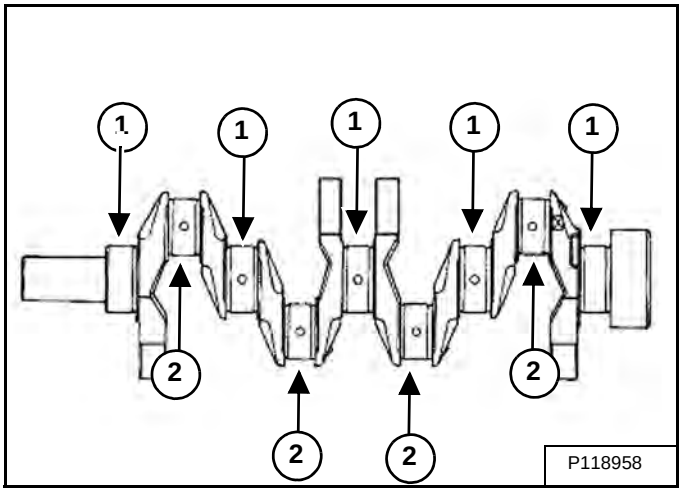
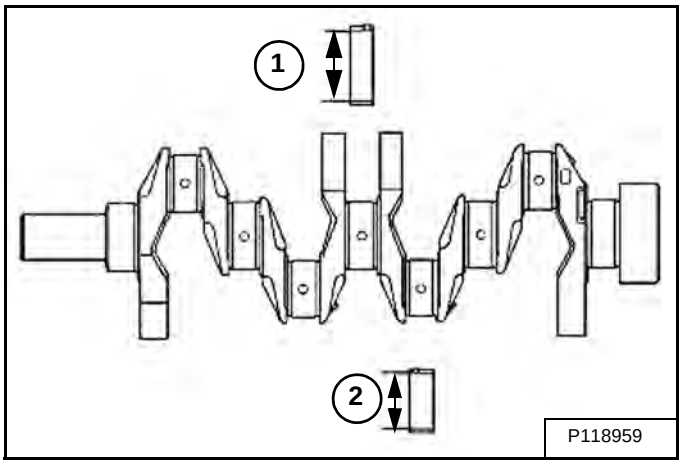



**Figure 50-70-61**



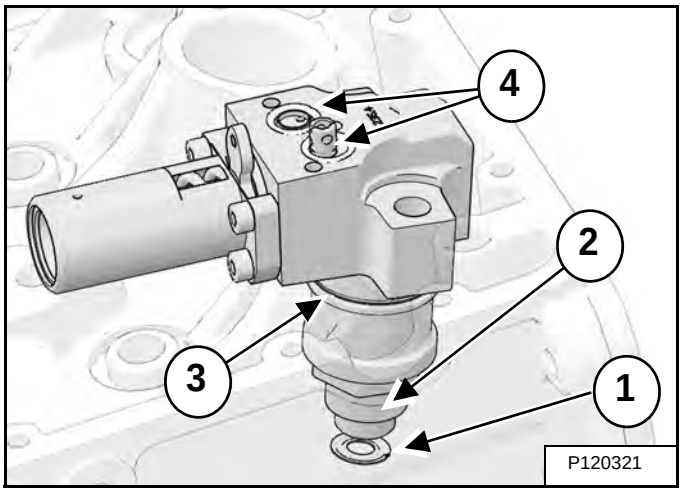

Measure the main (Item 1) and connecting rod (Item 2) **[Figure 50-70-60]** & **[Figure 50-70-61]** journal diameters. Measure the ID of the journal bearings. Check that the clearances are within specification.

| CRANKSHAFT MEASUREMENTS | | |
|---|---|---|
| **DIMENSION** | **SPECIFICATION** | **LIMIT VALUE** |
| Main Journal Diameter | 50,981 - 51,000 mm (2.0071 - 2.0079 in) | 50,900 mm (2.0039 in) |
| Connecting Rod Journal Diameter | 39,394 - 40,000 mm (1.5509 - 1.5750 in) | 39,900 mm (1.5709 in) |
| Main Journal Bearing ID | 51,023 - 51,059 mm (2.0088 - 2.0102 in) | 51,098 mm (2.0117 in) |
| Connecting Rod Journal Bearing ID | 40,021 - 40,050 mm 1.5759 - 1.5768 in) | 40,00 mm (1.5787 in) |
| Main Journal Clearance | 0,023 - 0,078 mm (0.0009 - 0.0031 in) | 0,200 mm (0.0079 in) |
| Connecting Rod Clearance | 0,021 - 0,066 mm (0.0008 - 0.0026 in) | 0,130 mm (0.0044 in) |

### Unit Injector Installation

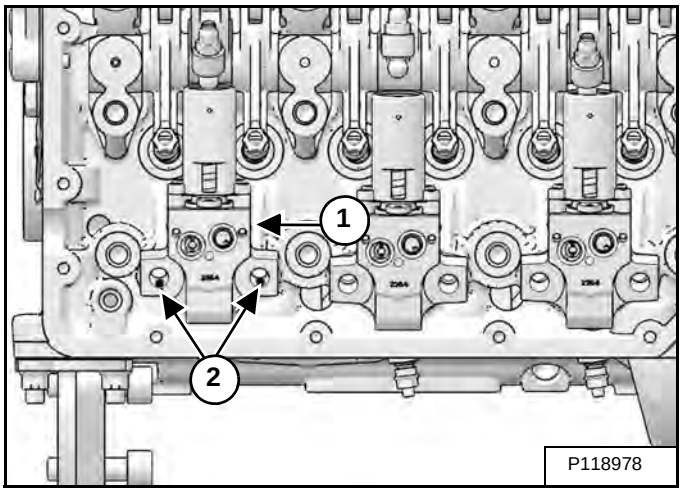
If the unit injector was not replaced, the rocker arm was not tampered with and the unit injectors are installed in the original cylinders, re-timing of the unit injector is not required.

**Figure 50-80-26**




Every time the unity injector is removed, the spark arrestor (Item 1), copper gasket (Item 2), oil O-ring (Item 3), and fuel O-rings (Item 4) **[Figure 50-80-26]** must be replaced. Insert the spark arrestor in the injector housing in the cylinder head with the concave surface facing up.

**Figure 50-80-27**

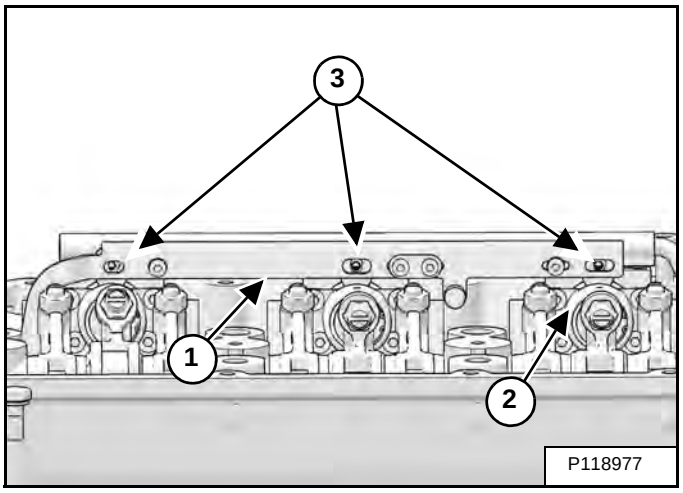



Install the unit injector (Item 1) **[Figure 50-80-27]**.

**NOTE: Make sure the non-return check valve is fully seated into the unit injector. Any gap can cause fuel to leak into the cylinder head.**

Install the bolts (Item 2) **[Figure 50-80-27]**. Tighten the bolts to 20 N•m (15 ft-lb) torque.

**Figure 50-80-28**

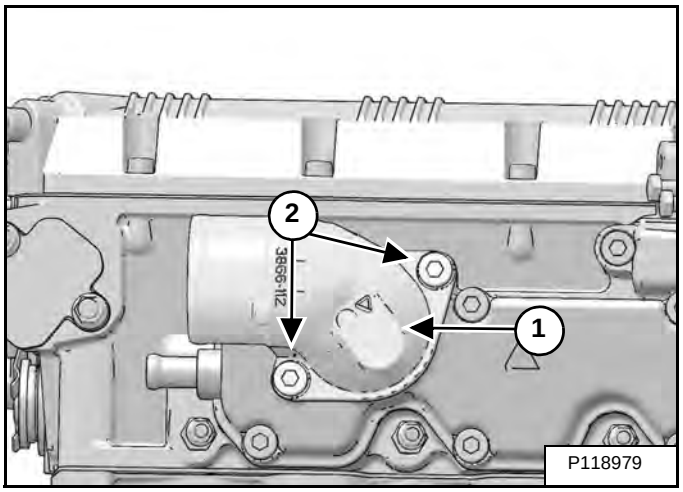



Install the injector control rod (Item 1) and attach the return spring (Item 2) **[Figure 50-80-28]**.

Install the bolts (Item 3) **[Figure 50-80-28]** and tighten to 1,1 N•m (9.7 in-lb) torque.

**Intake Manifold Installation (Cont'd)**

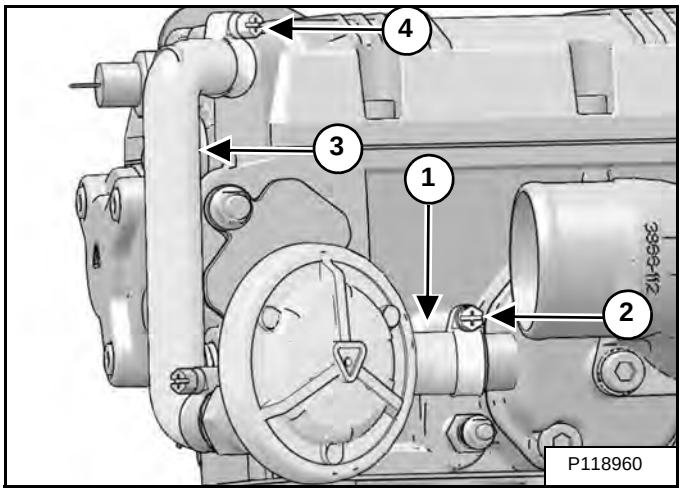
**Figure 50-80-56**




Position the intake manifold duct elbow (Item 1) and install the bolts (Item 2) **[Figure 50-80-56]**. Tighten the bolts to 22 N•m (16 ft-lb) torque.

**Crankcase Vacuum Regulator Valve Installation**

**Figure 50-80-57**

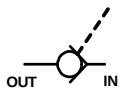
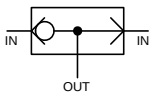


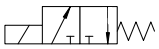
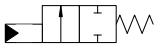
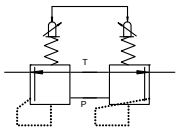
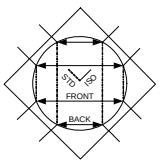
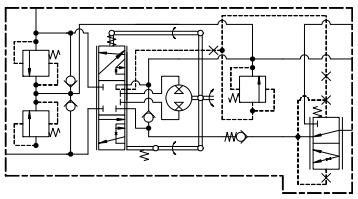
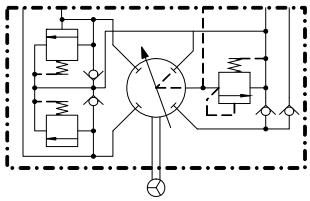
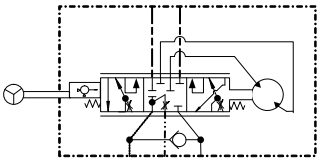

Install the hose (Item 1) on the intake manifold and tighten the clamp (Item 2) **[Figure 50-80-57]**.

Install the hose (Item 3) to the rocker arm cover and tighten the clamp (Item 4) **[Figure 50-80-57]**.

Do not over tighten the clamps.

