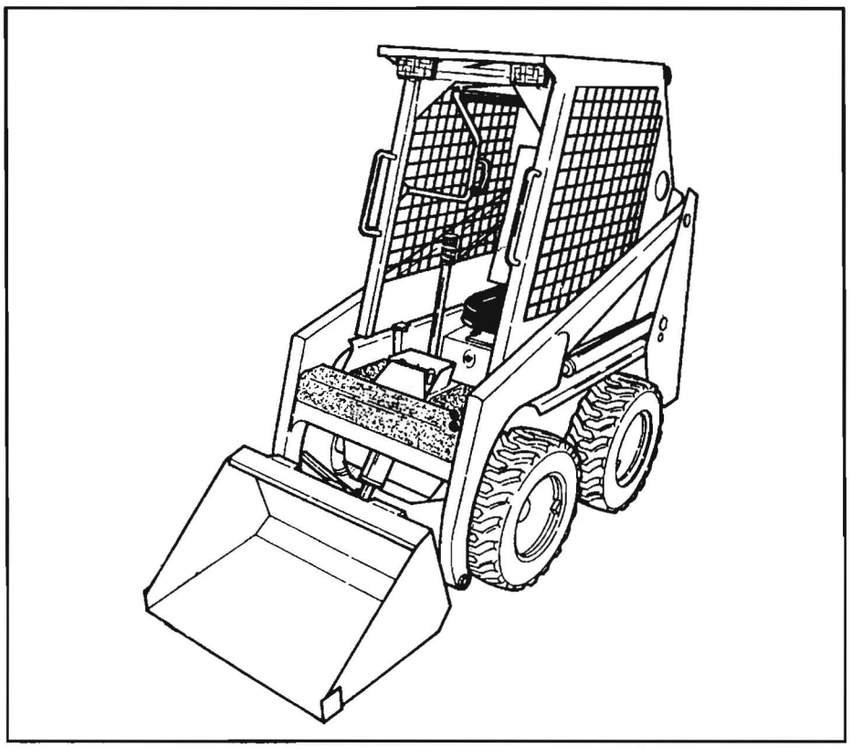
450
453

Service Manual

(450–S/N 561711001 & Above)
(453–S/N 561811001 & Above)



EQUIPPED WITH
BOBCAT INTERLOCK
CONTROL SYSTEM (BICS™)

MELROE
INGERSOLL-RAND

6724259(1–96) Printed in U.S.A.

bobcat®

© Melroe Company 1996


Bobcat®

MAINTENANCE SAFETY

⚠ WARNING

Instructions are necessary before operating or servicing machine. Read and understand the Operation & Maintenance Manual, 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–2003–0199

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

CORRECT



B–10731

⚠ **Never service the Bobcat® Skid Steer Loader without instructions.**

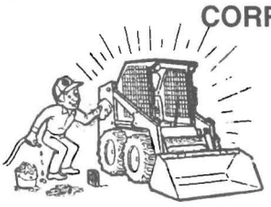
CORRECT



B–12365

⚠ **Use the correct procedure to lift or lower operator cab.**

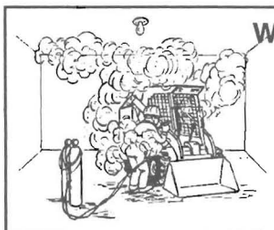
CORRECT



B–7469

⚠ **Cleaning and maintenance are required daily.**

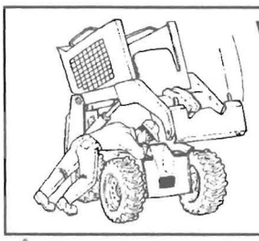
WRONG



B–11799

⚠ **Have good ventilation when welding or grinding painted parts.**
⚠ **Wear dust mask when grinding painted parts. Toxic dust and gas can be produced.**
⚠ **Avoid exhaust fume leaks which can kill without warning. Exhaust system must be tightly sealed.**

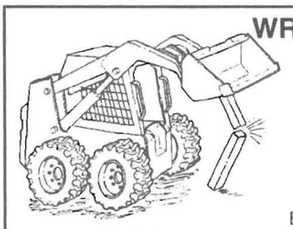
WRONG



B–15231

⚠ **Disconnecting or loosening any hydraulic tubeline, hose, fitting, component or a part failure can cause lift arms to drop. Do not go under lift arms when raised unless supported by an approved lift arm support device. Replace if damaged.**

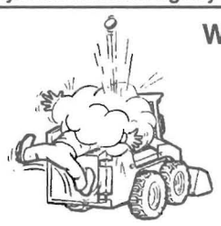
WRONG



B–15280

⚠ **Never work on loader with lift arms up unless lift arms are held by an approved lift arm support device. Replace if damaged.**
⚠ **Never modify equipment or add attachments not approved by Bobcat Company.**

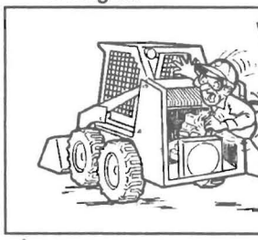
WRONG



B–6590

⚠ **Stop, cool and clean engine of flammable materials before checking fluids.**
⚠ **Never service or adjust loader with the engine running unless instructed to do so in the manual.**
⚠ **Avoid contact with leaking hydraulic fluid or diesel fuel under pressure. It can penetrate the skin or eyes.**
⚠ **Never fill fuel tank with engine running, while smoking or when near open flame.**

WRONG



B–6580

⚠ **Keep body, jewelry and clothing away from moving parts, electrical contacts, hot parts and exhaust.**
⚠ **Wear eye protection to guard from battery acid, compressed springs, fluids under pressure and flying debris when engines are running or tools are used. Use eye protection approved for type of welding.**
⚠ **Keep rear door closed except for service. Close and latch door before operating the loader.**

WRONG



B–6589

⚠ **Lead–acid batteries produce flammable and explosive gases.**
⚠ **Keep arcs, sparks, flames and lighted tobacco away from batteries.**
⚠ **Batteries contain acid which burns eyes or skin on contact. Wear protective clothing. If acid contacts body, flush well with water. For eye contact flush well and get immediate medical attention.**

Maintenance procedures which are given in the Operation & Maintenance Manual can be performed by the owner/operator without any specific technical training. Maintenance procedures which are **not** in the Operation & Maintenance Manual must be performed **ONLY BY QUALIFIED BOBCAT SERVICE PERSONNEL. Always use genuine Bobcat replacement parts.** The Service Safety Training Course is available from your Bobcat dealer.

MSW01–0600


bobcat®

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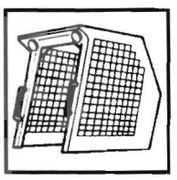
Added Oct. 98

FOREWORD

This manual is for the Bobcat loader mechanic. It provides necessary servicing and adjustment procedures for the Bobcat loader and its component parts and systems. Refer to the Operation & Maintenance Manual for operating instructions, starting procedure, daily checks, etc.

A general inspection of the following items must be made after the loader has had service or repair:

1. Check that the ROPS/FOPS (Including sidescreens) is in good condition and is not modified.



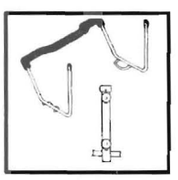
2. Check that ROPS mounting hardware is tightened and is Melroe approved.



3. The seat belt must be correctly installed, functional and in good condition.



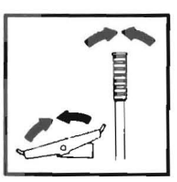
4. The seat bar and pedal interlocks must be correctly adjusted, clean and lubricated.



5. Machine signs must be legible and in the correct location.



6. Steering levers and foot pedals must return to neutral.



7. Check for correct funtion of the work lights.



8. The parking brake must function correctly.



9. Enclosure door latches must open and close freely.



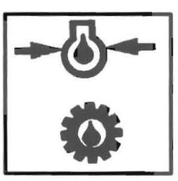
10. Bob–Tach wedges and linkages must function correctly and be in good condition.



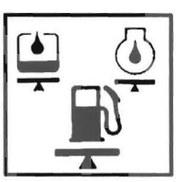
11. Safety treads must be in good condition.



12. Check for correct function of indicator lamps (Optional on some models).



13. Check hydraulic fluid level, engine oil level and fuel supply.



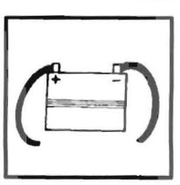
14. Inspect for fuel, oil or hydraulic fluid leaks.



15. Lubricate the loader.



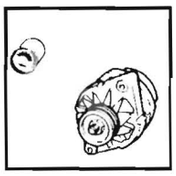
16. Check the condition of the battery and cables.



17. Inspect the air cleaner for damage or leaks. Check the condition of the element.



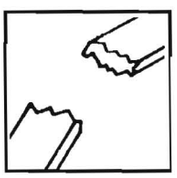
18. Check the electrical charging system.



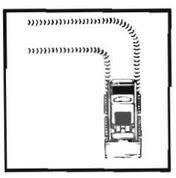
19. Check tires for wear and pressure.



20. Inspect for loose or broken parts or connections.



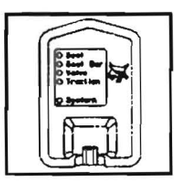
21. Operate the loader and check all functions.



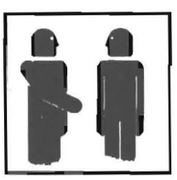
22. Check for any field modification not completed.



23. Check for correct function of the Bobcat Interlock Control System (BICS™) before the machine is returned to the customer.



Recommend to the owner that all necessary corrections be made before the machine is returned to service.



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CALIFORNIA
PROPOSITION 65 WARNING
Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects and other reproductive harm.


bobcat

⚠ WARNING

Instructions are necessary before operating or servicing machine. Read Operation & Maintenance Manual, 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. Failure to follow instructions can cause injury or death.

W–2003–0797

The following publications provide information on the safe use and maintenance of the loader and attachments:

- The Delivery Report is used to assure that complete instructions have been given to the new owner and that the machine is in safe operating condition.
- The Operation & Maintenance Manual delivered with the loader gives operating information as well as routine maintenance and service procedures. It is a part of the loader and must stay with the machine when it is sold. Replacement Operation & Maintenance Manuals can be ordered from your Bobcat loader dealer.
- The loader has machine signs (decals) which instruct on the safe operation and care. The signs and their locations are shown in the Operation & Maintenance Manual. Replacement signs are available from your Bobcat loader dealer.
- The loader has a plastic Operator's Handbook fastened to the operator cab. Its 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 EMI Safety Manual (available in Spanish) delivered with the loader gives general safety information.
- The Service Manual and Parts Manual are available from your dealer for use by mechanics to do shop–type service and repair work.
- The Skid–Steer Loader Operator Training Course is available through your local dealer. This course is intended to provide rules and practices for correct operation of the Bobcat loader. The course is available in English and Spanish version.
- The Bobcat Skid–Steer Loader Safety Video is available from your Bobcat Dealer.

⚠WARNING

Warnings on the machine and in the manuals are for your safety. Failure to obey warnings can cause injury or death.

W–2044–1285

IMPORTANT

This notice identifies procedures which must be followed to avoid damage to the machine.

I–2019–0284

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

SAFETY INSTRUCTIONS (Cont'd)

- Wear tight fitting clothing. Always wear safety glasses when maintaining or servicing loader. Safety glasses, hearing protection or loader special applications kit are required for some work. See your dealer for Melroe Safety equipment.
- Know where fire extinguisher and first aid kit are located and how to use them.
- Do not use the Bobcat loader where exhaust, arcs, sparks or hot components can contact flammable material, explosive dust or gases.
- The engine compartment and engine cooling system must be inspected every day and cleaned if necessary to prevent fire hazard and overheating.
- Check all electrical wiring and connections for damage. Keep the battery terminals clean and tight. Repair or replace any damaged part.
- Check fuel and hydraulic tubes, hoses and fittings for damage and leakage. Never use open flame or bare skin to check for leaks. Tighten or replace any parts that show leakage. Always clean fluid spills. Do not use gasoline or diesel fuel for cleaning parts. Use commercial nonflammable solvents.
- Follow any environmental safety regulations when disposing of used fluids such as engine oil, grease or anti–freeze.
- Do not use ether or starting fluids on engines which have glow plugs. These starting aids can cause explosion and injure you or bystanders.
- Always clean the loader and disconnect the battery before doing any welding. Cover rubber hoses, battery and all other flammable parts. Keep a fire extinguisher near the loader when welding. Have good ventilation when grinding or welding painted parts. Wear dust mask when grinding painted parts. Toxic dust or gas can be produced.
- Stop the engine and let it cool before adding fuel. No smoking!
- Use the procedure in the Operation & Maintenance or Service Manuals for connecting the battery.

A fire extinguisher is available from your local dealer. The fire extinguisher can be installed in the location shown **[A]**.



SI06–0398

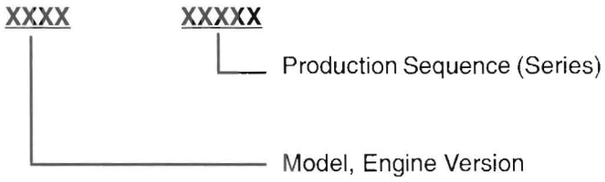
SERIAL NUMBER LOCATIONS

Always use the serial number of the loader when requesting service inofrmation or when ordering parts. Early or later models (identification made by serial number) may use different parts, or it may be necessary to use a different procedure in doing a specific service operation.

LOADER SERIAL NUMBER

The loader serial number plate is located on the inside of the operator cab on the right fender and in front of the seat **[A]**.

Explanation of loader Serial Number:

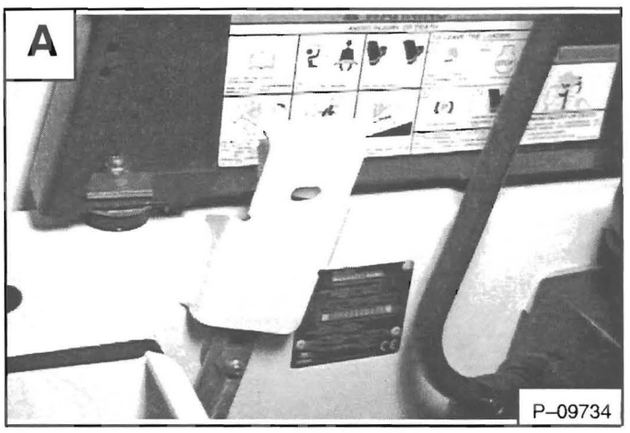


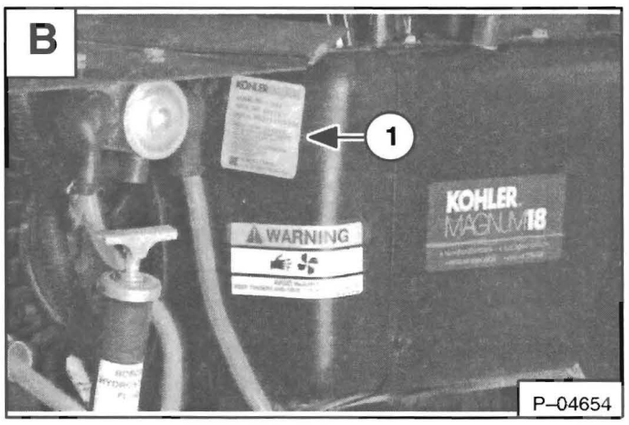
ENGINE SERIAL NUMBER

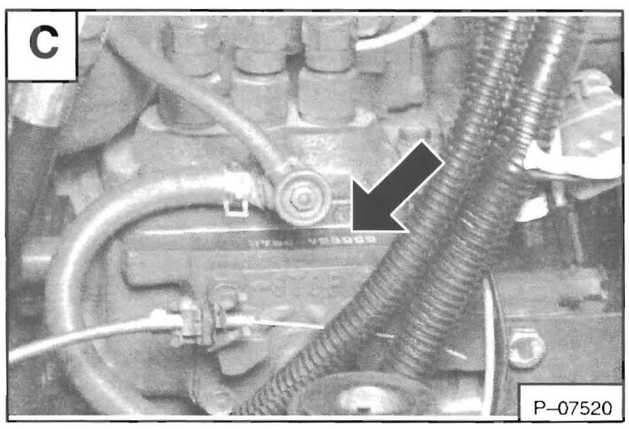
The engine serial number is located on the engine fuel injection pump. **[B]**.

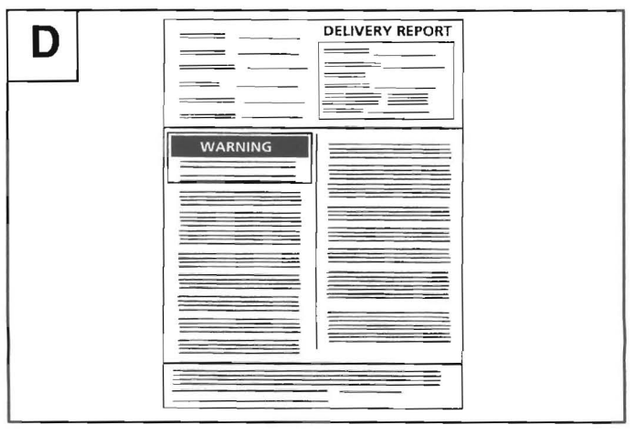
DELIVERY REPORT

The Delivery Report must be filled out by the dealer and signed by the owner or operator when the Bobcat loader is delivered. An explanation of the form must be given to the owner. Make sure it is filled out completely **[C]**.

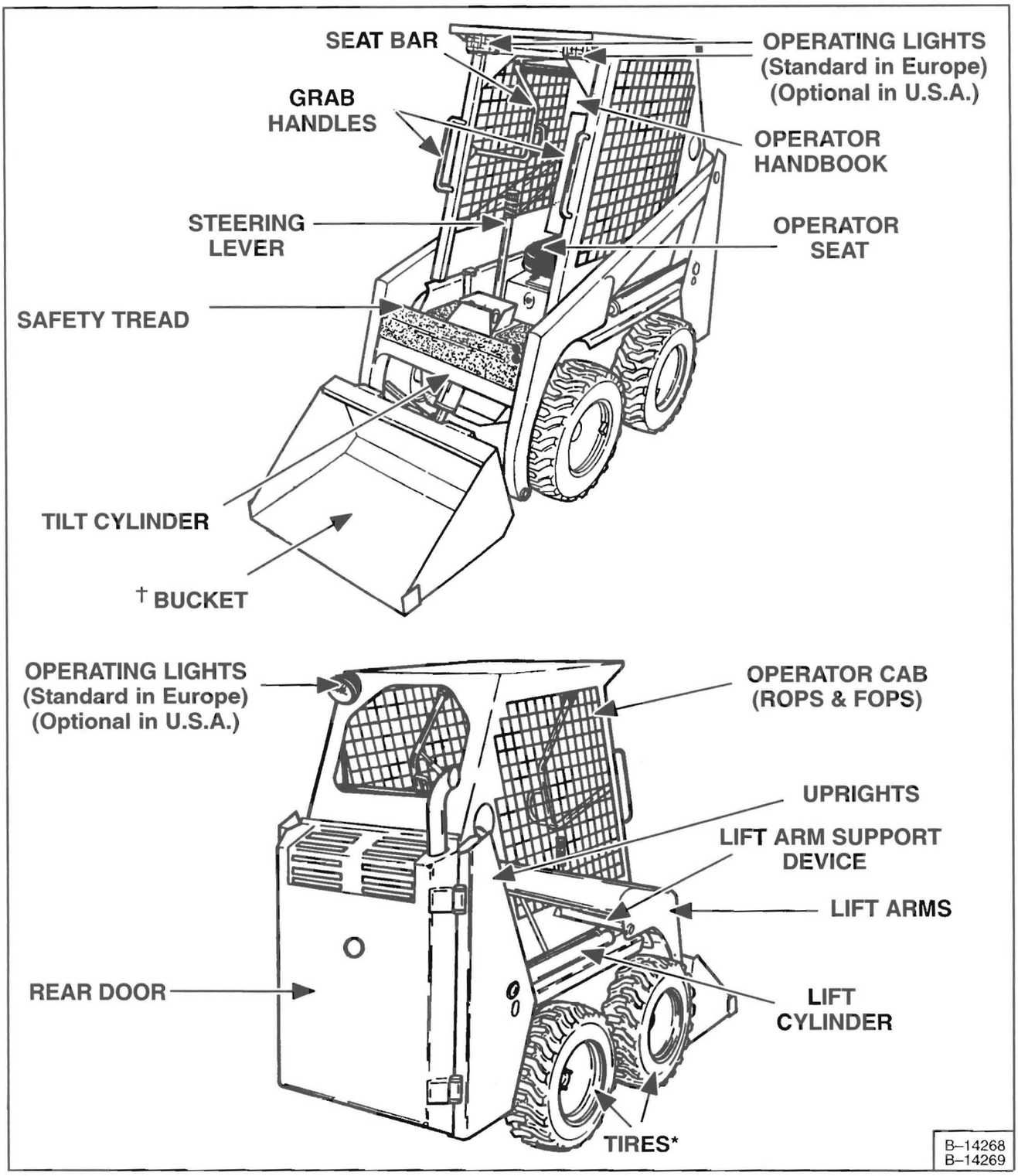








BOBCAT SKID STEER LOADER IDENTIFCATION



* TIRES – Flotation tires (Optional) are shown. Bobcats are base–equipped with standard tires.
† BUCKET – Several different buckets and other attachments are available for the Bobcat loader.
• ROPS, FOPS – Roll–Over Protective Structure,Falling Object Protective Stucture, per SAE J1040 and ISO 3471, and Falling Object Protective Structure per SAE J1043 and ISO 3449, Level I. The Bobcat loader is base–equipped with a standard operator cab as shown. Extra insulated cab is available as an option (Reduced noise level).

OPTIONS AND ACCESSORIES

All 453 Bobcat loaders are equipped with the following standard items:

Spark Arrestor Muffler	Seat Belt
Lift Arm Support Device	Seat Bar
Operator Cab (W/ROPS & FOPS Approval)	Parking Brake
Bobcat Interlock Control System (BICS™)	Hourmeter
Gauges/Warning Lights (453)	

Below is a listing of the optional equipment which is available through your Bobcat Loader dealer.

Tires

5:70 x 12, 4PR	Std.
23 x 8:50–12, 4PR	Opt.
23 x 8:50–12,6 PR Heavy Duty	Opt.

Operator Cab

85 dB(A) Sound Package	Opt. (Std. in Europe)
Suspension Seat	Opt. & FA (Std. in Europe)
Operating Lights (Front & Rear)	Opt. & FA (Std. in Europe)
Horn	FA (Std. in Europe)
Back–Up Alarm	Opt. & FA
Top Window	Opt. & FA (Std. in Europe)
Rear Window	Opt. & FA (Std. in Europe)
Vinyl Cab Enclosure	FA
Fire Extinguisher	FA
Flasher Lights	FA
Strobe or Rotating Beacon Light	FA
3" Seat Belt	FA
Special Application Kit	FA
Turn Signal Kit	FA in Europe
Fuel Shutoff Kit	FA
Operator Training Kit	FA
Padlock (Tailgate)	Std. in Europe

Hydraulics

Front Auxiliary Hydraulics	Opt. & FA

Other

Engine Block Heater (453)	FA
Single Point Lift	FA
Locking Fuel Cap	FA
Tool Box	FA (Std. In Europe)
Low Coolant Sensor Kit	FA
Rental Kit	FA

Std. = Standard Equipment
Opt. = Factory Installed Option
FA = Field Accessory
NA = Not Available

Specifications subject to change without notice


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SERVICE SCHEDULE

Maintenance work must be done at regular intervals. Failure to do so will result in excessive wear and early failures. The service schedule is a guide for correct maintenance of the Bobcat loader.

⚠ WARNING

Instructions are necessary before operating or servicing machine. Read Operation & Maintenance Manual, 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. Failure to follow instructions can cause injury or death.

W–2003–0797

SERVICE SCHEDULE		HOURS					
ITEM	SERVICE REQUIRED	8–10	50	100	250	500	■ 1000
Engine Air Cleaner	Empty the dust cup & replace the filter element as needed.						
Engine Oil	Check the oil level & add oil as needed.						
Engine Cooling System (453)	Clean debris from oil cooler, radiator & grill. Check coolant level in recovery tank and add as needed.						
Tires	Check the air pressure & for damaged tires.						
Indicators, Gauges (453) & Lights (Opt.)	Check for correct operation of all indicators, gauges (453) & lights (Opt.).						
Seat Belt and Seat Bar	Check the condition of seat belt. Check the seat bar & pedal interlocks for correct operation. Clean dirt and debris from moving parts.						
Safety Signs (Decals) and Safety Tread	Check for damaged signs and safety treads. Replace any signs or safety treads that are damaged or worn.						
Lift Arm and Bob–Tach Pivot Pin and Wedges	Lubricate with multi–purpose lithium based grease.						
Engine Fuel Filter (453)	Remove the water from the filter.						
Hyd. Fluid, Hoses & Tubelines	Check fluid level & add as needed. Check for damage & leaks. Repair & replace as needed.						
Bobcat Interlock Control System (BICS™)	Check BICS™ System Controller functions. Clean dirt, debris or objects from under or behind seat as required.						
Engine Oil & Filter (450)	Replace oil & filter.						
Battery	Check cables connections & electrolyte level. Add distilled water as needed.						
Control Pedals & Steering	Check for correct operation repair or adjust as needed.						
Bob–Tach	□ Check locking levers & wedges for condition & operation.						
Wheel Nuts	Check for loose wheel nuts & tighten to 40–45 ft.–lbs. (54–61 Nm) torque						
Parking Brake	Check operation.						
Alternator Belt (453 Only)	Check tension & adjust as needed.						
Hydraulic Filter Element	Replace filter element.						
Spark Arrestor Muffler	Clean the spark chamber.						
Engine Oil & Filter (453)	Replace oil & filter.						
Drive Belts	Check all drive belts for condition and tension.						
Steering Lever Pivots	Lubricate the grease fittings and the oil hole in the steering shaft.						
Engine Fuel Filter (453)	Replace filter element.						
Hydraulic Reservoir Fill Cap (Breather)	Replace the breather cap.						
Final Drive Transmission (Chaincase)	Replace the fluid.						
Hydraulic/Hydrostatic Reservoir	• Replace the fluid.						
Bobcat Interlock Control System (BICS™)	Check the lift arm bypass control.						
Case Drain Filter	Replace the Filter.						

□ **Check wheel nut torque every 8 hours for the first 24 hours.**
• **Also replace hydraulic/hydrostatic filter element when the transmission warning light stays on for five minutes after the fluid is at operating temperature.**
■ **Or every 12 months.**

⚠ WARNING

Instructions are necessary before operating or servicing machine. Read Operation & Maintenance Manuals, 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. Failure to follow instructions can cause injury or death [A].

W–2003–0797

A



B–7023

LIFTING AND BLOCKING THE LOADER

Procedure

Always park the loader on a level surface.

⚠ WARNING

Put jackstands under the front axles and rear corners of the frame before running the engine for service. Failure to use jackstands can allow the machine to fall or move and cause injury or death.

W–2017–0286

Put a floor jack under the rear of the loader **[B]**.

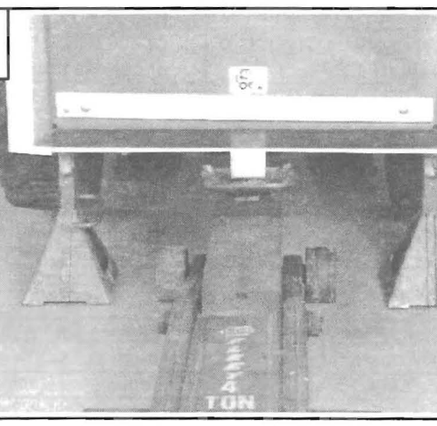
Lift the rear of the loader and install jackstands **[B]**.

Put the floor jack under the front of the loader **[C]**.

Lift the front of the loader and put jackstands under the loader frame.

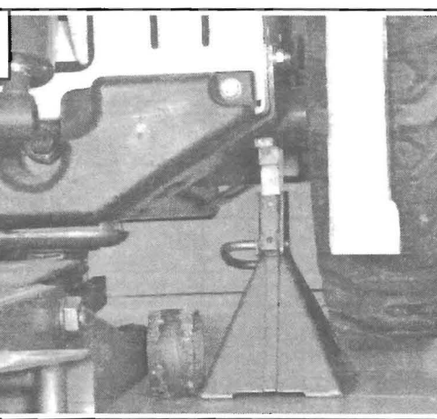
NOTE: Make sure the jackstands do not touch the tires.

B



P–7288

C



P–7289

TRANSPORTING THE LOADER

Procedure

Be sure the transport and towing vehicles are of adequate size and capacity.

⚠ WARNING

Adequately designed ramps of sufficient strength are needed to support the weight of the machine when loading onto a transport vehicle. Wood ramps can break and cause personal injury.

W–2058–0494

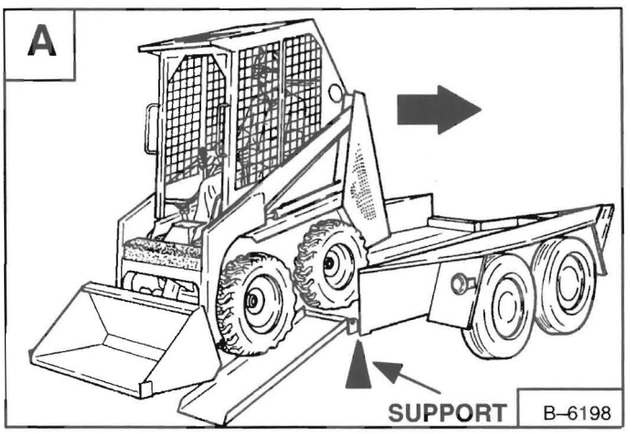
A loader with an empty bucket or no attachment must be loaded backward onto the transport vehicle **[A]**.

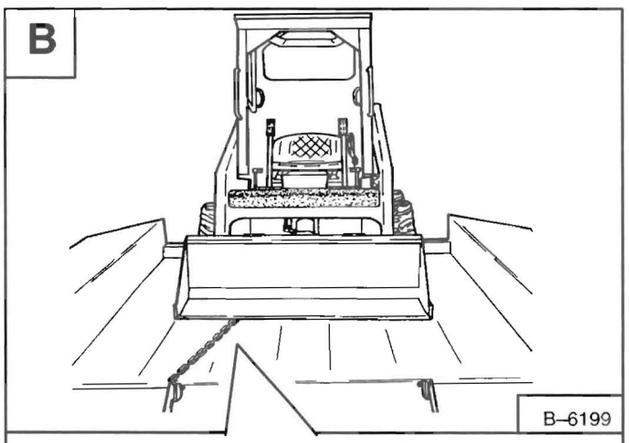
The rear of the trailer must be blocked or supported **[A]** when loading or unloading the loader to prevent the front end of the trailer from raising up.

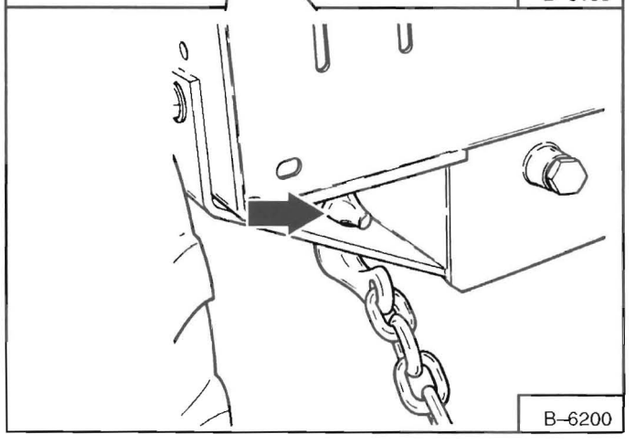
Use the following procedure to fasten the Bobcat loader to the transport vehicle to prevent the loader from moving during sudden stops or when going up or down slopes **[B]**.

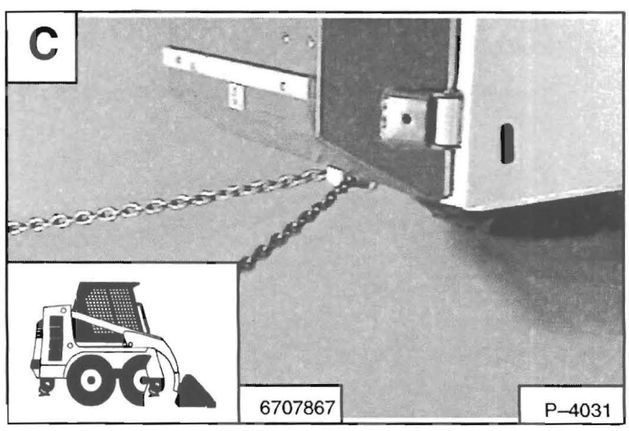
Lower the bucket or attachment to the floor. Stop the engine. Engage the parking brake. Install chains at the front and rear of the loader as shown **[B]**.

NOTE: Rear of the loader can be chained using the upright slots or using the loop below the rear door [C].









LIFTING THE LOADER

Single Point Lift

⚠ WARNING

AVOID INJURY OR DEATH

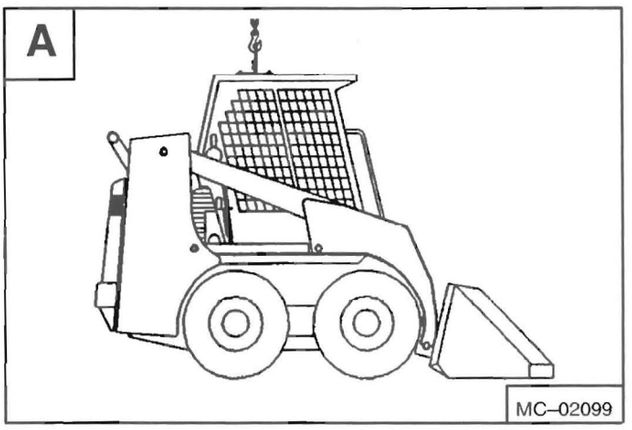
- **Before lifting, check fasteners on single point lift and operator cab.**
- **Assemble front cab fasteners as shown in this manual.**
- **Never allow riders in the cab or bystanders within 15 feet (5 meters) while lifting the machine.**

W–2007–0497

The loader can be lifted with the single point lift which is available as a kit from your Bobcat loader dealer.

Install the kit and lift the loader as shown **[A]**.

The single point lift, supplied by Melroe Company is designed to safely lift and support the Bobcat loader without affecting roll over and falling object protection features of the operator cab.



TOWING THE LOADER

To prevent damage to the loaders hydrostatic system, the loader must be towed only a short distance at slow speed. (Example: Moving the loader onto a transport vehicle).

Relief valve release tool set MEL1220 must be installed before towing.

Raise the operator cab. (See Page 1–9.)

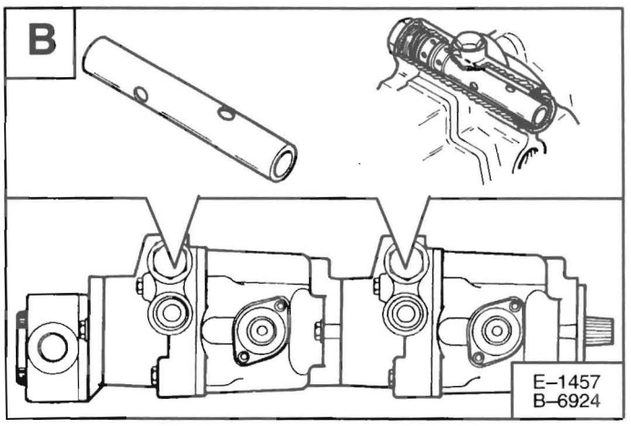
Clean the area around the hydrostatic pumps.

Remove the high pressure relief valve from one side of each hydrostatic pump **[B]** and install the relief valve tubes. Install the plugs and tighten.

The towing chain (or cable) must be rated at 1–1/2 times the weight of the loader. (See *SPECIFICATIONS* Page 69.)

Turn the key switch to ON and press the traction lock override button.

Tow the Bobcat at 2 MPH (3,2 km/hr) or less for not more than 25 feet (7,6 meters).



IMPORTANT

Never attempt to start the engine by pushing or pulling. Hydrostatic pumps and motors will be damaged.

I–2001–1285

Do not push or pull the machine at more than 2 MPH (3,2 km/h) or for a distance of more than 25 feet (7,6 meters) with the towing tool in place.

I–2017–0389

LIFT ARM SUPPORT DEVICE

⚠ WARNING

Never work on a machine with the lift arms up unless the lift arms are secured by an approved lift arm support device. Failure to use an approved lift arm support device can allow the lift arms or attachment to fall and cause injury or death.

W–2059–0598

Engaging The Lift Arm Support Device

Use the following procedure to use the lift arm support device:

Put jackstands under the rear corners of the loader. (See Page 1–4).

Disconnect the spring from the lift arm support device retaining pin (Item 1) **[A]**, hold the support device and remove the retaining pin.

Lower the lift arm support device on top of the lift cylinder. Fasten the free end of the spring (Item 1) **[B]** to the lift arm support device so there will be no interference with the support device engagement.

With the operator in the seat, seat belt fastened and seat bar lowered, engage the parking brake and start the engine.

Raise the lift arms until the the lift arm support device drops onto the lift cylinder rod **[C]**.

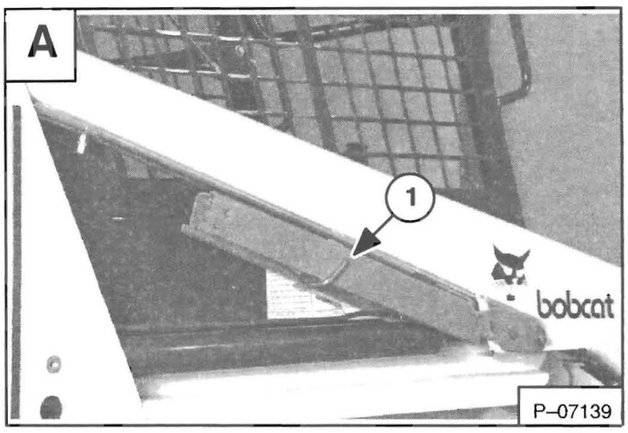
Lower the lift arms slowly until the support device is held between the lift arm and the lift cylinder. Stop the engine. Raise the seat bar and move pedals until both pedals lock.

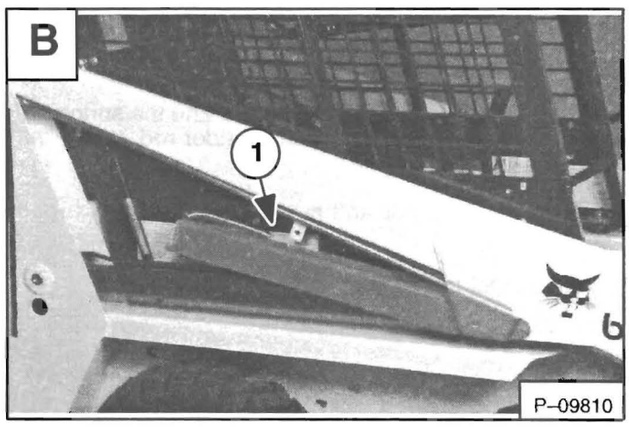
Install the retaining pin (Item 1) **[D]** into the rear of the lift arm support device below the cylinder rod.

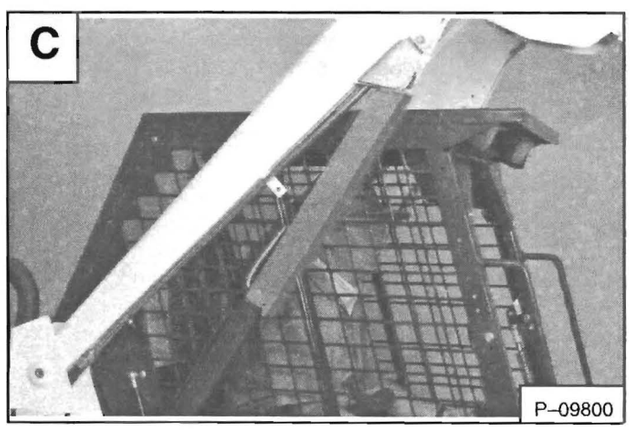
⚠ WARNING

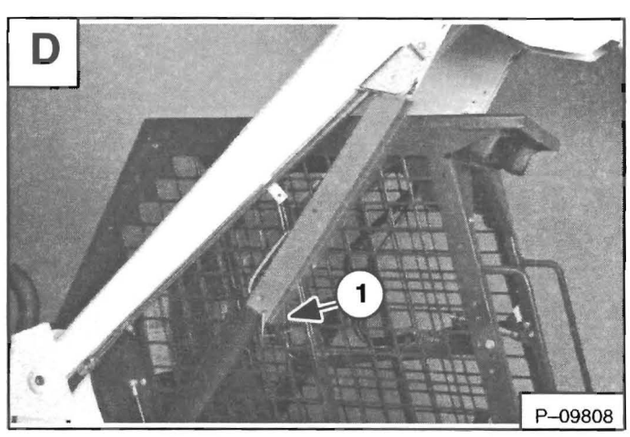
Service lift arm support device if damaged or if parts are missing. Using a damaged lift arm support or with missing parts can cause lift arms to drop causing injury or death.

W–2271–1197







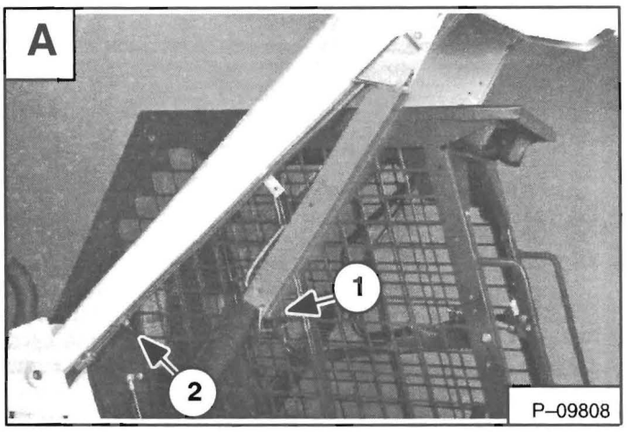


LIFT ARM SUPPORT DEVICE (Cont'd)

Disengaging The Lift Arm Support Device

Remove the retaining pin (Item 1) **[A]** from the lift arm support device.

Connect the spring from the lift arm support device to the tubeline bracket (Item 2) **[A]** on the lift arms.

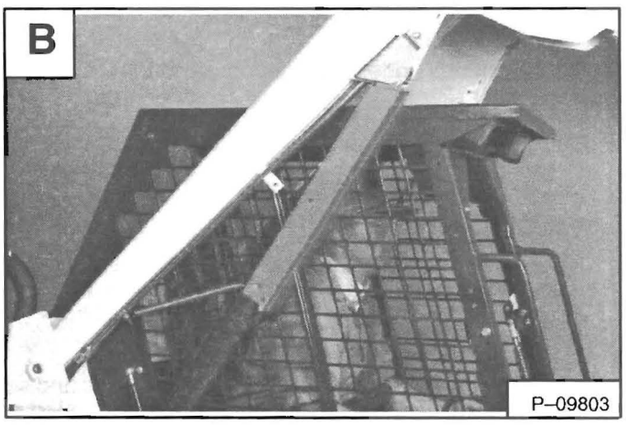


With the operator in the seat, seat belt fastened and seat bar lowered, start the engine **[B]**.

Raise the lift arms a small amount and the spring will lift the support device off the lift cylinder rod. Lower the lift arms. Stop the engine.

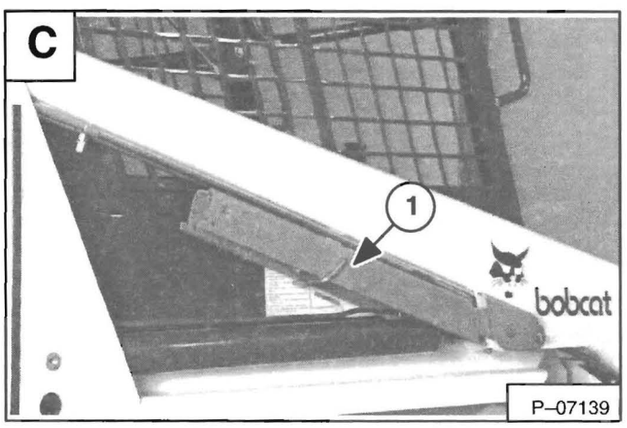
Raise the seat bar and move pedals until both pedals lock.

Disconnect the spring from the bracket.



Raise the support device into storage position and insert pin through the lift arm support device and bracket (Item 1) **[C]**.

Connect the spring to the pin **[C]**.



OPERATOR CAB

Description

The Bobcat loader has an operator cab (ROPS and FOPS) as standard equipment to protect the operator from rollover and falling objects. Check with your dealer if the operator cab has been damaged.

ROPS/FOPS Roll Over Protective Structure per SAE J1040 and ISO 3471, and Falling Object Protective Structure per SAE J1043 and ISO 3449, Level I.

Level I – Protection from falling bricks, small concrete blocks and hand tools encountered in operations such as highway maintenance, landscaping, and other construction site services.

Emergency Exit

The front opening of the operator cab and rear window provide exits.

To exit through the rear window, use the following procedure:

Pull on the tag (Item 1) **[A]** at the top of the rear window to remove the rubber cord.

Push the window out of the rear of the operator cab.

Exit through the rear of the operator cab **[B]**.

⚠ WARNING

Never modify operator cab by welding, grinding, drilling holes or adding attachments unless instructed to do so by Melroe Company. Changes to the cab can cause loss of operator protection from rollover and falling objects, and result in injury or death.

W–2069–1285

Before the cab or the lift arms are raised for service, jackstands must be put under the rear corners of the frame. Failure to use jackstands can allow the machine to tip backward causing injury or death.

W–2014–0895

The operator cab fastening nuts (Item 1) **[C]** must be tightened to 40–50 ft.–lbs. (54–68 Nm) torque.

Raising The Operator Cab

Stop the loader on a level surface. Put the lift arms all the way down.

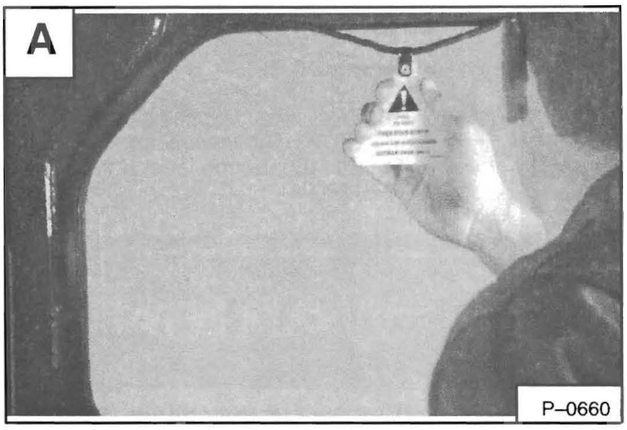
Open the rear door.

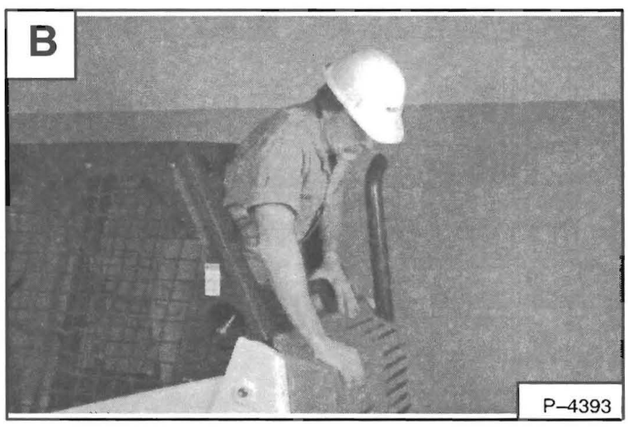
If the lift arms must be up while raising the cab, install the lift arm support device. (See Page 1–7.)

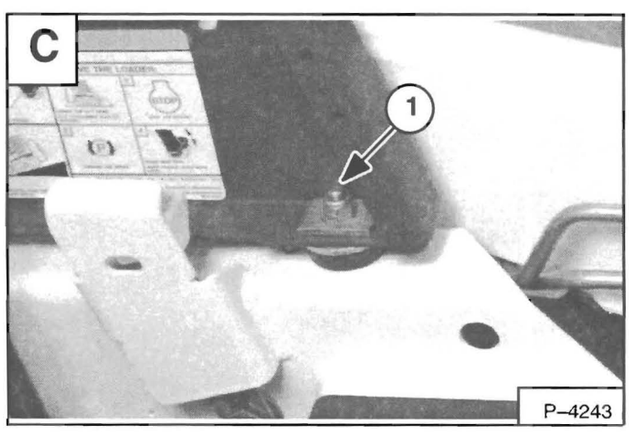
Remove the two fasteners and washers from the front corners of the operator cab (Item 1) **[C]**.

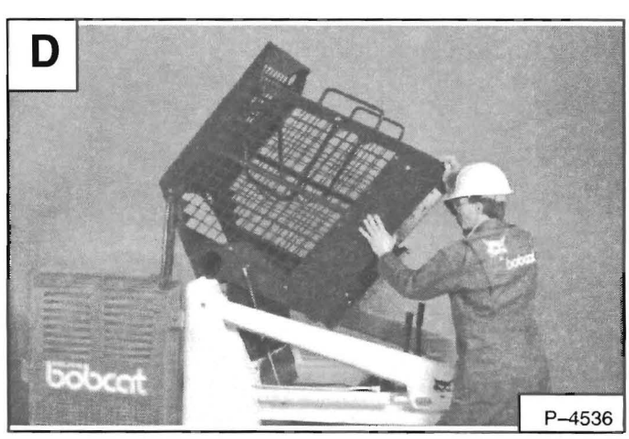
Stand on the ground. Lift slowly until operator cab is all the way up **[D]**.

The operator cab will lock in the raised position.









OPERATOR CAB (Cont'd)

Lowering The Operator Cab

Hold the operator cab. Release the locking mechanism by pushing the lever (Item 1) **[A]** inward from the locked position (Item 2) **[A]** and turning the lever until it stays in the unlocked position **[B]**.

⚠ WARNING

The cab must be held to prevent falling while hand is in access hole.

W–2205–0695

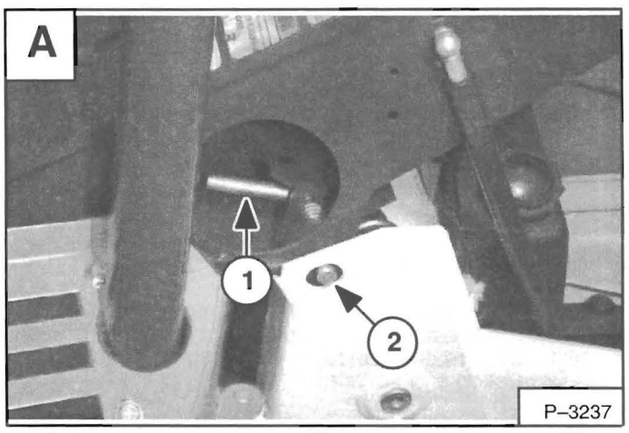
REMOVE YOUR HAND FROM THE HOLE BEFORE LOWERING THE OPERATOR CAB

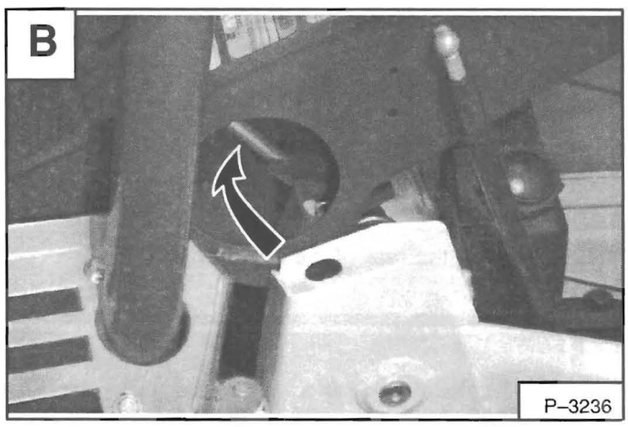
Stand on the ground and pull down on the operator cab.

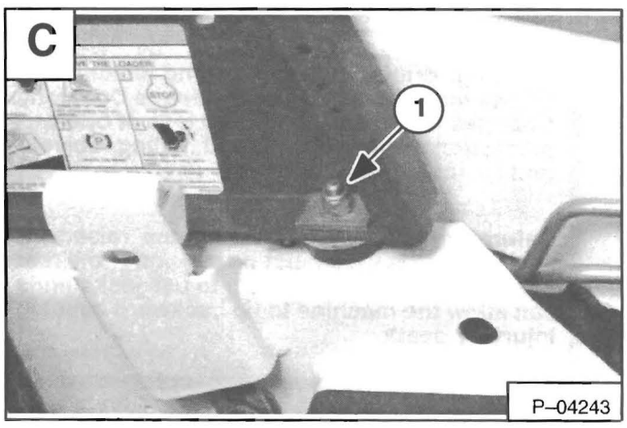
Avoid slippery surfaces when lowering the cab.

NOTE: Guide the operator cab over the fastening bolts to prevent thread damage.

Install the cab washers and nuts. Tighten the nuts (Item 1) **[C]** (both sides) to 40–50 ft.–lbs. (54–68 Nm) torque.







SEAT BAR RESTRAINT SYSTEM

The seat bar restraint system has a pivoting seat bar with arm rests and has spring loaded interlocks for the lift and tilt control pedals. The operator controls the use of the seat bar. The seat bar in the down position helps to keep the operator in the seat. The interlocks require the operator to lower the seat bar in order to operate the foot pedal controls. When the seat bar is up, the lift and tilt pedals are locked when returned to the neutral position.

⚠ WARNING

AVOID INJURY OR DEATH

The seat bar system must lock the lift and tilt control pedals in neutral when the seat bar is up. Service the system if pedals do not lock correctly.

W–2105–1285

Seat Bar Inspection

Sit in the seat and fasten the seat belt. Engage the parking brake. Pull the seat bar all the way down. Start the engine.

Operate each foot pedal to check both the lift and tilt functions.

Raise the lift arms until the bucket is about 2 feet (600 mm) off the ground. Raise the seat bar, try to move each pedal. The pedals must be firmly locked in neutral position. There must be no motion of the tilt (bucket) or the lift arms when the pedals are pushed.

Pull the seat bar down, lower the lift arms. Operate the lift pedals. While the lift arms are going up, raise the seat bar and the lift arms should stop.

Lower the seat bar, lower the lift arms and put the bucket flat on the ground. Stop the engine. Raise the seat bar and operate the foot pedals to be sure that the pedals are firmly locked in the neutral position. Unbuckle the seat belt.

Seat Bar Maintenance

See the Service Schedule Page 1–3 and located on the loader rear door for correct service interval.

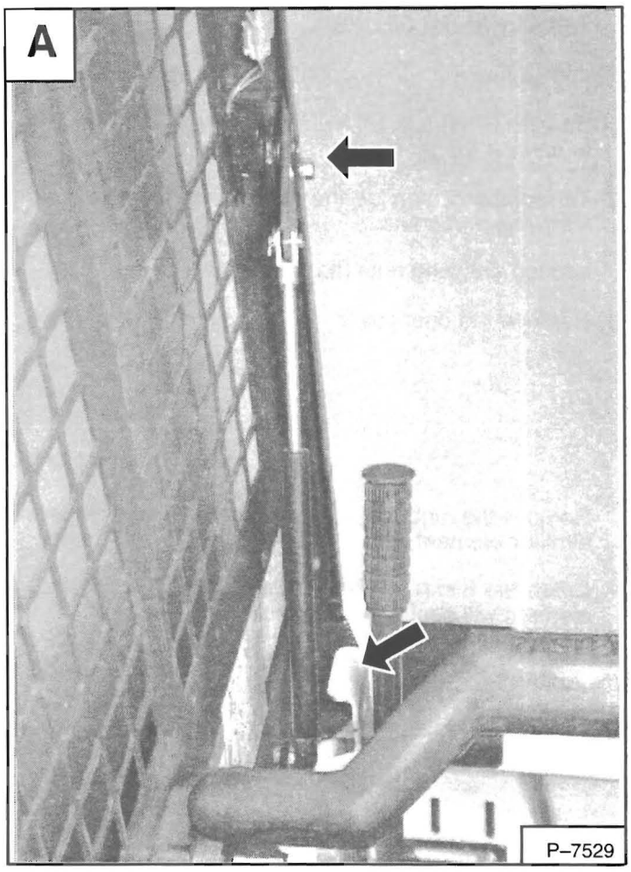
Clean any debris or dirt from the moving parts **[A]** & **[B]**.

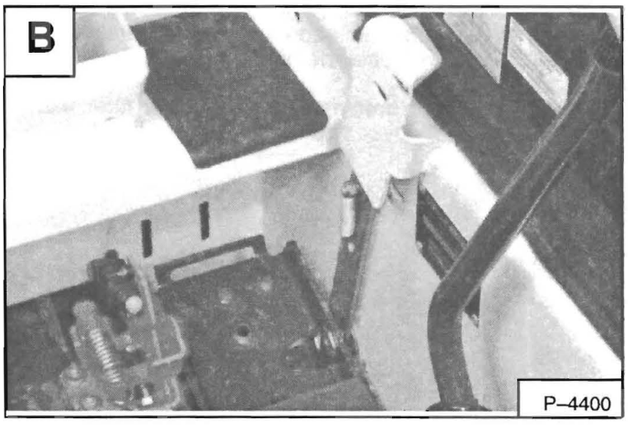
Inspect the linkage bolts and nuts for tightness. The correct torque is 25–28 ft.–lbs. (34–38 Nm).

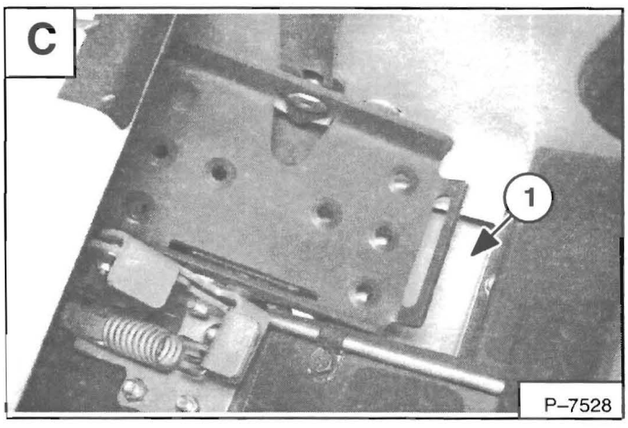
If the seat bar system does not function correctly, check for free movement of each linkage part. Check for excessive wear. Adjust pedal control linkage. Replace parts that are worn or damaged. Use only genuine Melroe replacement parts.

Foot Pedal Clean Out

Clean any debris from the holes (Item 1) **[C]** below the foot pedals as needed.







AIR CLEANER SERVICE

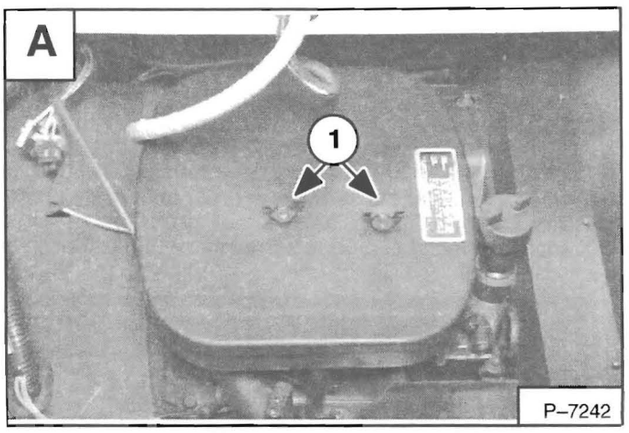
450 Loader:

See the *SERVICE SCHEDULE* Page 1–3 for the interval to service the air cleaner system.

To replace or service the air cleaner element, use the following procedure:

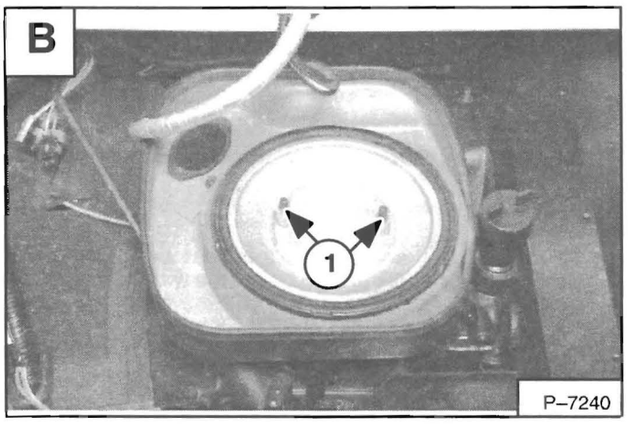
Loosen the wing nuts (Item 1) **[A]**.

Remove the dust cover.



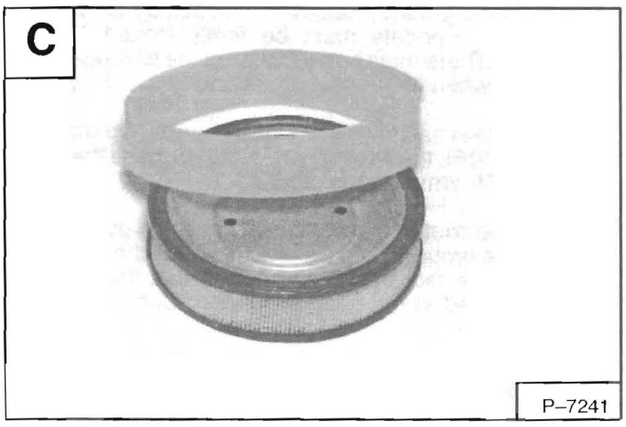
Remove the rubber bushings (Item 1) **[B]** and remove the air filter element **[B]**.

Clean the inside of the air cleaner housing so that the element will seal on a good surface.



Remove the foam precleaner from the paper element **[C]**. Wash the foam precleaner in clean solvent.

Install the foam precleaner on the new filter element. Install the dust cover and tighten the wing nut.



AIR CLEANER SERVICE (Cont'd)

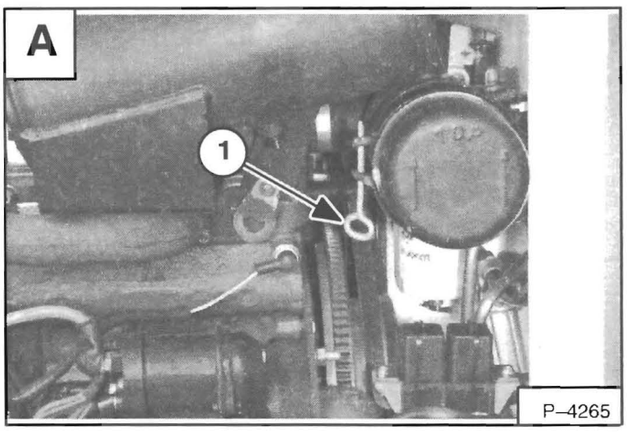
453 Loader:

See the *SERVICE SCHEDULE* Page 1–3 for the interval to service the air cleaner system.

Check the air intake hose for damage. Check the air cleaner housing for damage. Check to make sure all connections are tight.

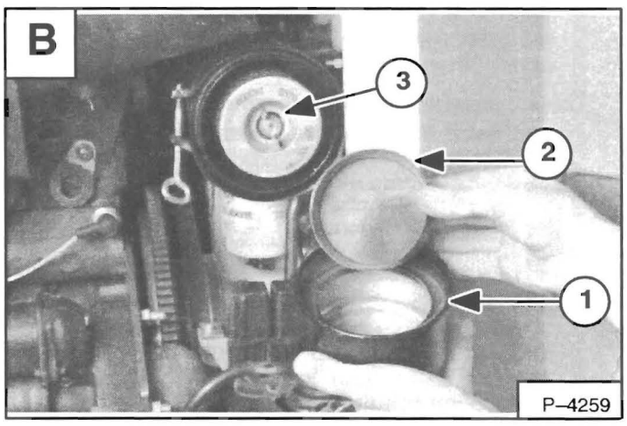
Service the air cleaner as follows:

Loosen the wing nut (Item 1) **[A]**.



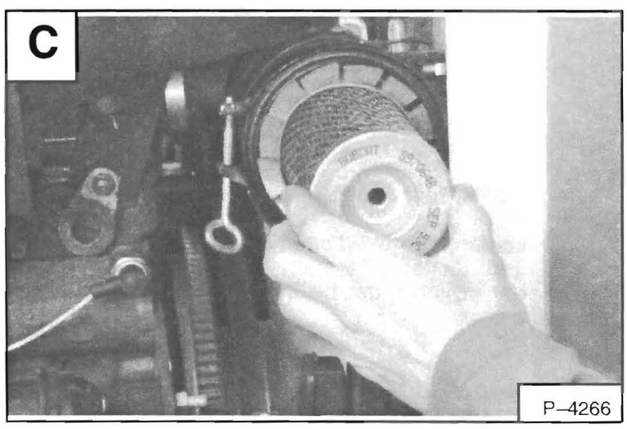
Remove the cover (Item 1) **[B]**, remove the dust cup (Item 2) **[B]**. Empty the debris from the dust cover.

Remove the wing nut (Item 3) **[B]** from the air filter.



Remove the air filter **[C]**.

NOTE: Make sure all sealing surfaces are free of dirt and debris.



FUEL SYSTEM

450 Loader:

Fuel Specifications

Use 87 octane regular gasoline or unleaded gasoline in the Kohler engine.

Gasohol (up to 10% ethyl alcohol, 90% unleaded gasoline by volume) is approved fuel for the Kohler engine.

⚠ WARNING

Stop and cool the engine before adding fuel. NO SMOKING! Failure to obey warnings can cause an explosion or fire.

W–2063–0887

⚠ WARNING

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 which can result in injury or death.

W–2103–1285

The fuel gauge (Item 1) **[A]** is located on the right side of the loader.

Filling The Fuel Tank

Remove the fuel fill cap (Item 1) **[B]**.

Use a clean, approved safety container to add fuel.

The key switch must be in the OFF position and the engine cool.

Add fuel only in an area that has a free movement of air and no open flames or sparks. NO SMOKING! **[C]**.

After the fuel tank is full, install the fill cap and tighten.

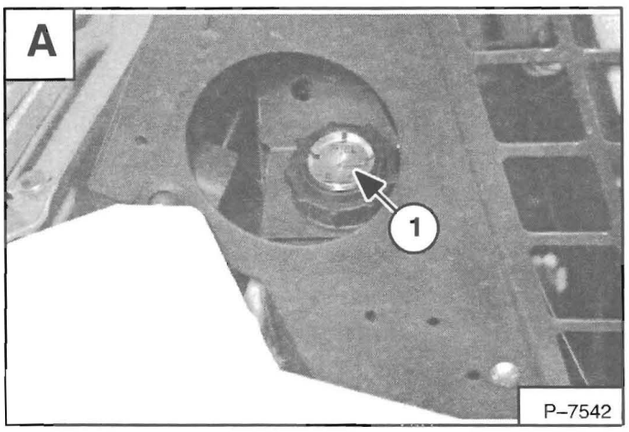
Check that the fuel gauge (Item 1) **[D]** works correctly.

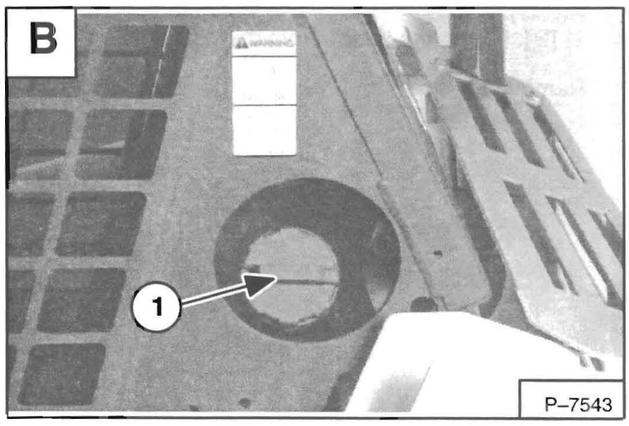
Fuel Filter

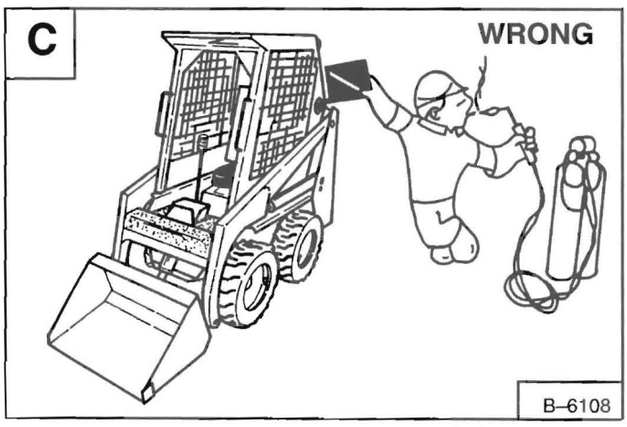
See the *SERVICE SCHEDULE* Page 1–3 for the interval to service the fuel filter.

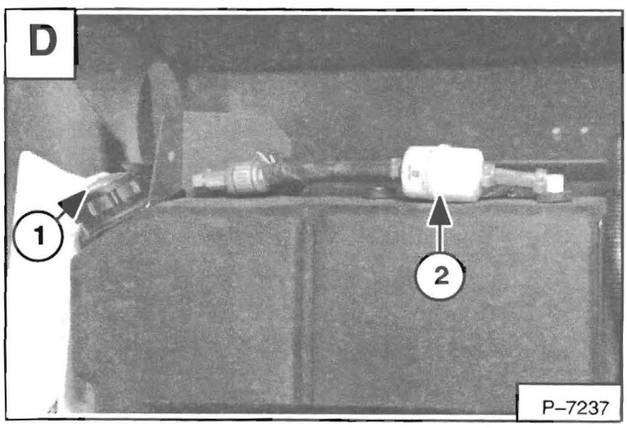
Raise the operator's cab. (See Page 1–9.)

Remove the fuel filter (Item 2) **[D]** and replace with a new filter. Make sure all the connections are tight.









FUEL SYSTEM (Cont'd)

453 Loader:

Fuel Specifications

Use only clean, high quality diesel fuel, Grade No. 1 or Grade No. 2.

The following is one suggested blending guideline which should prevent fuel gelling problems:

Temp. F°/C°	No. 2	No. 1
+15°(–9°)	100%	0%
Down to –20°/–29°	50%	50%
Below –20°/–29°	0%	100%

We recommend an operator contact their fuel supplier for local recommendations.

The fuel gauge (Item 1) **[A]** and the fuel shut off valve (Item 2) **[A]** are located on the right side of the loader.

Filling the Fuel Tank

⚠ WARNING

Stop and cool the engine before adding fuel. NO SMOKING! Failure to obey warnings can cause an explosion or fire.

W–2063–0887

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 which can result in injury or death.

W–2103–1285

Remove the fuel fill cap (Item 1) **[B]**.

Use a clean, approved safety container to add fuel of the correct specifications. Add fuel only in an area that has free movement of air and no open flames or sparks. NO SMOKING **[B]**.

Install and tighten the fuel fill cap (Item 1) **[B]**.

Fuel Filter

See the Service Schedule Page 1–3 for the service interval when to remove the water from the fuel filter.

Turn the fuel shut–off valve (Item 2) **[A]** clockwise to shut–off the fuel supply.

Loosen the drain (Item 1) **[D]** at the bottom of the filter element to drain the water from the filter.

Open the shut–off valve (Item 2) **[A]**.

See the Service Schedule Page 1–3 for the service interval when to replace the fuel filter.

Clean the area around the fuel filter. Close the shut–off valve **[A]**.

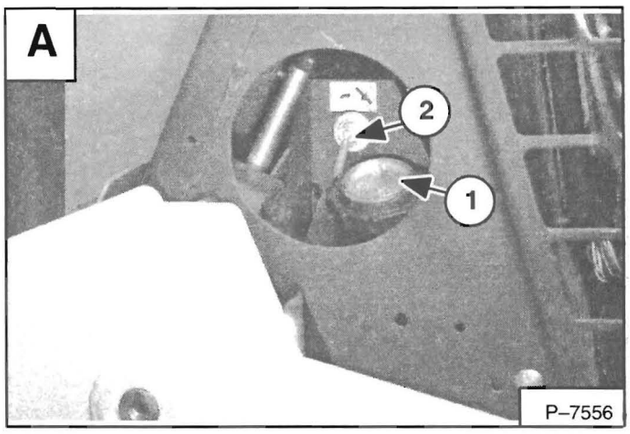
Remove the fuel filter **[D]**.

NOTE: Be sure the filter gasket is removed with the old fuel filter.

Install the new filter element.

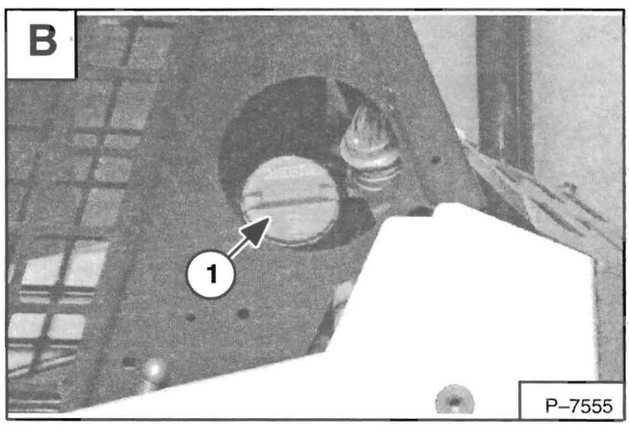
Open the shut–off valve **[A]**.

A



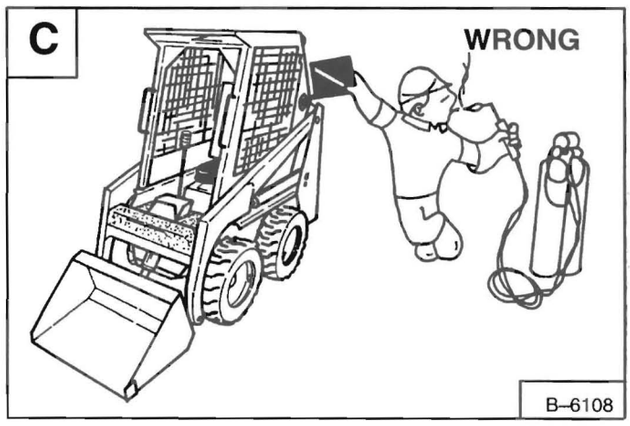
P–7556

B



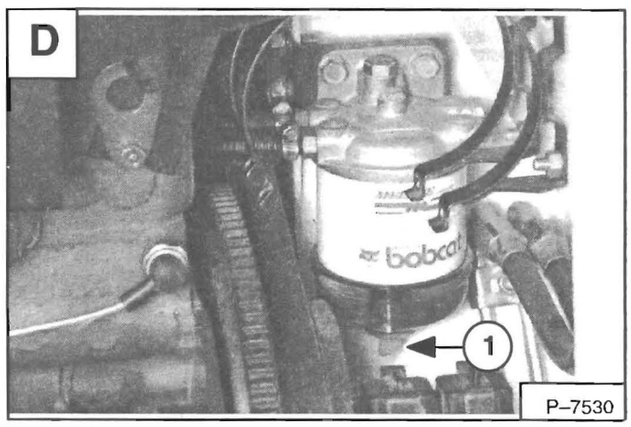
P–7555

C



B–6108

D



P–7530

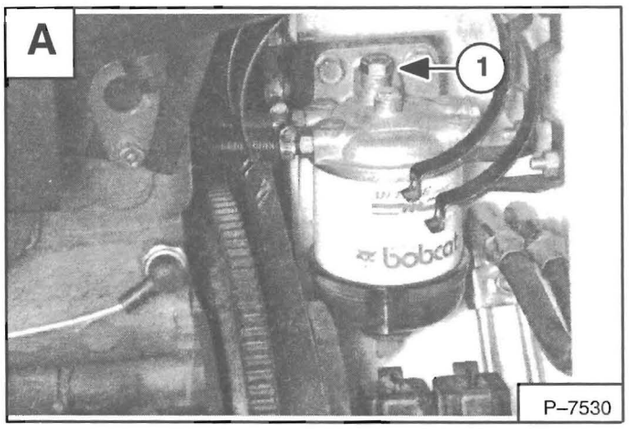
453 Loader:

Removing Air From The Fuel System

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

Open the rear door. The engine must be cool.

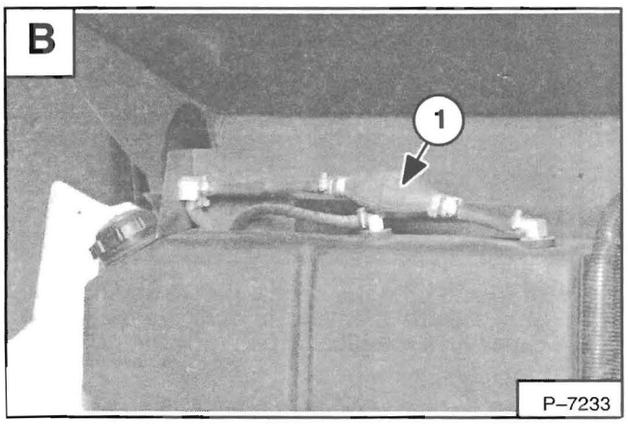
Open the vent plug (Item 1) **[A]**.



Operate the hand pump (Item 1) **[B]** until fuel flows from the vent plug with no air bubbles.

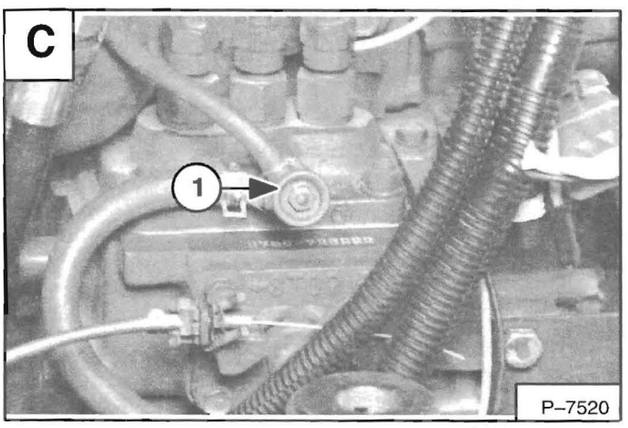
Tighten the vent plug.

Operate the hand pump until it feels solid **[B]**.



Move the engine speed control to minimum RPM. Open the valve (Item 1) **[C]** and squeeze the hand pump several times.

Start the engine. When the engine runs smoothly, close the valve (Item 1) **[C]**.



⚠ WARNING

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 which can result in injury or death.

W–2103–1285

ENGINE LUBRICATION SYSTEM

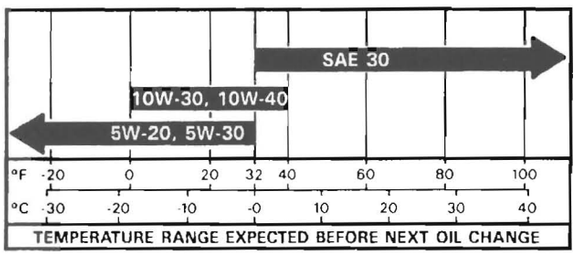
450 Loader:

Check the oil level every day **[A]**.

Stop the engine and remove the dipstick (Item 1) **[A]**. Keep the oil level between the ADD and FULL marks on the dipstick.

Use a good quality motor oil that has the correct API Service Classification. (See the Chart.)

RECOMMENDED SAE VISCOSITY GRADES



(Use API Classification SF)

Straight 30 weight oil is preferred. If multi–viscosity oil is used, be aware of resulting increase in oil consumption and in combustion deposits when used in temperatures above 32°F (0°C).

Using oil other than SF–quality, or oil change intervals longer than recommended could reduce engine life. Damage to engine due to improper maintenance or use of incorrect oil quality and/or viscosity is not covered by the engine warranty

Replacing Oil And Filter

See the *SERVICE SCHEDULE* Page 1–3 for the service interval for replacing the engine oil and filter.

Use the following procedure to replace the engine oil and filter:

Operate the engine until it is at operating temperature. Stop the engine.

Open the rear door.

Remove the drain plug (Item 1) **[B]**. Drain oil into a container.

Remove the oil filter (Item 1) **[C]** at the suggested interval.

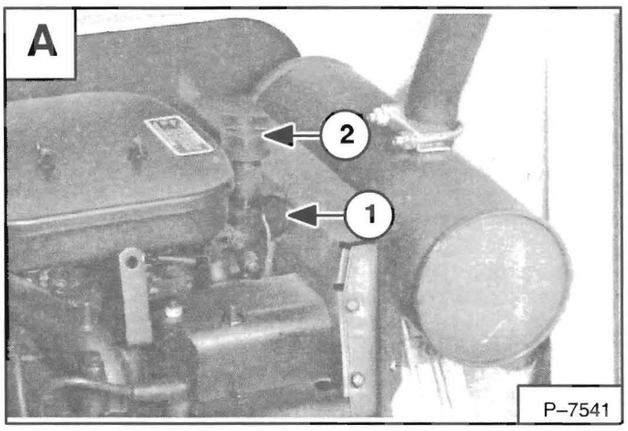
After all the oil is removed from the engine, install the plug and tighten.

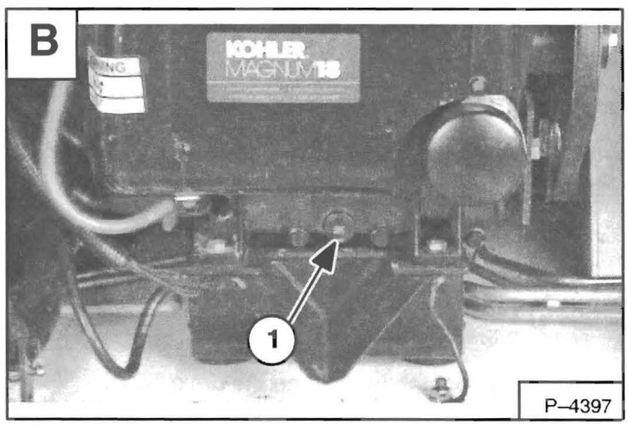
Clean the filter contact surface on the engine.

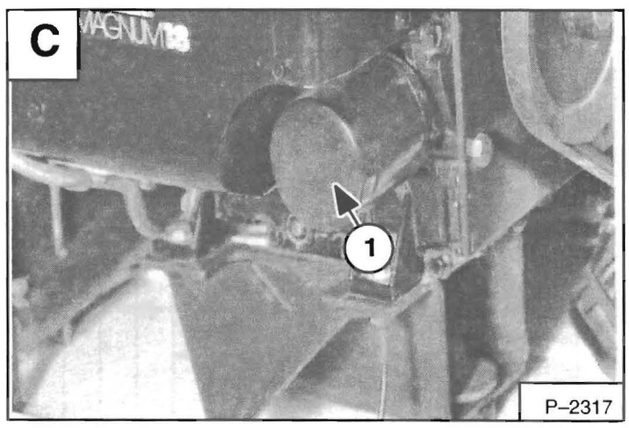
Put clean oil on the gasket of the new filter. Install filter and tighten hand tight.

Remove the fill cap (Item 2) **[A]**. Add the correct amount of oil. (See *SPECIFICATIONS* Page 1–3.) (See the Chart for the correct oil.) Install the oil fill cap.

Start the engine and let it run for several minutes. Stop the engine. Check the oil level. Add oil as needed if it is not at the top mark on the dipstick.







ENGINE LUBRICATION SYSTEM (Cont'd)

453 Loader:

Check the oil level every day.

Stop the engine and remove the dipstick (Item 1) **[A]**.

Keep the oil level between the marks on the dipstick.

Use a good quality motor oil that meets API Service Classification of CD. (See Oil Chart Below).

Replacing Oil And Filter

See the *SERVICE SCHEDULE* Page 1–3 for the service interval for replacing the engine oil and filter.

Run the engine until it is at operating temperature. Stop the engine.

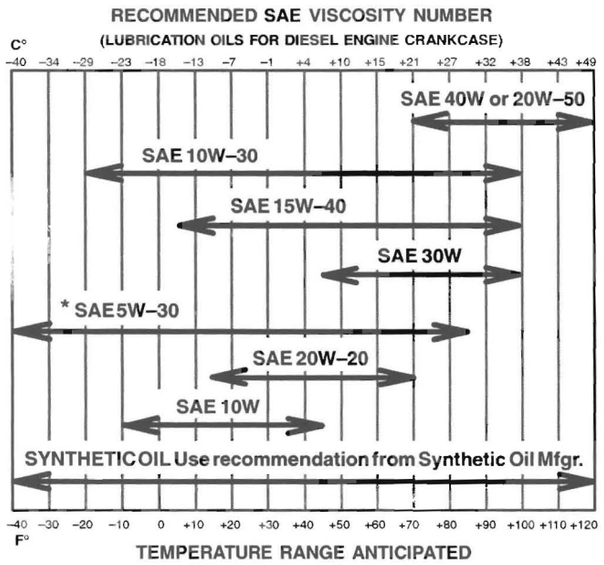
Open the rear door. Remove the cap from the end of the hose and drain the oil into a container **[B]**.

Remove the filter (Item 2) **[A]**.

Clean the filter housing surface. Put clean oil on the gasket of the new filter. Install the filter and hand tighten.

Turn the oil fill cap (Item 1) **[C]** counterclockwise to remove the cap.

Install and tighten the cap on the drain hose.

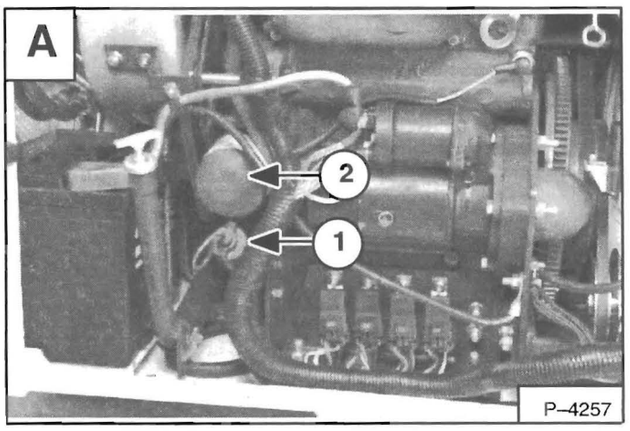


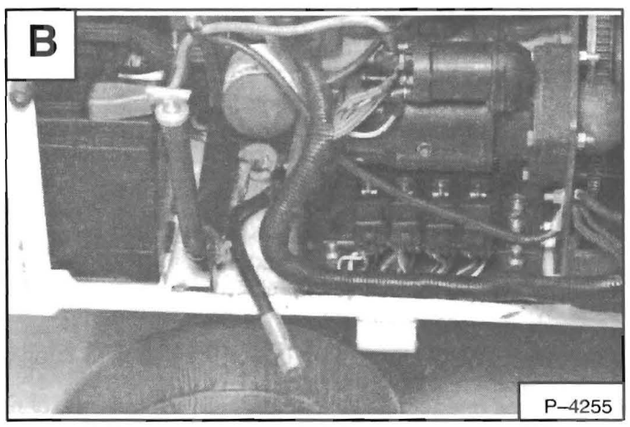
* Can be used **ONLY** when available with appropriate diesel rating.

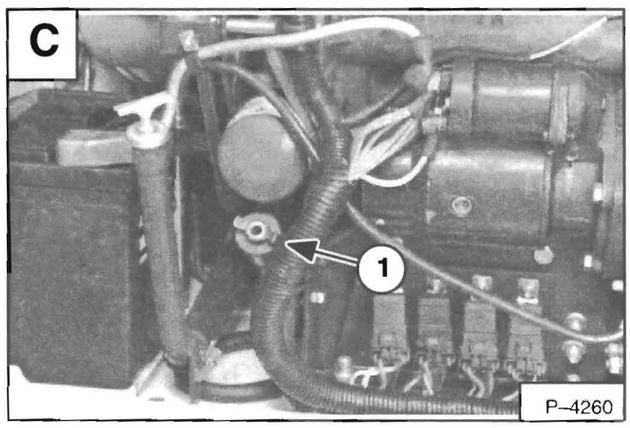
Fill to capacity. (See *SPECIFICATION* Section, Page 9–1.)

Start the engine and let it run for about 5 minutes. Check for leaks at the filter. Check the oil level. Add oil until the level is at the FULL mark on the dipstick. Install the oil filler cap (Item 1) **[C]**.

NOTE: DO NOT overfill the crankcase.







ENGINE COOLING SYSTEM

450 Loader:

The engine area and the engine cooling fins must be kept clean and free of debris or overheating will result.

⚠ WARNING

Wear safety glasses to prevent eye injury when any of the following conditions exist:

- **When fluids are under pressure.**
- **Flying debris or loose material is present.**
- **Engine is running.**
- **Tools are being used.**

W–2019–1285

Cleaning The Cooling System

Remove the shroud on the engine to check the cooling fins **[A]**.

Clean deposits from the cooling fins **[B]**.

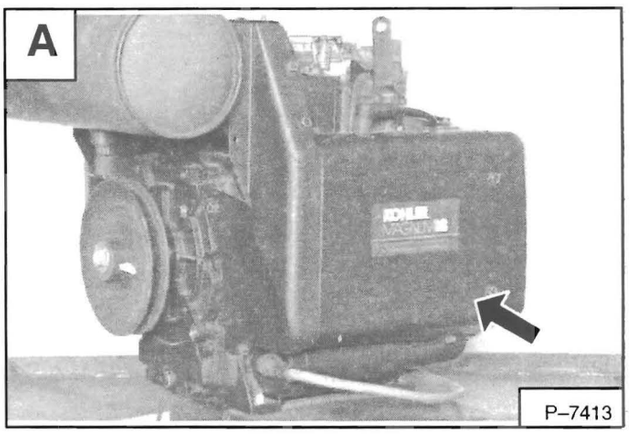
Replace all the covers and shroud after cleaning the cooling system.

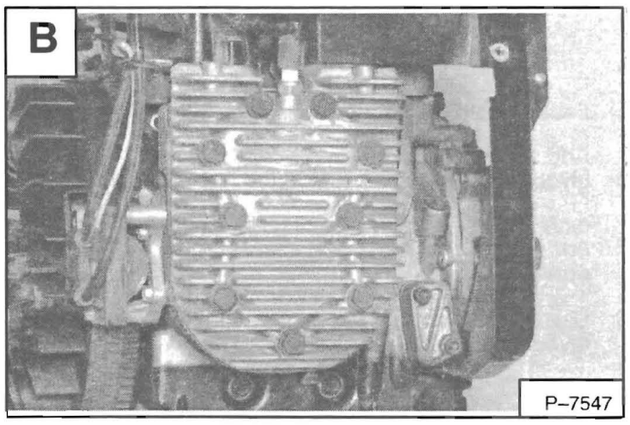
IMPORTANT

Never run the engine with any of the covers or air ducts removed. Overheating will damage the engine and hydraulic/hydrostatic system.

I–2020–1285

Check the condition of the rubber seal in the rear door. The rubber seal must be in good condition to prevent overheating of the engine.





COOLING SYSTEM

453 Loader:

Check the cooling system every day to prevent overheating, loss of performance or engine damage.

Checking The Coolant Level

Open the rear door.

The coolant recovery tank (Item 1) **[A]** is located between the radiator and the right upright.

The coolant level in the recovery tank must be between the maximum and minimum mark when engine is cool **[A]**.

NOTE: The loader is factory filled with propylene glycol coolant. DO NOT mix propylene glycol with ethylene glycol.

Propylene Glycol

Add premixed coolant; 47% water and 53% propylene glycol to the recovery tank if the coolant level is low.

One gallon and one pint of propylene glycol mixed with one gallon of water is the correct mixture of coolant to provide a –34°F (–37°C) freeze protection.

Use a refractometer to check the condition of propylene glycol in your cooling system.

NOTE: Coolant testing strips are available for checking the coolant condition. (See your Bobcat loader dealer.)

Cleaning The Cooling System

Open the rear door.

Use air pressure or water pressure to remove the debris in the area of the radiator and oil cooler.

Removing Coolant From The Cooling System

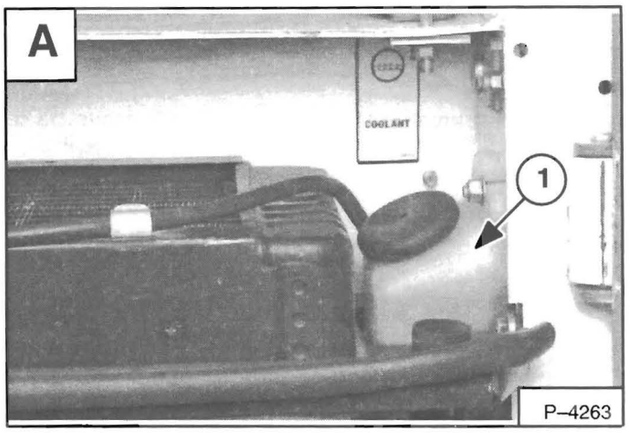
Open the rear door.

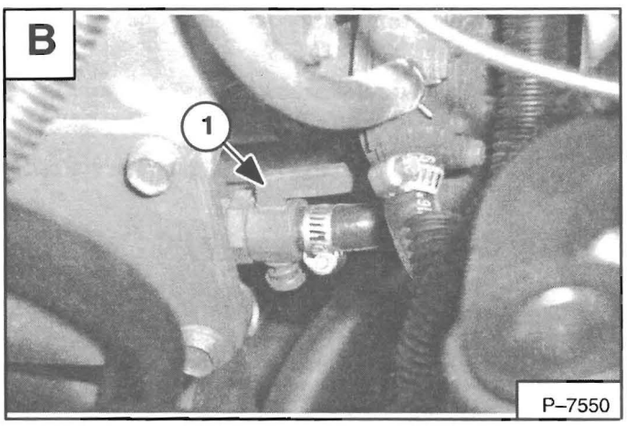
Raise the operator cab. (See Page 1–9.)

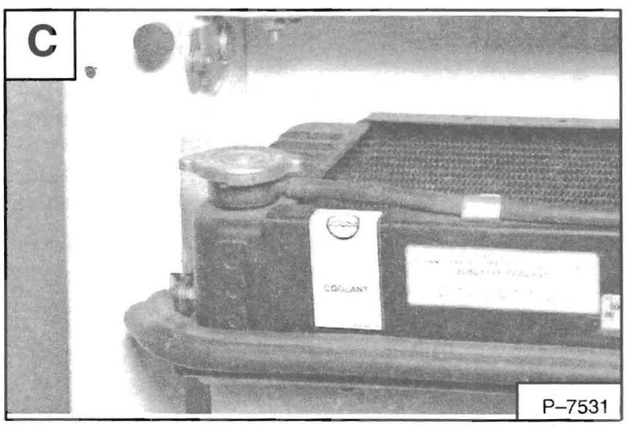
Connect a hose (Item 1) **[B]** to the valve to keep the coolant out of the engine compartment.

Remove the radiator cap **[C]**.

Turn the valve so the lever is toward the outlet of the valve.







⚠ WARNING

Wear safety glasses to prevent eye injury when any of the following conditions exist:

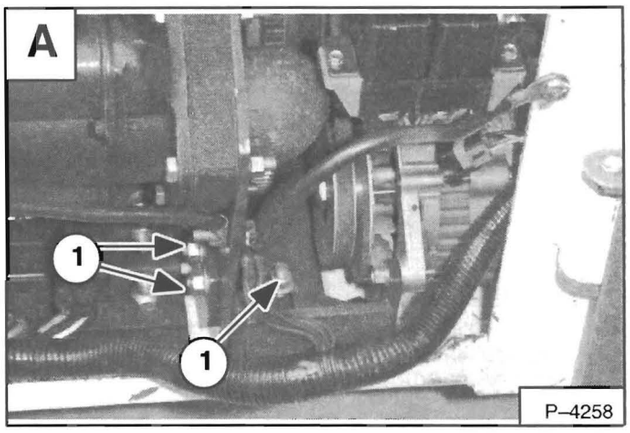
- **When fluids are under pressure.**
- **Flying debris or loose material is present.**
- **Engine is running.**
- **Tools are being used.**

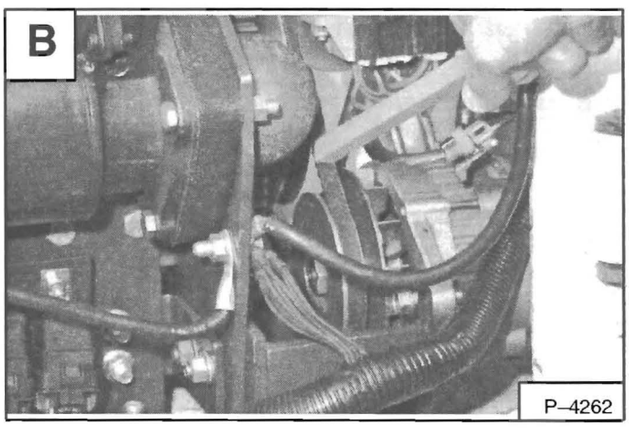
W–2019–1285

ALTERNATOR BELT ADJUSTMENT (453)

Stop the engine.

Loosen the three mounting bolts (Item 1) **[A]** and move the alternator bracket. Set the belt tension to 1/4 inch (6 mm) movement between pulleys with 15 pounds (67 N) of force **[B]**. Tighten the three adjustment bolts.





ELECTRICAL SYSTEM

Description

450: The loader has a 12 volt, negative ground flywheel alternator charging system. The alternator is located behind the flywheel.

453: The loader has a 12 volt, negative ground alternator charging system.

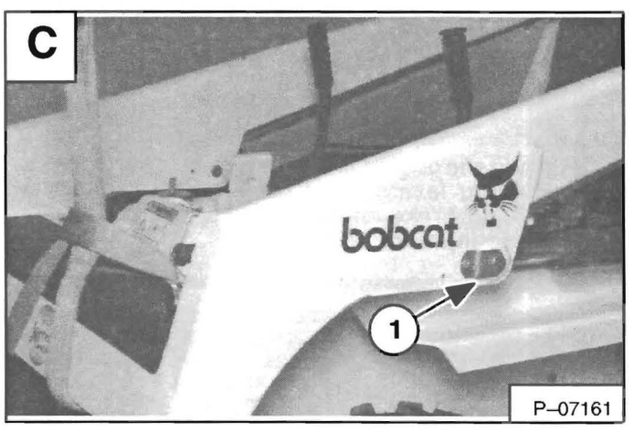
The electrical system is protected by 6 fuses.

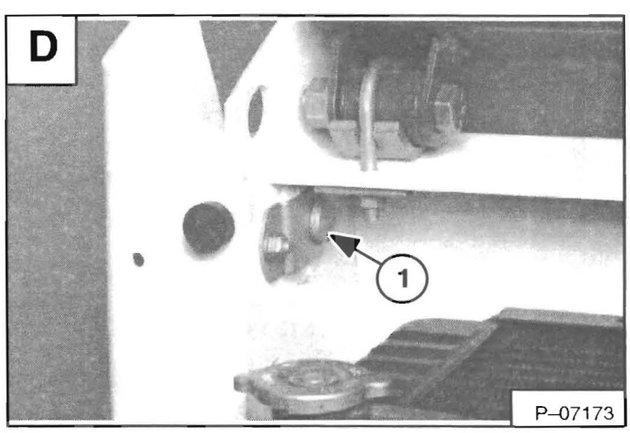
PIVOT PINS

All lift arm and cylinder pivots have a large pin held in position with a retainer bolt and lock nut (Item 1) **[C]** & **[D]**.

Check that the lock nuts are tightened to 8–10 ft.–lbs. (11–13 Nm) torque.

Do not over–tighten.





SPARK ARRESTOR MUFFLER

See the *SERVICE SCHEDULE* Page 1–3 for correct service interval. Do not operate the loader with a defective exhaust system.

⚠ WARNING

Stop engine and allow the muffler to cool before cleaning the spark chamber. Wear safety goggles. Failure to obey can cause serious injury.

W–2011–1285

When an engine is running in an enclosed area, fresh air must be added to avoid concentration of exhaust fumes. If the engine is stationary, vent the exhaust outside. Exhaust fumes contain odorless, invisible gases which can kill without warning.

W–2050–1285

Cleaning The Spark Arrestor Muffler

Stop the engine. Open the rear door.

Remove the plug (Item 1) **[A]** & **[B]** from the bottom of the muffler.

⚠ WARNING

When the engine is running during service, the steering levers must be in neutral and the parking brake engaged. Failure to do so can cause injury or death.

W–2006–0284

⚠ WARNING

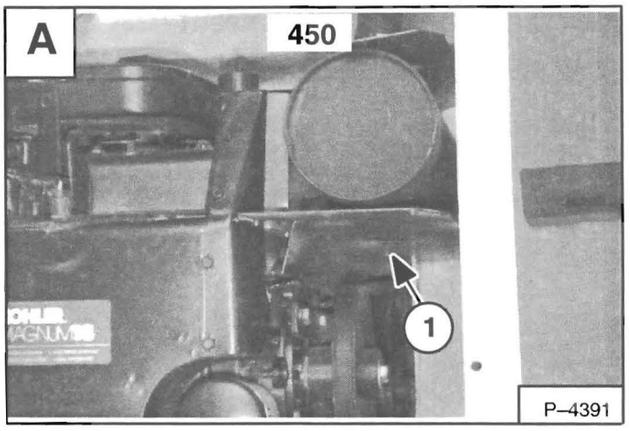
Never use machine in atmosphere with explosive dust or gases or where exhaust can contact flammable material. Failure to obey warnings can cause injury or death.

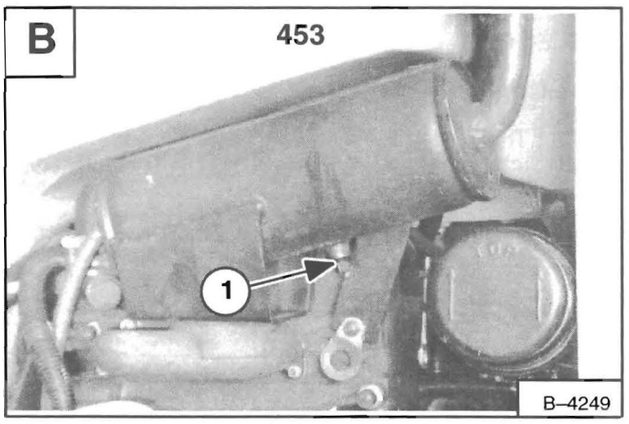
W–2068–1285

Start the engine.

Have a second person (wearing safety goggles) hold a block of wood over the outlet of the muffler (with the engine running) for about 10 seconds.

Stop the engine and install the plug. Close the rear door.





IMPORTANT

This loader is factory equipped with a U.S.D.A. Forestry Service approved spark arrestor muffler. It is necessary to do maintenance on this spark arrestor muffler to keep it in working condition. The spark arrestor muffler must be serviced by dumping the spark chamber every 100 hours of operation.

If this machine is operated on flammable forest, brush or grass covered land, it must be equipped with a spark arrestor attached to the exhaust system and maintained in working order. Failure to do so will be in violation of California State Law, Section 4442 PRC.

Make reference to local laws and regulations for spark arrestor requirements.