**Glossary Of Hydraulic / Hydrostatic Symbols (Cont'd)**

| SYMBOL | DESCRIPTION |
|---|---|
| | NON-RETURN VALVE, SHUTTLE VALVE: Valve which allows free flow in one direction only. |
|  | NON-RETURN VALVE (Check Valve) - Used as Replenishing Valve, Lock Check Valve or Anticavitation Valve - Opens if the Inlet pressure is higher than the Outlet pressure. Often contains internal spring which has NO significant pressure value. |
|  | SPRING LOADED VALVE (bypass Valve) - Opens if the Inlet pressure is greater than the Outlet pressure plus the spring pressure. |
|  | PILOT CONTROLLED NON-RETURN VALVE- It is possible to open the valve by pilot pressure. |
|  | SHUTTLE VALVE - The Inlet port connected to the higher pressure is automatically connected to the Outlet port while the other Inlet port is closed. |

| SYMBOL | DESCRIPTION |
|---|---|
| | DIRECTIONAL CONTROL VALVE: Valve providing for the opening (fully or restricted) or the closing of one or more flow paths (represented by several squares). |
|  | TWO PORTS and CLOSED FLOW PATHS |
|  | SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE (Two Position) - controlled by an electric solenoid (with return spring). |
|  | PILOT ACTIVATED DIRECTIONAL CONTROL VALVE (Two Position) - controlled by pressure (with return spring). |
|  | MANUALLY ACTIVATED DIRECTION CONTROL VALVE (Variable Position) Joystick Controlled, variable pressure to shift the pilot activated directional control valve spool. |
|  | MANUALLY ACTIVATED FLOW CONTROL VALVE (Two Position) allows for changing pilot flow to control switching joystick functions for STD / ISO Control (Excavators Only). |
|  | STEERING CONTROL VALVE (Variable Position) - Used for controlling the hydraulic flow for the steering cylinders in relationship to the amount the steering wheel is rotated. |
|  | |
|  | |

**Disassembly**

## ⚠ WARNING

**AVOID INJURY OR DEATH**

**Always clean up spilled fuel or oil. Keep heat, flames, sparks or lighted tobacco away from fuel and oil. Failure to use care around combustibles can cause explosion or fire.**

**W-2103-0508**

## IMPORTANT

**When repairing hydrostatic and hydraulic systems, clean the work area before disassembly and keep all parts clean. Always use caps and plugs on hoses, tubelines and ports to keep dirt out. Dirt can quickly damage the system.**

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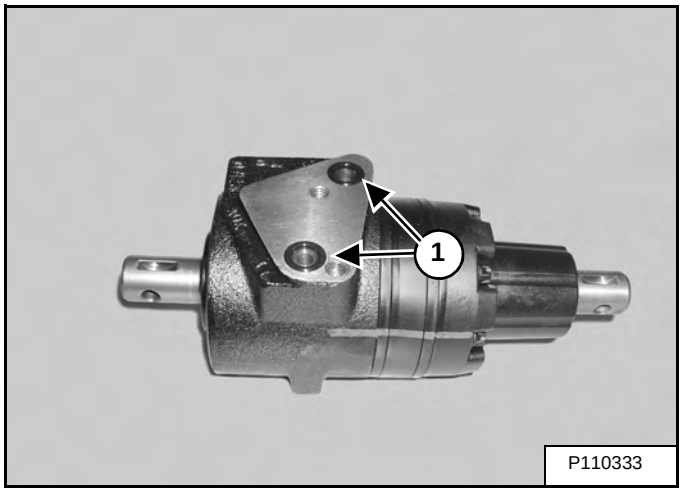
**NOTE: Some photo's may look different from what you have but the procedures are the same.**

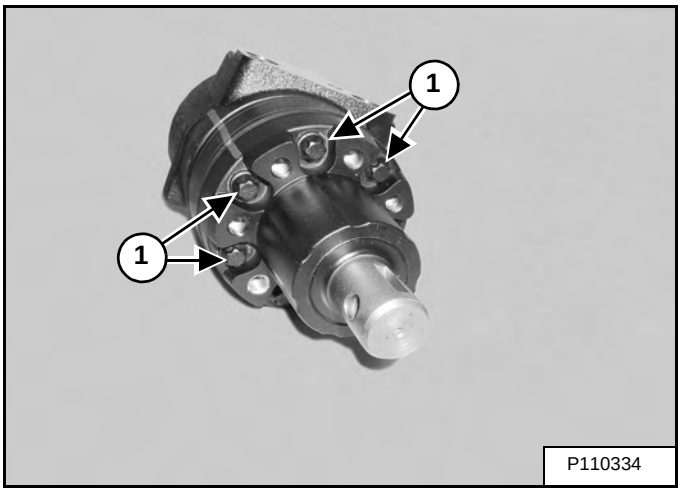
Clean the outside of the steering valve before disassembling.

**Figure 60-30-4**



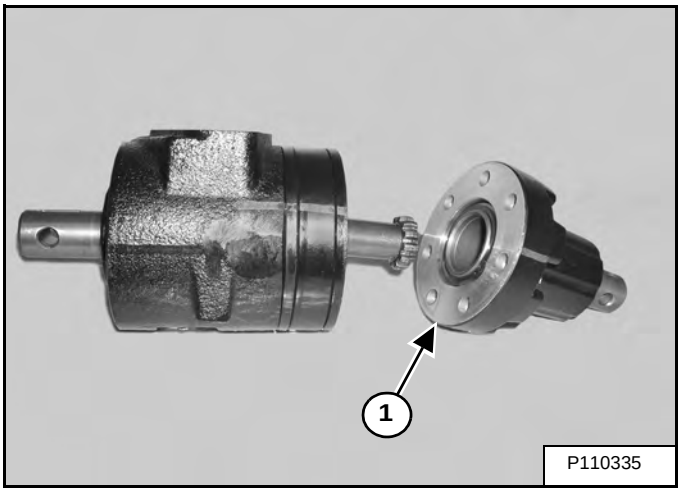

Remove the O-rings (Item 1) **[Figure 60-30-4]**.

**Figure 60-30-5**




Remove the bolts (Item 1) **[Figure 60-30-5]**.

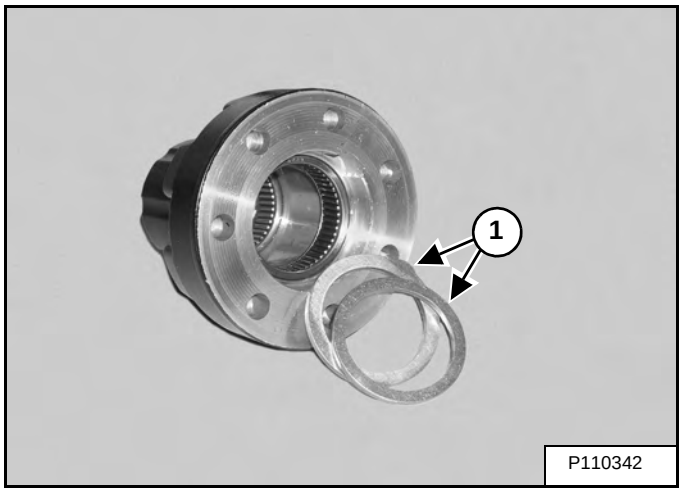
**Figure 60-30-6**




Remove the housing (Item 1) **[Figure 60-30-6]**.

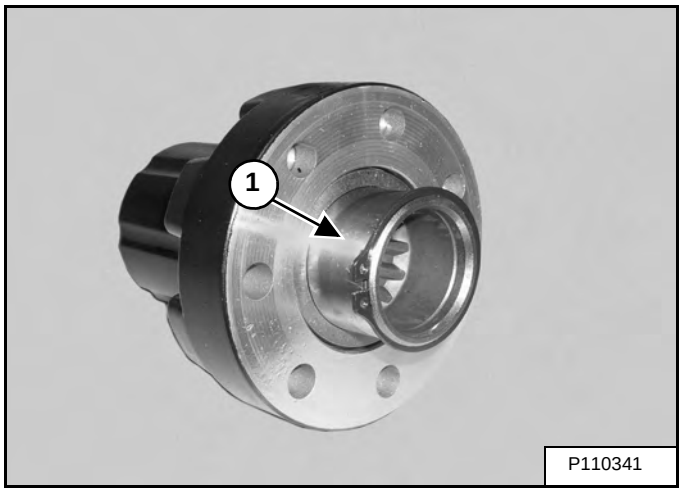
**Assembly (Cont'd)**

**Figure 60-30-41**



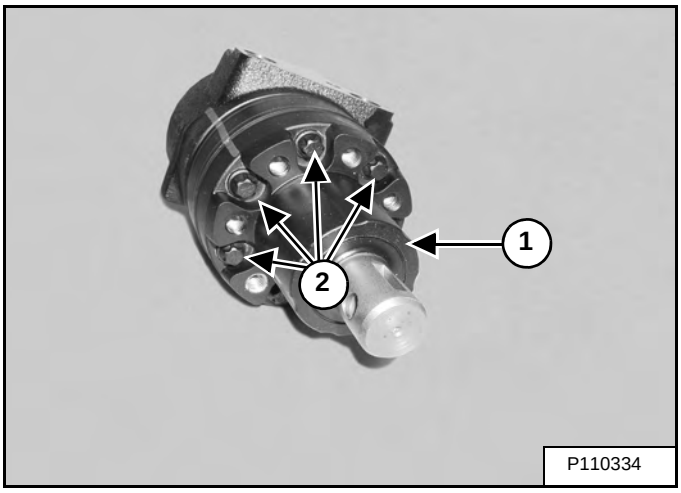

Install the washers (Item 1) **[Figure 60-30-41]**.

**Figure 60-30-42**




Install the shaft (Item 1) **[Figure 60-30-42]**.

**Figure 60-30-43**

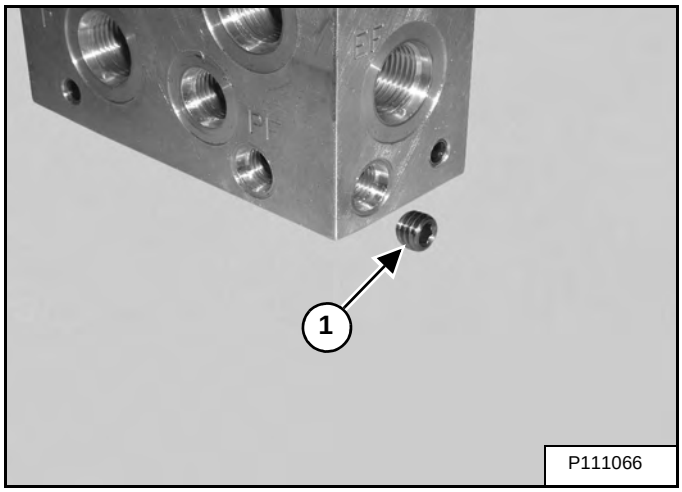



Install the end cap (Item 1) aligning the holes in the end cap with the holes in the valve housing. Install the bolts (Item 2) **[Figure 60-30-43]**.

Tighten the bolts to 23 N•m (200 in-lb) torque.

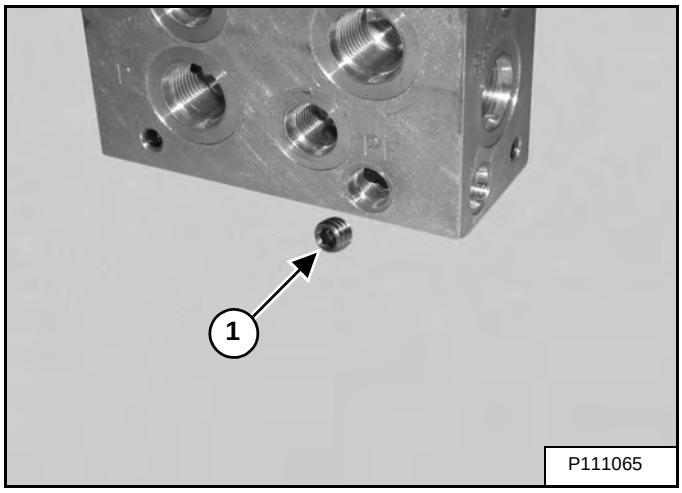
**Assembly**

**Figure 60-40-27**



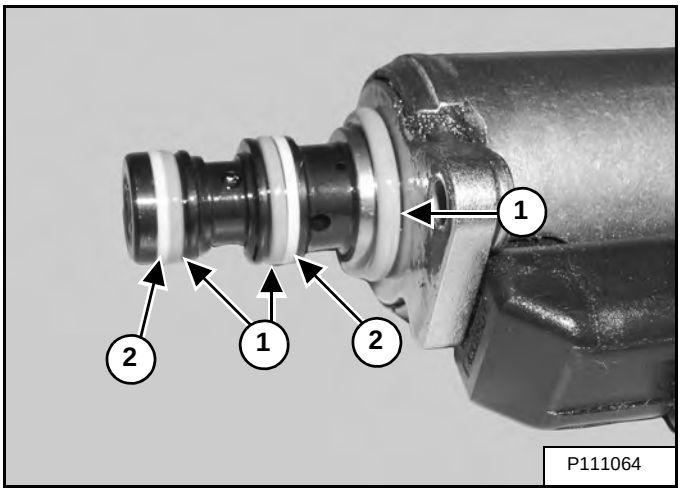

Install the orifice (Item 1) **[Figure 60-40-27]**.