I–2022–0595

HYDRAULIC/HYDROSTATIC SYSTEM

The hydraulic and hydrostatic systems use the same hydraulic fluid reservoir.

The system has an engine driven gear pump that supplies fluid to the control valve, lift and tilt cylinders.

Fluid also goes from the control valve to the hydrostatic transmission pumps to provide charge pressure and cooling.

A 10 micron filter element is installed on the left side of the engine compartment. This filter is used to clean the fluid for the hydrostatic transmission.

⚠ WARNING

Diesel fuel or hydraulic fluid under pressure can penetrate skin or eyes, causing serious injury or death. Fluid leaks under pressure may not be visible. Use a piece of cardboard or wood to find leaks. Do not use your bare hand. Wear safety goggles. If fluid enters skin or eyes, get immediate medical attention from a physician familiar with this injury.

W–2072–0496

Checking And Adding Fluid

Put the Bobcat loader on a level surface. Lower the lift arms and tilt the bucket fully backward.

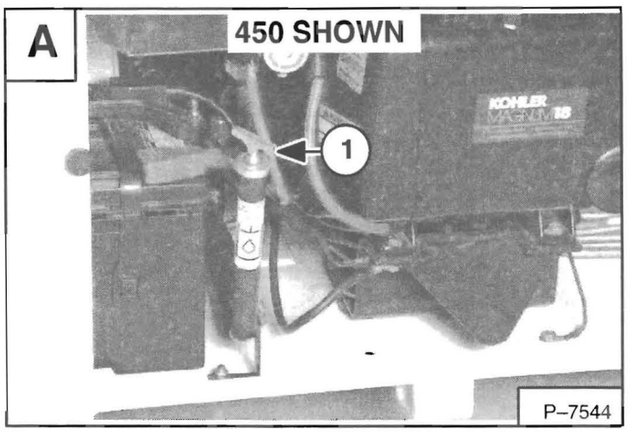
Open the rear door. Remove the dipstick (Item 1) **[A]**.

The fluid level is correct if the fluid level is between the marks on the dipstick.

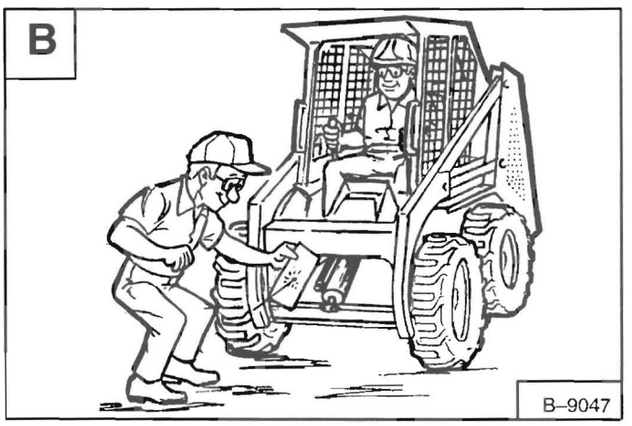
NOTE: The dipstick may indicate an incorrect level of fluid when first removed because of expansion or contraction of oil in the fill tube. Always (1) remove the dipstick, (2) wipe the dipstick, (3) insert the dipstick again and (4) re–check the fluid level.

If fluid is needed, remove the diptstick (Item 1) **[A]** and add fluid to the reservoir until the level is correct.

A



B

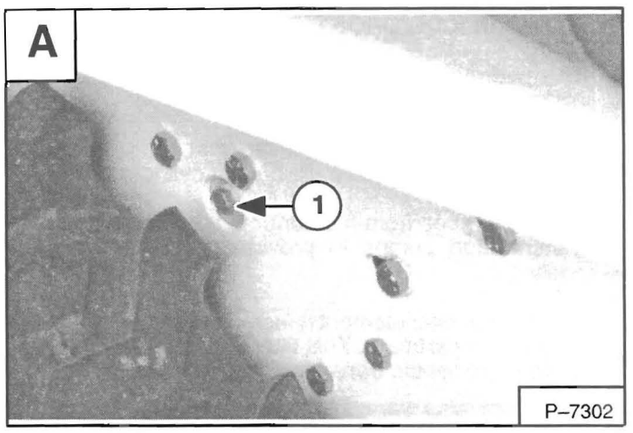


Replacing The Hydraulic/Hydrostatic Filter Element

See the *SERVICE SCHEDULE* Page 1–3 for the correct service interval.

Stop the engine. Open the rear door. Raise the operator cab. (See Page 1–9 for the correct procedure.) Clean the area around the filter housing. Remove the plug (Item 1) **[A]** from the filter housing (located on the outside of the loader at the right side).

After the fluid is drained from the filter, install the plug (Item 1) **[A]** and tighten.



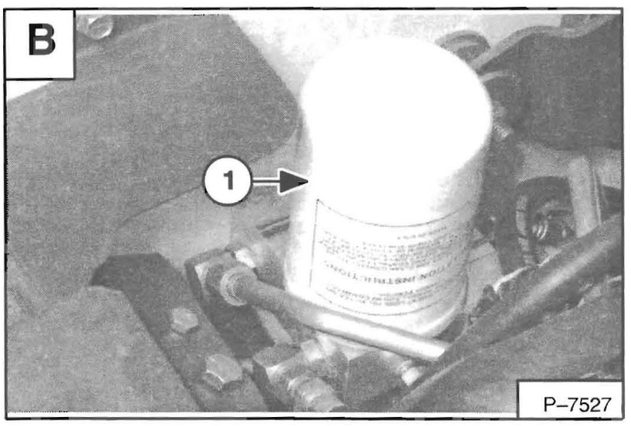
Remove the filter element (Item 1) **[B]**.

Clean the surface of the filter housing where the filter element seal contacts the filter housing.

Put grease on the seal of the filter element, install the element and hand tighten only.

Lower the operator cab.

Start the engine and operate the loader through the hydraulic and hydrostatic functions. Stop the engine. Check the fluid level and add fluid to the reservoir as needed.



Removing The Hydraulic/Hydrostatic Fluid

See the *SERVICE SCHEDULE* Page 1–3 for the service interval to replace the fluid. The fluid must also be replaced if it becomes contaminated and after any major repairs.

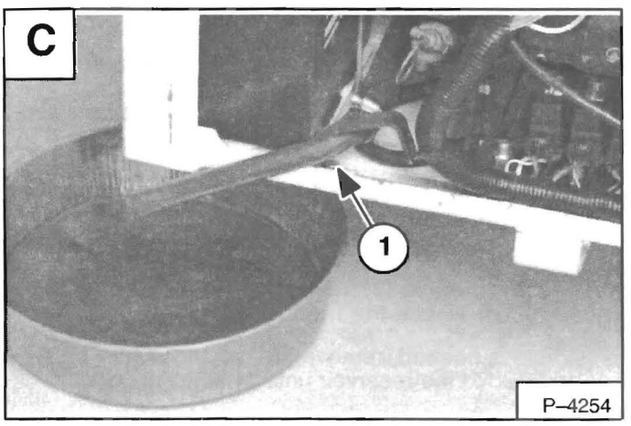
Stop the engine. Open the rear door.

Remove the fill cap/dipstick.

Loosen the nut (Item 1) **[C]** which fastens the fill tube to the loader frame.

Loosen the clamp at the fill tube, turn the fill tube down to drain the fluid from the reservoir **[C]**.

After the fluid is removed, put the fill tube in the correct position, tighten the hose clamp and tighten the bolt.



Replace the hydraulic filter element.

Add hydraulic/hydrostatic fluid to the reservoir. (See *SPECIFICATIONS*, Page 9–1 for the correct fluid.)

Do Not over–fill the reservoir.

FINAL DRIVE TRANSMISSION (CHAINCASE)

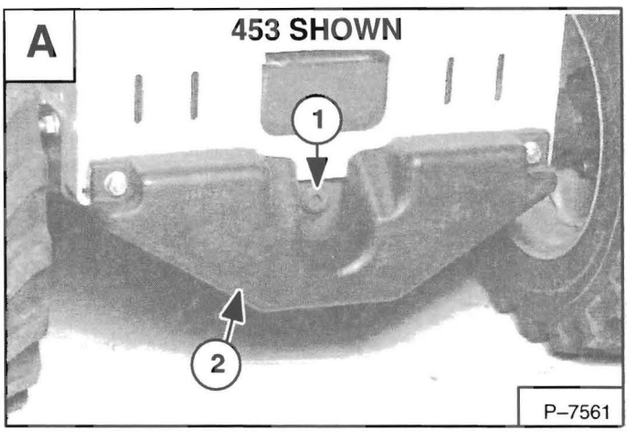
The chaincase contains the final drive sprockets and the chains and is filled with the same type of fluid as is used in the hydraulic system. (See *SPECIFICATIONS*, Page 9–1.)

Checking And Adding Oil

Put the loader on a level surface.Remove the plug (Item 1) **[A]** from the front of the chaincase. If the fluid can be reached with the tip of your finger through the hole, the level is correct.

Add fluid through the check plug hole until the fluid flows from the hole. Install and tighten the plug.

NOTE: Counterweight (Item 2) [A] is used on 453 loaders only.

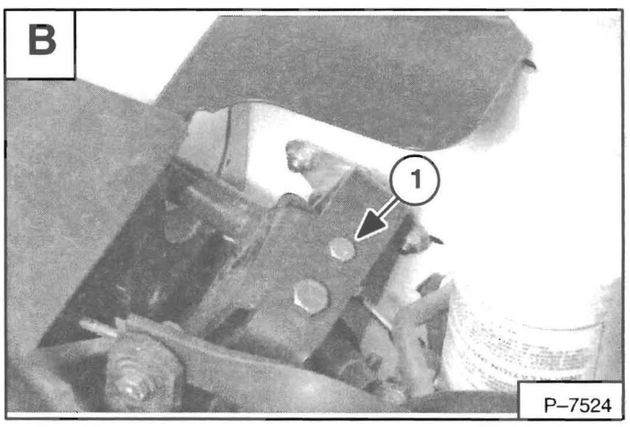


AUXILIARY CONTROL LOCKBOLT

The Auxiliary control has a lockbolt (Item 1) **[B]** that must be removed to use the optional auxiliary hydraulics.

Raise the operator cab. (See Page 1–9.)

Remove the nut and bolt (Item 1) **[B]** from the right hand steering lever.



TIRE MAINTENANCE

Wheel Nuts

See the *SERVICE SCHEDULE* Page 1–3 for the service interval to check the wheel nuts. The correct torque is 40–45 ft.–lbs. (54–61 Nm) .

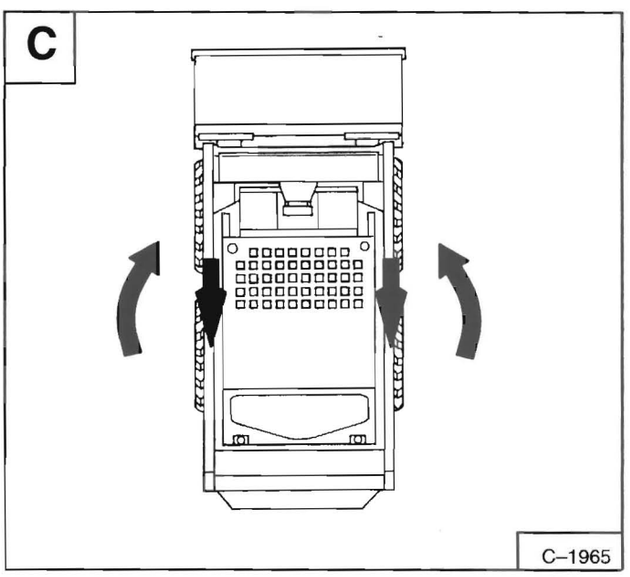
Tire Rotation

Check the tires regularly for wear, damage and pressure. (See *SPECIFICATIONS*, Page 9–1 for the correct tire pressure.)

Rear tires usually wear faster than front tires. To keep tire wear even, move the front tires to the rear and rear tires to the front **[C]**.

It is important to keep the same size tires on each side of the loader. If different sizes are used, each tire will be turning at a different rate and cause excessive wear. The tread bars of all the tires must face the same direction.

Recommended tire pressure must be maintained to avoid excessive tire wear and loss of stability and handling capability. Check for the correct pressure before operating the loader.



Tire Inflation

Tires are to be repaired only by an authorized person using the proper procedures and safety equipment. Tires and rims must always be checked for correct size before mounting. Check rim and tire bead for damage.

The rim flange must be cleaned and free of rust. The tire bead and rim flange must be lubricated with a rubber lubricant before mounting the tire, avoid excess pressure which can rupture the tire and cause serious injury or death. During inflation of the tire, check the tire pressure frequently to avoid over–inflation.

LUBRICATING THE LOADER

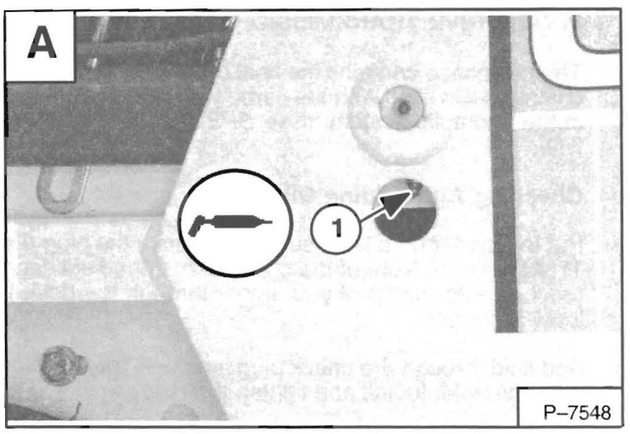
Lubricate the loader as specified in the *SERVICE SCHEDULE* Page 1–3 for the best performance of the loader.

Record the operating hours each time you lubricate the Bobcat loader.

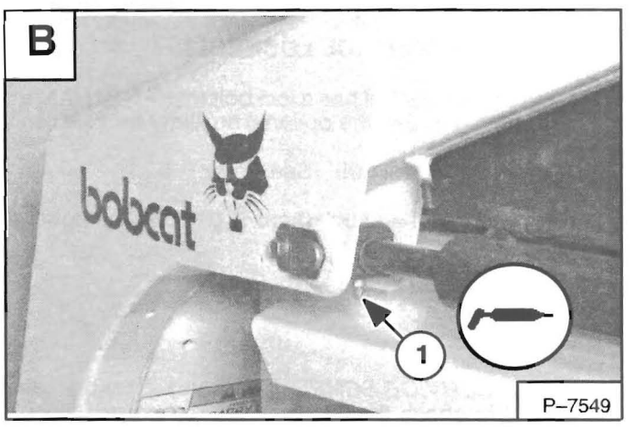
Always use a good quality lithium based multi–purpose grease when you lubricate the loader. Apply the lubricant until extra grease shows.

Lubricate the following locations on the loader:

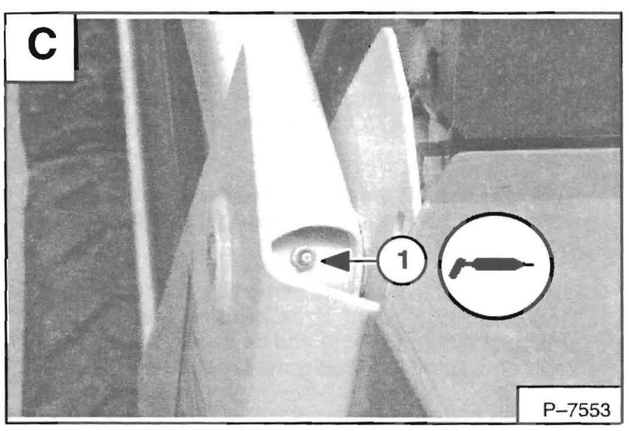
Base End Lift Cylinder (Item 1–Both sides) **[A]**.



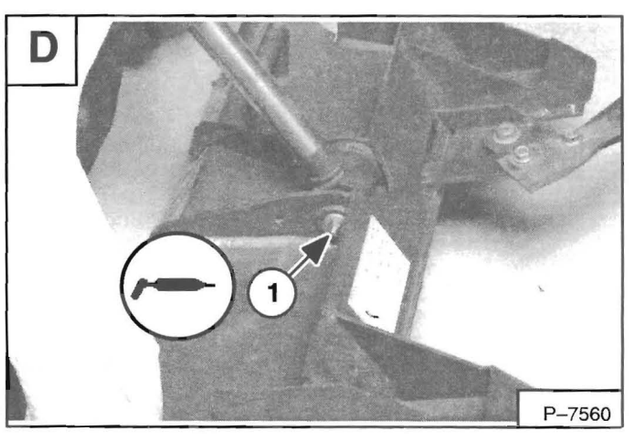
Rod End Lift Cylinder (Item 1–Both sides) **[B]**.



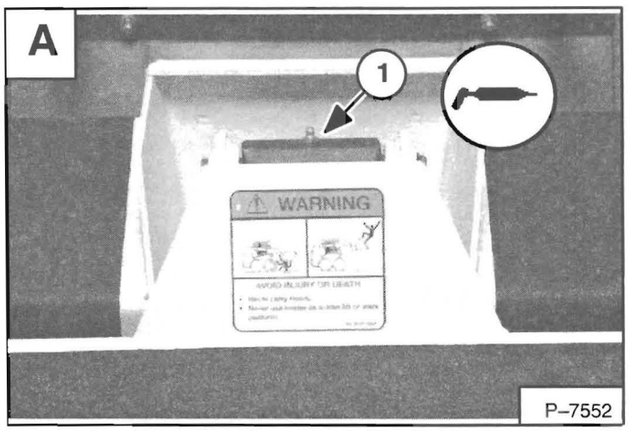
Lift Arm Pivot Pin (Item 1–Both sides) **[C]**.



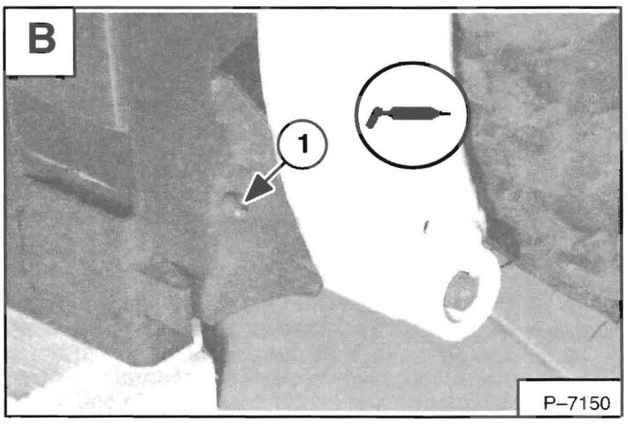
Rod End Tilt Cylinder (Item 1) **[D]**.



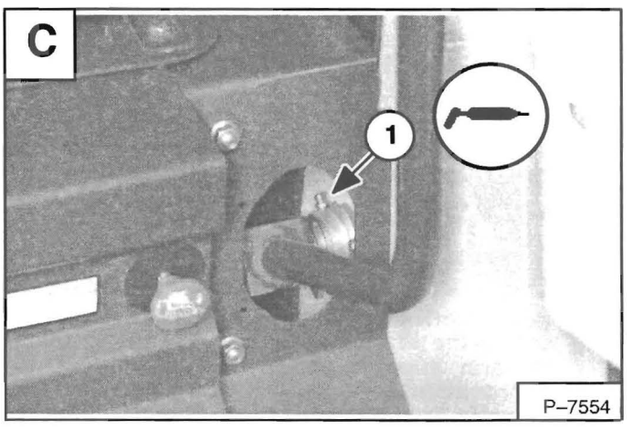
Base End Tilt Cylinder (Item 1) **[A]**.



Bob–Tach pivot pins (Item 1) **[B]** (Both sides).



Steering shaft pivot bearings (Item 1) **[C]** (Both sides).



NOTE: If the steering levers do not move freely, see page 2–1 to disassemble and lubricate the plastic bushings.

BOB–TACH

Check for free movement of wedges and Bob–Tach levers.

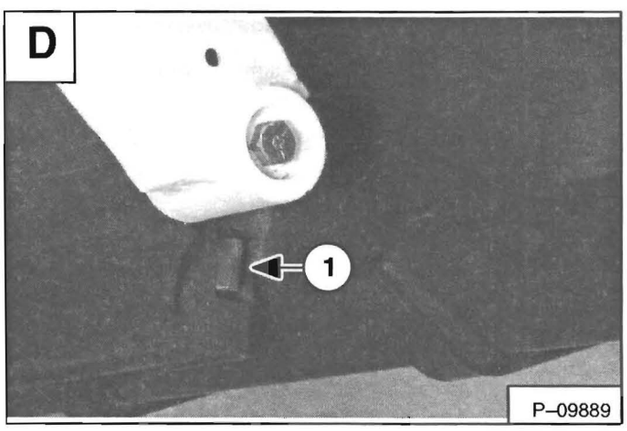
The wedges (Item 1) **[D]** must extend far enough to engage the holes in the attachment.

⚠ WARNING

Bob–Tach wedges must extend through the holes in attachment. Lever(s) must be fully down and locked. Failure to secure wedges can allow attachment to come off and cause injury or death.

W–2102–0497

Replace wedges that are bent or broken.



REMOTE START SWITCH

The tool listed will be needed to do the following procedure:

MEL1429–B – Remote Start Switch Kit

Kit Includes:

MEL1429–1 Adapter
MEL1429–2 Start Switch
MEL1429–3 Adapter

⚠ WARNING

Put jackstands under the front axles and rear corners of the frame before running the engine for service. Failure to use jackstands can allow the machine to fall or move and cause injury or death.

W–2017–0286

The Remote Start Switch is required when the operator cab is in the raised position for service and the service technician needs to start the engine. The operator cab wire harness connectors must be separated from the engine wiring harness connector under the cab.

The remote start switch is required when the service technician is adjusting the steering linkage and checking the hydraulic/hydrostatic system.

Lift and block the loader. (See Page 1–1.)

⚠ WARNING

Never work on a machine with the lift arms up unless the lift arms are secured by an approved lift arm support device. Failure to use an approved lift arm support device can allow the lift arms or attachment to fall and cause injury or death.

W–2059–0598

Raise the lift arms and install the lift arm support device. (See Page 1–7.)

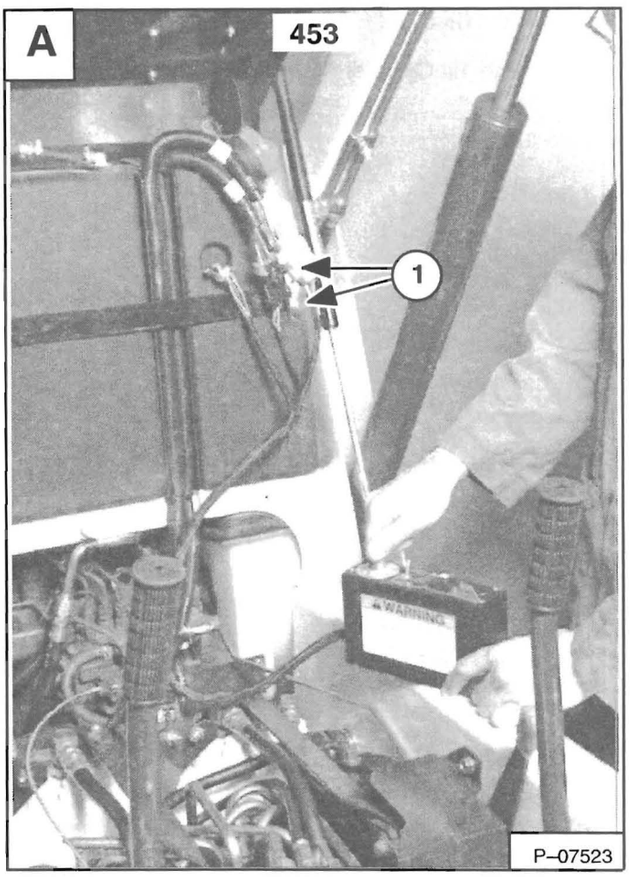
Raise the operator cab. (See Page 1–9.)

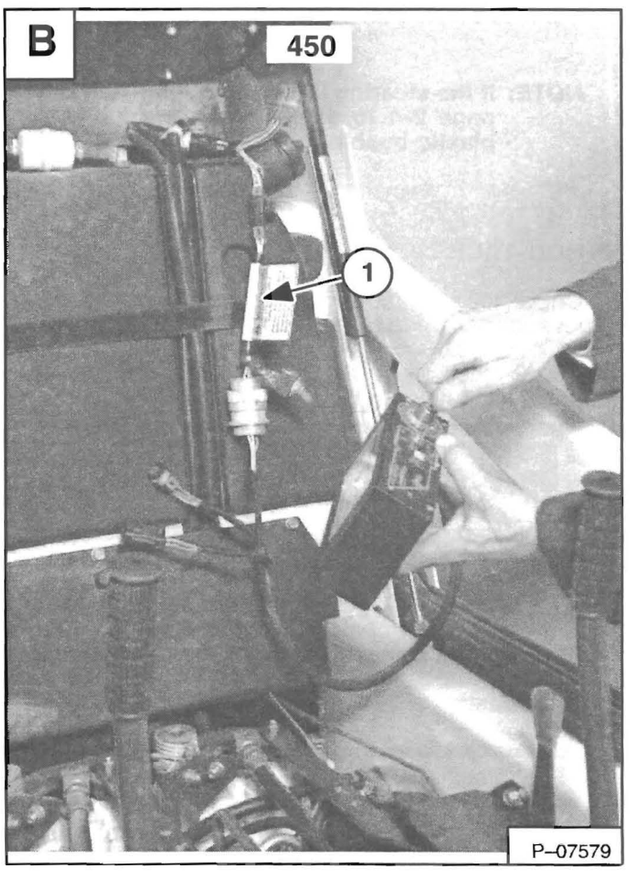
453 Connection

Connect the remote start switch to the connectors (Item 1) **[A]**.

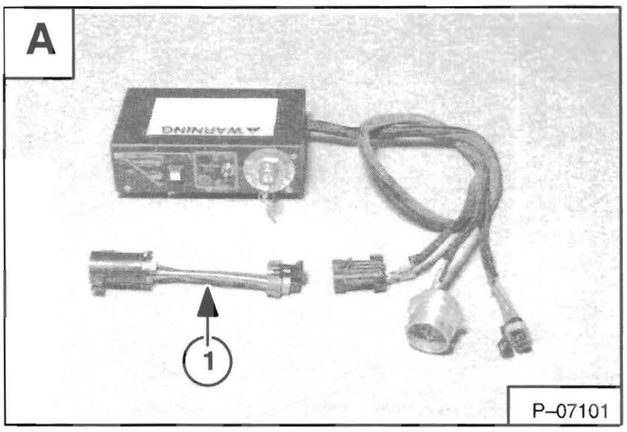
450 Connection

Install the adapter (Item 1) **[B]** between the remote start switch harness and the loader harness.



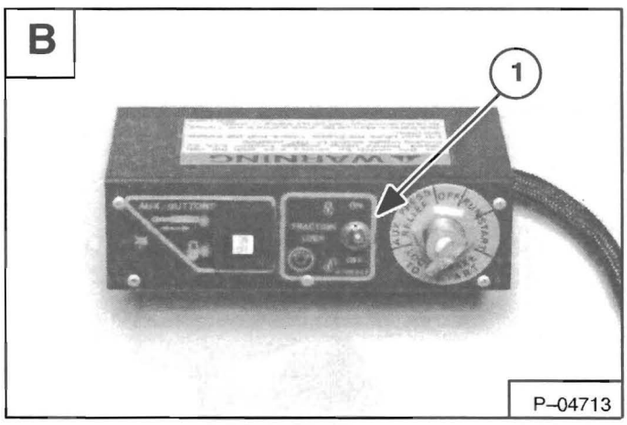


NOTE: On late model loaders, the connector on the BICS™ harness is a round 7–pin connector, NOT a rectangular 8–pin connector. Use the adapter (Item 1) [B] if your loader has a round 7–pin BICS harness connector.



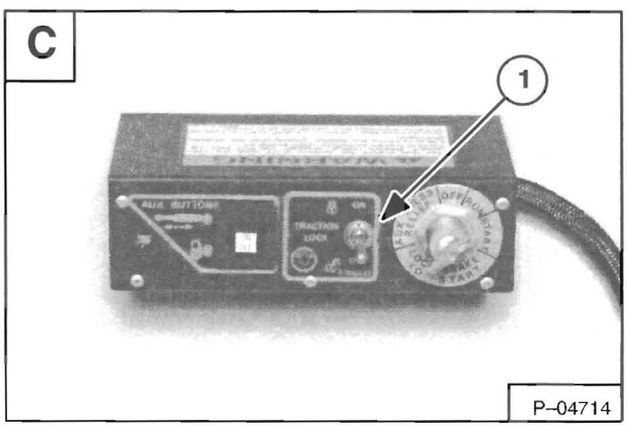
Procedure

Put the traction lock override switch (Item 1) **[B]** in the ON position so the traction function is locked. The wheels are not able to turn.



Turn the key to the right and start the engine.

Move the traction lock override switch (Item 1) **[C]** to the OFF position so the traction function is unlocked. The wheels are now able to turn.




bobcat

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bobcat

HYDRAULIC/HYDROSTATIC SCHEMATIC
453 BICS™ (S/N 515011001 and Above)
(S/N 515111001 and Above)

(Printed May 1997)

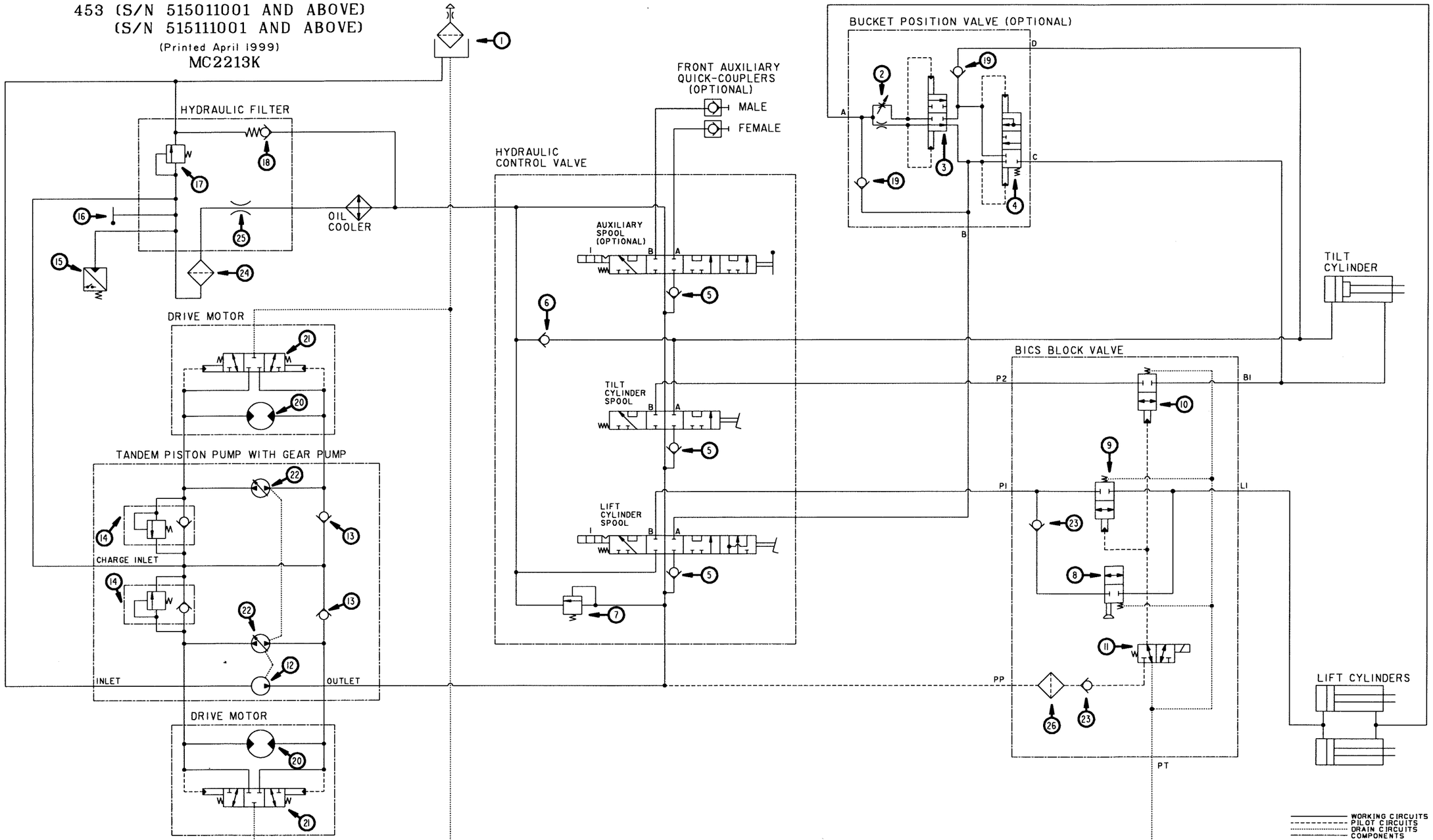
Printed in U.S.A.

MC 2213TK

HYDRAULIC/HYDROSTATIC SCHEMATIC
453 (S/N 515011001 AND ABOVE)
(S/N 515111001 AND ABOVE)

(Printed April 1999)

MC2213K



WORKING CIRCUITS
PILOT CIRCUITS
DRAIN CIRCUITS
COMPONENTS

Printed in U.S.A.

HYDRAULIC/HYDROSTATIC SCHEMATIC
453 BICS™ (S/N 515011001 and Above)
(S/N 515111001 and Above)

(Printed May 1997)

LEGEND

(1) RESERVOIR:
Capacity . . 5.3 Qts. (5.0 L)

(2) FLOW DIVIDER ADJUSTMENT VALVE

(3) PILOT ACTIVATED DIRECTIONAL CONTROL VALVE - FLOW CONTROL SPOOL

(4) PILOT ACTIVATED DIRECTIONAL CONTROL VALVE - UNLOADING SPOOL

(5) LOAD CHECK VALVE

(6) ANTICAVITATION VALVE

(7) RELIEF VALVE - MAIN:
1400-1450 PSI (9652-9996 kPa)

(8) PULL BUTTON ACTIVATED DIRECTIONAL CONTROL VALVE - LIFT ARM BY PASS

(9) PILOT ACTIVATED DIRECTIONAL CONTROL VALVE - LIFT CONTROL ("L1" & "P1")

(10) PILOT ACTIVATED DIRECTIONAL CONTROL VALVE - TILT CONTROL ("B1" & "P2")

(11) SOLENOID ACTIVATED DIRECTIONAL CONTROL VALVE

(12) HYDRAULIC/HYDROSTATIC PUMP:
Gear Type . . . 6.8 GPM (25.7 L/min.) @ 3000 RPM

(13) REPLENISHING VALVE

(14) RELIEF/REPLENISHING VALVE - HIGH PRESSURE: 3400 PSI (23440 kPa)

(15) DIFFERENTIAL PRESSURE SWITCH
17-21 PSI (118-144 kPa)

(16) TEMPERATURE SWITCH
225-232° F. (108-111° C.)

(17) RELIEF VALVE - CHARGE:
85 PSI (586 kPa)

(18) BY PASS VALVE - COOLER:
275 PSI (1896 kPa)

(19) CHECK VALVE - BUCKET POSITION VALVE

(20) FIXED CAPACITY DISPLACEMENT BIDIRECTIONAL HYDRAULIC/HYDROSTATIC MOTOR

(21) DRIVE MOTOR SHUTTLE VALVE

(22) VARIABLE CAPACITY DISPLACEMENT BIDIRECTIONAL HYDRAULIC/HYDROSTATIC PUMP

(23) VARIABLE CAPACITY DISPLACEMENT BIDIRECTIONAL HYDRAULIC/HYDROSTATIC PUMP

(24) FILTER - HYDRAULIC/HYDROSTATIC (CANISTER)

(25) RESTRICTION

(26) RESTRICTION

(27) FILTER - TILT/LIFT LOCK VALVE

(28) CHECK VALVE - TILT/LIFT LOCK VALVE

(29) CHECK VALVE - BUCKET POSITION VALVE

NOTE: Unless otherwise specified, springs have NO significant pressure value.

Printed in U.S.A.

MC 2213LK (5-6-97)

TROUBLESHOOTING

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

⚠ WARNING

Check for correct function after adjustments, repairs or service. Failure to make correct repairs or adjustments can cause injury or death.

W–2004–1285

PROBLEM	CAUSE
The hydraulic system will not operate.	1, 2, 3, 5, 8
The transmission warning light comes ON when hydraulics are operating. (453 Only)	1, 3
Slow hydraulic system action.	1, 3, 4, 6, 8
Hydraulic action is not smooth.	1, 4, 5, 6, 7
Lift arms go up slowly at full engine RPM.	1, 3, 4, 6, 7, 8, 9
The lift arms or Bob–Tach will move when the pedal is in neutral position.	4
The lift arms come down with the pedal in the neutral position.	4, 9, 10, 11

KEY TO CORRECT THE CAUSE

1. The fluid level is not correct.
2. The pedal linkage is disconnected.
3. The hydraulic pump has damage.
4. The pedal linkage is not adjusted correctly.
5. Relief valve is not at the correct pressure.
6. Suction leak on the inlet side of the hydraulic pump.
7. Fluid is cold. Wrong viscosity fluid. (See Section 9.)
8. Using the loader for more than its rated capacity.
9. Internal leak in the lift cylinder(s).
10. External leak from the lift cylinder(s).
11. Damaged lift spool.

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.

I–2003–0888

Tighten Procedures

To tightening the hydraulic fittings, tubelines etc., See Section 9. – *Hydraulic Connection Specifications*, for the correct procedure and torque.

⚠ WARNING

Hydraulic fluid escaping under pressure can have sufficient force to enter a person's body by penetrating the skin. This can cause serious injury and possibly death if proper medical treatment by a physician familiar with this injury is not received immediately.

W–2145–0290

LIFT CYLINDER(S)

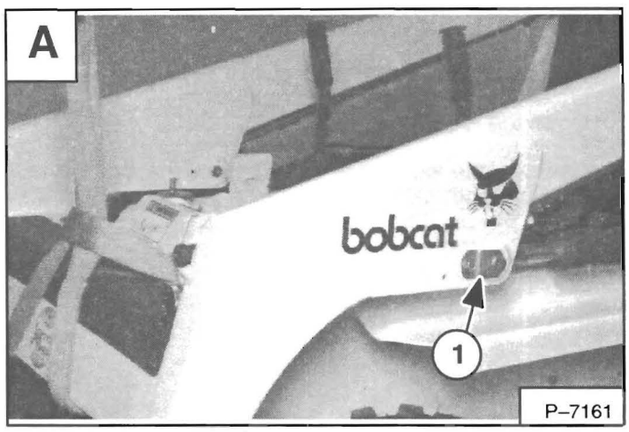
Removal and Installation

Stop the engine. Pull up on the lift arm by–pass control and move the lift pedal to release the hydraulic pressure. Raise the seat bar. Raise the operator cab. (See Page 1–1.)

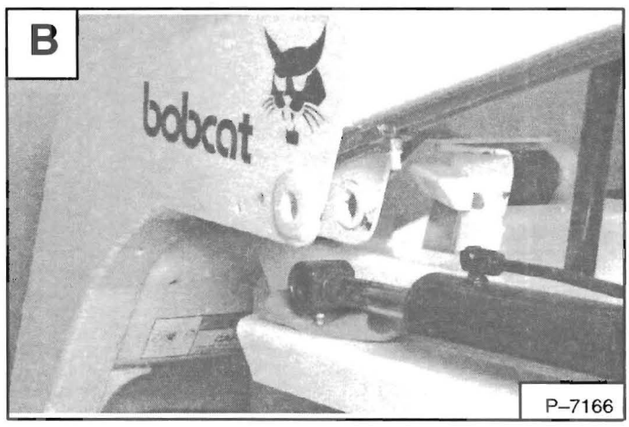
Install a lifting strap around the center of the lift arms crossmember, fasten the strap to a chain hoist and raise the lift arms slightly as shown **[A]**.

Remove the rod end retainer bolt (Item 1) **[A]** from the left cylinder.

Remove the retainer and rod end pin **[A]**.

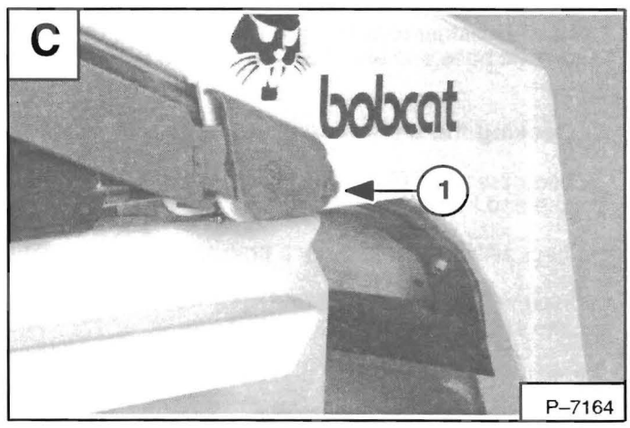


Lower the left cylinder on the fender **[B]**.

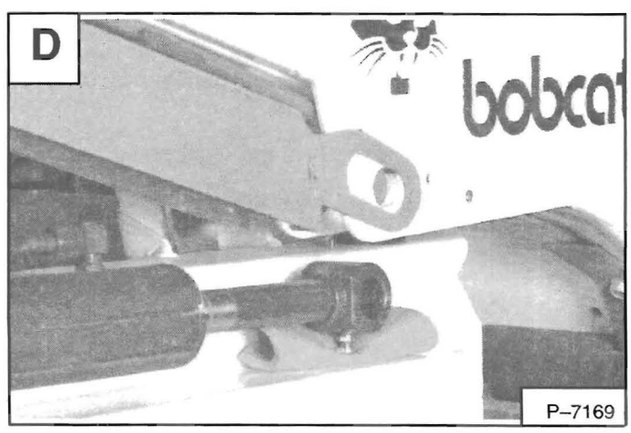


Remove the bolt (Item 1) **[C]** to remove the cover and pivot pin from the right lift cylinder.

Remove the cover and pivot pin **[C]**.



Lower the right lift cylinder to the fender **[D]**.

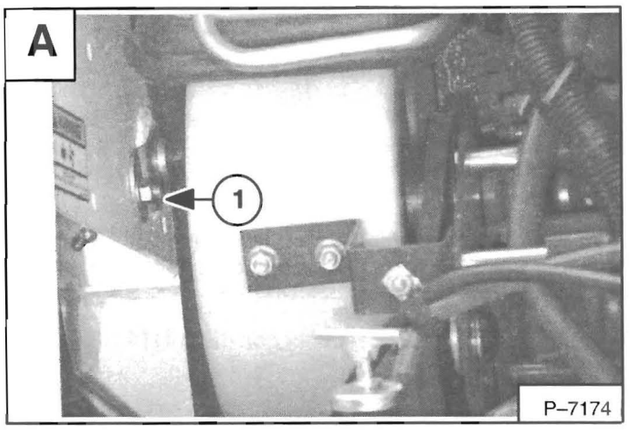


LIFT CYLINDER(S) (Cont'd)

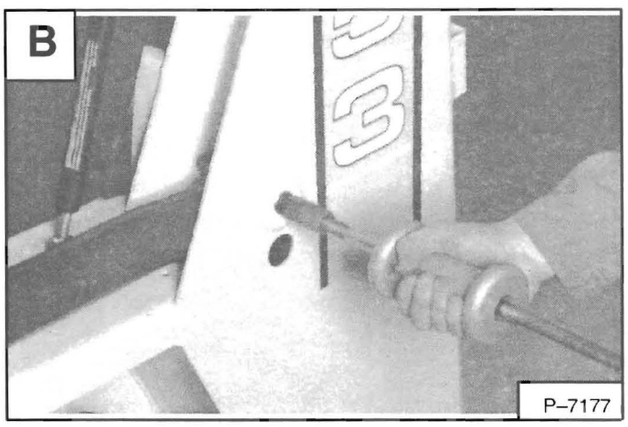
Removal and Installation (Cont'd)

Open the rear door.

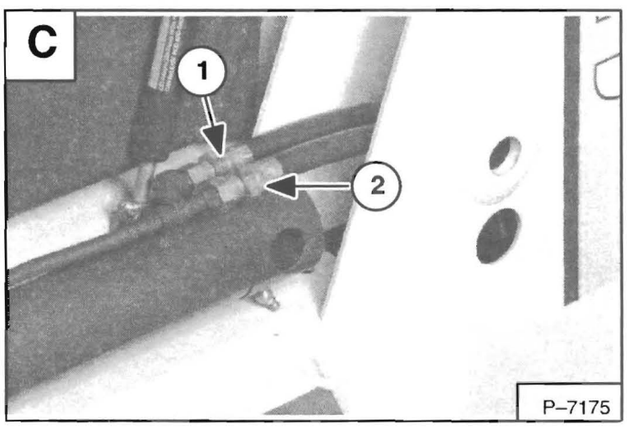
Remove the nut (Item 1) **[A]** from the base end pin retainer (both sides).



Use a slide hammer to remove the pivot pin (both sides) **[B]**.



Pull the cylinder forward to remove the hose (Item 1) **[C]** from the base end and the hose (Item 2) **[C]** from the rod end.



Checking the Lift Cylinder for Internal Leakage

Follow the steps **[A]** through **[C]** to remove the lift cylinder base end from the uprights.

Check only one cylinder at a time.

Disconnect the hose (Item 1) **[C]** from the lift cylinder base end port.

Install a plug in the hose and tighten the plug.

Lower the seat bar, engage the parking brake and start the engine.

Push the top (toe) of the lift pedal until system relief pressure is reached. Hold for one minute over the system relief pressure.

There should be no leaks at the base end port.

If there is leakage from the open base end port of the lift cylinder, remove the lift cylinder for repair.

TILT CYLINDER

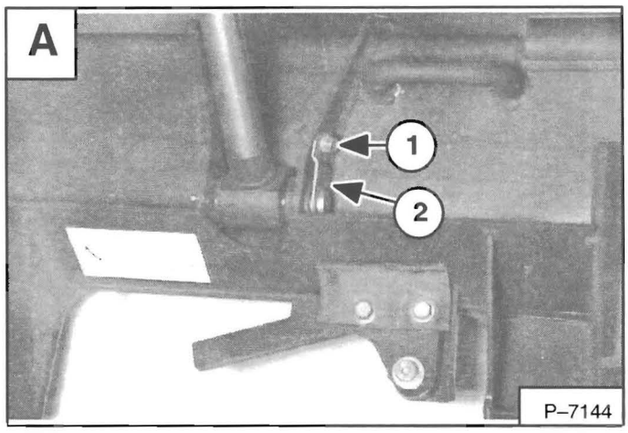
Removal and Installation

Tilt the Bob–Tach fully forward until it rests on the floor.

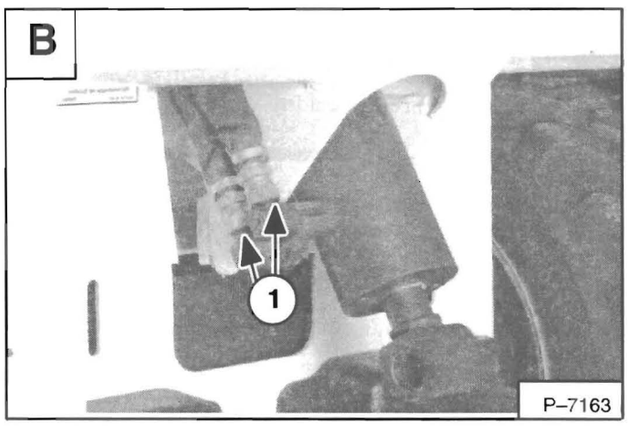
Stop the engine and raise the seat bar.

Remove the bolt (Item 1) **[A]** from the retainer (Item 2) **[A]**.

Remove the pivot pin from the Bob–Tach.



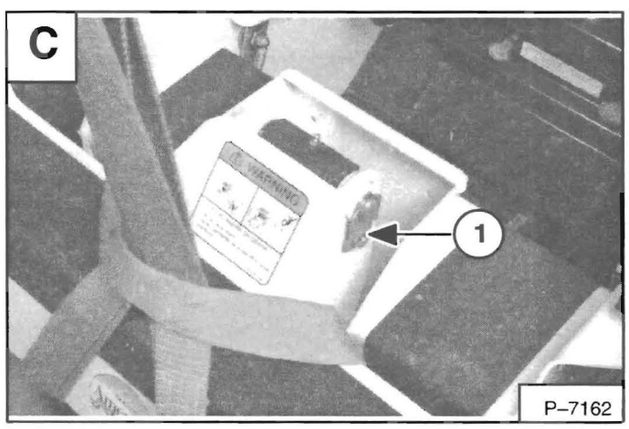
Remove the hoses (Item 1) **[B]** from the tilt cylinder fittings.



Fasten a lifting strap to the center of the lift arms crossmember **[C]**.

Install the lifting strap to a chain hoist and raise the lift arms up for clearance to remove the base end pivot pin from the tilt cylinder.

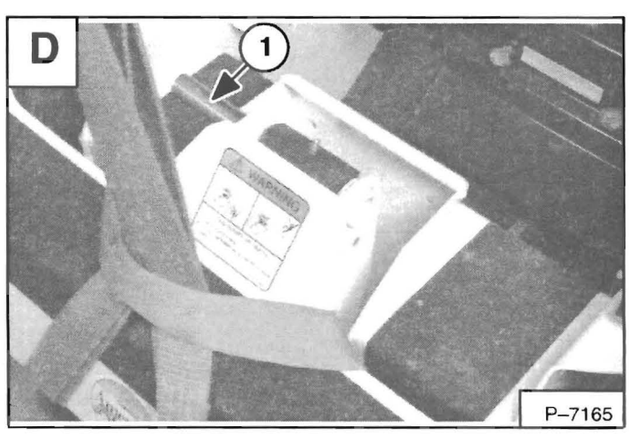
Remove the bolt (Item 1) **[C]** from the pivot pin retainer.



Remove the pivot pin (Item 1) **[D]**.

Remove the tilt cylinder from the loader.

Install the tilt cylinder in the reverse order.



Checking the Tilt Cylinder for Internal Leakage

NOTE: The tilt cylinder is removed from the Bob–Tach for clarity purposes only.

Stop the engine and raise the seat bar.

⚠ WARNING

Hydraulic fluid escaping under pressure can have sufficient force to enter a person's body by penetrating the skin. This can cause serious injury and possibly death if proper medical treatment by a physician familiar with this injury is not received immediately.

W–2145–0290

Disconnect the hose (Item 1) **[A]** from the base end of the tilt cylinder.

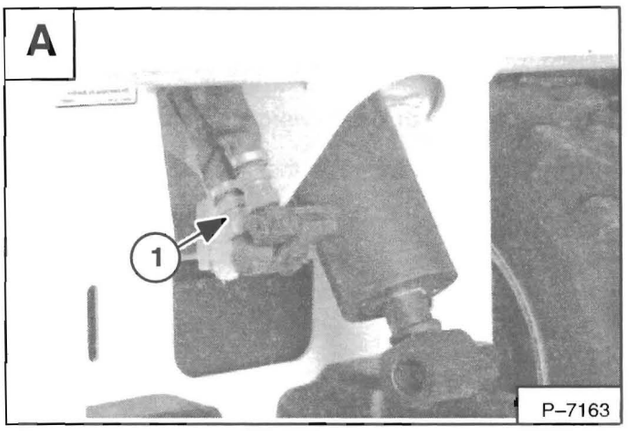
Install a plug in the hose and tighten the plug.

Lower the seat bar, engage the parking brake and start the engine.

Push the bottom (heel) of the tilt pedal until system relief pressure is reached. Hold for one minute over the system relief pressure.

There should be no leaks from the base end port.

If there is leakage from the open port of the tilt cylinder, remove the cylinder for repairs.



HYDRAULIC CYLINDERS

Disassembly and Assembly

Use the following tools to disassemble and assemble the cylinder:

MEL1074 – O–ring Seal Hook
MEL1396 – Seal Installation Tool
MEL1033 – Rod Seal Installation Tool
Piston Ring Compressor
Spanner Wrench

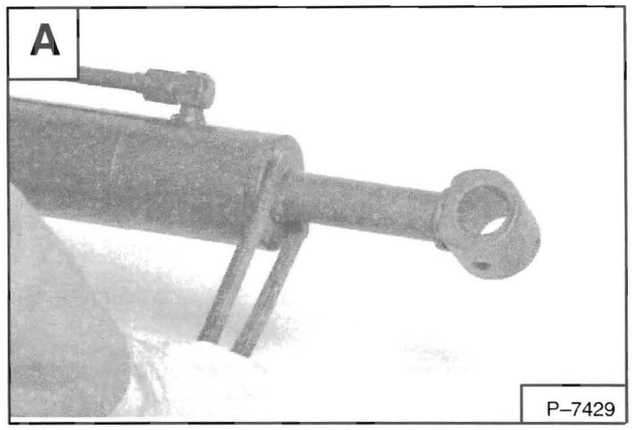
NOTE: The lift cylinder will be used to represent repair for both lift and tilt cylinders. The cylinders internal components are similar. The differences are listed below.

Tilt rod diameter is larger.
Piston relief area is slightly different.
No spacer in the tilt cylinder.
Higher torque for the tilt rod nut.

Hold the hydraulic cylinder over a drain pan and move the rod in and out slowly to remove the fluid from the cylinder.

Put the base end of the cylinder in a vise.

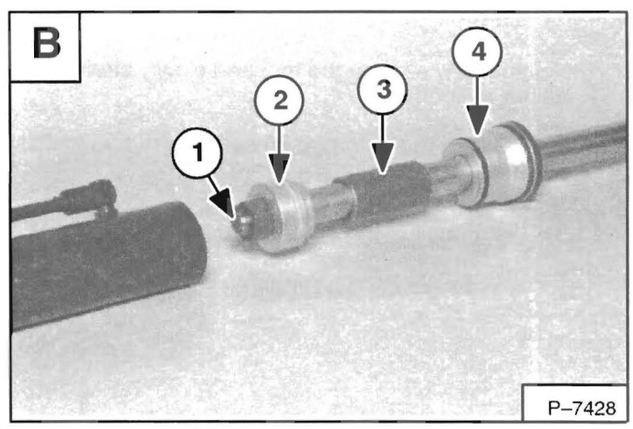
Use a spanner wrench to loosen the head **[A]**.



Remove the head and the rod assembly from the cylinder **[B]**.

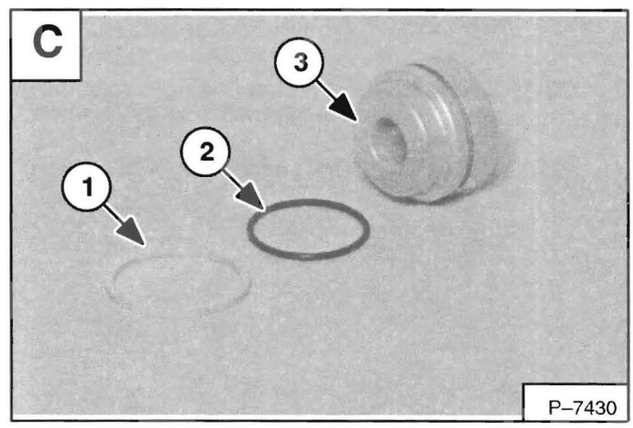
Put the rod end in a vise.

Remove the nut (Item 1) **[B]**, piston (Item 2) **[B]**, spacer (Item 3) **[B]** and head (Item 4) **[B]**.

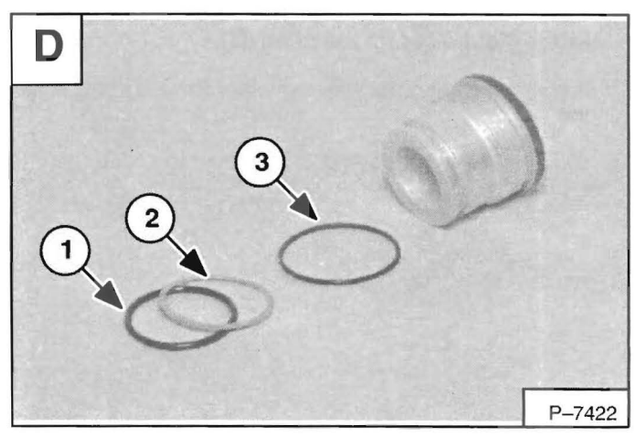


Installation: **Lift:** Tighten the nut to 105 ft.–lbs. (142 Nm) torque.
Tilt: Tighten the nut to 180 ft.–lbs. (244 Nm) torque.

Remove the seal (Item 1) **[C]** and O–ring (Item 2) **[C]** from the piston (Item 3) **[C]**.



Remove the thick O–ring (Item 1) **[D]** and the back up washer (Item 2) **[D]** from the groove in the head. Remove the thin O–ring (Item 3) **[D]**.



HYDRAULIC CYLINDERS (Cont'd)

Disassembly and Assembly (Cont'd)

Remove the wiper seal (Item 1) **[A]**, and the rod seal (Item 2) **[A]**.

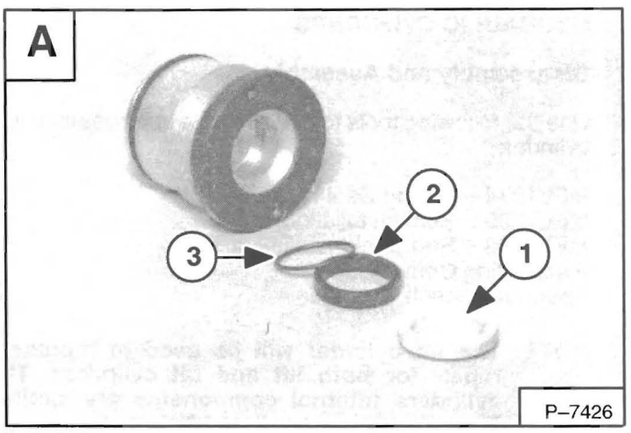
Remove the O–ring (Item 3) **[A]** from the rod seal.

Wash the cylinder parts in solvent and air dry them.

Inspect the cylinder parts for nicks, scratches or other damage. Replace any damaged parts.

Always install new O–rings and seals during assembly.

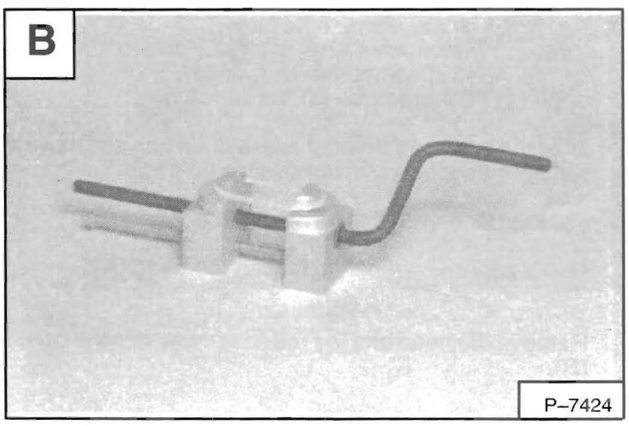
Lubricate all O–rings and seals with hydraulic oil during installation.



Install the new seal on the tool and slowly stretch it until it fits the piston **[B]**.

Allow the seal to stretch for 30 seconds before installing it on the piston.

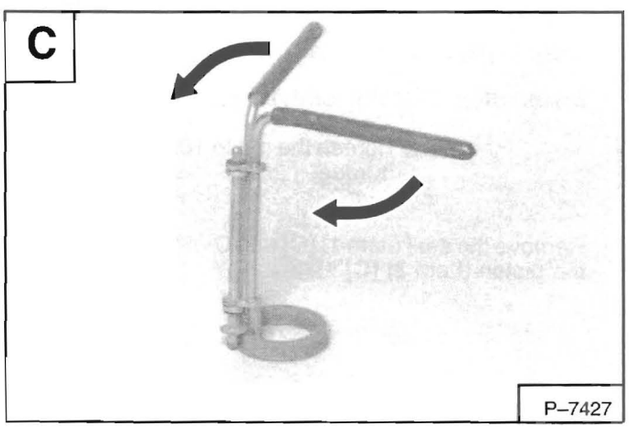
Use a ring compressor to compress the seal to the correct size. Leave the piston in the compressor for about three minutes.



Install the rod seal on the rod seal tool **[C]**.

NOTE: During installation the O–ring side of the seal must be toward the inside of the cylinder.

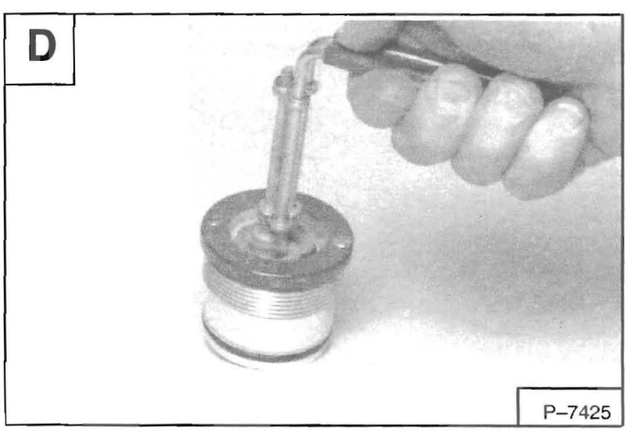
Rotate the handles to collapse the rod seal.



Install the rod seal in the head **[D]**.

Install the wiper seal with the wiper toward the outside of the head.

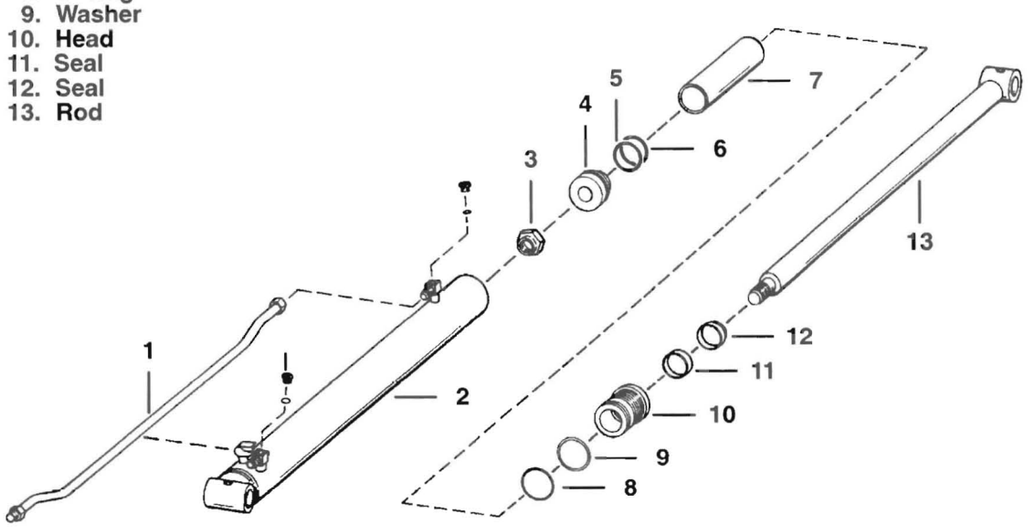
Assemble the cylinder(s) in the reverse order.



HYDRAULIC CYLINDER IDENTIFICATION

Lift Cylinder Identification

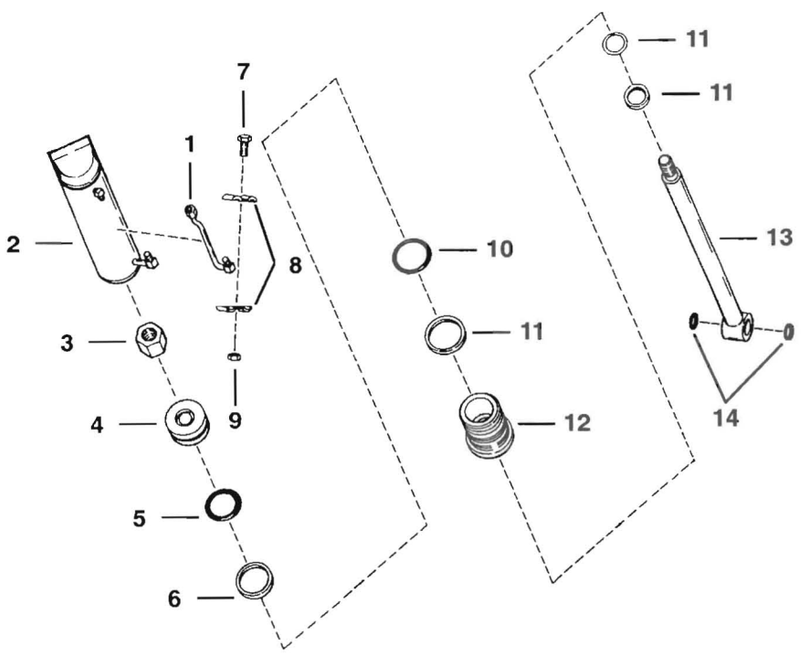
1. Tube
2. Case
3. Nut
4. Piston
5. Ring
6. O–ring
7. Spacer
8. O–ring
9. Washer
10. Head
11. Seal
12. Seal
13. Rod



B–6942

Tilt Cylinder Identification

1. Tubeline
2. Case
3. Nut
4. Piston
5. Seal
6. O–ring
7. Bolt
8. Clamp
9. Nut
10. O–ring
11. Seal
12. Head
13. Rod
14. Seal



C–1808

LIFT ARM BY–PASS BLOCK

Removal And Installation

Put jackstands under the rear corners of the loader.

⚠ WARNING

Never work on a machine with the lift arms up unless the lift arms are secured by an approved lift arm support device. Failure to use an approved lift arm support device can allow the lift arms or attachment to fall and cause injury or death.

W–2059–0598

Raise the lift arms and install the lift arm support device. (See Page 1–1).

⚠ WARNING

Before the cab or the lift arms are raised for service, jackstands must be put under the rear corners of the frame. Failure to use jackstands can allow the machine to tip backward causing injury or death.

W–2014–0895

Raise the operator cab. (See Page 1–1).

Remove the center shield and the steering lever panels. (See Page 3–1.)

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.

I–2003–0888

Install caps and plugs on hoses, tubelines and fittings.

Remove the tubelines and hose from the top of the by–pass block **[A]**.

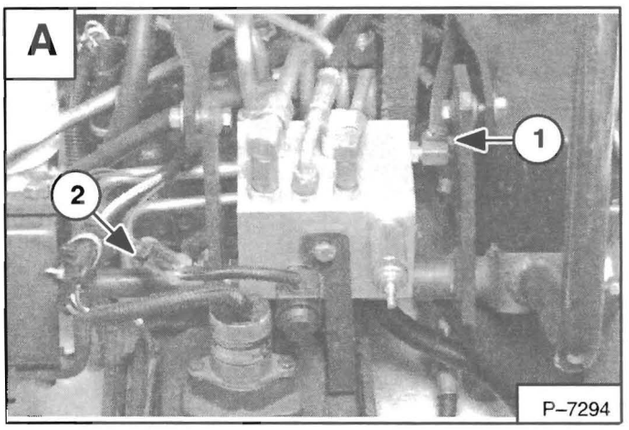
Remove the return hose (Item 1) **[A]**.

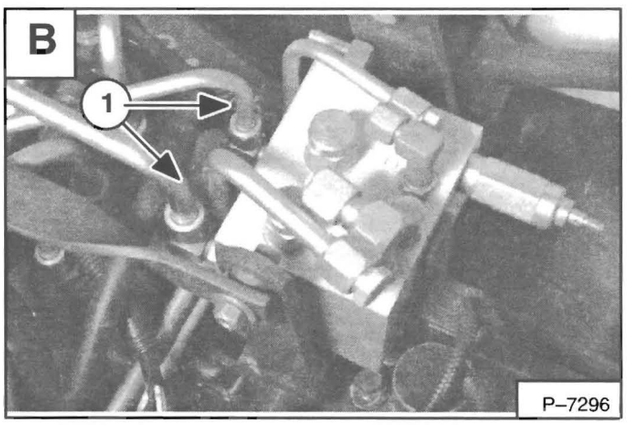
Disconnect the electric solenoid (Item 2) **[A]** from the loader harness.

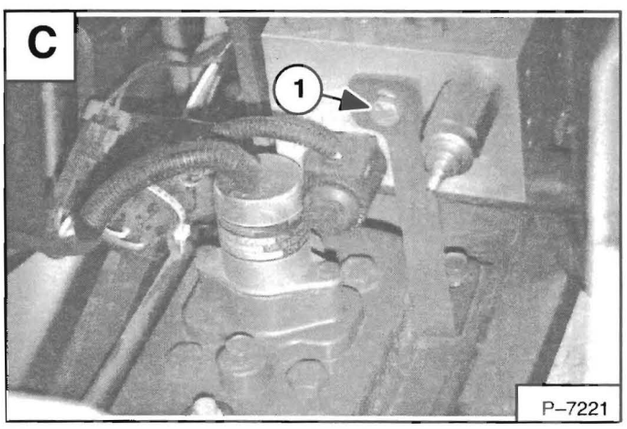
Remove the tubelines (Item 1) **[B]** from the rear of the block.

Remove the bolt (Item 1) **[C]** from the mounting bracket.

Remove the lift arm by–pass block.



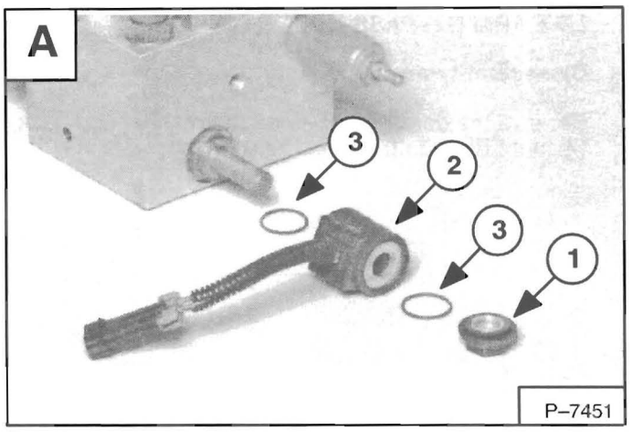




LIFT ARM BY–PASS BLOCK (Cont'd)

Disassembly and Assembly

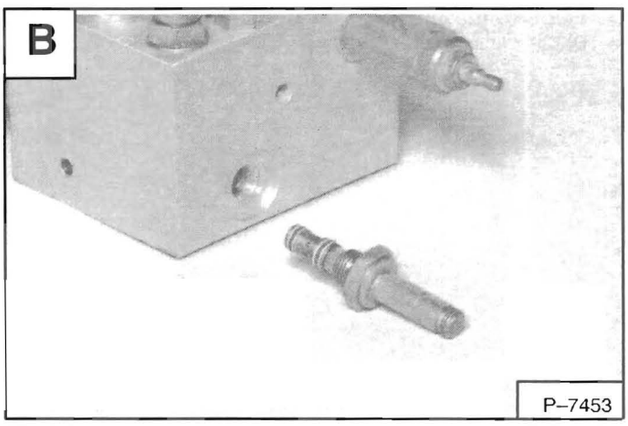
Remove the nut (Item 1) **[A],** the solenoid (Item 2) **[A]** and the O–rings (Item 3) **[A]** from the electric solenoid spool.



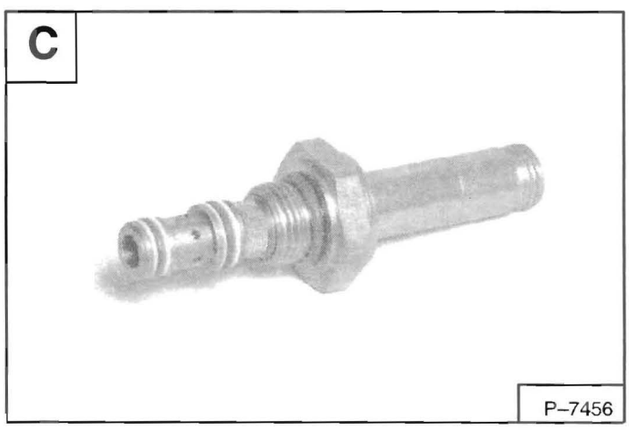
Remove the spool **[B]**.

Reseal if seals are damaged.

Replace the spool if damaged.



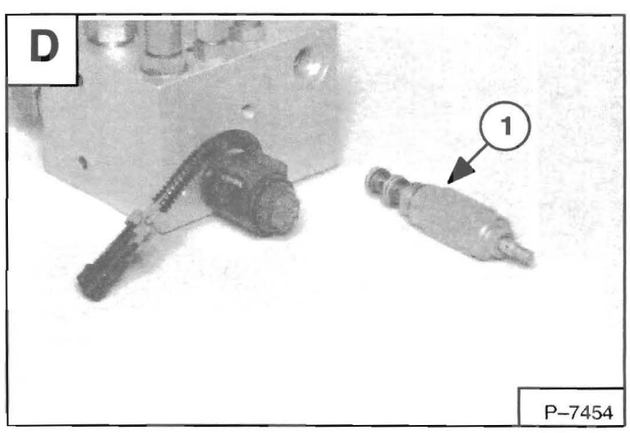
Remove the O–rings and back up washers from the spool **[C]**.



Remove the by–pass valve (Item 1) **[D]** from the block.

Reseal if seals are damaged.

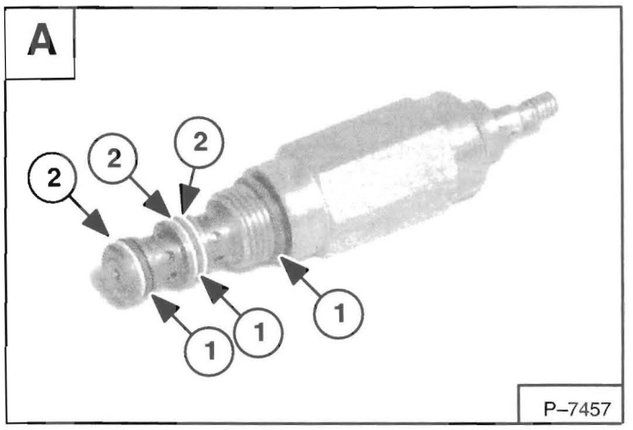
Replace the by–pass valve if damaged.



LIFT ARM BY–PASS BLOCK (Cont'd)

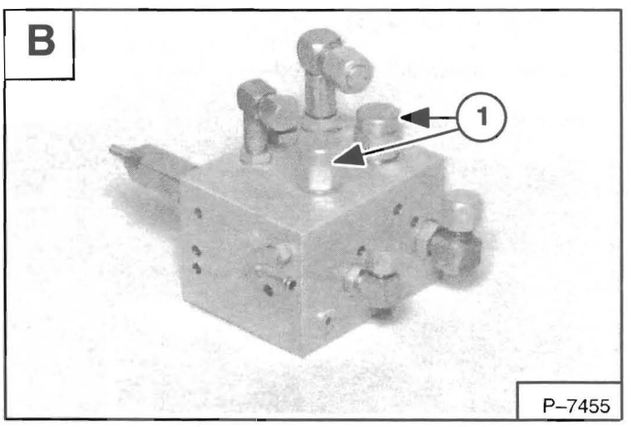
Disassembly and Assembly (Cont'd)

Remove the damaged O–rings (Item 1) **[A]** and back up washers (Item 2) **[A]** from the by–pass valve.

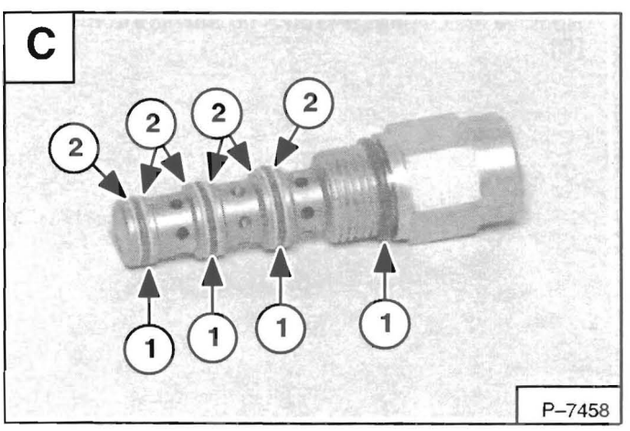


Remove the check valves (Item 1) **[B]** from the by–pass block.

Replace check valves if damaged.



Remove the damaged O–rings (Item 1) **[C]** and back up washers (Item 2) **[C]** from the check valve.



Checking the Main Relief Valve

NOTE: The following procedure is for checking the main relief valve only. Use this procedure when it is known that the hydraulic pump is in good working condition. If the hydraulic pump is not working correctly, refer to checking the output of the hydraulic pump. (See Page 2–28.)

The tools listed will be needed to do the following procedure:

MEL10003 – Hydraulic Tester
MEL10006 – Hydraulic Test Kit

Lift and block the loader. (See Page 1–1.)

Disconnect the hoses from the tilt cylinder **[A]**.

Connect the IN port of the hydraulic tester to the base end hose (Item 1) **[A]** on the loader.

Connect the OUT port of the hydraulic tester to the rod end hose (Item 2) **[A]** on the loader.

IMPORTANT

The hydraulic tester must be in the fully open position before you start the engine.

I–2024–0284

Sit in the operator seat, lower the seat bar and fasten the seat belt.

Start the engine and run at low idle RPM. Be sure the tester is connected correctly. If no flow is indicated on the tester the hoses are connected wrong. With the hoses connected correctly, increase the engine speed to full RPM.

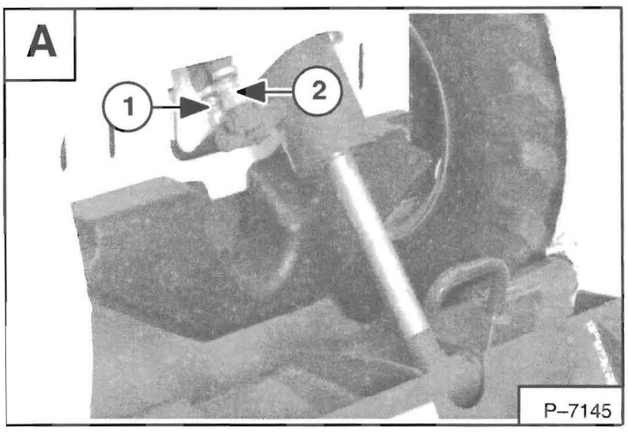
Push the bottom (heel) of the right foot pedal to retract the tilt cylinder rod until the system relief pressure is reached.

The correct pressure for the main relief valve is 1195–1245 PSI (8239–8584 kPa) at 7.3 GPM (27,5 L/min.).

If the relief valve pressure is not correct, stop the engine. Adjust or replace the main relief valve. (See Page 2–1.)

When the test is complete return the foot pedal to neutral position, reduce the engine RPM to idle.

Stop the engine.



WARNING

When the engine is running during service, the steering levers must be in neutral and the parking brake engaged. Failure to do so can cause injury or death.

W–2006–0284

WARNING

Put jackstands under the front axles and rear corners of the frame before running the engine for service. Failure to use jackstands can allow the machine to fall or move and cause injury or death.

W–2017–0286

Main Relief Valve Removal and Installation

Raise the operator cab. (See Page 1–1.)

Clean the area around the control valve. Loosen and remove the main relief valve (Item 1) **[A]**.

Installation: Tighten the main relief valve to 35–40 ft.–lbs. (47–54 Nm) torque.

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.

I–2003–0888

NOTE: The engine has been removed for clarity only. It does not need to be removed to remove the main relief valve.

Main Relief Valve Adjustment

If the main relief pressure is not correct, it needs to be adjusted.

An adjusting screw is located on the end of the main relief valve (Item 1) **[A]**.

Remove the end cap (Item 1) **[B]** from the main relief valve.

Turn the adjusting screw in (increase pressure) or out (decrease pressure) until the correct main relief pressure 1600–1650 PSI (11030–11375 kPa) is obtained.

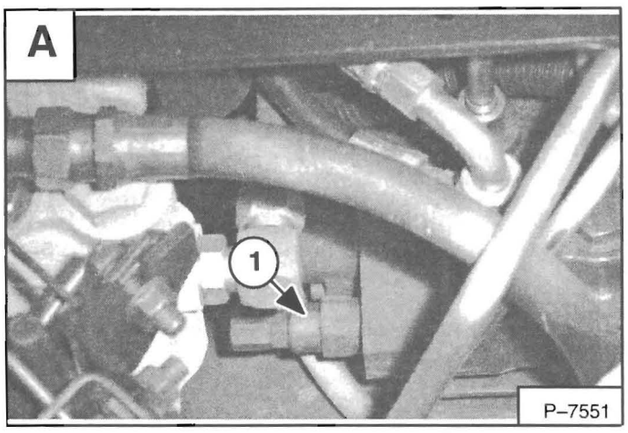
If the correct pressure can not be obtained, remove the main relief valve from the the main control valve. (See procedure above.)

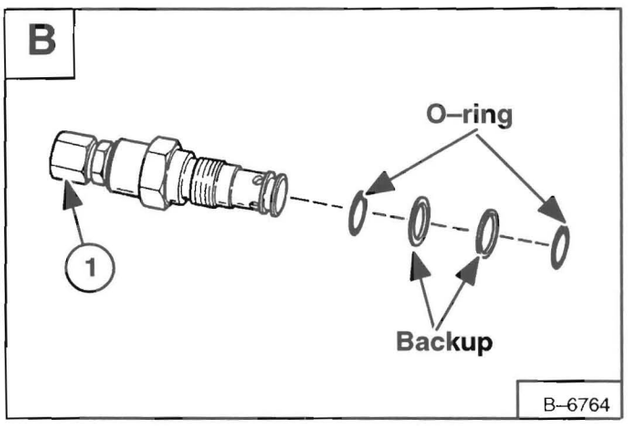
Remove the O–rings and backup washers from the main relief valve **[B]**.

Clean the main relief valve in clean solvent. Use air pressure to dry the valve.

Install new O–rings and backup washers. Install the main relief valve (Item 1) **[A]** and tighten. Readjust the main relief valve to the correct setting.

NOTE: If the correct pressure can not be obtained after cleaning and readjusting the main relief valve, replace the relief valve. Always check the pressure of a new relief valve.





Removal and Installation

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.

I–2003–0888

⚠ WARNING

Never work on a machine with the lift arms up unless the lift arms are secured by an approved lift arm support device. Failure to use an approved lift arm support device can allow the lift arms or attachment to fall and cause injury or death.

W–2059–0598

Raise the lift arms and install the lift arm support device. (See Page 5–1.)

Stop the engine. Pull out on the lift arm by–pass knob and move the lift pedal to release the hydraulic pressure. Raise the seat bar.

Install jackstands under the rear corners of the loader. (See Page 1–1.)

Raise the operator cab. (See Page 5–1.)

Remove the center control panel and the steering lever covers. (See Page 3–1.)

Remove the steering levers. (See Page 3–1.)

Remove the lift arm by–pass block. (See Page 2–1.)

Thoroughly clean the control valve area.

Remove the hair pin (Item 1) **[A]**, the fastener link (Item 2) **[A]** and the foot pedal linkage from the control valve spool (lift and tilt).

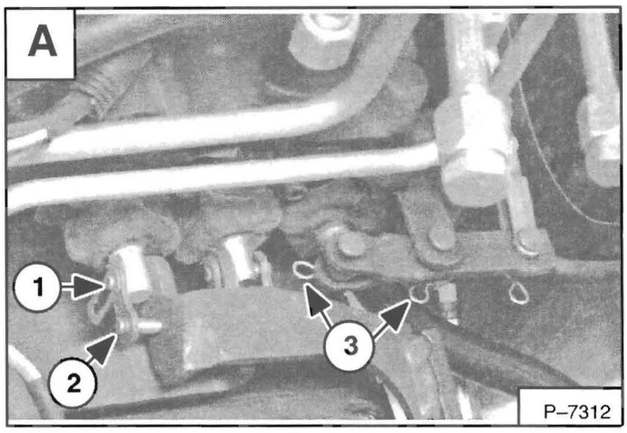
Remove the hair pin fastener (Item 3) **[A]** from the auxiliary spool.

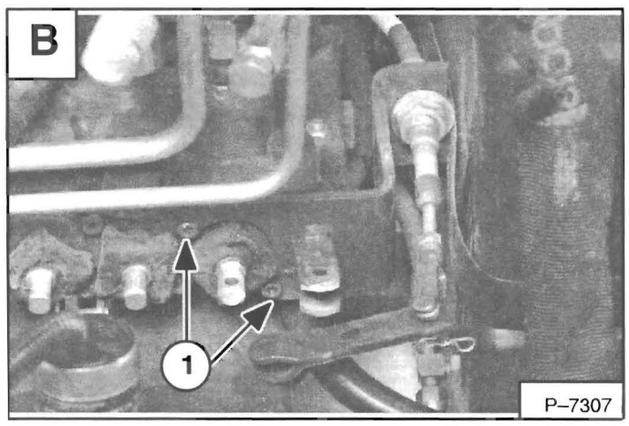
Remove the retaining pins from the spool and pivot **[A]**.

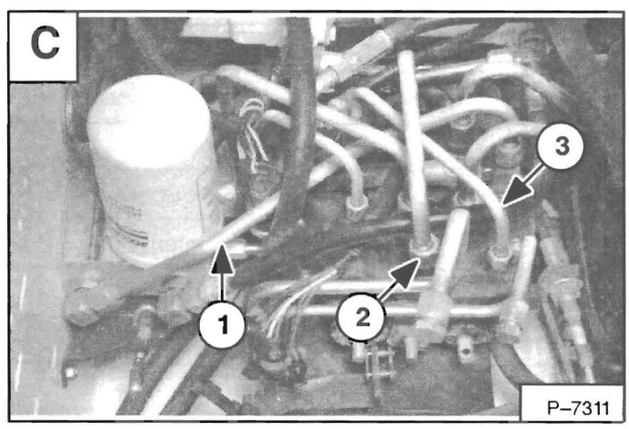
Remove the two screws (Item 1) **[B]** to remove the auxiliary bracket from the control valve.

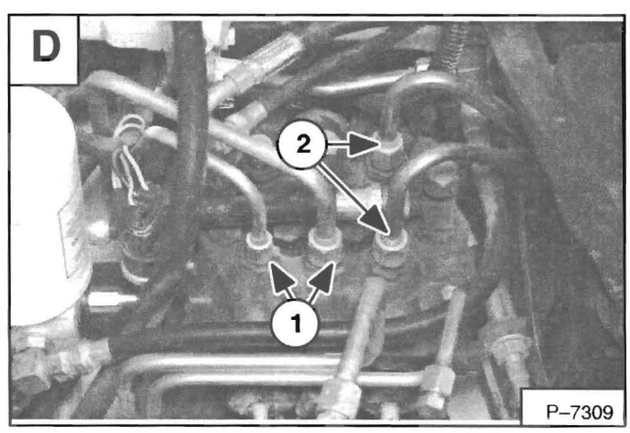
Remove the tubelines (Items 1, 2 & 3) **[C]** from the control valve and filter block.

Remove the lift and tilt tubelines (Item 1) **[D]** and the auxiliary tubelines (Item 2) **[D]** from the control valve.







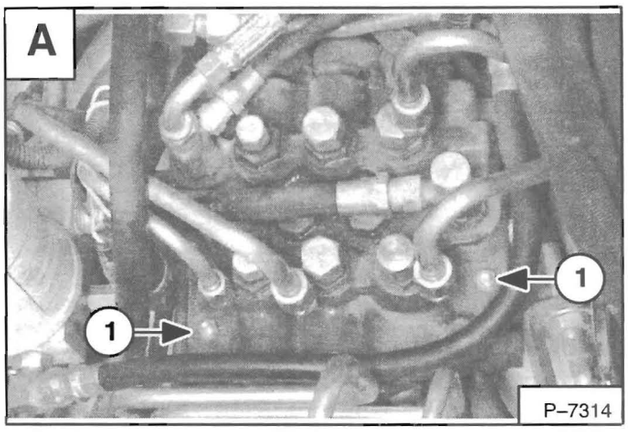


HYDRAULIC CONTROL VALVE (Cont'd)

Removal and Installation (Cont'd)

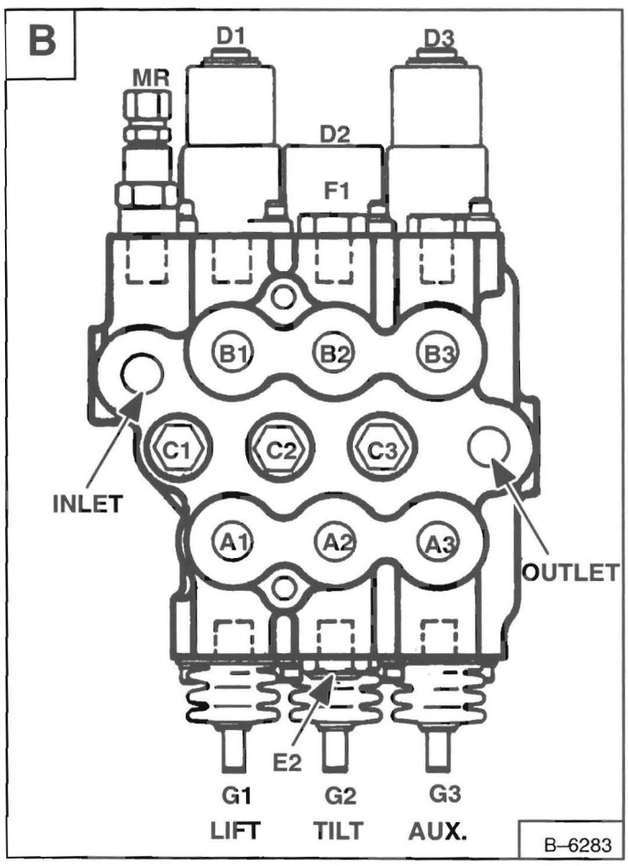
Remove the hoses from the control valve **[A]**.

Remove the mounting bolts (Item 1) **[A]** and remove the control valve.



Identification Chart

Item	450 Series
A1	Lift Cylinder Base End
A2	Tilt Cylinder Base End
A3	Auxiliary Hydraulics
B1	Lift Cylinder Rod End
B2	Tilt Cylinder Rod End
B3	Auxiliary Hydraulics
C1	Load Check Valve/Lift Function
C2	Load Check Valve/Tilt Function
C3	Load Check Valve/Auxiliary Function
D1	Lift Spool Detent
D2	Centering Spring Tilt Spool
D3	Auxiliary Spool Detent
E2	Anti–Cav. Valve (450 Opt.)
F1	Plug
G1	Lift Spool
G2	Tilt Spool
G3	Auxiliary Spool
MR	Main Relief Valve



Disassembly and Assembly

Refer to the control valve identification chart on page 2–18 for the control valve parts assembly.

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.

I–2003–0888

Mark each valve section and spool so that the parts will be returned to their original bore during assembly.

Use bolts to fasten the control valve to a work bench for easier disassembly and assembly.

Load Check Valve

Loosen the load check plug (Item 1) **[A]**.

Assembly: Always use new O–rings. Tighten the plug to 35–40 ft.–lbs. (47–54 Nm) torque.

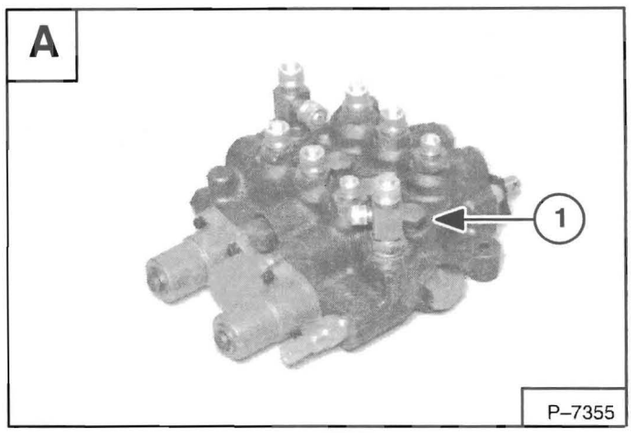
Remove the load check plug (Item 1) **[B]**, spring (Item 2) **[B]**, and load check valve (Item 3) **[B]**.

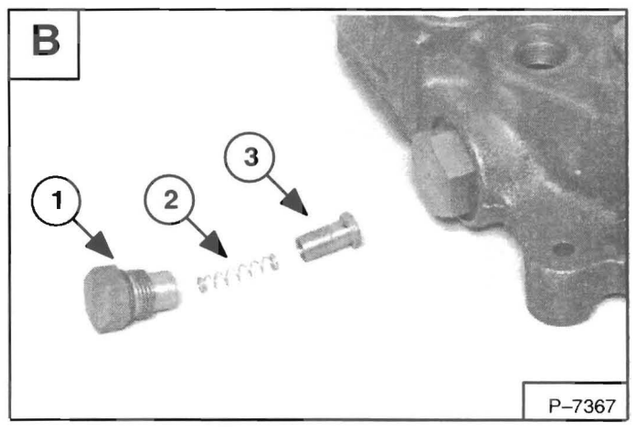
Main Relief Valve

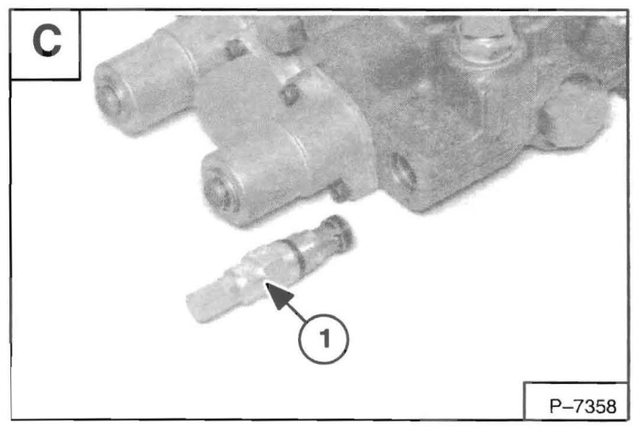
Remove the main relief valve (Item 1) **[C]** from the control valve.

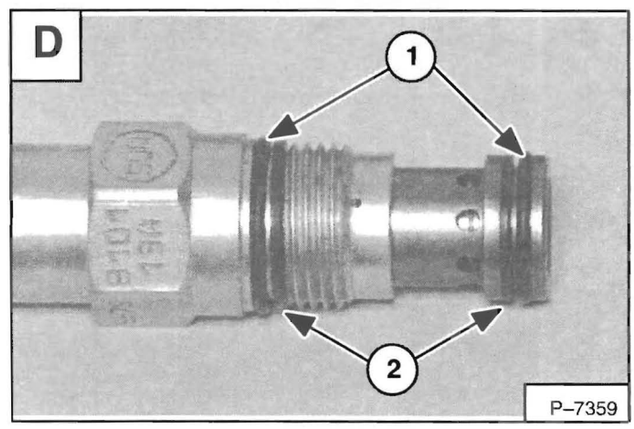
Assembly: Always use new O–rings and backup washers. Tighten to 35–40 ft.–lbs. (47–54 Nm) torque.

Remove the O–rings (Item 1) **[D]** and backup washers (Item 2) **[D]** from the main relief valve.







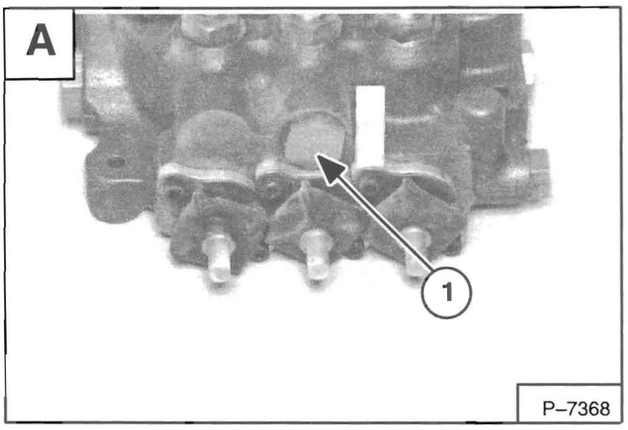


HYDRAULIC CONTROL VALVE (Cont'd)

Anti–Cavitation Valve

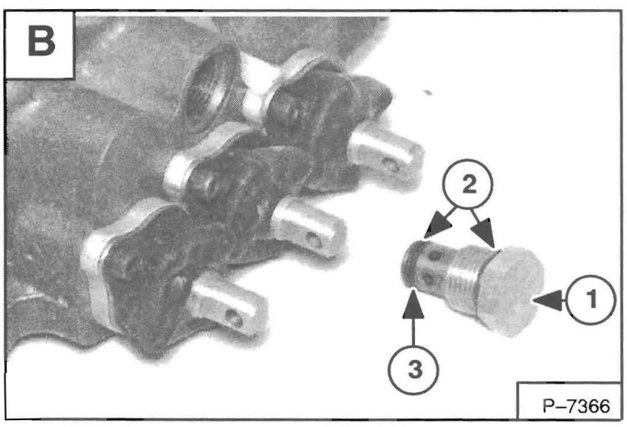
Loosen the Anti Cavitation valve (Item 1) **[A]**.

Assembly: Always use new O–rings and backup washers. Tighten to 35–40 ft.–lbs. (47–54 Nm) torque.



Remove the Anti Cavitation valve (Item 1) **[B]** from the control valve.

Remove the O–rings (Item 2) **[B]** and backup washers (Item 3) **[B]**.

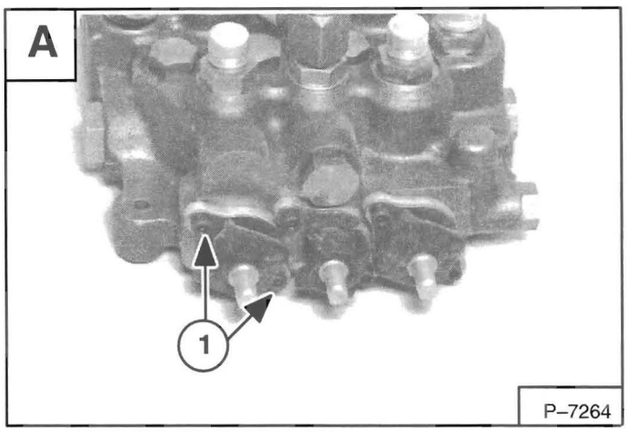


HYDRAULIC CONTROL VALVE (Cont'd)

Rubber Boot

Remove the two screws (Item 1) **[A]** from the rubber boot retainer.

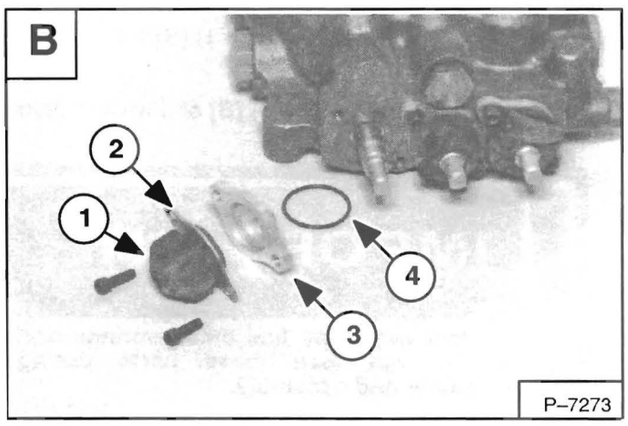
Assembly: Tighten the screws to 90–100 in.–lbs. (10,2–11,3 Nm) torque.



Remove the rubber boot (Item 1) **[B]** and boot retainer (Item 2) **[B]**.

Remove the O–ring retainer plate (Item 3) **[B]** and O–ring (Item 4) **[B]**.

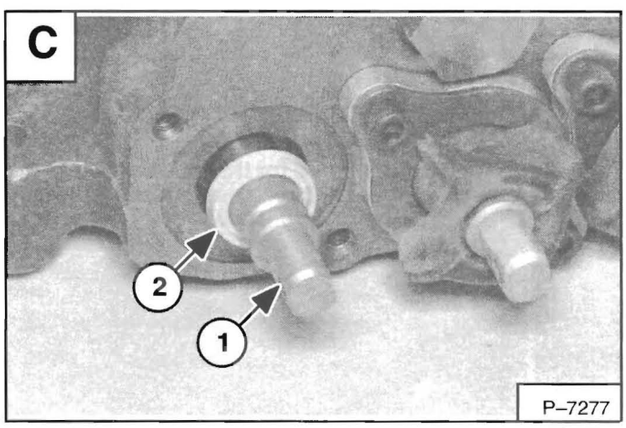
Assembly: Use a new O–ring (Item 4) **[B]** for assembly.



Remove the spool (Item 1) **[C]** from the control valve. (See Lift Spool Detent Page 2–28 for the correct procedure.) The spool seal (Item 2) **[C]** will remain seated in the spool chamber after the spool is removed.

Remove the spool seal (Item 2) **[C]** from the control valve.

Assembly: Lubricate the spool seal and install the spool seal (Item 2) **[C]** on the spool as shown. Push the spool seal into the control valve. Be sure the spool seal is evenly installed against the seat in the spool chamber.

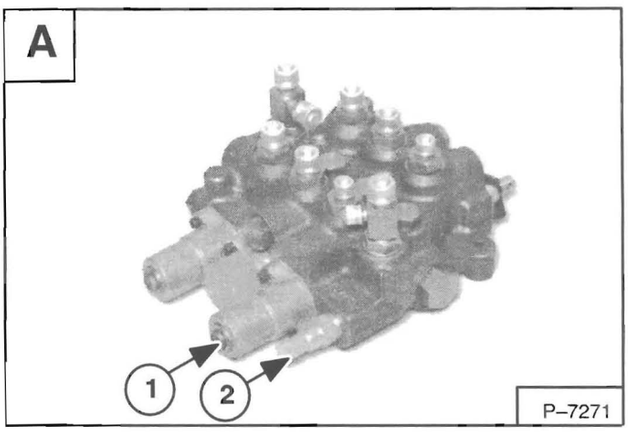


Lift Spool Detent

The tool listed will be needed to do the following procedure:

MEL1278 – Detent Tool

The lift spool detent (Item 1) **[A]** is located next to the main relief valve (Item 2) **[A]**.



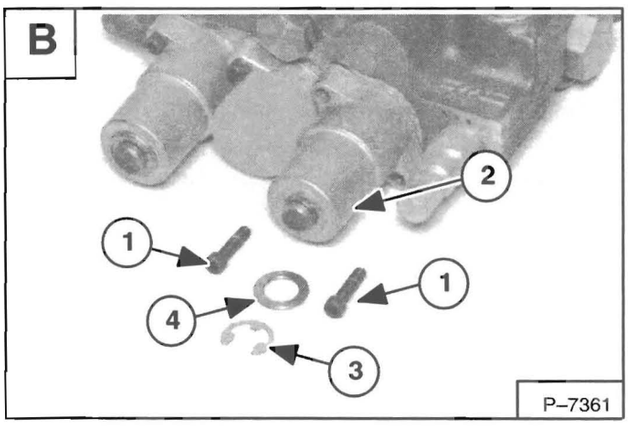
Remove the two (2) screws (Item 1) **[B]** from the detent cap (Item 2) **[B]**.

Remove the snap ring (Item 3) **[B]** and washer (Item 4) **[B]**.

IMPORTANT

The detent assembly has small springs and balls. Do not lose these parts during disassembly and assembly.