**Figure 60-40-28**



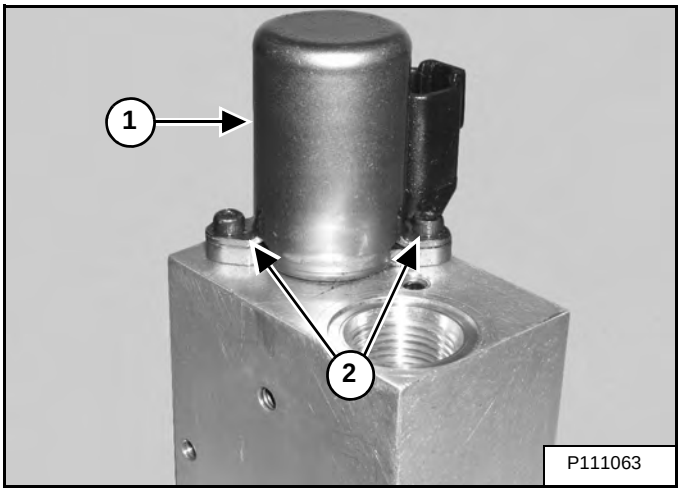

Install the orifice (Item 1) **[Figure 60-40-28]**.

**Figure 60-40-29**




Install the O-rings (Item 1) and back-up rings (Item 2) **[Figure 60-40-29]** on the two-speed valve.

**Figure 60-40-30**

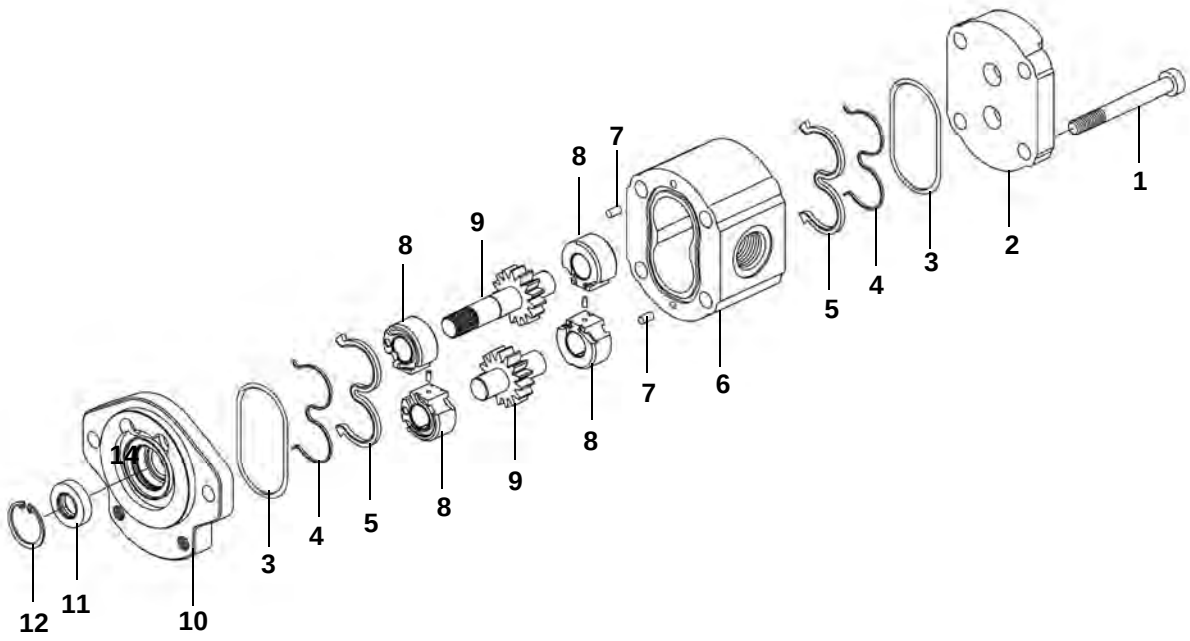



Install the two-speed valve (Item 1) and bolts (Item 2) **[Figure 60-40-30]**.

Tighten the bolts to 1,7 N•m (15 in-lb) torque.

**Parts Identification**

1. Bolt
2. End Cap
3. Seal
4. Back-up Ring
5. O-ring
6. Housing
7. Pin
8. Bearing
9. Gear
10. Mount Flange
11. Seal
12. Snap Ring




NA6950S

## HYDROSTATIC DRIVE MOTOR

### Description

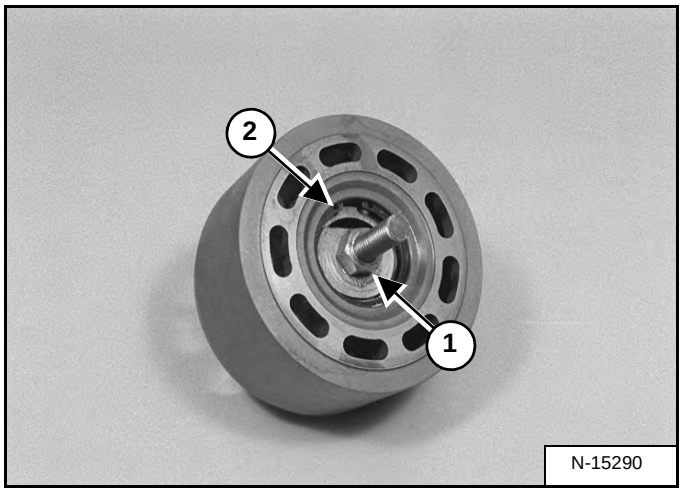
The hydrostatic drive motor is powered by the hydrostatic pump.

A shuttle valve located inside the end cap of the hydrostatic drive motor helps to keep the motor cool by mixing case drain oil with cooled low pressure oil from the charge circuit. The shuttle valve is shifted by the high pressure oil coming from the hydrostatic pumps.

The hydrostatic drive motor is mounted to the transmission.

**Disassembly (Cont'd)**

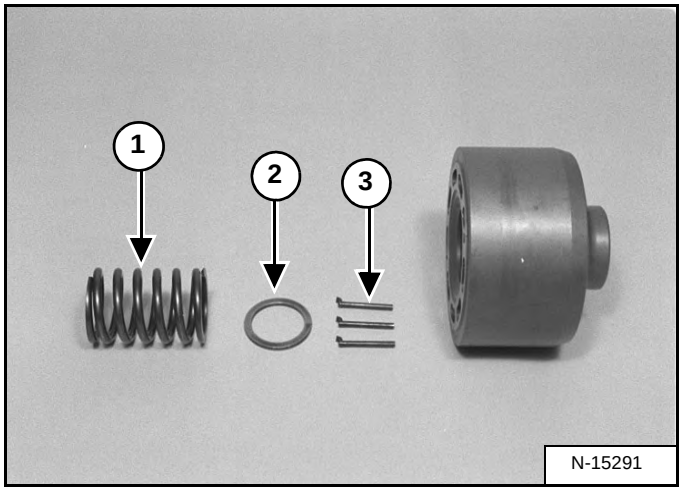
**Figure 70-20-34**




Tighten the nut (Item 1) until the spring is compressed enough to remove the snap ring (Item 2) **[Figure 70-20-34]**.

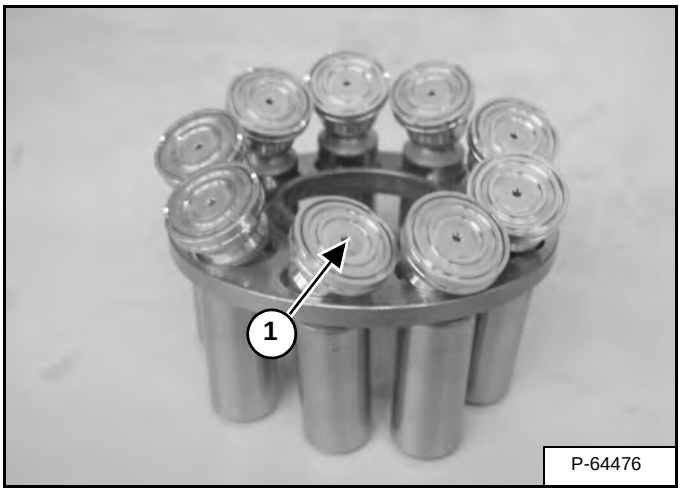
Loosen the nut to release the tension on the spring and remove the bolts and washers.

**Figure 70-20-35**



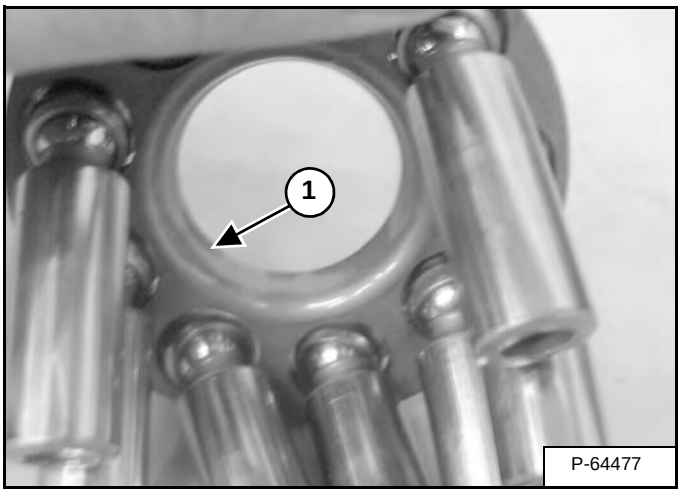

Remove the spring (Item 1) washer (Item 2) and pins (Item 3) **[Figure 70-20-35]** from the cylinder block.

**Figure 70-20-36**




Inspect the pistons for scoring and scratches. Verify the holes (Item 1) **[Figure 70-20-36]** in the slippers are not plugged.

**Figure 70-20-37**




Inspect the mating surface of the retaining ring for scoring and scratches **[Figure 70-20-37]**.

## HYDROSTATIC PUMP

### Description

The hydrostatic pump is composed of a single (piston) pump. The pump provides flow to the drive motor.

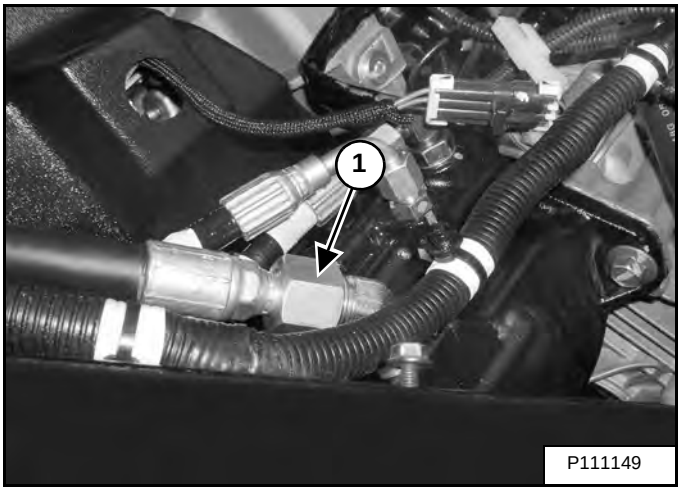
The pump contains replenishing valves and the function of the replenishing valves is to give replacement fluid to the low pressure side of the hydrostatic circuit. Replacement fluid is needed because of normal internal leakage and the controlled flow to the oil cooler for cooling. The replenishing valve also keeps high pressure fluid out of the low pressure side of the hydrostatic circuit.

The hydrostatic pump is bolted to the rear of the engine.

### Drive Relief Pressure Testing

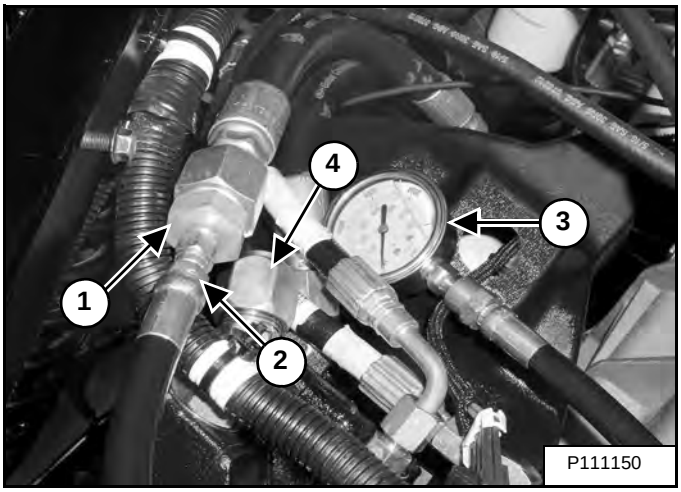
Raise the vehicle so all four wheels are off the ground and place on jack stands. (See LIFTING AND BLOCKING THE UTILITY VEHICLE on Page 10-10-1.)

**Figure 70-40-1**




Remove the hose (Item 1) **[Figure 70-40-1]** from the B port on the drive motor.

**Figure 70-40-2**




Install an adapter (Item 1), hose (Item 2) and a 68948 kPa (689 bar) (10000 psi) gauge (Item 3) **[Figure 70-40-2]** on the hose.

Install a cap (Item 4) **[Figure 70-40-2]** on the drive motor.

Start the engine and place the gear select lever in high.

Use the travel control pedal to obtain high idle. The gauge should read 34501 kPa (345 bar) (5004 psi).

**NOTE: Port B on the drive motor is the forward port and port A is the reverse port.**

**Hydrostatic Travel Control Adjustments**

**NOTE: The travel control adjustments are listed in the order in which they MUST be performed. Failure to do so will result in poor vehicle performance.**

Raise the vehicle so all four wheels are off the ground and place on jack stands. (See LIFTING AND BLOCKING THE UTILITY VEHICLE on Page 10-10-1.)

**Figure 70-40-37**

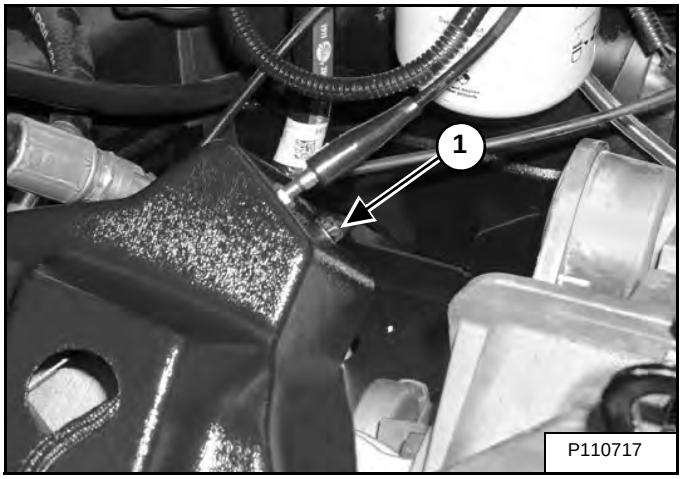
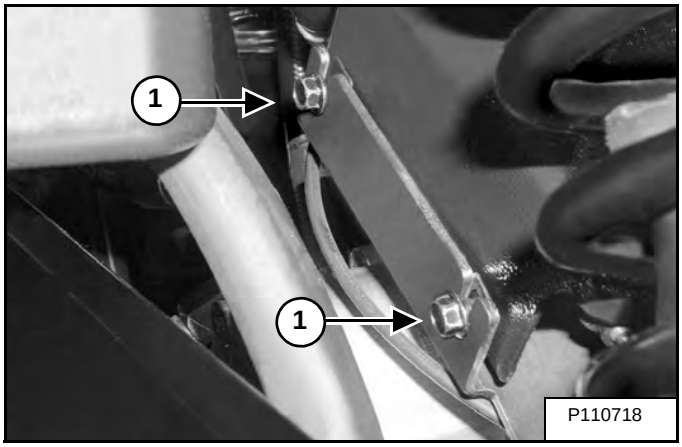
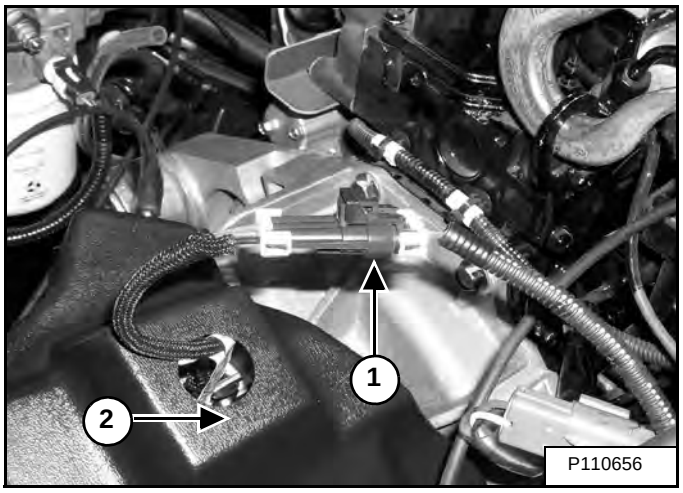



**Figure 70-40-38**




Remove the pump cover bolts (Item 1) **[Figure 70-40-37]** and **[Figure 70-40-38]**.

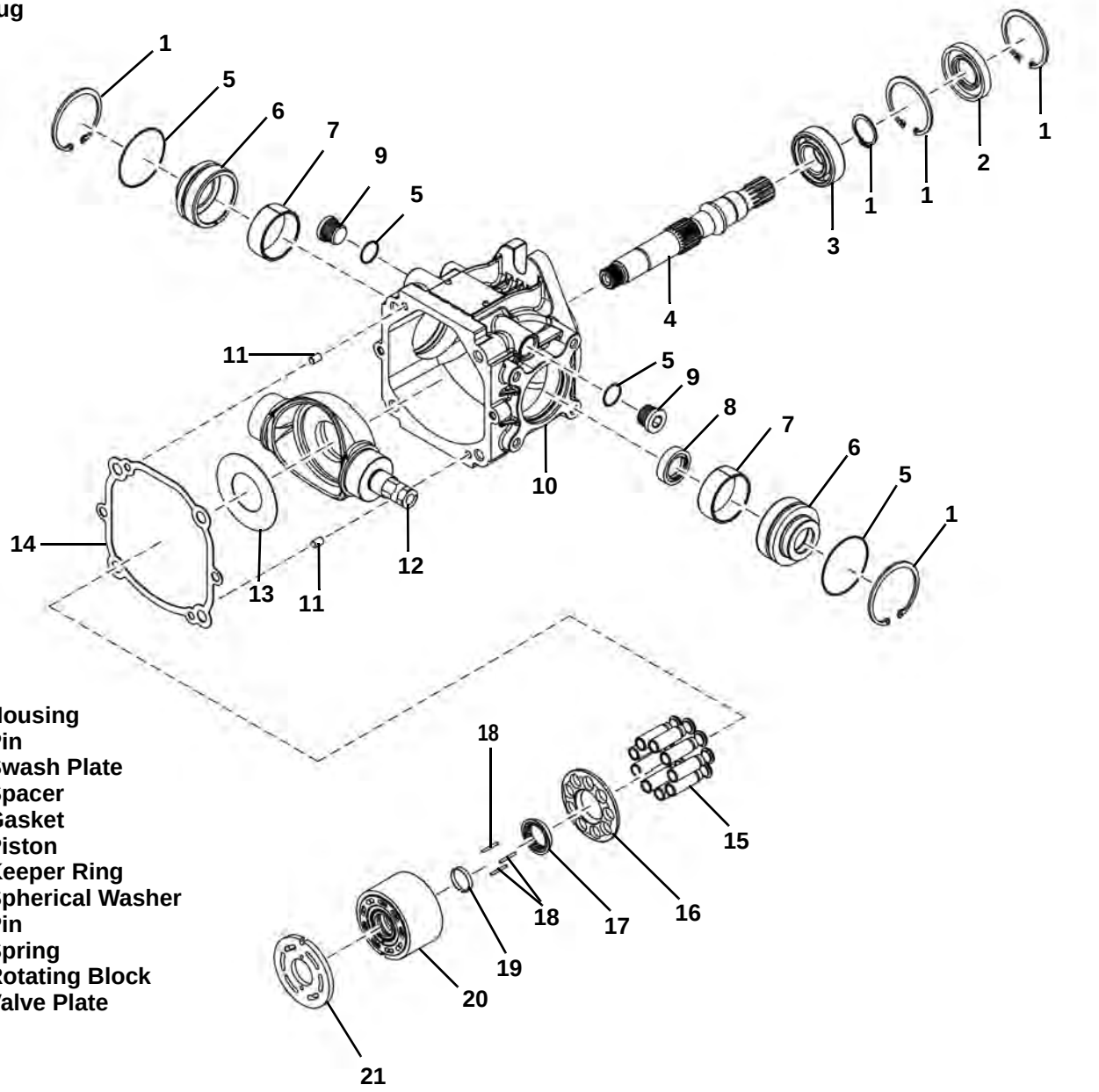
**Figure 70-40-39**




Disconnect the neutral safety switch connector (Item 1) and remove the pump cover (Item 2) **[Figure 70-40-39]**.

**Parts Identification**

1. Snap Ring
2. Seal
3. Bearing
4. Shaft
5. O-ring
6. Cap
7. Race
8. Bearing
9. Plug
10. Housing
11. Pin
12. Swash Plate
13. Spacer
14. Gasket
15. Piston
16. Keeper Ring
17. Spherical Washer
18. Pin
19. Spring
20. Rotating Block
21. Valve Plate

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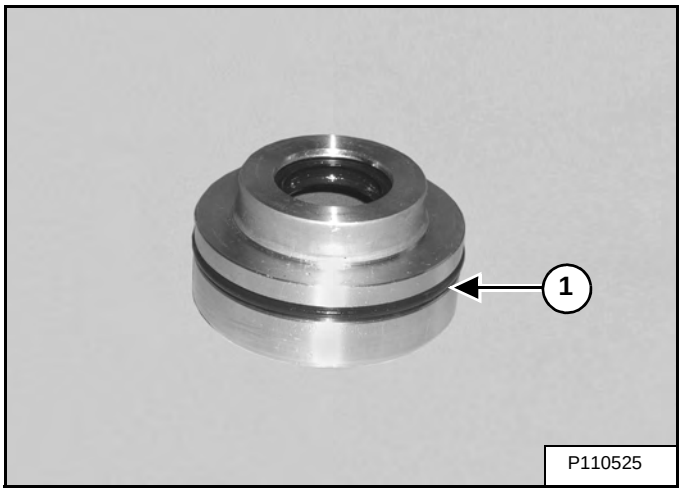
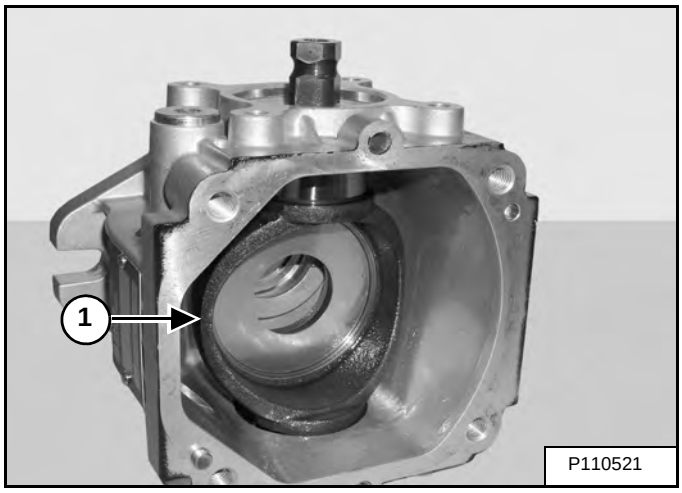
**Disassembly (Cont'd)**

**Figure 70-40-99**



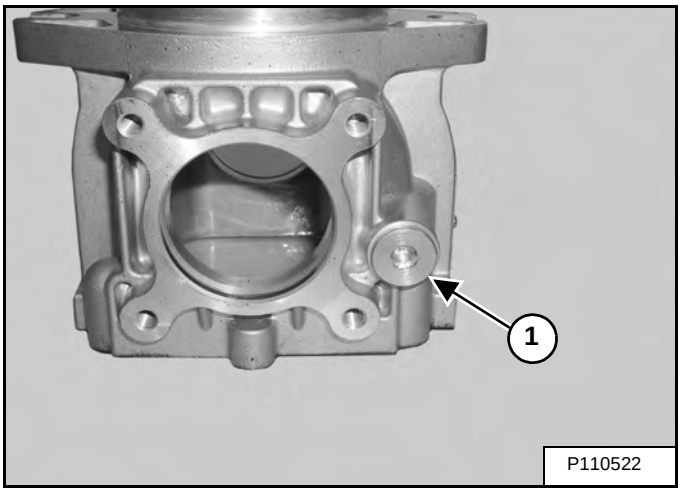

Remove the O-ring (Item 1) **[Figure 70-40-99]** from the cap.