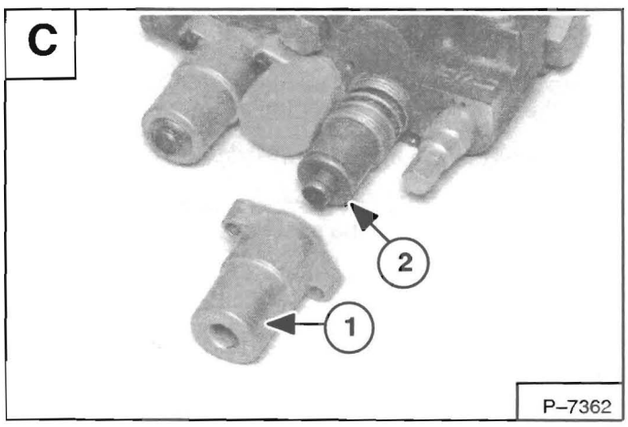
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Remove the detent cap (Item 1) **[C]**.

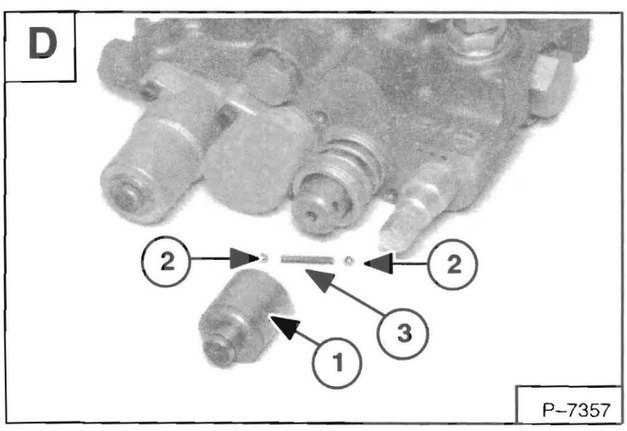
Wrap a clean rag around the detent sleeve (Item 2) **[C]** to prevent losing the two (2) detent balls.

NOTE: The detent sleeve for the lift spool (Item 2) [C] is longer than the detent sleeve located on the auxiliary spool. DO NOT switch the sleeves from one spool to the other.



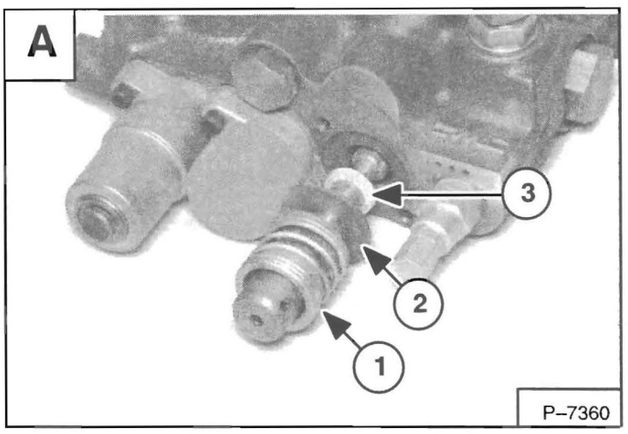
Remove the detent sleeve (Item 1) **[D]**, two (2) detent balls (Item 2) **[D]**, and detent spring (Item 3) **[D]**.

Remove the rubber boot assembly from the control valve (linkage side). (See Page 2–21 for the correct procedure.)



Lift Spool Detent (Cont'd)

Remove the spool assembly (Item 1) **[A]**, backup washer (Item 2) **[A]**, and spool seal (Item 3) **[A]** from the control valve.



Put the linkage end of the spool assembly (Item 1) **[B]** in a vise.

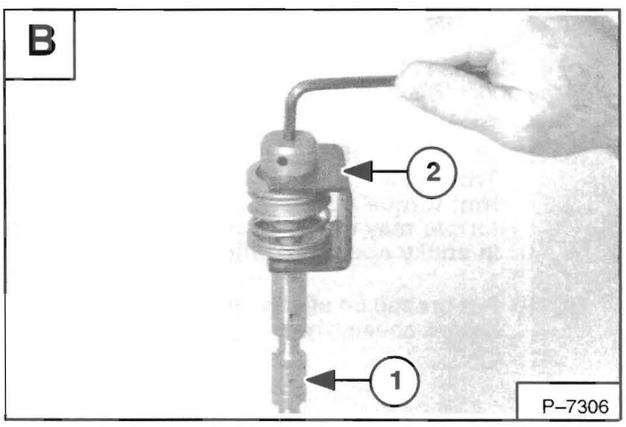
Install MEL1285 Spring Compressor Tool (Item 2) **[B]** on the spring assembly.

Loosen the detent adapter **[B]**.

IMPORTANT

The detent assembly has small springs and balls. Do not lose these parts during disassembly and assembly.

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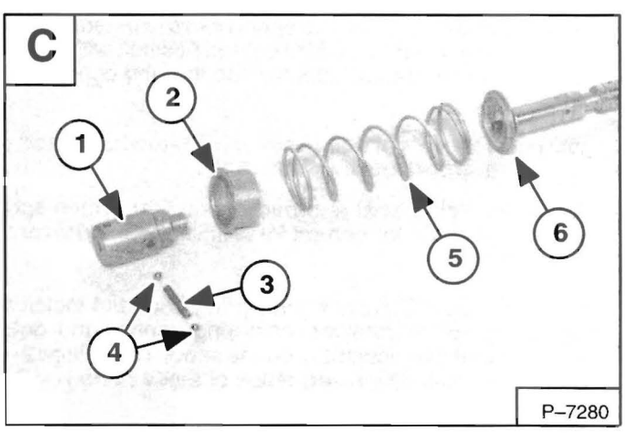


Wrap a clean rag around the assembled detent adapter (Item 1) **[C]** and adapter retainer (Item 2) **[C]**.

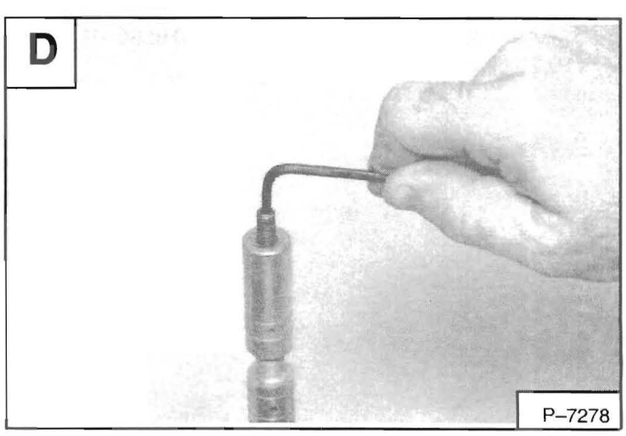
Remove the detent adapter (Item 1) **[C]** from the adapter retainer (Item 2) **[C]**.

Remove the detent spring (Item 3) **[C]** and detent balls (Item 4) **[C]**.

Remove the centering spring (Item 5) **[C]** and end cap (Item 6) **[C]** from the spool.



Lift Spool Only: Remove the stud from the end of the spool **[D]**.



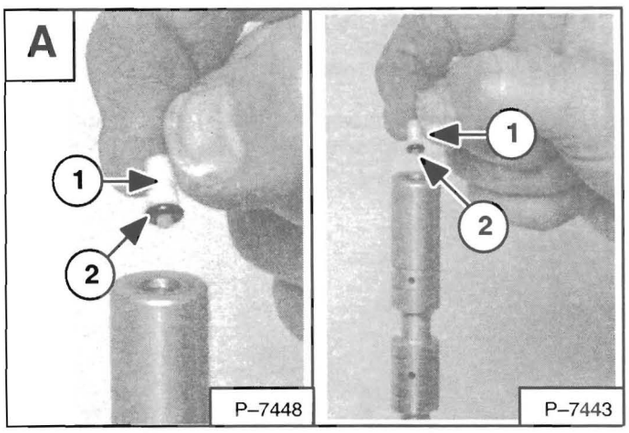
HYDRAULIC CONTROL VALVE (Cont'd)

Lift Spool Detent (Cont'd)

Removal of the plastic plug.

- Make a center point in the plug using a 3/16" drill.
- Drill a hole all the way through the plug using a 7/64" tap drill.
- Turn a 6–62 tap into the plug. Pull the tap and plug out of the spool. BE CAREFUL, do not break the tap.
- Clean all the debris from the inside of the spool bore.

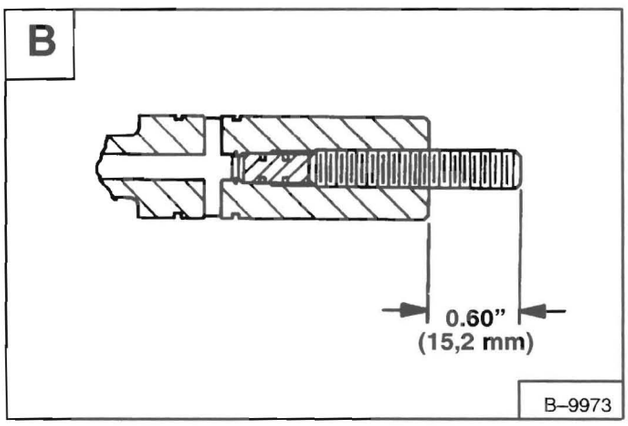
Assembly: Install the new plastic plug (Item 1) **[A]** and O–ring (Item 2) **[A]**.



Install the stud and leave 0.60" (15,2 mm) past the end of the spool **[B]**.

NOTE: DO NOT USE LOCTITE ON THE STUD THREADS. DO NOT EXCEED 70 in.–lbs. (8 Nm) torque during stud installation. Excess torque may cause spool distortion resulting in sticky spool operation.

NOTE: Put grease on all detent component surfaces before assembly.

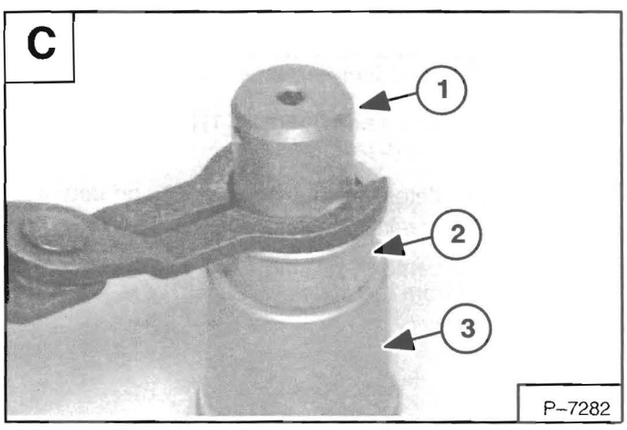


Install the detent balls and spring into the detent adapter (Item 1) **[C]**. Hold the detent balls in position with the tool and install the detent adapter into the end cap (Item 2) **[C]**.

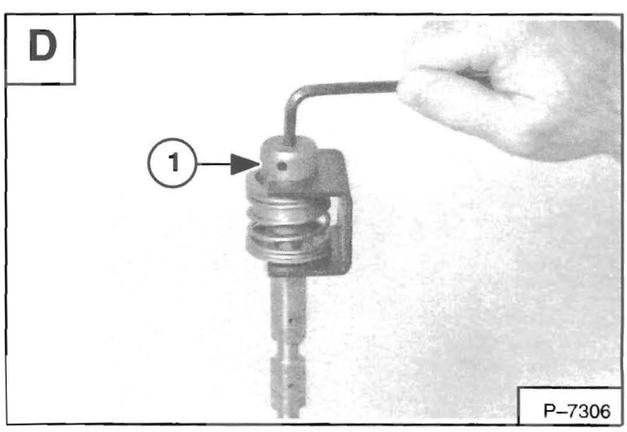
NOTE: The detent cap (Item 3) [B] shown, is used for support during assembly.

Install the spool seal and backup washer on the spool. (See Page 2–34 for correct installation procedure for the spool seal.)

Use MEL1285 Compression Spring Tool and install the centering spring retainer, centering spring, and detent adapter/end cap assembly on the spool. (See Page 2–23 for correct installation sequence of these parts.)

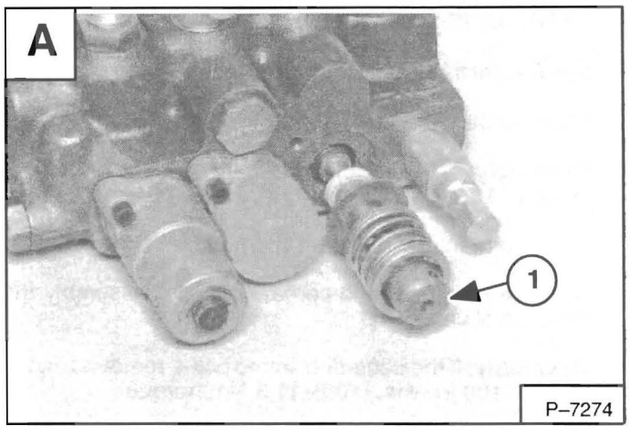


Tighten the detent adapter (Item 1) **[D]** to 90–100 in.–lbs. (10,2–11,3 Nm) torque.

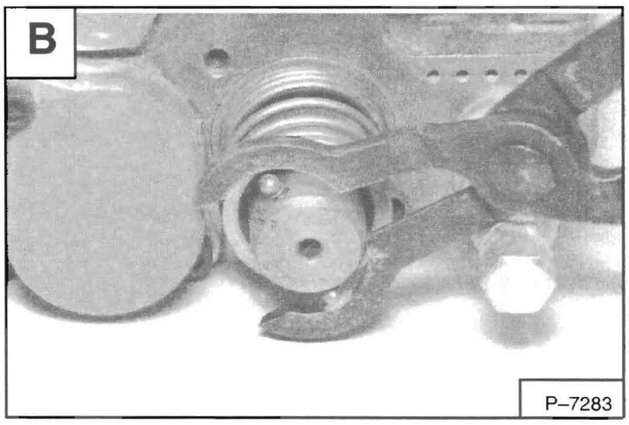


Lift Spool Detent (Cont'd)

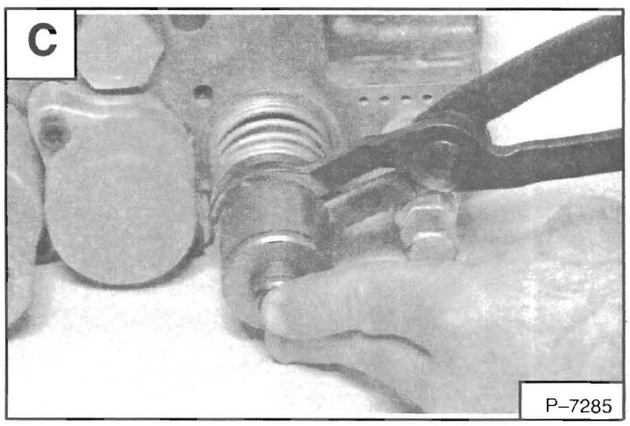
Install the spool assembly (Item 1) **[A]** in the control valve.



Hold the detent balls and spring in position with the tool **[B]**.



Install the detent sleeve over the balls and into position **[C]**.

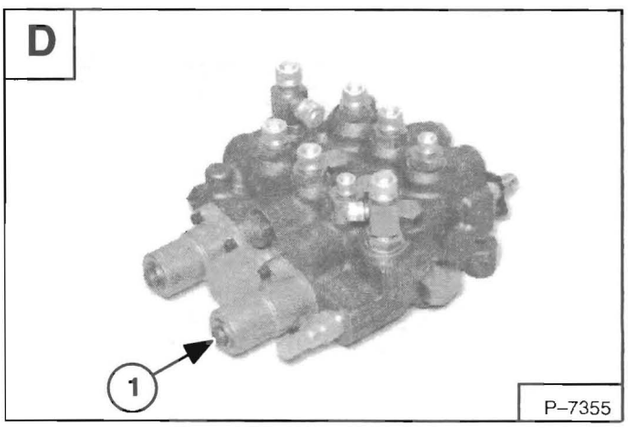


Install the detent cap (Item 1) **[D]**.

Install the washer and snap ring **[D]**.

Install the mounting bolts **[D]**.

Tighten the mounting bolts to 90–100 in.–lbs. (10,2–11,3 Nm) torque.



HYDRAULIC CONTROL VALVE (Cont'd)

Tilt Centering Spring

Remove the end cap mounting screws (Item 1) **[A]**.

Assembly: Tighten the mounting screws to 90–100 in.–lbs. (10,2–11,3 Nm) torque.

Remove the spool end cap (Item 2) **[A]**.

Remove the spool and centering spring assembly from the control valve **[A]**.

Assembly: If the centering spring bolt is removed, tighten it to 90–100 in.–lbs. (10,2–11,3 Nm) torque.

Put grease on all the center spring component parts. Always use a new spool seal.

Auxiliary Spool Detent

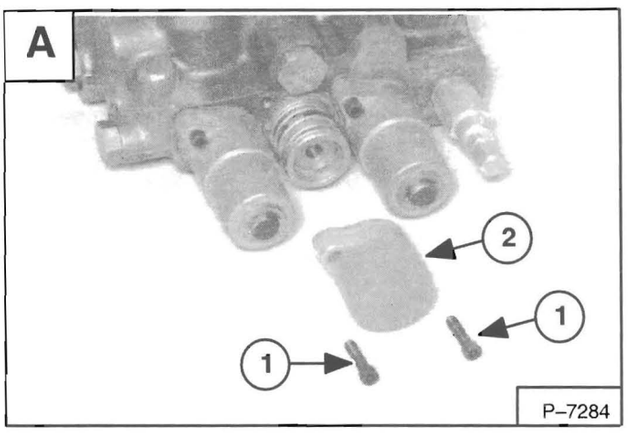
Remove the two (2) mounting screws (Item 1) **[B]** from the detent cap (Item 2) **[B]**.

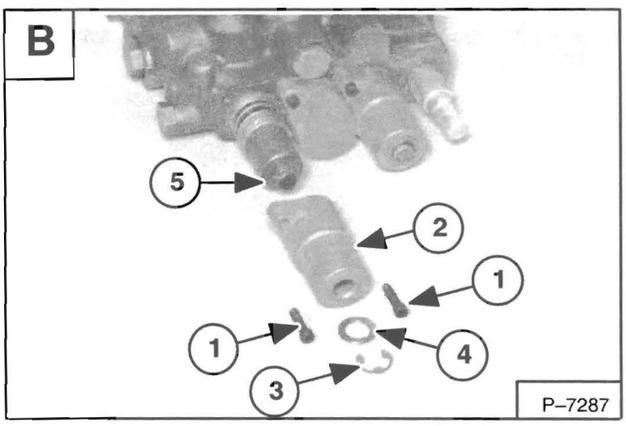
Remove the snap ring (Item 3) **[B]** and washer (Item 4) **[B]**.

Remove the detent cap (Item 2) **[B]**.

Refer to the Lift Spool Detent Page 2–28 for the correct removal and disassembly procedures. These procedures are the same for the Auxiliary Spool Detent.

NOTE: The detent sleeve for the auxiliary spool (Item 5) [B] is shorter than the detent sleeve on the lift spool. DO NOT switch the sleeves from one spool to the other.





Spool Seal Installation

To install new spool seals when the centering spring (tilt spool) or the detent assembly (lift spool) are not removed from the spool, use the following procedure:

Check the seal surface area (in the control valve) for rust, corrosion, scratches, etc. Correct any irregularities before continuing.

Install the backup washer on the spool.

Put plastic material on the valve spool **[A]**.

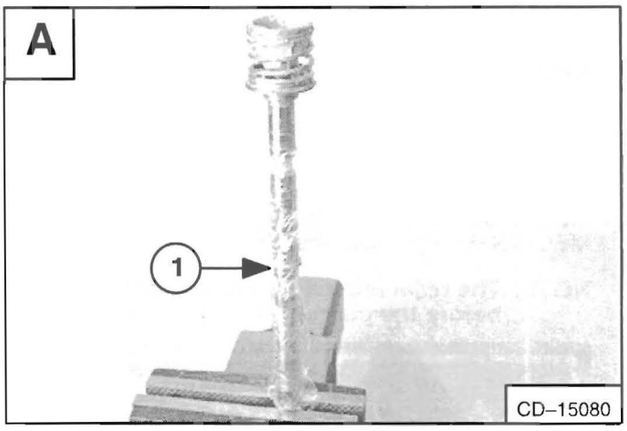
Put clean oil on the spool seal. Install the spool seal (Item 1) **[A]** on the spool being careful not to damage the seal on the sharp edges.

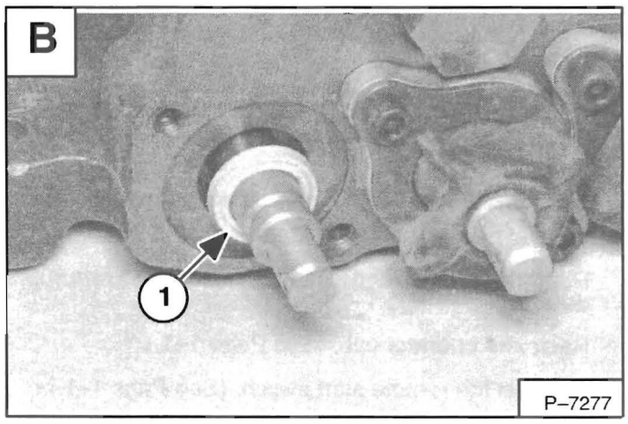
Remove the plastic material.

Install the spool into the control valve.

Slide the linkage end spool seal (Item 1) **[B]** over the rubber boot groove.

Be careful not to damage the spool seal.



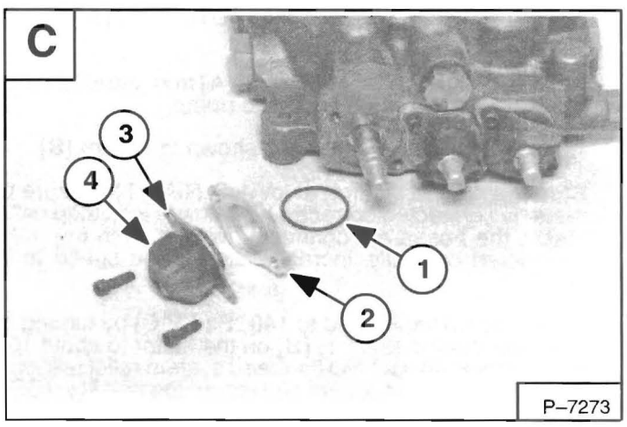


Install the O–ring (Item 1) **[C]** and O–ring retainer plate (Item 2) **[C]**.

Install the rubber boot retainer (Item 3) **[C]** and rubber boot (Item 4) **[C]**.

Install the two (2) mounting screws and tighten to 90–100 in.–lbs. (10,2–11,3 Nm) torque.

Continue assembling the control valve.



HYDRAULIC PUMP

Checking the Output of the Hydraulic Pump

The tools listed will be needed to do the following procedure:

MEL1429 – Remote Start Switch
MEL10003 – Hydraulic Tester
MEL10006 – Hydraulic Test Kit

NOTE: The relief pressure must be per specification before the output test is performed.

⚠ WARNING

Put jackstands under the front axles and rear corners of the frame before running the engine for service. Failure to use jackstands can allow the machine to fall or move and cause injury or death.

W–2017–0286

Lift and block the loader. (See Page 1–1.)

Raise the lift arms and install an approved lift arm support device. (See Page 1–1.)

Raise the operator cab. (See Page 1–1.)

Connect the remote start switch. (See Page 1–1.)

Disconnect the OUTLET hose (Item 1) **[A]** from the hydraulic pump. Connect the OUTLET hose from the tester to the hose (Item 1) **[A]**.

Connect the INLET hose (Item 2) **[A]** from the tester to the OUTLET fitting on the hydraulic pump.

A sample tester connection is shown in picture **[B]**.

Start the engine and run at low idle RPM. Make sure the tester is connected correctly. If no flow is indicated on the tester, the hoses are connected wrong. With the hoses connected correctly, increase the engine speed to full RPM*.

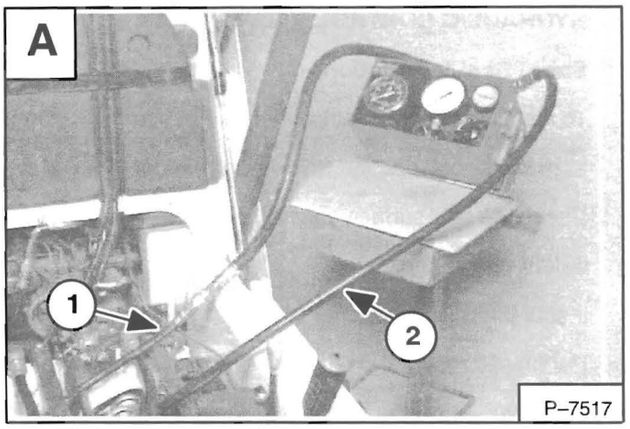
Warm the hydraulic fluid to 140° F (60° C) by turning the restrictor control (Item 1) **[B]** on the tester to about 1000 PSI (6895 kPa). DO NOT exceed system relief pressure. Open the restrictor control and record the free flow (GPM) at full RPM.

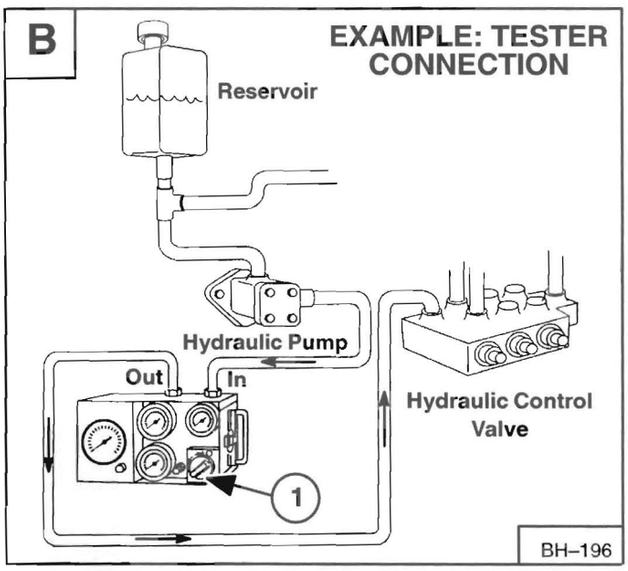
Remove the auxiliary hydraulics lock bolt and push the right steering lever all the way to the right (detent) **[B]** to engage the auxiliary hydraulics (attachment must be disconnected from the front auxiliary couplers). The fluid pressure will go over main relief. If the pressure does not go over, adjust the main relief valve. Record the highest pressure (PSI) and flow (GPM). The high pressure flow must be at least 80% of free flow.

$$\% = \frac{\text{HIGH PRESSURE FLOW (GPM)}}{\text{FREE FLOW (GPM)}} \times 100$$

A low percentage indicates a failed pump.

*Refer to specifications (Section 9) for system relief pressure, RPM, and hydraulic pump capacity (GPM).





IMPORTANT

The hydraulic tester must be in the fully open position before you start the engine.

I–2024–0284

Removal and Installation

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.

I–2003–0888

Raise the lift arms and install the lift arm support device. (See Page 1–1.)

Stop the engine and raise the seat bar.

Lift and block the loader. (See Page 1–1.) Raise the operator cab. (See Page 1–1.)

NOTE: The engine and hydrostatic pump assembly must be moved to the right to remove the hydraulic pump.

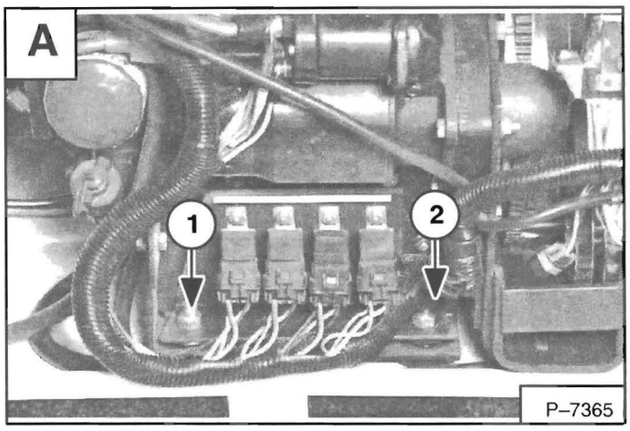
Remove the hydraulic reservoir. (See Page 2–1.)

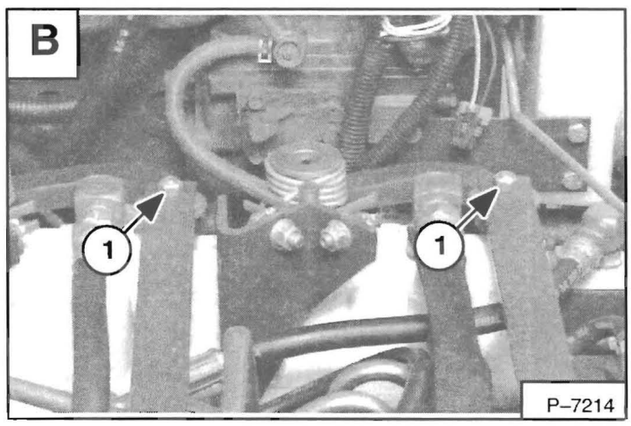
Loosen the left engine mounting bolt (Item 1) **[A]**, and remove the right engine mounting bolt (Item 2) **[A]**.

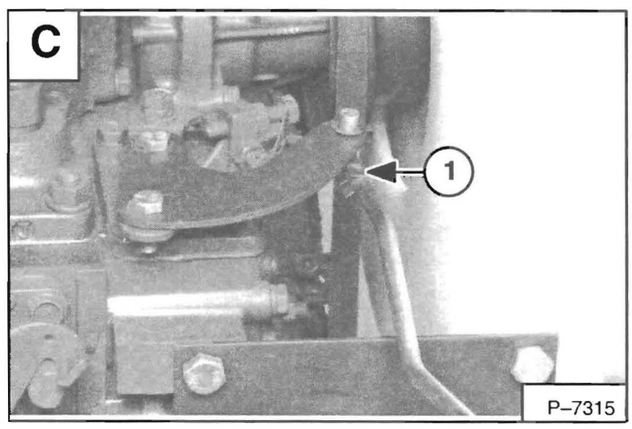
Remove the bolts (Item 1) **[B]** from the steering lever linkage. Remove the linkage from the hydrostatic pumps.

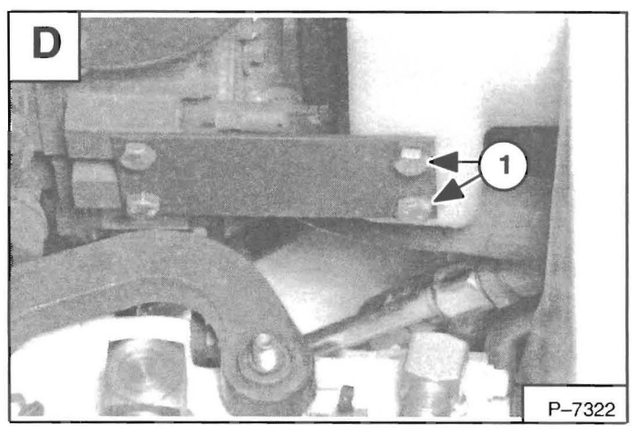
Disconnect the hair pin fastener (Item 1) **[C]** from the speed control linkage. Remove the linkage.

Remove the two bolts (Item 1) **[D]** from the fan housing stabilizer.



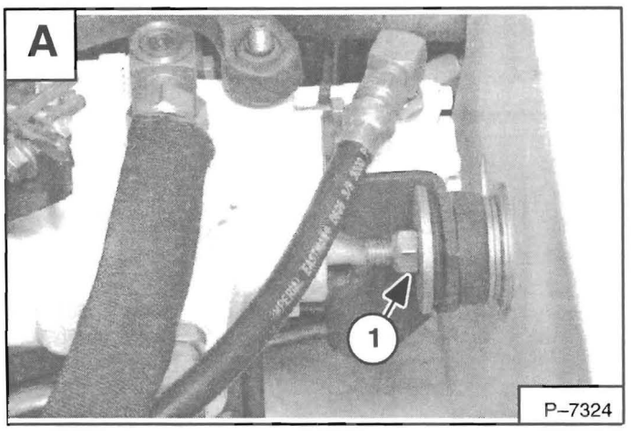






Removal and Installation (Cont'd)

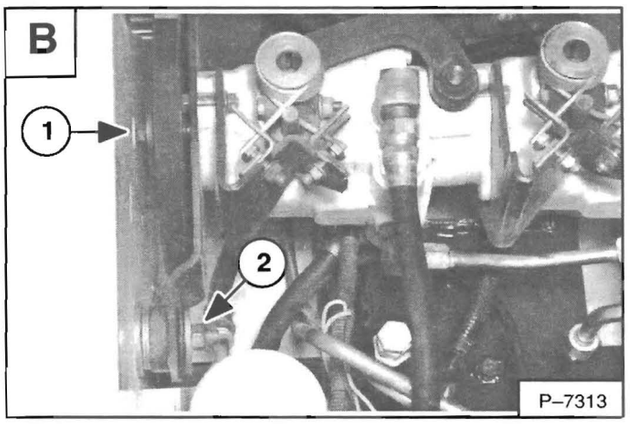
Remove the nut (Item 1) **[A]** from the left side hydrostatic pump mounting bolt. Remove the mounting bolt.



Remove the bolt (Item 1) **[B]** and washer from the hydrostatic pump pulley.

Remove the nut (Item 2) **[B]** from the right side hydrostatic pump mounting bolt.

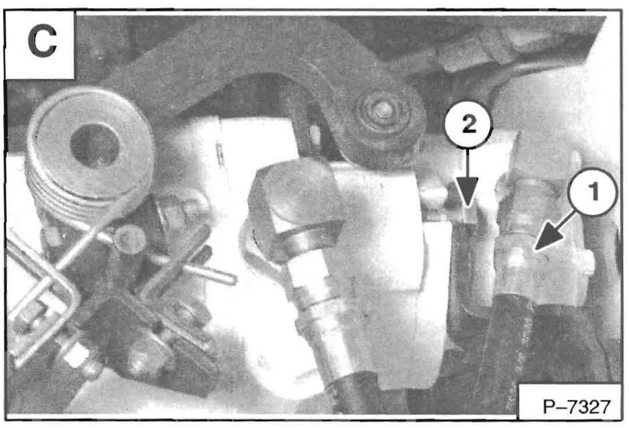
Remove the rubber mount and install the bolt. Tighten the bolt to pull the hydrostatic pump assembly to the right to allow clearance for hydraulic pump removal.



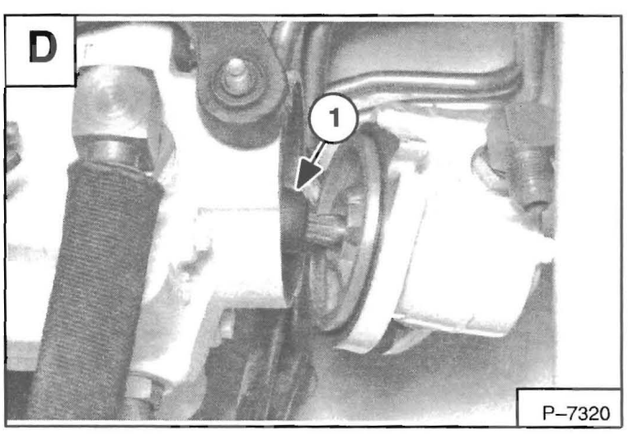
Remove the outlet hose (Item 1) **[C]** from the top of the hydraulic pump and the inlet hose from the bottom of the pump.

NOTE: Remove the battery (page 1–1) for access to the inlet hose removal.

Remove the two hydraulic pump mounting bolts (Item 2) **[C]** (top and bottom).



Remove the hydraulic pump and the coupler (Item 1) **[D]**.



Disassembly and Assembly

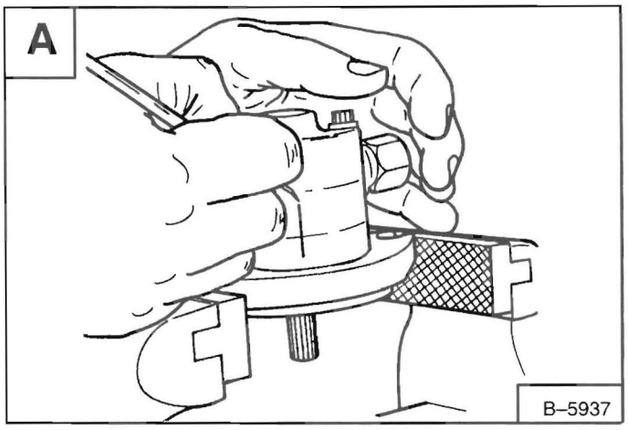
IMPORTANT

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.

I–2003–0888

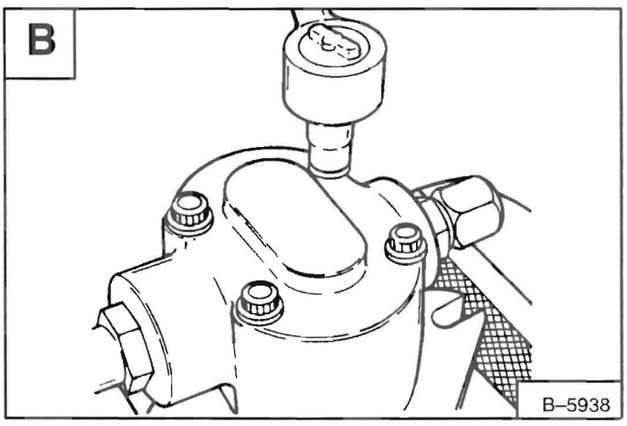
Put the hydraulic pump in the vise.

Put a mark across the housing of the pump for correct assembly **[A]**.

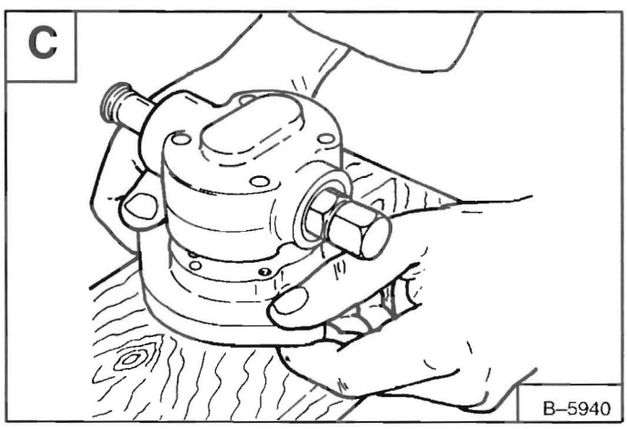


Remove the four bolts from the pump **[B]**.

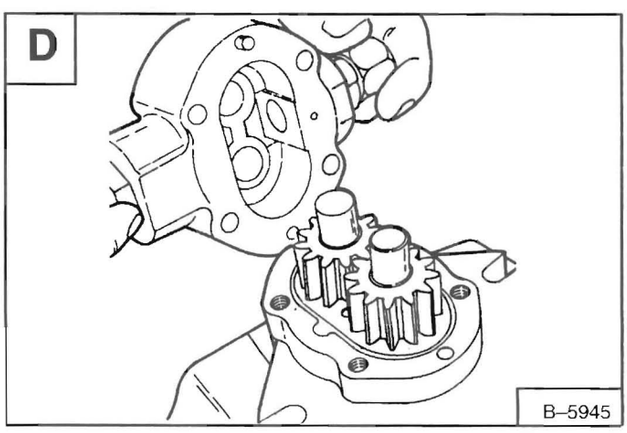
Assembly: Tighten the bolts to 25–28 ft.–lbs. (33–38 Nm) torque.



Remove the pump from the vise. Hold the pump in both hands and hit the shaft against a block of wood to separate the pump housing **[C]**.



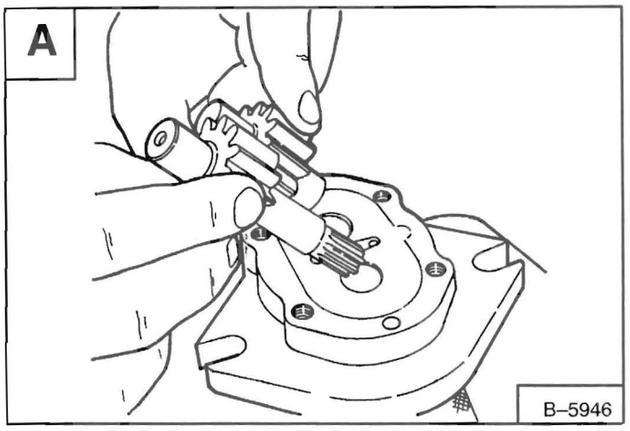
Remove the housing from the end of the pump **[D]**.



HYDRAULIC PUMP (Cont'd)

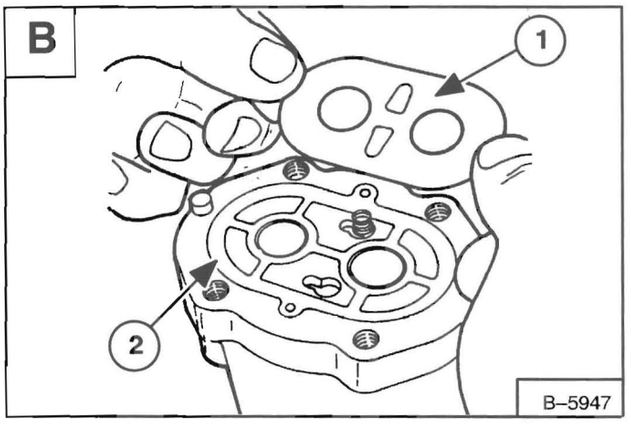
Disassembly and Assemble (Cont'd)

Remove the pump gears **[A]**.



Remove the wear plate (Item 1) **[B]**.

Remove the gasket and diaphragm seal from the pump housing **[B]**.



Remove the spring and steel ball from the pump housing **[C]**.

NOTE: Make sure to mark the port where the spring and ball are removed.

Clean and dry all the parts.

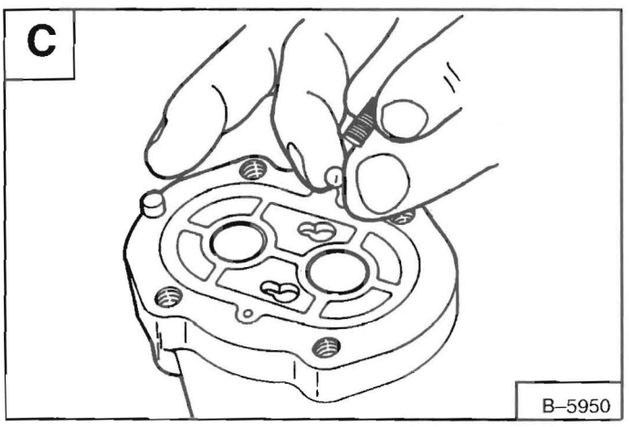
Inspect the drive gears **[D]**.

Inspect both drive gear and idler gear shafts at the bearing points and seal area for rough surface and wear.

Check the face of the gears for wear.

Check for wear on the face of the wear plate. If the wear is more than 0.0015" (0,038 mm) from one side to the other, the wear plate must be replaced.

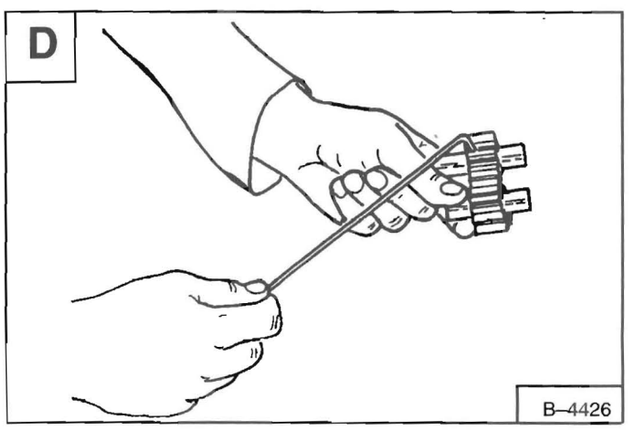
Check the housing in the gear area for wear.



IMPORTANT

The detent assembly has small springs and balls. Do not lose these parts during disassembly and assembly.

I–2012–0284

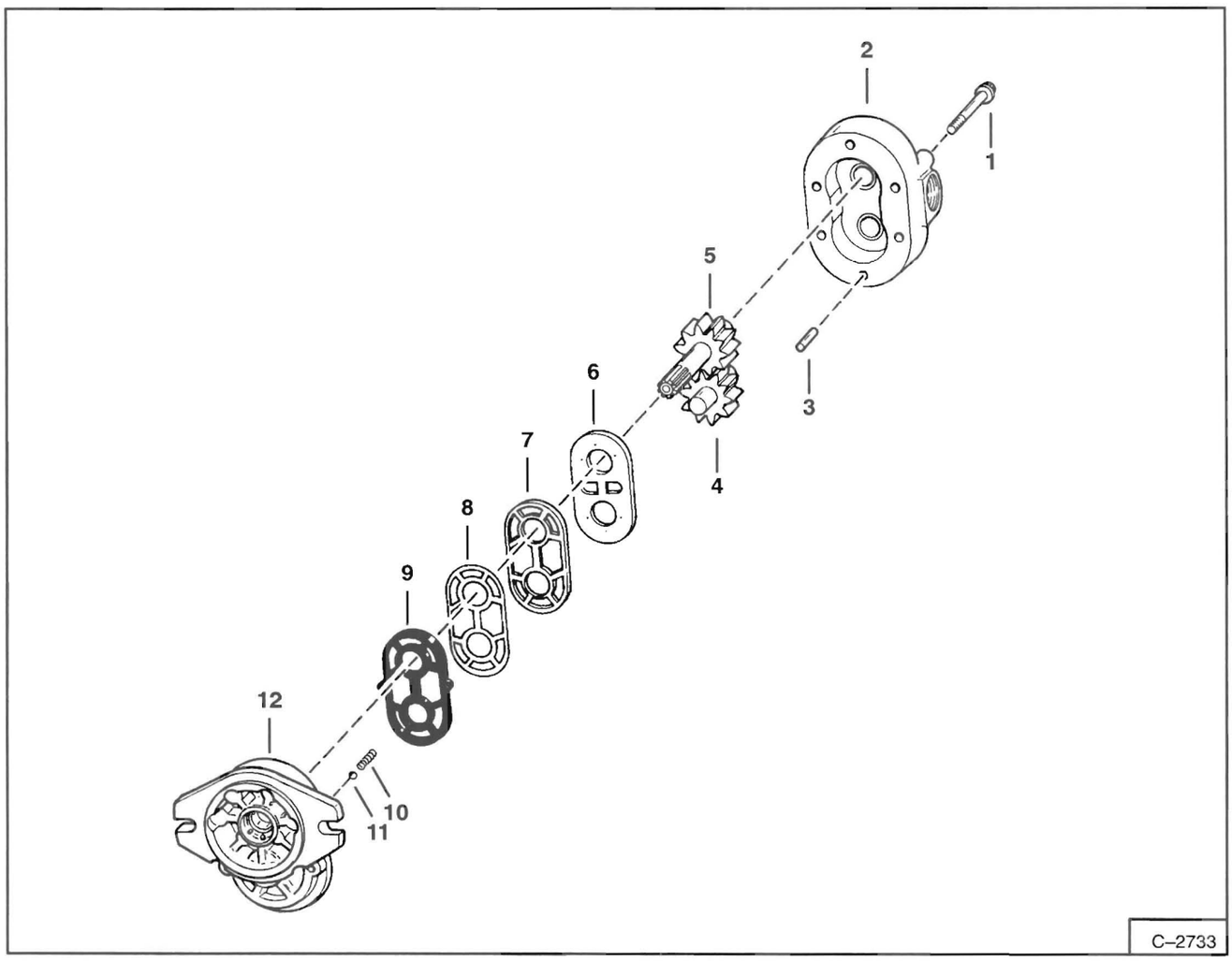


Put the spring and steel ball in the port that was marked during disassembly **[C]**.

Install Install the wear plate and diaphragm seal in the housing (Item 1 & 2) **[B]**.

Put oil in the port of the pump, use a grip pliers to rotate the pump shaft. The pump will have some resistance but will turn freely.

Parts Identification



MODEL: 450/453

Ref.	Description
1	BOLT
2	HOUSING
3	PIN, dowel
4	GEAR, idler
5	GEAR, drive
6	PLATE, wear
7	DIAPHRAGM
8	GASKET
9	SEAL
10	SPRING
11	BALL
12	PLATE, front

HYDRAULIC RESERVOIR

Removal and Installation

Install jackstands under the rear corners of the loader. (See Page 1–1.)

Raise the operator cab. (See Page 1–1.)

Remove the center shield and the steering lever panels. (See Page 3–1.)

Remove the steering levers. (See Page 3–1.)

Remove the Lift Arm By–pass block. (See Page 2–1.)

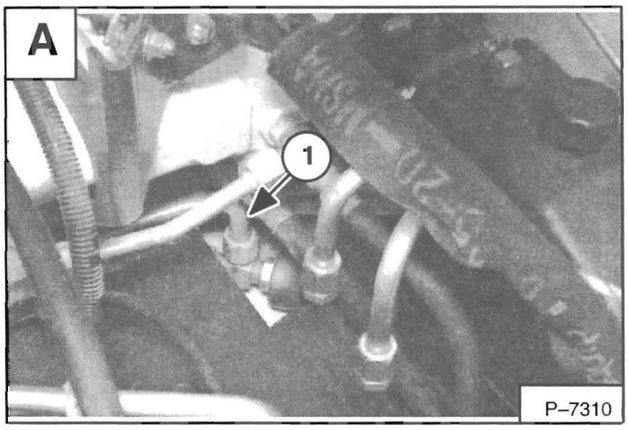
Remove the control valve. (See Page 2–1.)

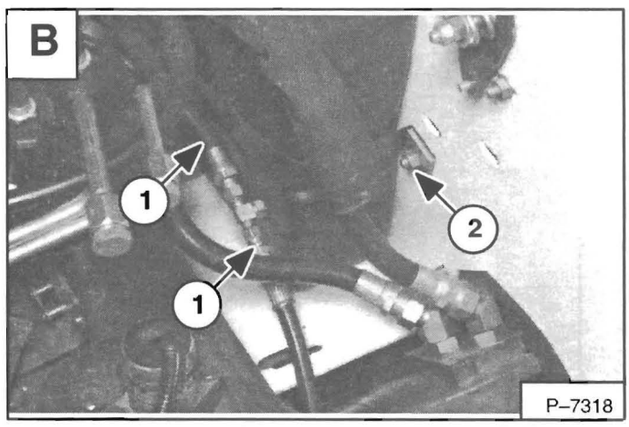
Remove the filter return hose (Item 1) **[A]** and the hydraulic pump inlet hose from the tee fitting below the reservoir.

Remove the return hoses (Item 1) **[B]** from the reservoir.

Remove the nuts (Item 2) **[B]** and bolts from the reservoir holding strap.

Remove the reservoir.





HYDRAULIC FILTER BLOCK

Removal and Installation

⚠ WARNING

Put jackstands under the front axles and rear corners of the frame before running the engine for service. Failure to use jackstands can allow the machine to fall or move and cause injury or death.

W–2017–0286

Put jackstands under the front and rear of the loader. (See Page 1–1.)

Raise the operator cab. (See Page 1–1.)

Raise the lift arms and install the lift arm support device. (See Page 1–1.)

Remove the center shield and steering lever panels. (See Page 3–1.)

Remove the tubelines (Item 1) **[A]** and hoses (Item 2) **[A]** from the filter block.

Disconnect the electrical connectors from the charge pressure switch and the temperature sender.

Remove the two mounting bolts (Item 1) **[B]** from the outside of the fender.

Disassembly and Assembly

450 Filter Block

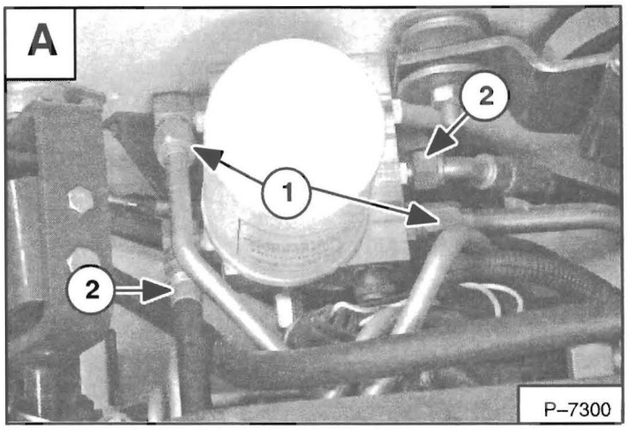
Remove the plug (Item 1) **[C]**, the cooler by–pass spring (Item 2) **[C]**, and poppet (Item 3) **[C]**.

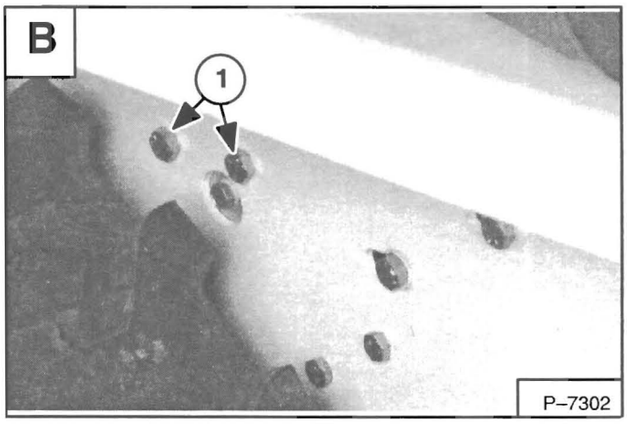
Clean and inspect the parts. Replace as needed.

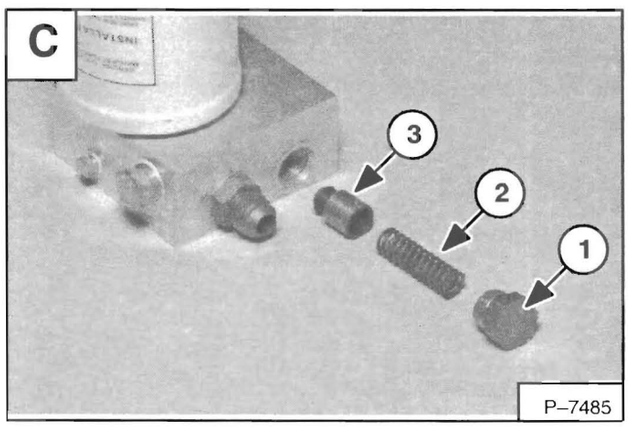
Install a new O–ring on the plug.

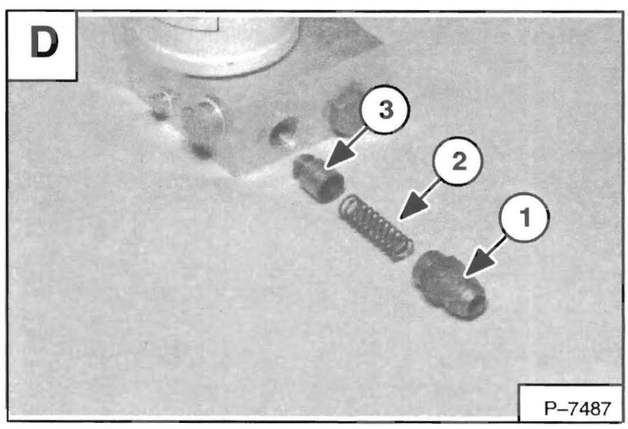
NOTE: The cooler by–pass spring is the stiffer (heavier) of the two springs.

Remove the fitting (Item 1) **[D]**, the charge pressure spring (Item 2) **[D]**, and the poppet (Item 3) **[D]**.









HYDRAULIC FILTER BLOCK (Cont'd)

Disassembly and Assembly (Cont'd)

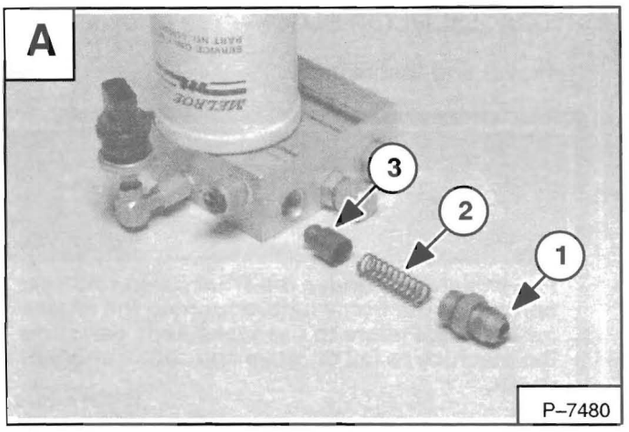
453 Filter Block

Remove the plug (Item 1) **[A]**, the cooler by–pass spring (Item 2) **[A]**, and poppet (Item 3) **[A]**.

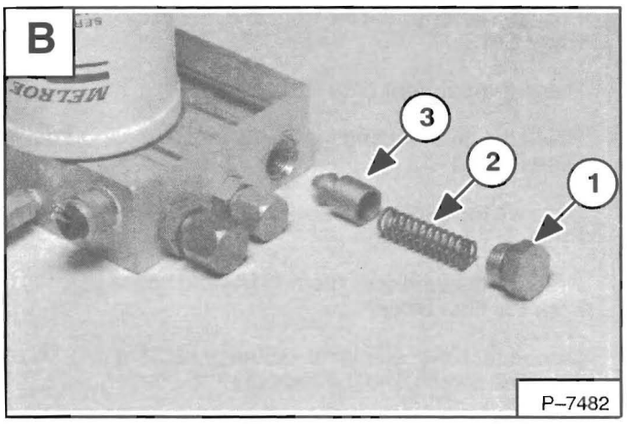
Clean and inspect the parts. Replace as needed.

Install a new O–ring on the plug.

NOTE: The cooler by–pass spring is the stiffer (heavier) of the two springs.

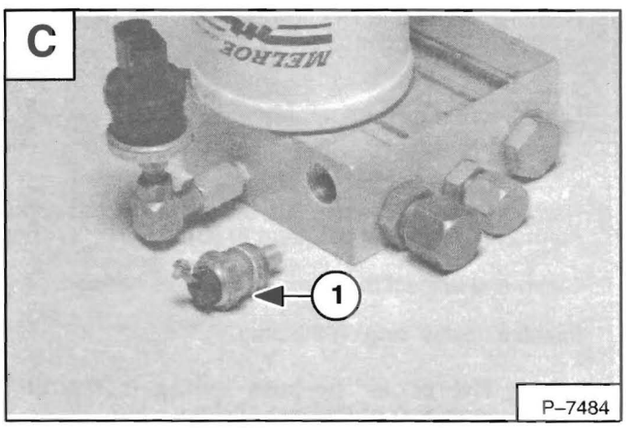


Remove the fitting (Item 1) **[B]**, the charge pressure spring (Item 2) **[B]**, and the poppet (Item 3) **[B]**.

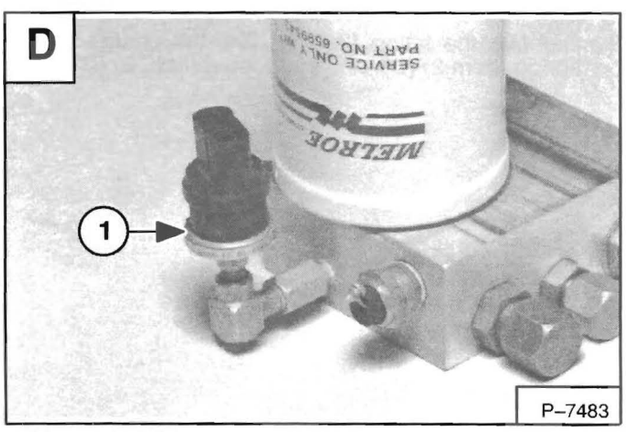


Remove the temperature sender (Item 1) **[C]** from the filter block.

Install a new O–ring on the temperature sender.



Remove the charge pressure switch (Item 1) **[D]** from the filter block.



PEDAL INTERLOCK LINKAGE

Removal and Installation

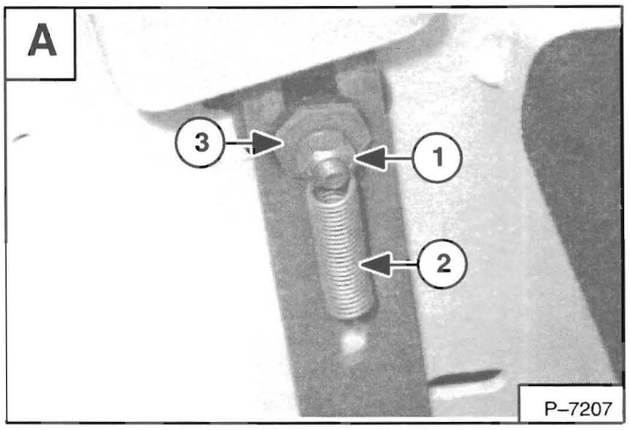
Remove the nut (Item 1) **[A]** from the top bolt on the interlock.

Remove the spring (Item 2) **[A]** from the bolt and interlock.

Installation: Tighten the interlock nut to 80–90 in.–lbs. (9–10 Nm) torque.

Remove the nut (Item 3) **[A]** and plastic washer from the interlock bolt.

Remove the bolt from the outside of the fender.

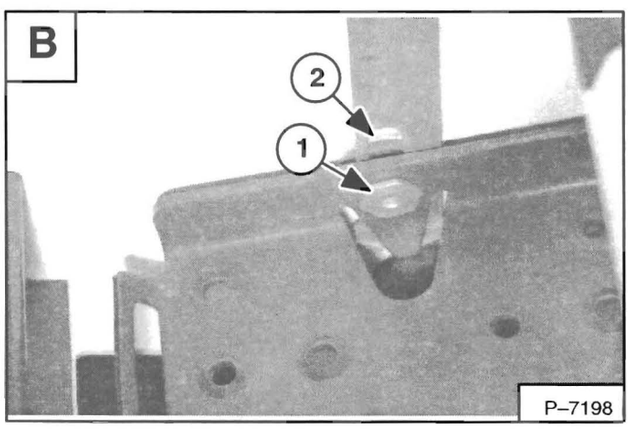


NOTE: Note the location of the interlock parts during removal for assembly purposes. There is a plastic washer which must be installed on each side of the interlock bar during assembly.

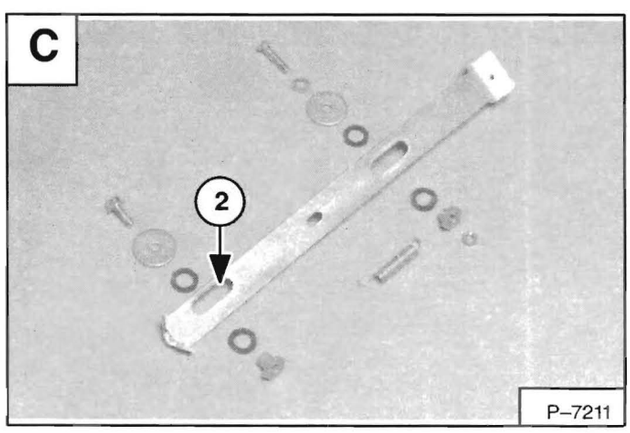
Remove the nut (Item 1) **[B]** from the bottom bolt on the interlock and pedal.

Installation: The bottom slot (Item 2) **[B]** & **[C]** on both interlock bars must be toward the rear of the pedal.

Always check for free movement of the interlock after assembly.



Remove the interlock assembly **[C]**.



CONTROL PEDALS

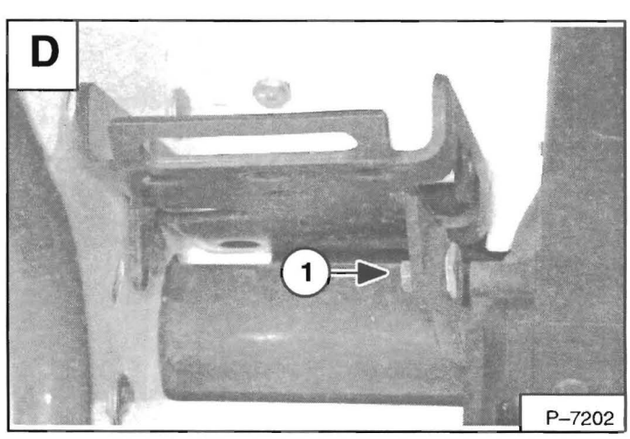
Removal and Installation

Remove the bottom nut, washers and bolt from the interlock and pedal **[B]**.

Remove the bolt (Item 1) **[D]** from the pedal linkage pivot. Remove the pedal from the linkage.

Pedal Adjustment

When installing the pedal and interlock, align them by moving the interlock forward or backward in the slot in the fender.




bobcat

Page Number

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DRIVE BELT
Removal and Installation 3–10

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Disassembly 3–26
Inspection 3–30
Parts Identification 3–25
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HYDROSTATIC PUMP
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STEERING LINKAGE
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TENSION PULLEY AND SPRING
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TROUBLESHOOTING
Chart 3–3


bobcat

TROUBLESHOOTING

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

⚠ WARNING

Check for correct function after adjustments, repairs or service. Failure to make correct repairs or adjustments can cause injury or death.

W–2004–1285

PROBLEM	CAUSE
No drive on one side, in one direction.	1, 2, 3, 4, 5, 19
No drive on one side in both directions.	2, 3, 5, 6, 7, 8
The loader does not move in a straight line.	2, 3, 4, 6, 7, 8, 10, 19
The hydrostatic system is overheating.	4, 11, 12, 13, 14, 15
The oil light comes ON.	16, 17, 18

KEY TO CORRECT THE CAUSE

1. The hydrostatic system has a fluid leak.
2. The steering linkage needs adjustment.
3. The high pressure replenishing valve(s) are defective.
4. The shuttle valve in the hydrostatic motor has a defect.
5. The balance plate in the hydrostatic motor seals are defective.
6. The hydrostatic pumps have a defect.
7. The final drive chain is broken.
8. The hydrostatic motor has a defect.
9. The tires do not have the correct tire pressure.
10. The tires are not the same size.
11. The hydrostatic fluid is not at the correct level.
12. The oil cooler has a restriction (Externally or Internally).
13. The temperature sending switch is not operating correctly (453 only).
14. The control valve is not operating correctly.
15. The loader is not being operated at the correct RPM.
16. The sender has a defective (453 only).
17. There is low charge pressure (453 only).
18. The charge relief has a defect.
19. Steering lever is obstructed.

IMPORTANT

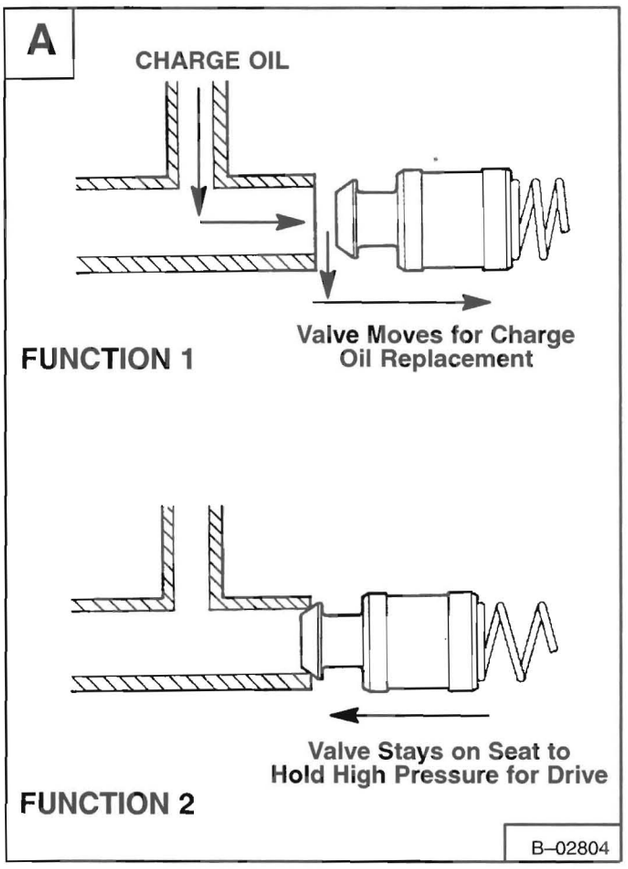
When repairing hydrostatic and hydraulic systems, clean the work area before disassembly and keep all parts clean. Always use caps and plugs on hoses, tubelines and ports to keep dirt out. Dirt can quickly damage the system.

I–2003–0888

Replenishing Valve Function

The functions of the replenishing valves are:

1. 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; Function 1 **[A]**.
2. To keep high pressure fluid out of the low pressure side of the hydrostatic circuitry; Function 2 **[A]**.



CONTROL SHIELD AND STEERING LEVER PANELS

Removal and Installation

⚠ WARNING

Put jackstands under the front axles and rear corners of the frame before running the engine for service. Failure to use jackstands can allow the machine to fall or move and cause injury or death.

W–2017–0286

Open the rear door.

Raise the operators cab. (See Page 1–1.)

Raise the lift arms. (See Page 1–1.)

Hold the lock nut and remove the lift arm by–pass knob (Item 1) **[A]** & **[B]**.

Remove the lock nut and rubber washer (Item 2) **[A]** & **[B]** from the by–pass valve.

Remove the four mounting bolts (Item 3) **[A]** & **[B]** from the control shield.

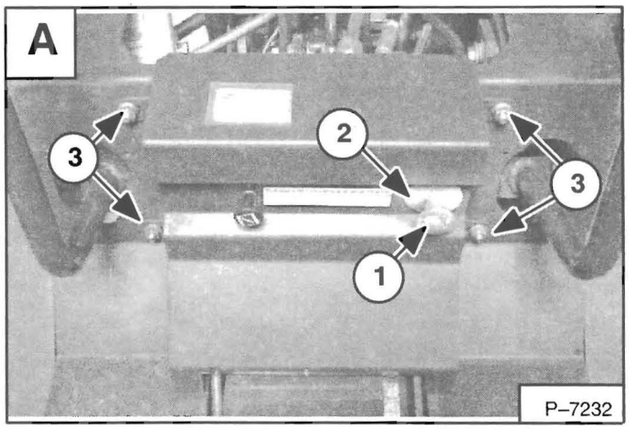
Remove the control shield.

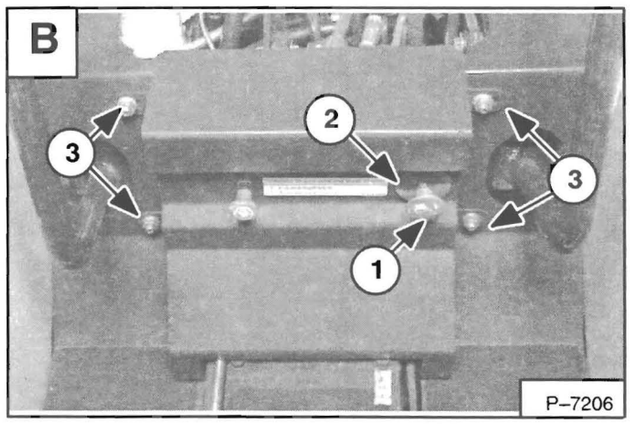
453: Disconnect the cable lock nut and jam nuts (Item 1) **[C]** from the fuel stop lever.

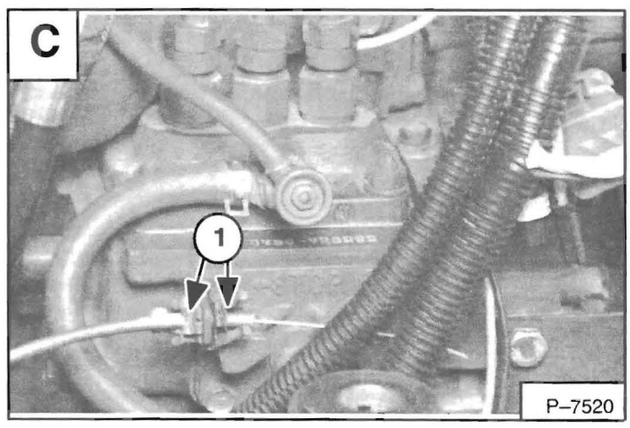
Remove the cable from the stop mechanism.

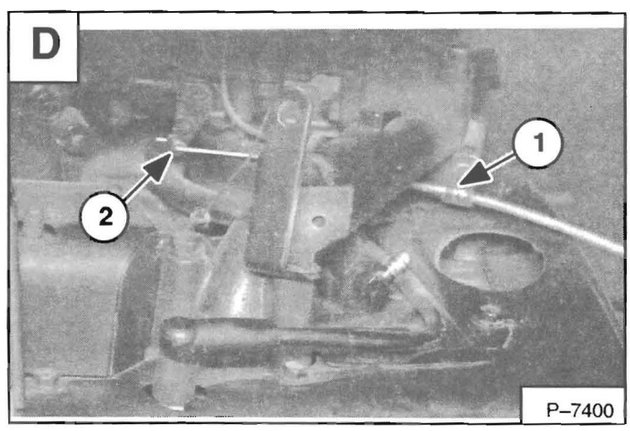
450: Disconnect the choke cable from the carburetor clamp (Item 1) **[D]** and linkage (Item 2) **[D]**.

Remove the choke cable.





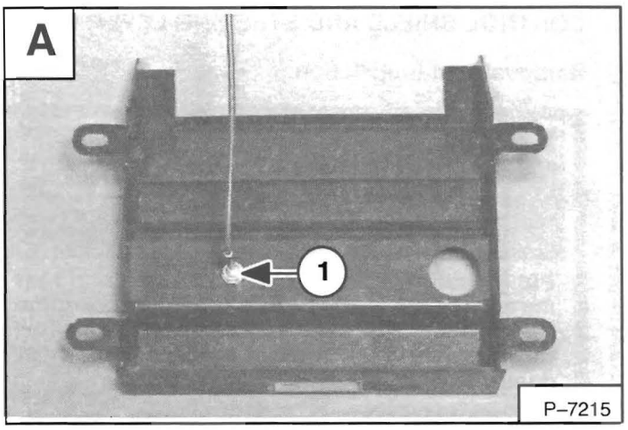




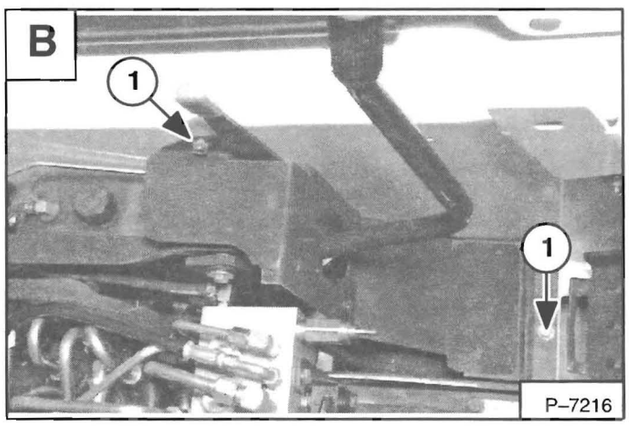
STEERING LEVERS AND STEERING LEVER PANELS (Cont'd)

Removal and Installation (Cont'd)

Remove the jam nut (Item 1) **[A]** from the cable on the back of the control panel.



Remove the two bolts (Item 1) **[B]** from the steering lever panels. Remove the panels.



STEERING LEVERS

Removal and Installation

⚠ WARNING

Put jackstands under the front axles and rear corners of the frame before running the engine for service. Failure to use jackstands can allow the machine to fall or move and cause injury or death.

W–2017–0286

Raise the lift arms and install an approved lift arm support device. (See Page 1–1.)

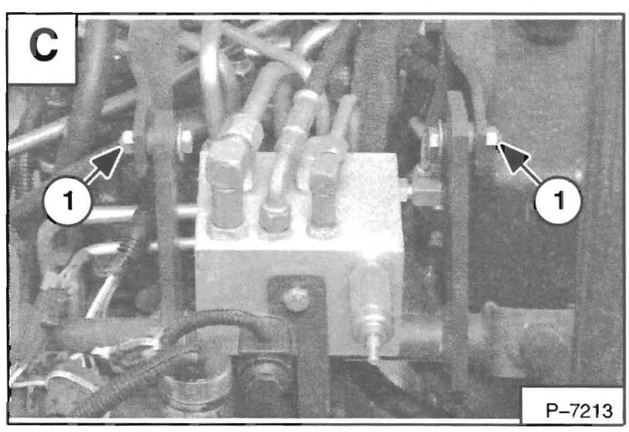
Raise the operator cab. (See Page 1–1.)

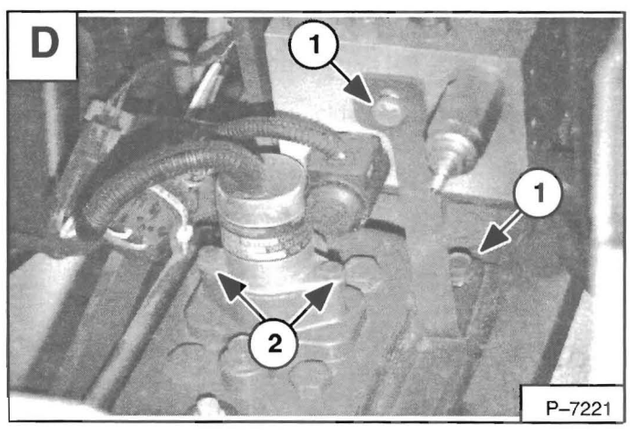
Remove the control shield and steering panels. (See Page 3–1.)

Remove the nuts and bolts (Item 1) **[C]** from the steering linkage.

Remove the bolts (Item 1) **[D]** and the support bracket from the lift arm by–pass block.

Remove the two bolts (Item 2) **[D]** from the parking brake solenoid.



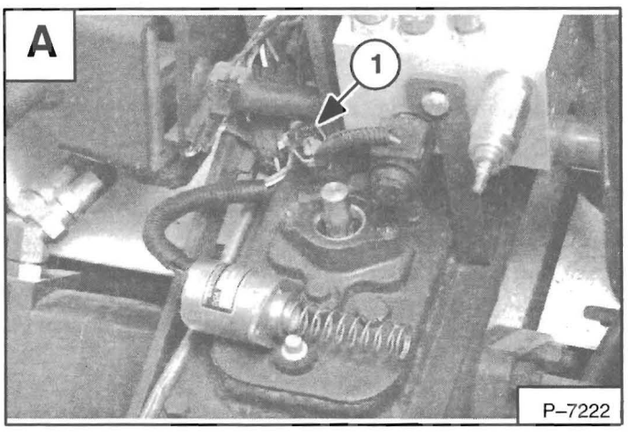


STEERING LEVERS (Cont'd)

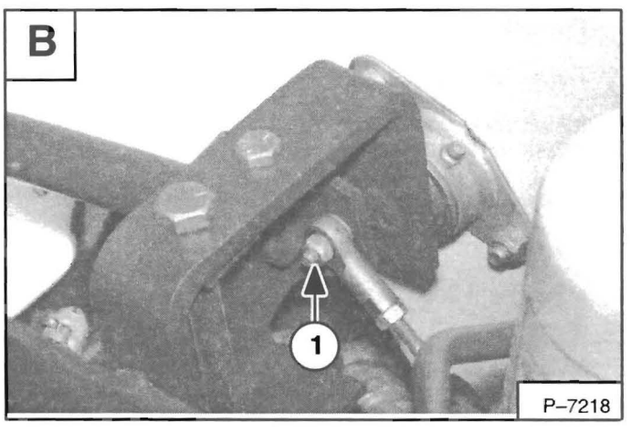
Removal and Installation (Cont'd)

Remove the parking brake solenoid and spring.

Disconnect the electrical connector from the by–pass solenoid (Item 1) **[A]**.

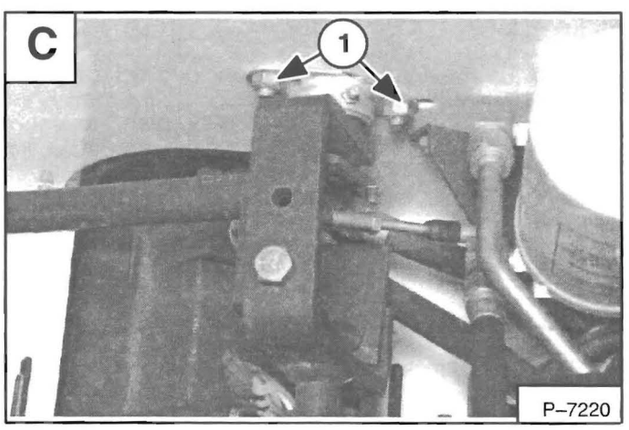


Remove the nut (Item 1) **[B]** from the auxiliary hydraulics cable bolt (If equipped). Remove the cable.



Remove the nuts (Item 1) **[C]** from the pivot bearings (both sides). Hold the bolts from outside the fender.

Remove the steering lever assembly from the loader.



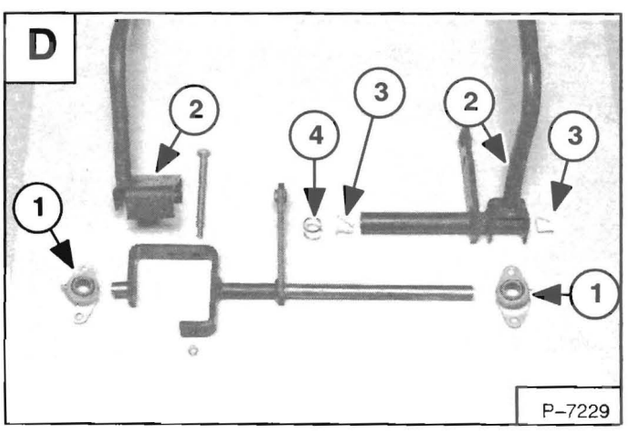
Disassembly and Assembly

Remove the bearings (Item 1) **[D]** from the shaft.

Slide the steering levers (Item 2) **[D]** from the shaft.

Check the plastic bushings (Item 3) **[D]** and the wave washers (Item 4) **[D]** for damage or wear and replace as necessary.

Assembly: Lightly lubricate the steering shaft during assembly.



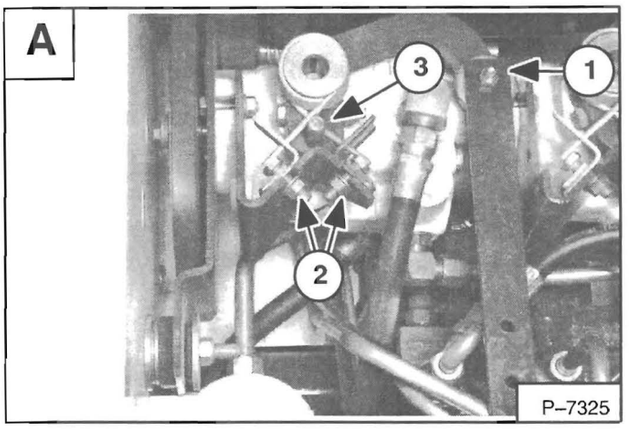
STEERING LINKAGE

Adjustment

⚠ WARNING

Put jackstands under the front axles and rear corners of the frame before running the engine for service. Failure to use jackstands can allow the machine to fall or move and cause injury or death.

W–2017–0286



Put jackstands under the loader frame.

Raise the operator cab. (See Page 1–1.)

Install the Remote Start Switch. (See Page 5–1.) Start the engine and run at a slow RPM.

Loosen the nuts and bolts on the pintle arms (Item 1) **[A]**.

Hold the nuts (Item 2) **[A]** and turn the bolts so the centering springs just touch the pin (Item 3) **[A]** and the adjustment bolts heads.

If the wheels are turning (creeping), move the steering lever to stop the creeping. Locate the correct side of the centering spring where the adjustment is to be made.

Turn the bolt out a small amount until the wheels stop turning.

Move the steering lever forward and backward and let the transmission return to neutral position. If the transmission does not return to the neutral position, repeat the adjustment.

Repeat the steps for the other side.

Installation: Tighten the nuts (Item 1) **[A]** on the steering linkage to 11–13 ft.–lbs. (15–18 Nm) torque.

Lower the operator cab. (See Page 1–1.)

Remove the jackstands from the loader frame.

Pintle Arm Removal and Installation

Put jackstands under the rear of the frame. (See Page 1–1.)

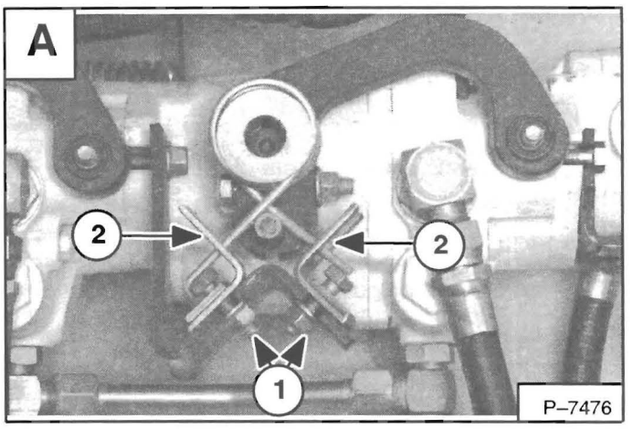
Raise the operator cab. (See Page 1–1.)

Raise the lift arms and install the lift arm support device. (See Page 1–1.)

Remove the steering linkage from the pintle arm.

Remove the adjustment nuts and bolts (Item 1) **[A]** from the centering spring.

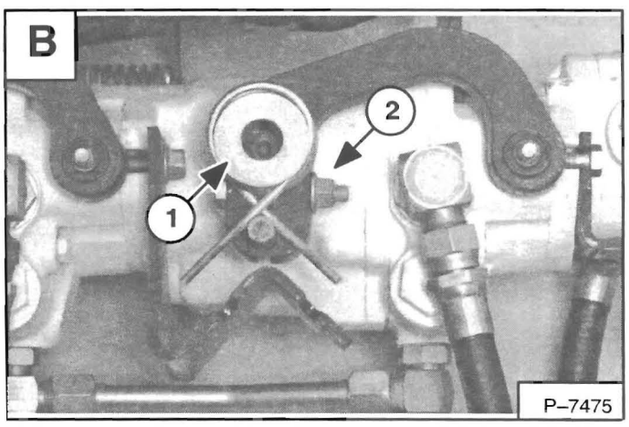
Remove the spring retainer brackets (Item 2) **[A]**.



Use a pliers to remove one of the spring ends from the bracket (Item 1) **[B]**. Remove the spring.

Loosen the pintle arm clamping bolt (Item 2) **[B]**.

Use a small gear puller and remove the assembly from the shaft of the hydrostatic pump.

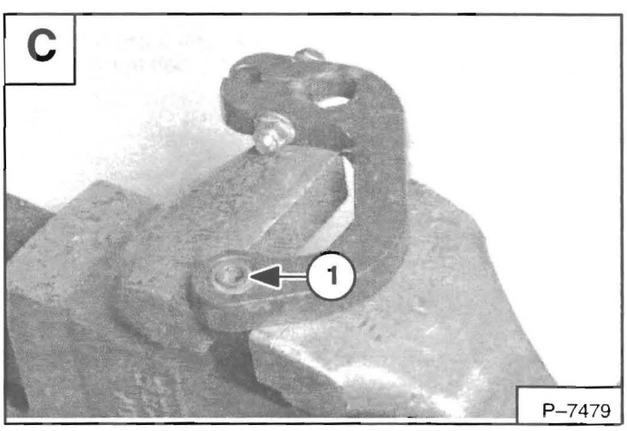


NOTE: Do not use a screwdriver to pry the pintle arm off, it will cause damage to the seal retainer.

Pintle Arm Disassembly and Assembly

Put the pintle arm on a vise and use a hammer to drive the bushing (Item 1) **[C]** from the pintle arm.

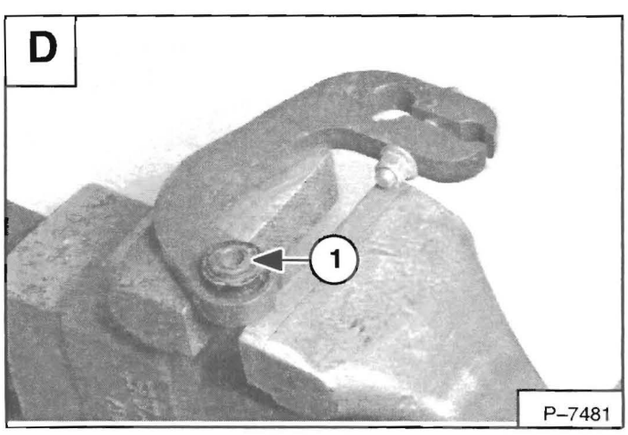
Replace the bushing if damaged.



Put the pintle arm on a vise and use a hammer to drive the bushing (Item 1) **[D]** into position.

Install the pintle arm on the hydrostatic pump in the reverse order.

Adjust the steering linkage. (See Page 3–8.)



DRIVE BELT

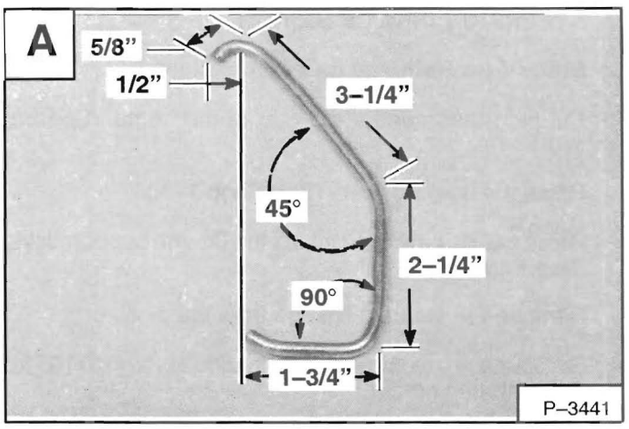
Removal and Installation

450 Loader

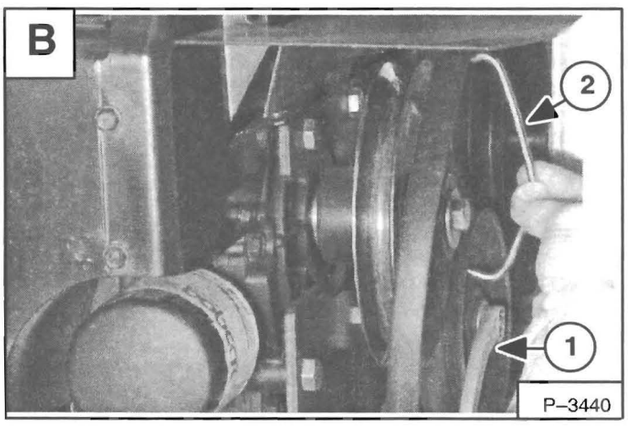
Put jackstands under the rear of the loader. (See Page 1–1.)

Raise the operator cab. (See Page 1–1.)

To hold the tension pulley while the drive belt is removed, bend a 3/16" diameter rod to the approximate dimensions shown **[A]**.



Use a wrench (Item 1) **[B]** to lift the tension pulley. Remove the drive belt and install the rod (Item 2) **[B]**, one end through the hole in the pulley and the other end over the top edge of the mounting plate.



If there is not a hole in the pulley, use a pry bar to lift up on the tension pulley and remove the belt from the engine pulley.

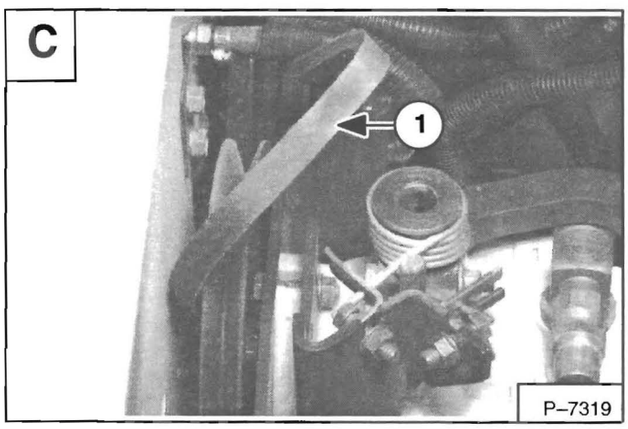
Release the tension pulley at a slow rate.

453 Loader

Remove the alternator from the loader. (See Page 6–1.)

Use a pry bar to lift the tension pulley.

Remove the belt (Item 1) **[C]** from the pulley. Lower the pulley slowly onto a wooden block.



HYDR0STATIC PUMP

Checking Charge Pressure

The tools listed are needed to complete the following procedure:

MEL1173 – Test Kit

⚠ WARNING

Put jackstands under the front axles and rear corners of the frame before running the engine for service. Failure to use jackstands can allow the machine to fall or move and cause injury or death.

W–2017–0286

Lift and block the loader. (See Page 1–1.)

Raise the operator cab. (See Page 1–1).

Disconnect the electrical connector (Item 1) **[A]** from the charge pressure switch.

Remove the charge pressure switch from the filter port block (Item 2) **[A]**.

Connect the pressure gauge into the sender port of the filter port block **[B]**.

Start the engine and run at full RPM. The pressure must be 75–85 PSI (241–586 kPa) minimum with no hydraulic action.

If the pressure is not correct, check the charge pressure spring and poppet. (See Page 3–1.)

Stop the engine.

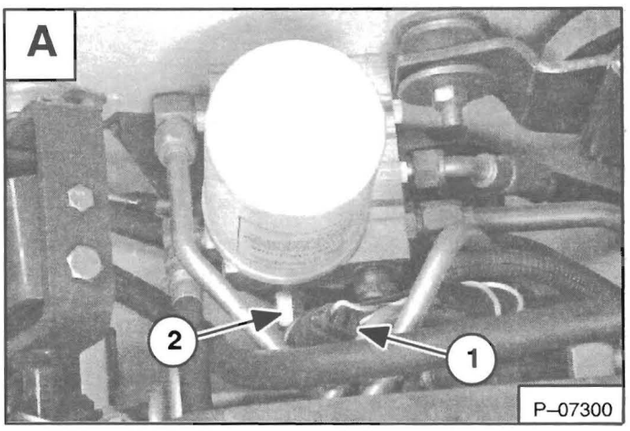
Disconnect the pressure gauge.

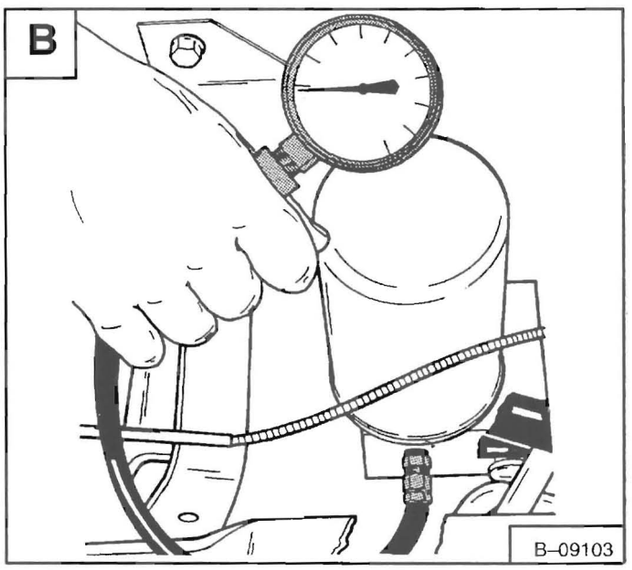
Install and tighten the charge pressure switch.

Reconnect the electrical connector to the charge pressure switch.

Lower the operator cab.

Remove the jackstands from under the loader frame.





Removal and Installation

IMPORTANT

When making repairs on 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.

I–2003–0284

Put jackstands under the rear of the frame. (See Page 1–1.)

Raise the operator cab. (See Page 1–1.)

Raise the lift arms and install the lift arm support device. (See Page 1–1.)

450 Loader

NOTE: The engine and the hydrostatic pump can be removed as an assembly from the 450 loader. For engine removal refer to the procedure on page 7A–1. Removal of the drive belt and hydrostatic pumps from the engine will be easier after the assembly is removed from the loader. Use the following procedure to make the hydrostatic pump ready for removal.

Remove the steering levers. (See Page 3–1.)

Remove the bolts (Item 1) **[A]** to remove the shield below the fuel tank.

Disconnect the choke cable and speed control linkage. (See Page 7A–1.)

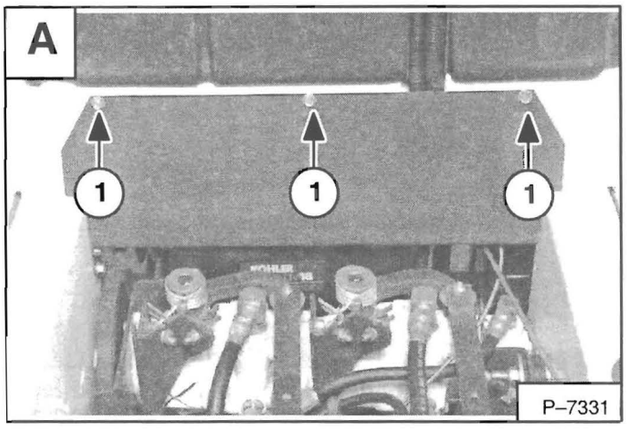
Disconnect the charge pressure hose (Item 1) **[B]** from the hydrostatic pump.

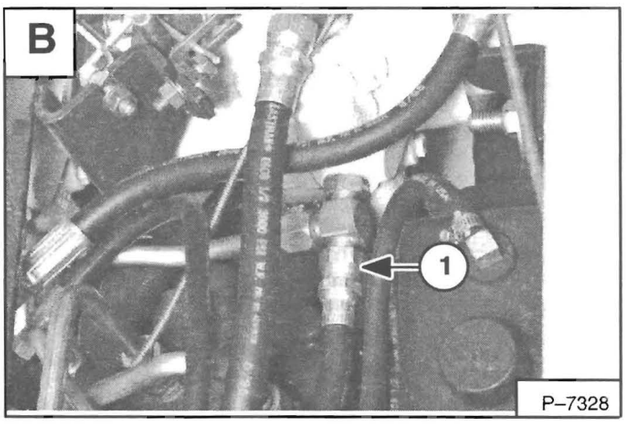
Remove the hydraulic reservoir. (See Page 2–1.)

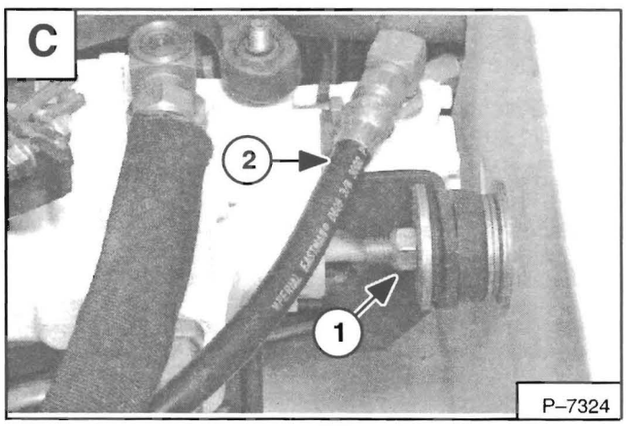
Disconnect the outlet hose (Item 2) **[C]** from the hydraulic pump.

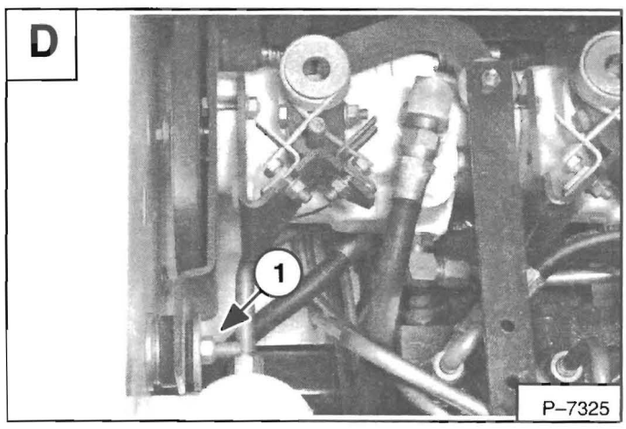
Remove the high pressure hoses form the drive motors. (See Page 3–1.)

Remove the nuts (Item 1) **[C]** & **[D]** and bolts from the hydrostatic pump mounts.









Removal and Installation (Cont'd)

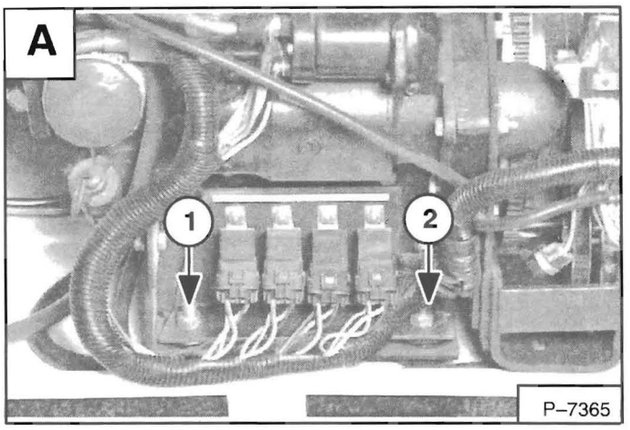
453 Loader

NOTE: The engine and hydrostatic pump assembly must be moved to the right to remove the hydrostatic pumps.

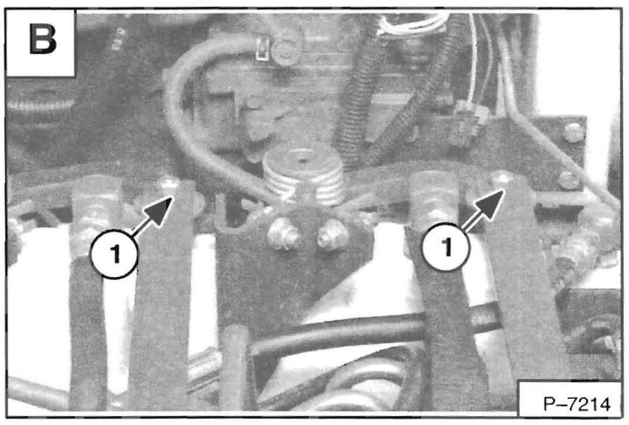
Use the following procedure to remove the hydrostatic pumps:

Loosen the left engine mounting bolt (Item 1) **[A]**, and remove the right engine mounting bolt (Item 2) **[A]**.

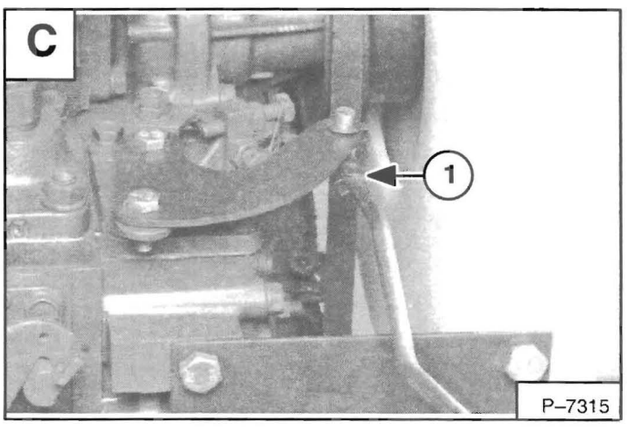
Remove the steering levers. (See Page 3–1.)



Remove the nuts (Item 1) **[B]** from the steering lever linkage. Remove the linkage from the hydrostatic pumps.