**Figure 70-40-100**



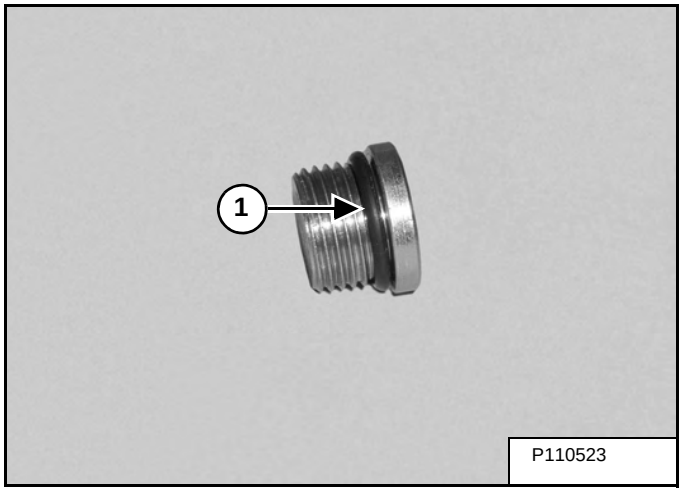

Remove the squash plate (Item 1) **[Figure 70-40-100]** from the pump housing.

**Figure 70-40-101**




Remove the plug (Item 1) **[Figure 70-40-101]** from the pump housing.

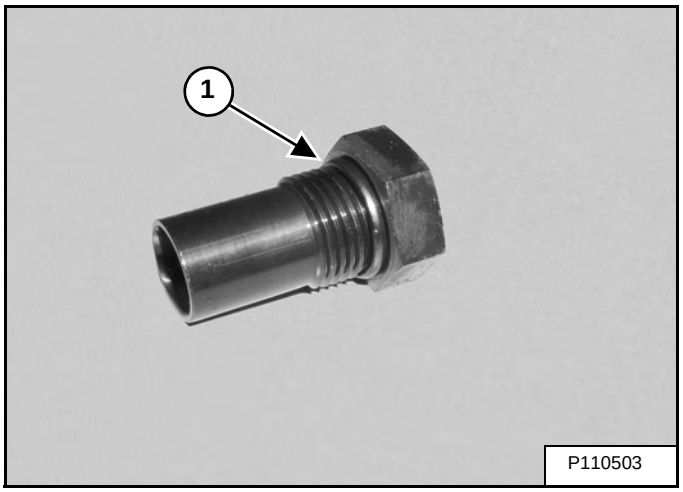
**Figure 70-40-102**




Remove the O-ring (Item 1) **[Figure 70-40-102]** from the plug.

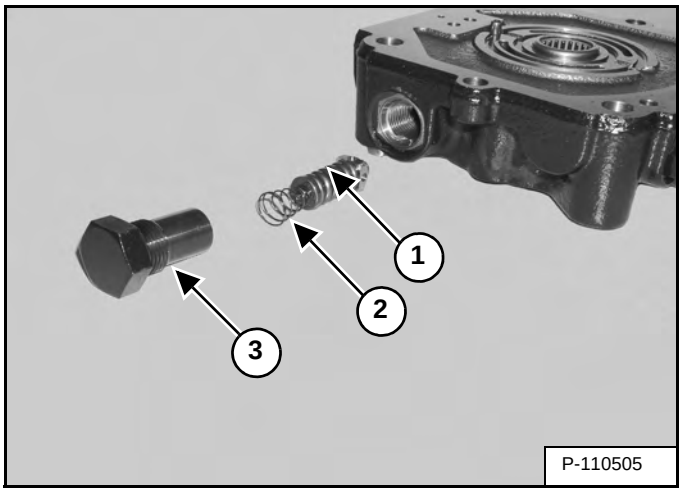
**Assembly (Cont'd)**

**Figure 70-40-135**



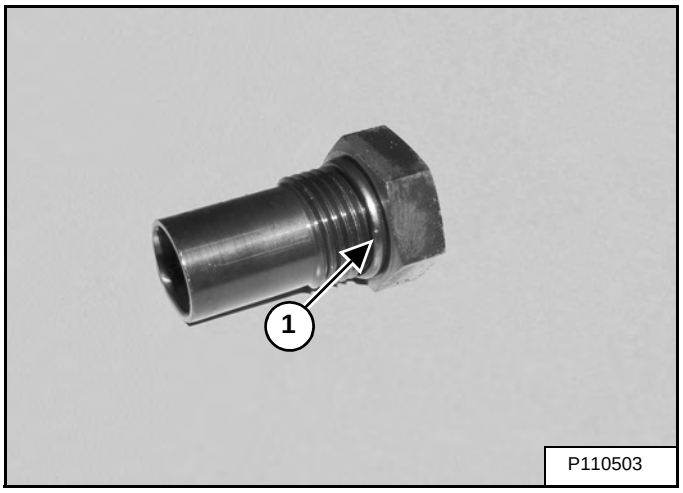

Install the O-ring (Item 1) **[Figure 70-40-135]** onto the plug.

**Figure 70-40-136**



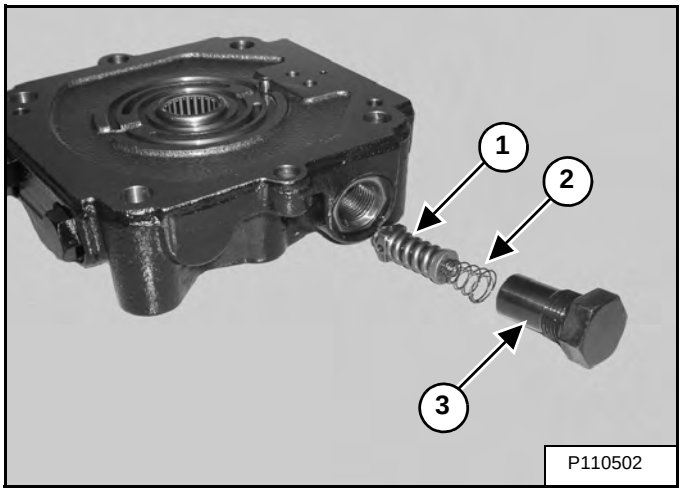

Install the relief valve (Item 1), spring (Item 2) and plug (Item 3) **[Figure 70-40-136]**.

**Figure 70-40-137**




Install the O-ring (Item 1) **[Figure 70-40-137]** on the plug.

**Figure 70-40-138**

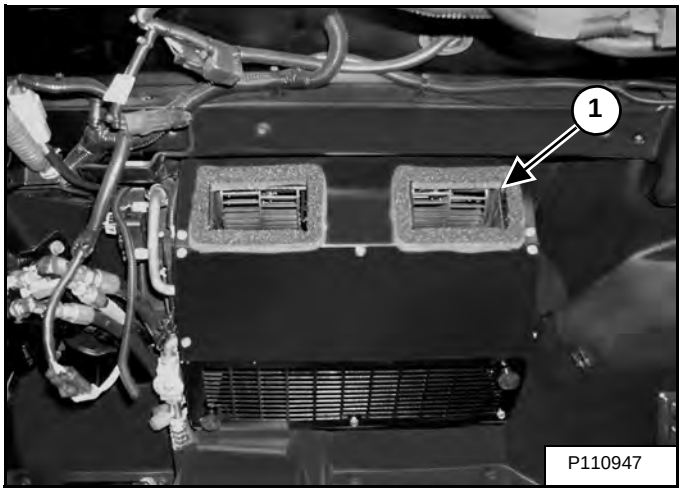



Install the relief valve (Item 1), spring (Item 2) and plug (Item 3) **[Figure 70-40-138]**.

**AIR CONDITIONING SYSTEM FLOW (S/N B3C216999 & BELOW) (CONT'D)**

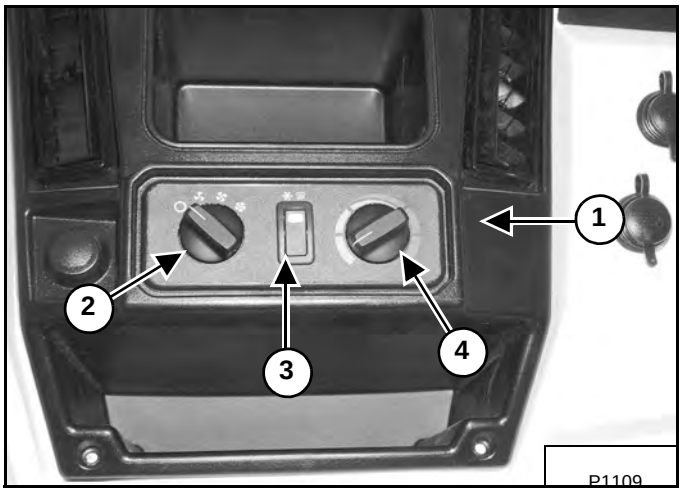
**Components (Cont'd)**

**Figure 80-10-9**




***Heater / Evaporator Blower:*** The blower (Item 1) **[Figure 80-10-9]** is used to pull air through the heater and evaporator coils and into the cab.

**Figure 80-10-10**



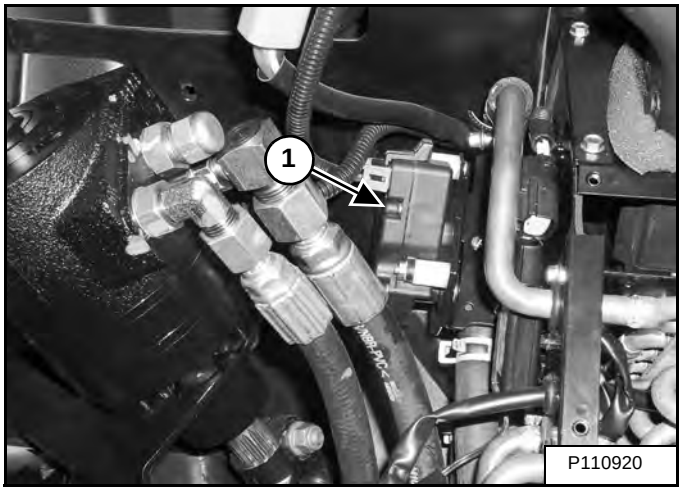

*Control Panel:* The panel (Item 1) **[Figure 80-10-10]** has three separate components.

*Fan Switch:* This is a four position rotary switch (Item 2) **[Figure 80-10-10]**. When the fan switch is in the off position the A/C will not engage, but the heater valve will operate, as it is controlled by the ignition power.

*A/C Switch:* The rocker switch (Item 3) **[Figure 80-10-10]** will be illuminated when the A/C is engaged.

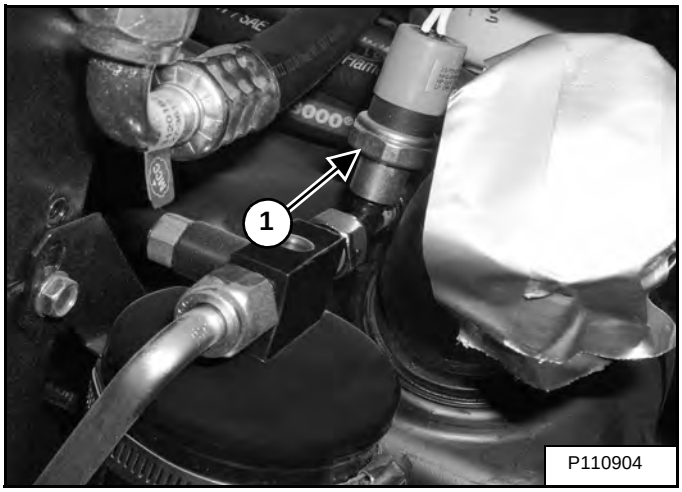
*Potentiometer:* The potentiometer (Item 4) **[Figure 80-10-10]** controls the Heater Valve from fully Off to fully On. This can be used in conjunction with the A/C for defrost of the windows and temperature control.

**Figure 80-10-11**




*Heater Valve:* The heater valve (Item 1) **[Figure 80-10-11]** is used to control the amount of engine coolant that flows to the heater coil.

**Figure 80-10-12**

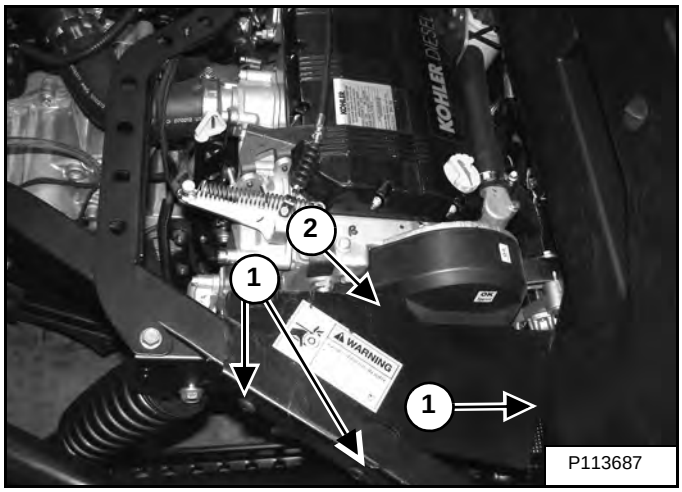



*Pressure Switch:* The high pressure switch (Item 1) **[Figure 80-10-12]** will disengage the compressor clutch at high pressure readings over 2,8 MPa (27,6 bar) (400 psi.) and will engage the clutch when pressures lower to 2,2 MPa (22,4 bar) (325 psi).

## REGULAR MAINTENANCE

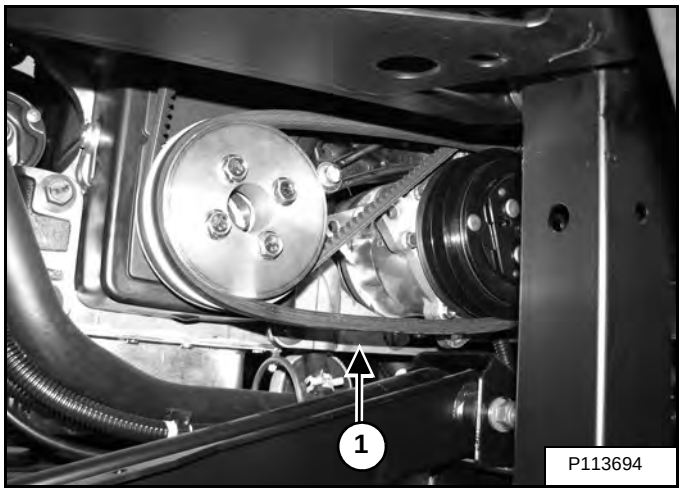
### Compressor Drive Belt Inspection

**Figure 80-20-1**




Remove the three bolts (Item 1) and shield (Item 2) **[Figure 80-20-1]**.

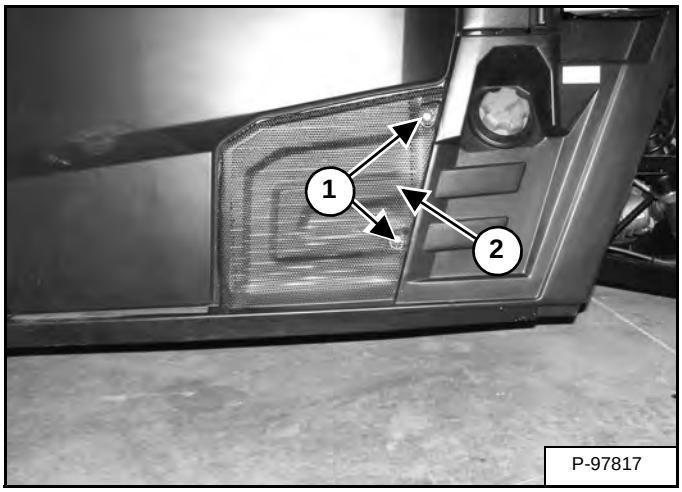
**Figure 80-20-2**




The tension is correct with 10 - 14 mm (0.3755 - 0.50 in) of belt deflection at the mid span (Item 1) **[Figure 80-20-2]** of the belt when 89 N (20 lb) is applied to the belt.

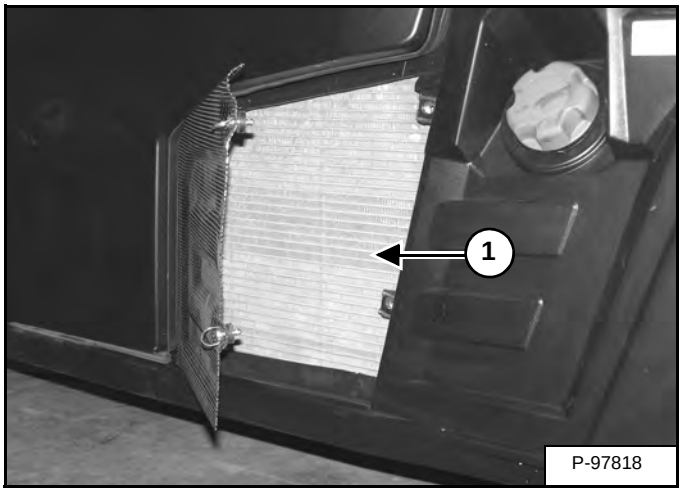
### Condenser

**Figure 80-20-3**




Turn the two fasteners (Item 1) counterclockwise 1/4 turn and open or remove the cover (Item 2) **[Figure 80-20-3]**.

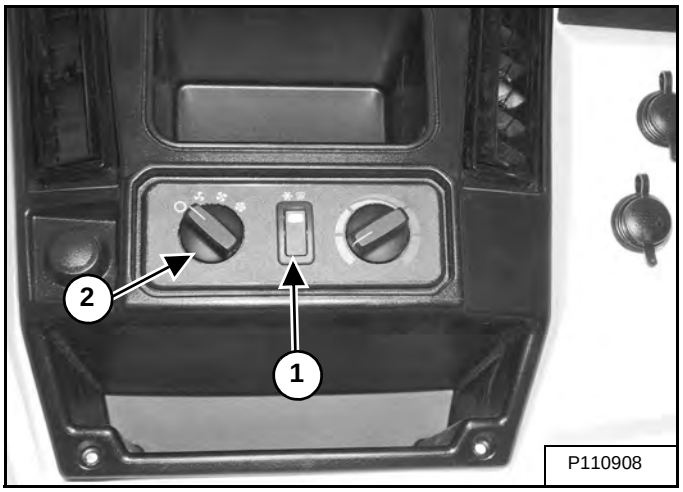
**Figure 80-20-4**




Clean the condenser (Item 1) **[Figure 80-20-4]** with water or air.

**Electrical System**

**Figure 80-30-4**



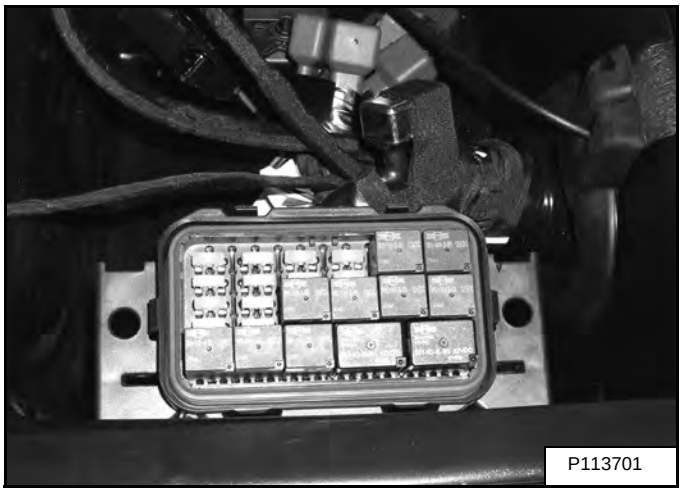

Check to see if the compressor clutch is engaging.

Turn the key switch to run, without starting the utility vehicle.

Push the A/C switch (Item 1) to the ON position. Turn the blower fan switch (Item 2) **[Figure 80-30-4]** to the first ON position.

The compressor should make a click sound, which indicates the clutch is engaging.

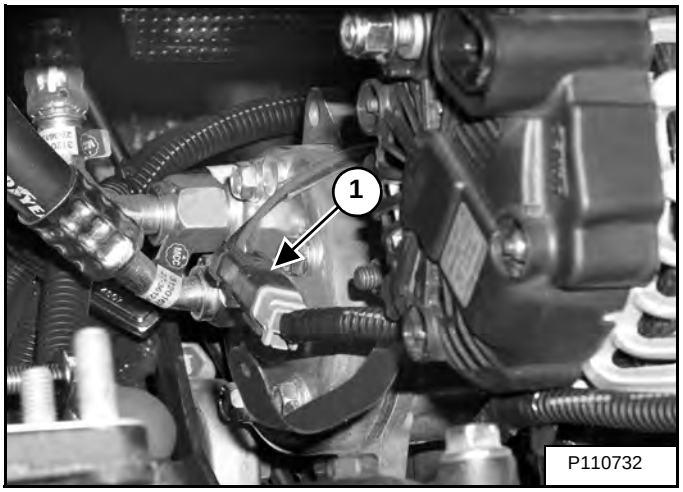
**Figure 80-30-5**




If the compressor does not engage, check the fuses located under the center console **[Figure 80-30-5]**.

Replace any fuse that is burned out.

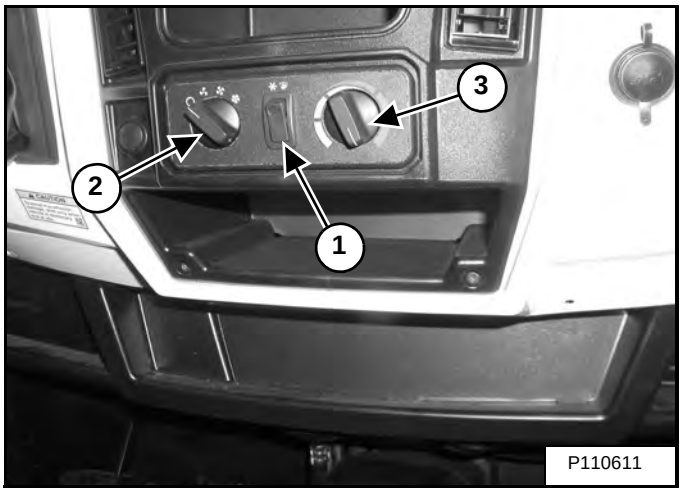
**Figure 80-30-6**




Disconnect the compressor clutch wire (Item 1) **[Figure 80-30-6]** from the utility vehicle harness.

**Heater Valve Not Opening Or Closing**

**Figure 80-30-39**



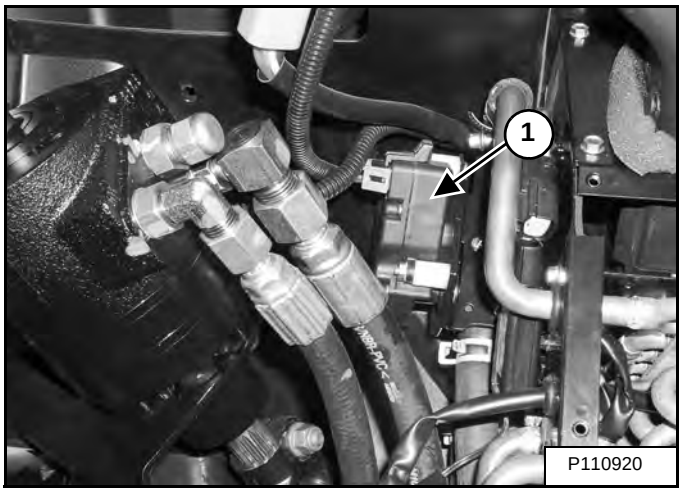

Push the A/C switch (Item 1) to the OFF position. Turn the fan switch (Item 2) to position 1. Turn the temperature control (Item 3) **[Figure 80-30-39]** to the High A/C position.

Listen for the heater valve (Item 1) **[Figure 80-30-40]**, as the key is turned to the ON position without starting the utility vehicle. The heater valve should rotate.

Turn the key to the OFF position.

Turn the temperature control (Item 3) **[Figure 80-30-39]** to the High Heater position, with the key switch OFF.