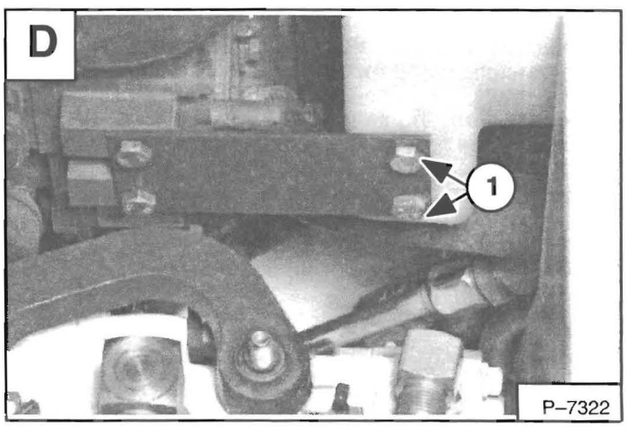
Disconnect the clip (Item 1) **[C]** from the speed control linkage. Remove the linkage.



Remove the two bolts (Item 1) **[D]** from the fan housing stabilizer bracket.

Remove the hydraulic reservoir. (See Page 2–1.)

Remove the control valve. (See Page 2–1.)

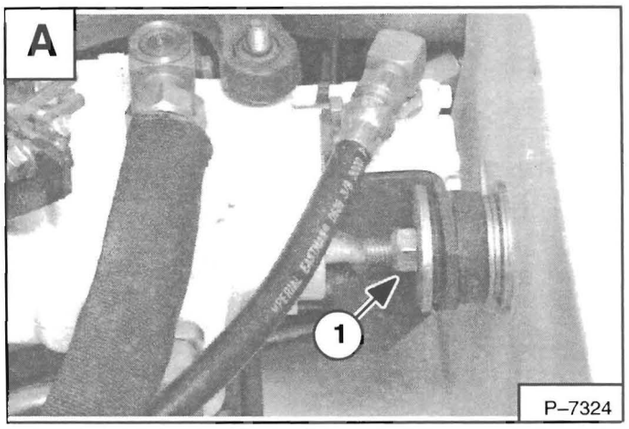


HYDROSTATIC PUMP (Cont'd)

Removal and Installation (Cont'd)

Remove the high pressure hoses from the drive motors. (See Page 3–1.)

Remove the nut (Item 1) **[A]** from the left side hydrostatic pump mounting bolt. Remove the mounting bolt.

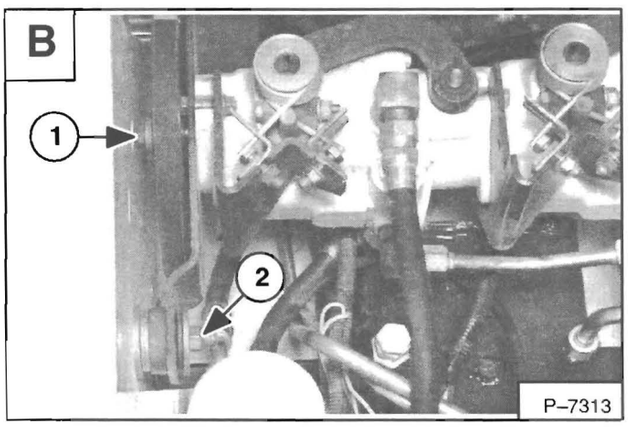


Remove the bolt (Item 1) **[B]** and washer from the hydrostatic pump pulley.

Remove the pulley. (See Page 3–1.)

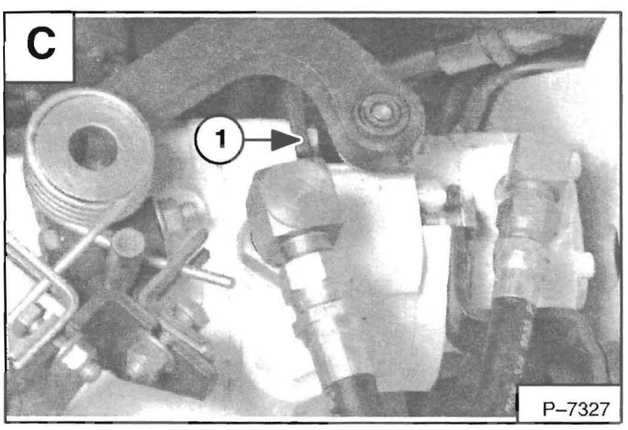
Remove the nut (Item 2) **[B]** and bolt from the right side hydrostatic pump mounting bolt.

Remove the rubber mount and install the bolt. Tighten the bolt to pull the hydrostatic pump assembly to the right to allow clearance fro hydrostatic pump removal.



Remove the two bolts (Item 1) **[C]** form the hydrostatic pump mounting bracket.

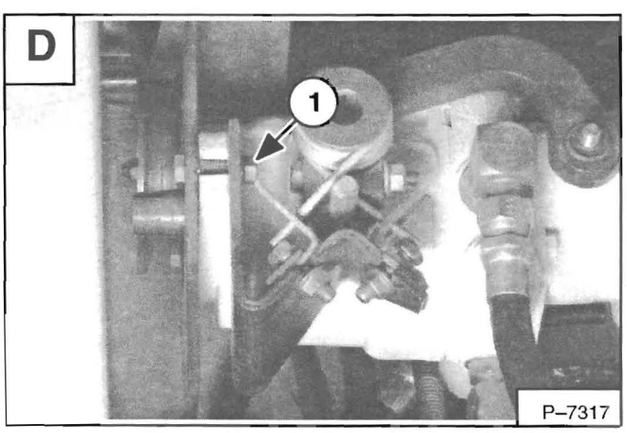
Installation: Tighten the bolts to 27–31 ft.–lbs. (37–42 Nm) torque.



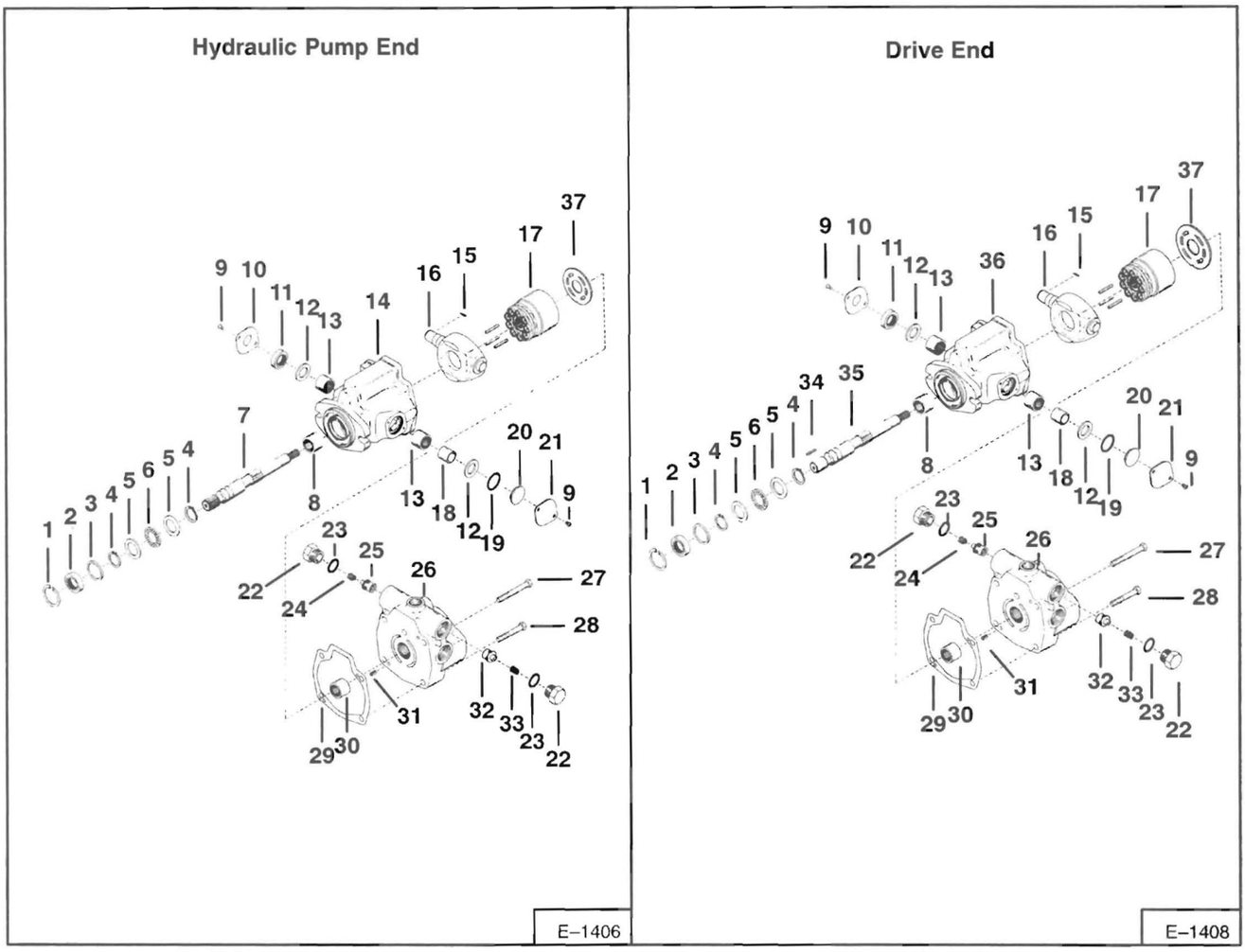
Remove the two right bolts (Item 1) **[D]** from the hydrostatic pump mounting bracket.

Installation: Tighten the bolts to 27–31 ft.–lbs. (37–42 Nm) torque.

Remove the hydrostatic pump.



Parts Identification



Ref.	Description	Ref.	Description
1	RING, retaining	19	O–RING
2	SEAL	20	COVER
3	WASHER	21	COVER
4	RING, retaining	22	PLUG
5	RACE	23	O–RING
6	BEARING, thrust	24	SPRING
7	SHAFT, drive	25	VALVE, relief
8	BEARING	26	PLATE, back
9	SCREW	27	BOLT
10	COVER	28	BOLT
11	SEAL	29	GASKET
12	WASHER	30	BEARING
13	BEARING	31	DOWEL
14	HOUSING	32	SEAT
15	KEY	33	SPRING
16	PLATE, yoke	34	KEY
17	ROTATING GROUP	35	SHAFT, drive
18	BEARING	36	HOUSING
		37	PLATE, valve wear

Disassembly and Assembly

The tool listed will be needed to do the following procedure:

MEL1219–4 – Torx Socket

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.

I–2003–0888

NOTE: Before you begin the disassembly procedure, remove the hydraulic pump from the loader.

Remove the charge tubeline (Item 1) **[A]**.

Remove the four replenishing valves from the pump **[B]**.

NOTE: Install relief/replenishing valves in the forward drive circuit (Item 2) [A] during assembly of hydrostatic pump. (See Service Letter dated 4 December 1996 for loader serial numbers affected.)

Remove the bolts and center bracket from the pumps **[C]**.

Assembly: Tighten the bolts to 27–31 ft.–lbs. (37–42 Nm) torque.

Separate the pump housing from the center section.

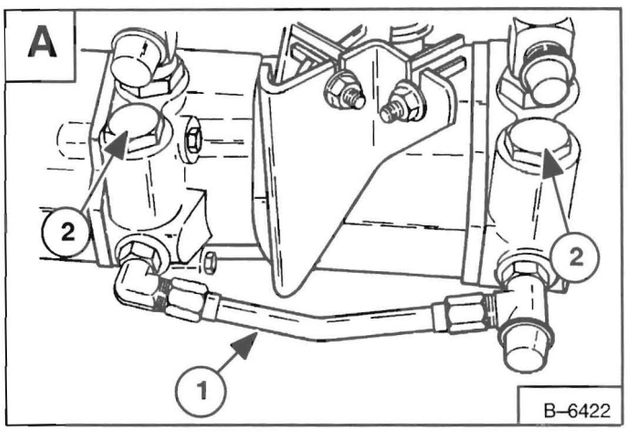
Remove the coupler from the center section.

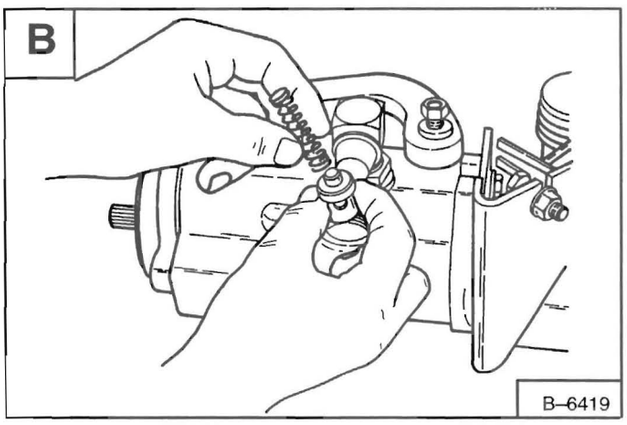
Remove the pintle levers from the pump.

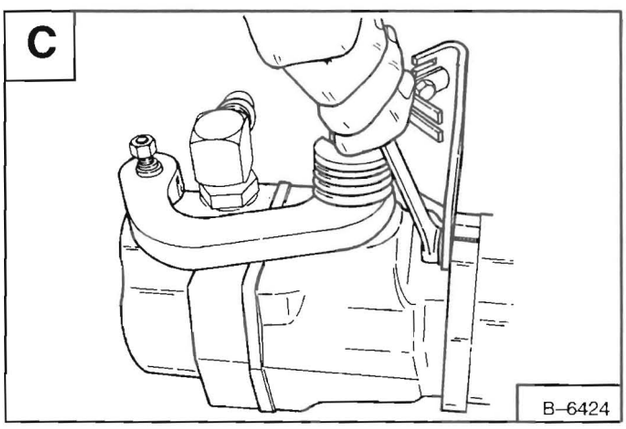
NOTE: The hydrostatic pump front and rear pump internal parts are the same. Keep all the parts for one pump separated from the parts for the other pump.

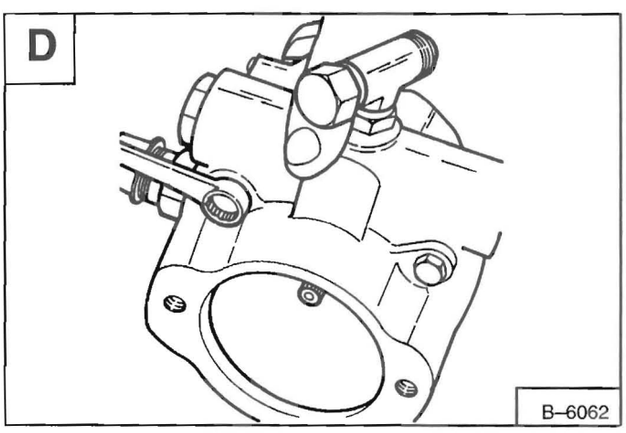
Remove the four bolts from the center section **[D]**.

Assembly: Tighten the bolts to 17–21 ft.–lbs. (23–28 Nm) torque.



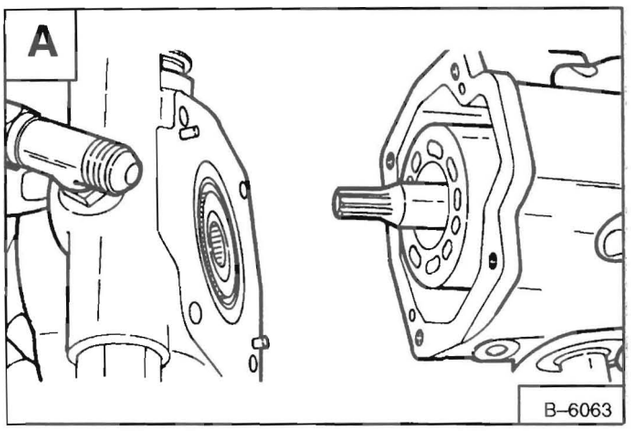






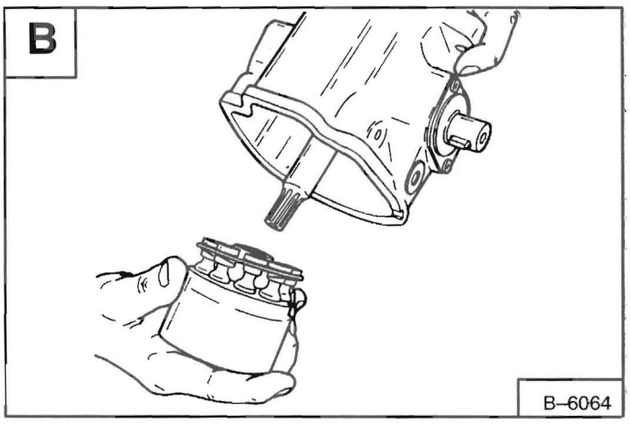
Disassembly and Assembly (Cont'd)

Remove the center section **[A]**.



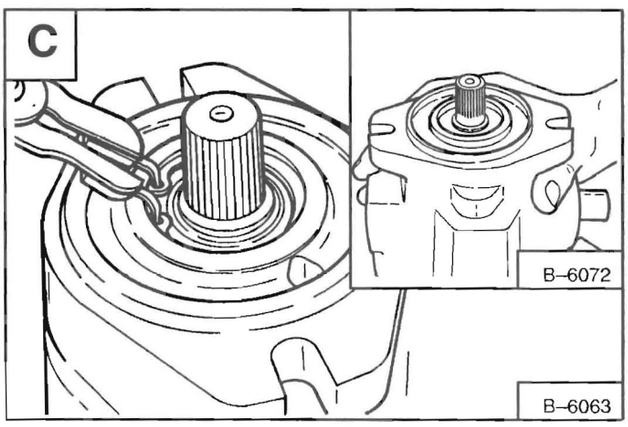
Remove the rotating group **[B]**.

Put your hand under the rotating group and turn the pump housing around so the rotating group will slide into your hand.

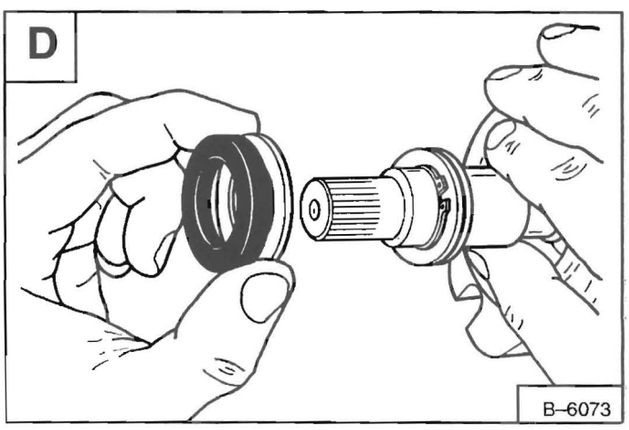


Remove the snap ring from the rear housing **[C]**.

Hit the shaft on a block of wood to remove the bearing and shaft.



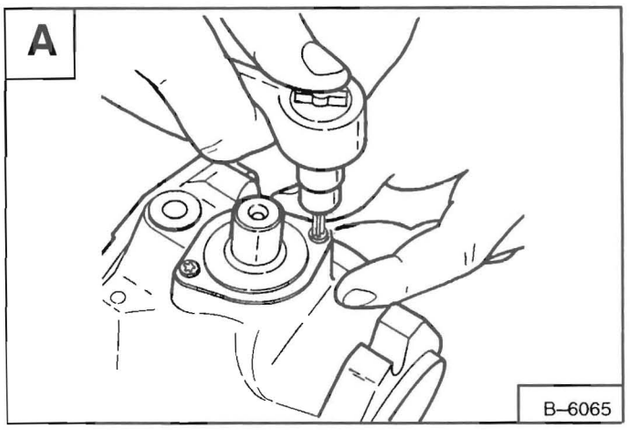
Remove the seal and back–up washer from the shaft **[D]**.



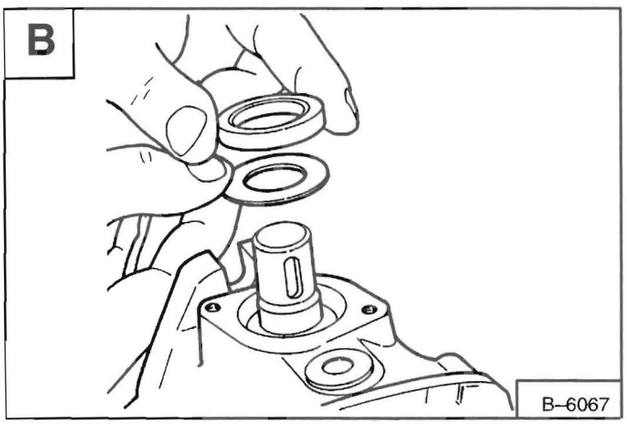
Disassembly and Assembly (Cont'd)

Remove the bolts from the cover of the long pintle shaft **[A]**.

Remove the pintle cover.

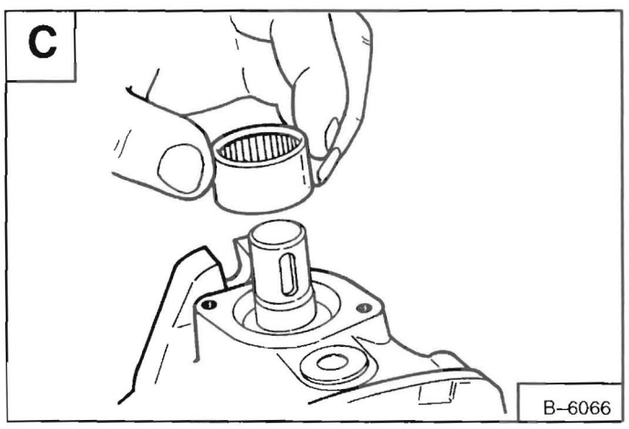


Remove the seal and washer **[B]**.

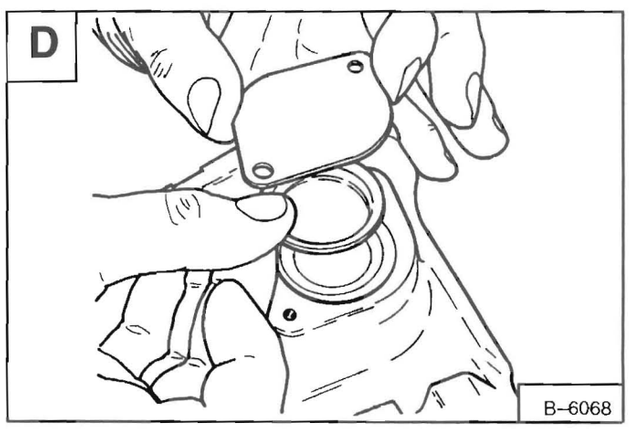


Remove the pintle shaft bearing **[C]**.

Assembly: When installing the bearing, make sure the numbered side of the bearing is toward the outside.

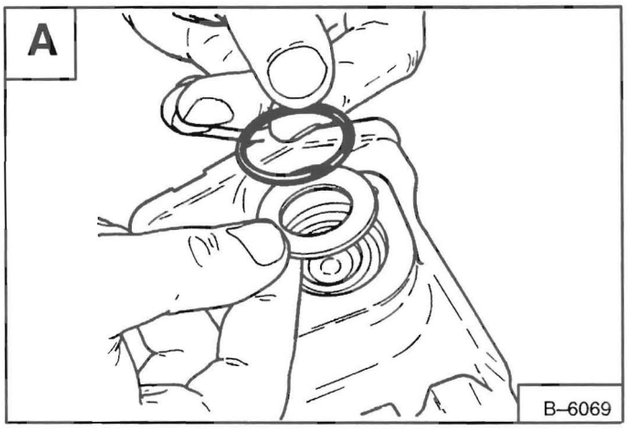


Remove the screws and cover from the short pintle shaft **[D]**.



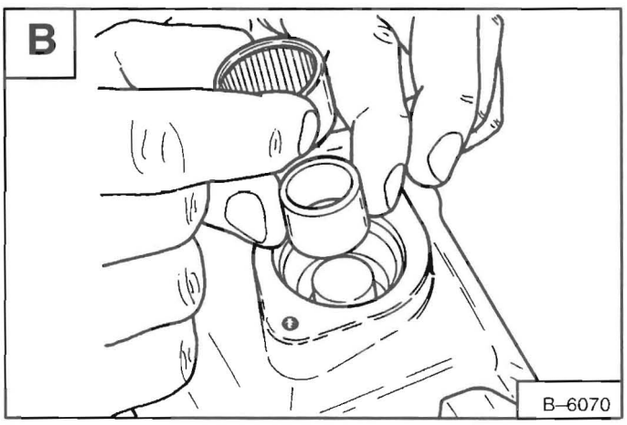
Disassembly and Assembly (Cont'd)

Remove the washer and O–ring from the shaft **[A]**.

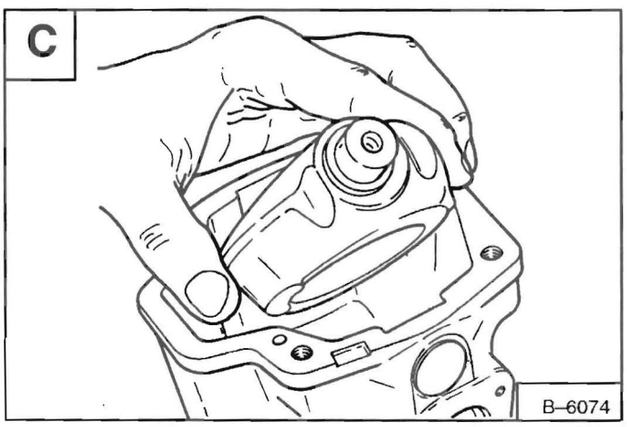


Remove the bearing and bearing race from the shaft **[B]**.

Assembly: When installing the race, make sure that the chamfer side of the race is toward the cam plate.



Remove the cam plate from the housing **[C]**.

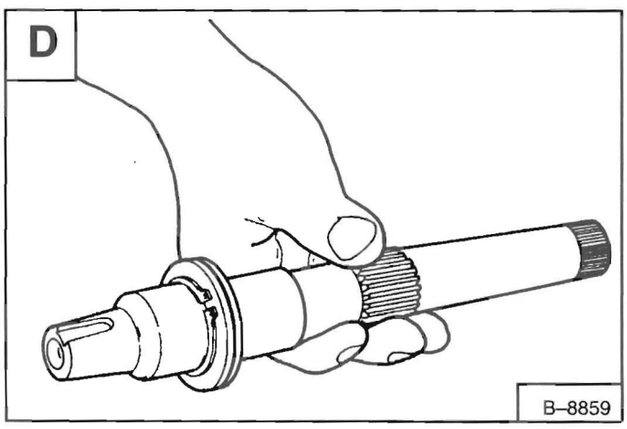


Inspection

NOTE: Keep all the parts for one pump separated from the parts for the other pump.

Clean all the parts in solvent and use air pressure to dry them. DO NOT use cloth or paper because small pieces of material can get into the system and cause damage.

Inspect the input drive shafts, bearings and races for wear and damage to the shaft splines **[D]**.

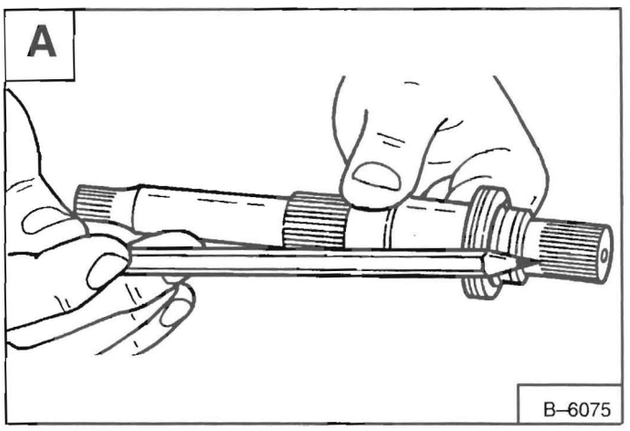


HYDROSTATIC PUMP (Cont'd)

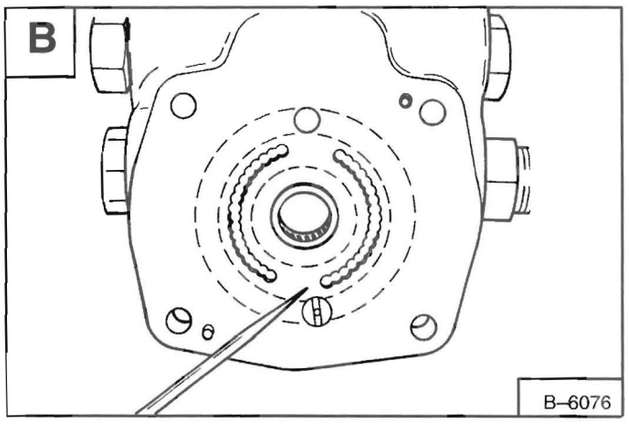
Inspection (Cont'd)

Inspect the input drive shafts, bearings and races for wear and damage to the shaft splines **[A]**.

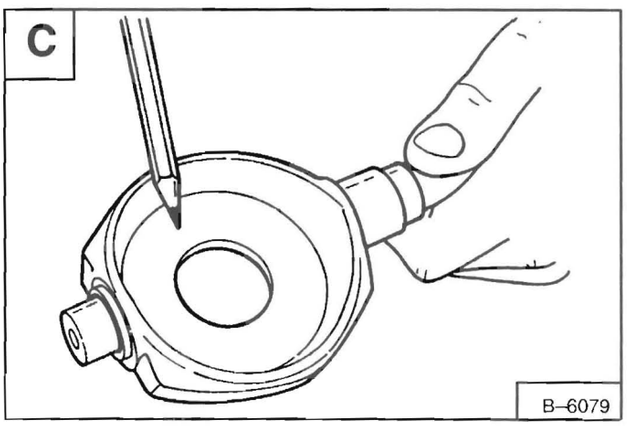
The bearings in the center section and housing, only need to be removed if they are loose and show wear. Use a press to remove and replace the bearings.



Inspect the flat surface of the sections. The finish must be smooth and free of grooves. If the grooves can be felt on the finished surfaced with a fingernail, replace the part **[B]**.



Inspect the camplate for wear. The finish must be smooth and free of grooves. If the grooves can be felt with a fingernail, replace the camplate **[C]**.



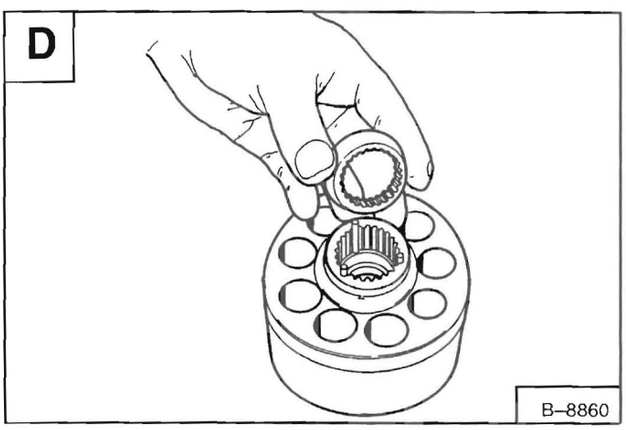
Inspect the rotating group as follows:

Check each piston in its bore. The piston must move freely.

Check the pins for wear or damage **[D]**.

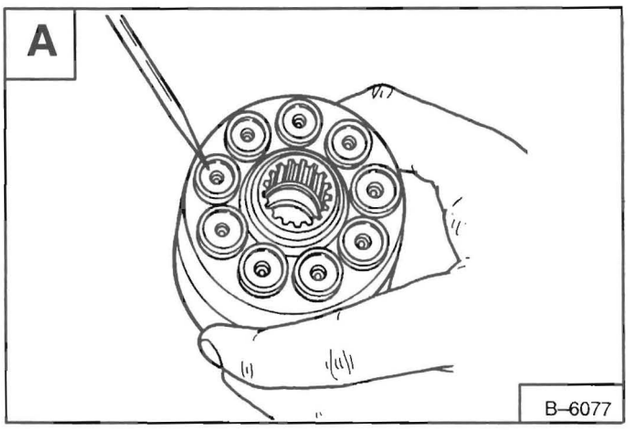
All the pins must be the same length and must not be bent.

Check the spherical washer for sharp edges, wear or scratches.

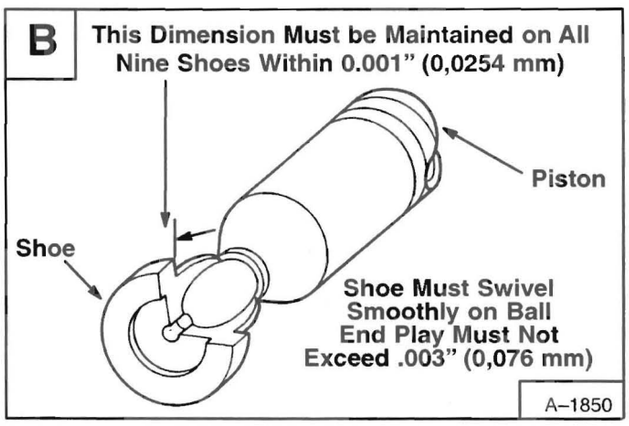


Inspection (Cont'd)

Check the piston shoe for scratches **[A]**.



Check the end play of each piston assembly **[B]**. Measure the thickness of each shoe. All shoes must be within 0.001" (0,025 mm) of each other **[B]**.

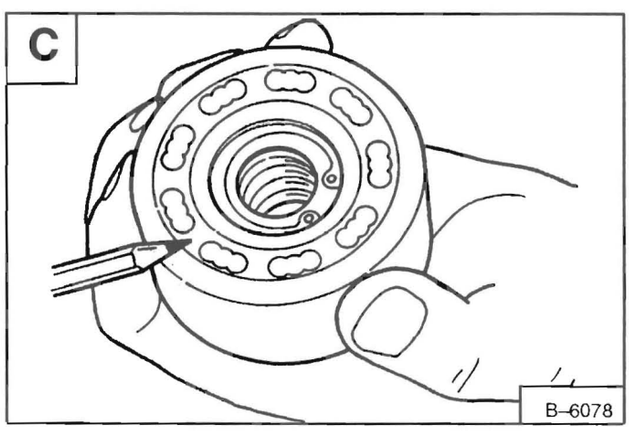


Check the flat surface of the piston block for being smooth and free of scratches **[C]**.

Inspect the shoe plate for wear or cracks. If there is any defect in the rotating group, the complete unit must be replaced.

DO NOT use sandpaper or a file to remove scratches.

NOTE: Always use new O–rings, gaskets and seals when assembling the hydrostatic pumps.



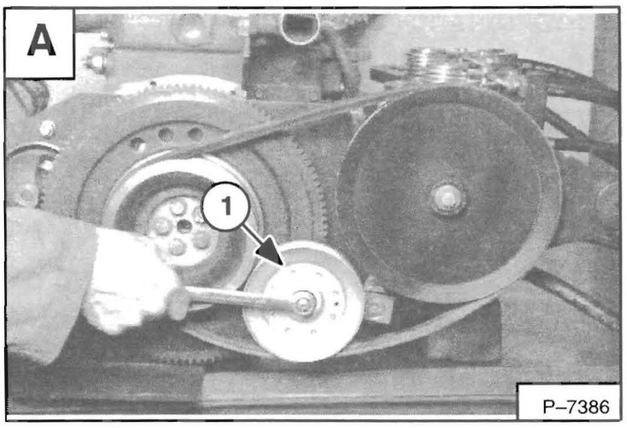
TENSION PULLEY AND SPRING

Removal and Installation

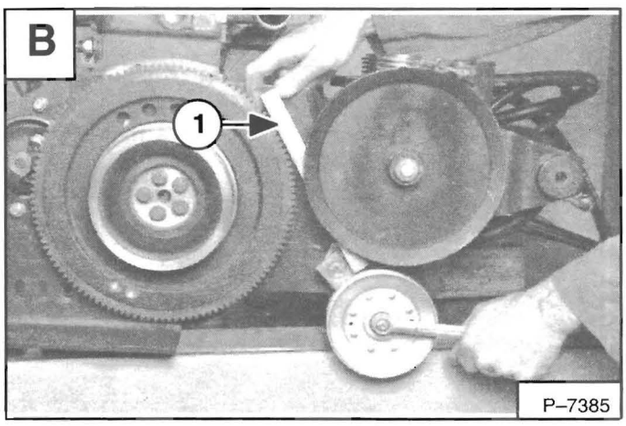
NOTE: Remove the engine and pump assembly from the loader. (See Page 3–1.)

NOTE: The removal and installation procedure is the same as the 450 and 453 loader.

Use a wrench to lift the tension pulley (Item 1) **[A]**. Remove the drive belt.



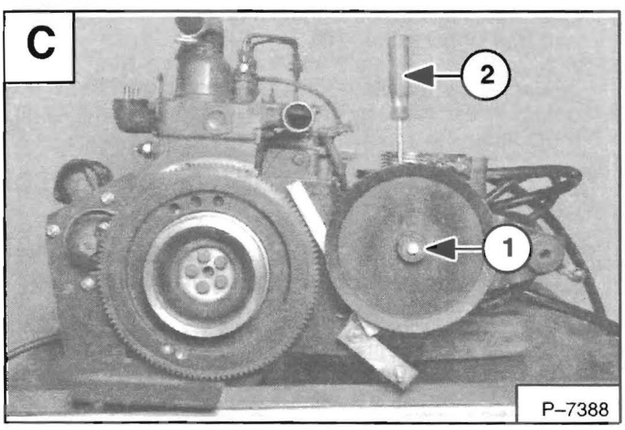
Use the wrench to turn the tension pulley clockwise to install a wooden block (Item 1) **[B]** between the flywheel and the tension pulley arm. Rest the pulley against the wooden block.



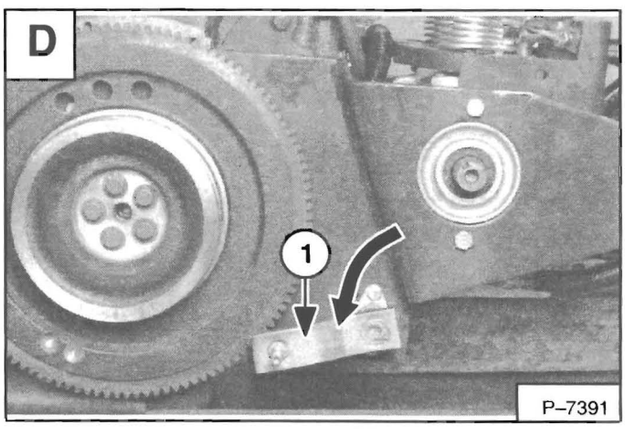
Loosen the bolt (Item 1) **[C]** and washer. Install a straight slot, square shank screwdriver (Item 2) **[C]** between the hub of the pulley and the mounting bracket.

Tap the bolt (Item 1) **[C]** with a hammer to remove the pulley from the shaft.

Remove the bolt and washer.



Hold the tension pulley arm and remove the wood block. Rotate the arm (Item 1) **[D]** counterclockwise to release the spring tension.

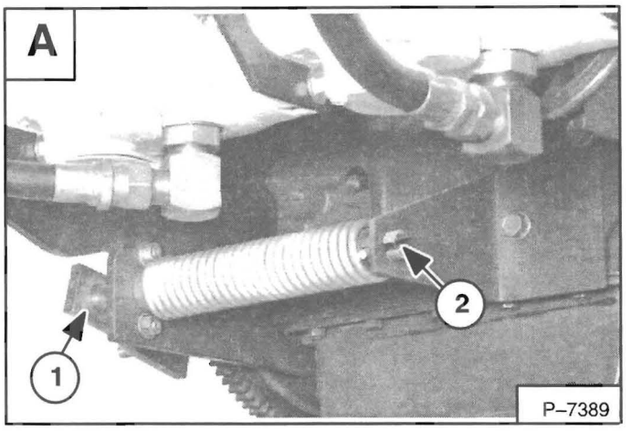


TENSION PULLEY AND SPRING (Cont'd)

Removal and Installation (Cont'd)

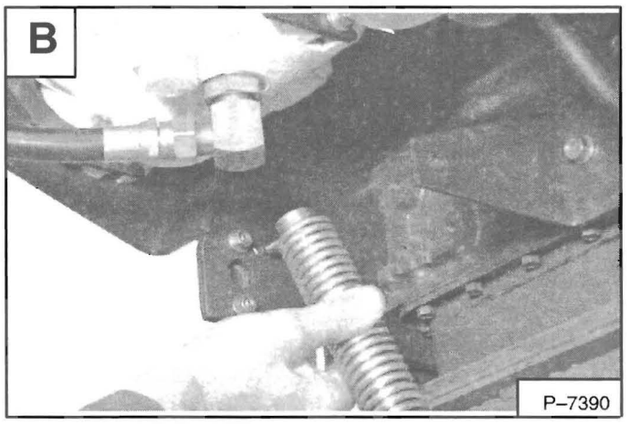
Pull the shaft (Item 1) **[A]** from the spring and mounting brackets.

Installation: Align the spring with the slot in the shaft (Item 2) **[A]**.



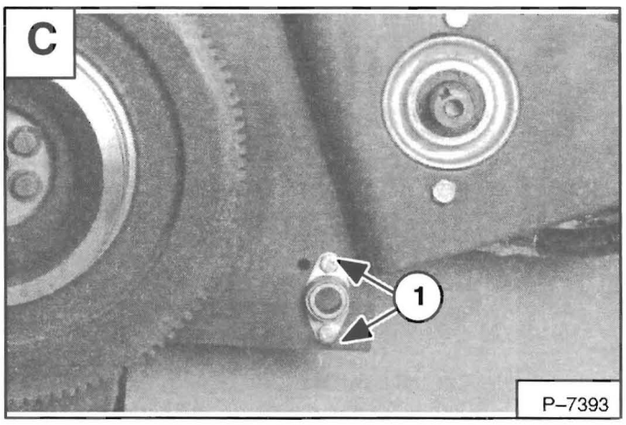
Remove the spring and tube from the mounting bracket **[B]**.

Installation: Install the spring hook in the mounting bracket.



Remove the bearing mounting bolts (Item 1) **[C]**.

Check the parts for damage and replace as needed.



HYDROSTATIC MOTOR

Removal and Installation

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.

I–2003–0888

⚠ WARNING

Put jackstands under the front axles and rear corners of the frame before running the engine for service. Failure to use jackstands can allow the machine to fall or move and cause injury or death.

W–2017–0286

Put jackstands under the front and rear of the loader. (See Page 1–1.)

Remove the wheels from the side of the loader where the motor is to be removed.

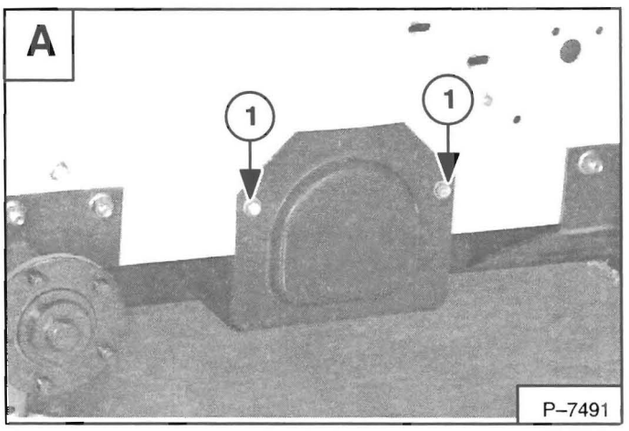
Raise the operator cab. (See Page 1–1.)

Raise the lift arms and install the lift arm support device. (See Page 1–1.)

Remove the center shield and steering lever panels. (See Page 3–1.)

Remove the motor cover bolts (Item 1) **[A]** from the outside of the loader.

Pull the cover outward and free from the slots under the frame.



HYDROSTATIC MOTOR (Cont'd)

Removal and Installation (Cont'd)

NOTE: Mark the hoses for installation purposes.

Remove the parking brake cover from the chaincase. (See Page 4–1.)

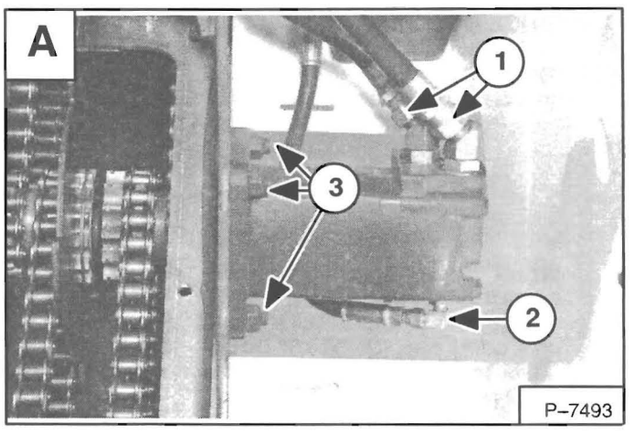
NOTE: Always use caps and plugs on hoses and fittings during disassembly and assembly.

Remove the high pressure hoses (Item 1) **[A]**, and the drain hose (Item 2) **[A]** from the motor. Cap and plug the hoses and fittings.

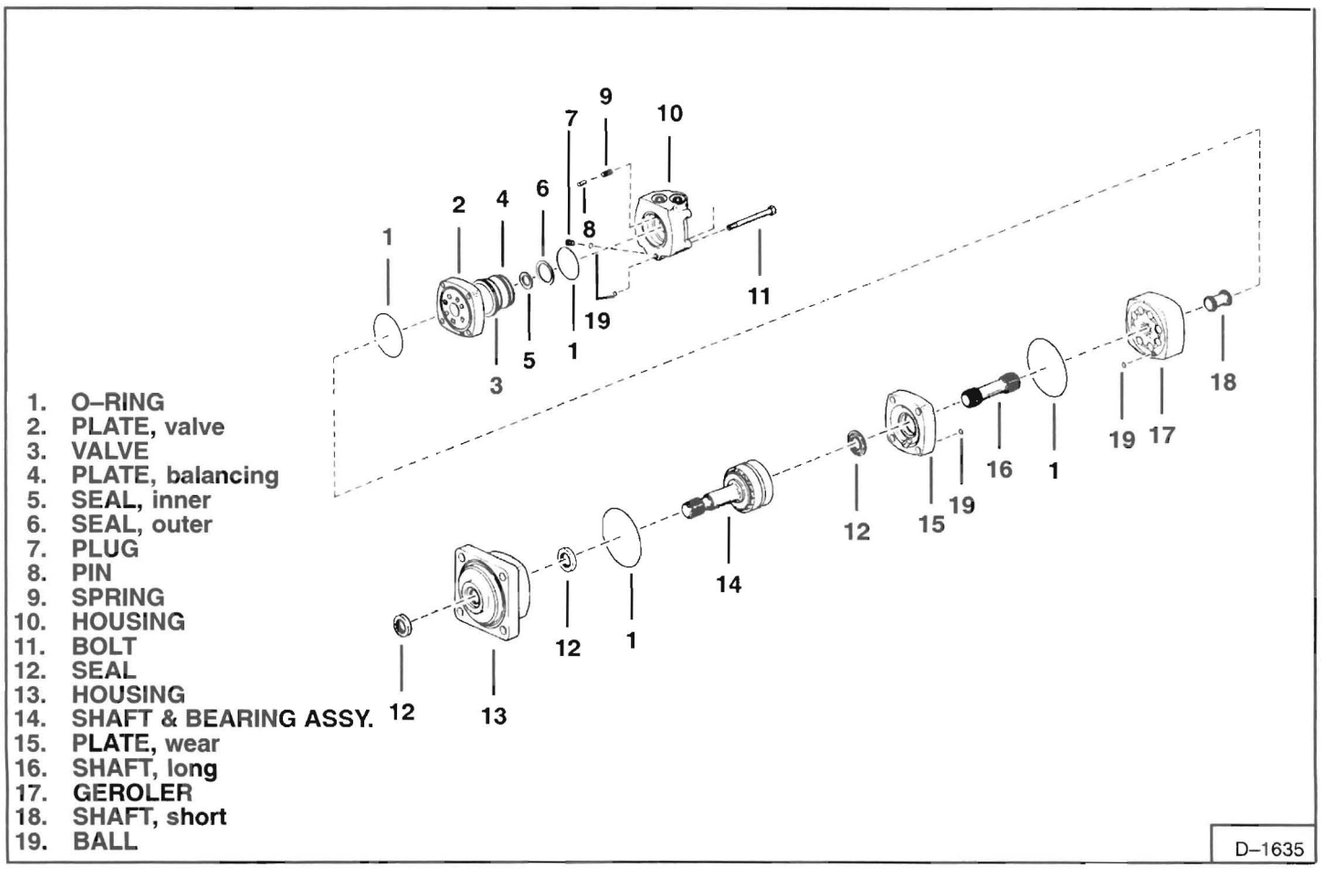
Remove the four motor mounting bolts (Item 3) **[A]**.

Installation: Lift the drive sprocket to align it with the motor splines. Be sure the O–ring is installed on the motor flange during installation. Tighten the bolts to 90–100 ft.–lbs. (123–135 Nm) torque.

Remove the motor from the chaincase.



Parts Identification



Disassembly

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.

I–2003–0888

NOTE: Clean the outside of the motor before disassembly. Keep all the parts of the motor clean.

Put the motor in a vise, holding it by the mounting flange with the shaft down **[A]**. Put a mark across the motor housing for correct assembly.

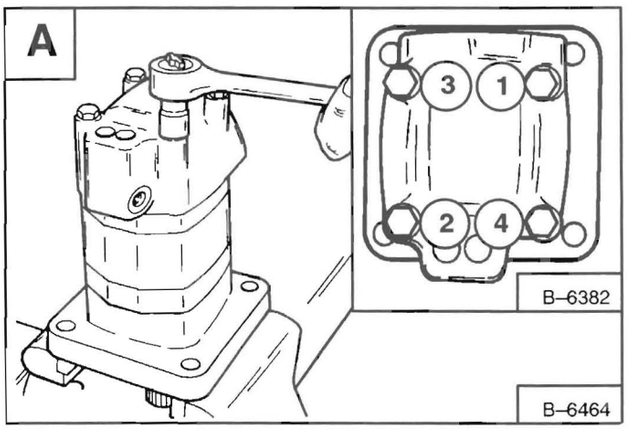
Remove the four bolts from the motor **[A]**.

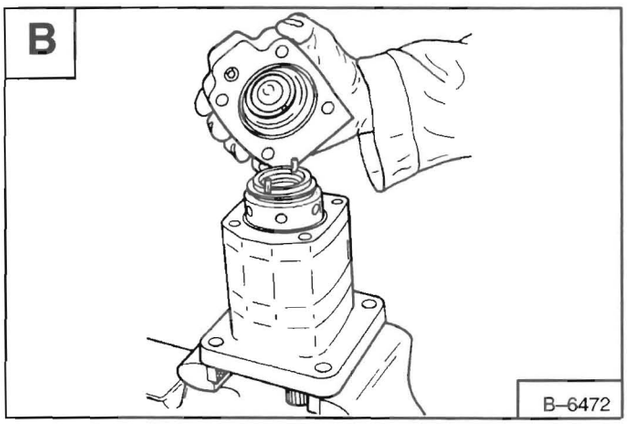
Installation: Tighten the bolts to 37 ft.–lbs. (50 Nm) torque in the sequence shown **[A]**.

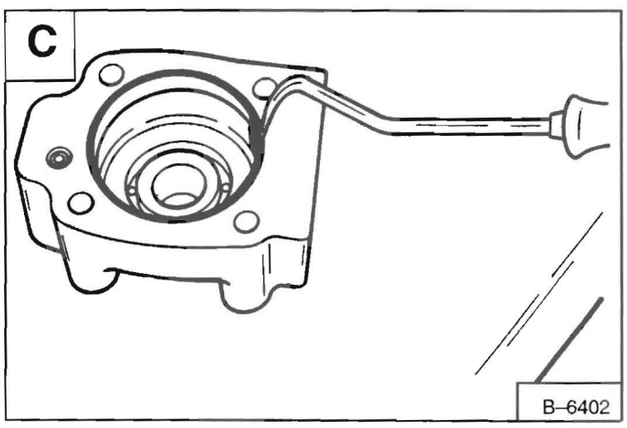
Lift the valve housing straight up **[B]**. If done carefully the balance ring assembly and valve will stay on the valve plate.

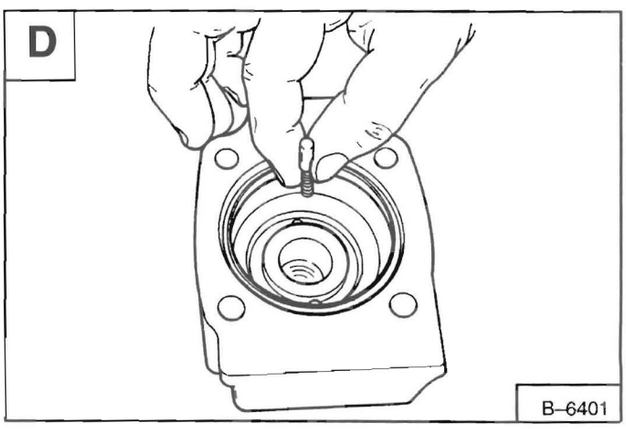
Remove the 3" (76 mm) diameter O–ring from the valve housing **[C]**.

Remove the pins and springs from the valve housing **[D]**.



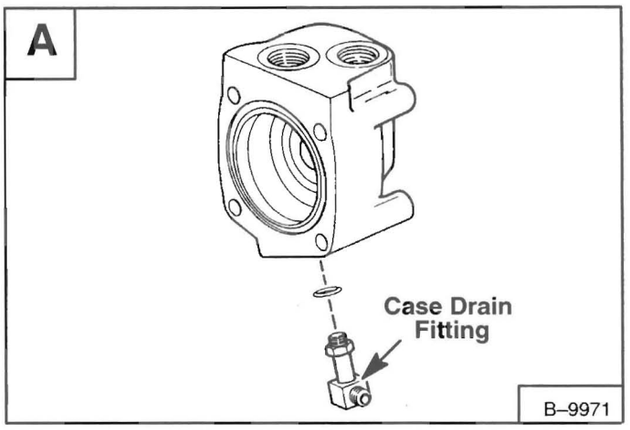




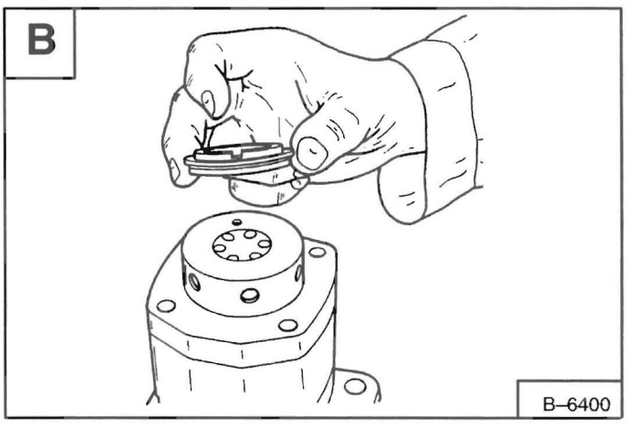


Disassembly (Cont'd)

Remove the case drain fitting from the valve housing **[A]**.

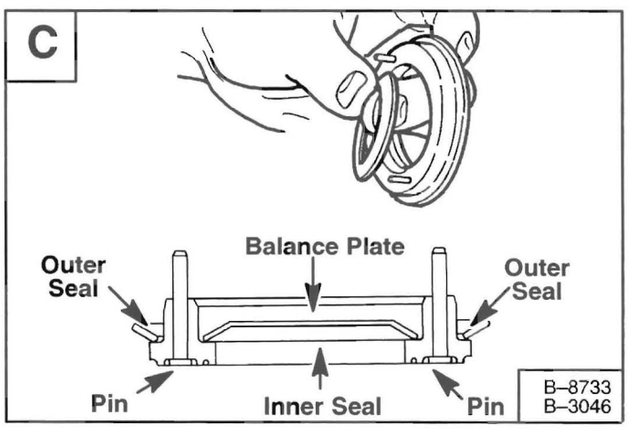


Remove the balance ring assembly **[B]**.



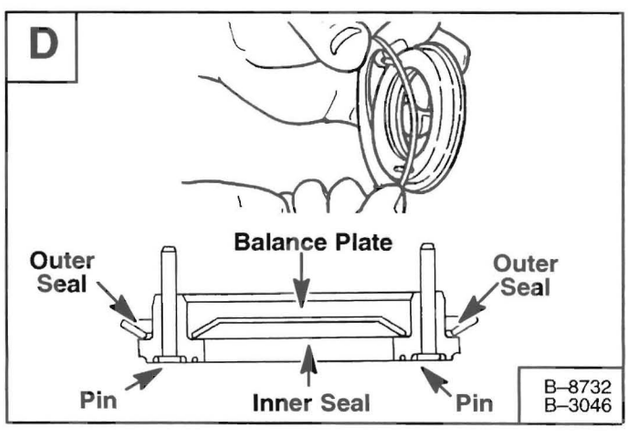
Remove the inner face seal from the balance plate **[C]**.

Installation: Put grease on the inner seal during assembly.



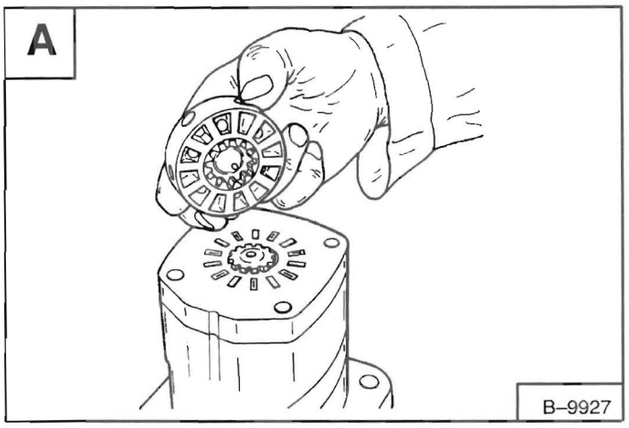
Remove the outer face seal **[D]**.

Installation: Put grease on the outer seal during assembly.

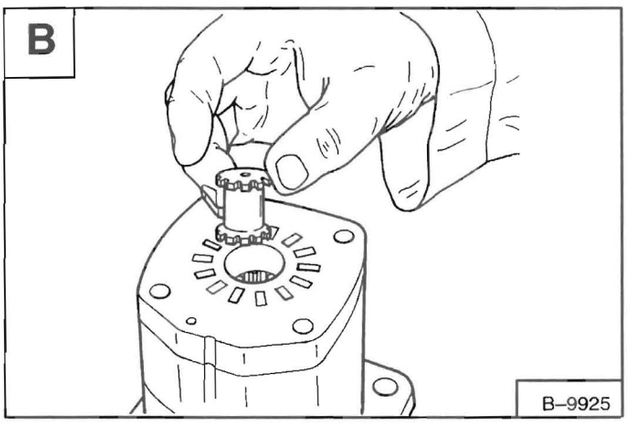


Disassembly (Cont'd)

Remove the valve **[A]**.

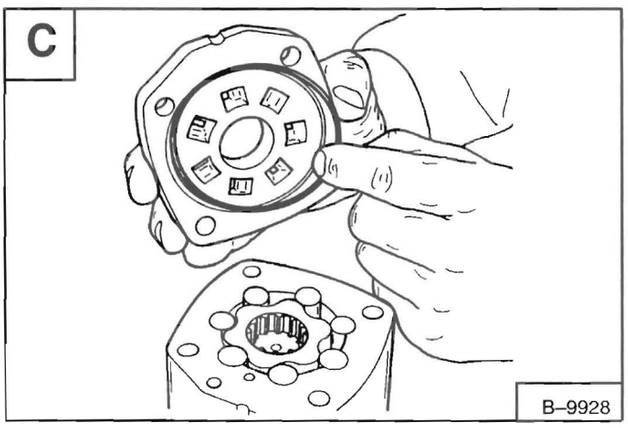


Remove the valve drive **[B]**.

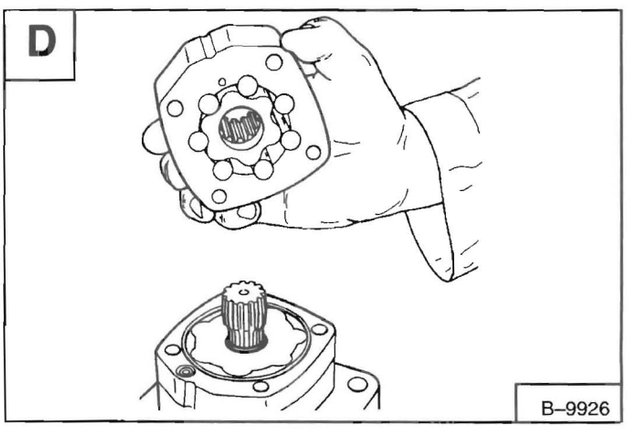


Remove the valve plate **[C]**.

Remove the 3" diameter O–ring from the valve plate **[C]**.



Remove the geroler **[D]**. Make sure the rollers are kept in place.

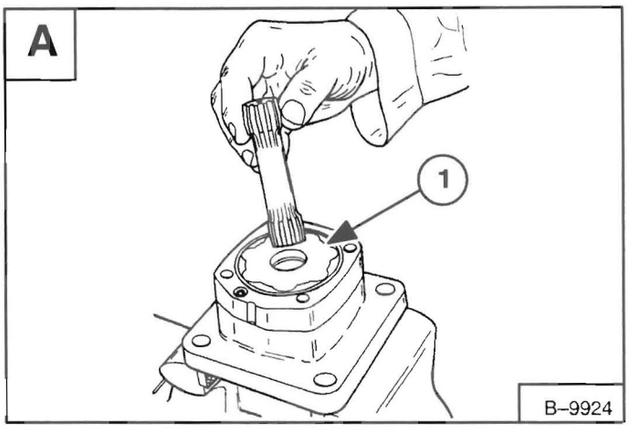


HYDROSTATIC MOTOR (Cont'd)

Disassembly (Cont'd)

Remove the drive shaft **[A]**.

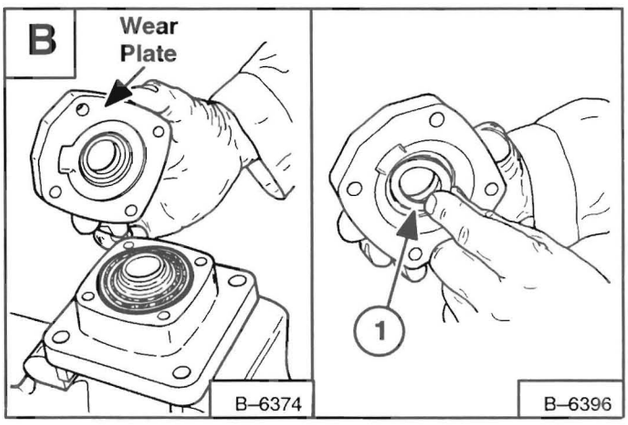
Remove the 3" diameter O–ring (Item 1) **[A]** from the wear plate.



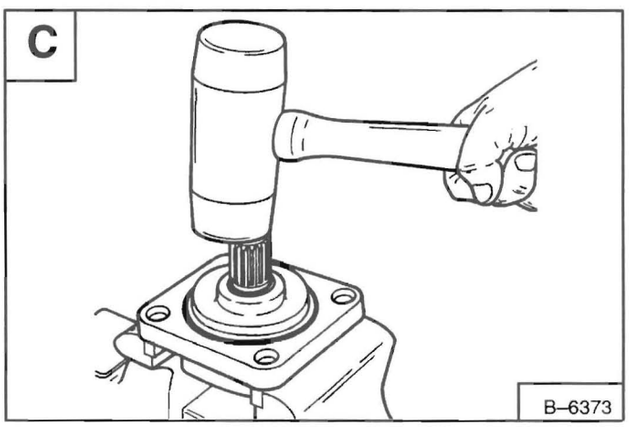
Remove the wear plate **[B]**.

Remove the shaft face seal (Item 1) **[B]** from the wear plate.

Remove the 3" diameter O–ring from the bearing housing.



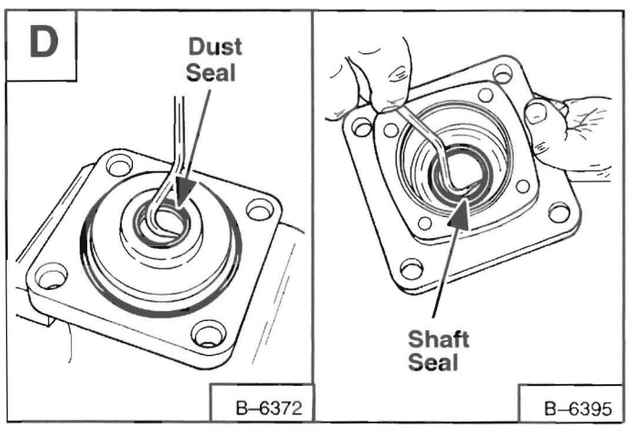
Remove the shaft and bearing assembly from the housing **[C]**.



Remove the dust seal from the housing **[D]**.

Remove the shaft seal from inside the housing **[D]**.

NOTE: The shaft and bearing assembly are not sold as individual parts. Replace as a unit.

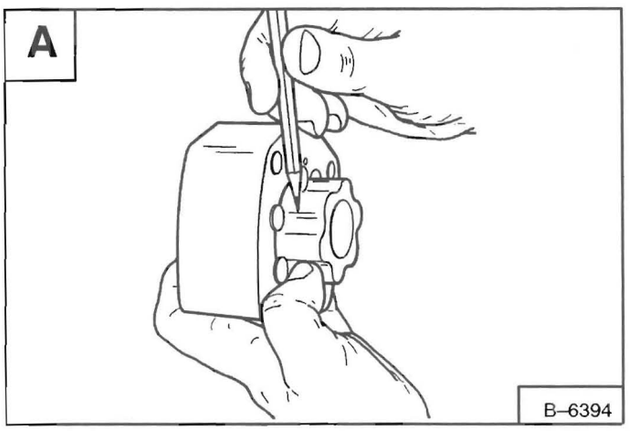


HYDROSTATIC MOTOR (Cont'd)

Inspection

Before the motor is assembled, check the following items:

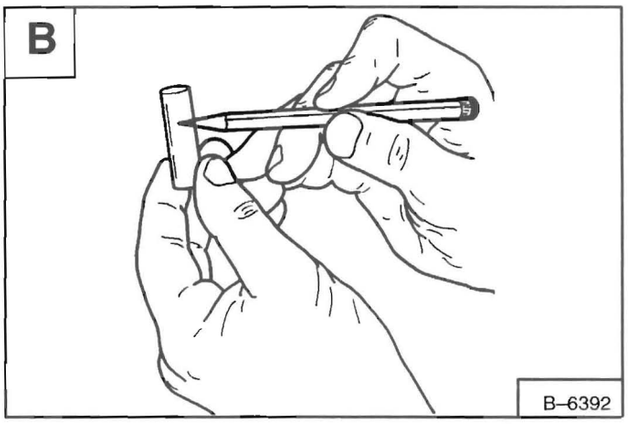
Check the geroler for wear or scratches **[A]**.



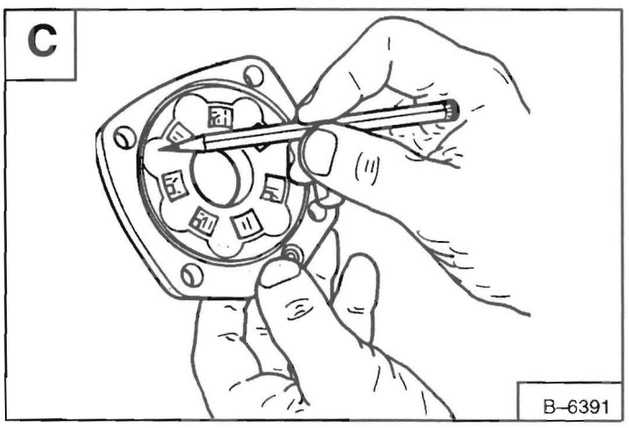
Check the geroler rollers **[B]**.

Check the rotor.

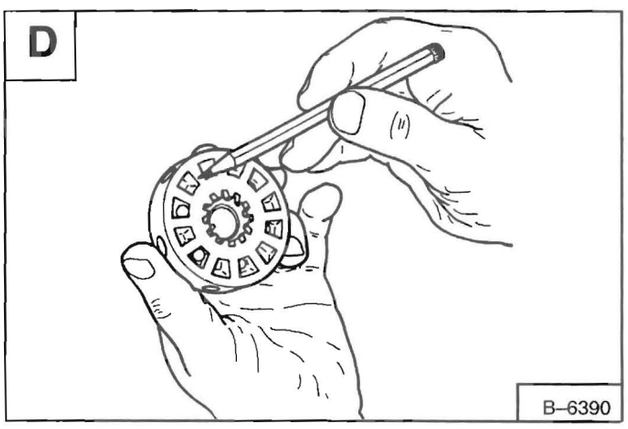
NOTE: Put all the rollers back in their original position.



Check the valve plate for wear or scratches **[C]**.



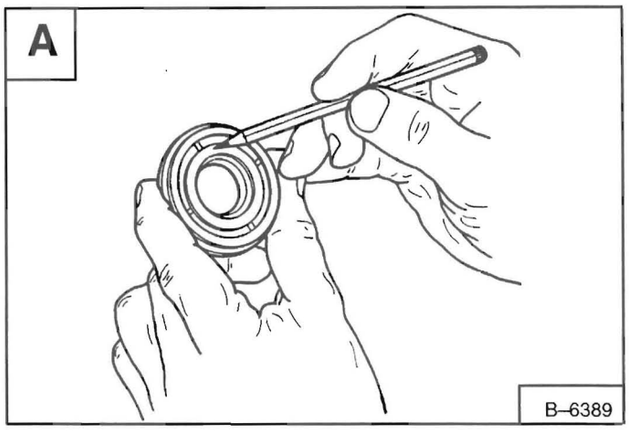
Check the valve **[D]**.



Inspection (Cont'd)

Check the balance plate **[A]**.

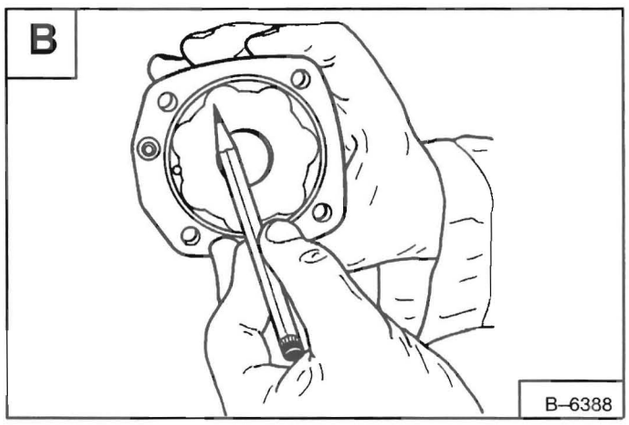
Check the valve drive shaft and main drive shaft for wear.



Check the end plate for scratches **[B]**.

Check all the contact surfaces. Replace any parts that have scratches or are worn.

Clean all the parts in solvent and use air pressure to dry the parts. DO NOT use cloth or paper because some material may get into the hydrostatic system and cause damage. DO NOT use sandpaper or a file to remove scratches on any of the parts.

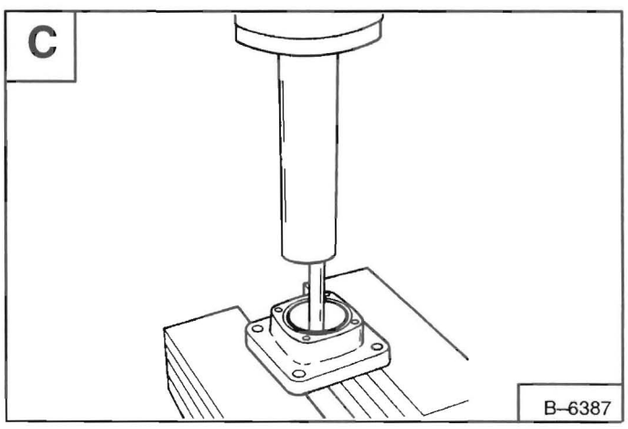


Assembly

IMPORTANT

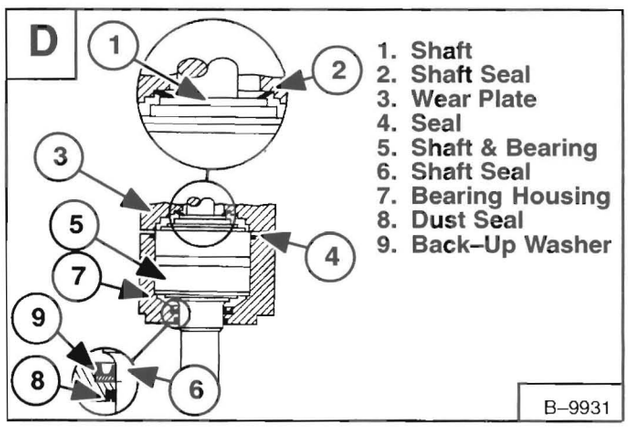
Use grease such as Dow Corning #44 or Vaseline petroleum jelly to hold seals, O–rings and bearings in position during assembly.

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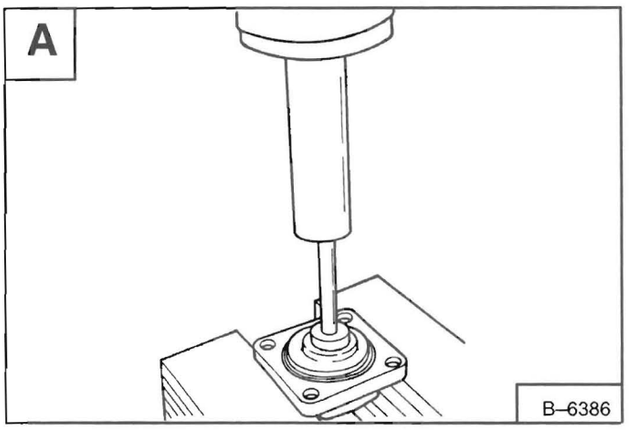
NOTE: Always use a NEW seal kit when assembling the hydrostatic motor.

Install the back–up washer and use a press to install the shaft seal in the bearing housing **[C]** as shown in (Item 9) **[D]**.



Assembly (Cont'd)

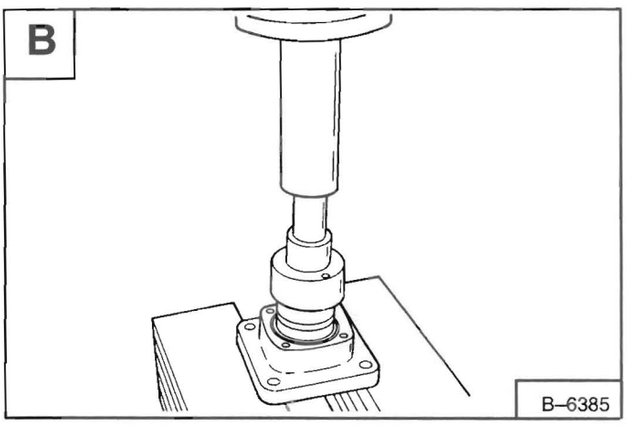
Install the dust seal **[A]** as shown in (Item 8) **[D]** Page 3–31.



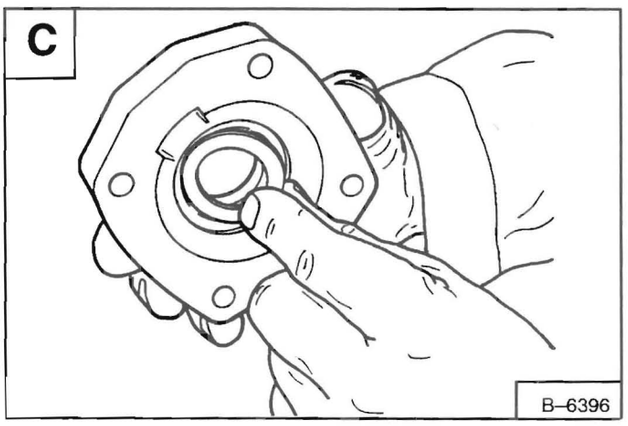
Use a press to install the bearing and shaft assembly in the housing **[B]**.

Lubricate and install the 3" diameter O–ring on the bearing housing.

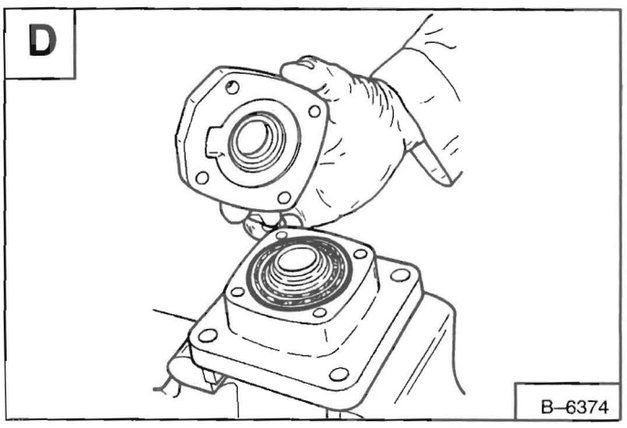
NOTE: You can use alignment studs for easier assembly of the motor.



Install the shaft face seal in the wear plate (Item 2) **[D]** Page 3–31 and **[C]**.



Install the wear plate **[D]**.

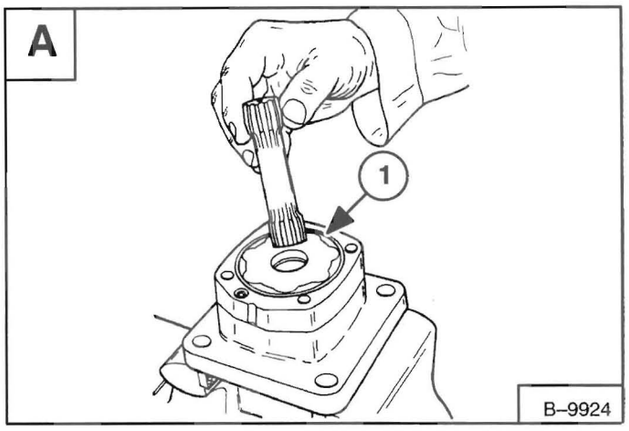


HYDROSTATIC MOTOR (Cont'd)

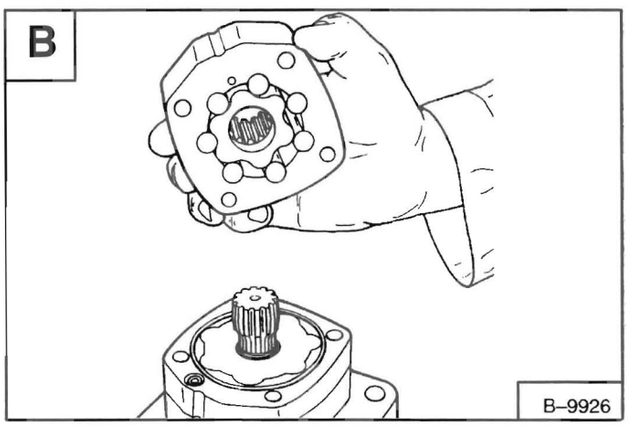
Assembly (Cont'd)

Lubricate the 3" diameter O–ring (Item 1) **[A]** and install a wear plate.

Install the drive in the housing **[A]**.



Align the notch on the outside of the geroler with the notch on the wear plate. Install the geroler against the wear plate. Hold the rollers in the geroler while installing it **[B]**.



The timing of the motor controls the direction of the rotation of the drive shaft of the motor. The timing parts are as follows **[C]**:

Geroler Ring (Item 1).

Valve Drive (Item 2)

Valve Plate (Item 3)

Valve (Item 4)

Find the largest opening between the geroler star and the geroler ring and mark the outside of the geroler ring at the location **[C]**.

Install the valve drive in the geroler (Item 2) **[C]**.

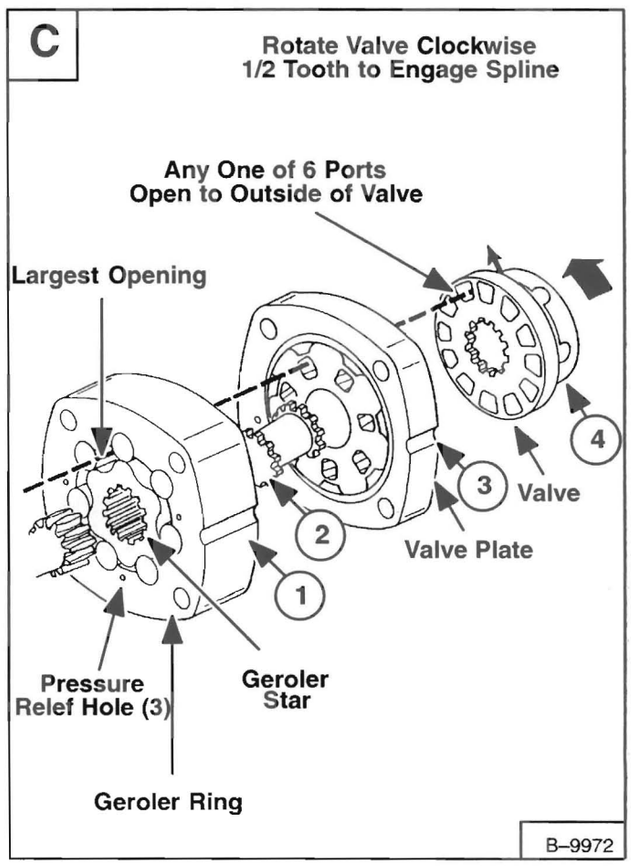
Lubricate the 3" diameter O–ring and install it on the valve plate.

Align the notch on the outside of the valve plate with the notch on the geroler ring **[C]**. Install the valve plate (O–ring side toward the geroler) on the geroler.

Align the slot opening in the valve plate with the largest opening of the geroler.

NOTE: If you can see a roller (in the geroler) in all the holes of the valve plate the motor is timed wrong.

Align the valve on the valve drive so that any one of the side openings is in alignment with the open slot of the valve plate and the largest opening of the geroler. Turn the valve CLOCKWISE 1/2 tooth to engage the drive.



Assembly (Cont'd)

Lubricate the inner and outer seals and install the seals on the balance ring **[A]**.

IMPORTANT

Install the seals in the position as shown [A] or the motor will not operate correctly. Do not force or bend the seals. Any damage to these seals will have a direct effect on the motor operation.

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Install the seals and the case drain fitting on the valve housing **[B]**.

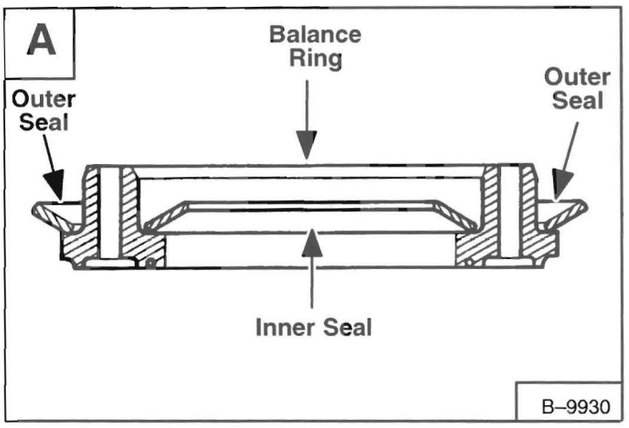
Install the pins and springs in the valve housing **[C]**.

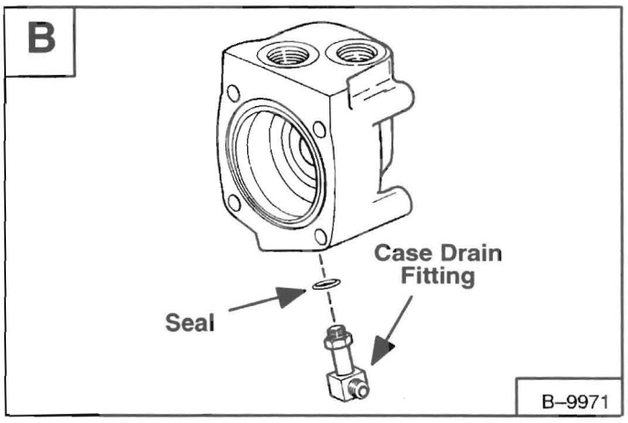
Lubricate the 3" diameter O–ring and install on the valve housing.

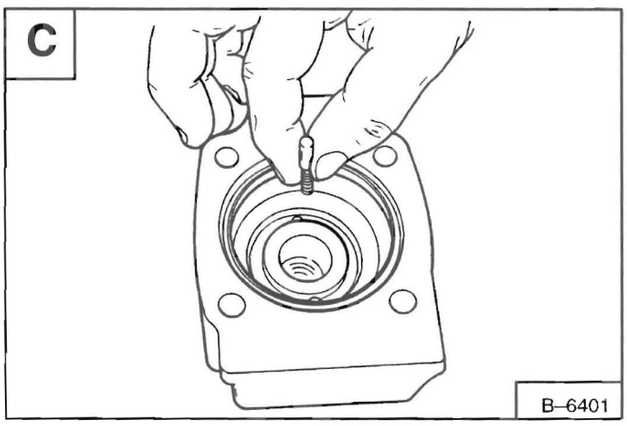
Align the pin grooves in the balance ring with the pins in the valve housing. Install the balance ring assembly in the housing.

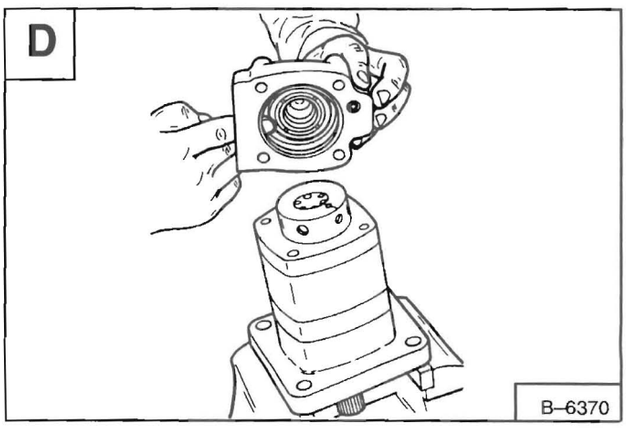
Put your finger through the port in the valve housing to hold the balance ring in position **[D]**

NOTE: You must feel a spring action of the balance ring after the valve housing is installed.









Page Number

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AXLE SEAL
Removal and Installation 4–7

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PARKING BRAKE PEDAL
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PARKING BRAKE DISC
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bobcat

PARKING BRAKE PEDAL

Removal and Installation

Raise the loader lift arms and install the lift arm support device. (See Page 1–1.)

Put jackstands under the rear of the loader. (See Page 1–1.)

Raise the operator cab. (See Page 1–1.)

Remove the center shield. (See Page 3–1.)

Remove the two bolts (Item 1) **[A]** from the parking brake mounting bracket.

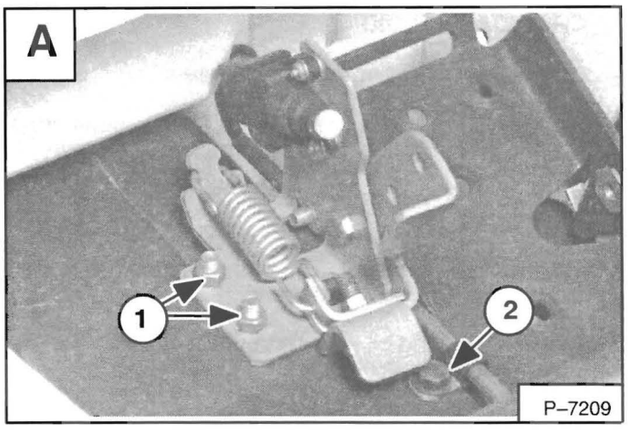
Installation: Tighten the mounting bolts to 25–28 ft.–lbs. (34–38 Nm) torque.

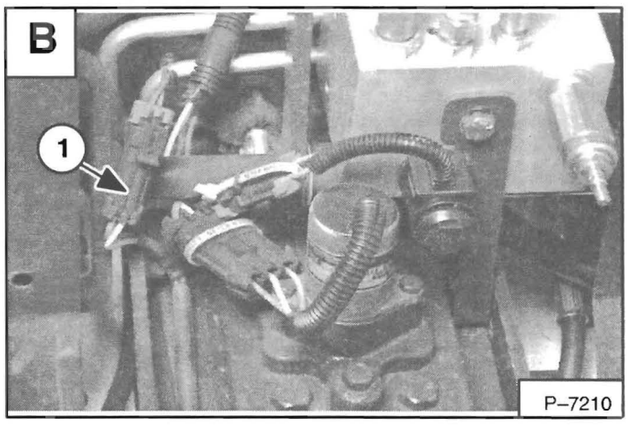
Remove the bolt (Item 2) **[A]** from the wiring tube clamp.

Disconnect the electrical connector (Item 1) **[B]**.

Remove the parking brake assembly from the loader.

Reverse the removal procedure to install the parking brake assembly in the loader.





Disassembly and Assembly

Loosen and remove the mounting bolt (Item 1) **[C]** and nut from the spring mounting bracket (Item 2) **[C]**.

Remove the brake pedal spring (Item 3) **[C]** from the spring mounting bracket (Item 2) **[C]** and from the brake pedal mounting bracket (Item 4) **[C]**.

Remove the two (2) mounting bolts, washers, and nuts (Item 5) **[C]** from the brake pedal sensor.

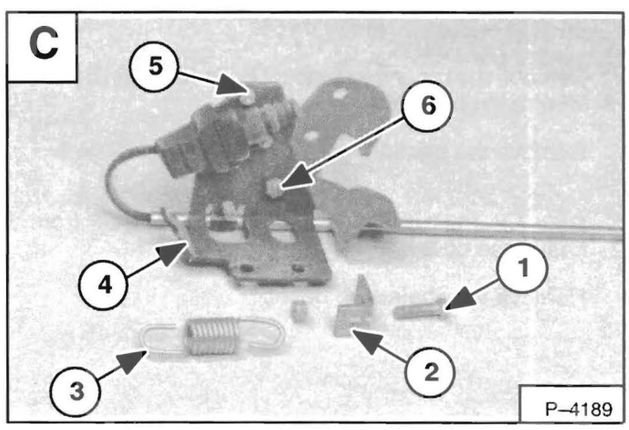
Remove the harness mounting clamp (Item 1) **[D]** from the pedal mounting bracket (Item 4) **[C]**.

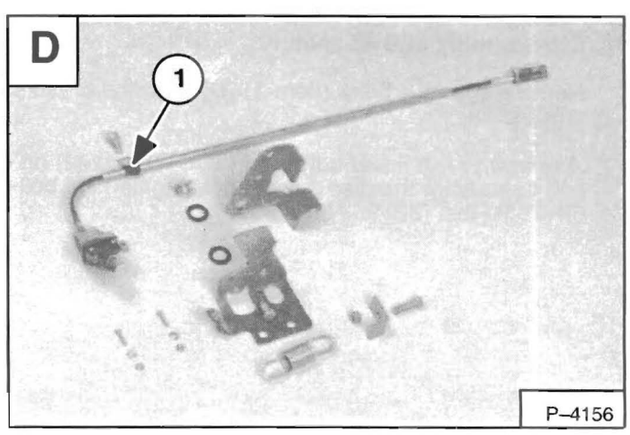
Remove the sensor harness from the pedal mounting bracket.

Remove the pedal mounting bolt (Item 6) **[C]**, plastic spacers, and bushing nut from the brake pedal.

Remove the pedal from the pedal mounting bracket.

Photo **[D]** shows the parking brake disassembled to identify the existing parts of the brake assembly.





CHAINCASE FLUID

Removing Oil From the Chaincase

NOTE: The removal procedure is the same for the 450 and 453 loaders. The 453 is shown [A].

Remove the plug located in front of the chaincase (Item 1) **[A]**.

Use a transfer pump **[A]** to remove the oil from the chaincase into a clean container.

Installation: Add oil to the chaincase through the check plug hole (see specifications).

NOTE: Oil can also be removed or added through the chaincase cover.

CHAINCASE COVER

Removal and Installation

Raise the loader lift arms and install the lift arm support device. (See Page 1–1.)

Put jackstands under the rear of the loader. (See Page 1–1.)

Raise the operator cab. (See Page 1–1.)

Remove the center shield and steering lever panels. (See Page 3–1.)

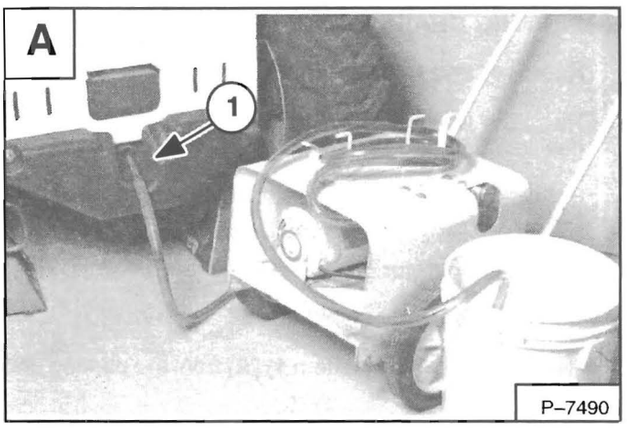
Disconnect the electrical harness (Item 1) **[B]** for the parking brake.

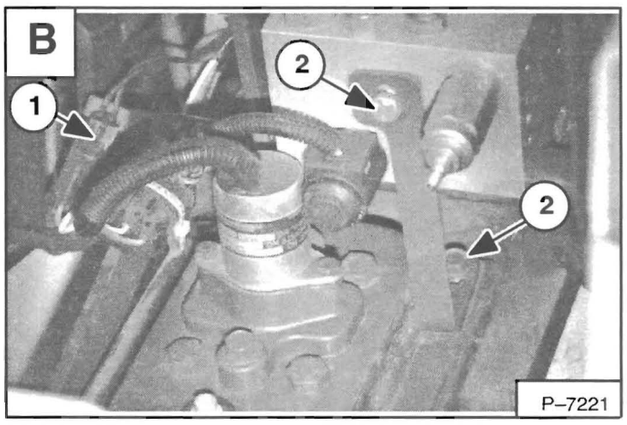
Remove the mounting bracket bolts (Item 2) **[B]** from the lift arm by–pass block.

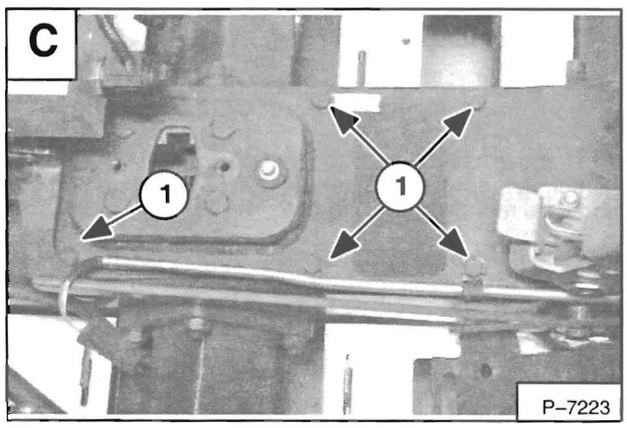
Remove the traction lock assembly. (See Page 8–1.)

Remove the mounting bolts (Item 1) **[C]** from the chaincase cover.

Remove the chaincase cover.



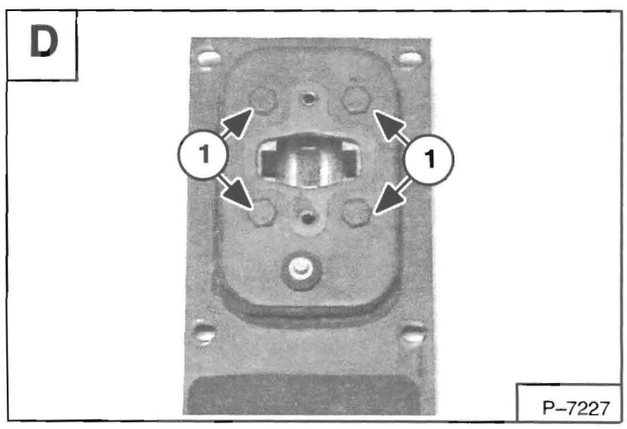




Disassembly and Assembly

Remove the four bolts (Item 1) **[D]** from the brake disc guide block.

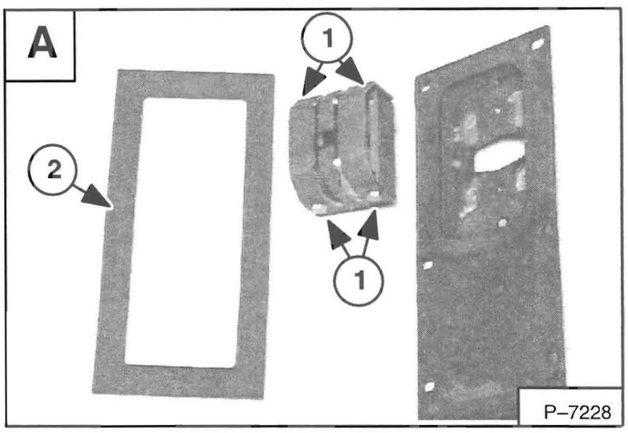
Assembly: Put liquid adhesive (LOCTITE #242) on the bolt threads for the disc guide block. Tighten the bolts to 65–70 ft.–lbs. (88–95 Nm) torque.



CHAINCASE COVER (Cont'd)

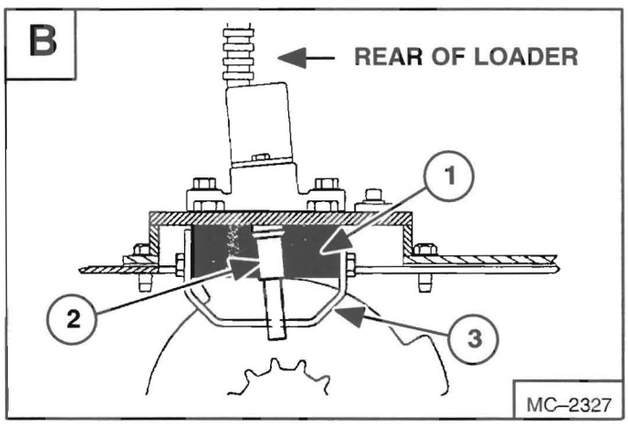
Disassembly and Assembly (Cont'd)

Remove the four mounting bolts (Item 1) **[A]** from the disc guides.



Assembly: The guide blocks (Item 1) **[B]** have angled slots (Item 2) **[B]** which must be parallel with each other when installed in the disc guide (Item 3) **[B]**. When installed in the chain case cover correctly the top of both slots must be toward the rear of the loader. Put liquid adhesive (LOCTITE #242) on the bolt threads for the disc guide. Tighten the bolts to 25–28 ft.–lbs. (34–38 Nm) torque.

Installation: Install a new gasket (Item 2) **[A]** under the cover during assembly.



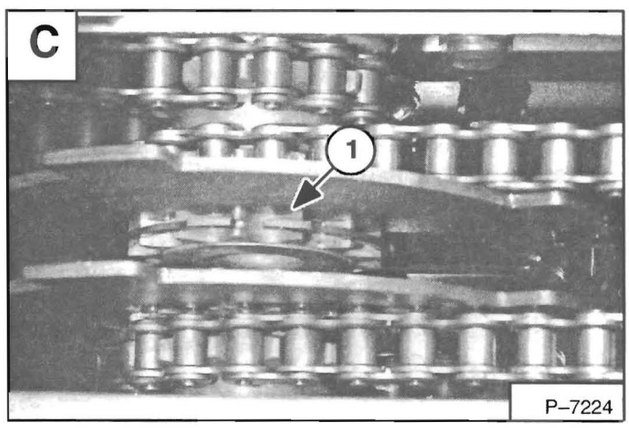
PARKING BRAKE DISC

Removal and Installation

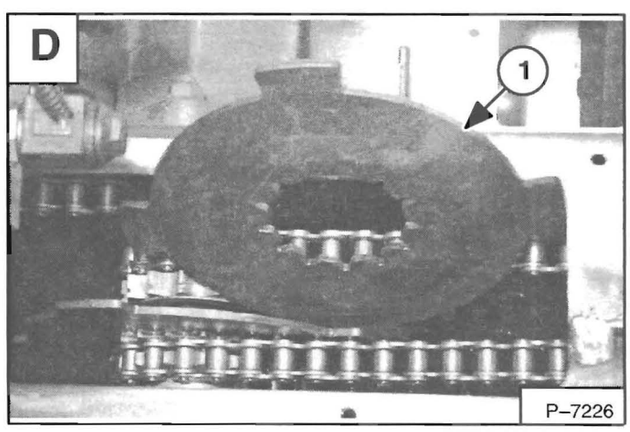
Remove the chaincase cover. (See Page 4–4.)

Use a snap ring pliers with a 90° tips to remove the parking brake disc.

Remove the snap ring (Item 1) **[C]** from the cluster sprocket.



Remove the brake disc (Item 1) **[D]**.



AXLE HUB

Removal and Installation

Axle Hub Puller Tool
Slide Hammer
MEL1525 – Seal Driver Tool

NOTE: The procedure is the same for the front and rear axles. The front axle will be used for the procedure.

To loosen the axle hub mounting bolt, use the following procedure:

Before lifting and blocking the loader, loosen the hub mounting bolt.

NOTE: If the axle and bearings are being replaced, loosen the sprocket mounting bolt inside the chaincase before lifting and blocking the loader.

Installation: Install thread adhesive LOCTITE # 242 to the bolt threads and tighten the axle hub mounting bolt to 175–190 ft.–lbs. (240–255 Nm) torque.

Lift and block the loader. (See Page 1–1.)

Remove the front wheel from the loader.

Installation: Tighten the wheel mounting nuts to 105–115 ft.–lbs. (142–156 Nm) torque.

Loosen the axle bolt 2–4 turns.

Install a nut on one of the wheel studs and use a hammer to remove the wheel stud (Item 1) **[A]**.

Installation: Support the flange of the axle hub and install the stud with a hammer. Use a hydraulic press if available for this procedure.

Install the puller tool (Item 2) **[A]** on the axle hub bolt.

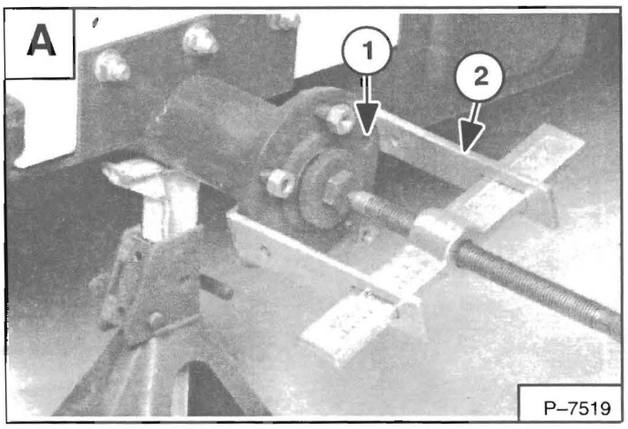
⚠ WARNING

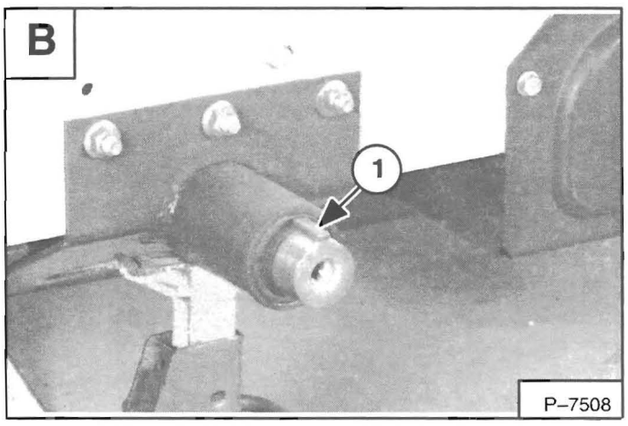
NEVER STAND IN–LINE OF THE HUB WHEN REMOVING A HUB FROM AN AXLE. The hub has a tapered fit on the axle end and can come off the axle with great force and cause serious injury.