**Figure 80-30-40**




Listen for the heater valve (Item 1) **[Figure 80-30-40]**, as the key is turned to the ON position without starting the utility vehicle. The heater valve should rotate.

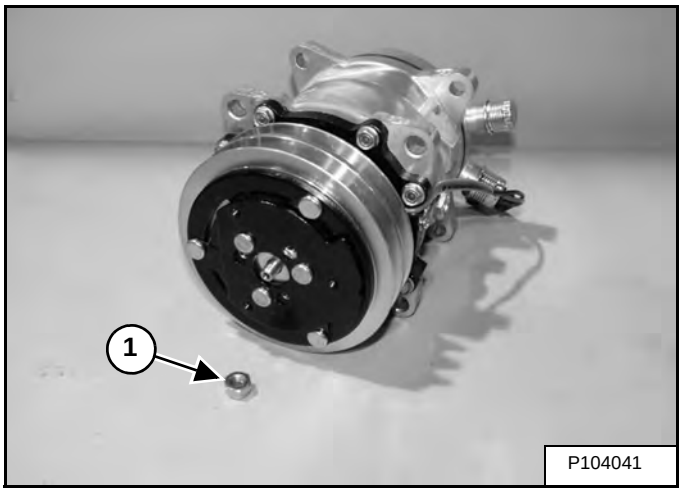
**NOTE: The heater valve is not visible with the HVAC box installed on later models.**

If it does not rotate, check the potentiometer for proper function **[Figure 80-30-28]**.

Replace the heater valve. (See Removal And Installation on Page 80-140-1.)

## Clutch Disassembly And Assembly

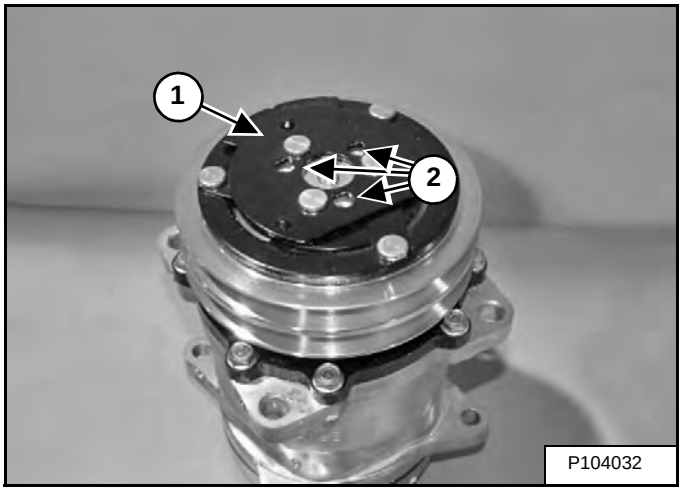
**Figure 80-50-13**




Remove the center armature nut (Item 1) **[Figure 80-50-13]**.

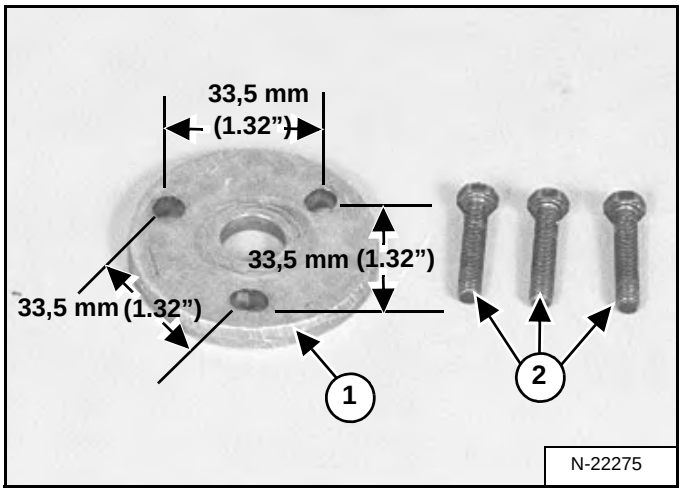
***Installation:*** Tighten the armature nut to 12 - 14 N•m (8 - 10 ft-lb) torque.

**Figure 80-50-14**




To remove the armature plate (Item 1) **[Figure 80-50-14]** from the clutch face, you must make an armature plate puller.

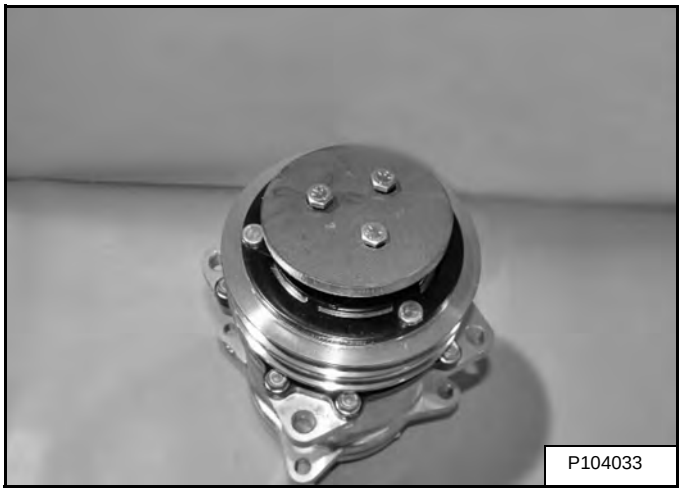
**Figure 80-50-15**




The armature plate puller, (Item 1) **[Figure 80-50-15]** can be constructed by drilling three 10 mm (0.4 in) holes in a flat circular plate, located 33,5 mm (1.32 in) apart.

Attach the puller to the armature plate using three 8 mm bolts (Item 2) **[Figure 80-50-15]**.

**Figure 80-50-16**




Turn the bolts into the three 8 mm (0.3 in) holes (Item 2) **[Figure 80-50-14]** on the armature plate as shown in **[Figure 80-50-16]**.

## EVAPORATOR / HEATER UNIT (S/N B3C216999 & BELOW)

### Removal And Installation

Remove the refrigerant from the A/C system. (See Reclamation And Charging With Recovery / Charging Unit on Page 80-40-2.)

**WARNING**

**In the event of a leak, wear safety goggles. Escaping refrigerant can cause severe injuries to eyes. In contact with a flame, R-134a refrigerant gives a toxic gas.**

**W-2371-0611**

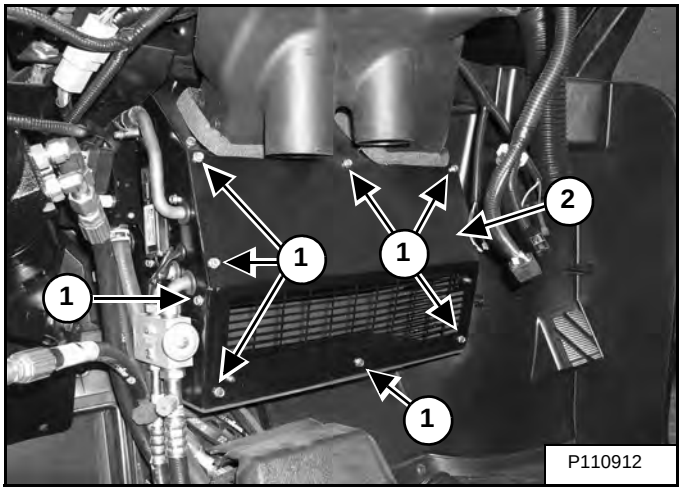
Drain the engine coolant from the cooling system. (See Removing And Replacing Coolant on Page 10-70-3.)

Remove the upper dash. (See Upper Dash Panel Removal And Installation on Page 30-30-1.)

Remove the lower dash. (See Lower Dash Panel Removal And Installation on Page 30-30-2.)

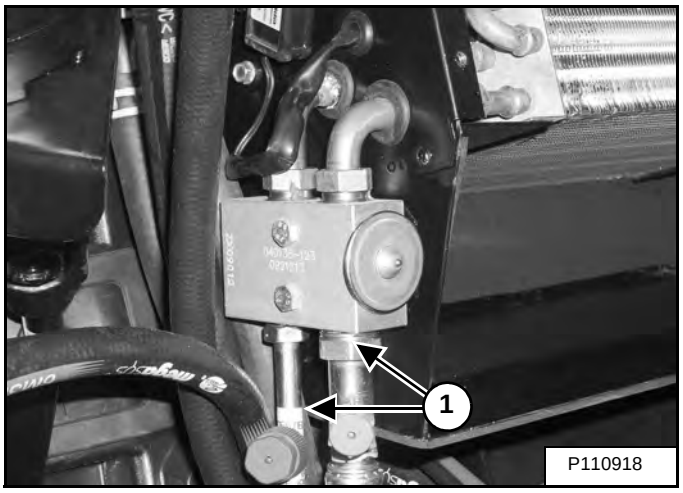
Remove the storage panel. (See Storage Panel Removal And Installation on Page 30-30-5.)

**Figure 80-80-1**




Remove the screws (Item 1) and front cover (Item 2) **[Figure 80-80-1]** from the evaporator / heater unit.

**Figure 80-80-2**




Mark and remove the air conditioning lines (Item 1) **[Figure 80-80-2]** from the evaporator.

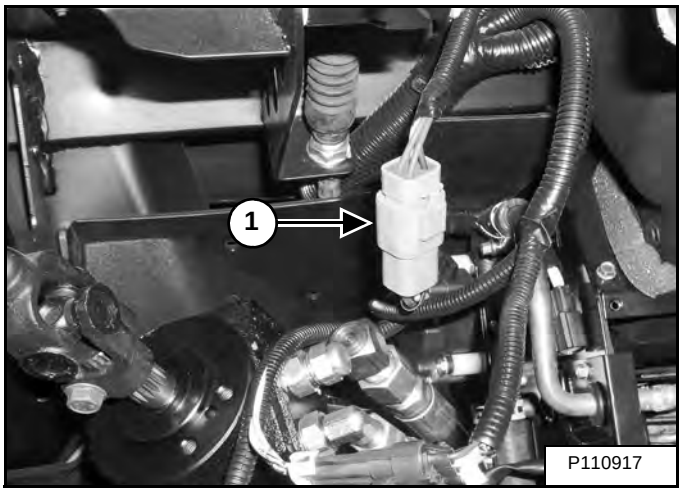
Cap and plug the hoses and the expansion valve fittings with the proper A/C caps and plugs

**WARNING**

**In the event of a leak, wear safety goggles. Escaping refrigerant can cause severe injuries to eyes. In contact with a flame, R-134a refrigerant gives a toxic gas.**

W-2371-0611

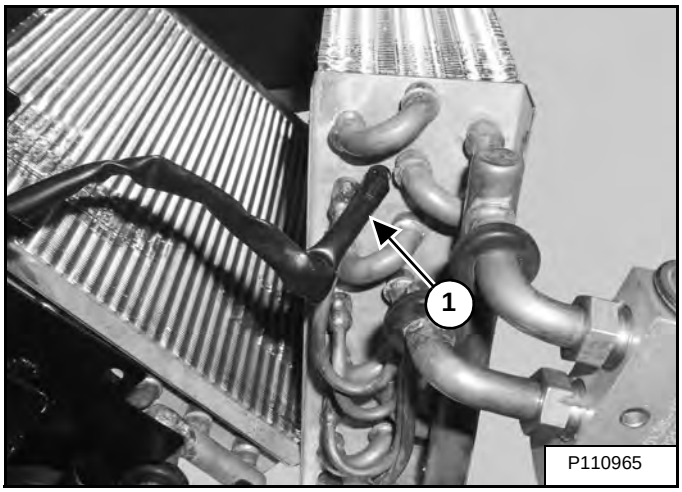
**Figure 80-80-3**




Disconnect the fan harness (Item 1) **[Figure 80-80-3]**.

**Removal And Installation (Cont'd)**

**Figure 80-90-6**




Separate the coils and remove the thermostat probe (Item 1) **[Figure 80-90-6]** from the evaporator coil.

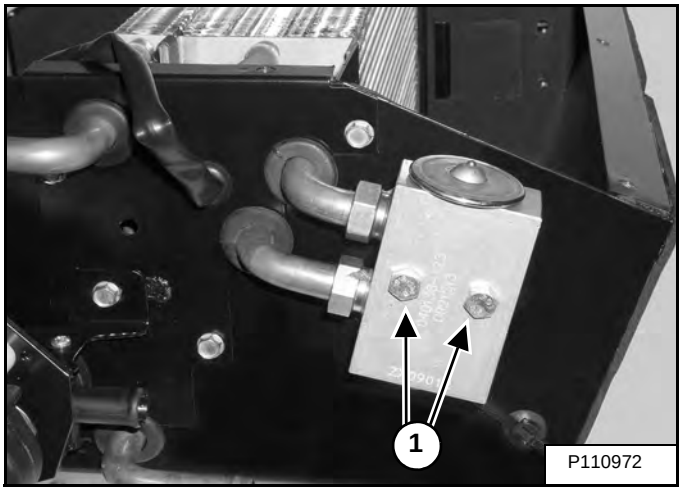
Remove the thermostat assembly from the bracket.

## EVAPORATOR COIL (S/N B3C216999 & BELOW)

### Removal And Installation

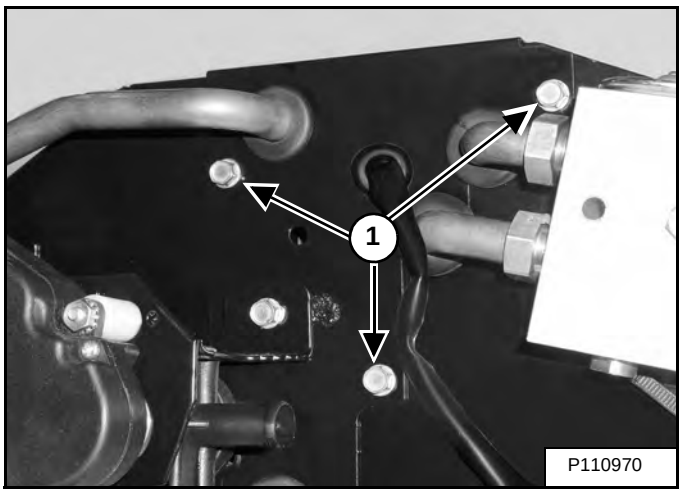
Remove the evaporator / heater unit. (See Removal And Installation on Page 80-80-1.)

**Figure 80-110-1**



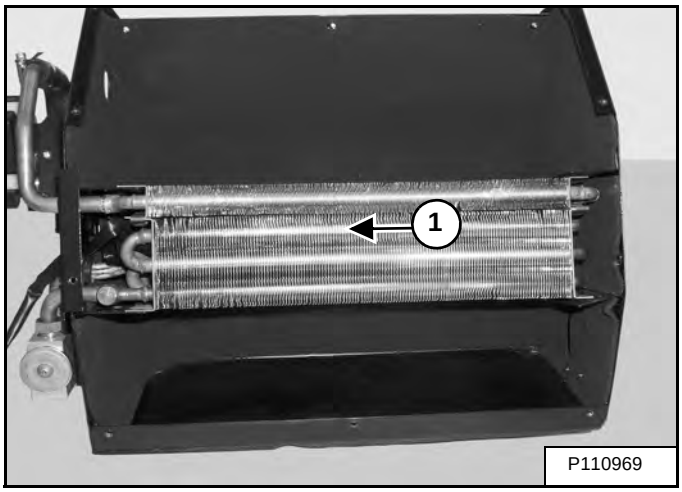

Remove the two bolts (Item 1) **[Figure 80-110-1]**.

**Figure 80-110-2**



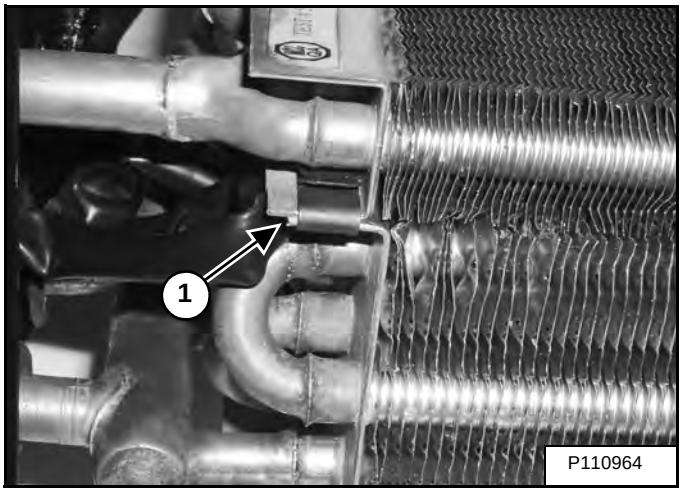

Remove the three bolts (Item 1) **[Figure 80-110-2]**.

**Figure 80-110-3**




Remove the evaporator / heater coils (Item 1) **[Figure 80-110-3]**.

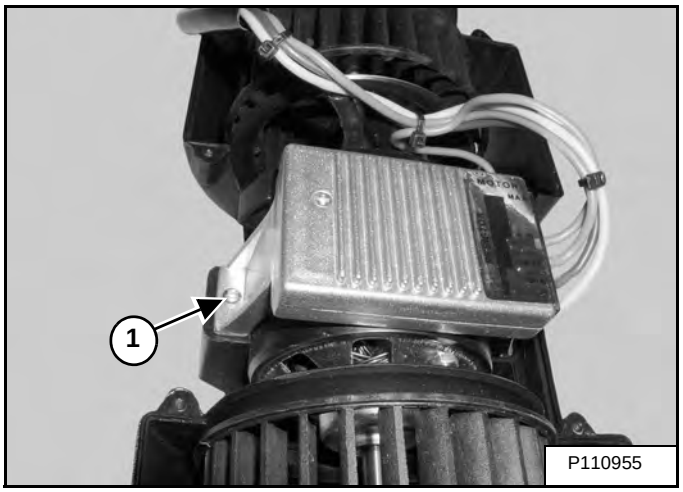
**Figure 80-110-4**




Remove the clips (Item 1) **[Figure 80-110-4]** holding the two coils together (both sides).

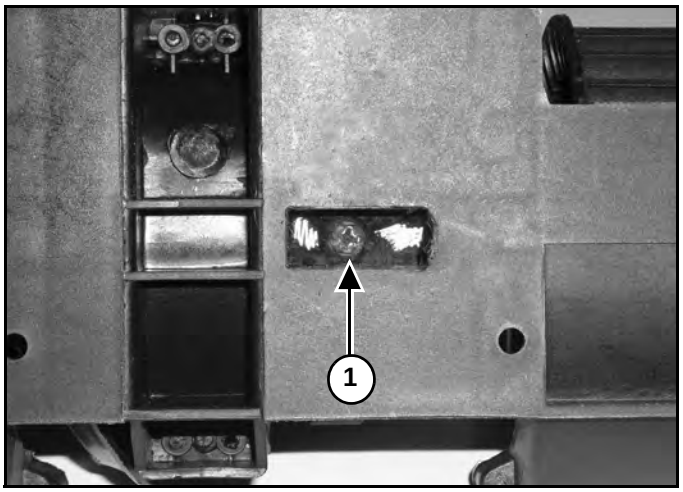
**Removal And Installation (Cont'd)**

**Figure 80-130-9**



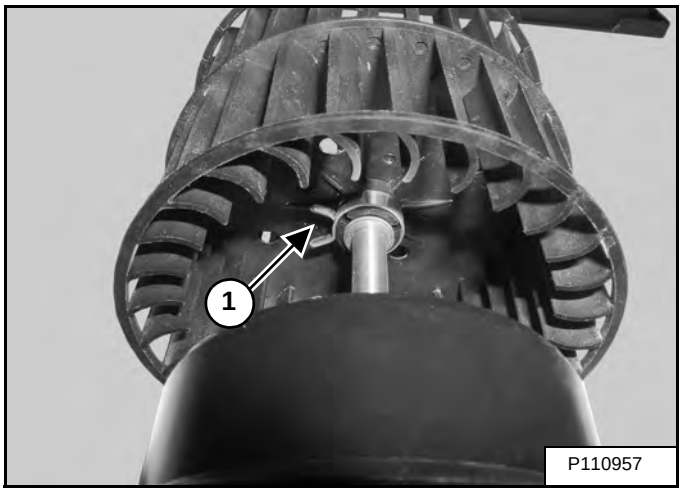

Remove the screw (Item 1) **[Figure 80-130-9]**. (Both sides)

**Figure 80-130-10**



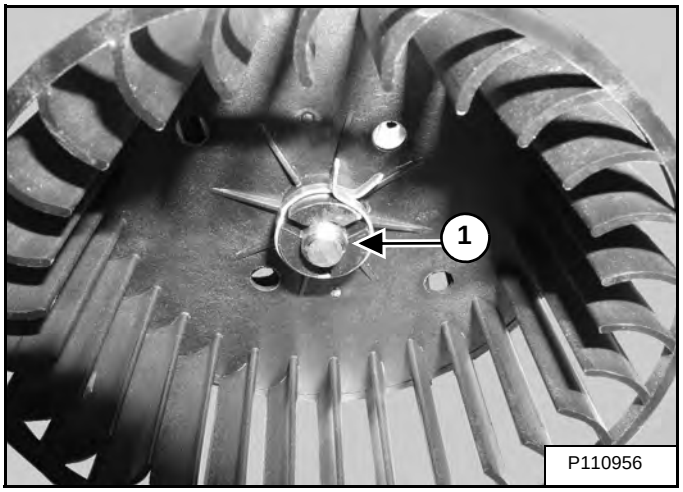

Remove the screw (Item 1) **[Figure 80-130-10]** on the bottom of the blower housing.

**Figure 80-130-11**




Remove the clamp (Item 1) **[Figure 80-130-11]**. (Both sides

**Figure 80-130-12**




Remove the clamp (Item 1) and fan blade **[Figure 80-130-12]**. (Both sides)

# SPECIFICATIONS



Certain specification(s) are based on engineering calculations and are not actual measurements. Specification(s) are provided for comparison purposes only and are subject to change without notice. Specification(s) for your individual Bobcat equipment will vary based on normal variations in design, manufacturing, operating conditions, and other factors.

## TORQUE SPECIFICATIONS FOR BOLTS

### Torque For General SAE Bolts

The following table shows standard torque specifications for bolts with zinc phosphate coating. Bolts purchased from Bobcat Company that have zinc phosphate coating are specified by the letter H following the part number.

| Thread size | | SAE grade 5 | SAE grade 8 |
|---|---|---|---|
| N•m<br>(in-lb) | 0.250 | 9,0 - 10,2<br>(80 - 90) | 12,4 - 13,6<br>(110 - 120) |
| | 0.3125 | 20,3 - 22,6<br>(180 - 200) | 24,2 - 27,1<br>(215 - 240) |
| N•m<br>(ft-lb) | 0.375 | 34 - 38<br>(25 - 28) | 47 - 54<br>(35 - 40) |
| | 0.4375 | 54 - 61<br>(40 - 45) | 81 - 88<br>(60 - 65) |
| | 0.500 | 88 - 95<br>(65 - 70) | 122 - 136<br>(90 - 100) |
| | 0.5625 | 122 - 136<br>(90 - 100) | 170 - 190<br>(125 - 140) |
| | 0.625 | 170 - 190<br>(125 - 140) | 240 - 260<br>(175 - 190) |
| | 0.750 | 300 - 330<br>(220 - 245) | 410 - 450<br>(300 - 330) |
| | 0.875 | 450 - 490<br>(330 - 360) | 645 - 710<br>(475 - 525) |
| | 1.000 | 645 - 710<br>(475 - 525) | 985 - 1085<br>(725 - 800) |
| | 1.125 | 880 - 975<br>(650 - 720) | 1425 - 1600<br>(1050 - 1175) |
| | 1.250 | 1200 - 1360<br>(900 - 1000) | 2000 - 2200<br>(1475 - 1625) |
| | 1.375 | 1630 - 1830<br>(1200 - 1350) | 2720 - 2980<br>(2000 - 2200) |
| | 1.500 | 2040 - 2240<br>(1500 - 1650) | 3530 - 3870<br>(2600 - 2850) |
| | 1.625 | 2720 - 2980<br>(2000 - 2200) | 4680 - 5150<br>(3450 - 3800) |
| | 1.750 | 3390 - 3730<br>(2500 - 2750) | 5830 - 6500<br>(4300 - 4900) |
| | 1.875 | 4270 - 4750<br>(3150 - 3500) | 5830 - 6500<br>(5500 - 6100) |
| | 2.000 | 5150 - 5700<br>(3800 - 4200) | 8800 - 9800<br>(6500 - 7200) |