W–2186–0395

Turn the threaded rod of the puller to remove the axle hub from the axle.

Remove the key (Item 1) **[B]** from the axle.





AXLE SEAL

Removal and Installation

Remove the axle hub.(See Page 4–6.)

Drill a small hole in the axle seal **[A]**.

Install a slide hammer (Item 1) **[A]** with a screw tip end in the drilled hole on the seal.

NOTE: More than one hole may need to be drilled in the seal for removal.

Remove the axle seal.

Installation: Use MEL1525 – seal driver to install the seal in the axle housing..

Clean the seal area and inspect the shaft for wear.

NOTE: If the shaft is damaged or worn, an axle repair sleeve kit is available from Melroe Parts Sales in Chicago or remove the axle. (See Page 4–8.)

Lubricate the seal lips before installation.

Put the new axle seal over the axle and into the axle tube.

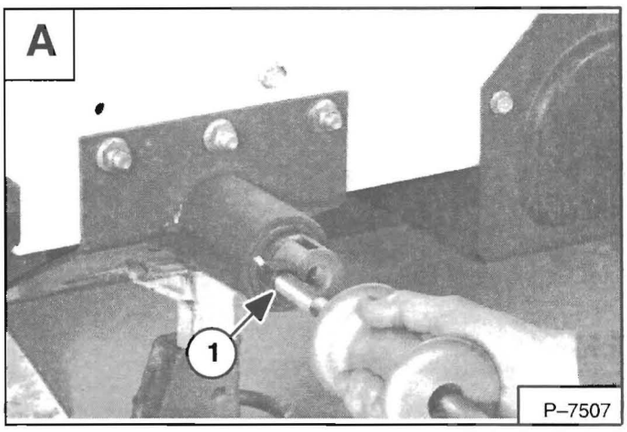
Install MEL1525 seal driver tool (Item 1) **[B]** over the end of the axle and against the seal.

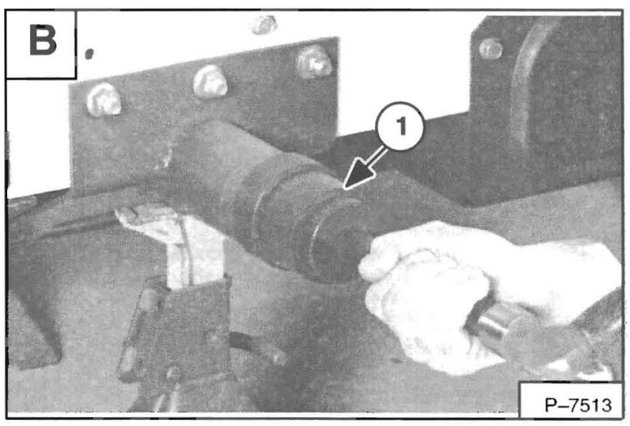
Hit the seal driver tool with a hammer **[B]**.

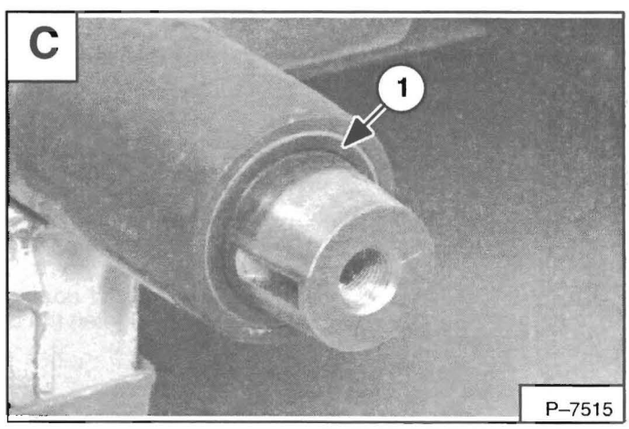
Drive the seal (Item 1) **[C]** into the axle tube until the seal tool is against the axle tube.

If installed correctly, the axle seal will be slightly recessed in the axle tube after installation.

Reverse the removal procedure to install the axle hub and wheel on the loader.







AXLE, BEARINGS, AND SPROCKET

Removing the Axle

The tools listed are needed for the following procedure:

MEL1202A – Axle Bearing Service Tool
Slide Hammer

NOTE: The procedure is the same procedure for the front and rear axle. The front axle will be used for the procedure.

Put jackstands under the rear of the loader.

Raise the lift arms and install the lift arm support device. (See Page 1–1.)

Raise the operator cab. (See Page 1–1.)

Remove the control shield and steering lever panels. (See Page 3–1.)

Remove the chaincase cover. (See Page 4–4.)

Remove the oil from the chaincase. (See Page 4–4.)

NOTE: Grind the correct size box end wrench to fit between the two axle bolts [A]. Loosen the bolt (Item 1) [A].

Install jackstands under the loader. (See Page 1–1.)

Remove the axle hub. (See Page 4–6.)

Remove the drive motor. (See Page 3–1.)

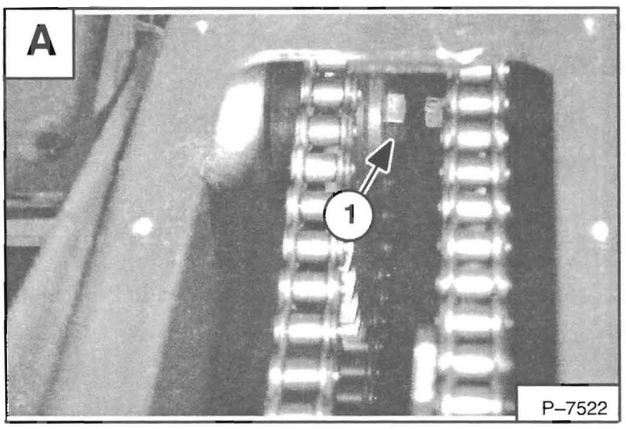
Install the axle puller (Item 1) **[B]**, loosen the sprocket bolt as much as possible and pull the axle out until the sprocket bolt stops the travel.

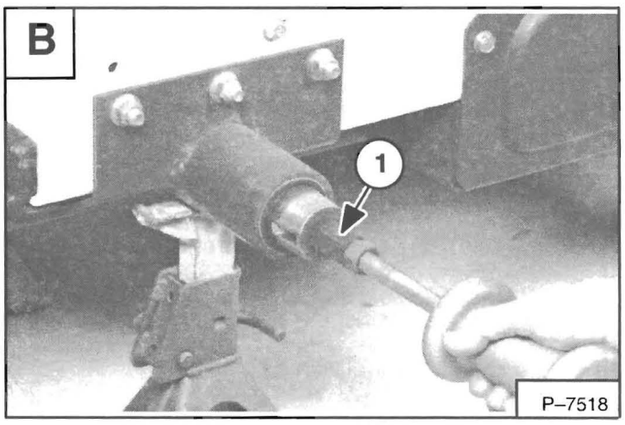
Repeat the procedure until the sprocket bolt is free from the axle. Remove the sprocket and bearing from the axle.

Installation: Apply grease to the axle bearing before installation.

Installation: Apply a small amount of liquid adhesive (LOCTITE #242) to the bolt threads and tighten the bolt to 175–190 ft.–lbs. (238–257 Nm) torque.

Remove the axle from the tube.





Removing and Installing the Axle Bearing

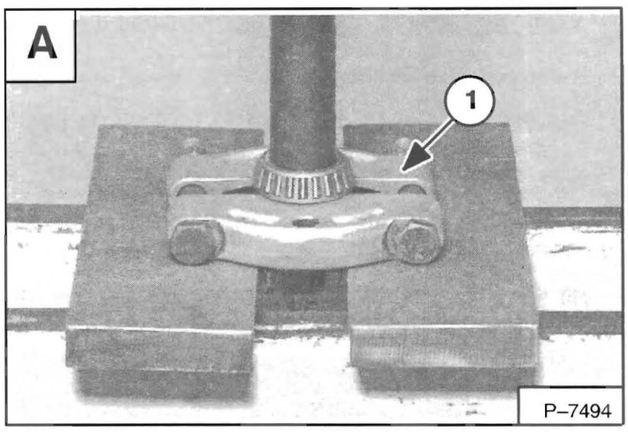
Install a bearing puller (Item 1) **[A]** between the bearing and the tapered flange for the hub. Be sure the bearing puller makes good contact with the inner race of the bearing.

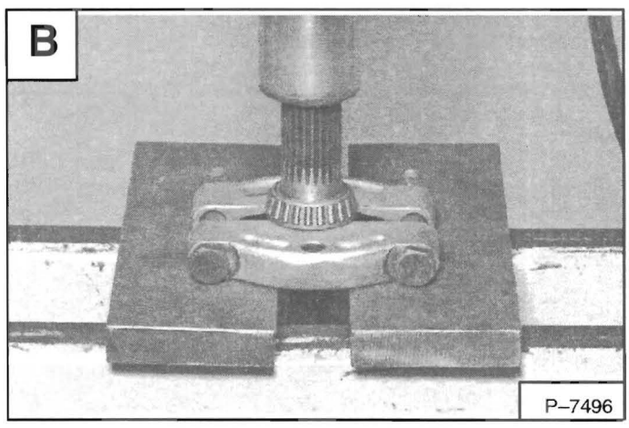
Put the axle and the bearing puller in the hydraulic press **[A]**.

Press the bearing off the mounting surface of the axle.

Be sure to hold onto the axle during removal. The bearing will slide freely along the axle shaft when the bearing is free of the mounting surfaces.

Press the bearing from the splined end of the axle **[B]**.





Installation: Apply grease to the bearing before installation.

Installation: Use a piece of round tube (Item 1) **[C]** to install the bearing on the axle shaft. The inside diameter of the tube should be slightly larger than the inside diameter of the bearing race (for axle diameter clearance) and **must make contact with only the inner race during installation.**

Use the same bearing puller (Item 2) **[C]** to install the bearing on the axle.

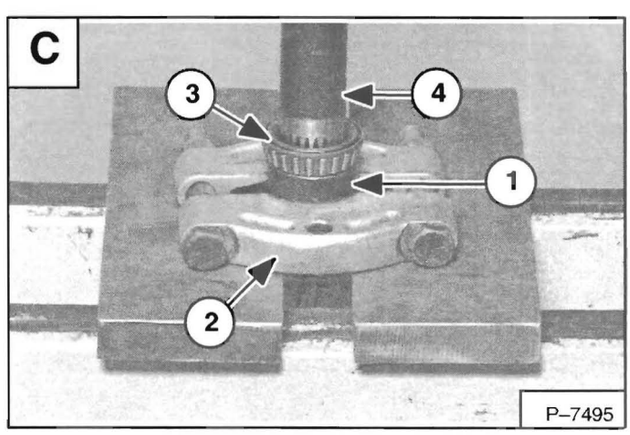
Put the tube (Item 1) **[C]** on the bearing puller (Item 2) **[C]**.

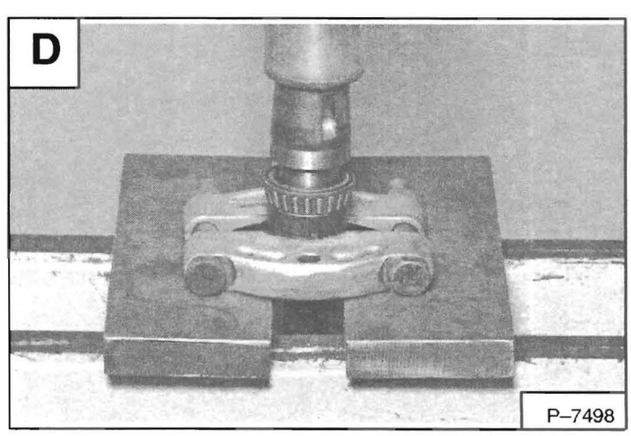
Put the bearing (Item 3) **[C]** on the tube as shown.

Put the splined end of the axle shaft (Item 4) **[C]** in the bearing and press the bearing onto the axle.

Be sure to hold the axle during installation. It will slide freely along the axle shaft after the splined end has passed through the bearing until it reaches the bearing mounting surface on the hub end of the axle.

Press the bearing until it is fully seated on the mounting surface at the hub end of the axle **[D]**.



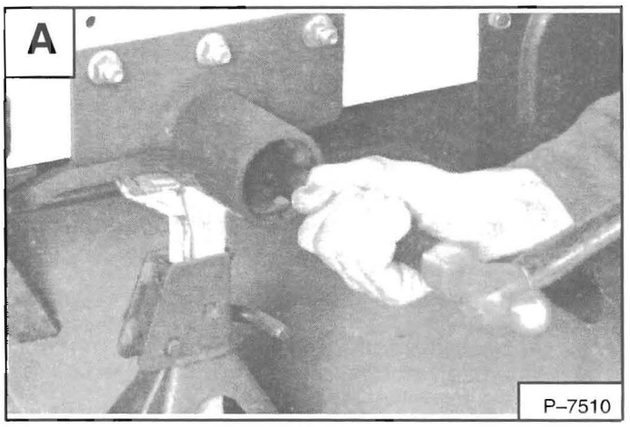


Removing the Bearing Races

Use the tools provided in the MEL1202A Axle Bearing Service Set for bearing cup removal and installation. A slide hammer is also necessary for this procedure.

Use the long rod and bearing cup tool to remove the inner bearing cup **[A]**.

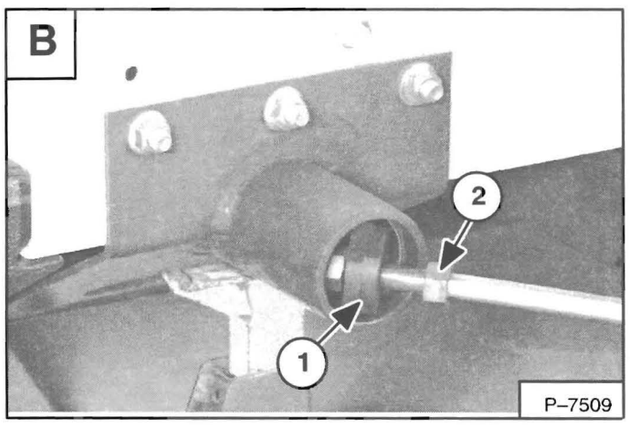
Hit the long rod with a hammer to remove the inner bearing cup from the axle tube **[A]**.



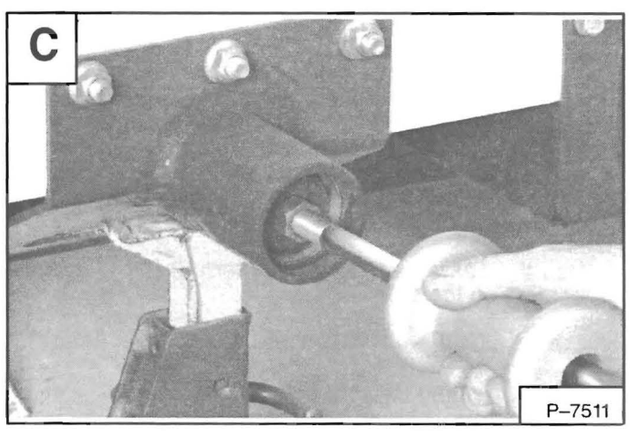
To remove the outer bearing cup, put the bearing cup tool (Item 1) **[B]** on the slide hammer.

Leave the bearing cup tool loose until the tool is installed inside the tube **[B]**.

After the bearing cup tool is inside the axle tube, pull the tool against the bearing cup and tighten the nut (Item 2) **[B]** on the tool.



Use the slide hammer to remove the bearing cup from the axle tube **[C]**.



AXLE, BEARING, AND SPROCKET (Cont'd)

Installing the Bearing Races

Use the bearing cup installation tools (Item 1) **[A]** and (Item 1) **[B]** and the long threaded rod (Item 2) **[B]** from the service set to install the inner and outer bearing cups.

Put the inner bearing cup in the axle tube (Item 2) **[A]**.

Put the installation tool (Item 1) **[A]** in the axle tube.

Install the long threaded rod (Item 2) **[B]** into the axle tube and through the installation tool (Item 1) **[A]**.

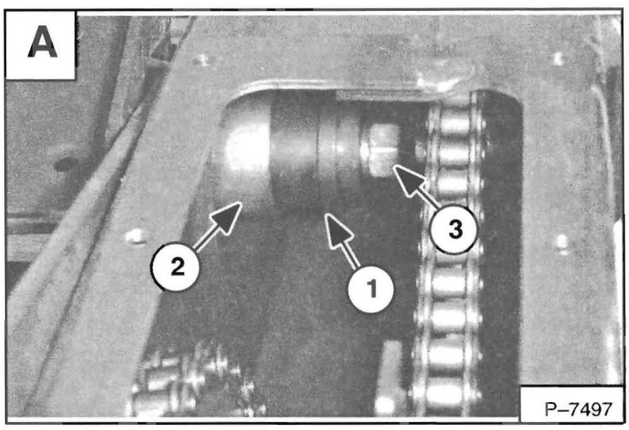
Secure the tool to the threaded rod with a nut (Item 3) **[A]**.

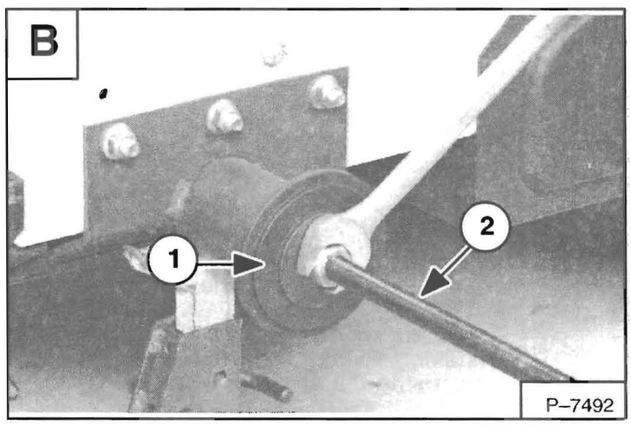
Put the installation tool (Item 1) **[B]** in the axle tube with the threaded rod through the hole in the tool.

Secure the tool to the threaded rod with a nut **[B]**.

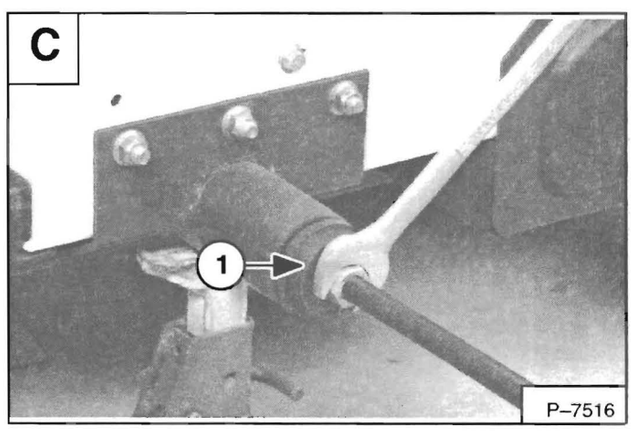
Hold the inside nut (Item 3) **[A]** with a wrench and tighten the outside nut as shown in photo **[B]**.

Tighten the nut until the bearing cup is seated.





To install the outer bearing cup, install the installation tool (Item 1) **[C]** and tighten the nut until the bearing is seated.



Installing the Inner Bearing and Axle Sprocket

Apply grease to the axle bearing before installation.

Install and hold the bearing in the inner race while sliding the axle in the tube and through the bearing.

Apply a small amount of liquid adhesive (LOCTITE #242) to the bolt threads.

Install the washer and bolt in the sprocket, align the sprocket splines with the axle splines. Continue to install the axle in the sprocket while threading the bolt in the axle.

Tighten the bolt to 175–190 ft.-lbs. (238–257 Nm) torque.

DRIVE CHAINS

Removal and Installation

Put jackstands under the rear of the loader.

Raise the lift arms and install the lift arm support device. (See Page 1–1.)

Raise the operator cab. (See Page 1–1.)

Remove the control shield and steering lever panels. (See Page 3–1.)

Remove the chaincase cover. (See Page 4–4.)

Remove the oil from the chaincase. (See Page 4–4.)

Remove the brake disc. (See Page 4–5.)

Remove the axle hub. (See Page 4–6.)

Remove the drive motor. (See Page 3–1.)

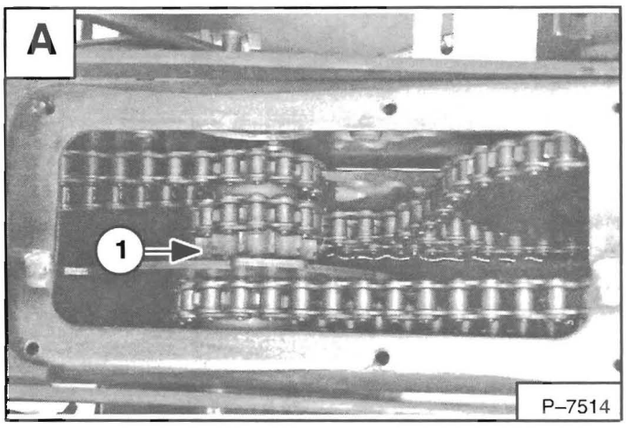
Remove the axle. (See Page 4–8.)

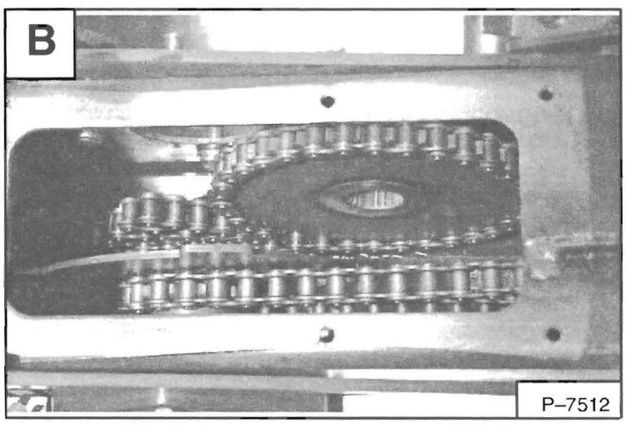
Remove the cluster sprocket (Item 1) **[A]** from the drive chains.

Remove the drive chain and axle sprocket from the chaincase **[B]**.

NOTE: Installing an old or new chain will be easier after using the above procedure.

NOTE: Due to the small area in the chaincase, assemble a new chain on a bench before installation, using a chain compression tool.





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Lever and Wedge Removal	5–15
Removal	5–13
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FUEL TANK	
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OPERATOR CAB	
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OPERATOR SEAT	
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REAR DOOR	
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Removal and Installation	5–24
REAR WINDOW	
Removal and Installation	5–23
SEAT BAR	
Assembly	5–7
Compressing the Gas Spring	5–4
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Seat Bar Removal and Installation	5–5

TIGHTEN ALL HARDWARE PER SIZE TO GRADE 5 TORQUE (SEE STANDARD TORQUE SPECIFICATIONS FOR BOLTS, SECTION 9) UNLESS OTHERWISE SPECIFIED.


bobcat

SEAT BAR

Gas Spring Removal and Installation

The tool listed is needed for the following procedure:

MEL1426 – Gas Spring Retainer Tool

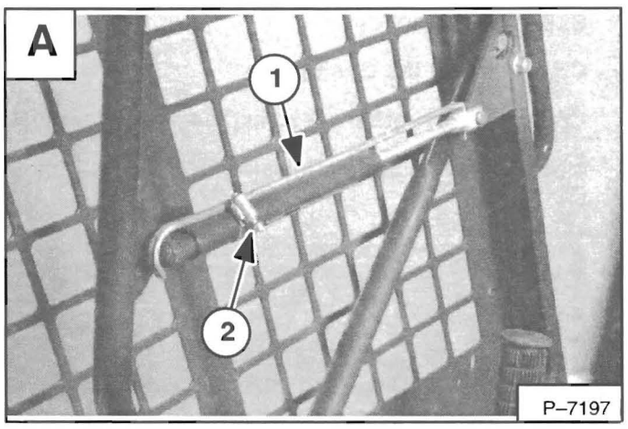
Raise the seat bar enough to install the tool (Item 1) **[A]**.

Support the seat bar while installing tool.

Install the end with the 90° bend in the rod end clevis **[A]**.

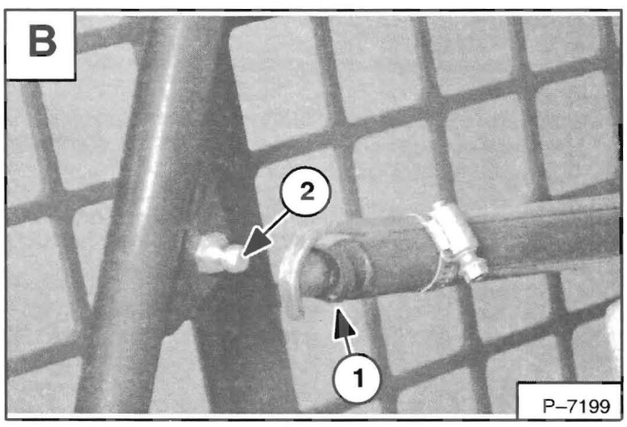
Install the end with the round bend on the base end **[A]**.

Use a hose clamp (Item 2) **[A]** to hold the tool in position.

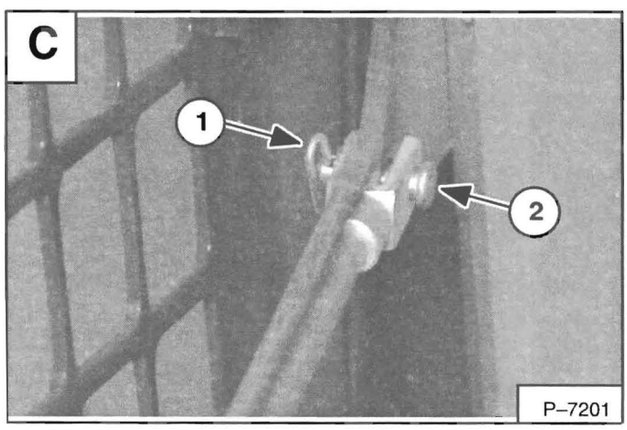


Pull the clip (Item 1) **[B]** enough to release the cylinder from the ball (Item 2) **[B]**.

Remove the seat bar support and lower the seat bar.



Remove the clip (Item 1) **[C]** from the clevis pin (Item 2) **[C]**. Remove the clevis pin.



SEAT BAR (Cont'd)

Compressing the Gas Spring

Compress the seat bar gas spring using the following tool:

MEL1426 – Gas Spring Retainer Tool
(2) Locking Plier

⚠ WARNING

Cylinder contains high pressure gas. Do not open. Opening cylinder can release rod and cause injury or death.

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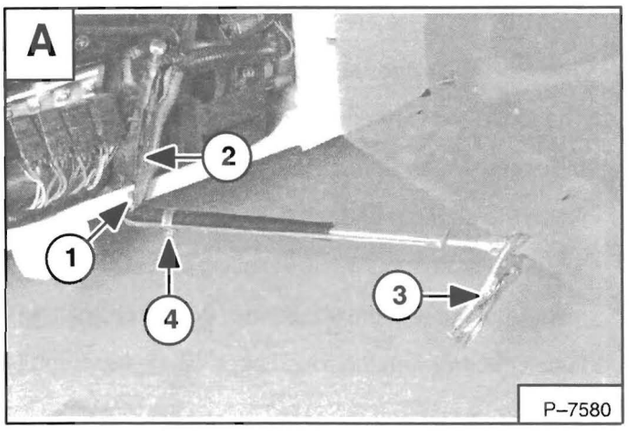
Open the rear door of the loader. Install the pivot ball and nut on the cylinder. Clamp the nut against the frame (Item 1) **[A]** with a locking plier (Item 2) **[A]**.

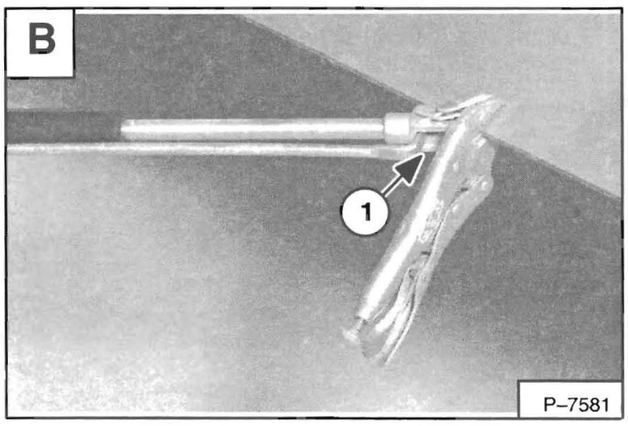
Install another locking plier (Item 3) **[A]** on the bottom of the rear door. Install the clevis end of the gas cylinder on the door edge and against the locking plier.

Install the curved end of the the tool on the base end of the cylinder secure with a hose clamp (Item 4) **[A]**. The 90° end of the tool will rest on the rod end of the cylinder.

Pull the door in to compress the gas cylinder. Install the 90° end of the tool (Item 1) **[B]** in the clevis end of the cylinder.

Install the gas cylinder on the seat bar in the reverse order.





SEAT BAR (Cont'd)

Seat Bar Removal and Installation

Disconnect the seat bar sensor connector (Item 1) **[A]**.

Remove the seat bar mounting bolt (both sides) (Item 2) **[A]**.

Installation: Tighten the seat bar mounting bolts to 25–28 ft.–lbs. (34–38 Nm) torque.

Remove the mounting bolt (Item 3) **[A]** and the gas spring mount (Item 4) **[A]**.

Remove the mounting bolt (Item 5) **[A]** from the seat bar sensor.

Installation: Tighten the sensor mounting bolt to 80–90 in.–lbs. (9–10 Nm) torque.

Remove the seat bar mounting bolt (Item 1) **[B]** (both sides).

Installation: Tighten the seat bar mounting bolts to 25–28 ft.–lbs. (34–38 Nm) torque.

Remove the mounting bolt and nut from the seat bar sensor (Item 2) **[B]**.

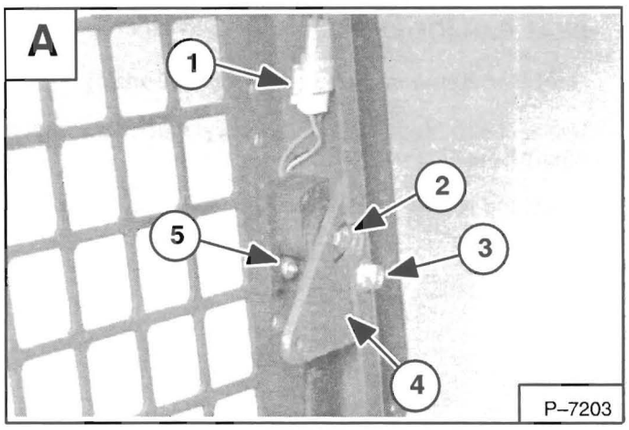
Installation: Tighten the sensor mounting bolt to 80–90 in.–lbs. (9–10 Nm) torque.

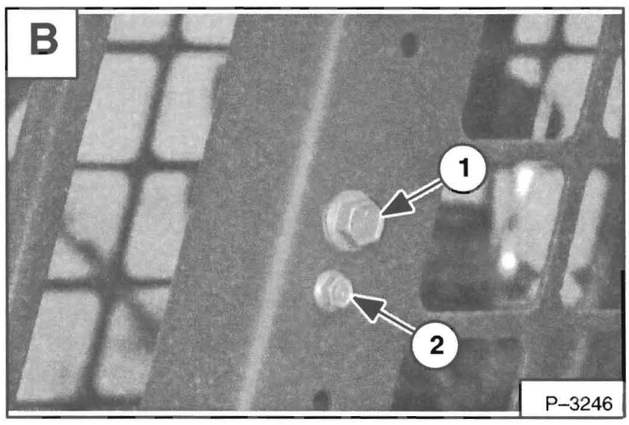
Remove the sensor assembly from the magnetic bushing on the seat bar.

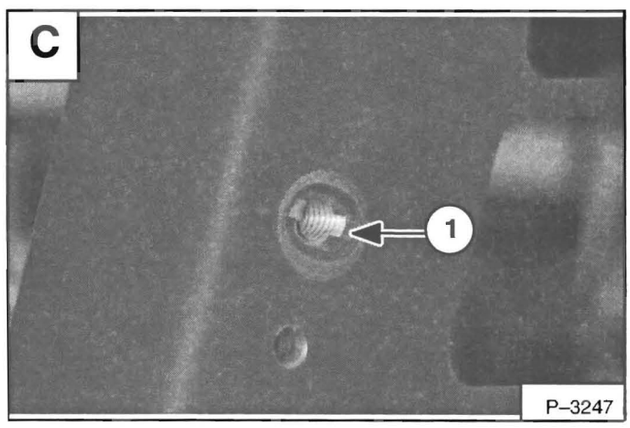
Installation: Be sure the two tabs on the pivot bushing are located in the slot (Item 1) **[C]** on the cab as shown.

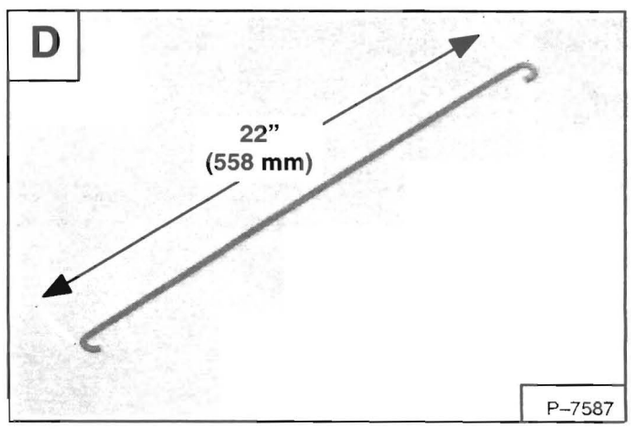
NOTE: The slots are located only on the left side of the cab.

NOTE: Hook a 3/16" diameter rod, 22" (558 mm) long, on each end as shown [D]. Pulling the seat bar together and holding it at the pivot holes with the 3/16" rod, will make removal and installation easier.







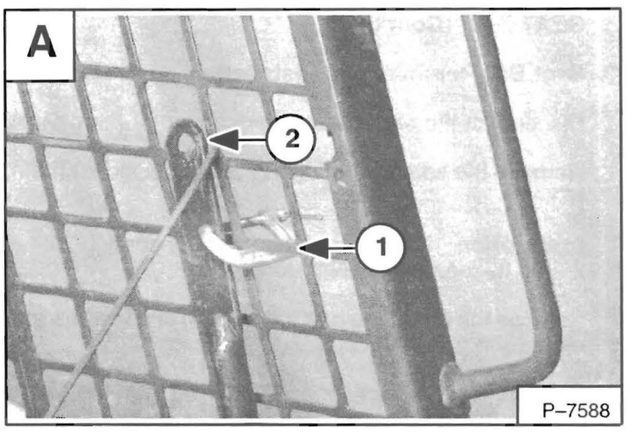


SEAT BAR (Cont'd)

Seat Bar Removal and Installation (Cont'd)

Use a clamp (Item 1) **[A]** to hold one side of the seat bar against the side screen.

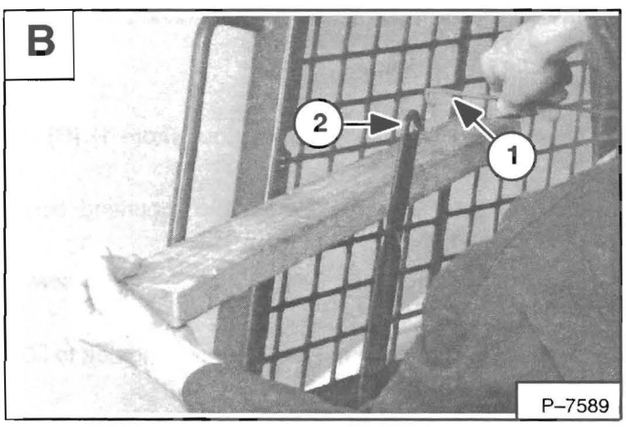
Install the rod (Item 2) **[A]** in the pivot hole.



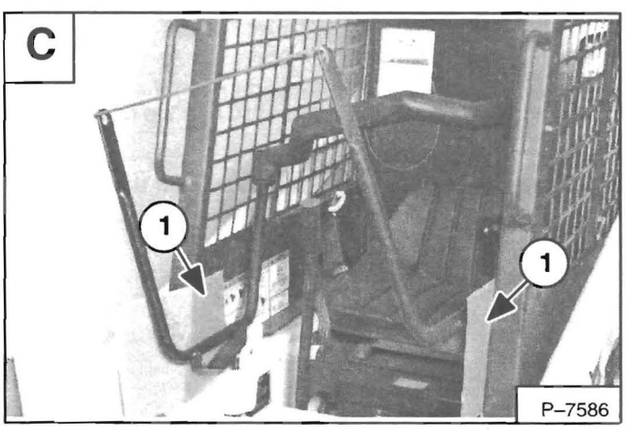
Use a wooden 2 x 4, installed with one end against the side screen to pry the seat bar together **[B]**.

Install the rod (Item 1) **[B]** in the seat bar pivot hole (Item 2) **[B]**.

Remove the wooden 2 x 4.



NOTE: To prevent damage, use cardboard (Item 1) [C] between both sides of the seat bar and the opening in the operator cab during removal and installation.

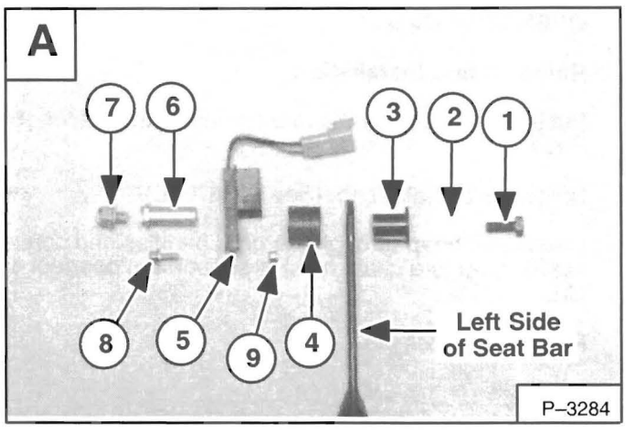


SEAT BAR (Cont'd)

Assembly

Assemble the parts as shown for the left side of the seat bar pivot assembly **[A]**.

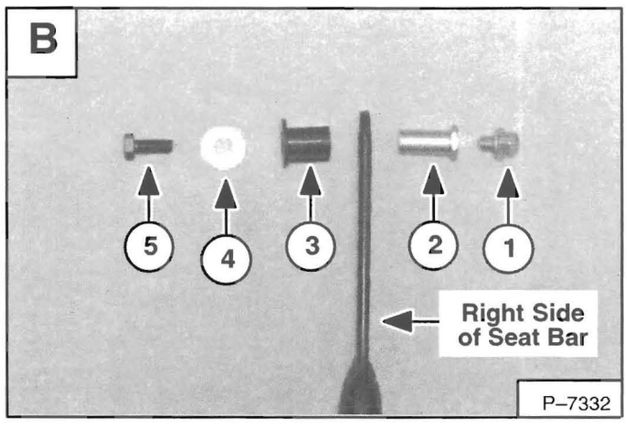
Mounting Bolt – (Item 1).
Washer – (Item 2).
Keyed Plastic Bushing – (Item 3).
Magnetic Bushing Assembly – (Item 4).
Sensor Bracket – (Item 5).
Pivot Bushing – (Item 6).
Mounting Bolt – (Item 7).
Sensor Mounting Bolt – (Item 8).
Sensor Mounting Nut – (Item 9).



Assemble the parts as shown for the right side of the seat bar pivot assembly **[B]**.

Mounting Bolt (Item 1).
Pivot Bushing (Item 2).
Keyed Plastic Bushing (Item 3).
Washer (Item 4).
Mounting Bolt (Item 5).

Tighten the mounting bolt to 180–200 in.–lbs. (21–23 Nm) torque.



OPERATOR CAB

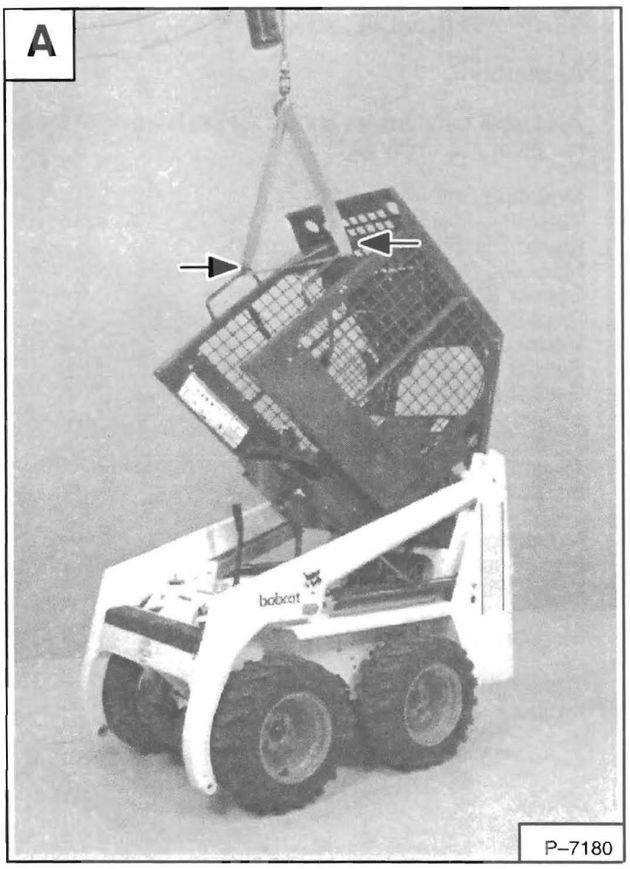
Removal and Installation

Put jackstands under the rear corners of the loader. (See Page 1–1.)

Raise the operator cab. (See Page 1–1.)

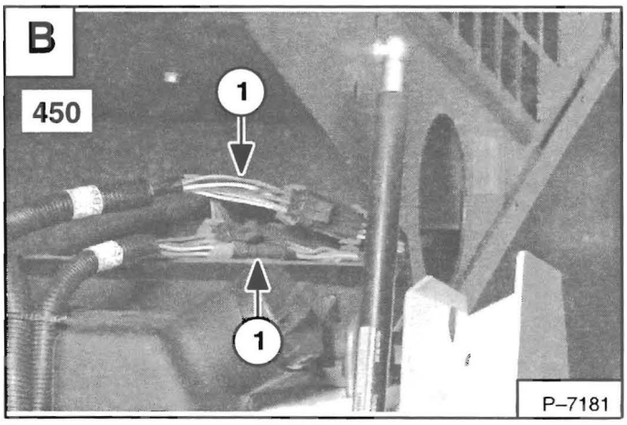
Install a lift strap through the grab handles and connect the lift strap to a chain hoist to support the operator cab **[A]**.

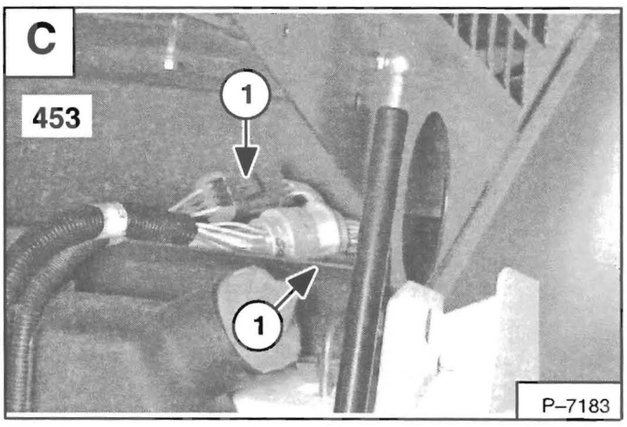
Release the lock pin.



Disconnect the electrical harness (Item 1) **[B]** or **[C]** from the operator cab.

Remove the gas cylinder from the operator cab. (See Page 5–10.)



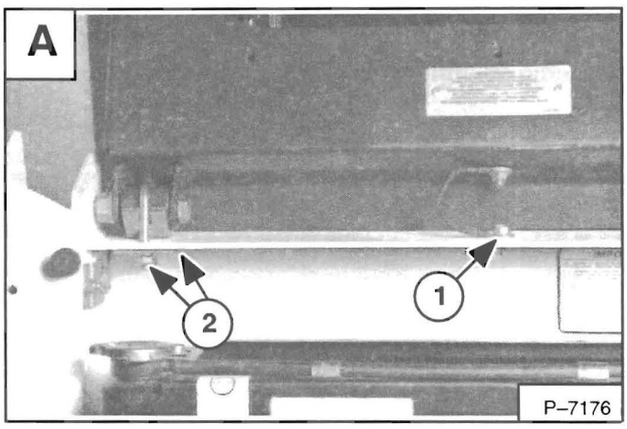


OPERATOR CAB (Cont'd)

Removal and Installation (Cont'd)

Disconnect the ground wire (Item 1) **[A]** from the operator cab.

Remove the U–bolt nuts (Item 2) **[A]** (both sides) from the rear mounting bolts.

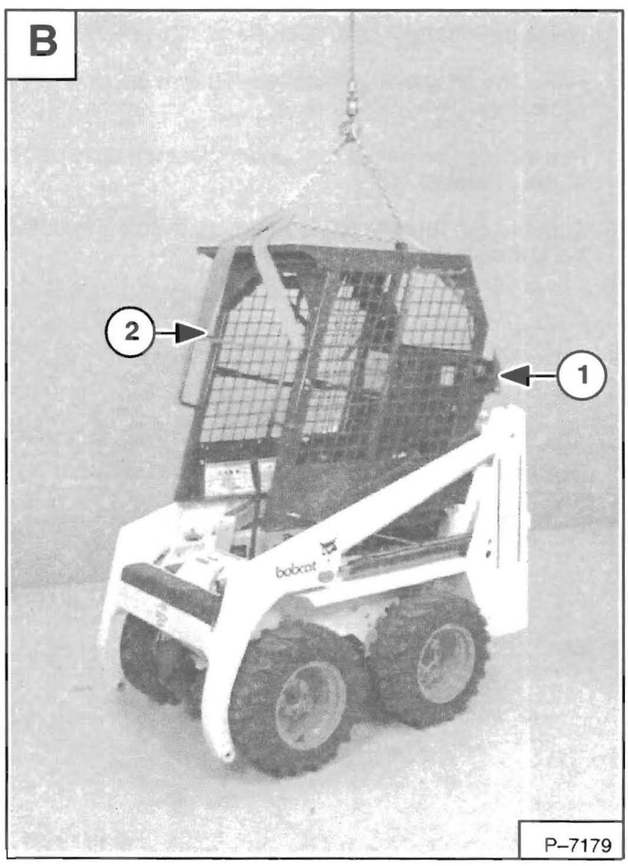


Install a lift strap through the fuel fill access hole (Item 1) **[B]** in the operator cab.

Use a chain connected to the two lift straps (Items 1 & 2) **[B]** and remove the operator cab.

Reverse the procedure to install the operator cab.

Lower the operator cab.



OPERATOR CAB GAS CYLINDER

Removal and Installation

Put jackstands under the rear corners of the loader.

⚠ WARNING

Cylinder contains high pressure gas. Do not open. Opening cylinder can release rod and cause injury or death.

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Raise the operator cab. (See Page 1–1.)

Raise the lift arm and install the lift arm support device. (See Page 1–1.)

Pull the clip (Item 1) **[A]** enough to clear the base end ball of the cylinder.

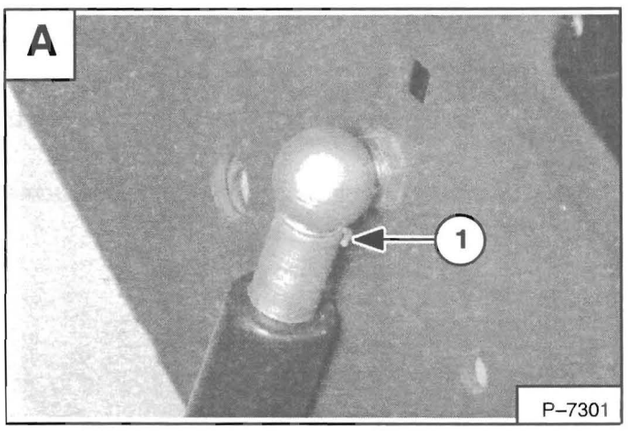
Turn the clip (Item 1) **[B]** to remove it from the hole in the base end of the cylinder.

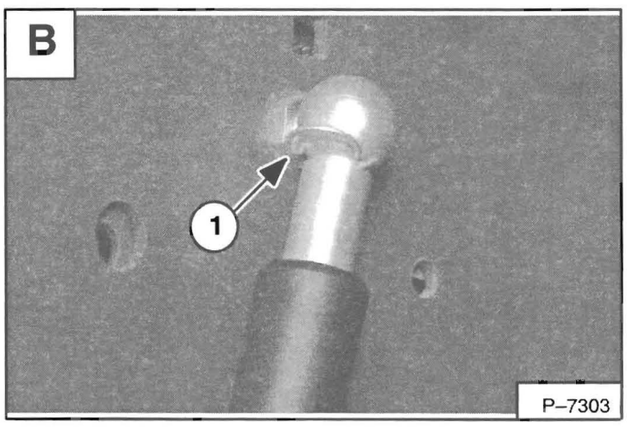
Rotate the cylinder to remove it from the ball (Item 1) **[C]**.

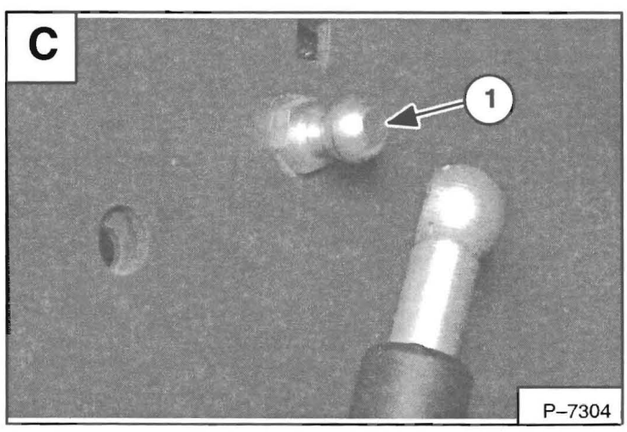
Hold the nut under the fender and remove the bolt (Item 1) **[D]** from the rod end of the cylinder.

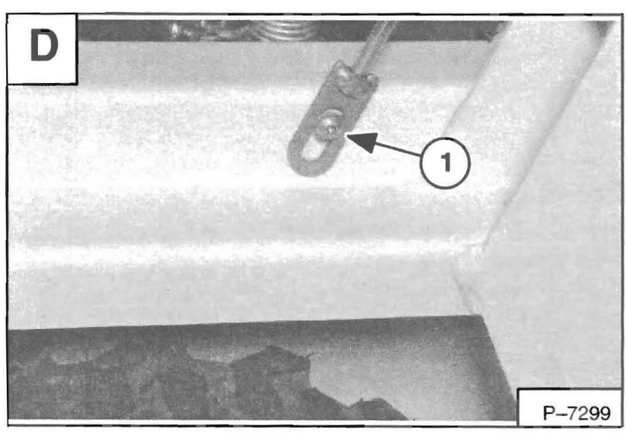
Remove the cylinder.

Reverse the procedure to install the gas cylinder.









OPERATOR SEAT

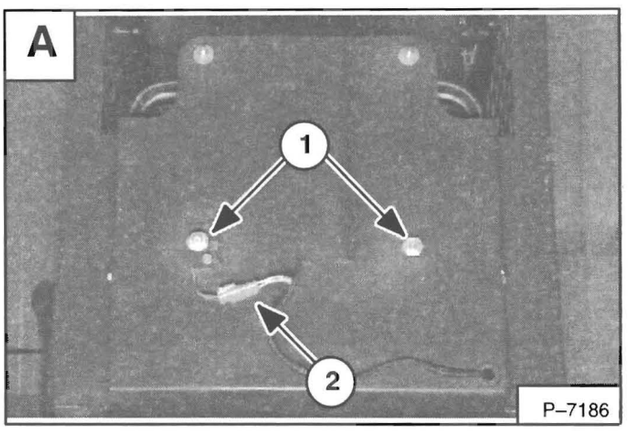
Removal and Installation

Put jackstands under the front and rear corners of the loader.

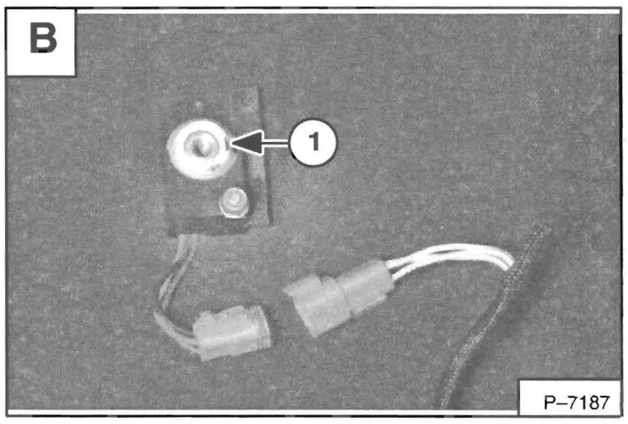
Raise the operator cab. (See Page 1–1.)

Remove the two (2) rear seat mounting bolts (Item 1) **[A]** from the seat mount.

Disconnect the electrical socket (Item 2) **[A]** from the seat sensor.

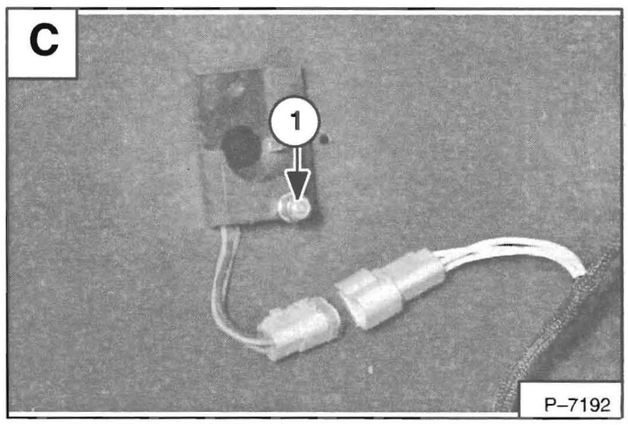


Remove the magnet collar (Item 1) **[B]** from the seat sensor.



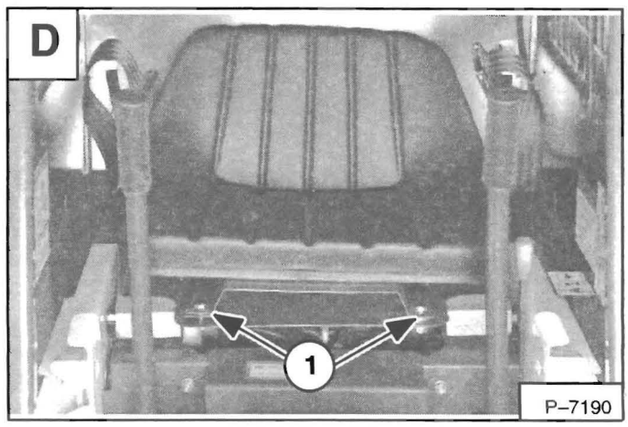
Remove the mounting bolt (Item 1) **[C]** from the sensor.

Remove the sensor.



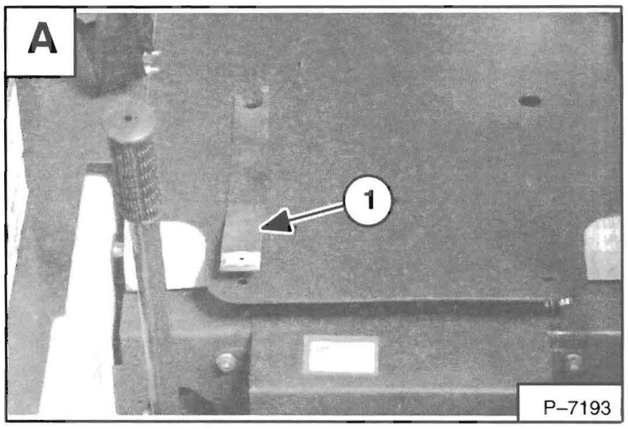
Lower the operator cab and remove the two (2) mounting bolts (Item 1) **[D]** from the front of the seat.

Remove the operator seat.

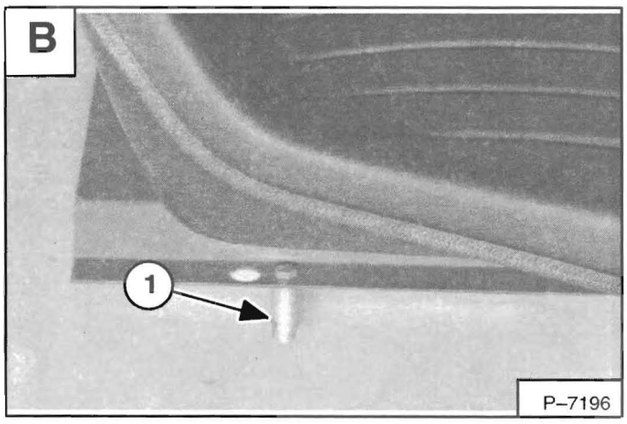


Removal and Installation (Cont'd)

Remove the seat spring (Item 1) **[A]** from under the right side of the seat.



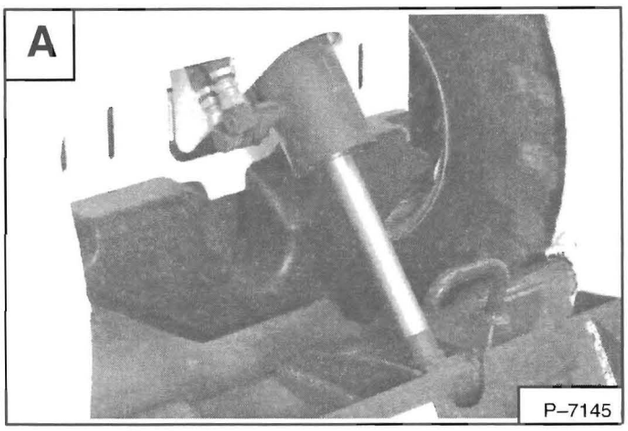
The seat sensor bushing (Item 1) **[B]** is located in the right rear corner of the seat.



BOB–TACH

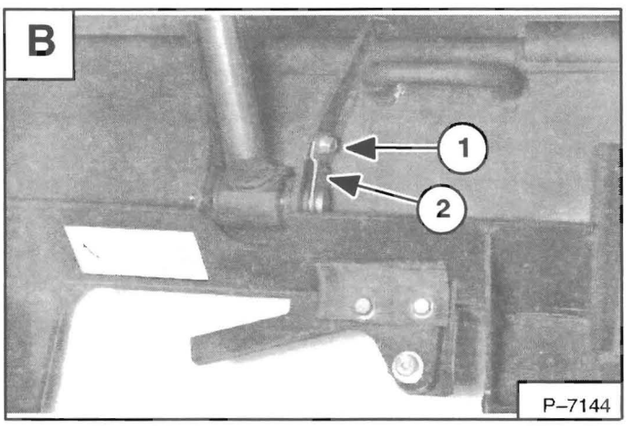
Removal

Tilt the Bob–Tach forward so it is parallel to the floor. Put blocks under the Bob–Tach and lower the Bob–Tach onto the blocks **[A]**.

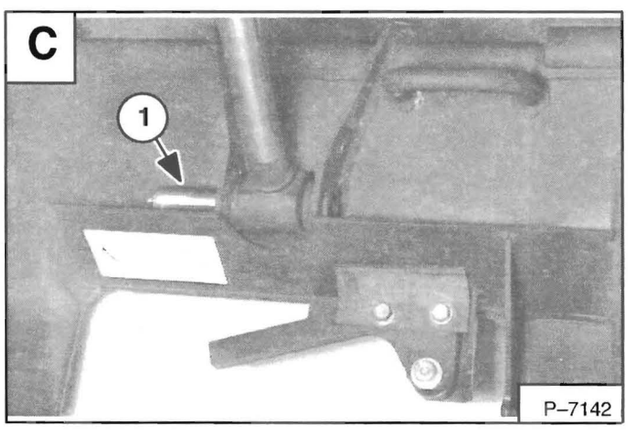


Remove the retainer bolt (Item 1) **[B]** from the rod end pivot pin retainer (Item 2) **[B]**.

Installation: Tighten the retainer bolt to 18–20 ft.–lbs. (24–27 Nm) torque.



Remove the pivot pin (Item 1) **[C]** from the tilt cylinder and the Bob–Tach.

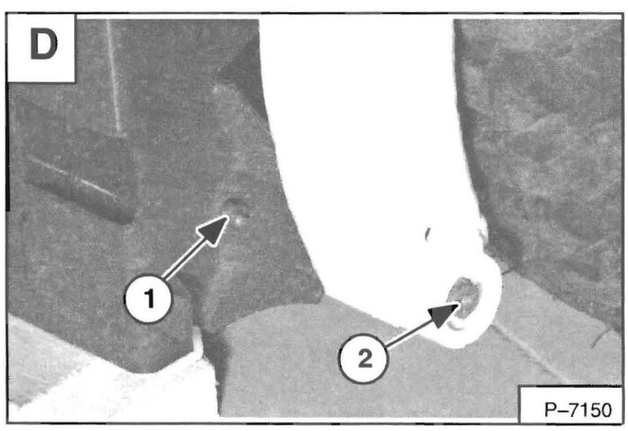


Lift the Bob–Tach and support it to remove the Bob–Tach pivot pin.

Remove the grease fitting (Item 1) **[D]** and slightly loosen the bolt (Item 2) **[D]**.

Cover the grease fitting hole with a rag and strike the pivot pin bolt with a hammer to loosen the tapered pin.

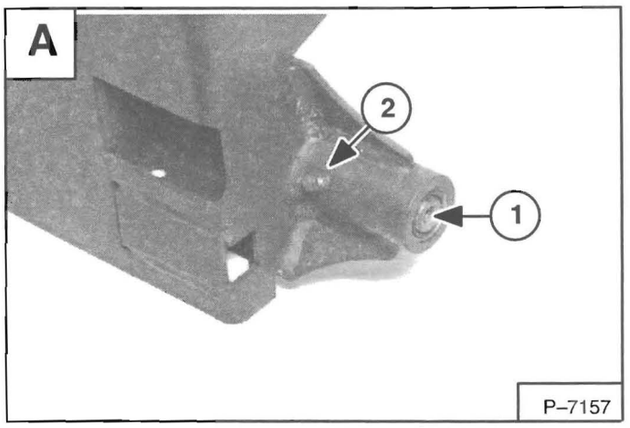
Remove the Bob–Tach.



BOB–TACH (Cont'd)

Installation

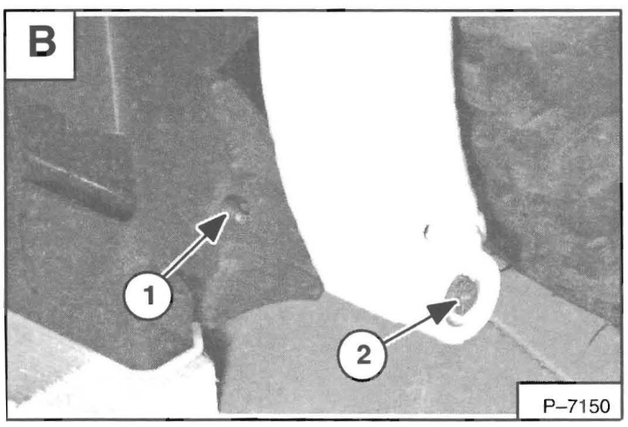
Push the pivot pin (Item 1) **[B]** in fully and install the grease fitting (Item 2) **[A]**.



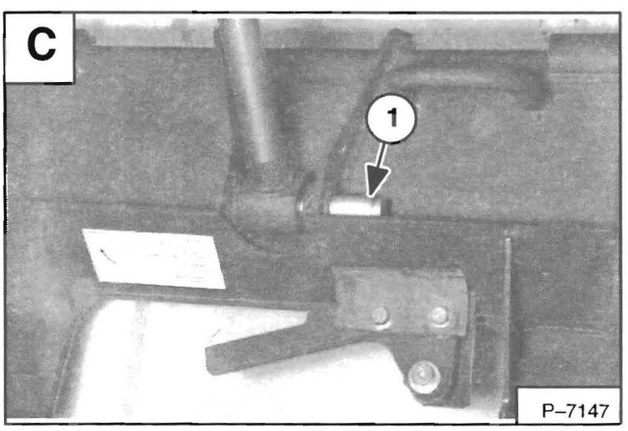
Align the Bob–Tach pivot pin with the lift arm hole (both sides).

Add grease to the fitting (Item 1) **[B]** to force the pivot pin into the lift arm hole.

Install the bolt (Item 2) **[B]** in the pivot pin. Tighten the bolt to 65–70 ft.–lbs. (88–95 Nm) torque.

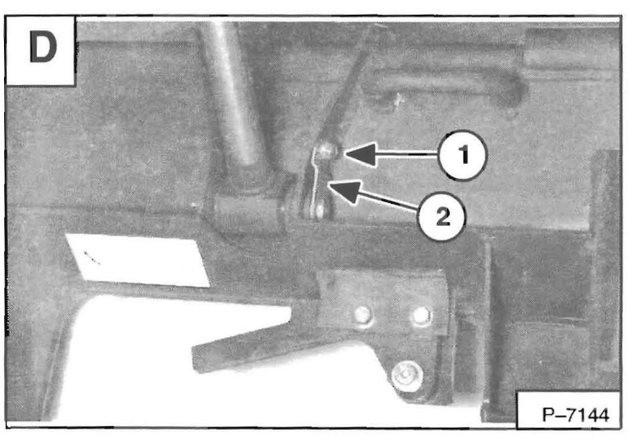


Align the tilt cylinder rod end with the bushings in the Bob–Tach and install the pin (Item 1) **[C]**.



Install the pin retainer (Item 1) **[D]** and the retainer bolt (Item 2) **[D]**.

Tighten the bolt (Item 2) **[D]** to 18–20 ft.–lbs. (24–27 Nm) torque.



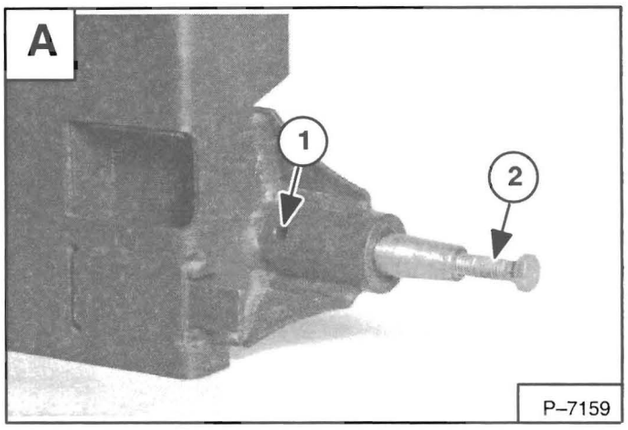
BOB–TACH (Cont'd)

Seal Removal and Installation

Remove the Bob–Tach. (See Page 5–13.)

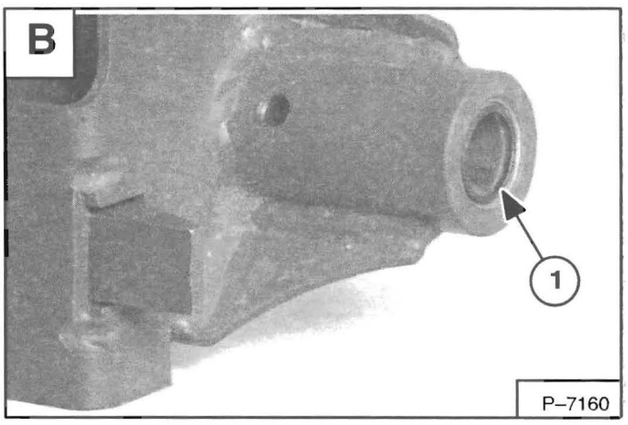
Remove the grease fitting from the pivot pin grease chamber (Item 1) **[A]**.

Install the Bob–Tach mounting bolt (Item 2) **[A]** in the pivot pin and remove the pivot pin.



Remove the seal (Item 1) **[B]** from the Bob–Tach.

NOTE: Install the seal with the lip facing outward.

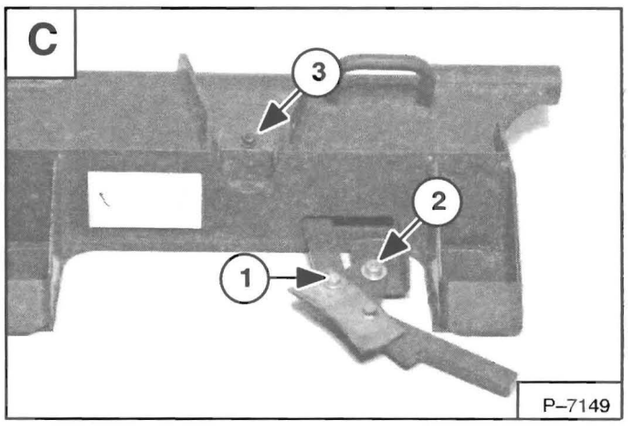


Lever and Wedge Removal

Remove the bolts (Items 1 & 2) **[C]** to remove the Bob–Tach lever.

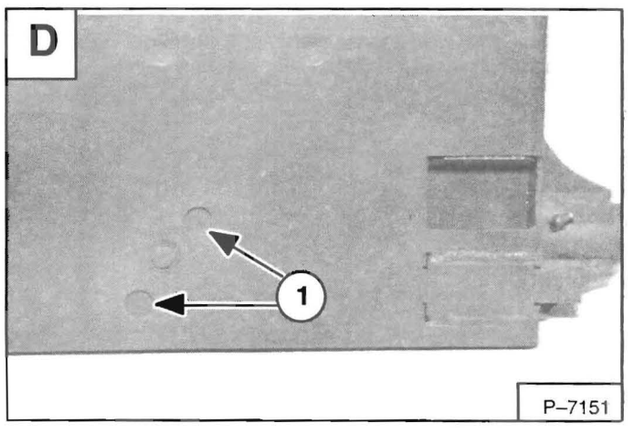
Remove the access cover bolt (Item 3) **[C]**

Remove the access cover.



Use a punch to remove the plugs (Item 1) **[D]** from the front of the Bob–Tach.

Remove the plugs through the access hole.

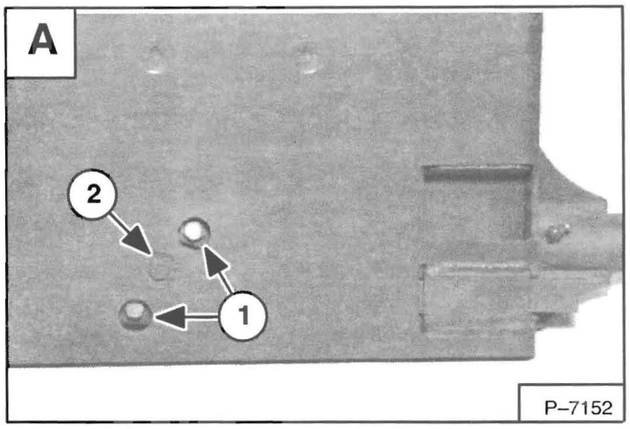


BOB–TACH (Cont'd)

Lever and Wedge Removal (Cont'd)

Remove the bolts (Item 1) **[A]** from the wedge linkage pivots.

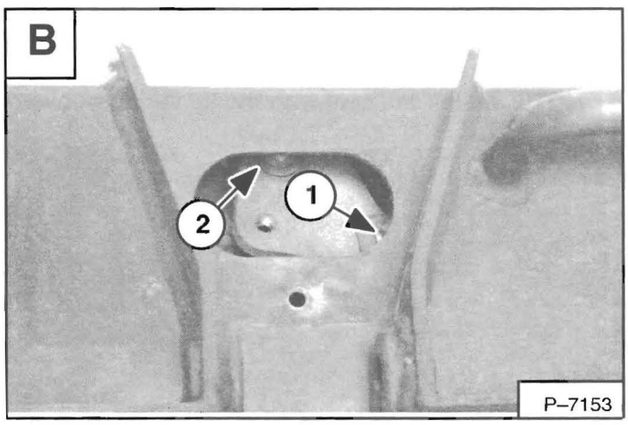
NOTE: The linkage pivots have spacers that must be installed during assembly.



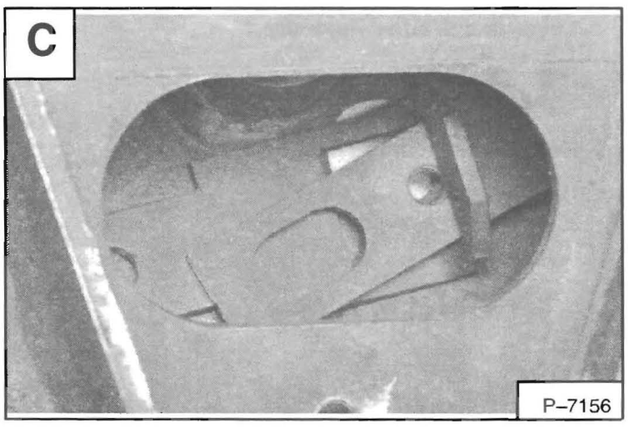
Remove the bolt (Item 1) **[B]** from the Bob–Tach lever linkage.

NOTE: Install the linkage spacer during assembly.

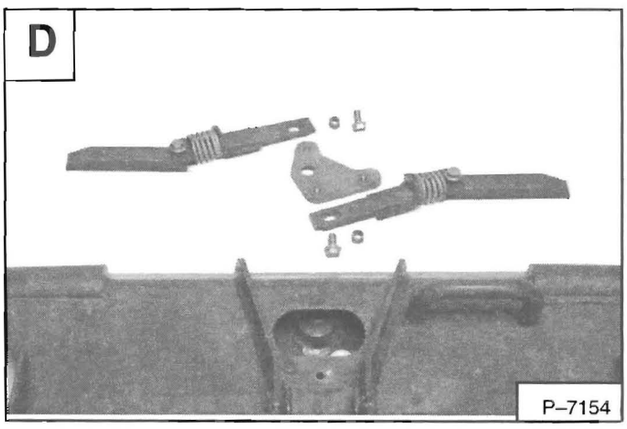
Remove the nut (Item 2) **[B]** from the wedge pivot plate by holding the bolt (Item 2) **[A]** on the front of the Bob–Tach.



Remove the wedge assembly from the access hole in the Bob–Tach **[C]**.



Check the wedge assembly for damage or wear and replace as needed **[D]**.



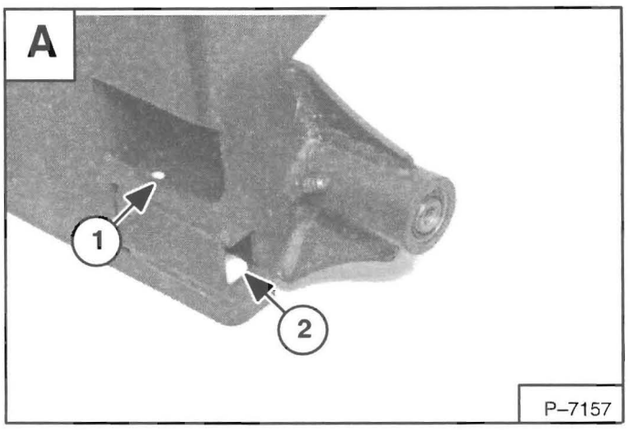
BOB–TACH (Cont'd)

Lever and Wedge Removal (Cont'd)

Remove the plastic wedge guides as follows:

Tap the plastic guide plugs (Item 1) **[A]** from the holes to remove the plastic guides (Item 2) **[A]**.

Replace worn or broken guides.



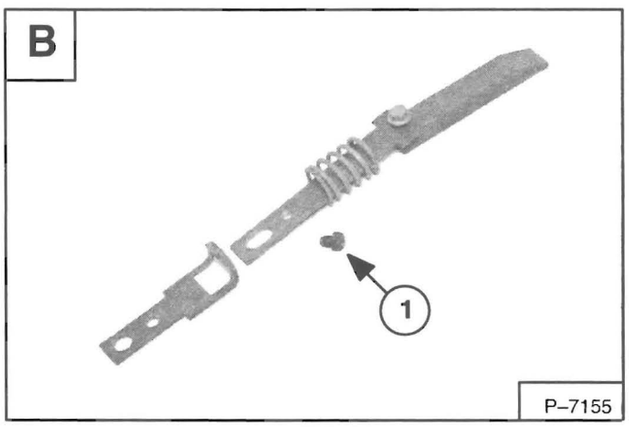
Lever and Wedge Installation

Assemble the wedge and linkage parts. Install a 1/2" long bolt (Item 1) **[B]** to temporarily hold the spring and link together during installation.

NOTE: The bolt (Item 1) [B] will be removed at the end of the assembly procedure.

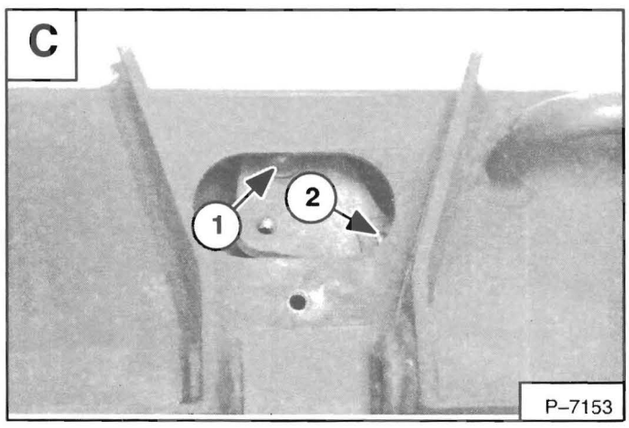
Install the right wedge assembly into the access hole first, then install the left assembly.

The wedges must go between the plastic guides.



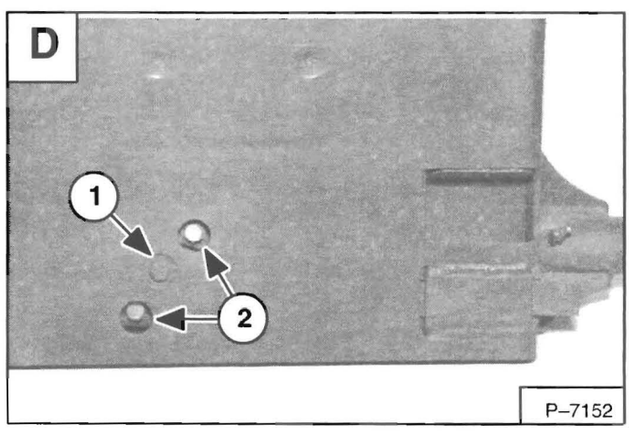
Install the pivot plate in the access hole **[C]**. Install the bolt (Item 1) **[D]** from the front of the Bob–Tach and install the nut (Item 1) **[C]** on the bolt.

Install the lever linkage bolt (Item 2) **[C]** in the pivot plate.



Align the wedge assembly mounting holes with the holes in the pivot plate and install the bolts (Item 2) **[D]** and bushings through the holes in the front of the Bob–Tach.

Installation: Tighten the bolts to 25–28 ft.–lbs. (34–38 Nm) torque.



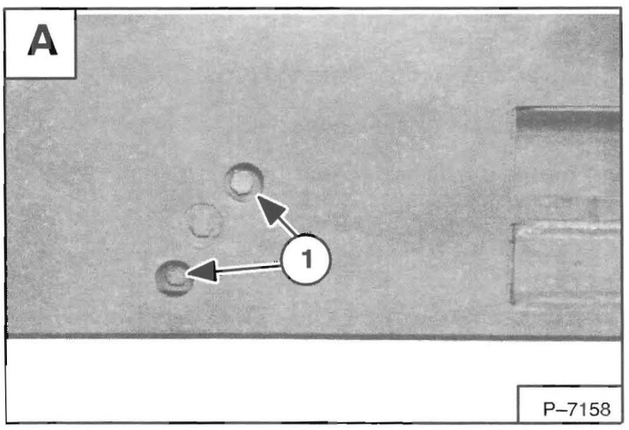
Lever and Wedge Installation (Cont'd)

Move the Bob–Tach lever to align the temporary bolts (Item 1) **[A]** with the holes in the front of the Bob–Tach.

Remove the bolts.

Install the plugs in the holes.

Install the access cover and bolt.



LIFT ARMS

Removal and Installation

Put jackstands under the front and rear corners of the loader. (See Page 1–1.)

Remove the Bob–Tach. (See Page 5–13.)

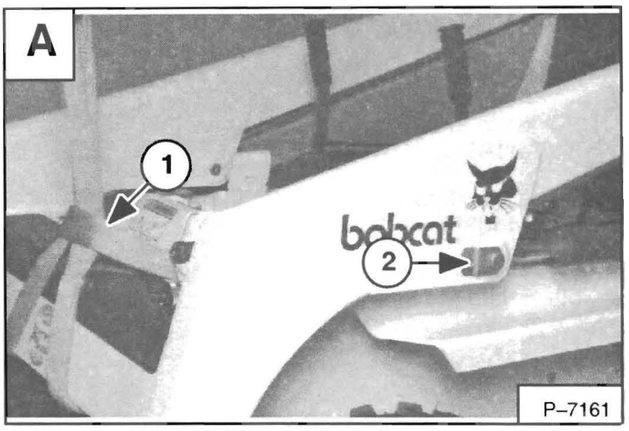
Install a sling (Item 1) **[A]** around the lift arm crossmember and use a chain hoist to raise the lift arms.

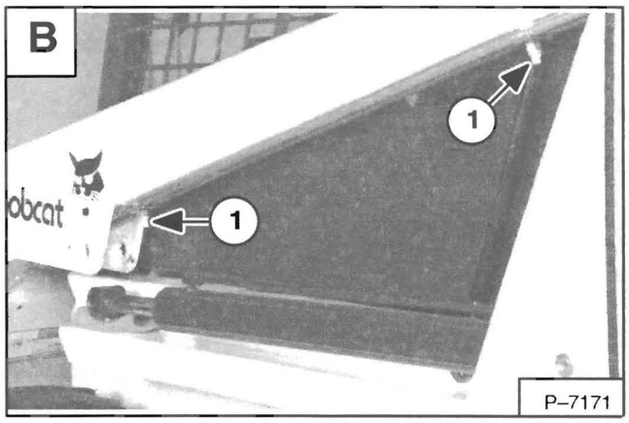
Remove the tilt cylinder. (See Page 2–1.)

Remove the bolt (Item 2) **[A]** from the rod end pivot pin retainer on the left lift cylinder. Remove the pivot pin.

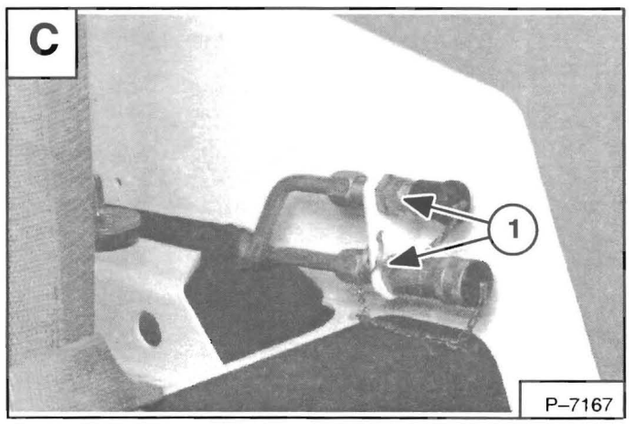
Lower the cylinder to the fender.

Remove the auxiliary tubeline clamps (Item 1) **[B]** (if equipped).





Remove the auxiliary couplers and tubelines (Item 1) **[C]** from the left lift arm.

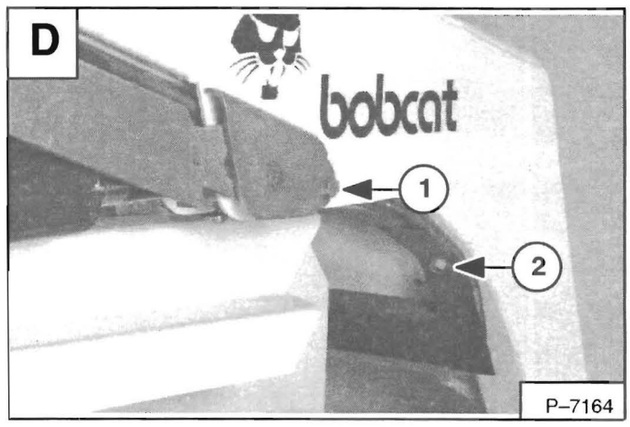


Remove the rod end pivot pin bolt (Item 1) **[D]** from the right lift cylinder. Remove the pivot pin.

Lower the cylinder to the fender.

Remove the bolt (Item 2) **[D]** from the tilt cylinder tubeline cover.

Remove the tubeline clamps from the right lift arm.

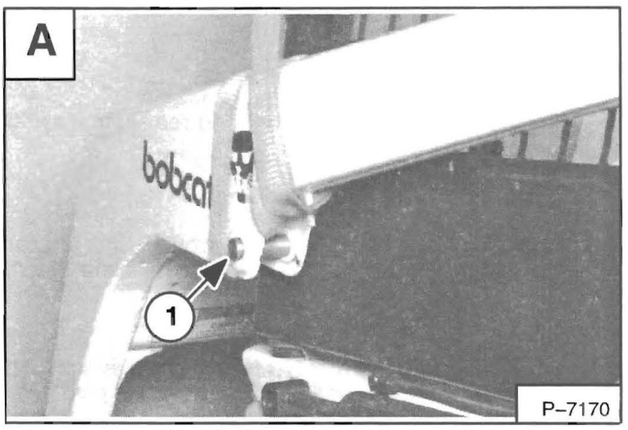


Removal and Installation (Cont'd)

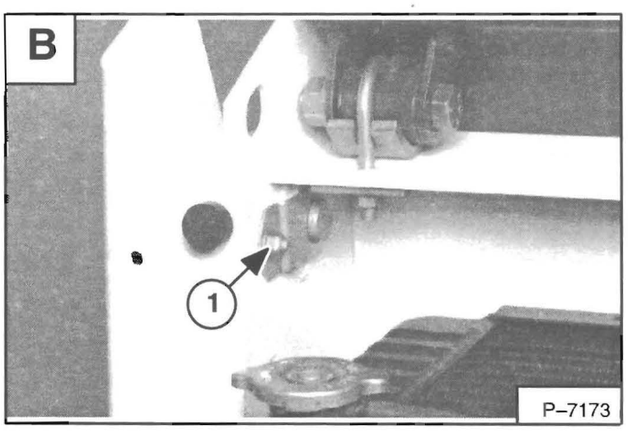
Put the loop of a second lift strap up into the lift arm as shown **[A]** (both sides).

Install the lift cylinder pivot pin (Item 1) **[A]** and secure the pin with the retainer and bolt.

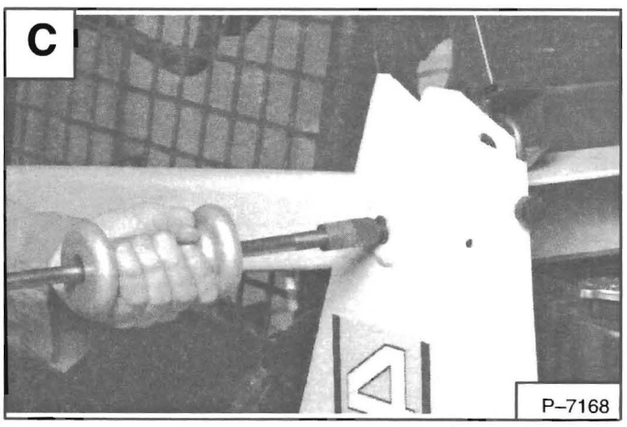
Wrap the lifting strap around the lift arm (both sides) and attach it to the chain hoist.



Remove the nut (Item 1) **[B]** from the upright pivot pin retainer (both sides).



Use a slide hammer to remove the pivot pin from the upright (both sides) **[C]**.



LIFT ARMS (Cont'd)

Removal and Installation (Cont'd)

Use the chain hoist to remove the lift arms from the loader.

Use the reverse procedure to install the lift arms on the loader.



FUEL TANK

Removal and Installation

Put jackstands under the rear corners of the loader.

Raise the operator cab. (See Page 1–1.)

453: Remove the hose clamps (Item 1) **[A]** to remove the priming bulb.

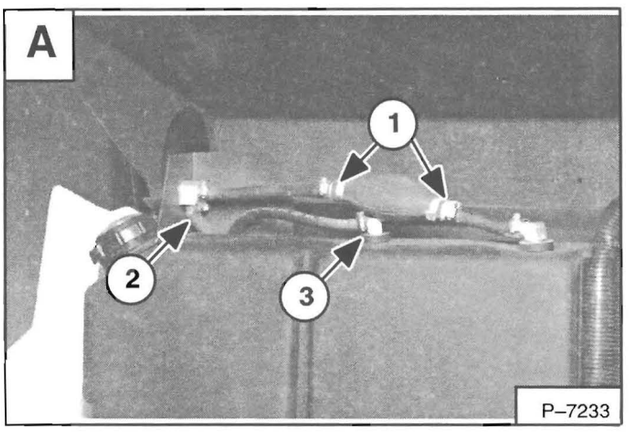
450: Remove the hose clamps (Item 1) **[B]** to remove the in–line fuel filter.

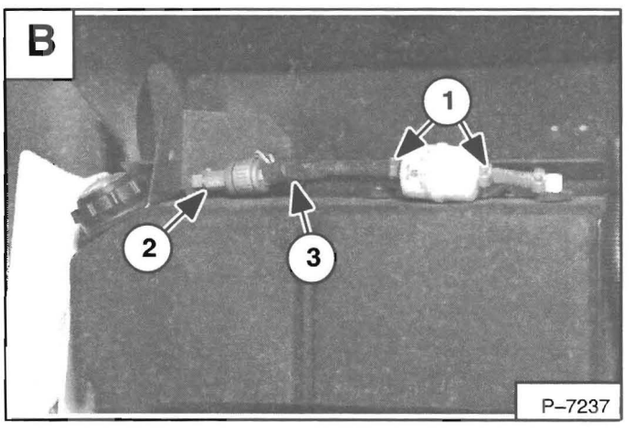
453: Remove the hose clamps (Items 2 & 3) **[A]** to remove the fuel supply and return lines.

450: Remove the hose clamp (Item 2) **[B]** and remove the fuel supply line.

Disconnect the electrical connector (Item 3) **[B]** from the electrical fuel shut off.

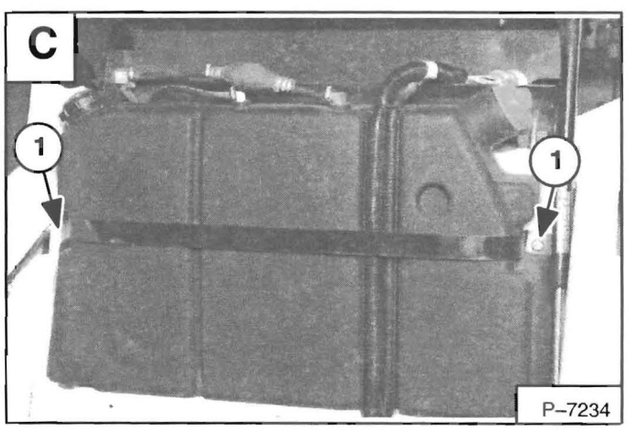
Disconnect the electrical harness (see Page 5–8) from the operator cab.





Remove the two bolts (Item 1) **[C]** from the fuel tank mounting strap.

Remove the fuel tank from the loader.

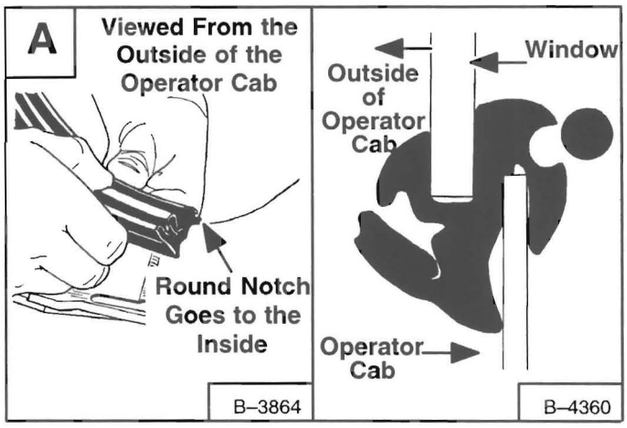


REAR WINDOW

Removal and Installation

Put the molding in the opening in the rear of the cab **[A]**. The groove for the rubber must be toward the inside of the cab.

Put the window in molding.



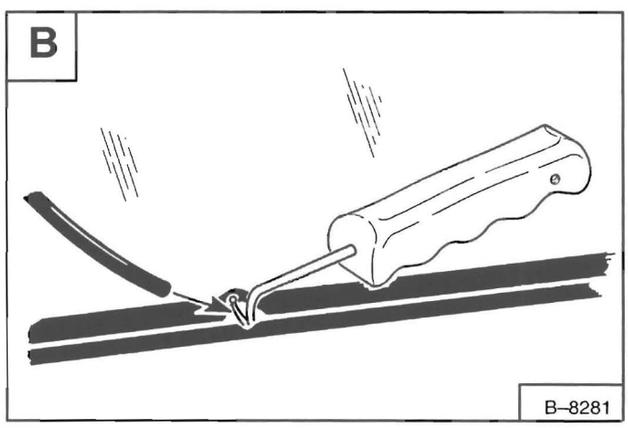
Insert the eye of the tool into the groove of molding **[B]**.

Insert cord from front of the tool eye **[B]**.

Slide the tool forward, following groove in the molding, while inserting the cord into the tool eye **[B]**.

Do not stretch the cord.

When completed, cut excess cord, leaving a small overlap. Push overlap into the groove to form a tight joint.

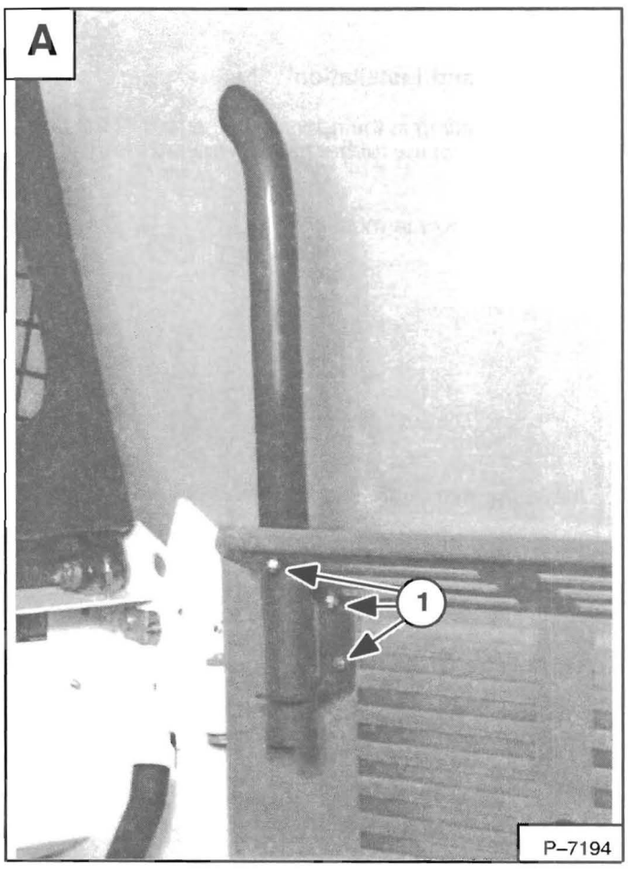


REAR DOOR

Exhaust Pipe Removal and Installation

Open the rear door.

Remove the mounting bolts (Item 1) **[A]** to remove the exhaust pipe.

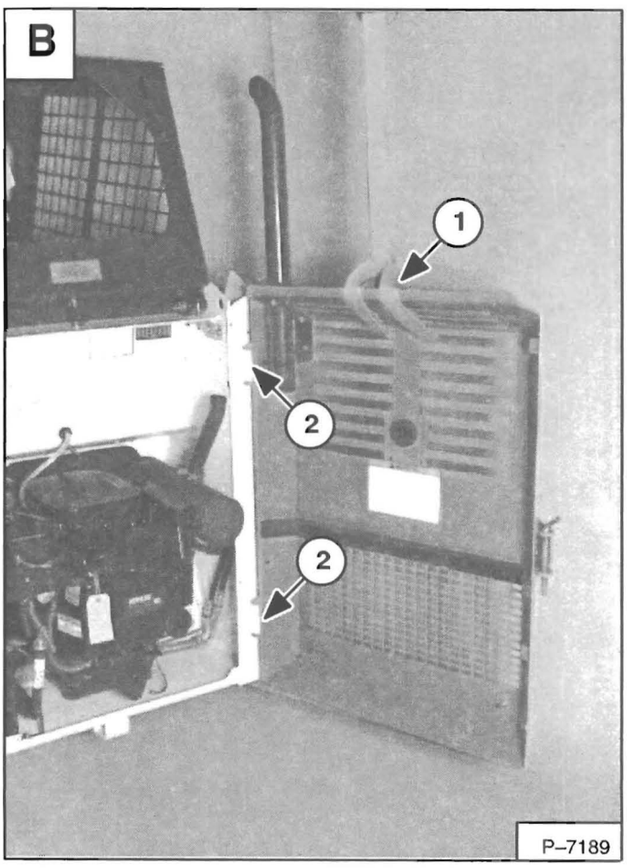


Removal and Installation

Install a lifting strap (Item 1) **[B]** through the slots in the rear door.

Remove the hinge pins (Item 2) **[B]** from the door hinges.

Remove the door from the loader.



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Alternator Regulator Test	6–11
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bobcat

453 BICS™
CAB WIRING DIAGRAM
INDEX

USE YOUR LOADER SERIAL NUMBER and OPTIONS
TO FIND THE CORRECT WIRING DIAGRAM SHEETS.

OPTION	LOADER S/N and COMMENTS	CAB	CONNECTOR	SEE WIRING DIAGRAM SHEET NUMBER: ENGINE
ALL	515011001 and Above 515111001 and Above	**1**	A	1

HOW TO USE YOUR WIRING DIAGRAM INDEX:

OPTION (when listed): Which OPTION does your loader have?

LOADER S/N and COMMENTS Identify your loader's SERIAL NUMBER. COMMENTS (when listed) are items to identify the latest changes made within the range of S/N's listed.

SHEET NUMBERS in LARGE BOLD Print Represent the SHEET NUMBERS which correspond to this INDEX'S WIRING DIAGRAM TYPE. The heading directly above each LARGE BOLD NUMBER identifies this INDEX'S WIRING DIAGRAM TYPE.

CONNECTOR A list of all CONNECTORS for each range of S/N's for this WIRING DIAGRAM TYPE and each of it's SHEETS.

SHEET NUMBERS in SMALLER Print Represent the SHEET NUMBERS which contain the matching CONNECTOR on a different TYPE of WIRING DIAGRAM. The matching WIRING DIAGRAM TYPE is identified in the heading directly above these SMALLER NUMBERS. If multiple SHEET NUMBERS are listed, refer to that WIRING DIAGRAM INDEX page to determine the correct SHEET NUMBER your SERIAL NUMBER loader is represented on.

Printed in U.S.A.

4530CW (5-6-97)

E-1

CAB WIRING DIAGRAM - SHEET 1
(Harness 6707498 Rev. D)
453 BICS™ (515011001 and Above)
(515111001 and Above)

(Printed May 1997)

Printed in U.S.A.

WIRE LEGEND

NO. 's	COLOR	GAUGE
10	Black	12
10P	Black	16
12CA	Orange	16
12F	Orange	16
12FA	Orange	16
12FB	Orange	16
12H	Orange	16
12T	Orange	16
19D	Red/White	16
19G	Red/White	16
19L	Red/White	14
19LA	Red/White	16
19LB	Red/White	16
19P	Red/White	14
19S	Red/White	14
21R	White	16
23BL	White/Black	16
28	Lt. Blue/Black	16
30	Black	16
30T	Black	16
31P	Yellow/Green	16
32PT	Yellow/Dk. Blue	16
35H	Yellow/Brown	16
36T	Purple/White	16
40	Black	16
40A	Black	16
40B	Black	16
40D	Black	16
40F	Black	16
40FA	Black	16
40FB	Black	16
40FC	Black	16
40FD	Black	16
40FL	Black	16
40FR	Black	16
40H	Black	16
40L	Black	16
40LA	Black	16
40R	Black	16
41	Pink	16
41A	Pink	16
41B	Pink	16
41C	Pink	16
42F	Dk. Blue	16
42FA	Dk. Blue	16
42FL	Dk. Blue	16
42FR	Dk. Blue	16
42R	Dk. Blue/White	16
42RF	Brown	16
46B	Brown/Red	16
46D	Brown	16
46H	Brown	16
46L	Brown/Yellow	16
46LA	Brown/Yellow	16

WIRE LEGEND (Cont'd)

NO. 's	COLOR	GAUGE
46LB	Brown	16
46LF	Brown/Yellow or Yellow	16
46R	Brown/Green	16
46RA	Brown/Green	16
46RB	Brown/Green	16
46RF	Brown/Green or Green	16
46T	Brown	16
49T	Gray	16
49V	Gray	16
59E	Orange	16
60H	Black	16
64	Orange/Blue	16

PARTS LEGEND

1. Cab Harness 6707498 Rev. D
2. Dome Light With Switch (> European Standard)
3. Left Front Turn Indicator (> Euro. Opt.)
4. Headlight Harness (453 Opt. and Euro. Std.) 6578528 Rev. B
5. Left Headlight (453 Opt. and Euro. Std.)
6. Flasher (> Euro. Opt.)
7. Right Headlight (453 Opt. and Euro. Std.)
8. Horn Alarm (453 Opt. and Euro. Std.)
9. Right Front Turn Indicator (> Euro. Opt.)
10. Rear Floodlight Lamp (453 Opt. and Euro. Std.)
11. Rear Tail Lamp (453 Opt. and Euro. Std.)
12. Glow Plug Switch
13. Bucket Level Switch (Opt.)
14. Rotating Beacon Switch (Opt.)
15. Hazard Switch (> Euro. Opt.)
16. Accessory Power Plug
17. Ignition Switch
18. Keyless Ignition Module (Opt.)
19. Headlight Switch (453 Opt.)
20. Headlight Switch (> Euro. Std.)
21. Transmission and Engine Warning Indicator Lights
22. Light Connectors
23. Hourmeter
24. Volt Gauge
25. Coolant Temperature Gauge

PARTS LEGEND (Cont'd)

26. Amber Strobe Light or Rotating Beacon Light Harness (Opt.) 6708318
27. Amber Strobe Light or Rotating Beacon Light (Opt.)
28. 4-Way Flasher Harness (> Euro. Opt.) 6709530
29. Amber Strobe Light or Rotating Beacon Light Connector
30. For Future Use
31. Left Front Turn Lamp (> Euro. Opt.)
32. Left Clearance (Worklight) Lamp (> Euro. Opt.)
33. Right Front Turn Lamp (> Euro. Opt.)
34. Right Clearance (Worklight) Lamp (> Euro. Opt.)
35. Euro. Headlight Harness (> Euro. Opt.) 6707672
36. Left Euro. Headlight (> Euro. Opt.)
37. Right Euro. Headlight (> Euro. Opt.)
38. Diode

> NOT AVAILABLE DOMESTICALLY

Printed in U.S.A.

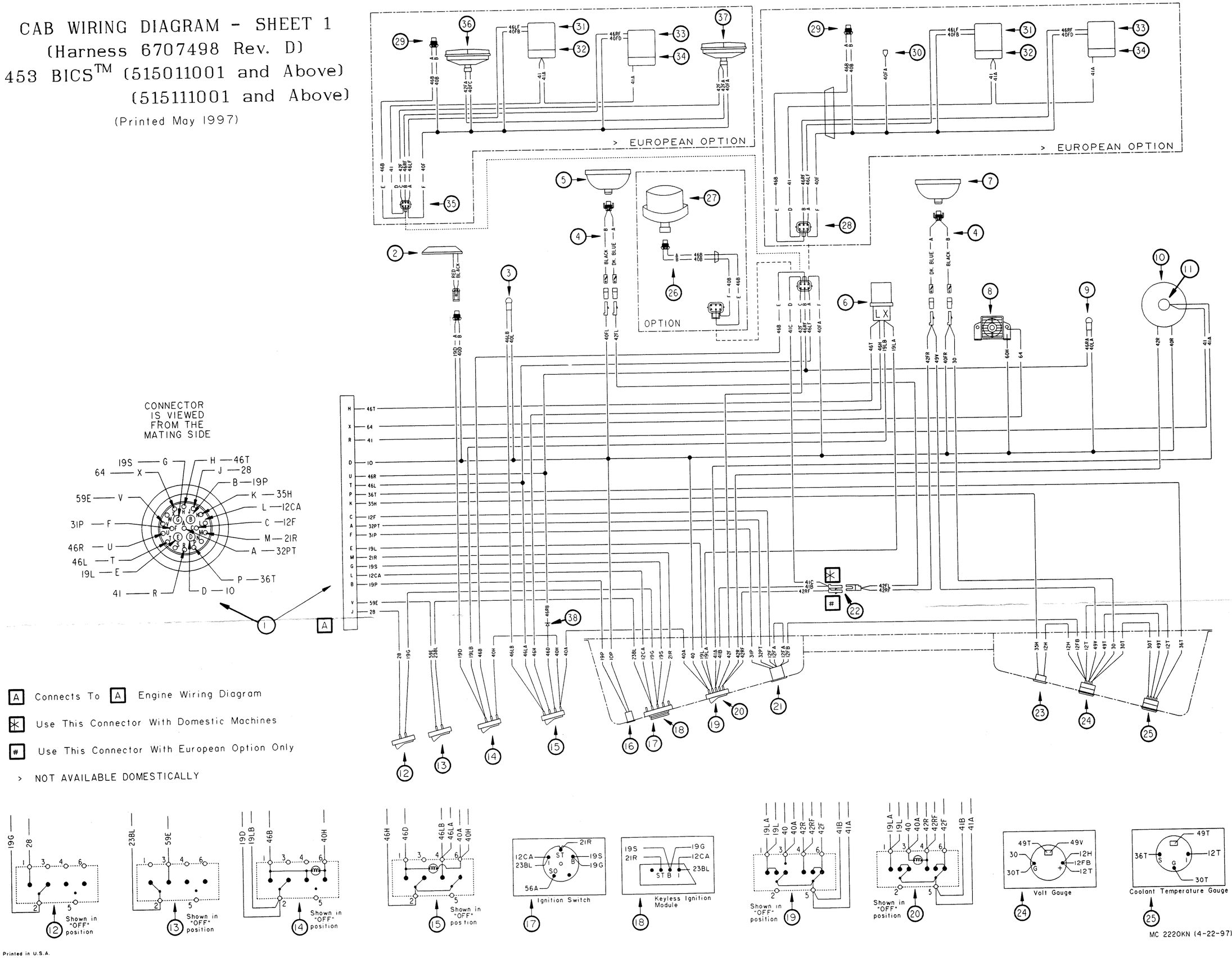
CAB WIRING DIAGRAM - SHEET 1

(Harness 6707498 Rev. D)

453 BICS™ (515011001 and Above)

(515111001 and Above)

(Printed May 1997)



453 BICS™
ENGINE WIRING DIAGRAM
INDEX

USE YOUR LOADER SERIAL NUMBER and OPTIONS
TO FIND THE CORRECT WIRING DIAGRAM SHEETS.

OPTION	LOADER S/N and COMMENTS	ENGINE	CONNECTOR	SEE WIRING DIAGRAM SHEET NUMBER: CAB	OPERATOR CONTROLS	BICS
ALL	515011001 and Above 515111001 and Above	1	A	1		
			B, C, D, E		1	
			F			1

HOW TO USE YOUR WIRING DIAGRAM INDEX:

OPTION (when listed): Which OPTION does your loader have?

LOADER S/N and COMMENTS Identify your loader's SERIAL NUMBER. COMMENTS (when listed) are items to identify the latest changes made within the range of S/N's listed.

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E-44

ENGINE WIRING DIAGRAM - SHEET 1

(Harness 6714018 Rev. A)

453 BICS™ (515011001 and Above)

(515111001 and Above)

(Printed May 1997)

Printed in U.S.A.

MC 2342TK

WIRE LEGEND

NO. 's	COLOR	GAUGE
0	Black	Cable
1	Red	Cable
1A	Red	12
1B	Red	10
1C	Red	12
1D	Red	12
1E	Red	14
1L	Red	12
1P	Red	14
1S	Red	12
1SA	Red	12
1SB	Red	16
1SC	Red	16
1SD	Red	12
1SE	Red	14
10	Black	12
10A	Black	16
10B	Black	16
10E	Black	16
10L	Black	14
10S	Black	16
12	Orange	16
12B	Orange	16
12BA	Orange	16
12BB	Orange	16
12C	Orange	14
12CA	Orange	16
12CB	Orange	16
12CC	Orange	14
12F	Orange	16
12FR	Orange	16
12H	Orange	16
14F	Lt. Green	16
14R	Lt. Green/White	16
14RA	Lt. Green/White	16
19E	Red/White	14
19L	Red/White	14
19P	Red/White	14
19S	Red/White	14
20T	Black	16
21R	White	16
21S	White/Lt. Green	12
23F	White/Black	14
23FA	White/Black	14
28	Lt. Blue/Black	16
28B	Lt. Blue/Orange	12
30P	Black	16
31P	Yellow/Green	16
32P	Yellow	16
32PT	Yellow	14
35H	Yellow/Brown	16
36T	Purple/White	14
40	Black	16
40L	Black	16
40R	Black	16
41	Pink	16
41L	Pink	16
41R	Pink	16
43LP	Lt. Blue/Yellow	16
46L	Brown/Yellow	16
46LA	Brown/Yellow	16
46LB	Brown/Yellow	16
46R	Brown/Green	16
46RA	Brown/Green	16
46RB	Brown/Green	16
46T	Brown	16

WIRE LEGEND (Cont'd)

NO. s	COLOR	GAUGE
59E	Orange	16
60B	Black	16
60BA	Black	16
60BB	Black	16
60BC	Black	16
64	Orange/Blue	16
66	Black	16
70	Black	14
70C	Black	16
72B	Pink/White	16
78	White	14

PARTS LEGEND

1. Engine Harness 6714018 Rev. A
2. Engine Coolant Temperature Switch
3. Engine Oil Pressure Switch
4. Bucket Level Off Connector (Position Valve)
5. Transmission Oil Temperature Switch
6. Transmission Oil Pressure Switch
7. Steering Lever Connector
8. Fuel Shutoff Timer
9. Fuel Shutoff Solenoid
10. Glow Plugs
11. Alternator
12. Starter
13. Battery
14. Starter Relay
15. Switched Power Relay
16. Glow Plug Relay
17. Brake Relay
18. Fused 10 Amp - BICS
19. Fused 15 Amp - Engine
20. Fused 25 Amp - N/S Timer
21. Fused 25 Amp - Brake
22. Fused 25 Amp - Accessories
23. Fused 25 Amp - Accessories (Power Plug)
24. Fused 25 Amp - Lights
25. Fused 10 Amp - Instrumentation
26. Accessory Fused and Switched Connector
27. BICS Connector
28. Steering Lever Connector
29. Back-up Alarm (Opt.)
30. Back-up Alarm Harness (Opt.) 6708739 Rev. B
31. Back-Up Alarm Switch (Opt.)

PARTS LEGEND (Cont'd)

32. Tailgate Harness (> Euro. Opt.) 6707509
33. Left Rear Taillight (> Euro. Opt.)
34. License Plate Light (> Euro. Opt.)
35. Right Rear Taillight (> Euro. Opt.)
36. Diode

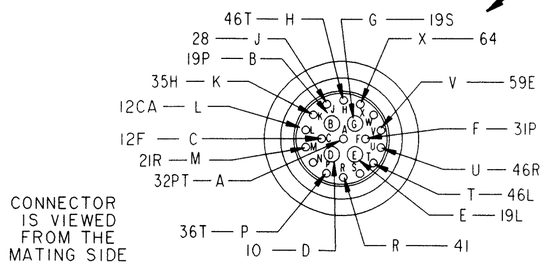
> NOT AVAILABLE DOMESTICALLY

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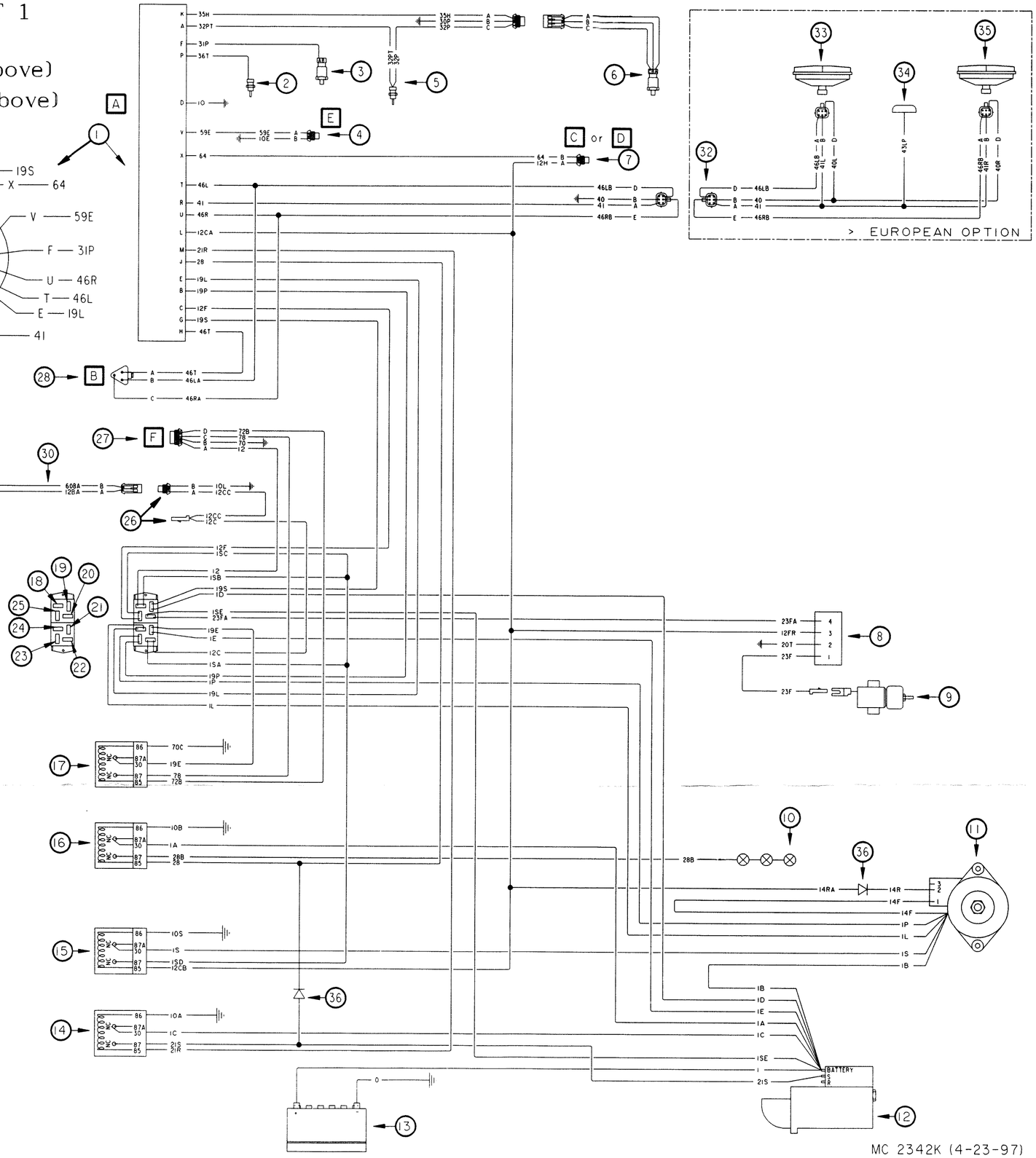
MC 2342LK (4-24-97)

ENGINE WIRING DIAGRAM - SHEET 1
(Harness 6714018 Rev. A)
453 BICS™ (S/N 515011001 and Above)
(S/N 515111001 and Above)

(Printed May 1997)



CONNECTOR IS VIEWED FROM THE MATING SIDE



Printed in U.S.A.

MC 2342K (4-23-97)

453 BICS™
BICS™ WIRING DIAGRAM INDEX

USE YOUR LOADER SERIAL NUMBER and OPTIONS TO FIND THE CORRECT WIRING DIAGRAM SHEETS.

OPTION	LOADER S/N and COMMENTS	BICS	CONNECTOR	SEE WIRING DIAGRAM SHEET NUMBER: ENGINE
ALL	515011001 and Above 515111001 and Above	**1**	F	1

HOW TO USE YOUR WIRING DIAGRAM INDEX:

OPTION (when listed): Which OPTION does your loader have?

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BICS™ WIRING DIAGRAM - SHEET 1
(BICS™ Controller Harness 6710422)
453 BICS™ (515011001 and Above)
(515111001 and Above)

(Printed May 1997)

Printed in U.S.A.

MC 2343TK

WIRE LEGEND

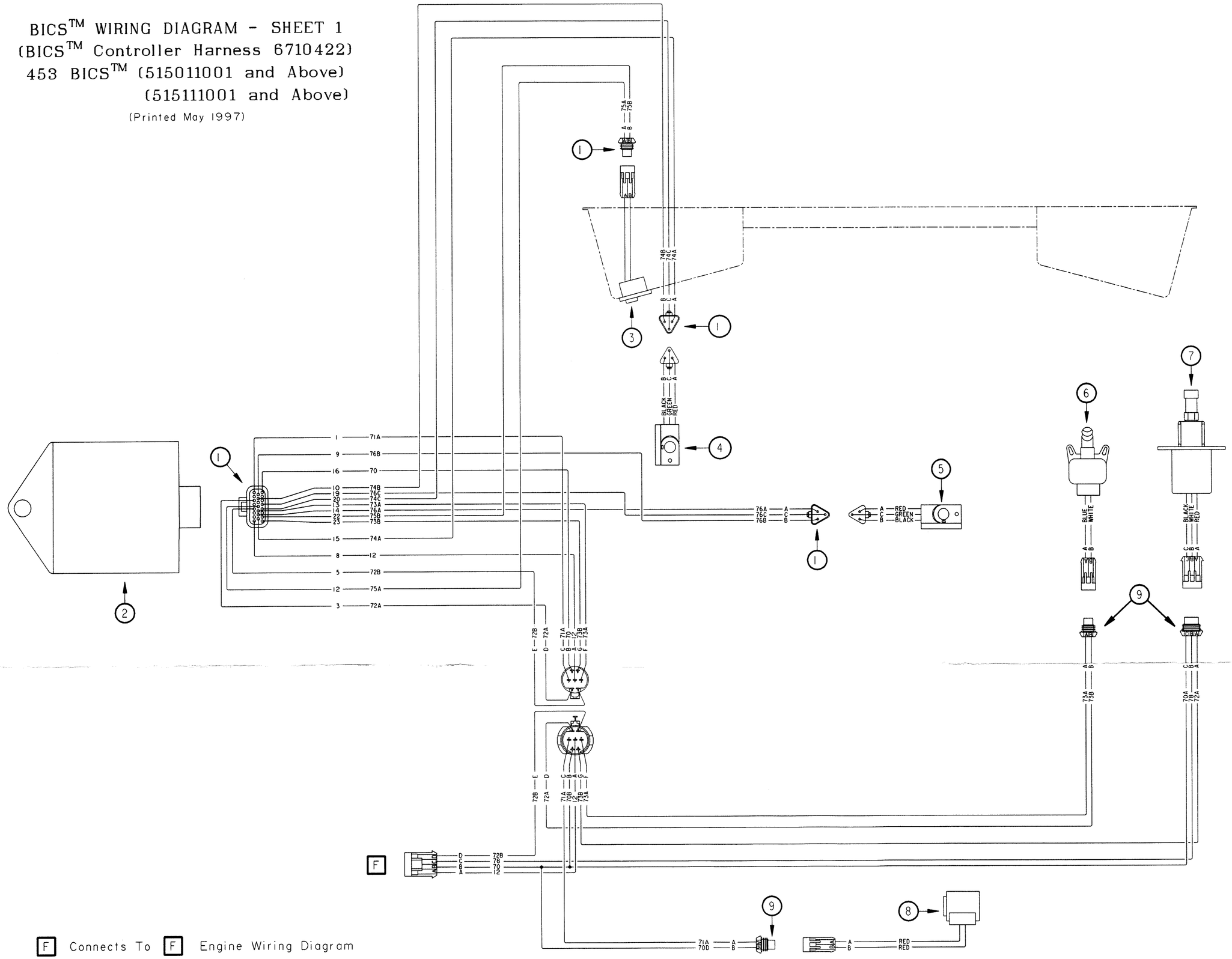
NO.'s	COLOR	GAUGE
12	Orange	16
70	Black (BICS Controller Harness)	16
70	Black (Mainframe Harness)	14
70A	Black	12
70B	Black	16
70D	Black	16
71A	Dk. Green	16
72A	Red	16
72B	Pink/White	16
73A	Dk. Blue	16
73B	White	16
74A	Lt. Blue/Red	16
74B	Lt. Blue/Black	16
74C	Lt. Blue/Green	16
75A	Dk. Blue/White	16
75B	Gray	16
76A	Yellow/Red	16
76B	Yellow/Black	16
76C	Yellow/Green	16
78	White	14

PARTS LEGEND

1. BICS Controller Harness
   6710422
2. BICS Controller
3. Traction Lock (Brake) Override Switch
4. Seatbar Sensor
5. Seat Sensor
6. Traction Lock (Manual Brake) Assembly Switch
7. Traction Lock (Brake) Solenoid
8. Combination Valve Solenoid
9. Mainframe Controller Harness
   6710423

BICS™ WIRING DIAGRAM - SHEET 1
(BICS™ Controller Harness 6710422)
453 BICS™ (515011001 and Above)
(515111001 and Above)

(Printed May 1997)



F Connects To F Engine Wiring Diagram

Printed in U.S.A.

MC 2343K (4-23-97)

453 BICS™
OPERATOR CONTROLS WIRING DIAGRAM INDEX

USE YOUR LOADER SERIAL NUMBER and OPTIONS
TO FIND THE CORRECT WIRING DIAGRAM SHEETS.

OPTION	LOADER S/N and COMMENTS	OPERATOR CONTROLS	CONNECTOR	SEE WIRING DIAGRAM SHEET NUMBER: ENGINE
ALL	515011001 and Above 515111001 and Above	**1**	B, C, D, E	1

HOW TO USE YOUR WIRING DIAGRAM INDEX:

OPTION (when listed): Which OPTION does your loader have?

LOADER S/N and COMMENTS Identify your loader's SERIAL NUMBER. COMMENTS (when listed) are items to identify the latest changes made within the range of S/N's listed.

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OPERATOR CONTROLS (Optional) WIRING DIAGRAM - SHEET 1
453 BICS™ (515011001 and Above)
(515111001 and Above)

(Printed May 1997)

PARTS LEGEND

① Left Multi-Switch Control
Handle (> Euro. Option)

② Horn Switch (453 Opt. and Euro. Standard)

③ Horn Harness (453 Opt. Only) 6709526

④ Horn Harness (> Euro. Standard) 6708506

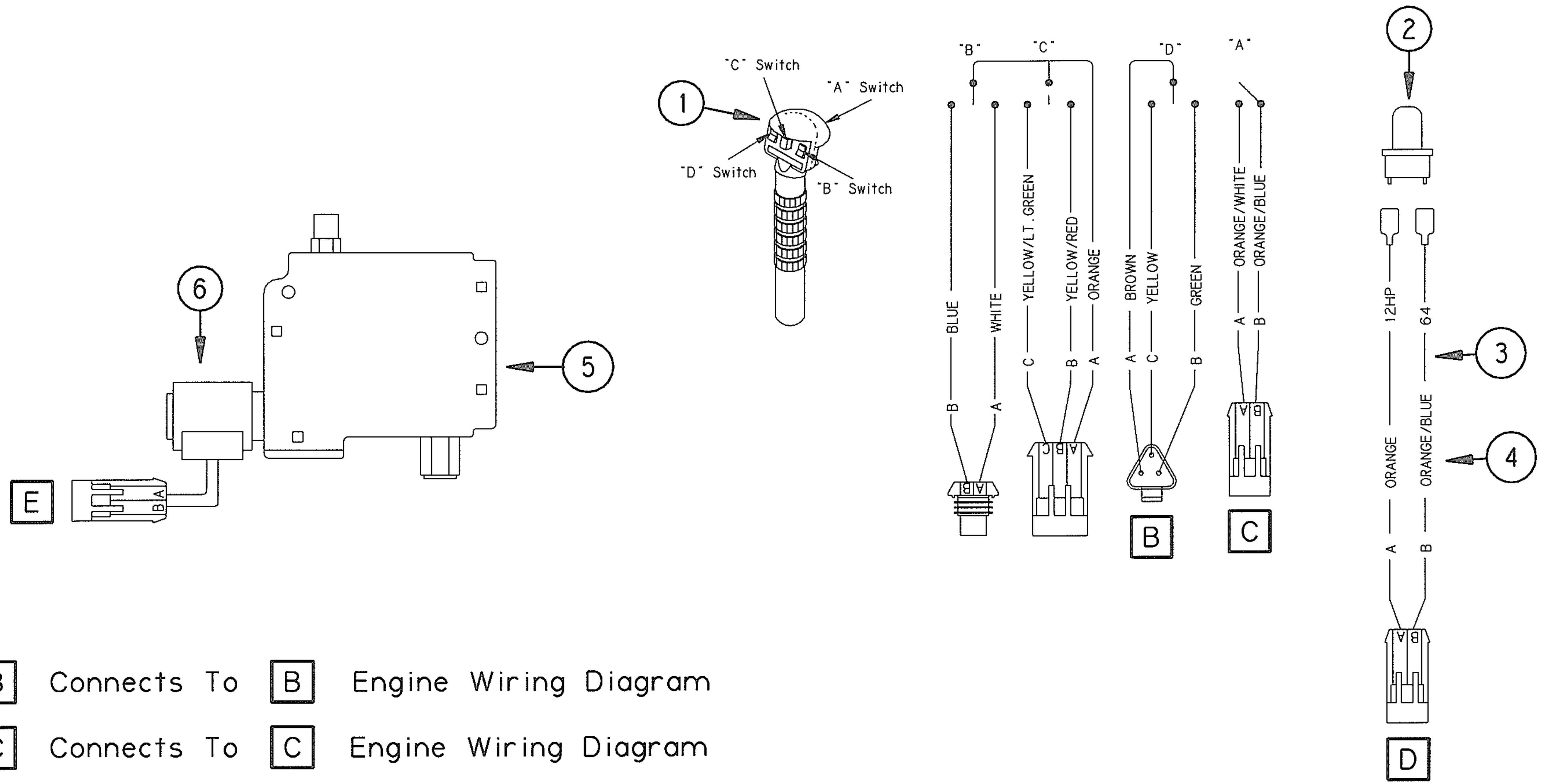
⑤ Bucket Positioning Valve
(453 Opt. ONLY)

⑥ Bucket Level Off Solenoid
(Opt.)

> NOT AVAILABLE DOMESTICALLY

OPERATOR CONTROLS (Optional) WIRING DIAGRAM - SHEET 1
453 BICS™ (515011001 and Above)
(515111001 and Above)

(Printed May 1997)



B Connects To B Engine Wiring Diagram

C Connects To C Engine Wiring Diagram

D Connects To D Engine Wiring Diagram

E Connects To E Engine Wiring Diagram

BATTERY

Removal and Installation

⚠ WARNING

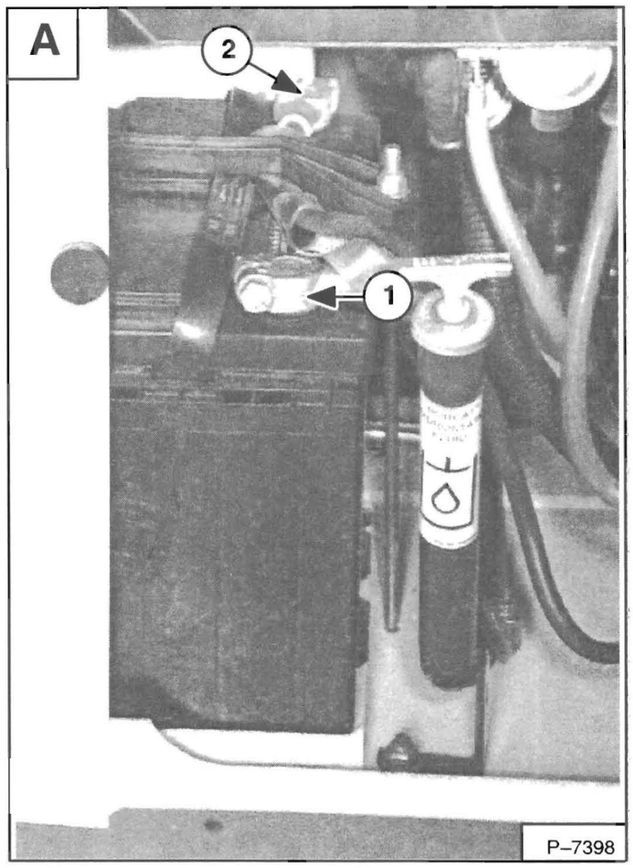
Batteries contain acid which burns eyes and skin on contact. Wear goggles, protective clothing and rubber gloves to keep acid off body.

In case of acid contact, wash immediately with water for several minutes and get medical attention in case of eye contact.

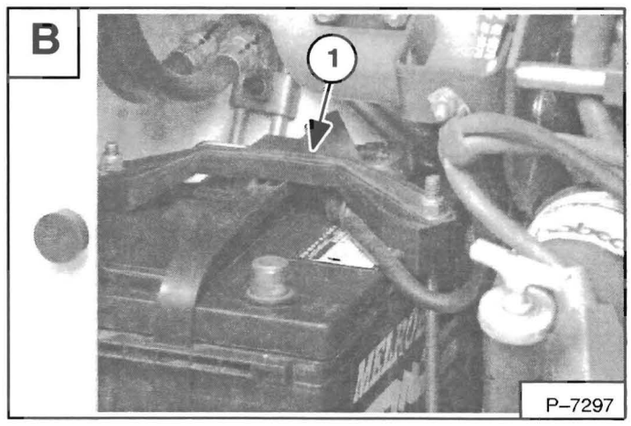
W–2065–1286

Open the rear door.

Disconnect both the negative(–) cable (Item 1) **[A]** and positive (+) cable (Item 2) **[A]** from the battery.



Remove the nuts from the battery holddown clamp (Item 1) **[B]**.



⚠ WARNING

Keep arcs, sparks, flames and lighted tobacco away from batteries. When "jumping" from booster battery make final connection (negative) at engine frame.

Do not jump start or charge a frozen battery. Warm battery to 60°F. (16°C.) before connecting to a charger. Unplug charger before connecting or disconnecting cables to battery.

Battery gas can explode and cause serious injury.

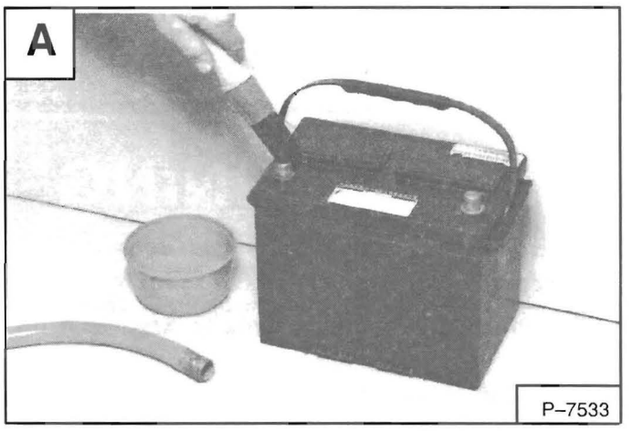
W–2066–0490

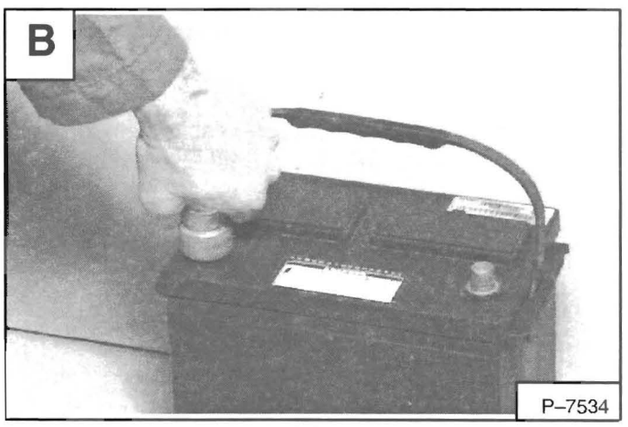
Use the reverse procedure to install the battery.

BATTERY (Cont'd)

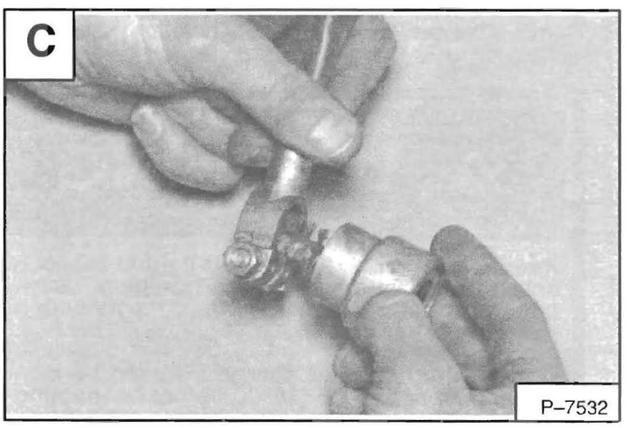
Maintenance

Always clean the terminals when installing a battery **[A]** & **[B]**.

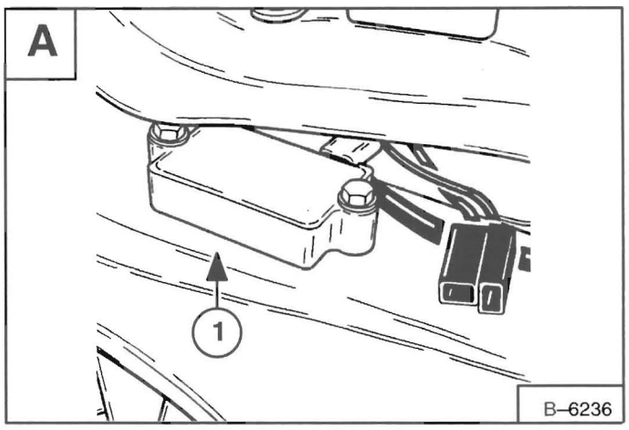




Clean the cable ends when installing a battery **[C]**.



ALTERNATOR (450)



This is a 15 amp. system and has a rectifier/regulator mounted on the blower housing (Item 1) **[A]**. There are no adjustments possible in this alternator system and field service is not recommended. All faulty parts must be replaced.

The 15 amp alternator circuit has three major components which are:

- Ceramic magnet permanently mounted in the inner ring of the flywheel.
- Alternator stator mounted on the crankcase.
- Rectifier/Regulator.

Checking the Alternator Circuit (450)

⚠ WARNING

Put jackstands under the front axles and rear corners of the frame before running the engine for service. Failure to use jackstands can allow the machine to fall or move and cause injury or death.

W–2017–0286

NOTE: Always zero the ohmmeter scale to be used before testing or you will not get a correct reading.

PROBLEM	TEST	CONCLUSION
BATTERY NOT CHARGING	(1) Connect ammeter to the B+ lead (Page 6–8 **[A]**. Check B+ (at terminal of rectifier/regulator) to ground with a DC voltmeter. Run engine at full RPM, no load.	If 13.8 bolts or higher, place a 5 amp. load on the battery. If charge rate increases, the alternator is OK. If charge rate does not increase, check for stator or rectifier/regulator defect. See TEST (2).
	(2) Disconnect both AC leads (Page 6–8 **[A]**) at the rectifier/regulator. Connect an AC voltmeter across the leads. Check AC voltage. Run engine at full RPM, no load.	If voltage is less than 28 volts, the stator has a defect. If the voltage is more than 28 volts, the rectifier/regulator is defective.
BATTERY CHARGING AT HIGH RATE	(1) Check B+ to ground with CD voltmeter. Run engine at full RPM, no load.	If less than 14.7 volts, alternator is OK. Battery can not hold charge. Check the battery. If more than 14.7 volts rectifier/regulator is defective.*

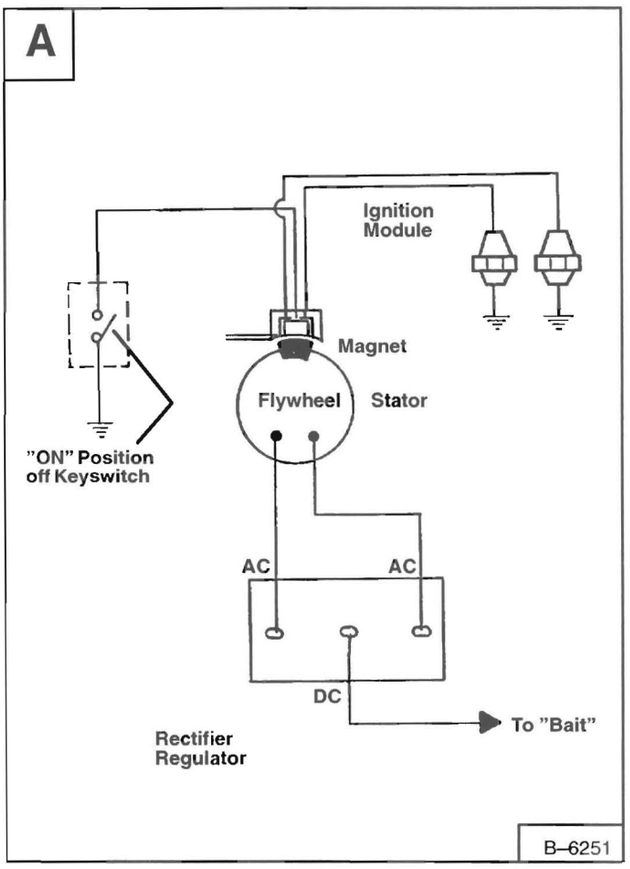
NOTE: *Faulty ignition switch or poor connections can cause increased resistance and the rectifier/regulator will not operate correctly.

ALTERNATOR (450)

Replacing the Stator

Remove the engine air shrouding from the flywheel. (See Page 7A–1 for the correct procedure.)

Remove the flywheel. (See Page 7A–1 for the correct procedure.)



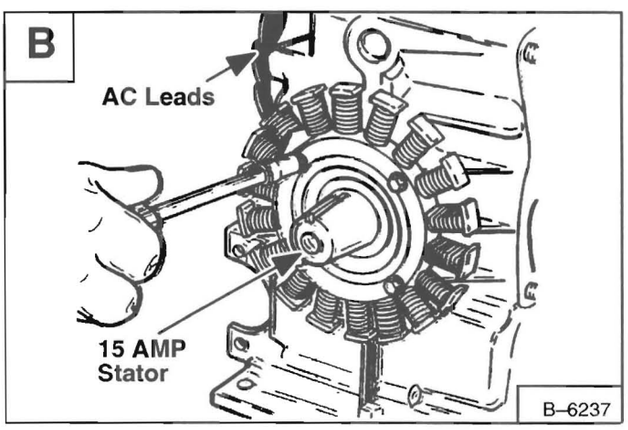
Remove the bolts that hold the stator to the crankcase **[B]**.

Install a new stator, rotate the stator on the crankcase until the clip that holds the leads together is between the eight and ten o'clock position.

Install the bolts and tighten.

Install the flywheel. (See Page 7A–1 for the correct procedure.)

Install the air shrouding. (See Page 7A–1 for the correct procedure.)



ALTERNATOR (453)

Removal and Installation

IMPORTANT

Damage to the alternator can occur if:

- **Engine is operated with battery cables disconnected.**
- **Battery cables are connected when using a fast charger or when welding on the loader (Remove both cables from the battery).**
- **Extra battery cables (booster cables) are connected wrong.**

I–2023–1285

Open the rear door. Disconnect the negative (–) battery cable.

Disconnect the red wire (Item 1) **[A]** from the alternator.

Disconnect the wiring harness connector (Item 2) **[A]**.

Loosen the adjustment bolts (Item 1) **[B]**

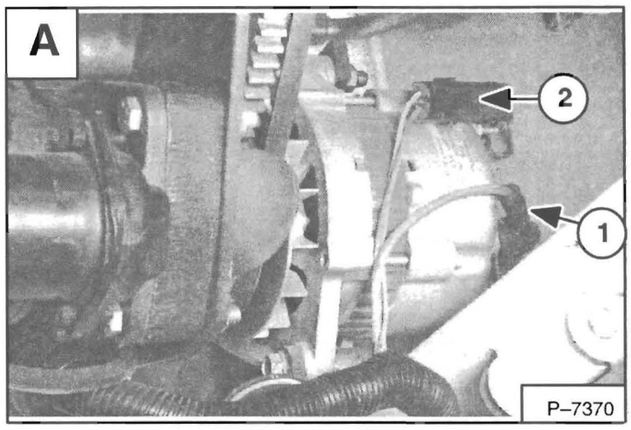
Remove the fuse holder bolt (Item 2) **[B]**.

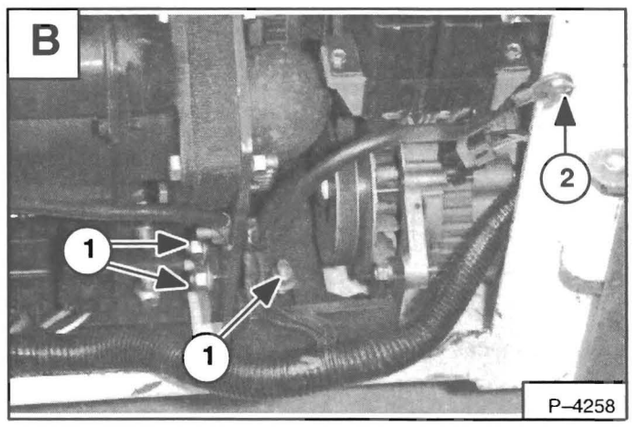
Remove the fuse holder.

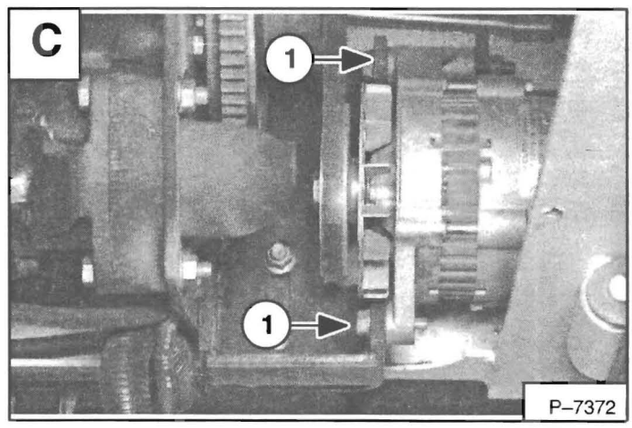
Remove the alternator mounting bolts (Item 1) **[C]**.

Remove the alternator belt.

Remove the alternator.





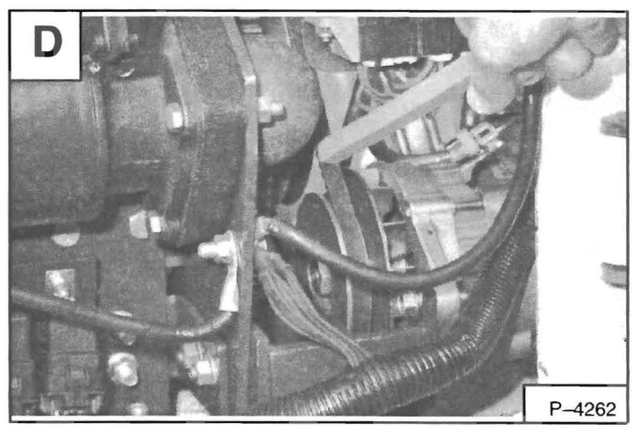


Adjusting the Alternator Belt

Stop the engine and open the rear door.

Loosen the adjustment bolts (Item 1) **[B]** and move the alternator bracket so there is 1/4" (6 mm) movement between pulleys with 15 pounds (67 N) of force **[D]**.

Tighten the three adjustment bolts.



ALTERNATOR (Cont'd)

Alternator Output Test

⚠ WARNING

Put jackstands under the front axles and rear corners of the frame before running the engine for service. Failure to use jackstands can allow the machine to fall or move and cause injury or death.

W–2017–0286

The alternator is removed from the loader and the connections shown for clarity purposes **[B]**.

Lift and block the loader. (See Page 1–1.)

Disconnect the negative (–) cable from the battery.

Disconnect the red wire (Item 1) **[A]** from the alternator. Connect that wire to the negative (–) side of the ammeter (Item 1) **[B]**.

Connect the positive (+) side of the ammeter to the output terminal on the alternator (Item 2) **[B]**.

Disconnect the fuel stop solenoid connector.

Connect the negative (–) cable to the battery.

Turn on the lights (if equipped) and crank the engine for 30 seconds to discharge the battery.

Connect the fuel stop solenoid, start the engine and run at 3000 RPM.

The ammeter reading should be between 37 amps. at 3000 RPM.

If the reading is low, remove the screws and pull the regulator cover away from the alternator.

Rectifier (Diode) Test

NOTE: The alternator is removed from the loader for clarity purposes.

Disconnect the negative (–) cable from the battery.

Install the wires in their original location on the back of the alternator.

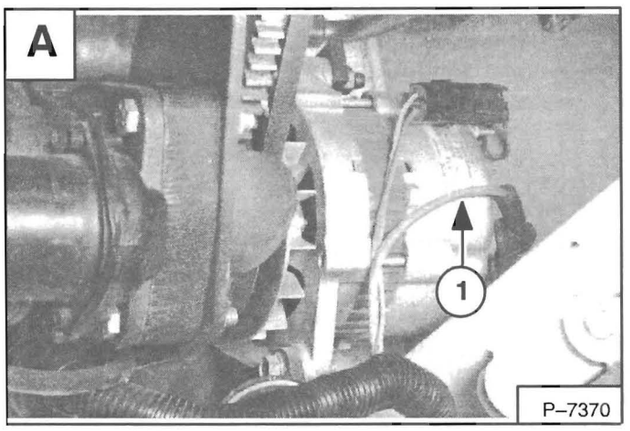
Connect a jumper wire (Item 1) **[C]** to the alternator output terminal and the regulator terminal.

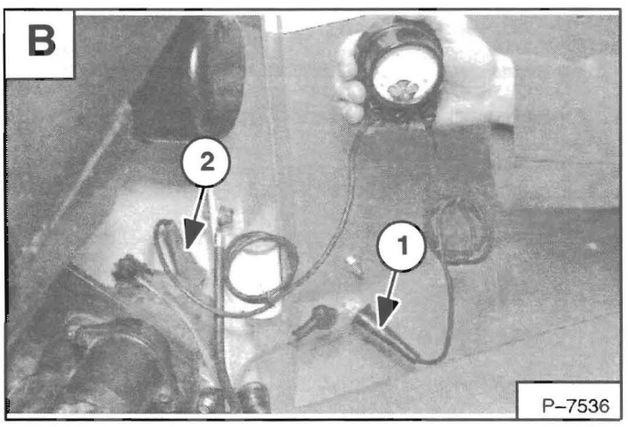
Connect the battery negative (–) cable.

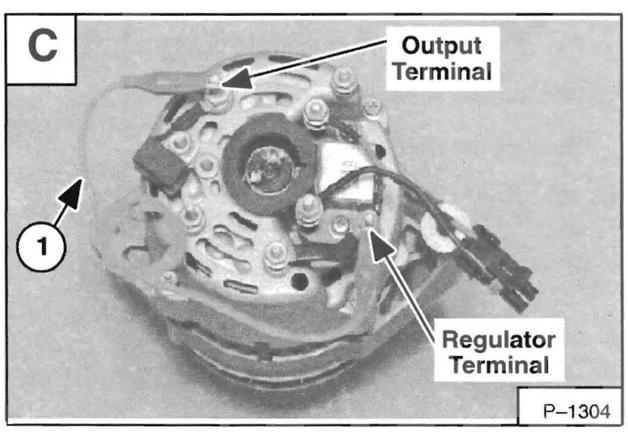
Start the engine and run at 3000 RPM.

If the reading is within 37 amps. at 3000 RPM replace the rectifier (diode) assembly or replace the alternator.

If the reading is low, do the Alternator Regulator Test.







Alternator Regulator Test

⚠ WARNING

When an engine is running in an enclosed area, fresh air must be added to avoid concentration of exhaust fumes. If the engine is stationary, vent the exhaust outside. Exhaust fumes contain odorless, invisible gases which can kill without warning.

W–2050–1285

Connect the positive (+) voltmeter lead to the positive (+) battery terminal (Item 1) **[A]**.

Connect the negative (–) voltmeter lead to the negative (–) battery terminal (Item 2) **[A]**.

Start the engine and run at 3000 RPM.

The voltmeter should read between 13.9–14.7 volts.

If the reading is low stop the engine and disconnect the battery negative (–) cable.

NOTE: The alternator is removed from the loader for clarity purposes.

Remove the wires from the back of the alternator.

Remove the regulator cover from the back of the alternator.

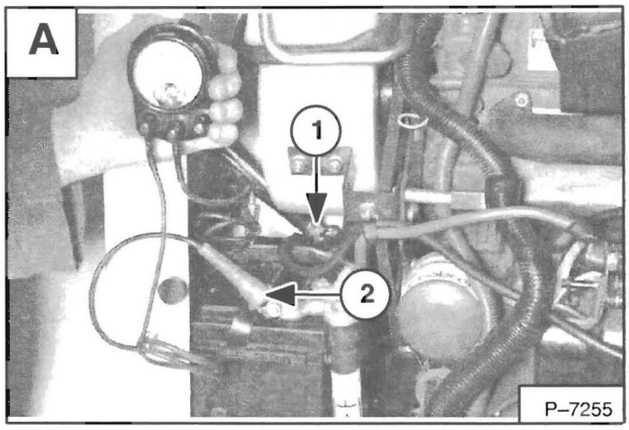
Install the wires on the back of the alternator.

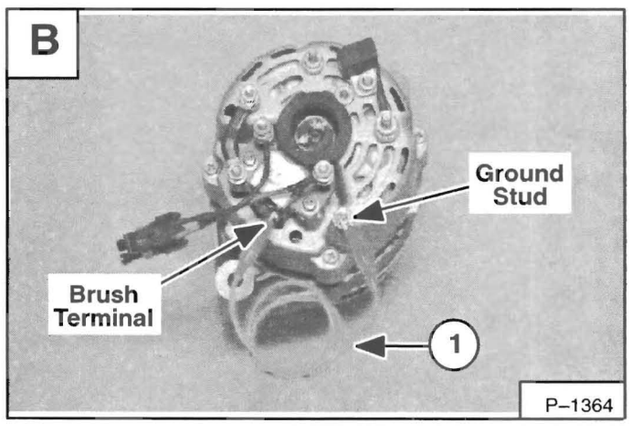
Connect a jumper wire (Item 1) **[B]** from the brush terminal to the ground stud.

Connect the negative (–) battery cable and start the engine. Run at 3000 RPM.

If the voltmeter reading is 14.7 or above replace the regulator.

If the voltmeter reading is below 13.9, repair or replace the alternator.





ALTERNATOR (Cont'd)

Disassembly and Inspection – Parts Identification

Disassemble the alternator. (See Parts Identification **[A]**.)

Remove the regulator cover and regulator.

Remove the four bolts holding halves together.

Pry the halves apart (use a press if needed).

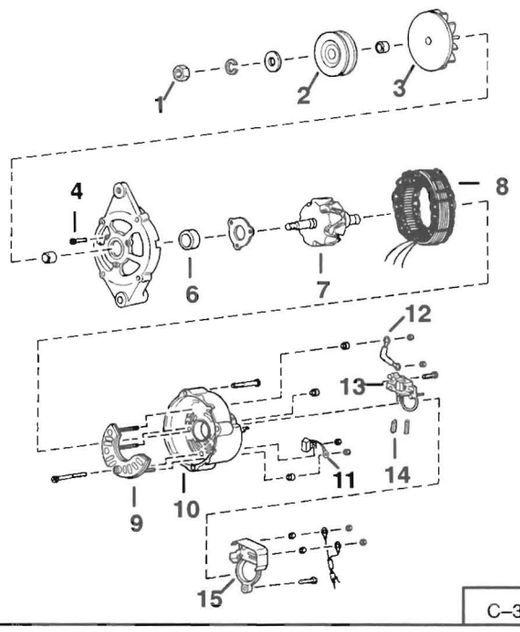
Use a soft jaw vise to hold rotor while removing pulley nut.

Remove front case half from the rotor using a plastic hammer or press.

Unsolder the stator leads from the rectifier. Remove the stator.

A

1. Nut
2. Pulley
3. Fan
4. Bolt
5. Case Half (Front)
6. Bearing
7. Rotor
8. Stator
9. Rectifier (Diode)
10. Case Half (Rear)
11. Condenser Assy.
12. Strap
13. Regulator
14. Brush
15. Cover



C–3312

Stator Continuity Test

Use an ohmmeter to test the stator.

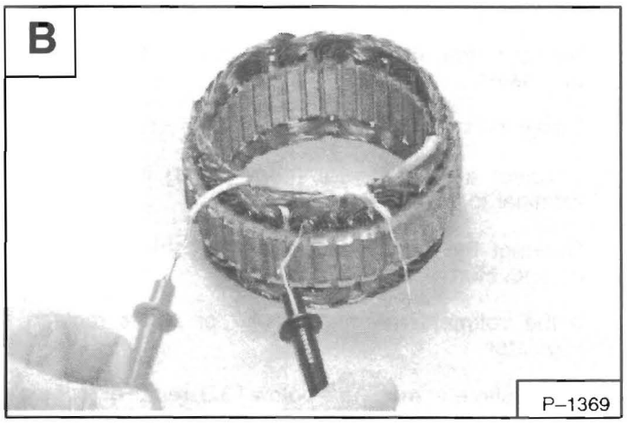
Touch the probes to two of the bare stator wires **[B]**.

Move one of the probes to the third wire.

The readings should be the same.

If there is no continuity, replace the stator.

B



P–1369

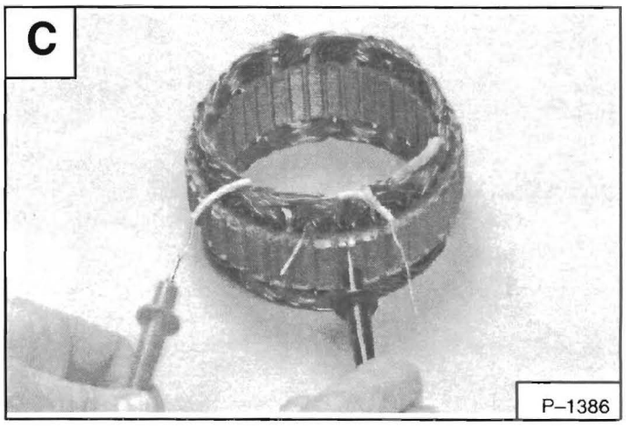
Stator Ground Test

Touch one probe to a bare stator lead and the other probe to the bare metal surface of the stator **[C]**.

There should be no continuity.

Replace the stator if there is continuity.

C



P–1386

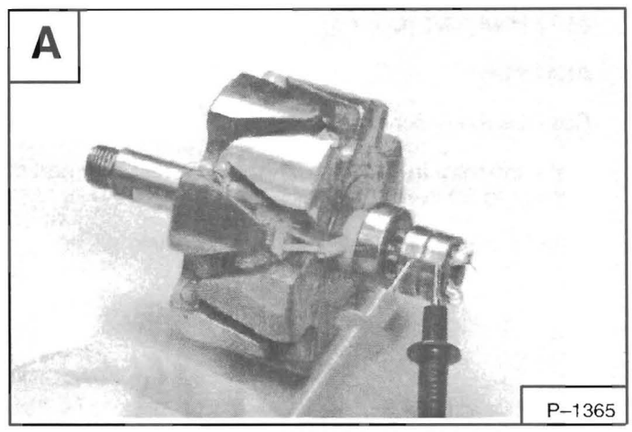
ALTERNATOR (Cont'd)

Rotor Continuity Test

Touch the probes to the slip rings **[A]**.

The ohmmeter should read between 3.065–33.85 ohms.

If there is no continuity replace the rotor.

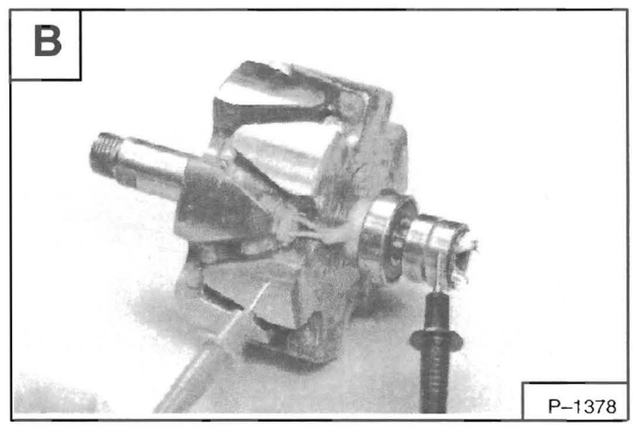


Rotor Ground Test

Touch one probe to one of the slip rings and the other probe to the rotor shaft **[B]**.

There should be no continuity.

Replace the rotor if there is continuity.



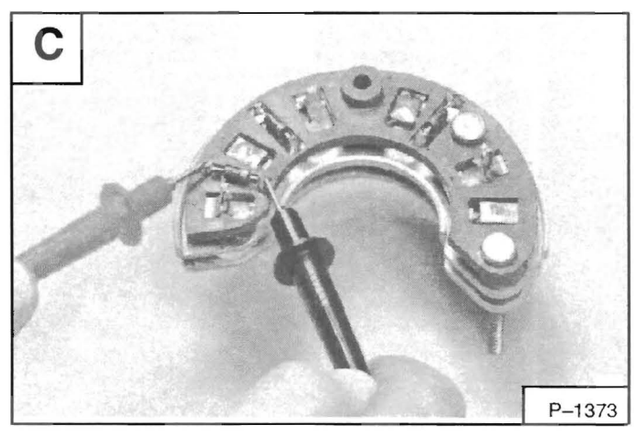
Rectifier Continuity (Diode) Test

NOTE: In the diode tests there should be continuity in one direction only. If the diode being tested shows no continuity or continuity in both directions, replace the rectifier assembly.

Touch the probes to the terminals of each diode and read the meter **[C]**.

Reverse the probes to check the diode in the other direction.

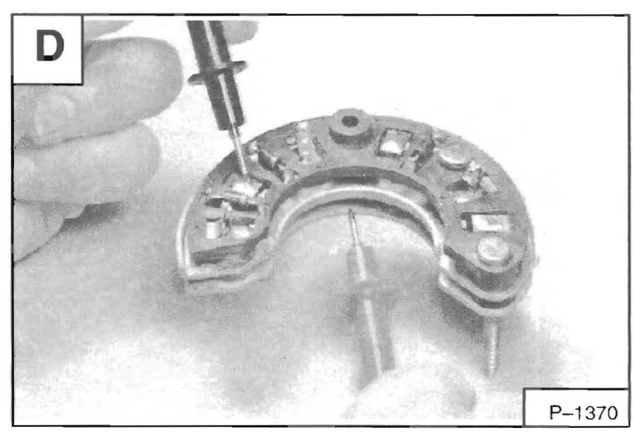
There should be continuity in one direction only.



Touch one probe to the diode and the other probe to the connected heatsink and read the meter **[D]**.

Reverse the probes to check the diode in the other direction.

There should be continuity in one direction only.



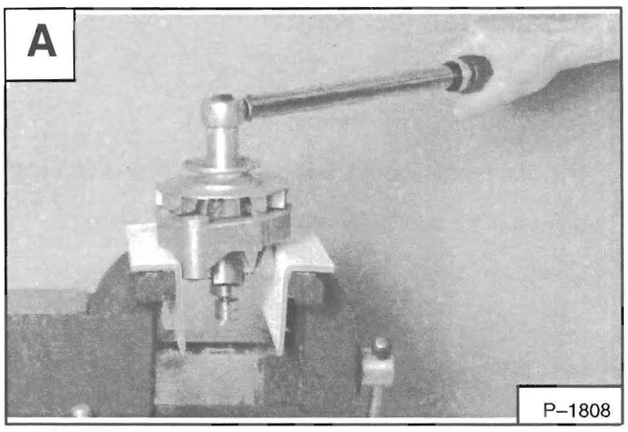
ALTERNATOR (Cont'd)

Assembly

Reverse the order of disassembly.

Place the rotor in soft jaws when tightening the shaft nut. Tighten to 50 ft.–lbs. (68 Nm) torque **[A]**.

Install the rear case half and the remaining parts.



STARTER (453)

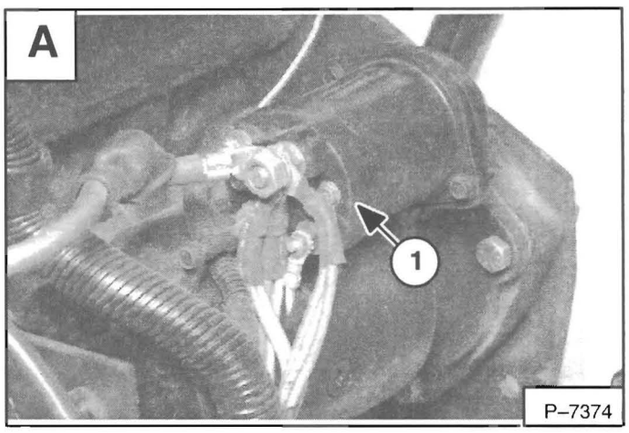
Removal and Installation

Stop the engine and open the rear door.

Disconnect the negative (–) and positive (+) cables from the battery.

Installation: Make note of the wiring connections on the starter solenoid to ensure correct installation.

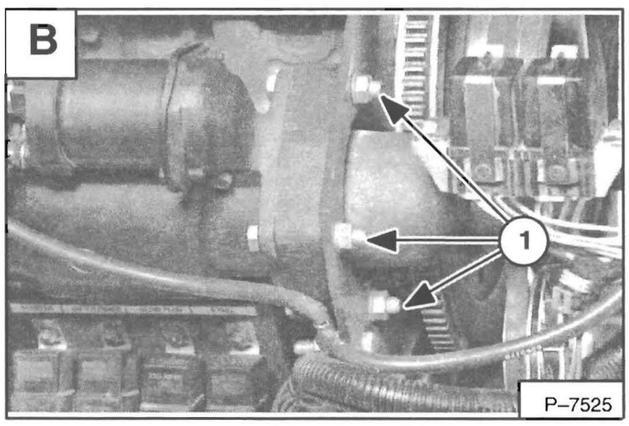
Disconnect the wiring from the starter solenoid (Item 1) **[A]**.



Remove the three (3) nuts (Item 1) **[B]** from the starter mounting bolts.

Installation: Tighten the starter mounting bolts to 25–28 ft.–lbs. (34–38 Nm) torque.

Remove the starter.



Checking the Starter

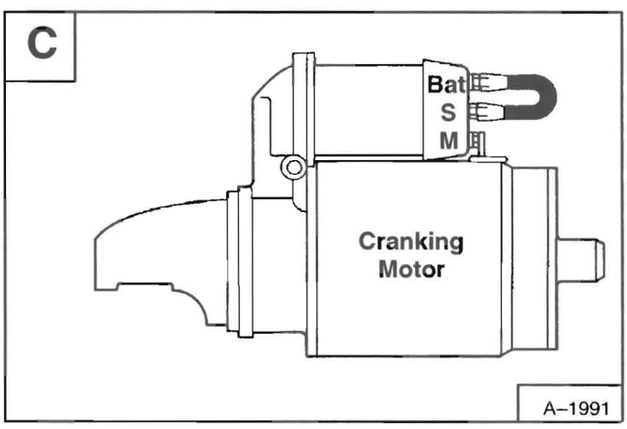
The key switch must be in the OFF position.

The battery must be at full charge.

The cable connections on the battery must be clean and tight.

Connect a jumper wire between S terminal and BAT terminal **[C]**.

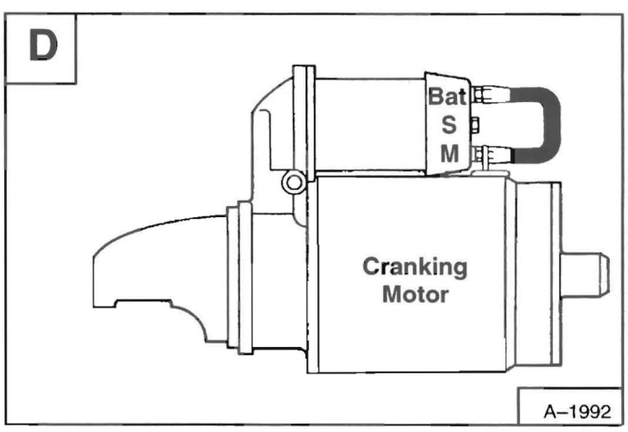
If the starter turns but does not turn the engine, the starter drive has a defect.



Connect a jumper wire between the M terminal and the BAT terminal **[D]**.

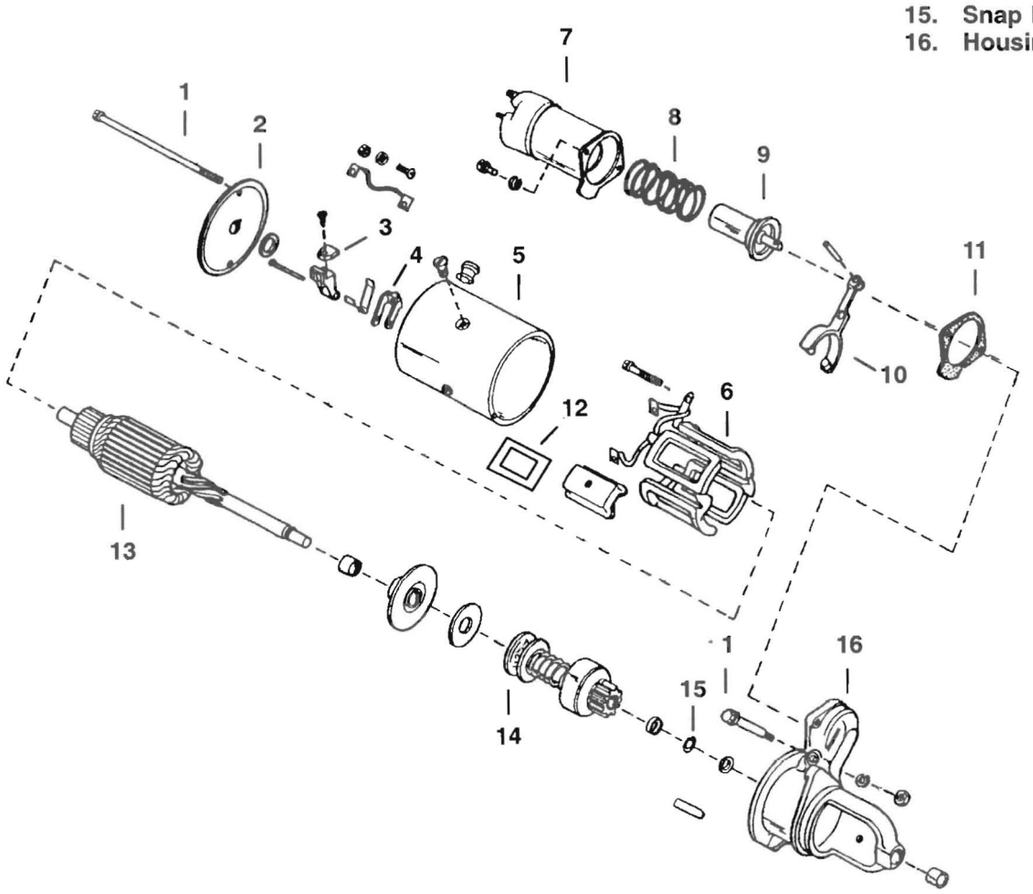
If the starter turns, the defect is in the solenoid.

If the starter does not turn, the starter is defective.



Parts Identification

1. Bolt
2. Frame
3. Brush
4. Holder
5. Field Housing
6. Field Coils
7. Solenoid
8. Spring
9. Plunger
10. Shift Lever
11. Gasket
12. Insulator
13. Armature
14. Drive
15. Snap Ring
16. Housing



D–1192

Disassembly, Assembly and Inspection

⚠ WARNING

Wear safety glasses to prevent eye injury when any of the following conditions exist:

- **When fluids are under pressure.**
- **Flying debris or loose material is present.**
- **Engine is running.**
- **Tools are being used.**

W–2019–1285

Use a brush and air pressure to clean the starter.

NOTE: DO NOT use solvent to clean the drive assembly. The solvent will remove the lubricant and the drive will slip.

Remove the two solenoid mounting bolts (Item 1) **[A]**.

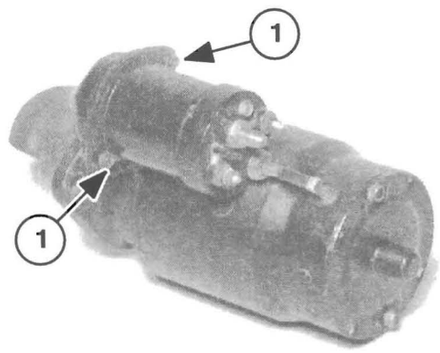
Turn the solenoid to remove the solenoid, spring and gasket from the mount **[B]**.

Remove the two bolts (Item 1) **[C]** and the nuts (Items 2 & 3) **[C]** to remove the solenoid cap.

NOTE: Remove the solenoid cap carefully so as not to lose any internal parts.

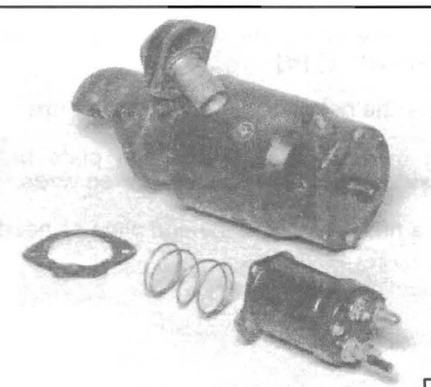
Check the condition of the disc (Item 1) **[D]** and bolt head (Item 2) **[D]**.

A



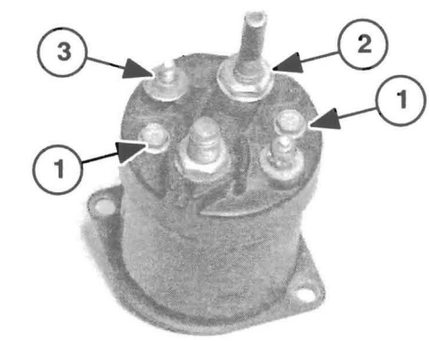
P–7460

B



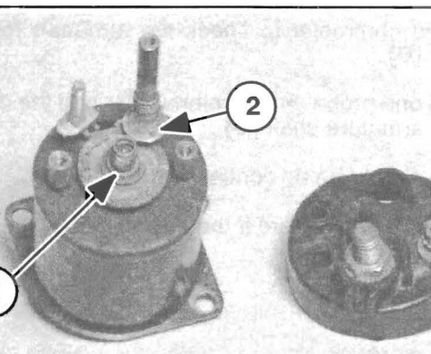
P–7461

C



P–7469

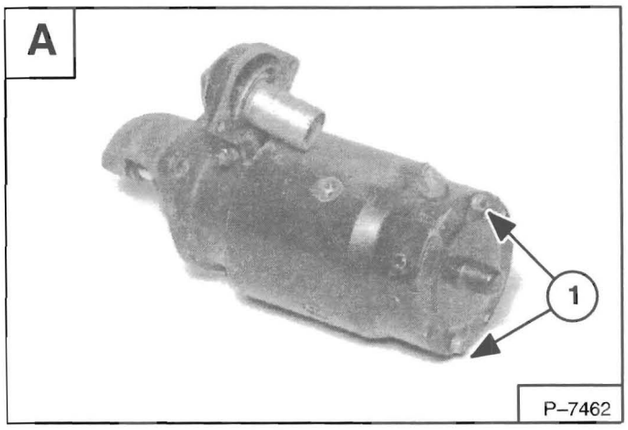
D



P–7468

Disassembly, Assembly and Inspection (Cont'd)

Remove the two bolts (Item 1) **[A]** from the starter end plate.

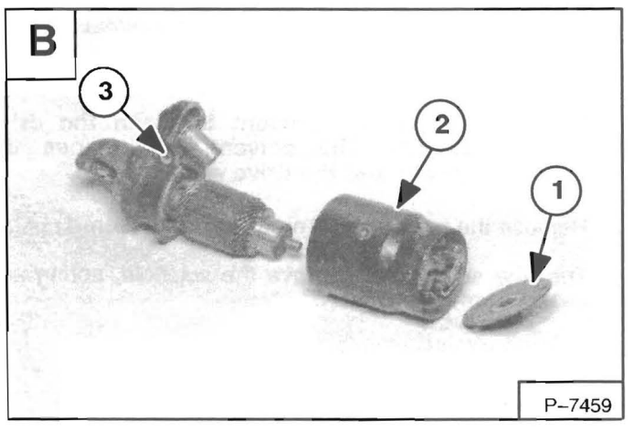


Remove the end plate (Item 1) **[B]** and the field coil housing (Item 2) **[B]**.

Remove the bolt (Item 3) **[B]** to remove the yoke.

Check the condition of the end plate bushing, the brushes, and the field coils for broken wires.

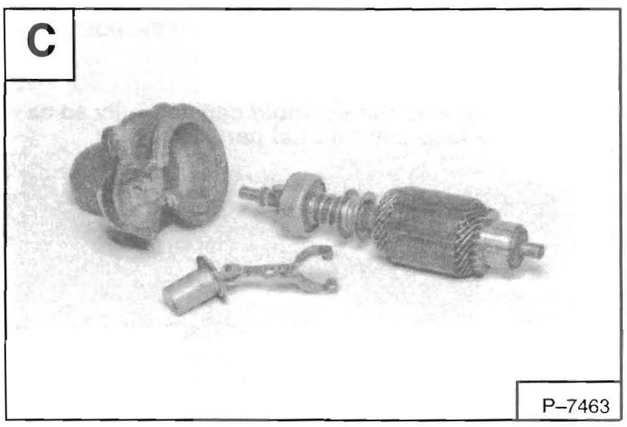
Install a new bushing in the end plate as needed.



Remove the shift lever and the armature assembly **[C]**.

Check the condition of the armature windings, the commutator, the bendix mechanism, and the shift lever.

Install a new bushing in the bendix cover if needed.



Use an ohmmeter to check the armature for an open circuit **[D]**.

Touch one probe on the commutator and the other probe to the armature shaft **[D]**.

There should be no continuity.

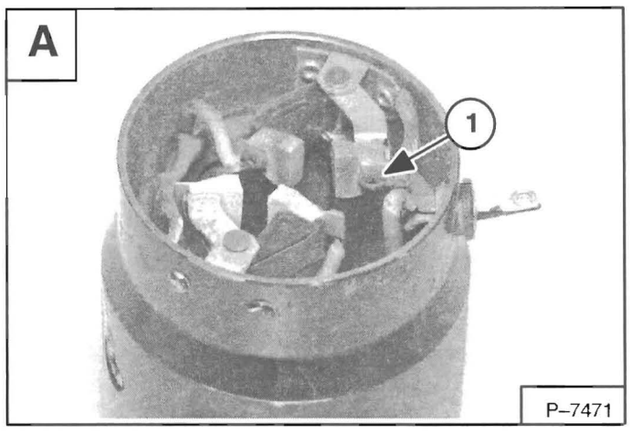
Replace the armature if there is continuity.



Disassembly, Assembly and Inspection (Cont'd)

Check the brushes for wear, broken wires, or worn parts.

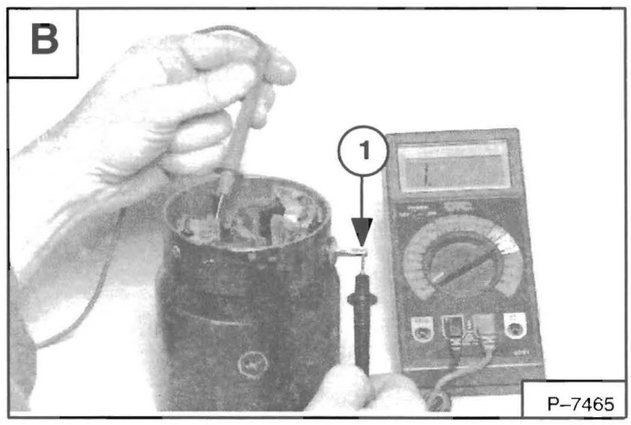
Remove the screw (Item 1) **[A]** to remove or replace the brushes.



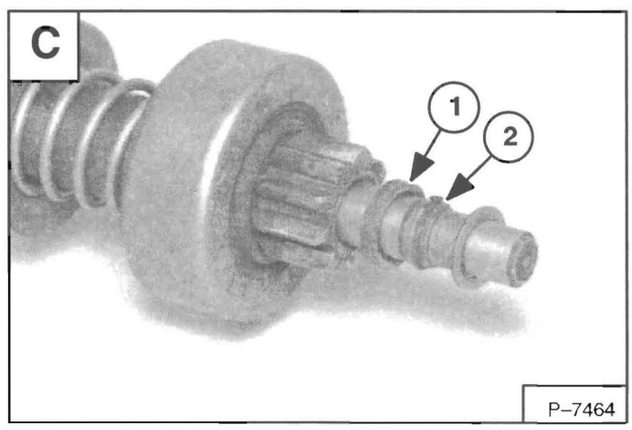
Use an ohmmeter to check the field coils for a grounded circuit **[B]**.

Touch one probe to the field coil prong (Item 1) **[B]** and one probe on the brushes.

There should be no continuity.

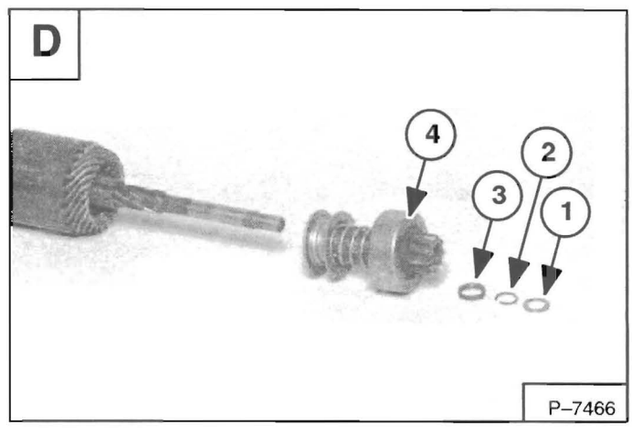


To remove the bendix, move the stop (Item 1) **[C]** toward the bendix. Remove the snap ring (Item 2) **[C]**.



Remove the washer (Item 1) **[D]**, the snap ring (Item 2) **[D]**, the stop (Item 3) **[D]** and the bendix (Item 4) **[D]**.

Assembly: Assemble the starter in the reverse order. Put a small amount of grease on the splines of the armature and bushings. Install the same amount of shims removed, to the drive end of the armature.



STARTER (450)

Checking the Starter

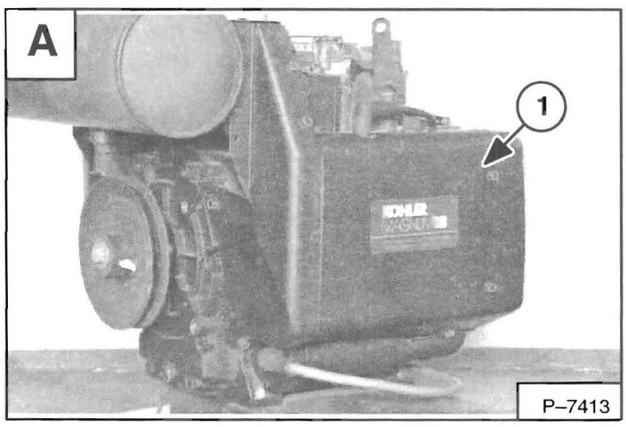
The following chart is problems which can most often occur during normal use. If the corrections do not solve the problem, repair or replace the starter.

PROBLEM	POSSIBLE FAULT	CORRECTION
STARTER DOES NOT TURN	Wiring	1. Clean corroded connections – tighten loose connections. 2. Replace wires in poor condition – frayed or broken insulation.
	Starter Switch or Solenoid	By–pass the switch or solenoid with a jumper wire – if starter cranks normally, replace either part.
	Battery	Check specific gravity of battery – if low, recharge or replace as needed.
STARTER TURNS SLOWLY	Battery	Check specific gravity of battery – it low, recharge ore replace as needed.
	Brushes	Check for excessively dirty or worn brushes and commutator. Clean or replace brushes if worn.

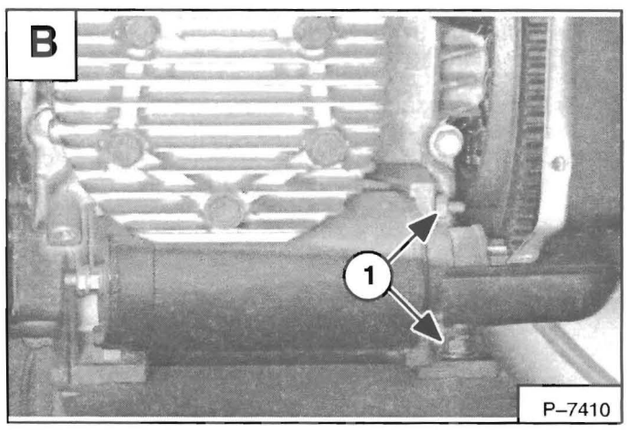
Removal and Installation

The engine must be removed from the loader to remove the starter. (See Page 7A–1.)

Remove the engine shield (Item 1) **[A]**.



Remove the two mounting bolts (Item 1) **[B]** to remove the starter.

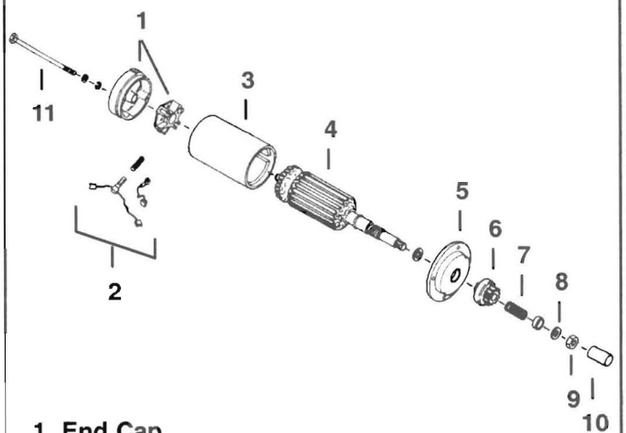


Disassembly, Assembly and Inspection

Mark the starter end caps for correct assembly.

Use the Parts Identification **[A]** for assistance during assembly.

A

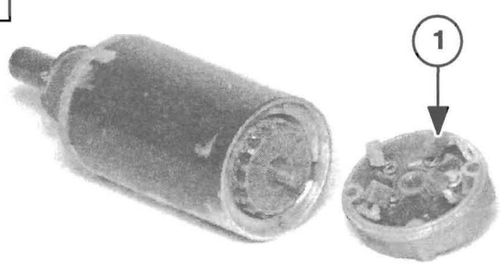


1. **End Cap**
2. **Brush Assy.**
3. **Frame**
4. **Armature**
5. **Drive End Cap**
6. **Drive Pinion**
7. **Anti–Drift Spring**
8. **Shield Retainer**
9. **Pinion Stop Nut**
10. **Dust Shield**
11. **Thru Bolts**

C–2039

Remove the brush cap mounting bolts and remove the brush cap (Item 1) **[B]**.

B

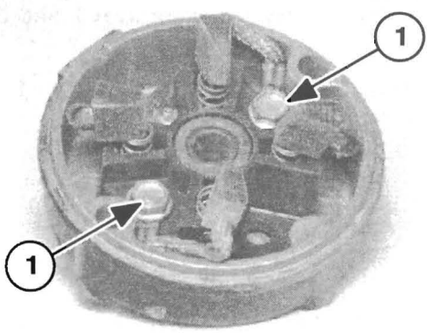


P–7444

Inspect the brushes for wear, check for broken wires, and check for broken springs.

Remove the bolts (Item 1) **[C]** to remove the brushes.

C



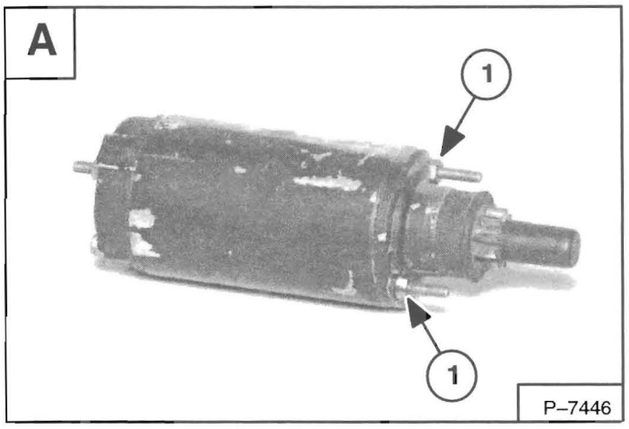
P–7474

STARTER (450) (Cont'd)

Disassembly, Assembly and Inspection (Cont'd)

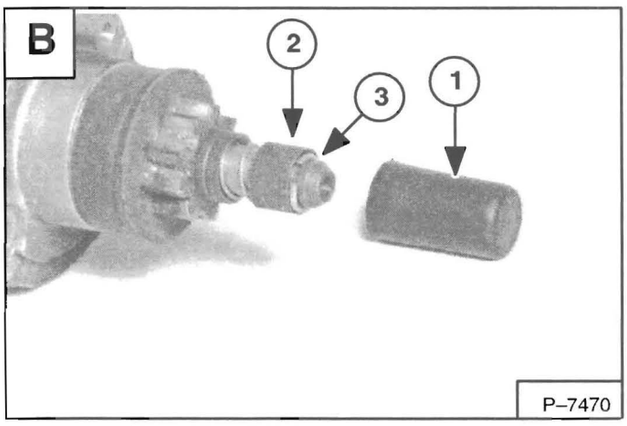
Remove the nuts (Item 1) **[A]** from the through bolts.

Remove the bolts.

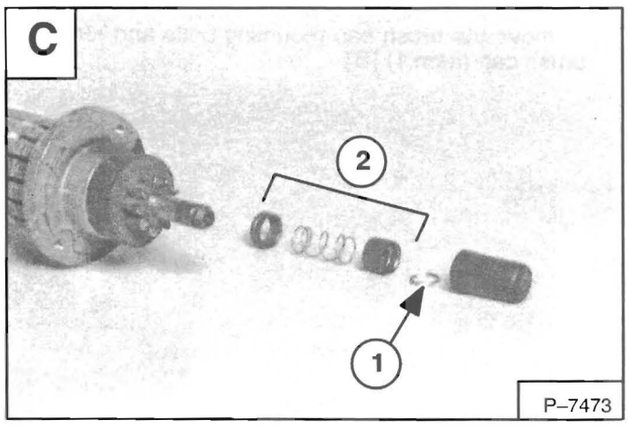


To remove the bendix, remove the cap (Item 1) **[B]**.

Move the stop (Item 2) **[B]** toward the bendix to remove the snap ring (Item 3) **[B]**.

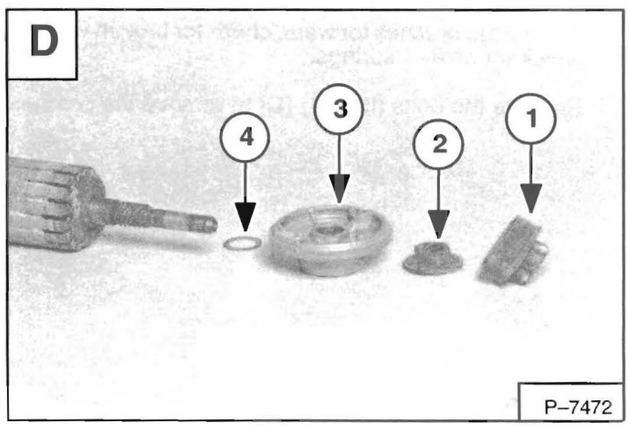


Remove the snap ring (Item 1) **[C]** and the stop assembly (Item 2) **[C]**.



Remove the bendix (Item 1) **[D]**, unscrew the nut (Item 2) **[D]**, remove the end cap (Item 3) **[D]**, and the washer (Item 4) **[D]**.

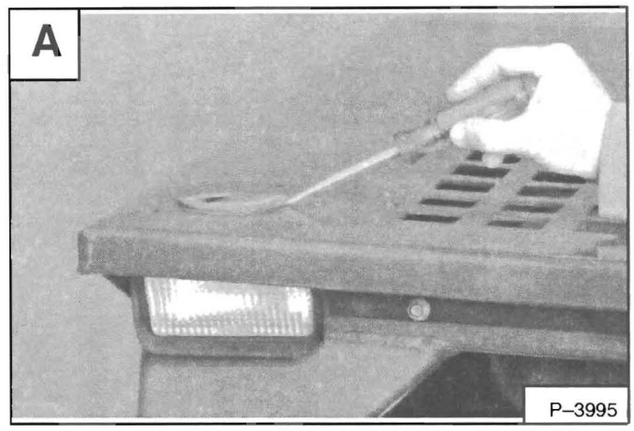
Assembly: Assemble the starter in the reverse procedure.



INSTRUMENT PANEL

Removal and Installation

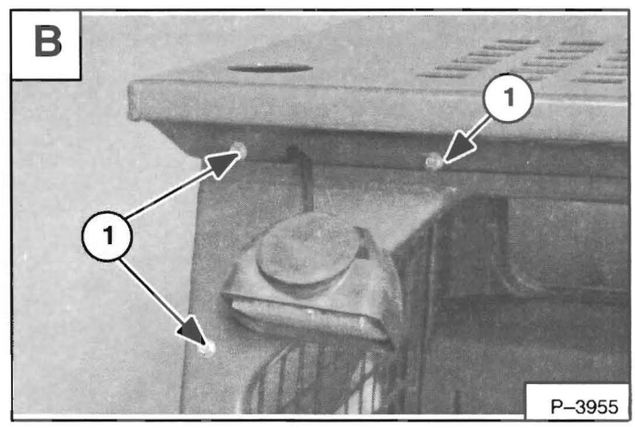
Pry the rubber light mount (optional) loose from the operator cab (both sides) **[A]**.



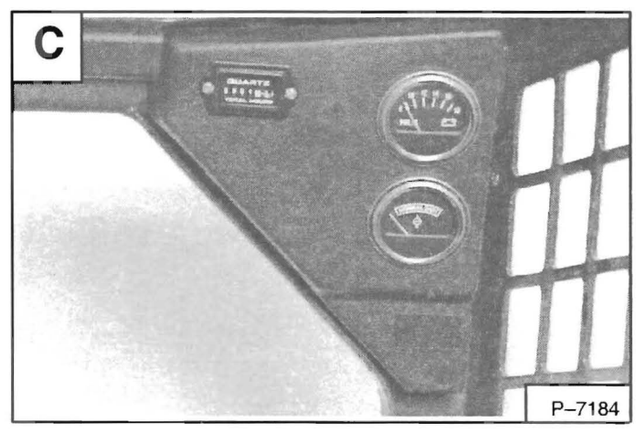
Lower the light (optional) from the operator cab and locate the (3) instrument panel mounting bolts (Item 1) **[B]** (both sides).

Remove the (3) mounting bolts (Item 1) **[B]**.

Installation: Be careful to not overtighten the instrument panel mounting bolts to prevent stripping of the threaded holes in the panels.

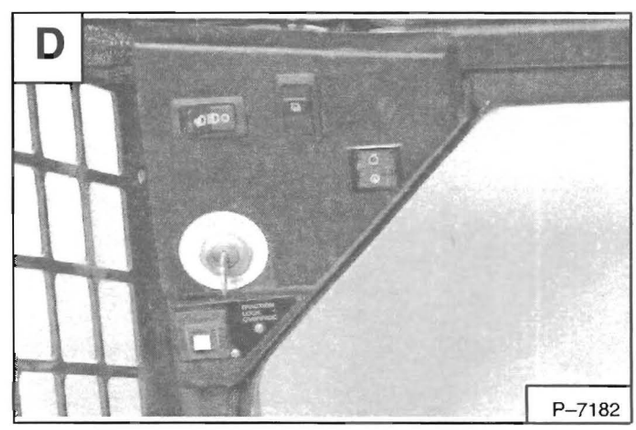


Pull the right instrument panel down and disconnect the wire harness connectors from the panel. Remove the panel **[C]**.



Repeat steps **[A]** and **[B]**. Pull the left instrument panel down and disconnect the wire harness connectors from the panel. Remove the panel **[D]**.

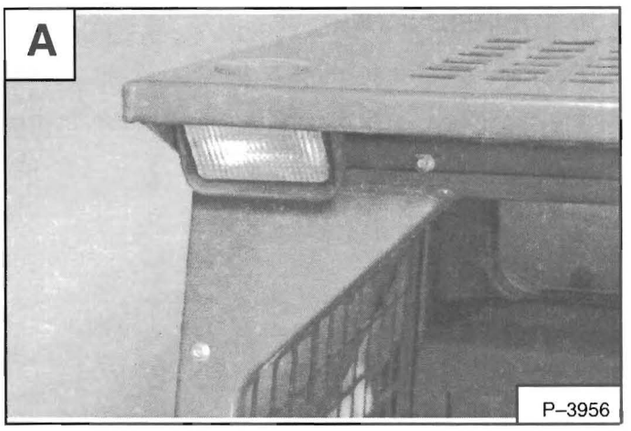
Reverse the removal procedure to install the instrument panel.



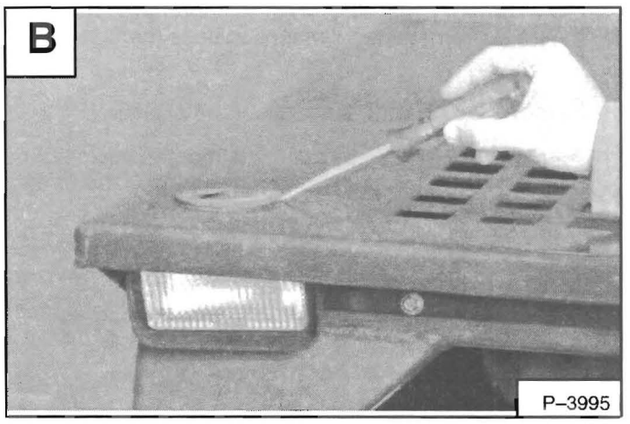
FRONT LIGHTS (OPTIONAL)

Removal and Installation

The front lights are mounted in the upper corners of the operator cab **[A]**.

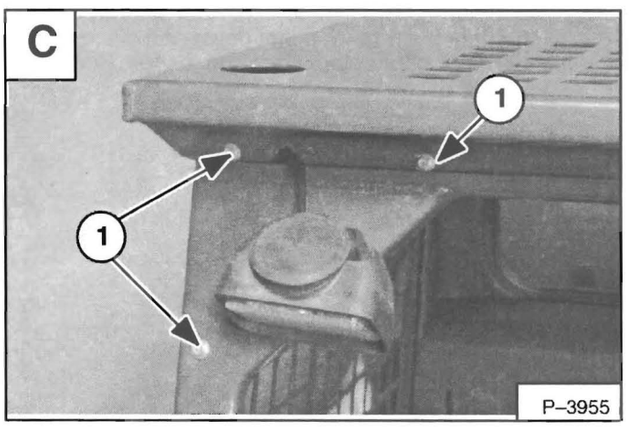


Pry the rubber light mount free from the operator cab **[B]**.

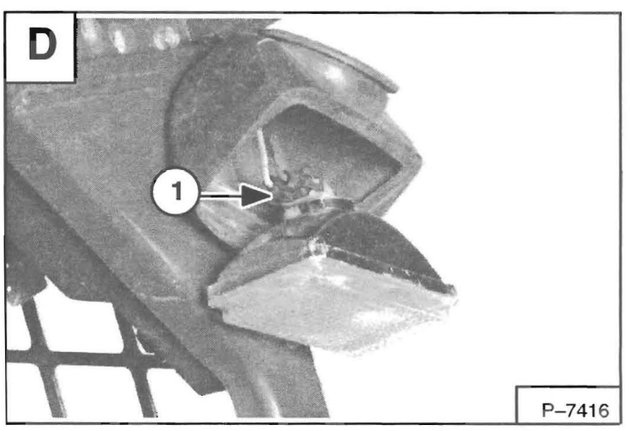


Pull the light down and remove the (3) mounting bolts (Item 1) **[C]** from the instrument panel.

Disconnect the front light connector from the instrument panel. Remove the front light from the operator cab.



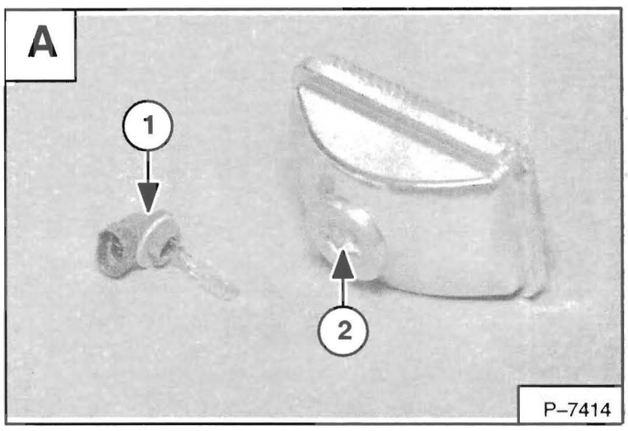
Disconnect the electrical connector (Item 1) **[D]** to remove the light from the rubber light mount.



FRONT LIGHT (OPTIONAL)

Removal and Installation (Cont'd)

Turn the bulb (Item 1) **[A]** and remove it from the cover (Item 2) **[A]**.



REAR LIGHT (OPTIONAL)

Removal and Installation

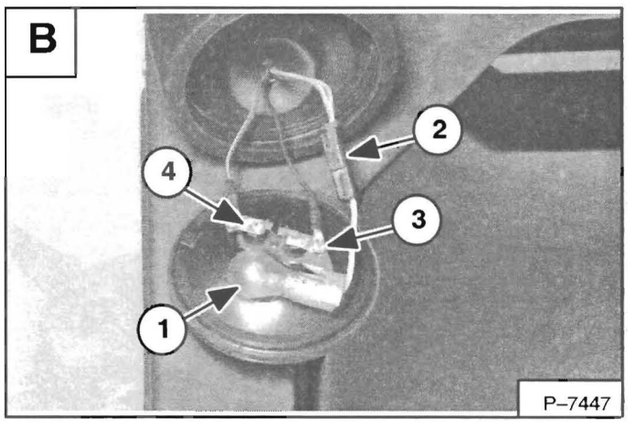
Remove the light from the rubber mount.

Push the work bulb (Item 1) **[B]** in and turn it counterclockwise to remove it from the socket.

Disconnect the electrical connector (Item 2) **[B]** from the cab harness.

Remove the screw (Item 3) **[B]** to remove the work light socket from the rear light.

Remove the screws (Items 3 & 4) **[B]** to remove the rear light




bobcat

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ENGINE SERVICE


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Chart

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

⚠ WARNING

Check for correct function after adjustments, repairs or service. Failure to make correct repairs or adjustments can cause injury or death.

W–2004–1285

PROBLEM	CAUSE
Slow cranking speed.	1, 2, 3, 4, 48, 49
Engine will not start.	5, 6, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 19, 27, 28, 29, 30, 48, 49
Difficult to start.	5, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 18, 19, 21, 26, 27, 28, 29, 30
No power from the engine.	7, 8, 9, 10, 11, 14, 16, 17, 18, 19, 20, 21, 22, 23, 24, 27, 28, 29, 30, 48, 49
Engine is mis–firing.	7, 8, 9, 10, 14, 16, 17, 22, 23, 25, 26, 27, 28, 29, 30
Too much fuel consumption.	7, 11, 14, 17, 20, 21, 22, 24, 25, 26, 27, 28, 29, 30
Black exhaust.	7, 11, 14, 16, 17, 19, 21, 22, 24, 25, 26, 29, 30
Low oil pressure.	4, 32, 33, 34, 35, 36, 38, 39, 40, 46
Engine knocking.	9, 16, 23, 25, 26, 28, 30,, 32, 41, 47
Engine running rough.	7, 8, 9, 10, 11, 14, 15, 17, 18, 20, 23, 25, 26, 27, 30, 41, 47
Vibration.	14, 15, 17, 20, 22, 23, 26, 27, 30, 41, 43
High oil pressure.	4, 34, 37
Overheating.	11, 16, 21, 41, 42
Too much crankcase pressure.	22, 28, 30, 31, 41 ,44
Poor compression.	16, 22, 25, 26, 28, 29, 30, 31
Start and stop.	8,10, 11, 12, 14, 18, 21

Chart (Cont'd)

DESCRIPTION OF THE CAUSE	
1. Battery capacity low.	25. Incorrect valve tappet adjustment.
2. Bad electrical connection.	26. Sticking valves.
3. Faulty starter motor.	27. Spark plug gap not correct.
4. Incorrect grade of oil.	28. Worn cylinder bores.
5. Low cranking speed.	29. Worn valves and seats.
6. Fuel tank empty.	30. Broken, worn or sticking piston rings.
7. Ignition system has damage.	31. Worn valve stems or guides.
8. Plugged fuel line.	32. Worn or damaged bearings.
9. Faulty fuel lift pump.	33. Not enough oil in the oil pan.
10. Plugged fuel filter.	34. Gauge is not correct.
11. Restriction in the air cleaner.	35. Oil pump is worn.
12. Wrong starting procedure.	36. Pressure relief valve is open.
13. Choke not completely closed.	37. Pressure relief is sticking closed.
14. Choke not completely opened.	38. Broken relief valve spring.
15. Carburetor is dirty or has a defect.	39. Faulty suction pipe.
16. Incorrect valve timing.	40. Plugged oil filter.
17. Poor compression.	41. Piston seizure.
18. Plugged fuel tank vent.	42. Damaged fan.
19. Dirt or water in the fuel.	43. Faulty engine mounting.
20. Sticking or restricted throttle.	44. Plugged breather pipe.
21. Exhaust pipe restriction.	45. Valve stem seals damaged.
22. Cylinder head gasket leaking.	46. Plugged oil pump pipe strainer.
23. Overheating.	47. Broken valve spring.
24. Governor adjustment not correct.	48 Auxiliary hydraulics engaged.
	49. Hydrostatic drive not in neutral.

IGNITION SYSTEM

The basic components of the battery ignition systems are the battery, ignition module, rectifier regulator, electric solenoid and spark plugs.

Spark Plugs

Use the following procedure to check the condition of the spark plugs:

Clean the area around the spark plugs.

Remove the spark plugs from the engine **[A]**.

Examine the spark plugs for deposits which could indicate the condition of the ring, valves, carburetor and ignition system.

The correct spark plug gap is 0.035 inches (0,89 mm). Bend the outside (grounded) electrode only **[B]**.

NOTE: For best engine performance, install new spark plugs in pairs.

Install the spark plugs and tighten to 10–15 ft.–lbs. (14–20 Nm) torque.

Ignition Module Air Gap

Remove Engine. (See Page 7A–16.)

Remove the engine shroud from the flywheel end to access the ignition module.

Remove the kill lead from the terminal (Item 1) **[C]** of the module.

Loosen the bolts (Item 2) **[C]** and pull the module away from the magnet.

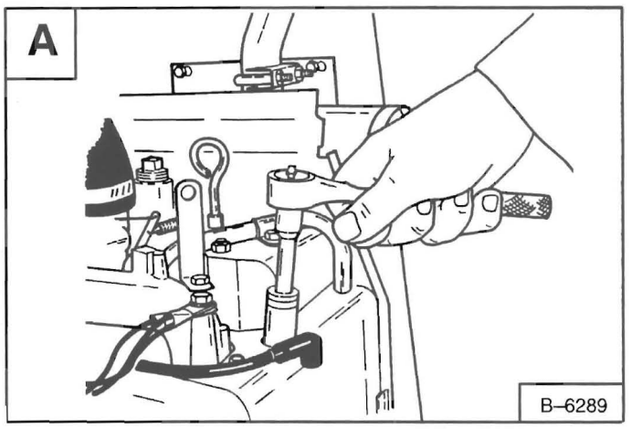
Install a 0.014 inch (90,35 mm) flat feeler gauge (Item 3) **[C]** between the magnet and the module. Release the module and let the magnet pull the module against the feeler gauge.

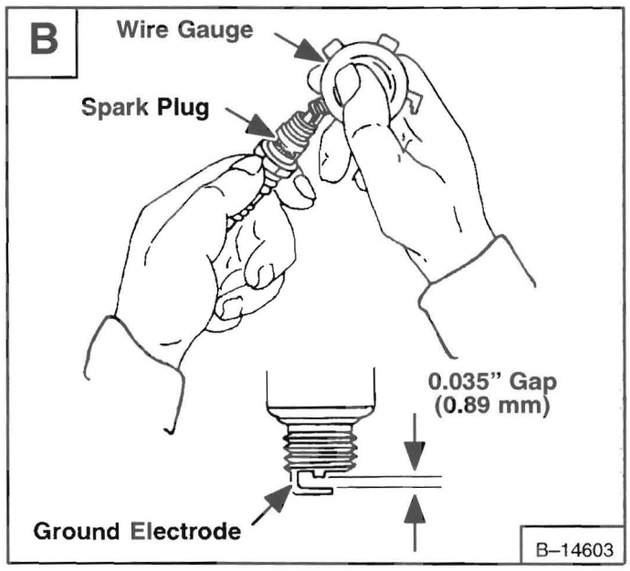
Tighten bolts.

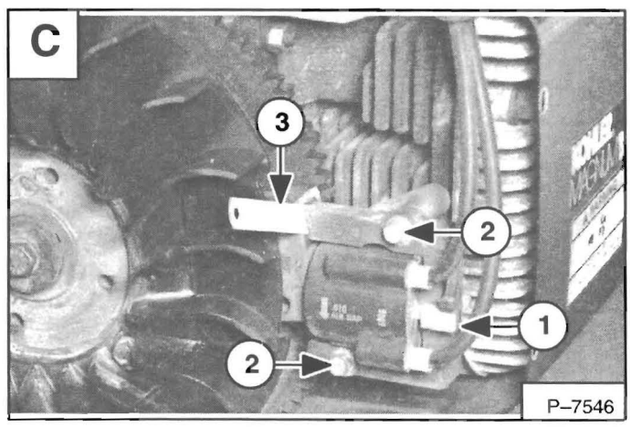
Due to the pull of the magnet, the bracket and hardware will flex slightly. The air gap should be within 0.008–0.012 inch (0,20–0,30 mm)

Rotate the flywheel back and forth to check the gap. Readjust if needed.

Install the kill lead to the terminal and install the engine shroud.







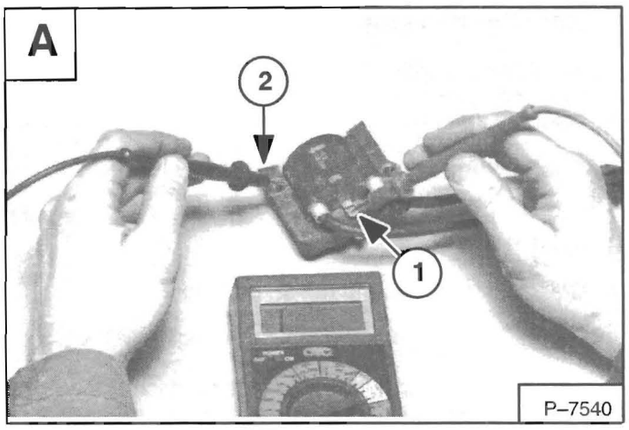
Testing Ignition Module Primary

Remove the spark plug wires, remove the ignition module bolts and remove the ignition module from the engine.

Use an ohmmeter to check the module primary for continuity.

Touch one probe to the kill lead (Item 1) **[A]** and one probe to the module body (Item 2) **[A]**.

There should be no continuity.

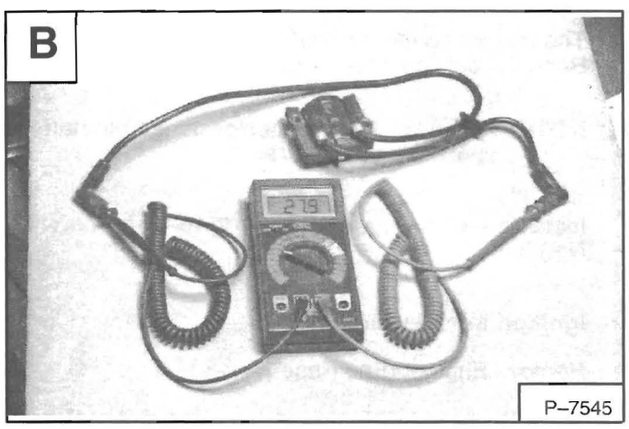


Testing Ignition Module Secondary.

With the spark plug wires connected to the module, install one probe in each spark plug boot **[B]**.

The ohms should be 22,000–42,000.

Replace the ignition module if either the primary or the secondary test doesn't meet the specifications.



Valve & Tappet Clearance

The following procedure will enable you to measure valve clearance without disassembly of the engine.

Remove the exhaust elbow from the #1 cylinder.

Remove the valve cover and breather assembly at #1 cylinder. Remove the valve cover from the #2 cylinder.

Remove the spark plugs.

Turn the flywheel backward and forward a small amount, look into the valve–tappet area. The valves which do not move can be checked for clearance.

Measure the valve–tappet clearance with a feeler gauge.

Intake Valve (Closest to Flywheel) ..... (Cold)
0.003–0.006 inch (0,08–0,16 mm)
Exhaust Valve (Closest to PTO) ..... (Cold)
0.011–0.014 inch (0,28–0,36 mm)

Rotate the flywheel 360°. Check the clearance at the other valves–tappets.

If the clearance is not enough, remove the valves and grind the ends until the clearance is correct.

NOTE: Use care when grinding the ends of the valves. Remove small amounts of material and recheck.

If there is excessive clearance, the valves must be replaced.

Compression Test

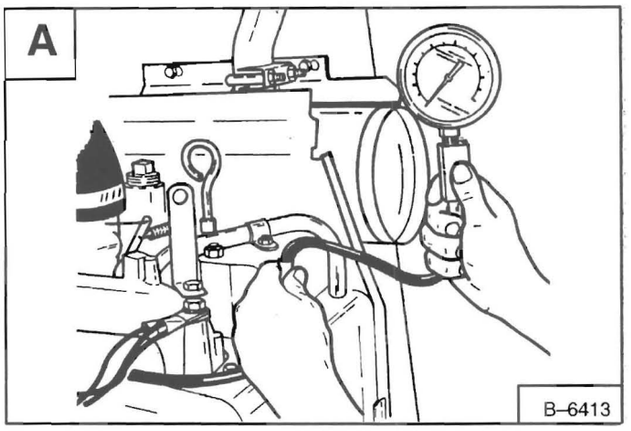
Make sure the engine is at operating temperature.

Remove both spark plugs.

Open the throttle and choke fully.

Install the compression gauge in the cylinder to be tested **[A]**

Turn the engine several times with the starter. The difference in pressure readings between the cylinders must not be in excess of 15% or below 90 PSI (621 kPa). See the chart for the problem if the compression is low.



CAUSE	CORRECTION
1. Cylinder head gasket leaking.	Remove the head, check for straight surface, replace gasket, install the head and check the compression again.
2. Cylinder head not straight or loose.	Remove the head, check for straight surface.
3. Piston rings worn – blowby occurring.	Recondition the engine.
4. Valves leaking.	Recondition the valves and the seats.
5. Excessive combustion deposits.	Remove the head, clean the combustion deposits from the combustion chamber.

CARBURETOR AND GOVERNOR

Carburetor Adjustment on the Engine

NOTE: Make the carburetor adjustments after the engine is at operating temperature.

Main Fuel Adjustment [A]

Stop the engine. Turn the adjustment screw (Item 1) **[A]** in until it bottoms.

Turn the adjustment screw out counterclockwise 2–1/2 turns.

Start the engine. Run at full RPM with no load.

Turn the screw (Item 1) **[A]** clockwise from the preliminary setting until the engine speed decreases. Make note of this position.

Turn the screw counterclockwise until the engine speed decreases (engine speed may first increase and then decrease again). Make note of this position.

Turn the fuel needle in. The engine speed will increase, then it will decrease as the needle is turned in (lean). Set the adjusting needle midway between the rich and lean setting **[B]**.

Idle Fuel Adjustment

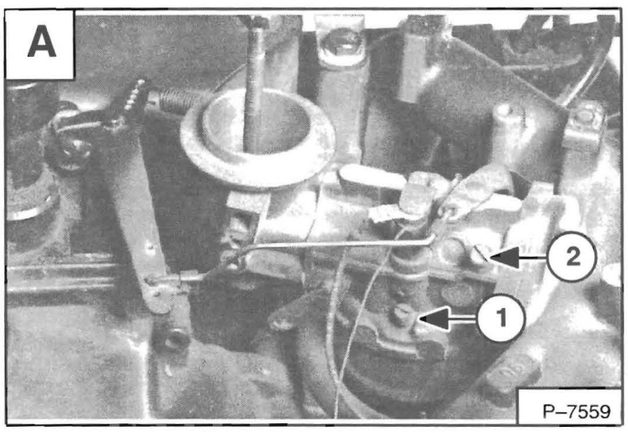
Stop the engine. Turn the adjustment screw (Item 2) **[A]** in until it bottoms.

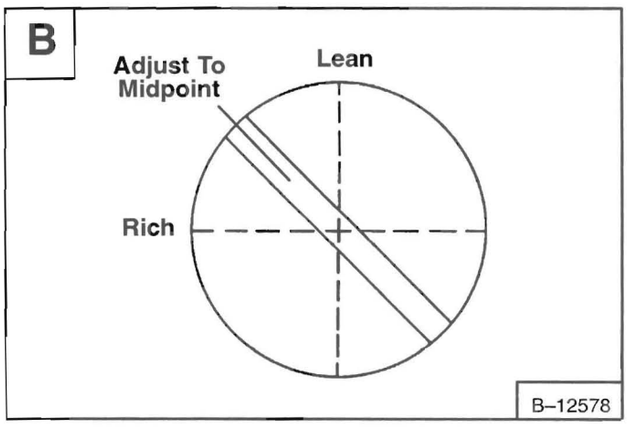
Turn the adjustment screw (Item 2) **[A]** counterclockwise 1 to 1–1/4 turns.

Start the engine. Run at full RPM with no load for 5–10 minutes.

Slow the engine to idle speed.

Use the same procedure for the idle fuel screw as the main fuel adjustment.



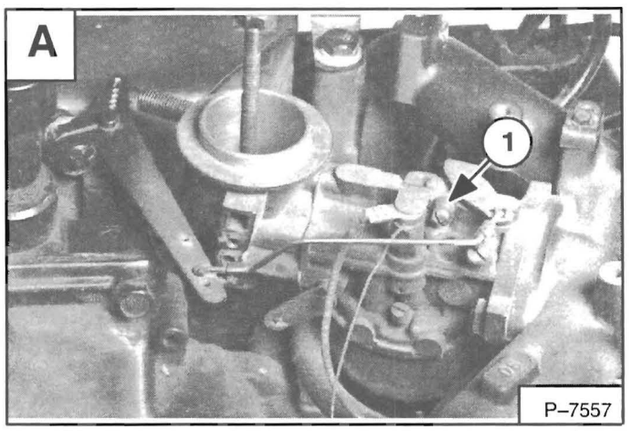


Idle Speed Setting

Run the engine at full governed RPM with no load for 5–10 minutes.

Put the engine speed control in the idle position.

Turn the speed screw (Item 1) **[A]** in or out so the engine will idle at 1200 RPM.



Shutdown Control Solenoid

The engine shutdown control solenoid prevents the engine from *running on* after the ignition switch is turned OFF.

Make sure the solenoid has a good electrical connection (Item 1) **[B]** and good contact with the holddown bracket (ground).

Remove the screw (Item 2) **[B]**.

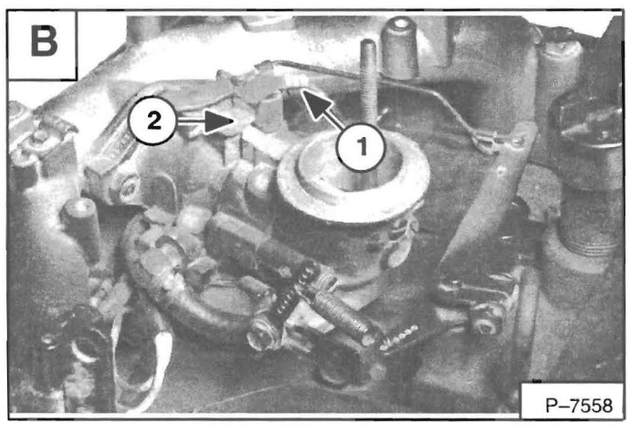
Remove the solenoid and plunger from the carburetor **[B]**.

Check the plunger for being stuck. Replace if damaged.

Check for a defect in the solenoid with an ohmmeter. Solenoid resistance is about 20 ohms.

Install the plunger and solenoid **[B]**.

Install the main fuel screw, make adjustment to the main fuel screw. (See Page 7A–10.)



Governor and Adjustment

⚠ WARNING

Never change the governor setting to exceed engine RPM given in the manual. Excess speed can cause explosive failure of engine parts which can cause injury

W–2080–1285

The governor is adjusted at the factory and further adjustment is not necessary.

NOTE: Mark the location of the linkage and spring for correct location during assembly.

The governor sensitivity can be adjusted by putting the spring end in different holes in the governor arm **[A]**. To make the governor more sensitive, increase the spring tension by moving the spring end closer to the center of the governor arm. To allow the governor to be less sensitive and more governor control, move the spring end closer to the end of the governor arm.

The speed adjustment is set at the stop tab (Item 5) **[A]**. Check the operating speed with a hand tachometer. The maximum allowable speed is 3200 RPM with no load. DO NOT EXCEED THIS RPM. If adjustment is necessary, loosen the speed adjusting screw (Item 8) **[A]** and turn the speed stop tab until the correct speed is set. Tighten the screw.

Always mark the position of the spring ends and governor linkage before any disassembly is done, so the governor linkage can be assembled correctly **[B]**.

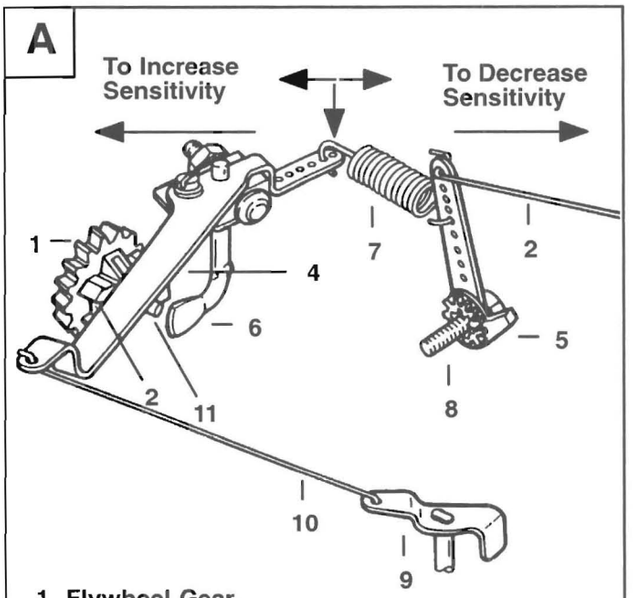
Disassembly and Assembly

Remove the fuel supply line.

Disconnect the governor linkage (Item 1) **[B]** and the spring (Item 2) **[B]** from the carburetor.

Remove the two mounting bolts (Item 3) **[B]** to remove the carburetor.

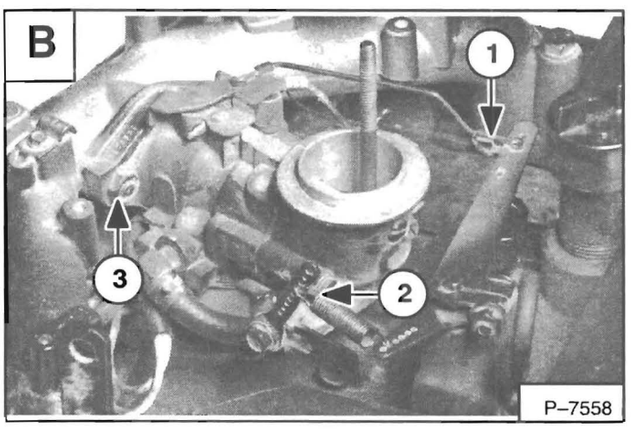
A



1. Flywheel Gear
2. Flyweight
3. Throttle Control Rod
4. Governor Arm
5. High Speed Stop Tab
6. Cross Shaft
7. Spring
8. Speed Adjusting Screw
9. Carburetor Control
10. Governor Linkage
11. Rod

B–2853

B



P–7558

Disassembly and Assembly (Cont'd)

Remove the bowl retaining screw, gasket and fuel bowl **[A]**,

Assembly: Tighten the bowl retaining screw to 45–55 in.–lbs. (5,1–6,2 Nm) torque.

Remove the bowl gasket, float pin, float and fuel inlet needle **[A]**,

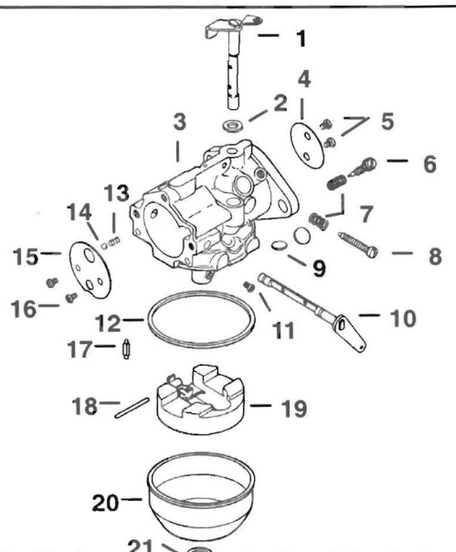
NOTE: Do not attempt to remove the fuel inlet seat. Replace the carburetor if the inlet seat is damaged.

Remove the idle fuel adjusting needle and spring. Remove the idle speed screw.

Remove the main fuel jet **[A]**.

Assembly: Tighten the main fuel jet to 12–16 in.–lbs. (1,4–1,8 Nm) torque.

A

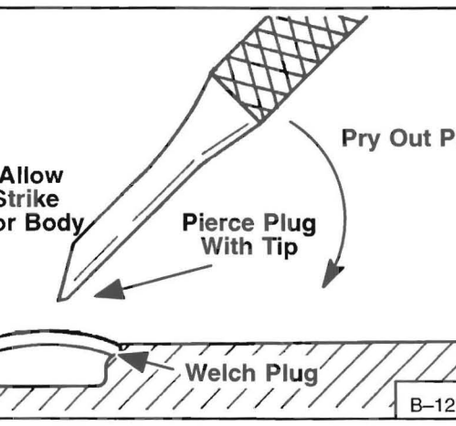


1. Throttle Shaft
2. Dust Seal
3. Carburetor Body
4. Throttle Plate
5. Screws
6. Idle Fuel Needle
7. Spring
8. Idle Speed Screw
9. Welch Plug
10. Choke Shaft
11. Fixed Main Jet
12. Bowl Gasket
13. Spring
14. Detent Ball
15. Choke Plate
16. Screw
17. Fuel Needle Inlet
18. Float Pin
19. Float
20. Fuel Bowl
21. Gasket
22. Fuel Bowl Screw

C–3104

To clean the *off–idle* ports and bowl vent channel, the welch plugs must be removed using a pointed tool **[B]**.

B

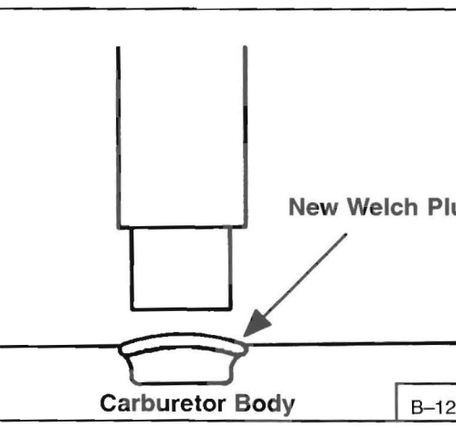


B–12579

Installation: Place the new welch plug into the hole with the raised portion up. Use the end of the tool that is about the same size as the plug and flatten the plug **[C]**

Do not force the plug below the top surface.

C



B–12585

Disassembly and Assembly (Cont'd)

Further disassembly to remove the throttle and choke shaft is recommended if these parts are to be replaced.

Throttle Shaft

The throttle plate edges are beveled. Mark the throttle plate and carburetor body to ensure correct assembly (Item 1) **[A]**.

Remove the screws (Item 2) **[A]**.

Remove the throttle plate.

File off any burrs from the throttle shaft before removing the throttle shaft from the carburetor body.

Installation: Install the foam dust seal on the throttle shaft. Install the shaft with the flat area toward the carburetor mounting flange.

Install the throttle plate.

Put LOCTITE #242, or equivalent, on the two screws. With your finger, push the throttle shaft into the carburetor body **[A]**.

Install the screws, rotate the shaft until the throttle plate is fully closed, then tighten the screws to 8–10 in.–lbs. (0,9–1,4 Nm) torque.

Check for free operation of the throttle plate.

Choke Shaft

Remove the three screws (Item 1) **[B]** to remove the air cleaner mounting flange.

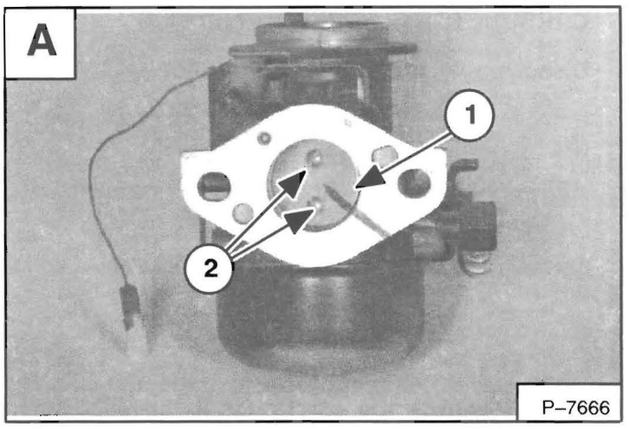
The choke plate edges are beveled. Mark the choke plate and carburetor body (Item 1) **[C]** to ensure correct assembly.

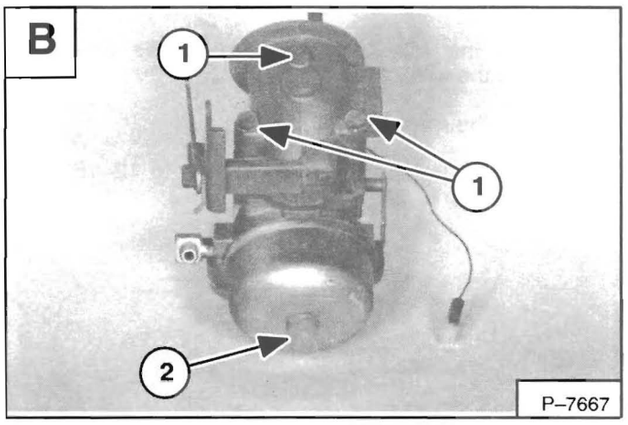
Remove the screws (Item 2) **[C]**.

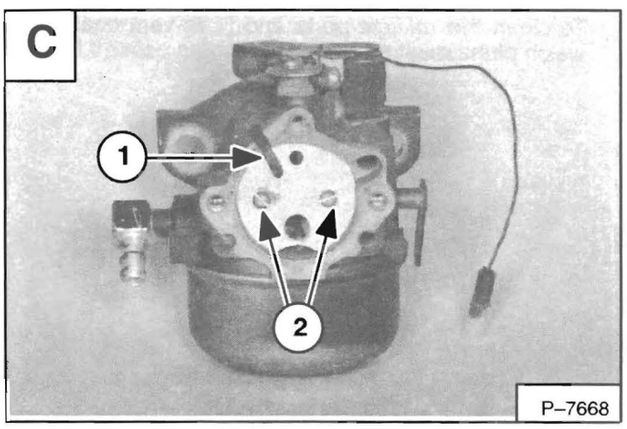
Remove the choke plate.

File off any burrs from the choke shaft before removing the choke shaft from the carburetor body.

Put the carburetor on the work bench with the choke side down. Remove the choke shaft. The detent ball and spring will drop out.







Disassembly and Assembly (Cont'd)

Choke Shaft (Cont'd)

Installation: Install the detent spring and ball (Item 1) **[A]**. Push down on the ball while pushing the choke shaft into the carburetor. Turn the choke shaft so that the flat area is toward the air inlet.

Install the choke plate.

Put LOCTITE #242 on the screws. Install the screws, rotate the shaft until the choke plate is fully closed, then tighten the screws to 8–12 in.–lbs. (0,9–1,4 Nm) torque.

Check for free operation of the choke plate.

Float Level

Remove the bolt (Item 2) **[C]** (page 7A–13) to remove the bowl from the carburetor.

Turn the carburetor so that the float is up and the float tab rests on the fuel inlet needle **[B]**. The float should be parallel with the bowl gasket surface.

The free end of the float should be 0.690–0.720 inch (17,5–18,3 mm) from the bowl gasket surface **[B]**.

Bend tab to adjust (Item 1) **[B]**.

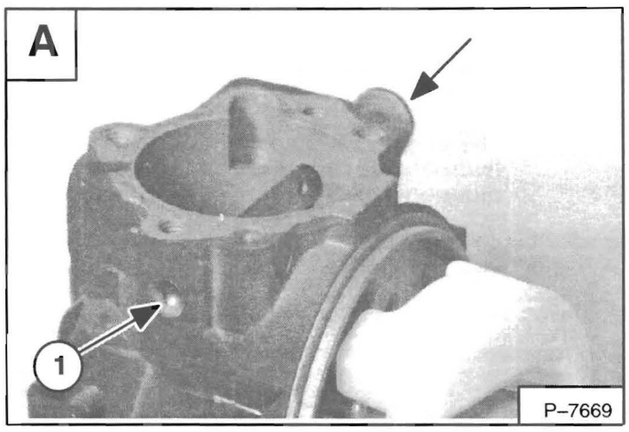
Install bowl.

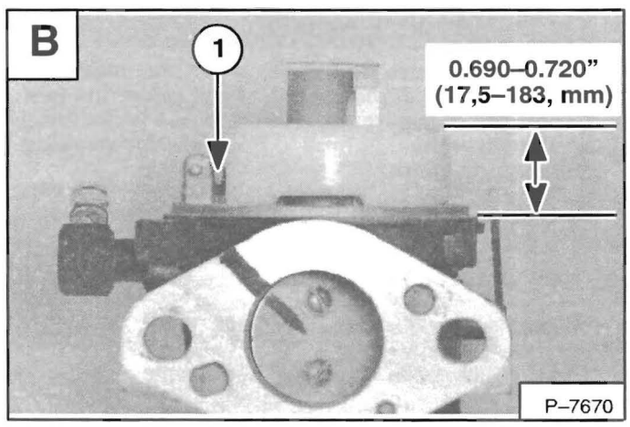
Replace gaskets or seals as necessary.

Installation: Install the carburetor on the intake manifold and tighten the bolts.

Connect the fuel line, governor linkage, choke cable and shutdown solenoid wires.

Install the air cleaner.





Removal and Installation

NOTE: The engine cab can be removed without the hydrostatic pump due to a slotted engine mounting plate.

Use the following procedure to remove the engine from the loader.

Put jackstands under the rear of the loader.

⚠ WARNING

Before the cab or the lift arms are raised for service, jackstands must be put under the rear corners of the frame. Failure to use jackstands can allow the machine to tip backward causing injury or death.

W–2014–0895

Open the rear door.

Raise the operator cab. (See Page 1–1.)

Remove the bolts (Item 1) **[A]** to remove the engine shield.

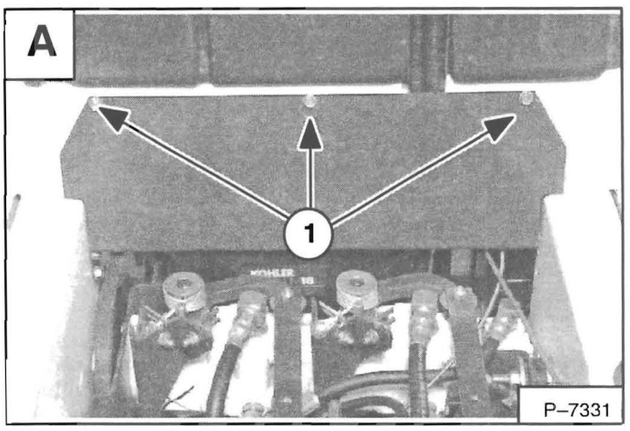
Loosen the clamp (Item 1) **[B]** and remove the fuel supply line.

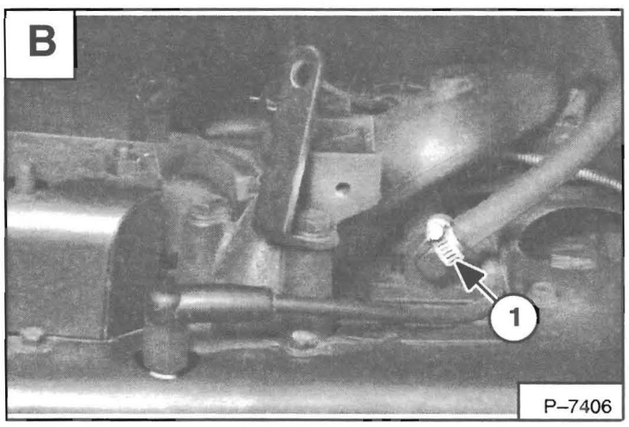
Loosen the screw (Item 1) **[C]** to remove the choke cable from the carburetor (Item 2) **[C]**.

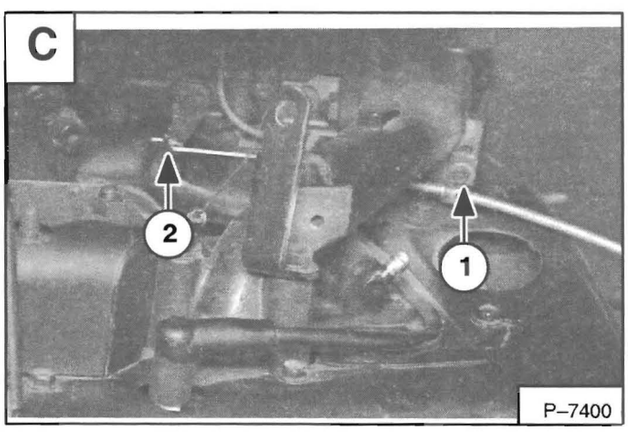
Lower the operator cab.

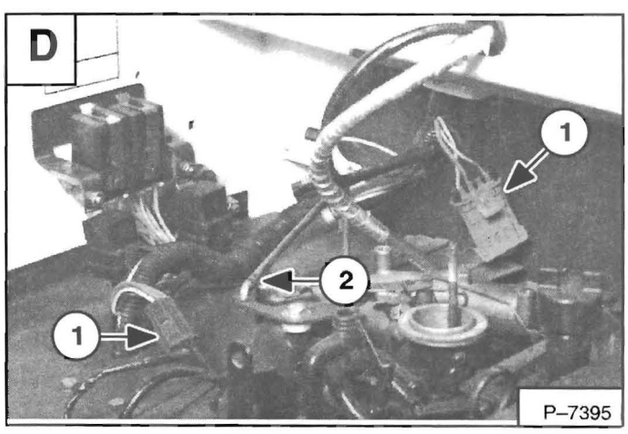
Disconnect the electrical harness connectors (Item 1) **[D]** from the engine.

Disconnect the speed control linkage (Item 2) **[D]** from the engine.





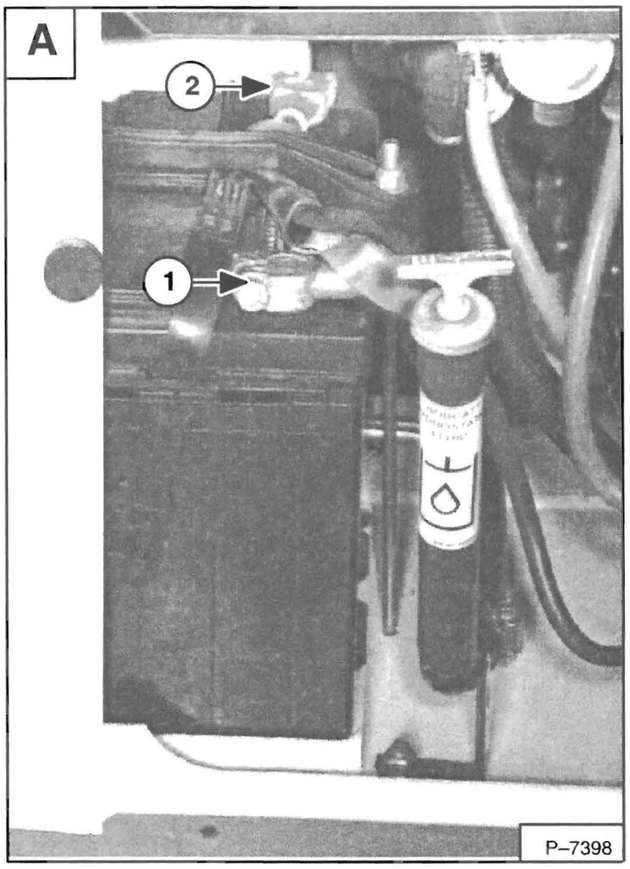




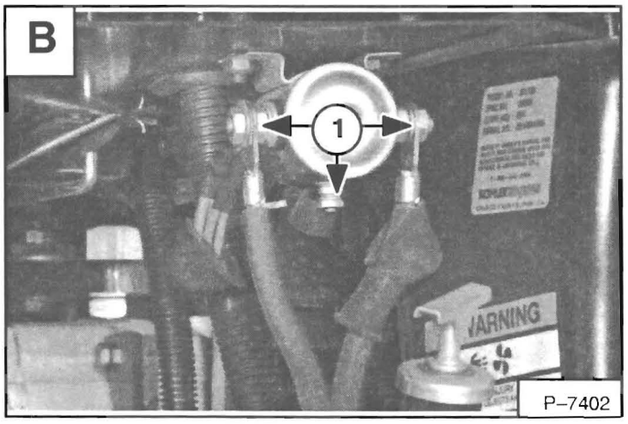
Removal and Installation (Cont'd)

Remove the battery cables from the battery.

Remove the negative (–) cable (Item 1) **[A]** first then the positive (+) cable (Item 2) **[A]**.



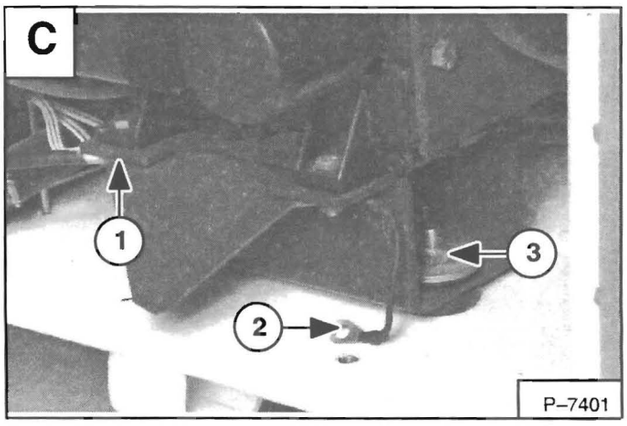
Remove the electrical wires (Item 1) **[B]** from the solenoid.



Remove the ground wires (Item 1) **[C]** from the engine.

Remove the ground wire (Item 2) **[C]** from the loader frame.

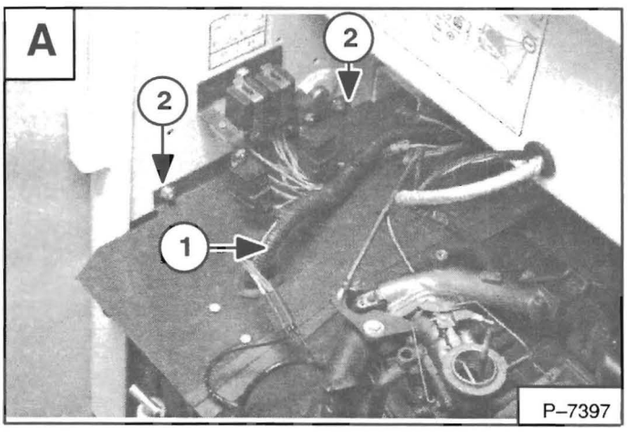
Remove the engine mounting nuts and bolts (Item 3) **[C]**.



Removal and Installation (Cont'd)

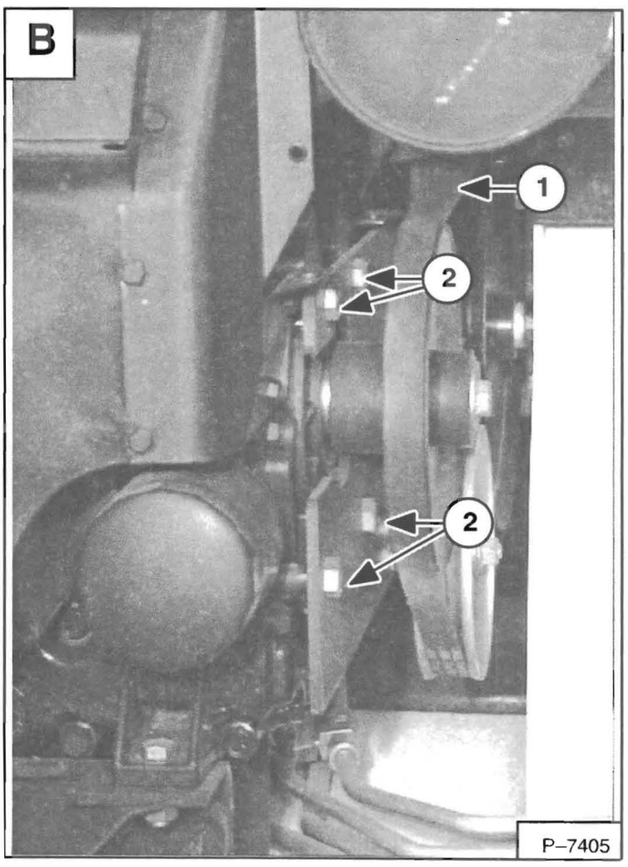
Pull the electrical harness (Item 1) **[A]** through the hole in the shield.

Remove the two mounting bolts (Item 2) **[A]** for the shield. Remove the shield.



Remove the drive belt (Item 1) **[B]** from the engine pulley. Support the tension pulley on a wooden block.

Remove the four bolts (Item 2) **[B]** from the engine and pump mounting bracket.



Removal and Installation (Cont'd)

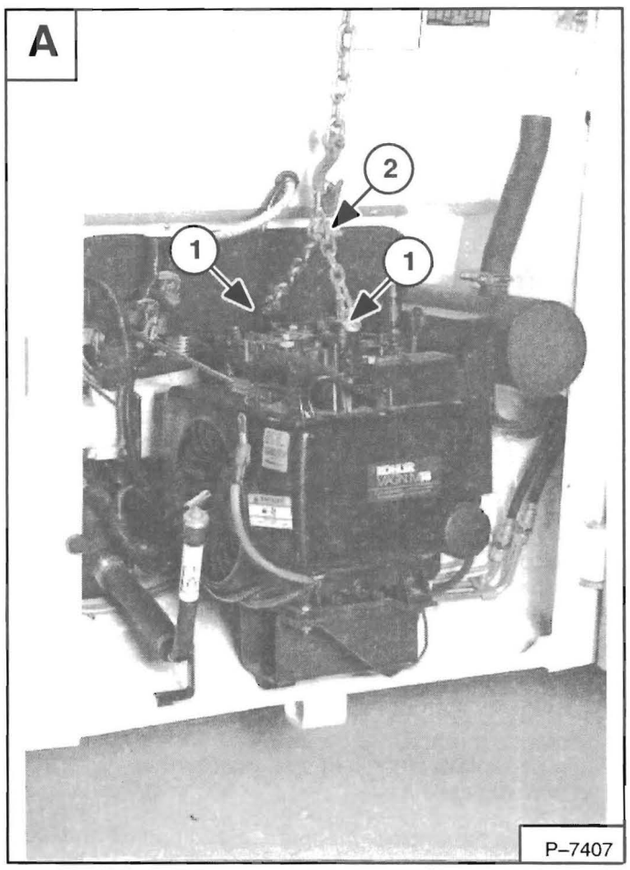
Install a chain to the lift eyes (Item 1) **[A]**.

Install a chain hoist to the lifting chain (Item 2) **[A]**.

Install a bolt below the chain hoist hook to help stabilize the engine during removal.

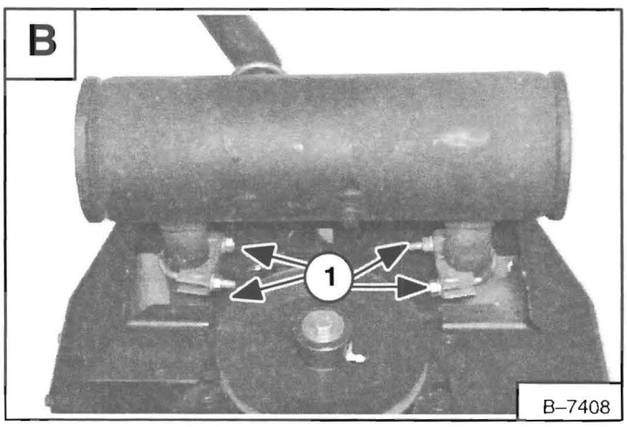
Lift the engine and slowly pull it to the rear while checking for removal clearances.

Installation: Install the engine in the reverse procedure.



Muffler Removal and Installation

Loosen the u–clamps (Item 1) **[B]** to remove the muffler.



Intake Manifold Removal and Installation

Remove the governor arm clamp, spring and linkage **[A]**.

Mark the position of governor spring in governor arm and speed control lever for location during assembly.

Disconnect the fuel line from the carburetor.

⚠ WARNING

AVOID INJURY OR DEATH

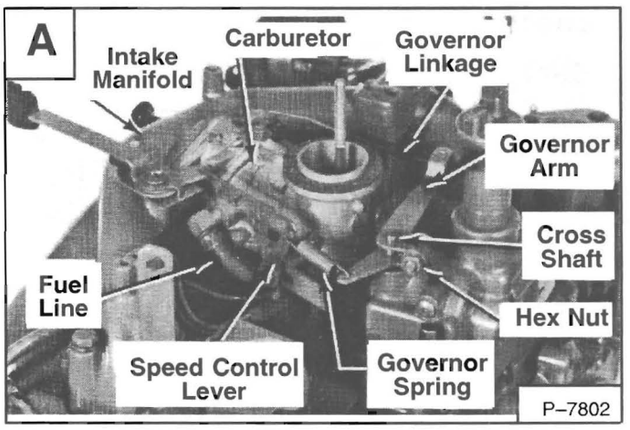
Gasoline may be present in the intake manifold, carburetor, and fuel system. Gasoline is extremely flammable, and its vapors can explode if ignited. Keep cigarettes, sparks, open flames, and other sources of ignition away from the engine. Wipe up spilled fuel immediately.

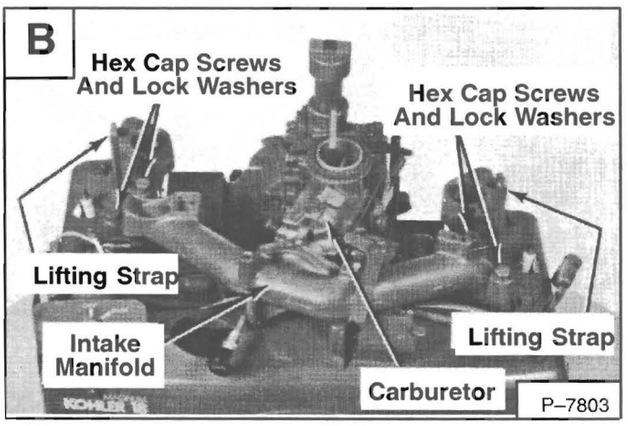
W–2232–0196

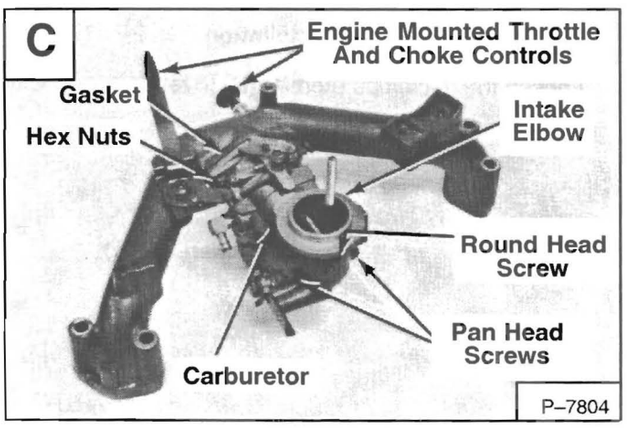
Remove the hex cap screws, split lock washers, lifting straps, intake manifold with carburetor, and intake manifold gaskets **[B]**.

Remove the engine–mounted speed control and choke controls.

Remove the hex nuts, carburetor with intake elbow, and gasket from the intake manifold **[C]**.





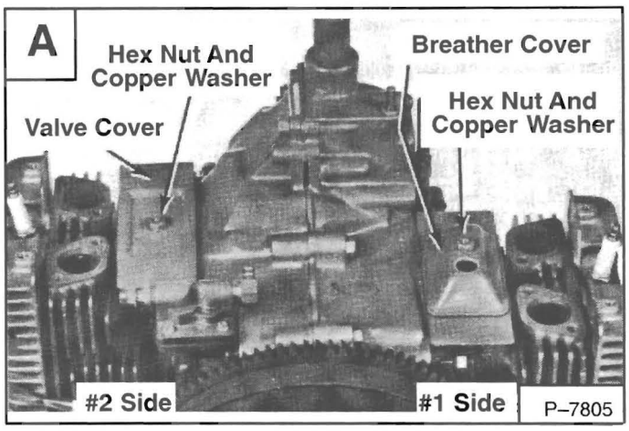


Breather and Valve Cover Removal and Installation

The intake manifold and carburetor are removed for clarity purposes.

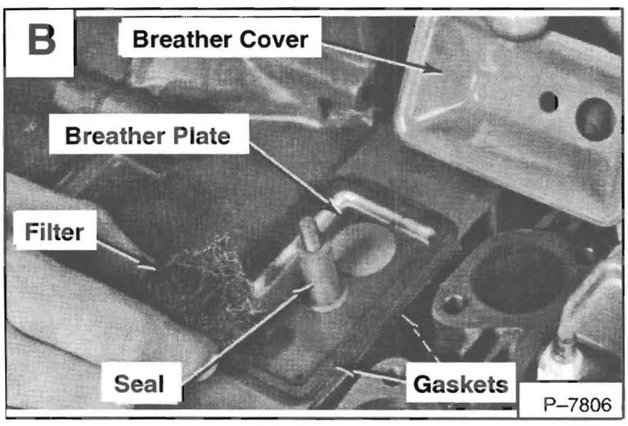
Remove the hex nut, copper washer, breather cover, and gasket **[A]**.

Remove the filter, seal, breather plate, and gasket **[A]**.



Remove the hex nut, copper washer, valve cover, and gasket **[B]**.

Installation: Install new gaskets under both the covers. Clean the filter as required.



Fuel Pump Removal and Installation

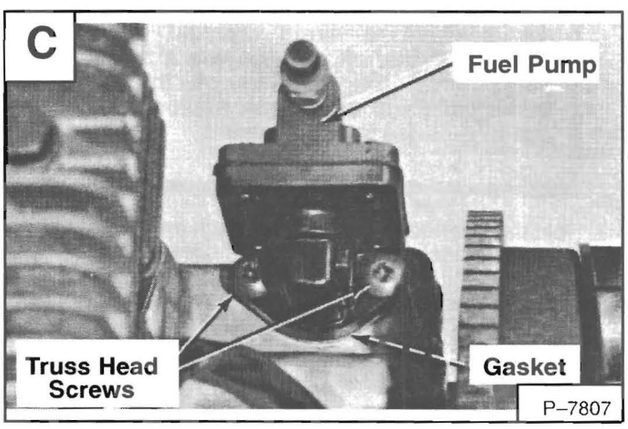
⚠ WARNING

AVOID INJURY OR DEATH

Gasoline may be present in the intake manifold, carburetor, and fuel system. Gasoline is extremely flammable, and its vapors can explode if ignited. Keep cigarettes, sparks, open flames, and other sources of ignition away from the engine. Wipe up spilled fuel immediately.

W–2232–0196

Remove the truss head screws, fuel pump, and gasket **[C]**.



ENGINE DISASSEMBLY

The tools listed will be needed to do the following procedure:

MEL1499 – Driver
MEL1501 – Gauge
MEL1502 – Gauge
MEL1503 – Reamer
MEL1508 – Puller
MEL1494 – Puller
MEL1495 – Screw
MEL1496 – Adapter, 1/2–13 x 3/8–16
MEL1206 – Wrench
MEL1509 – Wrench–Offset 1/2
MEL1510 – Scraper–Plastic
MEL1498 – Slide Hammer Kit
MEL1512 – Valve Guide Puller Kit

Remove the engine from the loader. (See Page 7A–16.)

Remove the muffler. (See Page 7A–19.)

Remove the intake manifold. (See Page 7A–20.)

Remove the air shrouding from the engine.

Flywheel Removal and Installation

⚠ WARNING

Use the procedure in the manual for removing the flywheel to avoid cracked flywheel or broken crankshaft. Do not use a puller which holds only the outside of the flywheel. Damaged parts can break explosively during use and cause injury or death.

W–2079–1285

Hold the flywheel with a strap wrench and remove the hex cap screw, lock washer & plain washer **[A]**.

Installation: Lubricate the threads with oil and tighten the screw to 40 ft.–lbs. (54 Nm) torque.

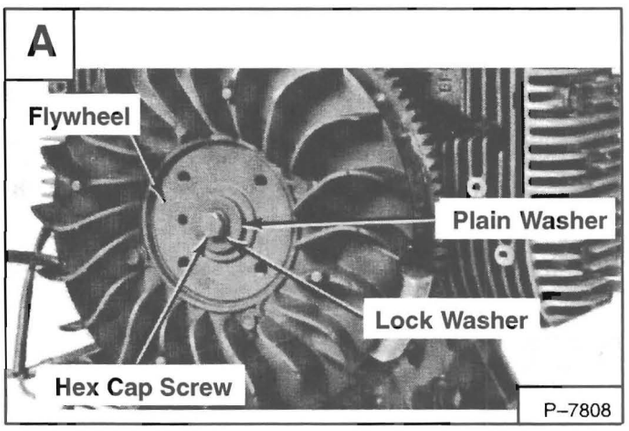
Use a MEL1508 – Puller to remove the flywheel from the crankshaft **[B]**.

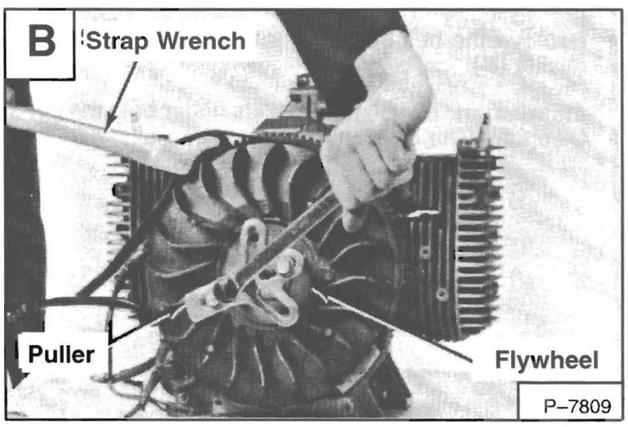
Remove the hex flange screws, spacers and fan from the crankshaft **[C]**.

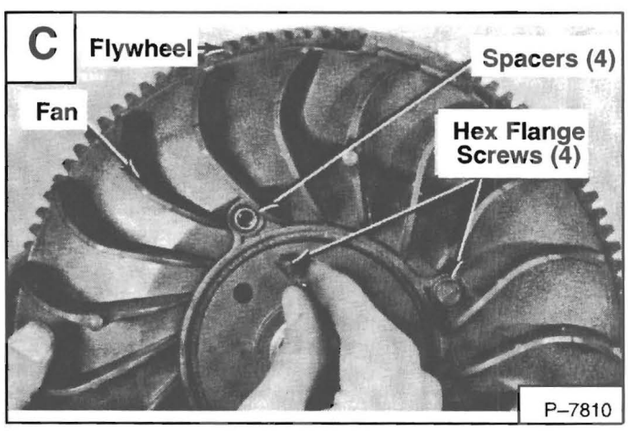
Stator Removal and Installation

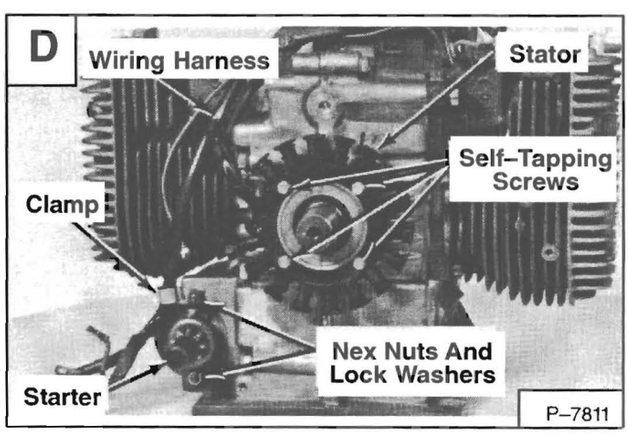
Disconnect the wiring harness and remove the self–tapping screws to remove the stator **[D]**.

Remove the stator **[D]**.



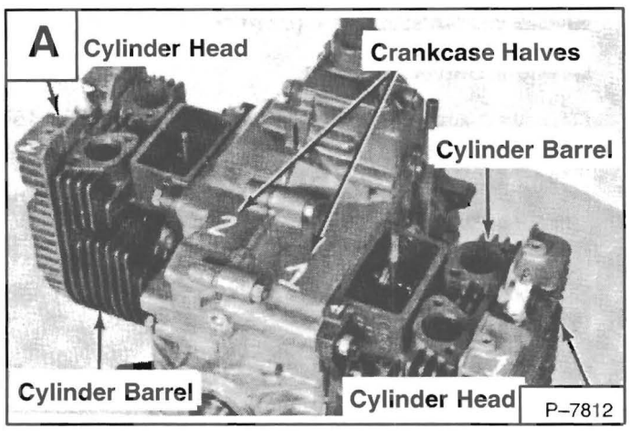






Stator Removal and Installation (Cont'd)

Mark the crankcase halves **[A]**. Side one is the closest to the flywheel. It contains the governor, oil pump gear and dipstick tube.



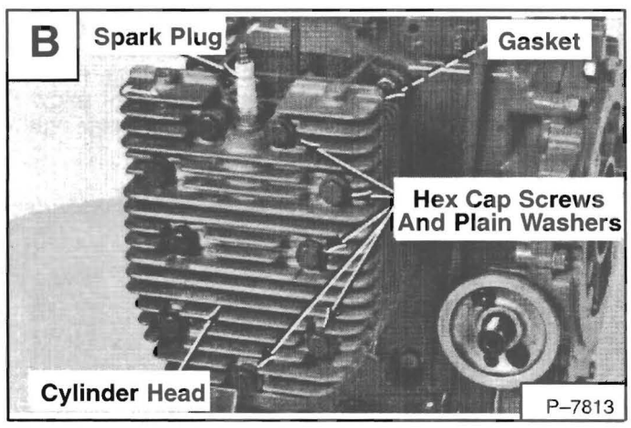
Cylinder Head Removal

Plugged cylinder head cooling fins can cause *hot spots* which can *blow* the head gasket. Clean the cylinder head fins.

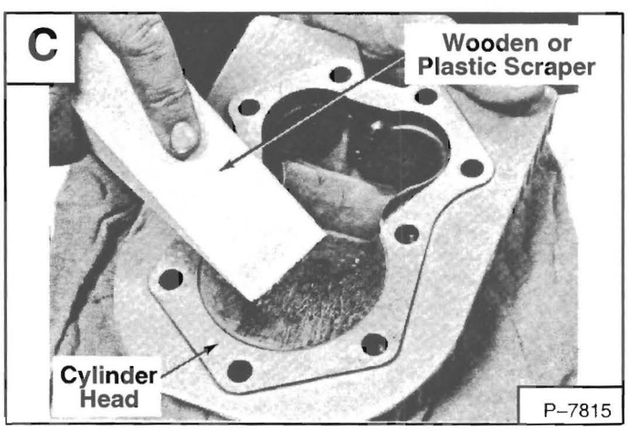
Remove the spark plug.

Remove the hex cap screws and plain washers from the cylinder head **[B]**.

Remove the cylinder head and the gasket.

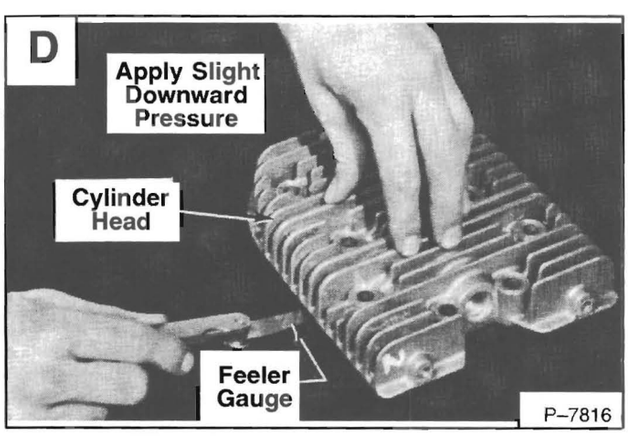


If the head is in good condition use MEL1510 plastic scraper to clean the carbon deposits **[C]**. Be careful not to scratch the aluminum head in the gasket seat area.



Check the cylinder head for being straight **[D]**, using a surface plate and feeler gauge. The cylinder head must not be more than 0.003 inch (0,008 mm) from being straight, if it is not, replace the cylinder head.

In cases where the head is not straight or burned away it will be necessary to also replace the head bolts.

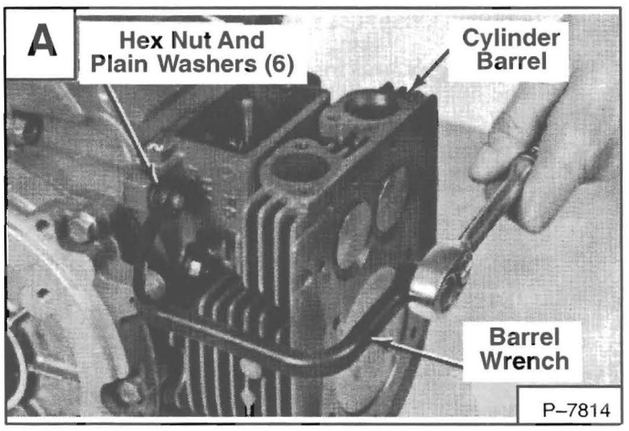


Cylinder Barrel Removal

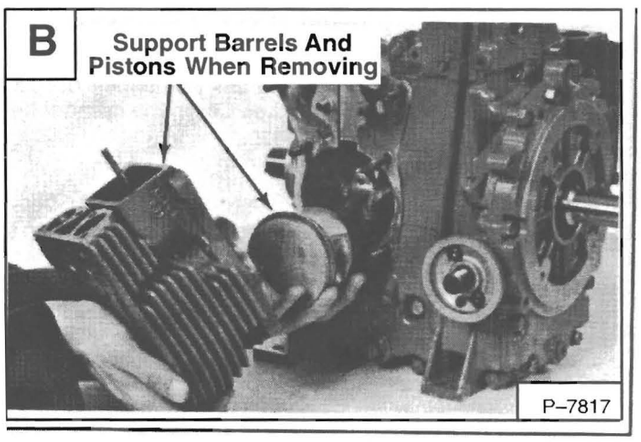
Remove the hex nuts and plain washers using MEL1509 – offset wrench **[A]**.

Using a soft–faced hammer, carefully tap the cylinder barrels between the intake and exhaust ports to break the seal between cylinder barrels and crankcase.

Support the weight of barrels and carefully pull the barrels from the studs and pistons.



NOTE: To prevent damage to pistons or connecting rods when removing barrels, make sure the cylinder barrels and connecting rods are supported at all times [B]. Do not allow the pistons or connecting rods to drop against edges of crankcase.



Thoroughly remove the sealant from the mating surfaces of crankcase and cylinder barrels.

Remove the valves from the cylinder barrels. (See Page 7A–26 for the procedure.)

Cylinder Barrel Inspection and Resizing

If the cylinder bore is badly scored, excessively worn, tapered, or out of round, resizing is necessary. Use an inside micrometer to determine amount of wear (refer to *SPECIFICATIONS* 9–1 for correct bore size), then select the nearest suitable oversize of either 0.003 inch (0.07mm), 0.010 inch (0.25mm), 0.020 inch (0,51mm), or 0.030 inch (0.76mm).

Initially, resize using a boring bar, then use the following procedures for honing the cylinder:

Use a low speed drill press will provide a more accurate alignment of the bore in relation to the crankshaft crossbore. Honing is best accomplished at a drill speed of about 150 RPM and 60 strokes per minute.

Install the coarse stones in the hone and lower hone into bore. Adjust so that the stones are in contact with the cylinder wall. Use a commercial cutting–cooling agent is recommended.

With the lower edge of each stone positioned even with the lowest edge of the bore, start drill and honing process

Move hone up and down while resizing to prevent formation of cutting ridges. Check size frequently after the barrel is cool **[B]**.

When bore is within 0.0025 inch (0.064mm) of desired size, remove coarse stones and replace with burnishing stones.

Continue with burnishing stones until within 0.0005 inch (0.013mm) of desired size and then use finish stones (220–280 grit) and polish to final size. A crosshatch should be observed if honing is done correctly.

After resizing, check the bore for roundness, taper, and size. Use an inside micrometer, telescoping gauge, or bore gauge to take measurements **[B]**.

The measurements should be taken at three locations in the cylinder—at the top, middle, and bottom Two measurement should be taken (perpendicular to each other) at each of the three locations.

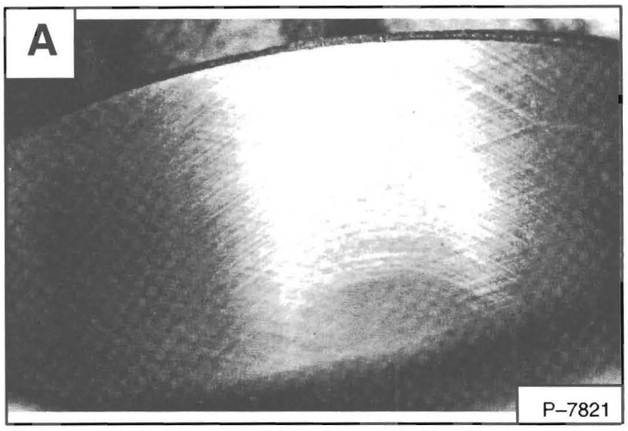
Proper cleaning of the cylinder walls following boring and/or honing is very critical to a successful overhaul.

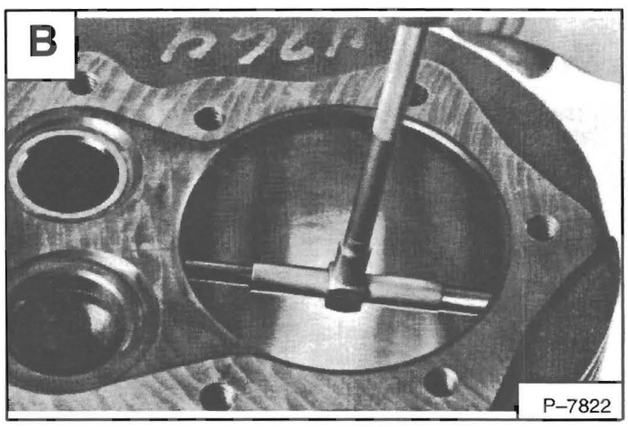
Machining grit left in the cylinder bore can destroy an engine in less than one hour of operation after a rebuild.

The final cleaning operation should always be thorough scrubbing with a brush and hot, soapy water.

Use a strong detergent that is capable of breaking down the machining oil while maintaining a good level of suds. If the suds break down during cleaning, discard the dirty water and start again with more hot water and detergent.

Following the scrubbing, rinse the cylinder with very hot, clear water, dry it completely, and apply a light coating of engine oil to prevent rusting.





Valve Removal and Installation

With a marking pen or paint, mark the valves as coming from the #1 or #2 cylinder barrel. Exhaust valves are already identified with an EX stamp on the valves.

Compress the valve springs with a valve spring compressor and remove keepers.

There are two different valve springs used; a short spring free length 1.54 inch (39,17 mm) and a long spring free length 1.688 inch 42,88 mm). The short spring is used with the valve rotators.

Replace broken or worn parts as needed.

To check valve guide to valve stem clearance, thoroughly clean the valve guide and, using a split–ball gauge, measure the inside diameter.

Then, using an outside micrometer, measure the diameter of the valve stem at several points on the stem where it moves in the valve guide. Use the largest stem diameter to calculate the clearance.

If the clearance exceeds 0.005 inch (0,127 mm) intake or 0.007 inch (0,18 mm) on exhaust valve, determine if the valve stem or the guide is worn.

Valve Guide Removal and Installation

Use the following tool to remove the valve guides:

MEL1498 – Slide Hammer
MEL1496 – Adapter
MEL1512 – Valve Guide Puller Kit

Install 5/16–18 NC nut on coarse threaded end of 2–1/2 inch (63.5mm) long stud **[B]**.

Insert other end of stud through the valve guide bore and install 5/16–24 NF nut. Tighten both nuts securely.

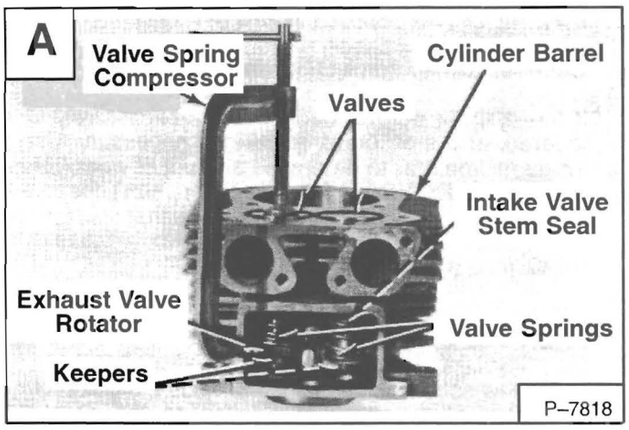
NOTE: Valve guide must be held firmly by the stud assembly so that all slide hammer force will act on the guide.

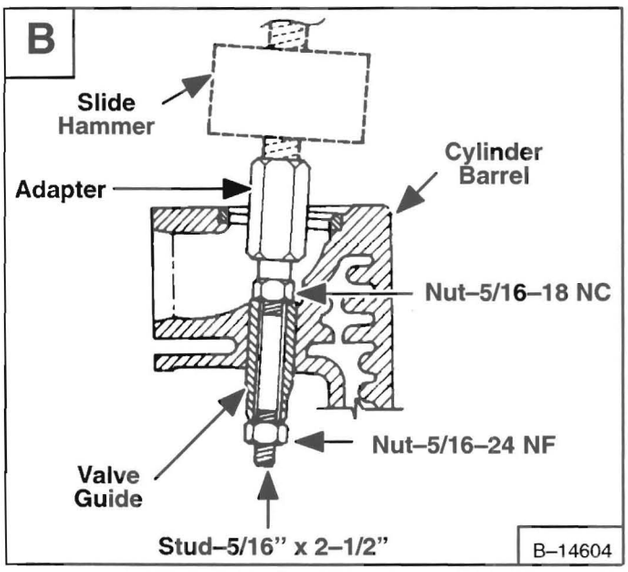
Assemble MEL1496 valve guide removal adapter to the stud and MEL1498 slide hammer to the adapter **[B]**.

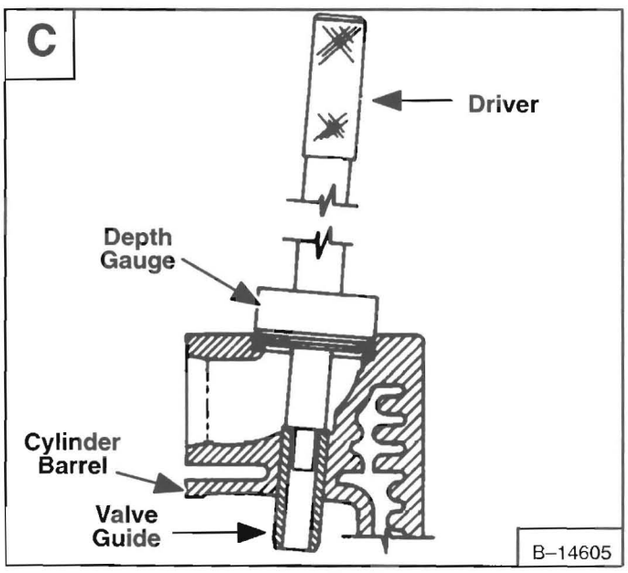
Use the slide hammer to pull the guide out.

Use MEL1499 – Driver and MEL1501 or MEL1502 – Depth guide to align and press the guide until the depth guide bottoms **[C]**.

Valve guides are often slightly compressed during insertion. Use MEL1502 – Reamer to resize the guide bore to 0.3125 inch (7,937 mm).







Valve Seat Insert Removal

If the seats become badly pitted, cracked, or distorted, the inserts must be replaced.

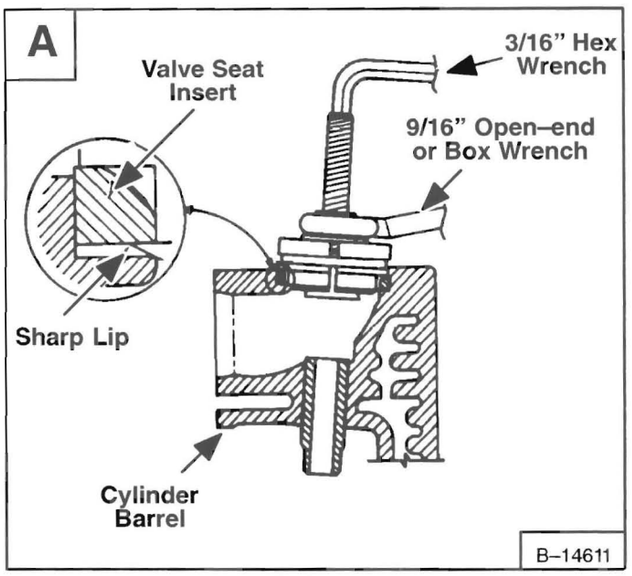
Install MEL1494 – valve seat puller on MEL1495 – forcing screw and lightly secure with washer and nut **[A]**.

Center the puller assembly on valve seat insert. Hold forcing screw with a hex wrench to prevent turning and slowly tighten nut **[A]**.

Continue to tighten the nut until the puller is tight against the valve seat insert.

Assemble MEL1496 – adapter to the valve seat puller forcing screw and slide hammer to adapter **[A]**.

Use MEL1498 – slide hammer to remove the valve seat insert **[A]**.



Valve Seat Insert Installation

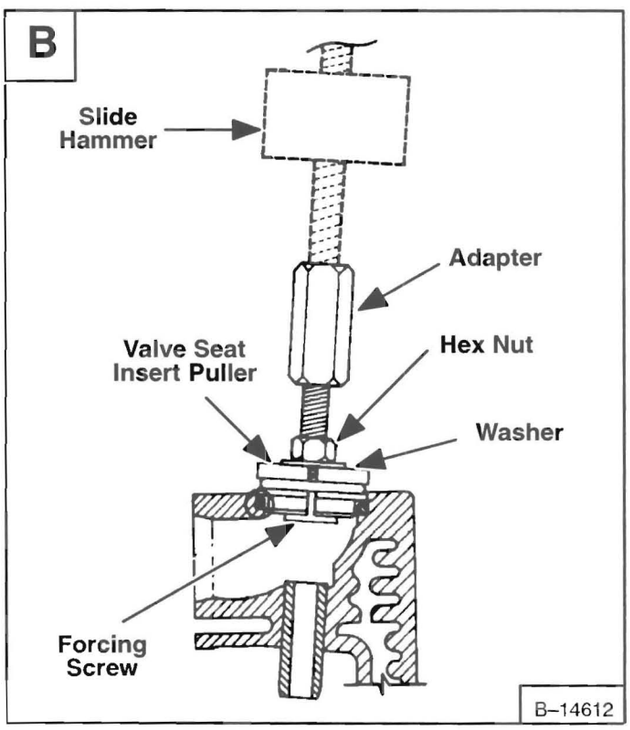
Make sure valve seat insert bore is clean and free of nicks or burrs.

Align valve seat insert in counterbore and using valve seat installer and driver, press seat in until it bottoms **[B]**.

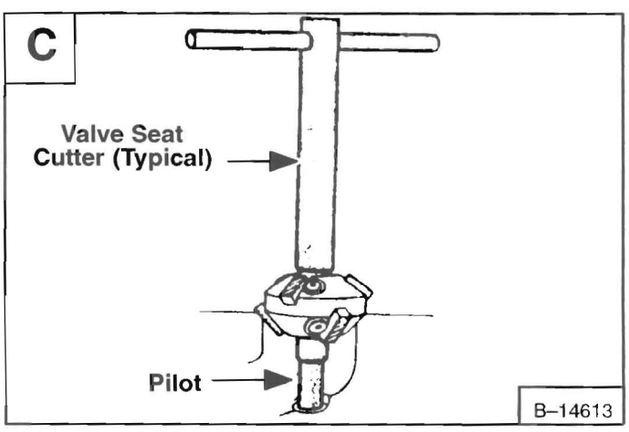
Reground or new valves must be lapped in, to provide fit. Use a hand valve grinder with suction cup for final lapping. Lightly coat valve face with *fine* grade of grinding compound, then rotate valve on seat with grinder. Continue grinding until smooth surface is obtained on seat and on valve face.

Thoroughly clean cylinder barrel in soap and hot water to remove all traces of grinding compound. After drying cylinder barrel, apply a light coating of SAE 10 oil to prevent rusting.

NOTE: These engines use valve stem seals on the intake valves. Always use new seals when valves are removed from cylinder. Seals should also be replaced if deteriorated or damaged in any way. Never reuse old seals.

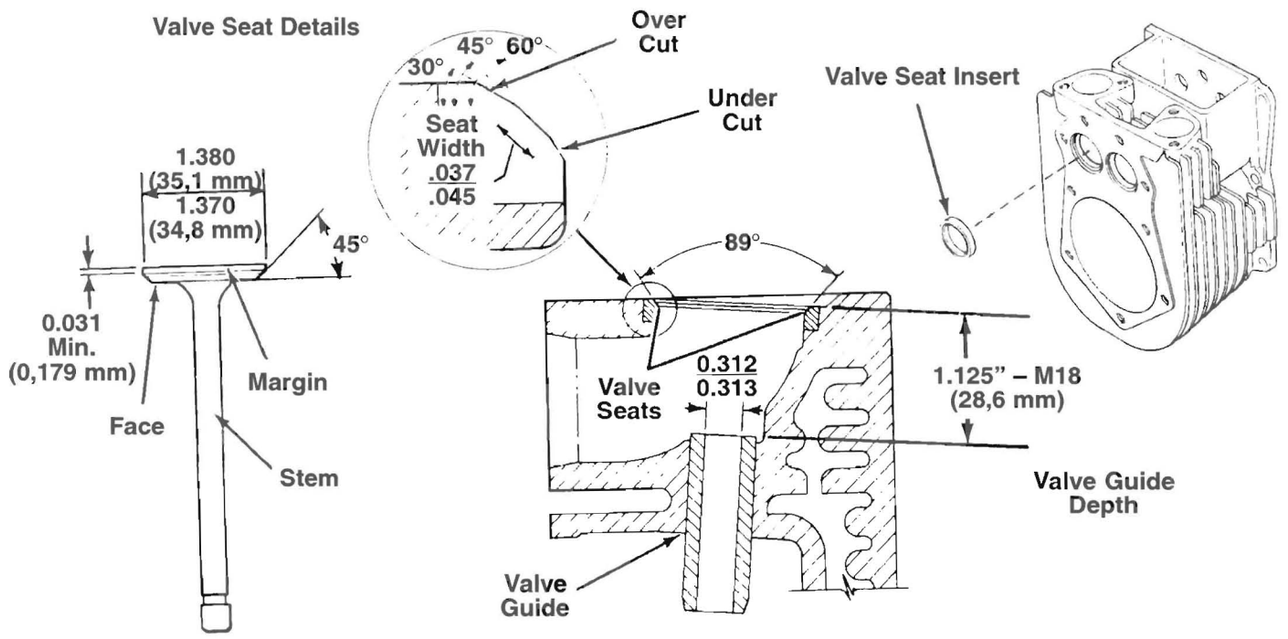


Use a standard valve seat cutter **[C]** to cut the seats to the dimensions shown on Page 7A–28 **[A]** & **[B]**.



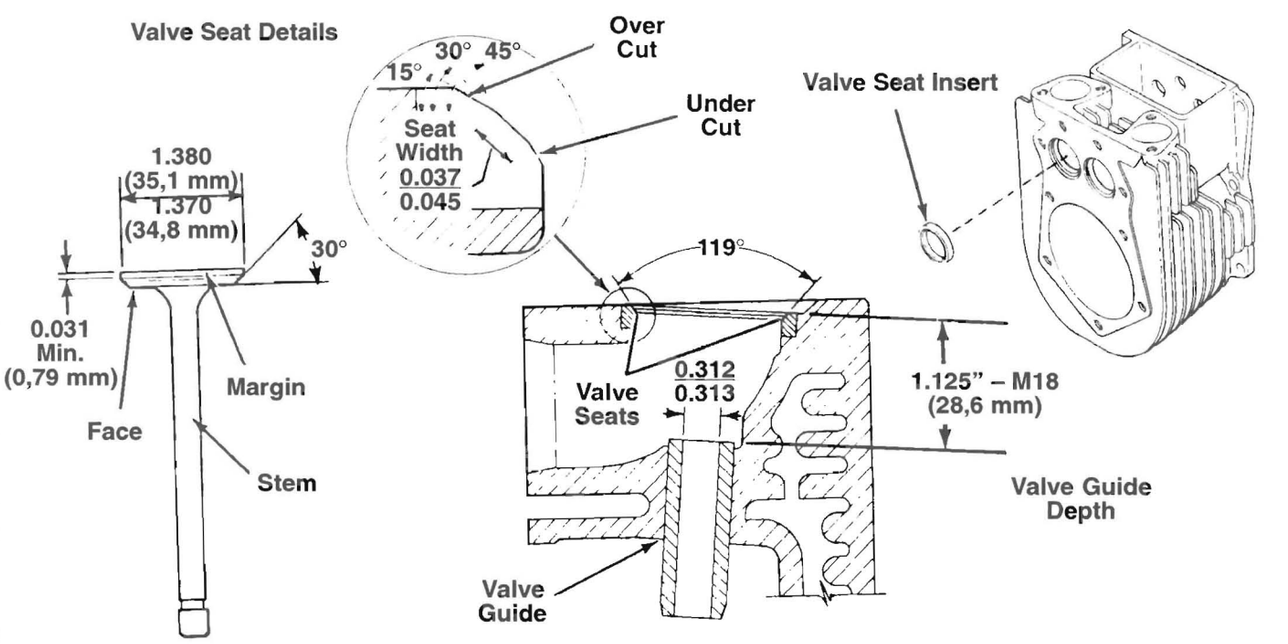
Valve Details

A INTAKE VALVE DETAILS (45° Angle)



B–14606

B EXHAUST VALVE DETAILS (30° Angle)

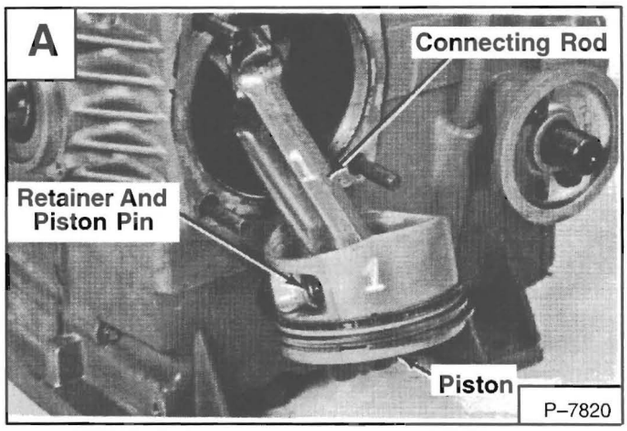


B–14607

Piston and Piston Rings

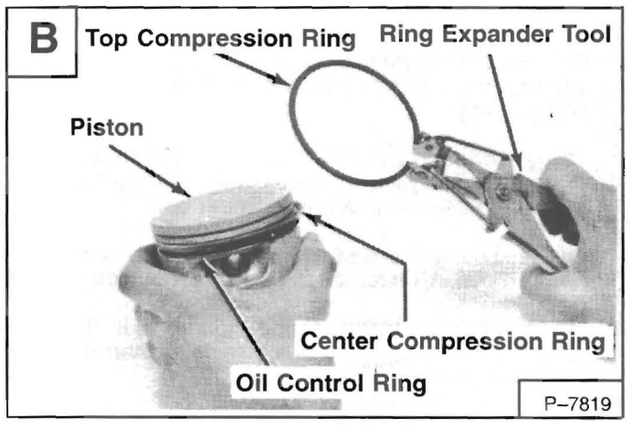
Using a marking pen, number the pistons and connecting rods for assembly purposes **[A]**.

Remove the piston pin retainers, piston pins, and pistons **[A]**.



Remove the top and center compression rings using a ring expander tool **[B]**.

Remove the oil control ring rails; then remove rails spacer **[B]**.



Piston and Piston Rings (Cont'd)

The ring replacement sets and pistons are available in standard size, 0.010 inch (0.25 mm), 0.020 inch (0.51 mm) and 0.030 inch (0.76 mm) oversize sets. The oversize pistons are used only when the cylinder has been rebored.

The cylinder bore must be deglazed before service ring sets are used.

If the cylinder block does not need reboring and if the old piston is within wear limits and free of score or scuff marks, the old piston may be reused.

Remove old rings and clean up grooves. Never reuse old rings.

Before installing new rings on piston, place top two rings, each in turn, in its running area in cylinder bore and check end gap **[A]**.

The gap should be 0.010–0.32 inches (0,243–0,812 mm) in a used cylinder bore and .010–.012 inches (0,254–0,584 mm) in a new cylinder bore.

This installing the new compression (top and middle) rings on piston, check piston–to–ring side clearance **[B]**.

Maximum recommended side clearance is 0.006 inch (0,15 mm). If side clearance is greater than 0.006 inch (0,15mm), a new piston must be used.

Install the piston rings as follows:

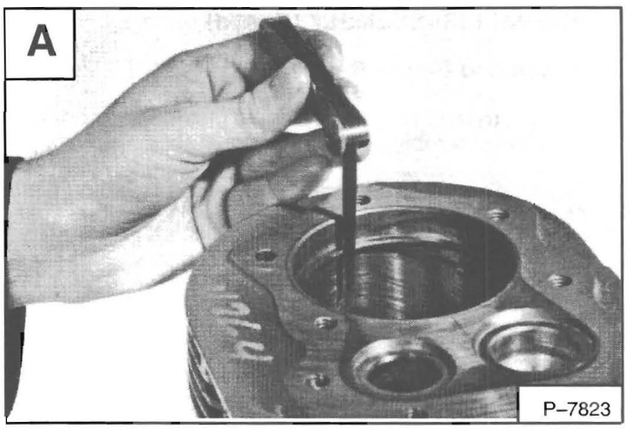
Use a ring installation tool and install the rings on the piston. Ring gaps must be staggered, 120° apart.

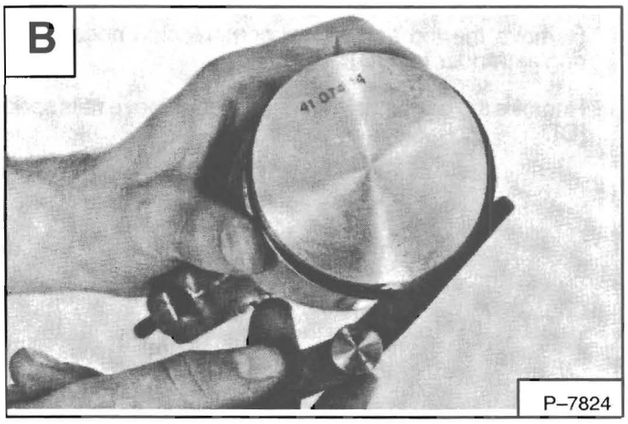
Oil Control Ring (Bottom Groove): Install the expander and then the rails. Make sure the ends of expander are not overlapped.

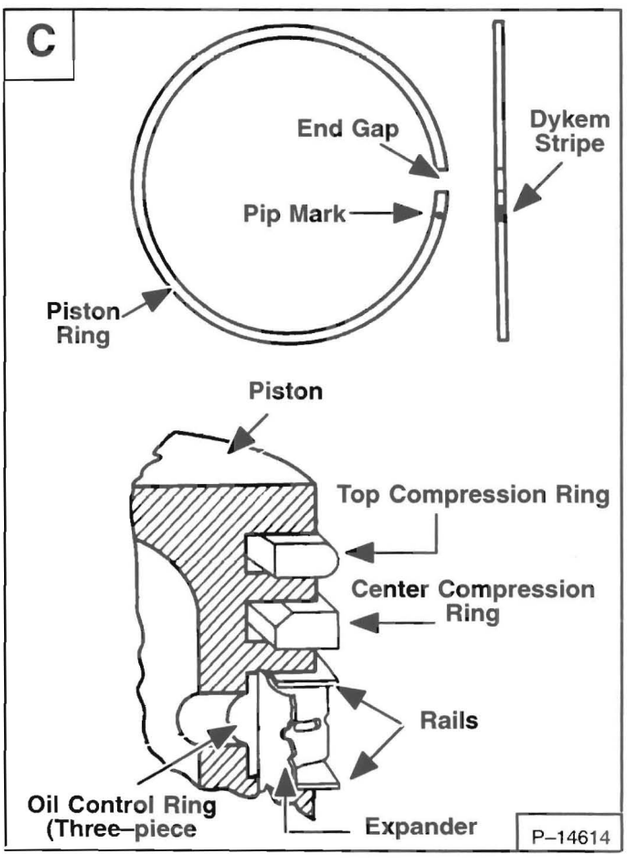
Compression Ring (Center Groove): Install the beveled ring using a piston ring installation tool. Make sure the *pip* mark is up and the PINK dykem stripe is to the left of the end gap.

Compression Ring (Top Groove): Install the top ring using a piston ring installation tool. Make sure the *pip* mark is up and the BLUE dykem stripe is to the left of the end gap.

See Page 7A–46 for piston installation.

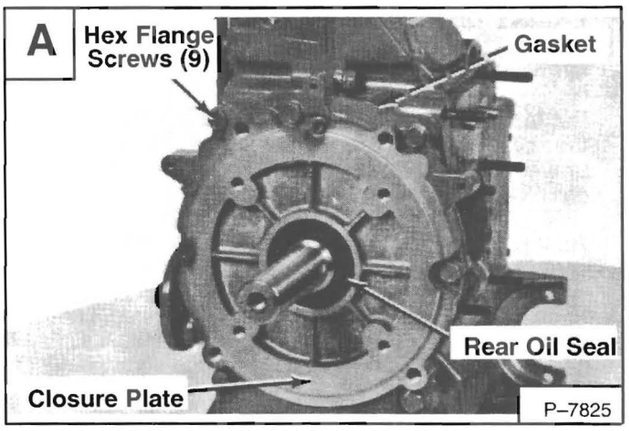






Closure Plate

Remove the hex flange screws, closure plate and the gasket **[A]**.

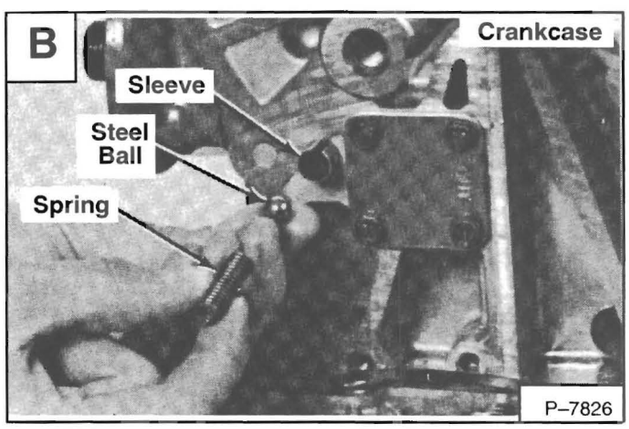


Remove the oil pressure relief valve spring, steel ball, and sleeve **[B]**.

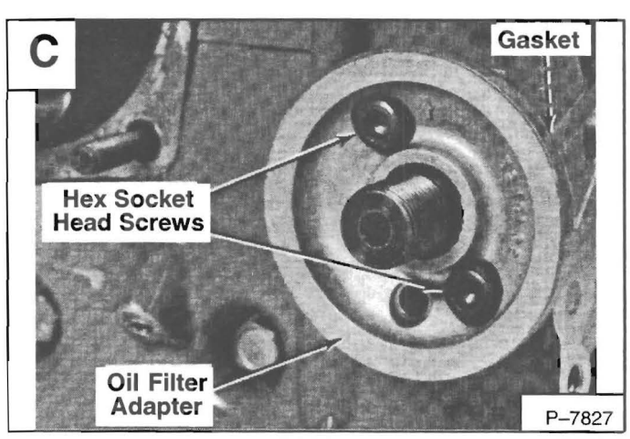
Remove the rear oil seal from the closure plate.

Check oil pump relief valve ball, seat and spring **[B]**.

Ball and seat should be free of nicks or burrs. Check spring for wear or distortion. Spring free length should be approximately .992 inches (25,2 mm). Replace spring if distorted or worn.

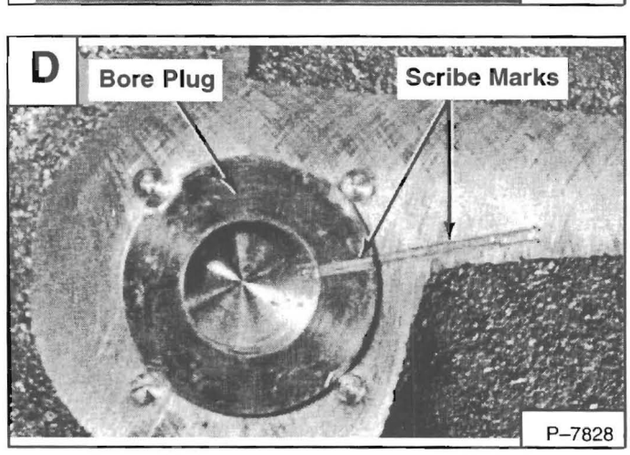


Remove the hex, socket head screws, oil filter adapter and the gasket **[C]**.



Crankcase Halves

Scribe a line across the camshaft bore plug and the #1 crankcase side. This line is used to align the plug on reassembly **[D]**.



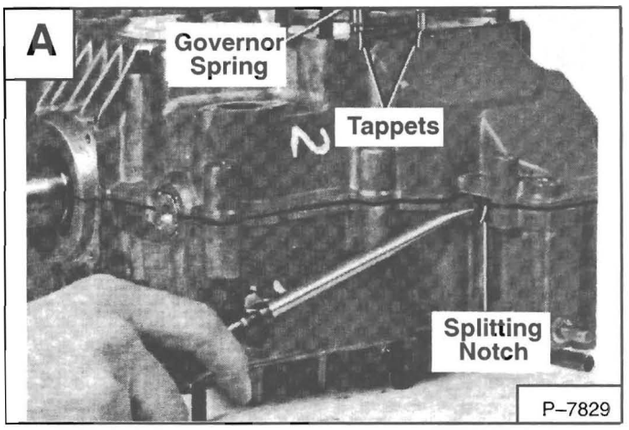
Crankcase Halves (Cont'd)

Put tape or governor spring around the tappet stems in the #2 crankcase side. (See Page 7A–41 **[A]**.) This prevents the tappets from falling into the #1 side when the crankcase is split.

Remove the hex nuts, plain washers, and hex flange screws securing the crankcase halves together.

Lay the crankcase down so the #2 side is up. Locate the splitting notches in the seam of the crankcase. Pry the halves apart using the blade of a large screwdriver **[A]**.

NOTE: Insert the screwdriver only in the splitting notches. Do not pry on the basket surfaces of the crankcase as this can cause leaks [A].

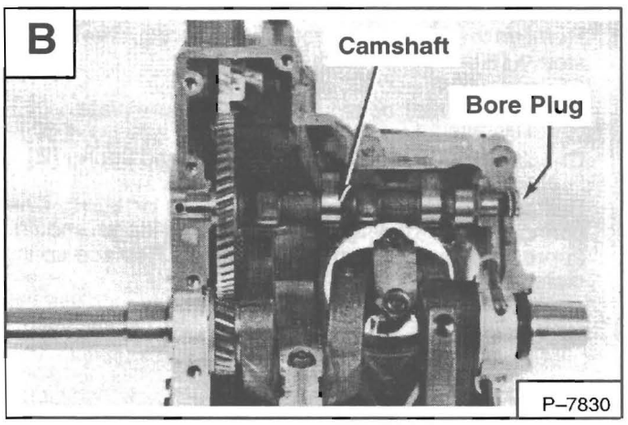


Camshaft Removal

With a marking pen or paint, mark the tappets according to crankcase side and intake or exhaust. Remove tappets from both crankcase sides **[B]**.

NOTE: The intake valve tappet is closest to the flywheel side of crankcase. The exhaust valve tappet is closest to the PTO side of crankcase.

Remove the camshaft and camshaft bore plug from the #1 crankcase side **[B]**.

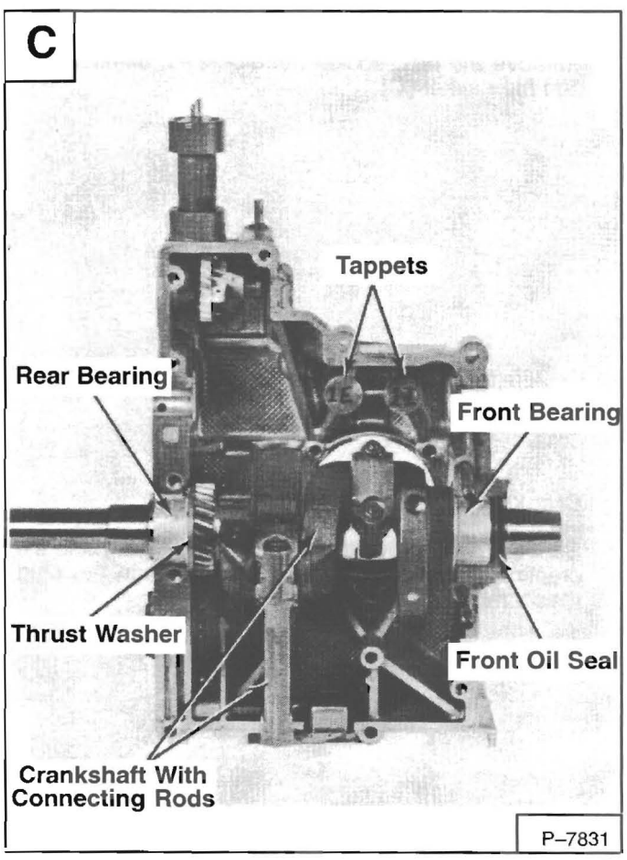


Crankshaft Removal

Remove the crankshaft with connecting rods, bearings, and front oil seal from the #1 crankcase side **[C]**.

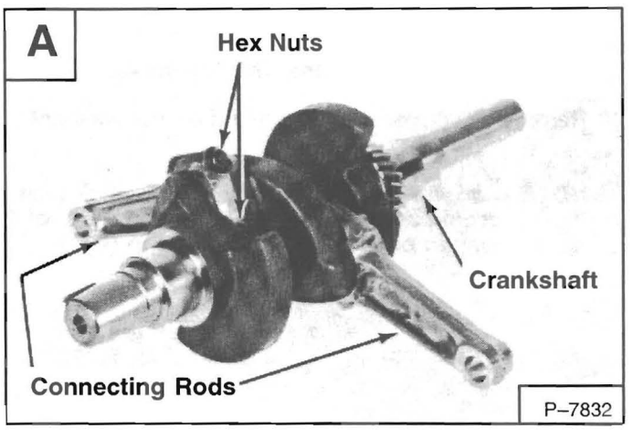
Remove the front oil seal from the flywheel end of crankshaft. Remove bearings and thrust washer from crankshaft.

Note the location of the thrust washers and bearings. Install replacement parts in the same locations during assembly **[C]**.

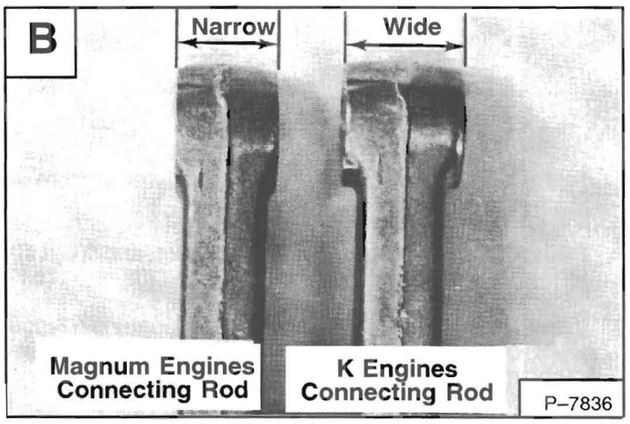


Connecting Rod Removal

With a marking pen or paint, mark the connecting rods and rod caps as #1 side and #2 side. On M18 mark which side is top **[A]**.



Posi–Lock Connecting Rods are used in all Magnum M18 engines. Because of the increase in piston pin boss thickness of the new pistons the connecting rods on these engines have a narrower piston pin end than on older style Posi–Lock connecting rods **[B]**.



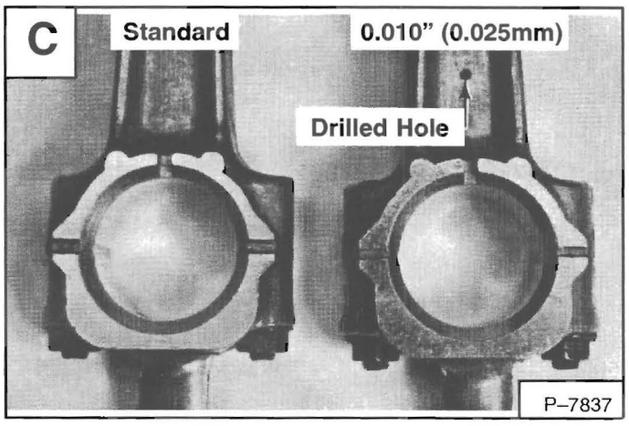
Check the bearings (big end) for wear, score marks, running and side clearance.

Piston Pin Running . . . . . 0.0006–0.0011 inch (0,016–0,027 mm)
Side Play on Crankpin . 0.005–0.0167 inch (0,13–0,41 mm)
Crankpin Running . . 0.0012–0.0022 inch (0,030–0,056 mm)
Crankpin Bore New Dia. . . . . 1.3750–1.3755 inch (34,93–34,94 mm)
Crankpin Bore Max. Dia. . . . . 1.376 inch (34,950 mm)
Wristpin Bore New Dia. . . . 0.62565 inch (15,891 mm)

The connecting rods are available in 0.010 inch (0.25 mm) undersize if the crankshaft is undersize **[C]**.

The 0.010 inch (0.25 mm) undersized rod can be identified by the drilled hole located in the lower end of the rod shank **[C]**.

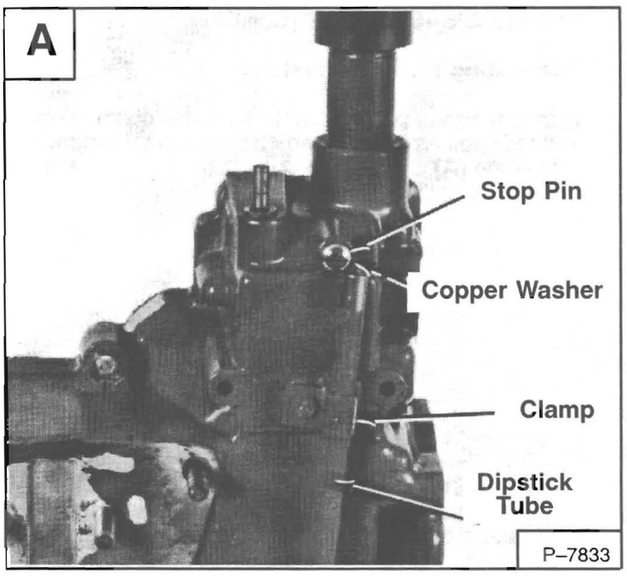
Always refer to the appropriate parts information to ensure that correct replacements are used.



Governor Gear and Cross Shaft Removal

Remove the governor stop pin and copper washer **[A]**.

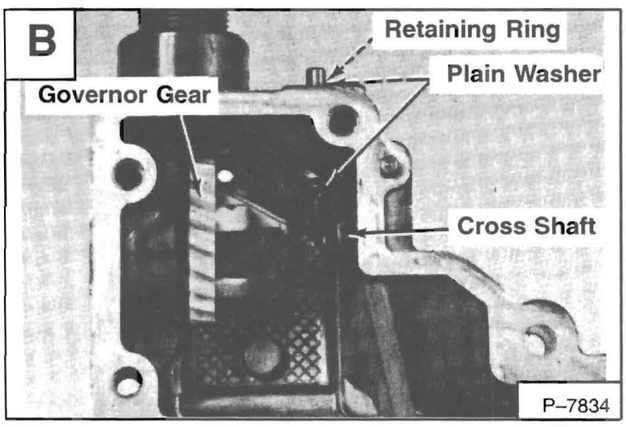
NOTE: Loosen the clamp securing dipstick tube to crankcase. Move the dipstick tube out of the way to ease removal of stop pin [A].



Remove the governor gear and thrust washer from stub shaft **[B]**.

Remove the retaining ring, plain washers, and cross shaft **[B]**.

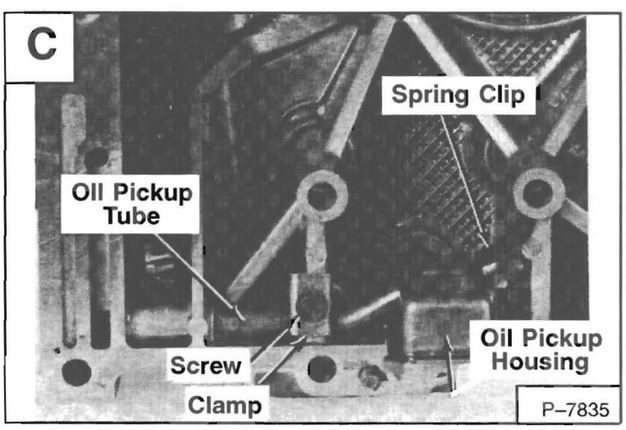
Inspect the governor gear teeth. Look for any evidence of worn, chipped, or cracked teeth. If one or more of these problems is noted, replace the governor gear.



Oil Pickup Removal

Remove the spring clip using a long–nosed pliers. Remove the oil pickup housing **[C]**.

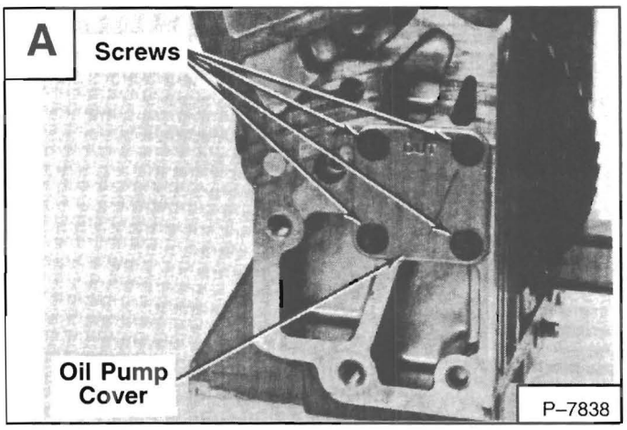
Remove the self–tapping screw, clamp, and oil pickup tube **[C]**.

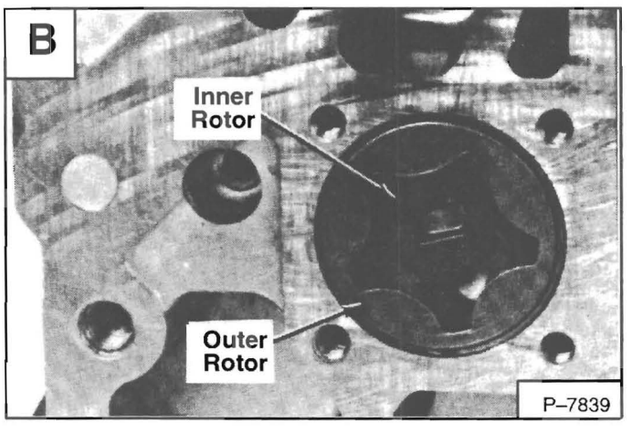


Oil Pump Removal

NOTE: The oil pump rotors, shaft, and drive gear are virtually trouble–free and normally require little service. These parts should be removed only if service or replacement is necessary.

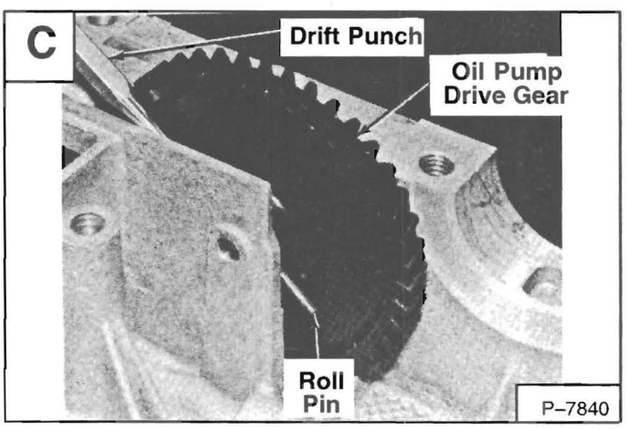
Remove the self–tapping screws, cover, and pump rotors **[A]** & **[B]**.





Using a small–diameter drift punch, drive the roll pin out of the pump drive gear and shaft. Remove shaft, drive gear, and shim spacer **[C]**.

Check oil pump gear for any cracked, chipped, or badly worn teeth. Replace gear if needed **[C]**.



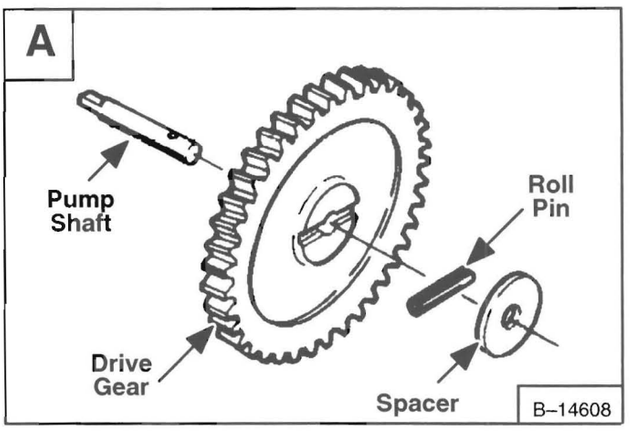
ENGINE ASSEMBLY

The tools listed will be needed to do the following procedure:

MEL1504 – Installer, PTO
MEL1505 – Installer, Flywheel
MEL1506 – Handle
MEL1507 – Seal Sleeve Kit
MEL1511 – Handle
MEL1497 – Installer

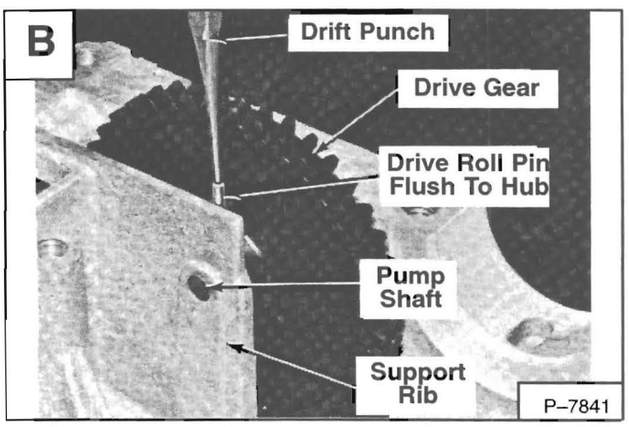
Oil Pump Installation

Install the shim spacer (next to support rib), oil pump drive gear (slotted end of gear hub towards spacer and support rib), and oil pump drive shaft (through support rib and into pump cavity) **[A]**.



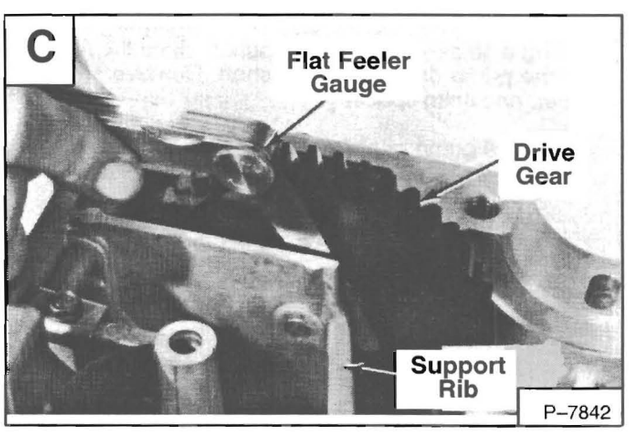
Rotate the drive shaft and drive gear until hole in shaft is aligned with slot in gear hub **[B]**.

Lubricate a new roll pin with grease. Drive the roll pin until it is flush with gear hub **[B]**.

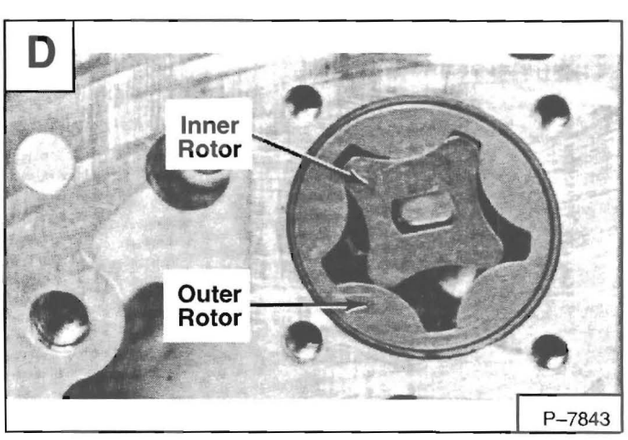


Measure pump drive gear end play with a flat feeler gauge **[C]**.

Recommend end play is 0.010/0.029 inch (0,25–0,74 mm). Add one additional shim spacer, if necessary, to bring end play within range.

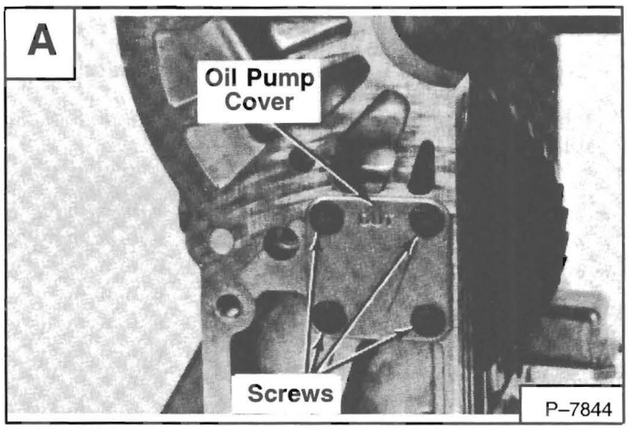


Lubricate the oil pump cavity with engine oil. Install inner and outer rotors **[D]**.



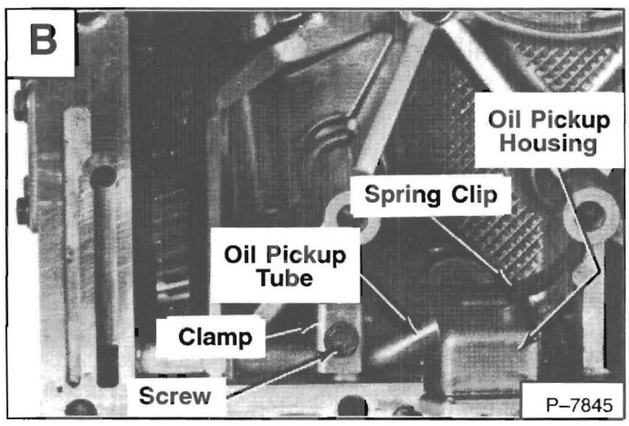
Oil Pump Installation (Cont'd)

Install the cover (side marked OUT away from crankcase) and self–tapping screws **[A]**.



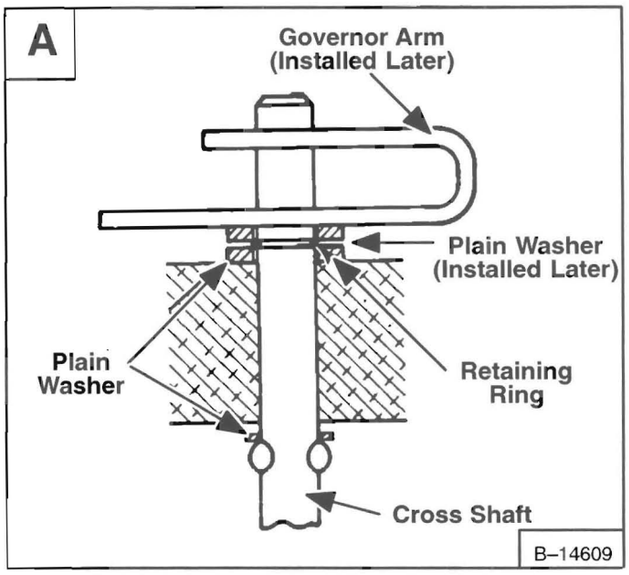
Install the oil pickup tube. Make sure tube is angled upward. Install clamp and self–tapping screw **[B]**.

Install the oil pickup housing and spring clip (install narrow side of clip into crankcase first) **[B]**.

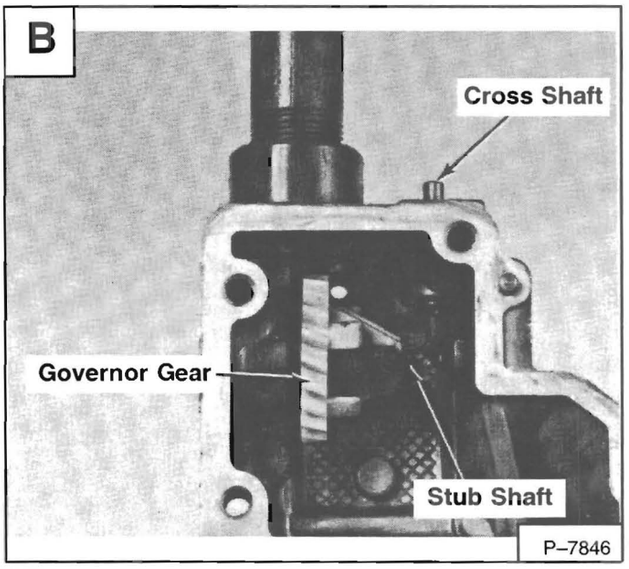


Cross Shaft and Governor Shaft Installation

Install the plain washer, cross shaft, plain washer, and retaining ring **[A]**.

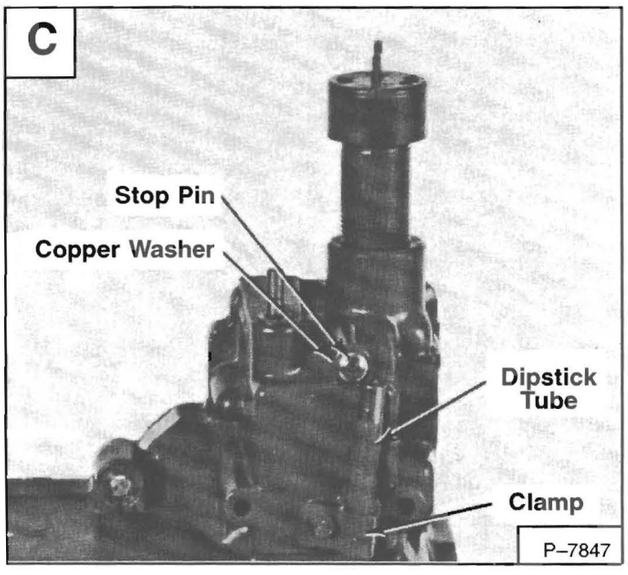


Install the thrust washer and governor gear to stub shaft **[B]**.



Install the copper washer and governor stop pin **[C]**.

NOTE: If not loosened during disassembly, loosen the clamp securing the dipstick tube to crankcase. Move the dipstick tube out of the way to ease installation of stop pin. Tighten the clamp securely after installing stop pin.



Connecting Rod Installation

Lubricate the connecting rod journals and bearings. Install the connecting rods and the caps on the crankshaft so that the two match marks are aligned and the proper cap is installed on each connecting rod **[A]**.

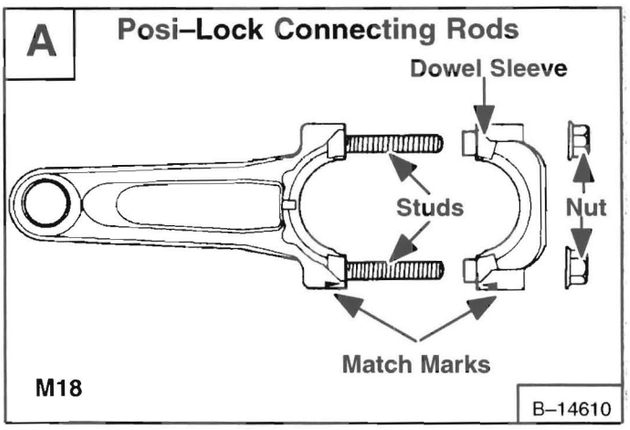
When installing a NEW Posi–Lock rod–tighten the nuts to 140 in–lbs. (16 Nm) torque.

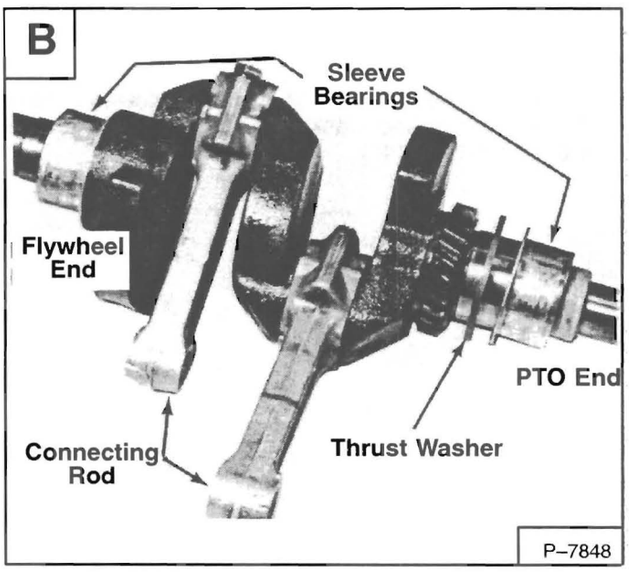
When installing USED Posi–Lock rod–tighten the nuts to 100 in–lbs. (11 Nm) torque.

NOTE: To prevent damage to the connecting rods and engine, do not overtorque – loosen – and retorque the hex nuts on Posi–Lock connecting rods. Torque the nuts, in increments, directly to the specified values.

Crankshaft and Bearing Installation

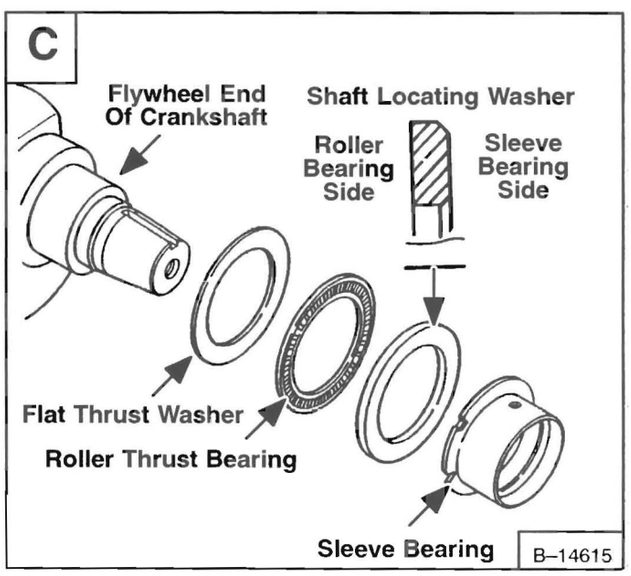
NOTE: Install the thrust washers and bearings of the same size and thickness during assembly [B].





Some engines for high thrust applications use a roller thrust bearing and flat thrust washers on the flywheel end of the crankshaft **[C]**.

Install the 0.039 inches (0.99 mm) thrust washer, roller thrust bearing, 0.156 inches (3,96 mm) shaft locating washer, and flanged sleeve bearing to flywheel end of crankshaft **[C]**.

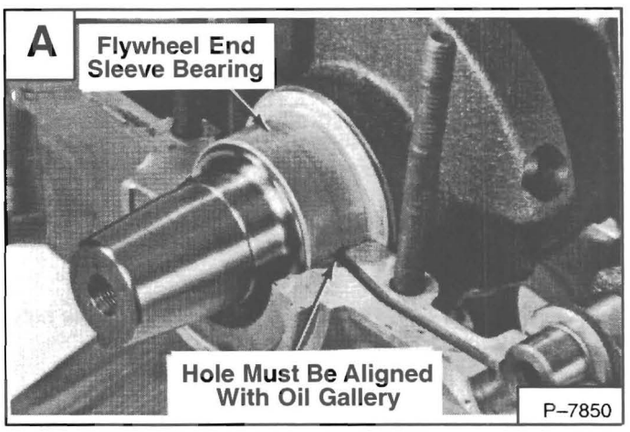


Crankshaft and Bearing Installation (Cont'd)

Install the crankshaft and rod assembly into the #1 crankcase.

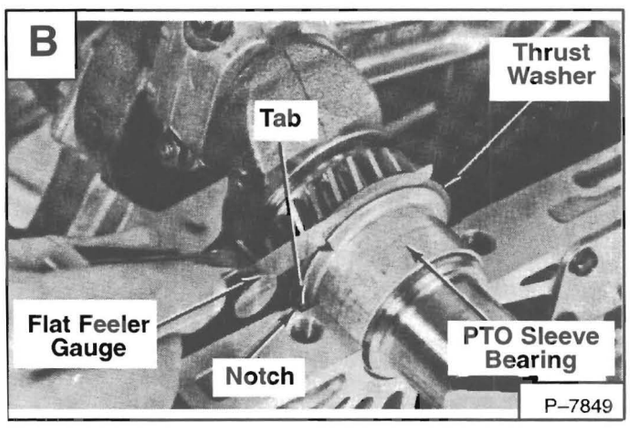
Install the sleeve bearing so the oil hole aligns with the oil gallery **[A]**.

NOTE: Improper positioning of bearings could result in engine failure do to lack of lubrication.



Locate the tab on the sleeve bearing with the notch in the crankcase **[B]**.

Measure the crankshaft end play with a flat feeler gauge. The recommended crankshaft end play is 0.002–0.014 inch (0,05–0,35 mm).

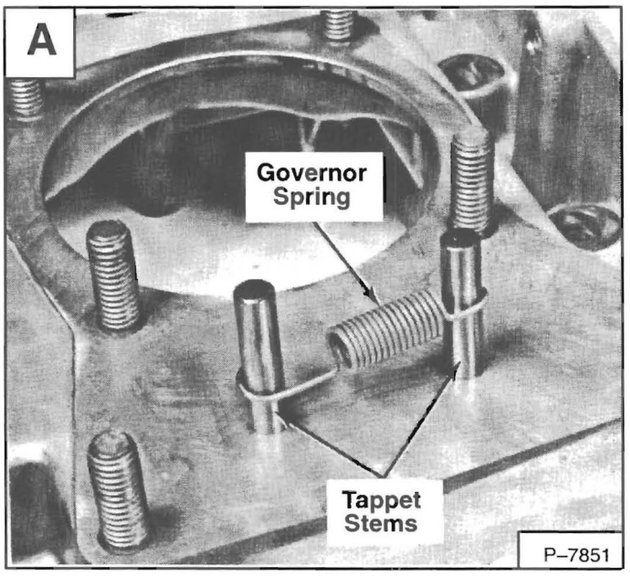


Tappets and Camshaft Installation

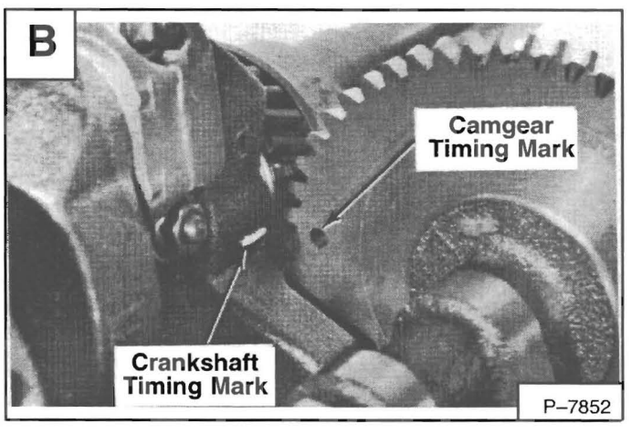
Lubricate the stems of tappets with engine oil. Install the tappets into crankcase sides. Make sure that used tappets are reinstalled into the proper sides and location (intake or exhaust) as marked during disassembly.

NOTE: The intake valve tappet is closest to the flywheel side of crankcase. The exhaust tappet is closest to the PTO side of crankcase.

Put tape or governor spring around the tappet stems in the #2 crankcase side. This prevents the tappets from falling into the #1 side when reassembling crankcase **[A]**.

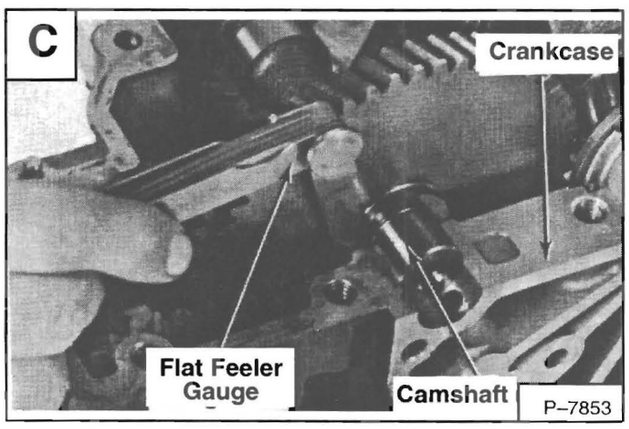


Place the camshaft into the #1 side of crankcase. Make sure the timing mark on crankshaft aligns with the timing mark on cam gear **[B]**.



Measure the camshaft end play with a flat feeler gauge. The recommended camshaft end play is 0.003–0.013 inch (0,077–0,33 mm) **[C]**.

Add shim spacers, if necessary, to bring end play within specifications.



Sealing the Crankcase

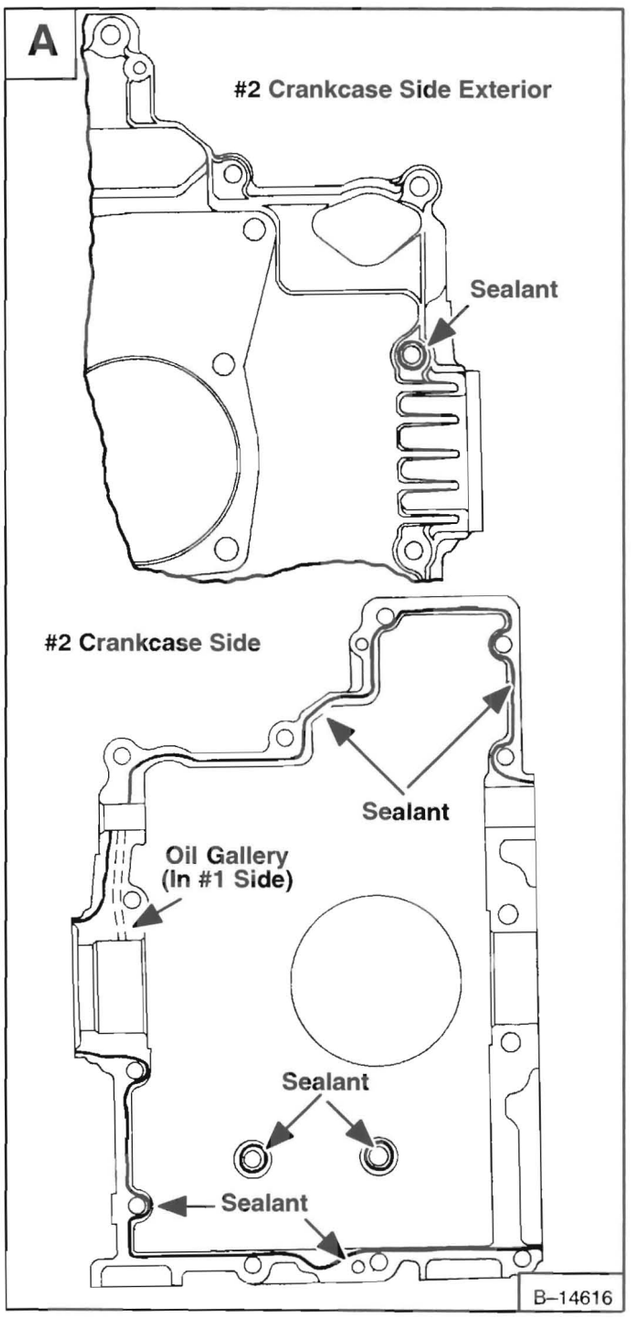
Clean the sealing surfaces of the crankcase sides and mating surfaces of crankcase and cylinder barrels.

NOTE: Do not scrape the surfaces when cleaning as this will damage the surfaces causing leaks. The use of a gasket removing solvent is recommended.

Apply a 1/16 inch (0.063 mm) bead of sealant to the #2 crankcase side **[A]**.

Be careful around the oil passages. Any sealant left in the passages will cause lack of lubrication.

The sealants listed on page 7A–43 are recommended for the M18 engine.



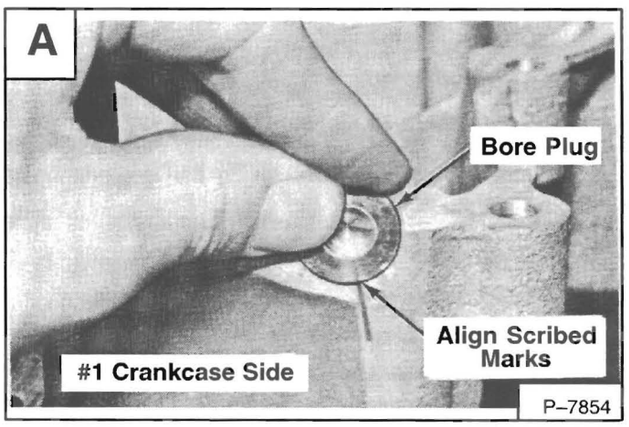
Recommended Sealants

VENDOR	PRODUCT	VENDOR NO. & DESCRIPTION	AVAILABILITY
Dow Corning	Silicone Rubber Sealant	732 Aluminum, Black, Bronze, Clear, White	Automotive, Hardware, and Discount Stores
GE	RTV Silicone Rubber	RTV102–White RTV103–Black RTV106–Red RTV108–Clear RTV 109–Gray RTV154–Gray RTV156–Red Silmate–Black	GE Silicone Products Distributors
GE	Silicone Instant Gasket	Red	Automotive, Hardware, and Discount Stores
GE	Silicone Hi Temp Instant Gasket	Red	Automotive, Hardware and Discount Stores
LOCTITE®	Superflex Silicone Adhesive Sealant	593–Black 594–White 595–Clear	LOCTITE® Distributors
Permatex	Silicone Form–A–Gasket	6 Blue 3 oz. Bubble pack tube 6B Blue 3 oz. Boxed tube 6C Blue 11 oz. Cartridge 6M Blue 12 oz. Tube 66B Clear 3 oz. Tube 66C Clear 11 oz. Tube	Automotive Hardware, and Discount Stores

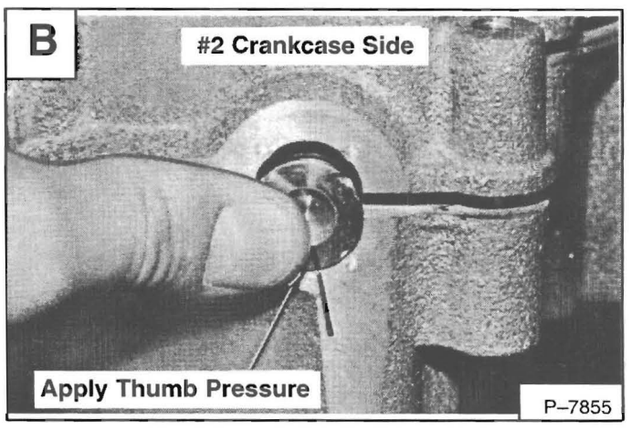
Installing Camshaft Bore Plug

Lubricate the O–ring of camshaft bore plug with engine oil. Insert the plug into the camshaft bore in flywheel end of #1 crankcase side **[A]**.

When reinstalling a used plug, make sure the marks scribed on the crankcase and plug during disassembly are aligned.



Place the #2 crankcase side on the #1 side. Apply thumb pressure on the plug as the sides are brought together. Maintain pressure on the plug as the crankcase fasteners are installed and tightened. This ensures the plug shoulder is bottomed tightly against the crankcase **[B]**.

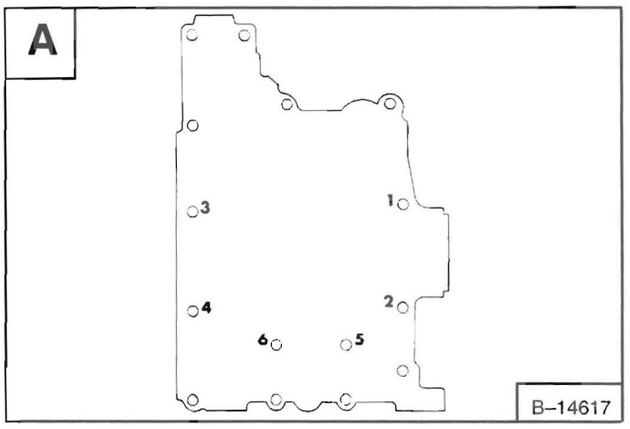


Installing Crankcase Halves

Install the hex flange screws, plain washers, and hex nuts.

Torque screws #1 through #6 in the sequence shown to a preliminary valve of 100 in.–lbs. (11,3 Nm). Torque the remaining screws to 100 in–lbs. (11,3 Nm) **[A]**.

Torque screws #1 through #4 to 260 in–lbs. Torque screws #5 and #6 to 200 in–lbs. (22,6 Nm). Torque the remaining screws to 200 in–lbs. (22,6 Nm) **[A]**.

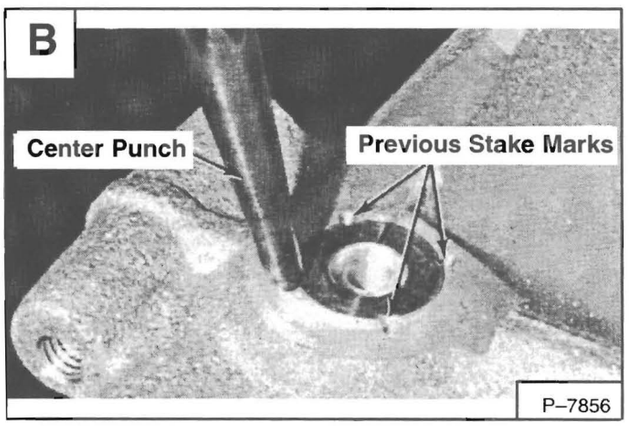


Locate a center punch in the previous stake marks surrounding the camshaft bore plug. Restake the plug securely in plate **[B]**.

IMPORTANT

DO NOT *stake* the plug on the crankcase split line.

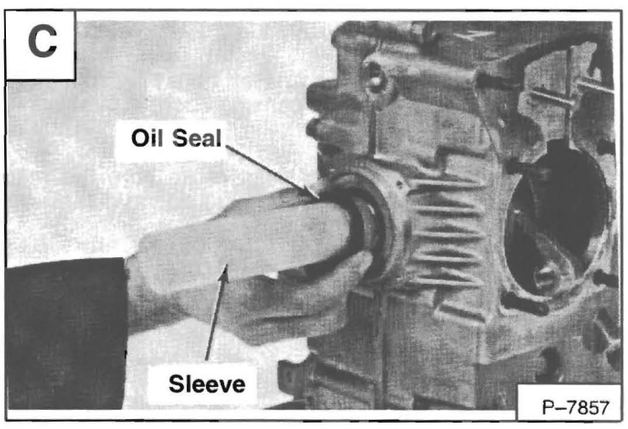
I–2103–0196



Remove the tape or governor spring from tappets in #2 crankcase side.

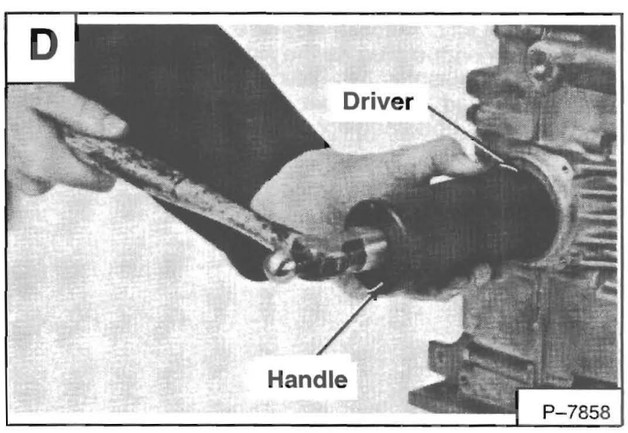
Front and Rear Seal Installation

Lubricate the lips of the front oil seal with light grease. Slide the oil seal onto the sleeve and install the sleeve over the flywheel end of the crankshaft **[C]**.



Using MEL1506 seal driver and MEL1505 – seal installer to install the seal in flywheel end of the engine **[D]** to a depth of 0.031 inches (0,795 mm).

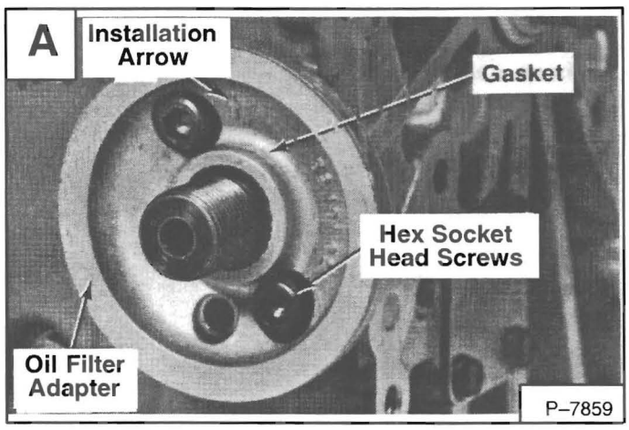
Using MEL1506 – seal driver and MEL1504 – seal installer to install the seal in the rear closure plate to a depth of 0.1562 inches (3,97 mm).



Filter Adapter Installation

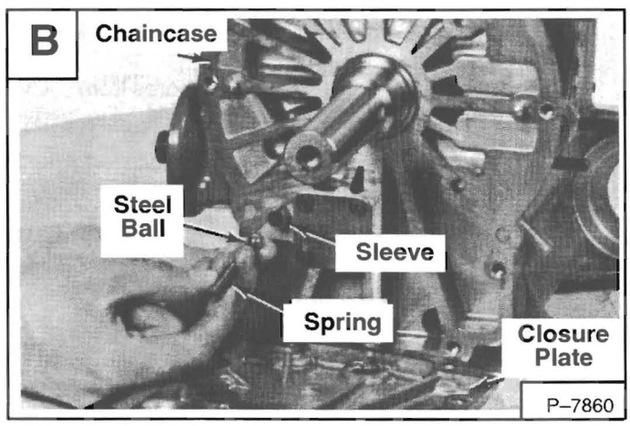
Install the gasket, oil filter adapter and hex socket head screws. Make sure the arrow on filter adapter is pointing to top of crankcase **[A]**.

Tighten the screws to 75–90 in.–lbs. (8,5–10,2 Nm) torque.



Installing Oil Pressure Relief Valve and Closure Plate

Install the oil pressure relief valve sleeve, steel ball and spring **[B]**.



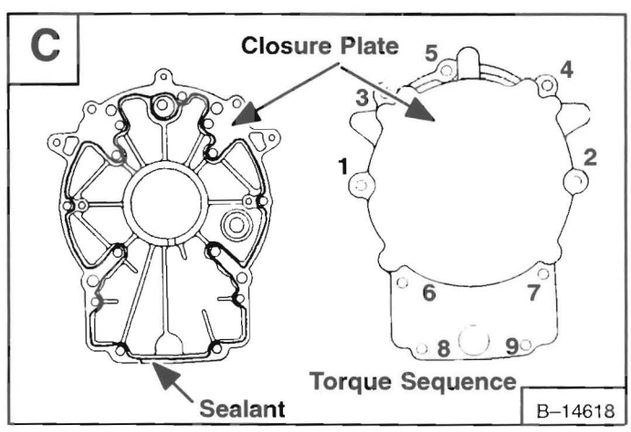
NOTE: When reinstalling a closure plate that used a gasket, install a new gasket.

NOTE: When reinstalling a closure plate that used sealant, apply a new bead of sealant to the closure plate [C].

Apply a 1/16 inch (0.063mm) bead of sealant to the closure plate as shown **[C]**.

Install the closure plate and hex flange screws.

Tighten the screws to 150 in–lbs. (17 Nm) torque in the sequence shown **[C]**.

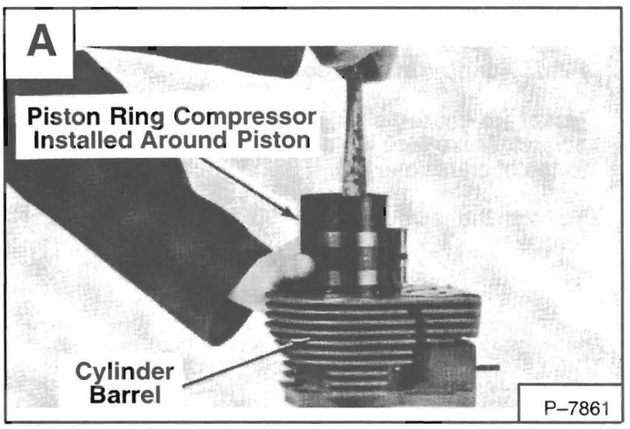


Piston Installation

NOTE: Proper orientation of the pistons within cylinder barrels is extremely important. Improper orientation may cause extensive wear or damage.

Stagger the piston rings in grooves until the end gaps are 120° apart.

Lubricate the pistons and rings with engine oil. Install piston ring compressor around pistons.



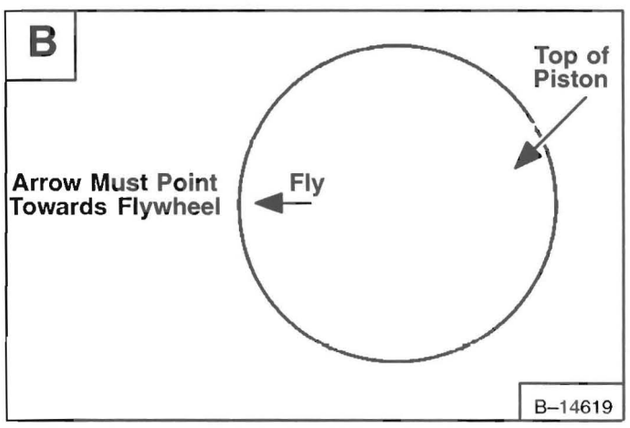
Orient the Fly mark on pistons so it points towards flywheel (intake port) side of cylinder barrels **[B]**.

Gently push the pistons into cylinder bores from cylinder head side–DO NOT pound on piston **[A]**.

Make sure that used pistons are reinstalled into the proper cylinder barrels as marked during disassembly.

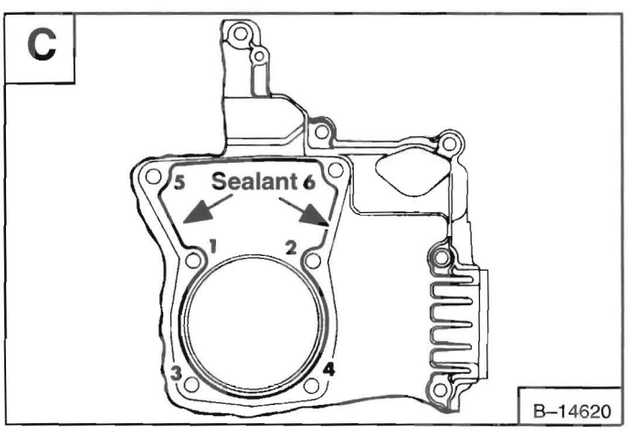
Continue pushing the piston into bore until the piston pin bore is completely exposed on the crankcase side of cylinder barrel. Make sure the oil control ring is not exposed.

Make sure the mating surfaces of crankcase and cylinder barrels are cleaned before assembly.



Apply a 1/16 inch (0,063) bead of sealant to the crankcase as shown **[C]**.

Install one new piston pin retainer in one side of each piston pin bore.



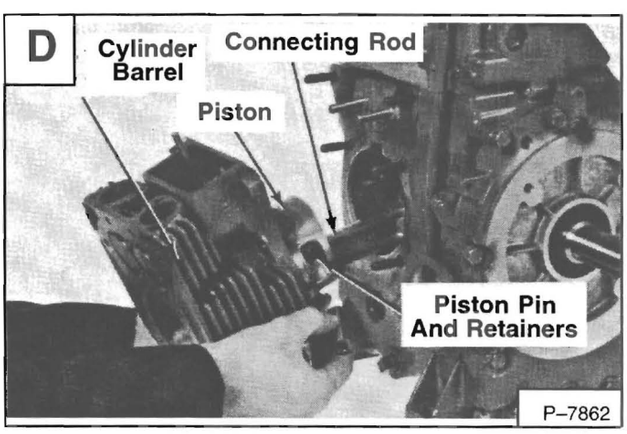
Install one new piston pin retainer in one side of each piston pin bore.

Install the pistons (inside cylinder barrels), piston pins, and new piston pin retainers to connecting rods **[D]**.

Use MEL1027 – extender wrench to tighten the nuts as follows:

Tighten the nuts to 100 in–lbs. (11,3 Nm) torque in the sequence shown **[C]**.

Tighten the nuts to a final torque of 200 in.–lbs. (22,6 Nm) in the sequence shown **[C]**.



Setting Valve To Tappet Clearance

The valve faces and seats must be lapped in before check/adjusting valve–to–tappet clearance. (See Page 7A–27 for lapping procedure.)

The piston must be at top dead center (TDC) of the compression stroke to measure valve–to–tappet clearance.

Rotate the crankshaft and look into the valve boxes. The tappets will move in only one of the boxes.

Install valve into valve guides for the cylinder in which *no movement* was observed. Hold valves firmly against seat and measure valve–to–tappet clearance with a flat feeler gauge **[A]**.

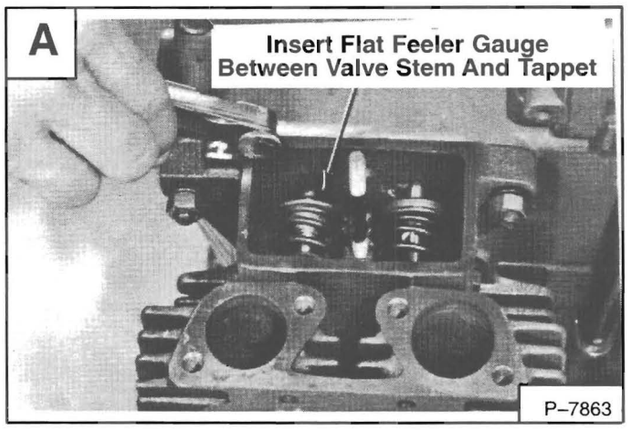
Intake Valves (Cold)	0.003–0.006 inch (0,076–0,150 mm)
Exhaust Valves (Cold)	0.011–0.014 inch (0,279–0,355 mm)

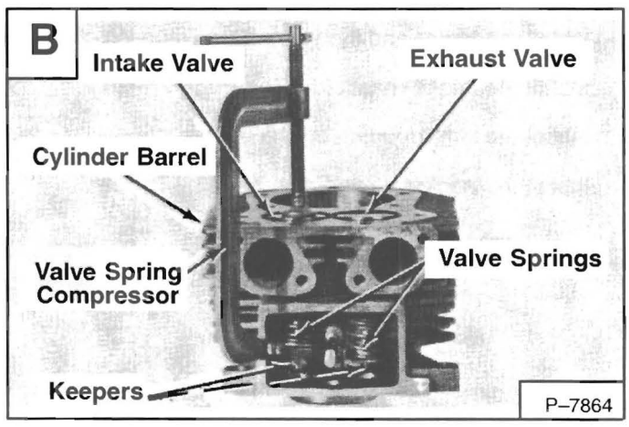
If the clearance is not correct, remove the valve and grind the stem until the clearance is correct. Make sure to grind the valve stem perfectly flat.

Valve stem seals can now be installed over the valve stem and onto the valve guides. Make sure the tip on the seal is completely over the machined area of the valve guide.

Install the upper spring retainer, spring (close coils towards cylinder head), lower spring retainer and rotators on the valve stem.

Compress the valve spring with a valve spring compressor tool and install the keepers **[B]**.





Cylinder Head Installation

Install the cylinder head bolts into the cylinder heads.

Position the head gasket on the bolts.

Install the cylinder head and gasket on the cylinder barrels. Tighten the bolts in the correct sequence, to 15–20 ft.–lbs. (20–27 Nm) torque **[A]**.

Install the breather assembly and the valve spring cover. (See Page 7A–21.)

Install the fuel pump. (See Page 7A–21.)

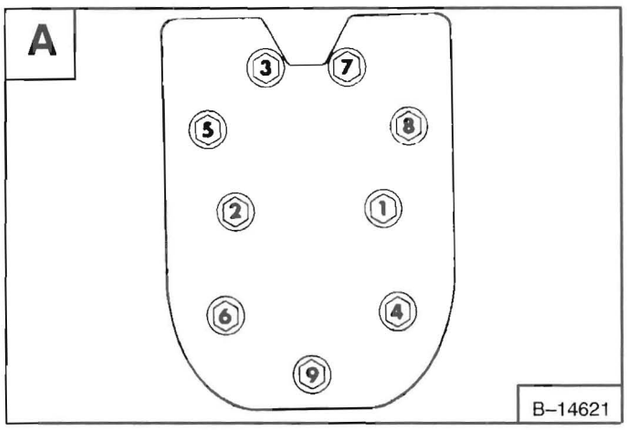
Install the starter. (See Page 6–1.)

Install the stator and flywheel. (See Page 7A–22.)

Install the intake manifold. (See Page 7A–20.)

Install the air shrouding on the engine.

Install the engine. (See Page 7A–16.)



ENGINE SERVICE 453 (KUBOTA)

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Servicing the Timing Gear and Camshaft 7B–34
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TROUBLESHOOTING
Chart 7B–3

Chart

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

⚠ WARNING

Check for correct function after adjustments, repairs or service. Failure to make correct repairs or adjustments can cause injury or death.

W–2004–1285

PROBLEM	CAUSE
Slow cranking speed.	1, 2, 3, 4
Engine will not start.	5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 22, 30, 31, 32
Difficult to start.	5, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 18, 19, 20, 21, 22, 23, 28, 30, 31, 32
No power from the engine.	8, 9, 10, 11, 12, 13, 14, 18, 19, 20, 21, 22, 23, 24, 25, 26 30, 31, 32
Engine is mis–firing.	8, 9, 10, 11, 12, 13, 14, 16, 18, 19, 20, 24, 25, 27, 28, 30, 31, 32
Too much fuel consumption.	11, 13, 14, 16, 18, 20, 22, 23, 24, 26, 27, 28, 30, 31, 32
Black exhaust.	11, 13, 14, 16, 18, 19, 20, 22, 23, 24, 26, 27, 28, 30, 31, 32
Blue/White exhaust.	4, 16, 18, 19, 20, 24, 26, 30, 32, 33, 34, 44, 54
Low oil pressure.	4, 35, 36, 37, 38, 39, 41, 42, 32, 56
Engine knocking.	9, 14, 16, 18, 19, 22, 25, 27, 28, 30, 32, 34, 35, 44, 45, 57
Engine running rough.	7, 8, 9, 10, 11, 12, 13, 14, 16, 20, 21, 25, 27, 28, 29, 32, 34 44, 57
Vibration.	13, 14, 20, 24, 25, 28, 29, 32, 44, 47
High oil pressure.	4, 37, 40
Overheating.	11, 13, 14, 16, 18, 19, 23, 24, 44, 46, 48, 49, 50, 51, 52, 55
Too much crankcase pressure.	24, 30, 32, 33, 44, 53
Poor compression.	11, 19, 24, 27, 28, 30, 31, 32, 33, 45, 57
Start and stop.	10, 11, 12

Chart (Cont'd)

DESCRIPTION OF THE CAUSE	
1. Battery capacity low.	30. Worn cylinder bores.
2. Bad electrical connection.	31. Worn valves and seats.
3. Faulty starter motor.	32. Broken, worn or sticking piston rings.
4. Incorrect grade of oil.	33. Worn valve stems and guides.
5. Low cranking speed.	34. Overly full air cleaner.
6. Fuel tank empty.	35. Worn or damaged bearings.
7. Faulty stop control operation.	36. Not enough oil in the oil pan.
8. Plugged fuel line.	37. Gauge is not correct.
9. Faulty fuel lift pump.	38. Oil pump worn.
10. Plugged fuel filter.	39. Pressure relief valve is open.
11. Restriction in the air cleaner.	40. Pressure relief valve is sticking closed.
12. Air in the fuel system.	41. Broken relief valve spring.
13. Faulty fuel injection pump.	42. Faulty suction pipe.
14. Faulty fuel injectors.	43. Plugged oil filter.
15. Incorrect use of the glow plugs.	44. Piston seizure.
16. Glow plugs not working.	45. Incorrect piston height.
17. Broken fuel injection pump drive.	46. Damaged fan.
18. Incorrect fuel pump timing.	47. Faulty engine mounting.
19. Incorrect valve timing.	48. Faulty thermostat.
20. Poor compression.	49. Restriction in the water jacket.
21. Plugged fuel tank vent.	50. Loose fan belt.
22. Incorrect type or grade of fuel.	51. Plugged radiator.
23. Exhaust pipe restriction.	52. Faulty water pump.
24. Cylinder head gasket leaking.	53. Plugged breather pipe.
25. Overheating.	54. Valve stem seals damaged.
26. Cold running.	55. Coolant level low.
27. Incorrect valve tappet adjustment.	56. Plugged oil pump pipe strainer.
28. Sticking valves.	57. Broken valve spring.
29. Incorrect high pressure tubelines.	

Replacing the Fuel Filter

The fuel filter (Item 1) **[A]** is on the right hand side of the engine compartment. Replace the fuel filter every 250 hours of loader operation.

To replace the fuel filter, use the following procedure:

Clean the area round the fuel filter.

Shut–off the fuel at the fuel tank (Item 1) **[B]**.

Remove the thumb screw (Item 2) **[A]** at the bottom of the filter, drain the fuel from the filter.

Remove the filter by removing the bolt (Item 3) **[A]** at the top of the filter head while holding the nut below the filter bowl. Remove the filter bowl.

Check the condition of the seals and replace as needed.

Install the filter, bowl, nut and thumb screw. Tighten the thumb screw finger tight only.

Turn the fuel shut–off valve to the ON position (Item 1) **[B]**.

Remove the air from the fuel system.

Removing the Air From the Fuel System

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

To remove the air from the fuel system, use the following procedure:

Raise the operator cab. (See Page 1–1.)

Open vent (Item 4) **[A]**

Operate the hand pump (Item 1) **[C]** until fuel flows with no air bubbles. Tighten the vent plug.

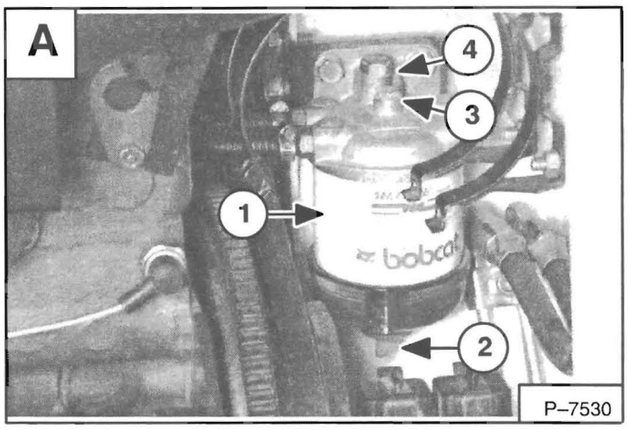
Open the vent (Item 1) **[D]** on the fuel injection pump.

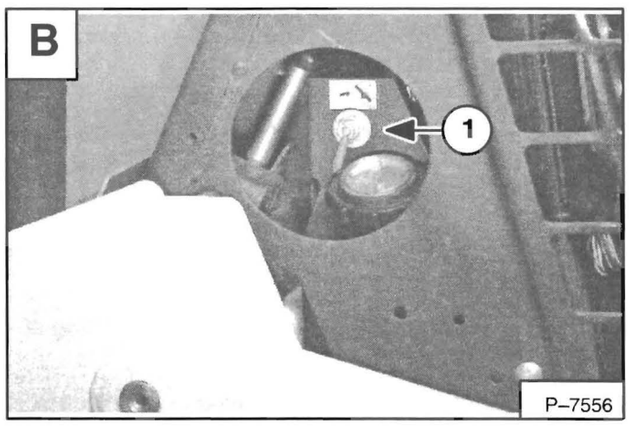
Operate the hand pump at the top of the fuel tank (Item 1) **[C]** until the hand pump feels solid.

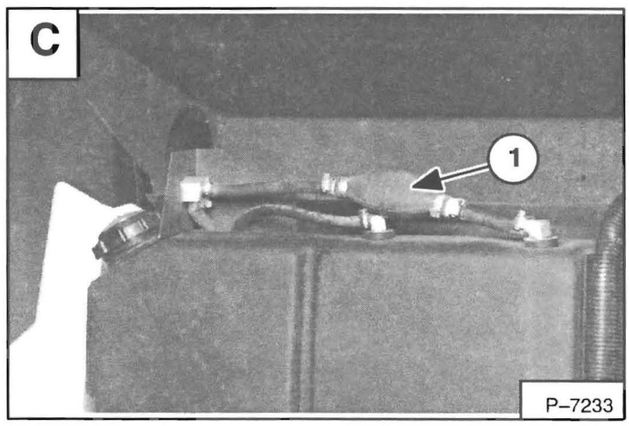
Close the vent plug (Item 1) **[D]**.

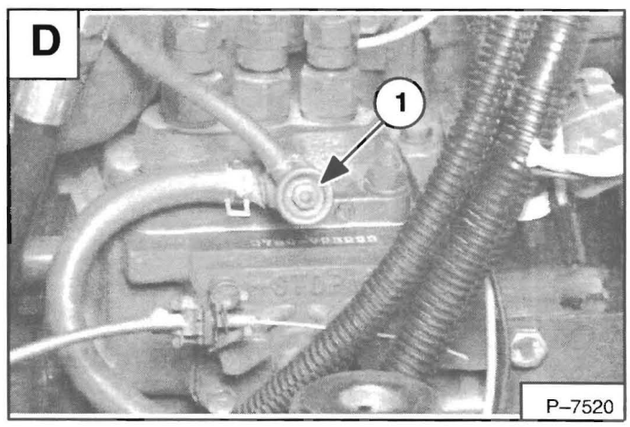
Lower the operator cab. (See Page 1–1.)

Start the engine. It may be necessary to open the vent plug (Item 1) **[D]** until the engine runs smoothly.









Fuel Injection Pump

The injection pump has parts that have been machined to a very close specification and pump operation has a direct effect on the engine performance.

Use special care when working on the injection pump.

Checking the Injection Pump

The tools listed will be needed to do the following procedure:

MEL1237 – Adapter Fuel Line
MEL1173–1 – Pressure Gauge

To check the initial discharge pressure, remove a high pressure tubeline (Item 1) **[A]** from the fuel injection pump.

Loosen the other end of the tubeline at the injector, so that the tubeline can be turned away from the fitting.

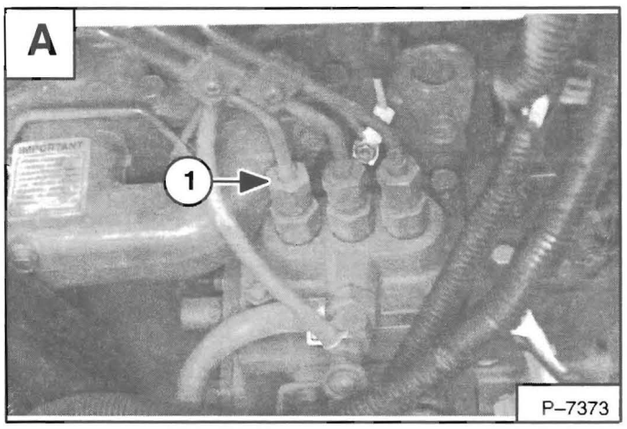
Connect a pressure gauge to the long leg of the test tubeline (Item 1 & 2) **[B]** and tighten.

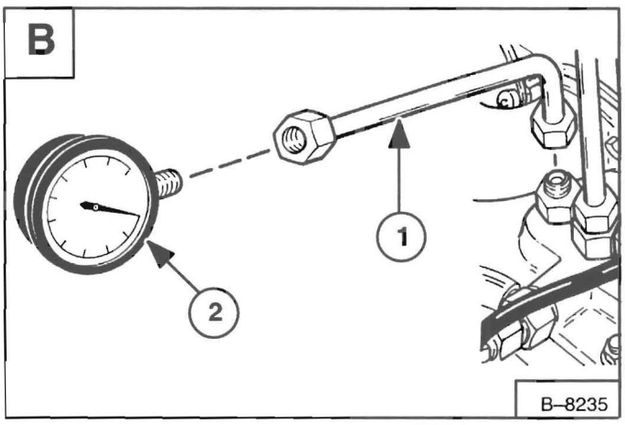
Connect the short leg of the tubeline to the fitting at the fuel injection pump (Item 2) **[B]**.

With the starter, rotate the engine to increase the pressure to 2133 PSI (14707 kPa). Align the plunger with TDC.

The pressure should hold at 2133 PSI (14707 kPa), for 5 seconds or more.

If the time is less than the allowable limit, replace the injection pump.





Removing the Injection Pump

IMPORTANT

Do not attempt to maintain or adjust unless you are trained and have the correct equipment.

I–2028–0289

Clean the injection pump and area around it with a cleaning solvent or steam cleaning.

IMPORTANT

Never steam clean or put cold water on an injection pump while the engine is running or while it is hot. If you do it will cause serious damage to the injection pump.

Use these tools for the following procedure:

MEL1270 – Fuel Line Removal Tool
MEL1271 – Delivery Valve Removal Tool

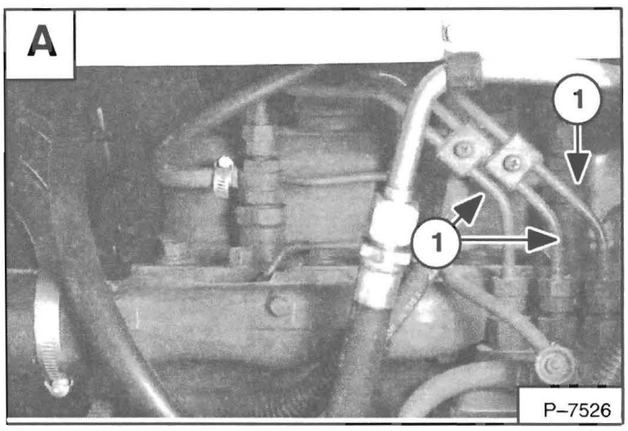
Remove the injector nozzle tubelines (Item 1) **[A]**.

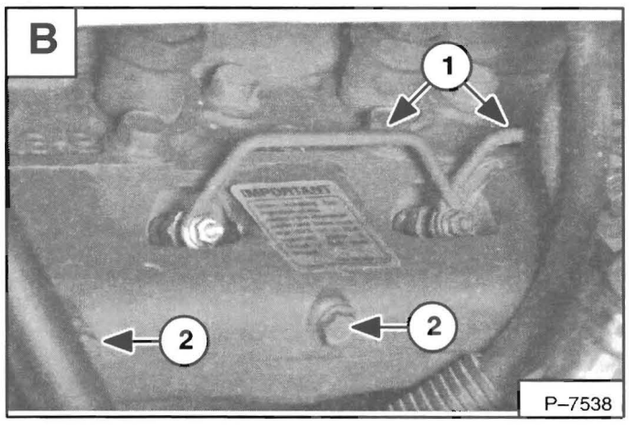
Disconnect the wires (Item1) **[B]** from the glow plugs.

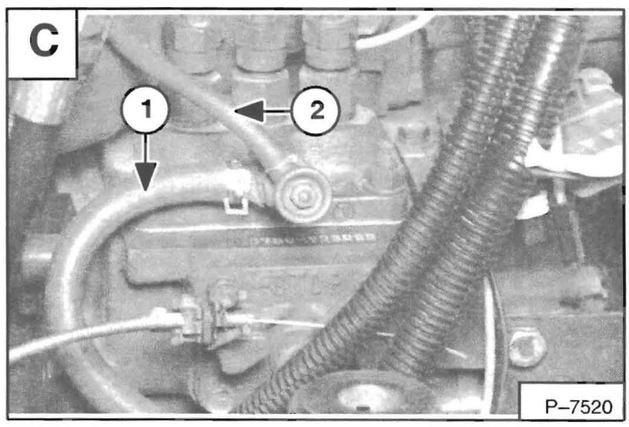
Remove the bolts (Item 2) **[B]** from the intake manifold. Remove the intake manifold from the engine.

Disconnect the fuel inlet hose (Item 1) **[C]**.

Disconnect the fuel return hose (Item 2) **[C]**.







Removing the Injection Pump (Cont'd)

Remove the engine lift hook (Item 1) **[A]**.

Remove the four nuts from the injection pump **[A]**.

Put the pin in the control rack in alignment with the slot in the engine block (Item 1) **[B]**.

NOTE: Make note of the number of shims installed under the injection pump. The shims are for the engine timing.

Installing the Injection Pump

When the injection pump is installed, make sure the pin on the control rack is correctly installed in the fork lever number 1 slot (Item 1) **[B]**. If the pin is not correctly installed, the engine will run over maximum speed and serious damage can result.

To install the injection pump, use the following procedure:

Install the injection pump with the shims between the pump housing and the engine block **[B]**.

Tighten the four nuts to 17–20 ft.–lbs. (23–27 Nm) torque.

Install the fuel inlet hose and the return hose. (See Page 7B–7.)

Install the intake manifold and tighten the bolts.

Install the engine lift hook.

Connect the wires to the glow plug.

Install the high pressure tubelines at the injection pump and injector nozzles. Tighten to 11–19 ft.–lbs. (15–26 Nm) torque.

Remove the air from the fuel system. (See Page 7B–5.)

Timing the Injection Pump

Timing the fuel injection pump is done by changing the number of shims between the injection pump and engine block (Item 1) **[C]**. Each shim will change the timing 1.5 degrees. The timing of the pump will be later when a shim is added, and earlier when a shim is removed.

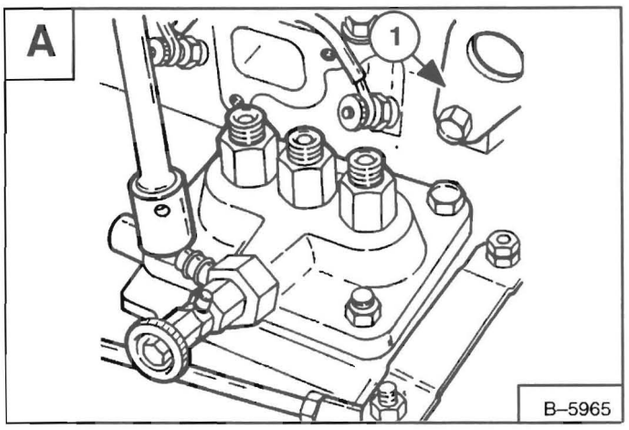
To time the injection pump, use the following procedure:

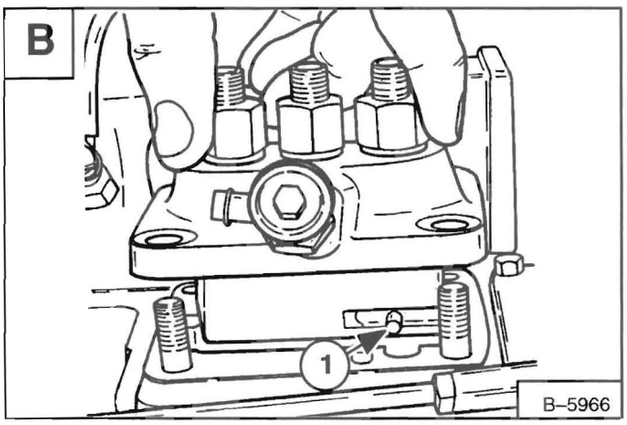
Remove the number 1 cylinder high pressure tubeline from the injection pump.

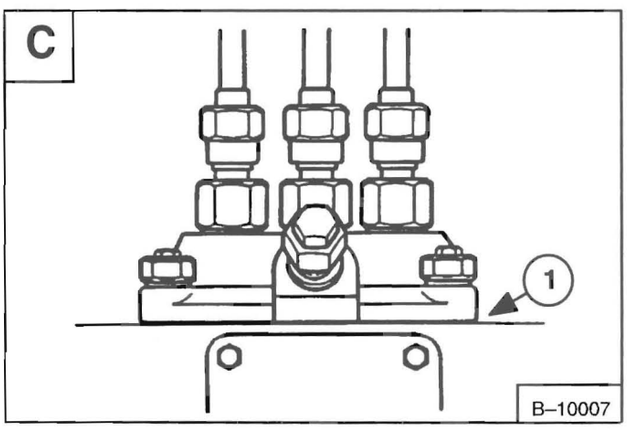
Install a short pipe to the number 1 outlet of the pump. Point the pipe up (vertical).

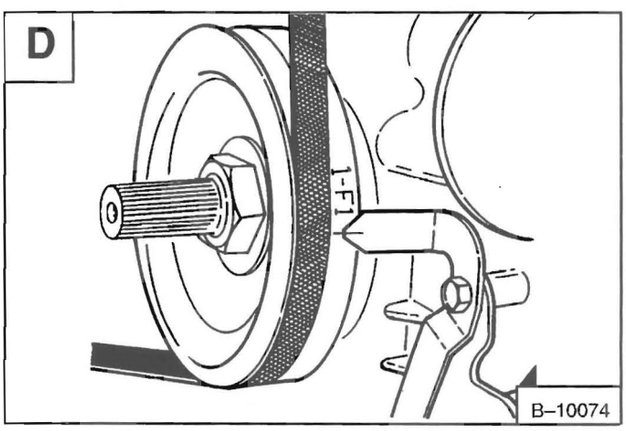
With supply to the injection pump, rotate the engine in a counterclockwise direction (viewed from the flywheel side of the engine). Fuel must flow from the pipe as the mark 1–F1 on the crankshaft pulley and the point are in alignment **[D]**. The correct timing for the engine is 23 to 25 degrees B.T.D.C.

Add or subtract shims as needed to adjust the delivery time of the fuel injection pump. Each shim will change the timing 1.5 degrees.









Fuel Injector Nozzles

⚠ WARNING

Keep away from fuel under pressure in injector system. It may not be visible. Wear safety goggles. Fuel under pressure can penetrate skin or eyes causing serious injury. If fluid enters skin or eyes, get immediate medical attention.

W–2072–1285

These are some engine problems caused by damaged injector nozzles.

- The engine is hard to start or will not start.
- Engine operation is not smooth.
- The engine will not idle correctly.
- Bad engine performance.
- The engine exhaust smoke is black, white or blue.

Remove the injector nozzles from the engine and test the injectors only after engine performance shows that there may be damage.

Removing the Fuel Injector Nozzle

The tool listed will be needed to do the following procedure:

MEL1181 – Socket

To remove the injector nozzles, use the following procedure:

Remove the high pressure tubelines (Item 1) **[A]** from the injectors.

Remove the fuel return hoses (Item 2) **[A]** from the banjo fittings.

Remove the banjo fittings (Item 3) **[A]** from the fuel injector nozzles.

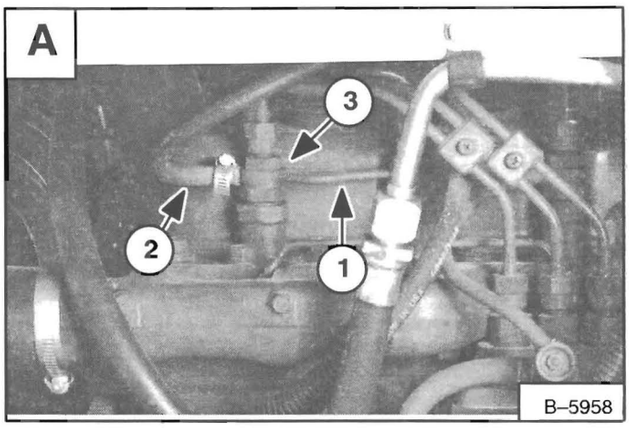
Loosen the fuel injector with a special socket **[B]**.

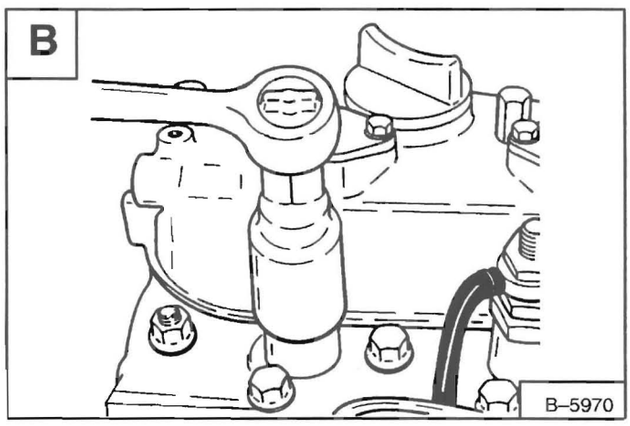
Remove the fuel injector nozzle from the engine **[C]**.

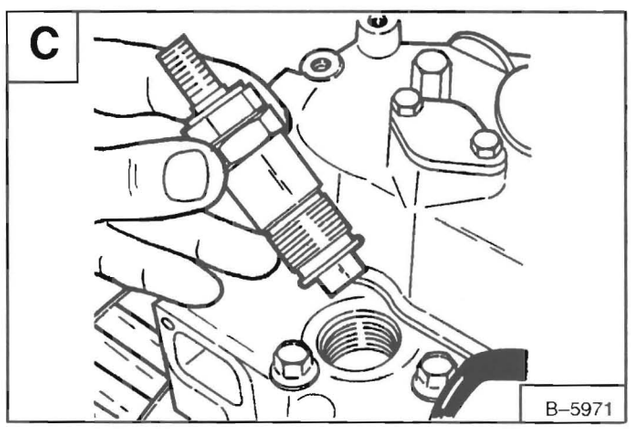
IMPORTANT

Do not disassemble or test the fuel injector nozzles unless you have the correct service and testing tools.

I–2027–0284







Checking Fuel Injector Nozzles

The tools listed will be needed to do the following procedure:

MEL10018 – Injector Nozzle Tester
MEL10019 – Accessory Set

NOTE: You can adjust the release pressure of the injector nozzle by adding or removing spacers (Item 1) [A] from the top of the nozzle spring (Item 2) [A]. Each spacer will change the release pressure about 142 PSI (980 kPa). The release pressure must be 1990–2133 PSI (13721–14707 kPa).

Connect the injector nozzle to the tester with the nozzle in the down position **[B]**.

Slowly operate the hand lever of the test pump until the injector nozzle valve opens. The pressure must be 1990–2133 PSI (13721–14707 kPa).

If the pressure is not correct, disassemble the injector nozzle and add or remove spacers (Item 1) **[A]**.

NOTE: When assembling the injector nozzle, tighten the retainer nut (Item 3) [A] to 43–58 ft.–lbs. (59–79 Nm) torque. Any higher torque will cause slow action of the valve.

Check for inside leakage. Operate the hand lever until the pressure is almost enough to open the injector valve. Make a record of the pressure. Release the hand lever. Check the pressure decrease to 10 seconds. The nozzle has damage if the pressure decrease is more than 740 PSI (5162 kPa) in 10 seconds.

Check the spray pattern of the nozzle for the following conditions **[C]**:

Does not come out the side of the nozzle.
Does not have drops coming from the nozzle.
Does not have a flow (solid stream) coming from the nozzle.

Any of the above conditions show a defect or a dirty injector nozzle. Clean the nozzle that does not operate correctly and check again.

Installing the Fuel Injector Nozzle

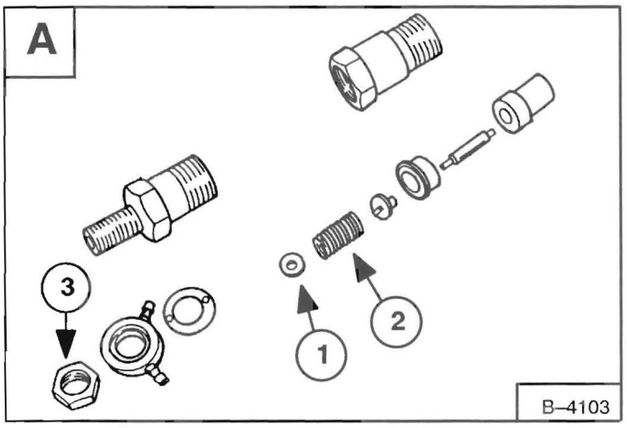
Install the injector nozzle in the cylinder head and tighten to 21–36 ft.–lbs. (29–49 Nm) torque.

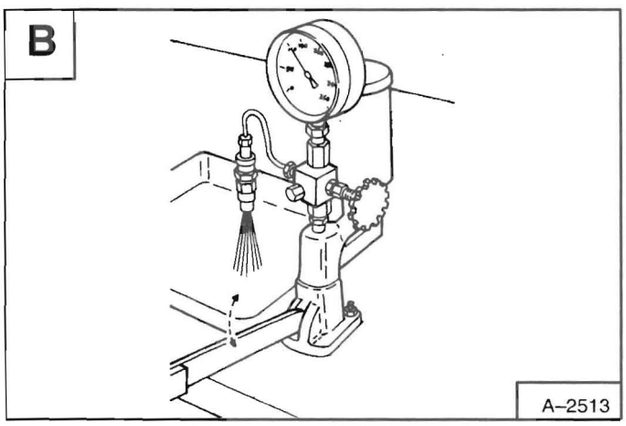
Install the banjo fitting on the injector nozzle and tighten.

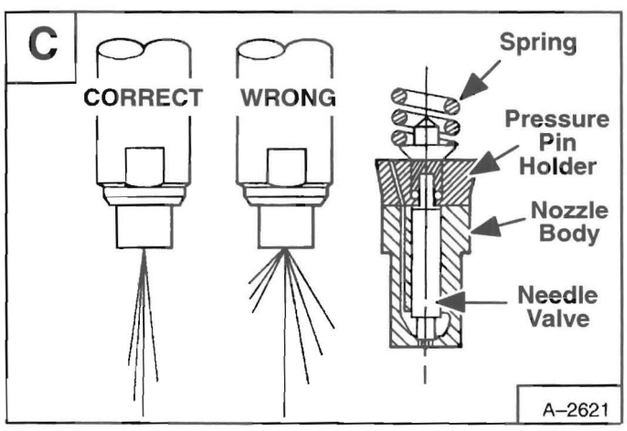
Connect the return fuel line to the banjo fittings.

Install the high pressure tubelines at the injectors and tighten.

Remove the air from the fuel system. (See Page 7B–5 for the correct procedure.)







⚠ WARNING

Keep away from fuel under pressure in injector system. It may not be visible. Wear safety goggles. Fuel under pressure can penetrate skin or eyes causing serious injury. If fluid enters skin or eyes, get immediate medical attention.

W–2072–1285

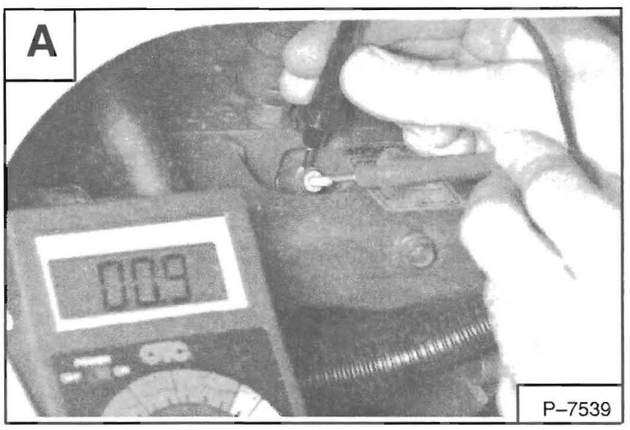
Checking Glow Plugs

Disconnect the glow plug wires.

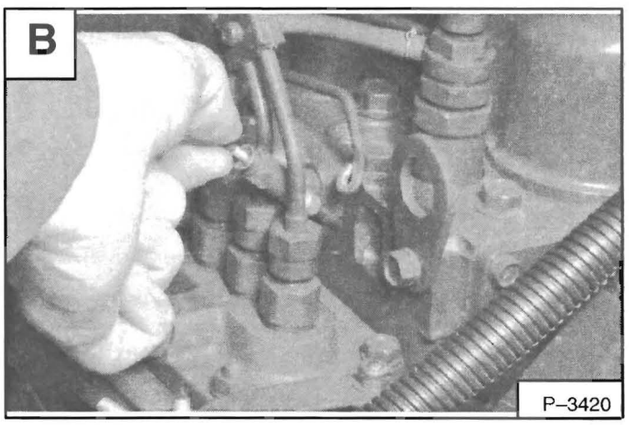
Touch one probe to the end of the glow plug and the other probe to the body of glow plug **[A]**.

The reading must be approximately 1.5. If the resistance is zero ohms the glow plug has a short circuit. If the resistance is infinite the coil of the glow plug is broken.

Repeat the procedure for each glow plug.



Replace the glow plugs as needed **[B]**.



Engine Compression Test

The tool listed will be needed to do the following procedure:

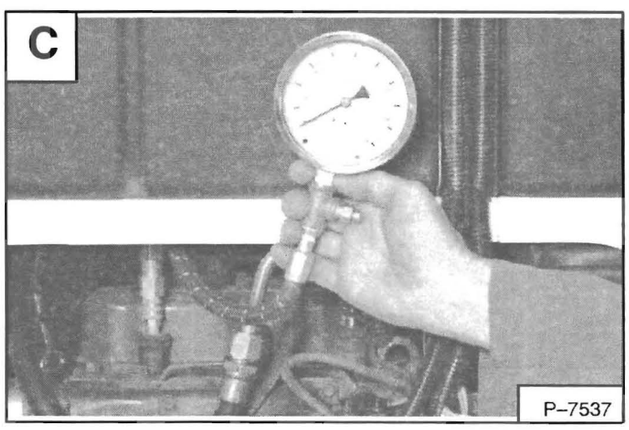
MEL10630 – Engine Compression Test Kit

Warm the engine.

Remove the fuel injector nozzles from the engine. (See Page 7B–9.)

Install the compression adapter in the cylinder head.

Connect the compression gauge to the adapter **[C]**.



Turn the engine with the starter at 200 to 300 RPM. Run the test for each cylinder two times at 5 to 10 seconds each time and take the average reading.

The correct compression for the engine is 337–448 PSI (2324–3089 kPa) with no more than 10% difference between the cylinders.

OIL COOLER & SHROUDING

Removal and Installation

Open the rear door.

Remove the oil cooler hose and tubeline (Item 1) **[A]**. Drain the hydraulic oil into a clean container.

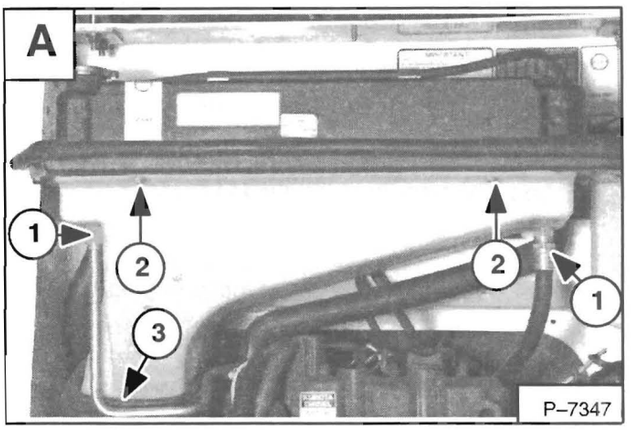
Remove the two bolts (Item 2) **[A]** from the oil cooler shrouding.

Slide the oil cooler and shrouding to the rear to remove.

Remove the rubber seal (Item 3) **[A]** between the shroud and the blower housing.

The oil cooler will lift out of the shroud.

Reverse the procedure to install the oil cooler and shroud.



RADIATOR

Removal and Installation

Open the rear door.

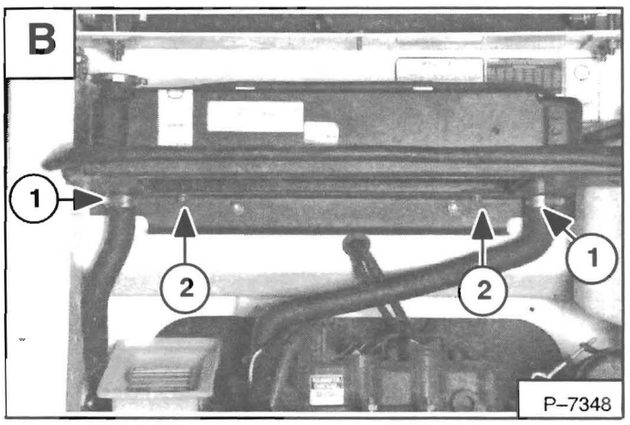
Remove the oil cooler and shroud (see above).

Drain the coolant from the engine. (See Page 7B–15.)

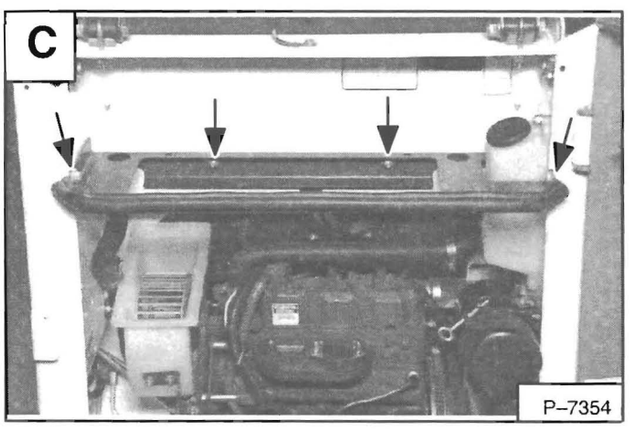
Remove the hose clamps (Item 1) **[B]** from the radiator.

Remove the two (2) mounting bolts (Item 2) **[B]**. Remove the radiator.

Reverse the procedure to install the radiator.



Remove the bolts from the radiator mounting bracket **[C]**. Remove the bracket.



ENGINE SPEED CONTROL

Adjustment

Install jackstands under the rear of the loader. (See Page 1–1.)

Raise the lift arms. (See Page 1–1.)

Raise the operator cab. (See Page 1–1.)

Remove the center shield and left steering lever panel. (See Page 3–1.)

Mark the position of the two adjustment bolts and nuts (Item 1) **[A]** for installation purposes.

Move the bolts as needed to adjust the engine speed.

Removal and Installation

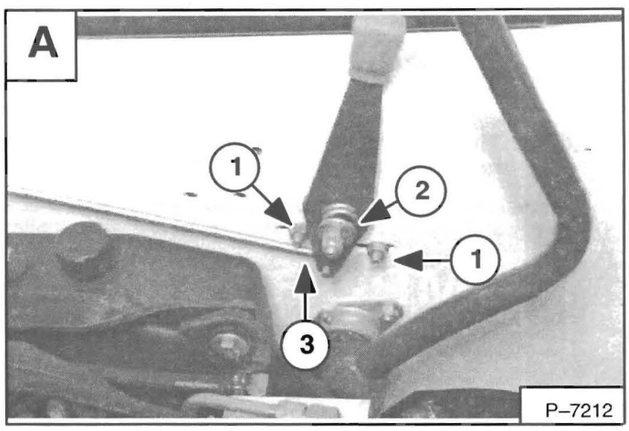
Remove the mounting bolt and nut (Item 2) **[A]**, and the tension spring from the speed control mounting bracket.

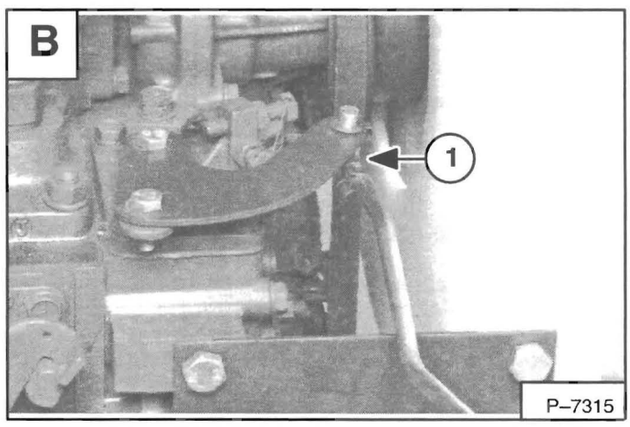
Remove the lever and fiber washer between the lever and the fender.

Installation: Tighten the mounting bolt until the speed control lever moves back and forth at a comfortable tension.

Remove the speed control rod (Item 3) **[A]** from the lever.

Remove the clip (Item 1) **[B]** from the speed control lever. Remove the speed control rod from the lever.





Removal and Installation

NOTE: The engine and hydrostatic pumps are removed from the loader as an assembly.

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.

I–2003–0888

Put jackstands under the rear of the frame. (See Page 1–1.)

Raise the operator cab. (See Page 1–1.)

Raise the lift arms and install the lift arm support device. (See Page 1–1.)

Remove the center shield and steering lever panels. (See Page 3–1.)

Disconnect the charge pressure hose (Item 1) **[A]** from the hydrostatic pump.

Remove the hydraulic reservoir. (See Page 2–1.)

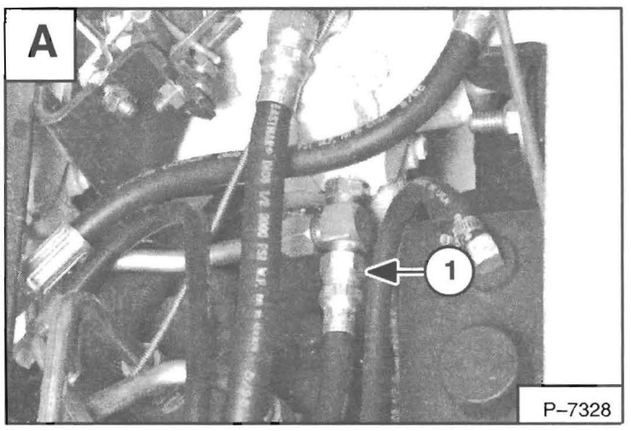
Remove the nuts (Item 1) **[B]** from the steering lever linkage. Remove the linkage from the hydrostatic pumps.

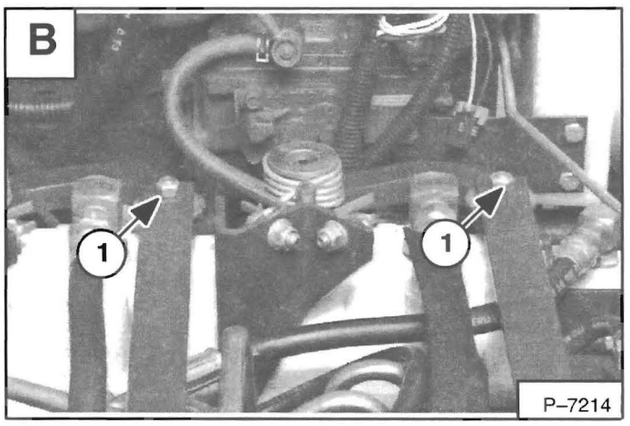
Disconnect the speed control linkage from the injector pump. (See Page 7B–13.)

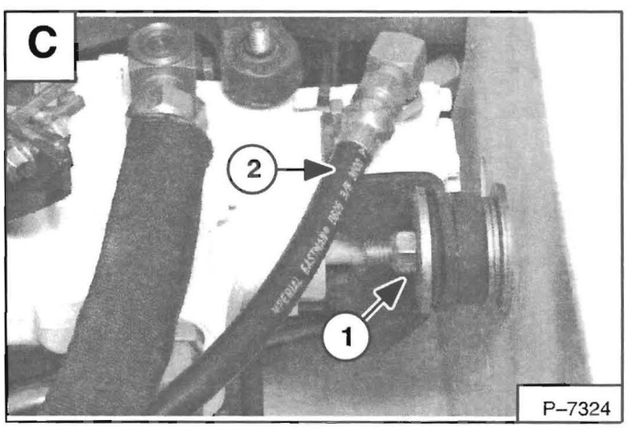
Disconnect the outlet hose (Item 2) **[C]** from the hydraulic pump.

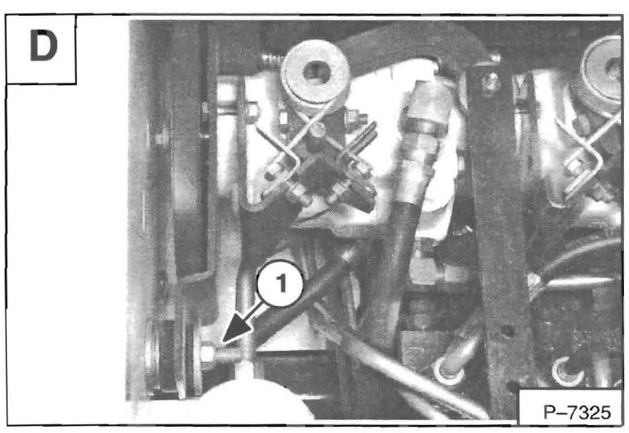
Remove the nuts (Item 1) **[C]** & **[D]** and bolts from the hydrostatic pump mounts.

Remove the high pressure hoses from the drive motors. (See Page 3–1.)





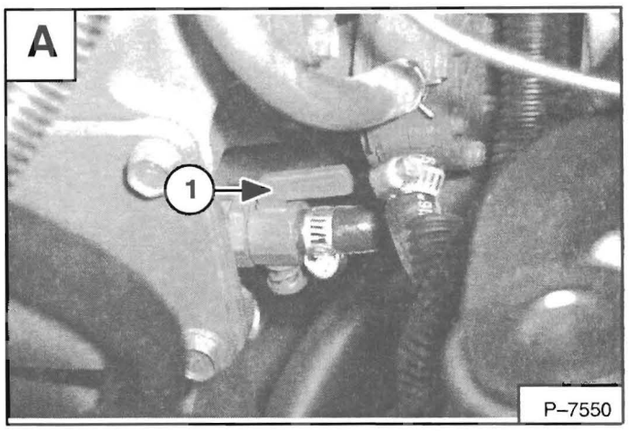




Removal and Installation (Cont'd)

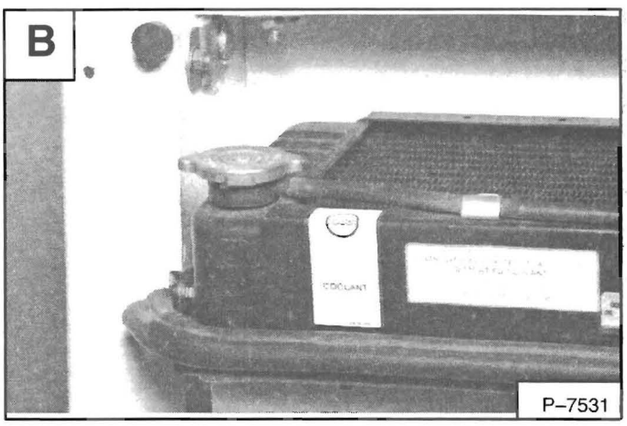
Open the rear door and route the engine coolant drain hose into a clean container.

Open the coolant valve (Item 1) **[A]** to drain the coolant.



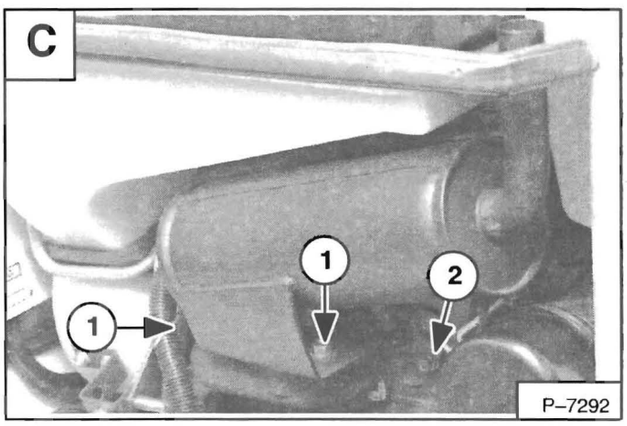
Open the radiator cap **[B]**.

Remove the battery from the loader. (See Page 6–1.)



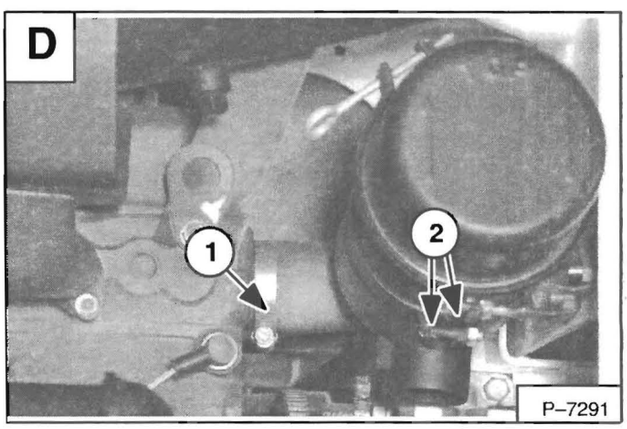
Remove the nuts (Item 1) **[C]** from the muffler exhaust manifold and loosen the support bracket nut (Item 2) **[C]**.

Remove the muffler.



Loosen the hose clamp (Item 1) **[D]** from the air intake hose.

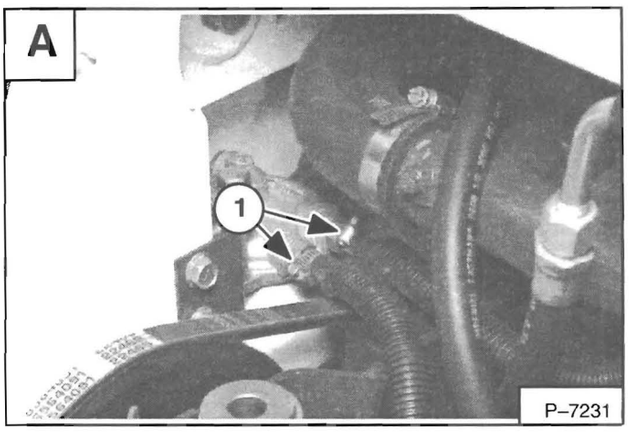
Remove the air cleaner clamps (Item 2) **[D]**. Remove the air cleaner.



Removal and Installation (Cont'd)

Disconnect the fuel lines (Item 1) **[A]** from the fuel filter.

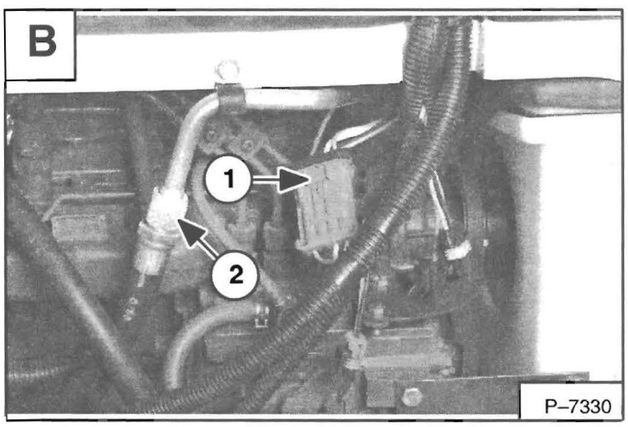
Plug the fuel lines to prevent fuel spills.



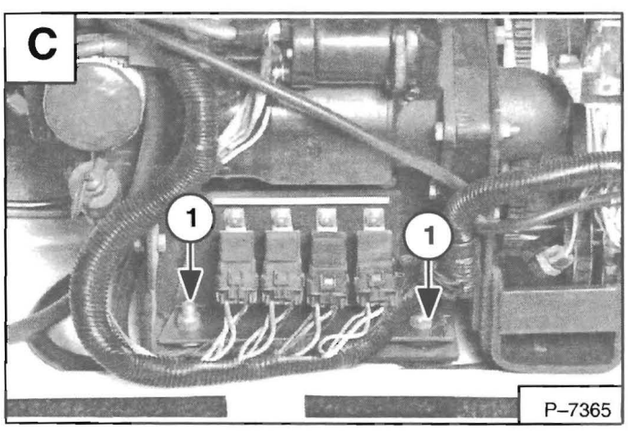
Disconnect the electrical harness (Item 1) **[B]** from the engine.

Remove the hose (Item 2) **[B]** from the oil cooler tubeline.

Disconnect the wire from the glow plugs.

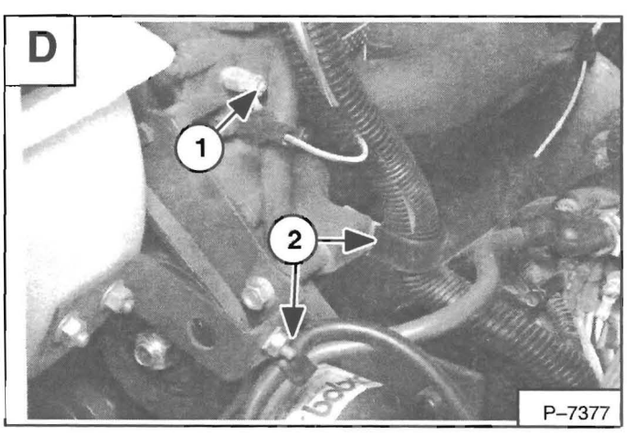


Remove the two engine mounting bolts (Item 1) **[C]**.



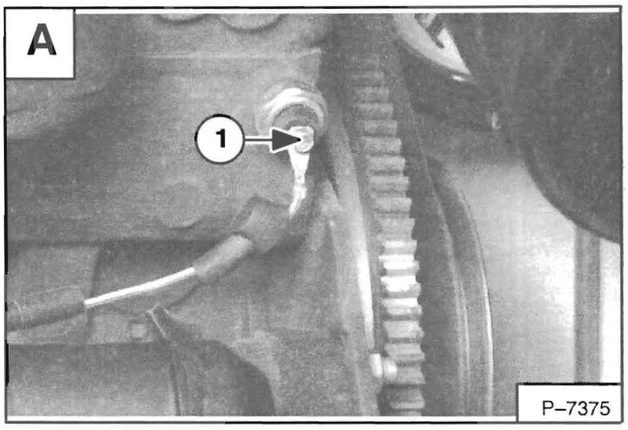
Disconnect the wire (Item 1) **[D]** from the water temp. sender.

Remove the harness clamps (Item 2) **[D]**.

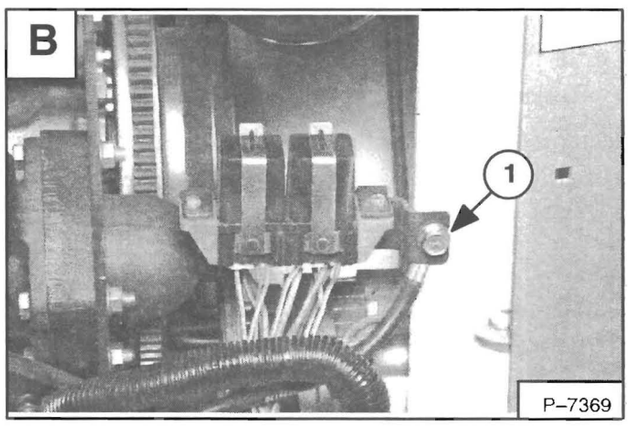


Removal and Installation (Cont'd)

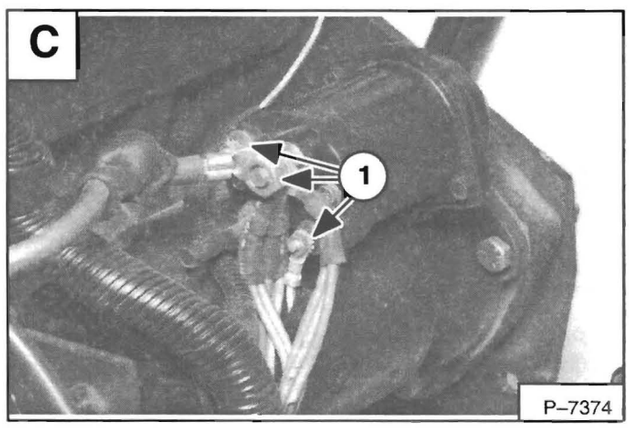
Remove the wire (Item 1) **[A]** from the oil pressure sender.



Remove the fuse holder bolt (Item 1) **[B]**.

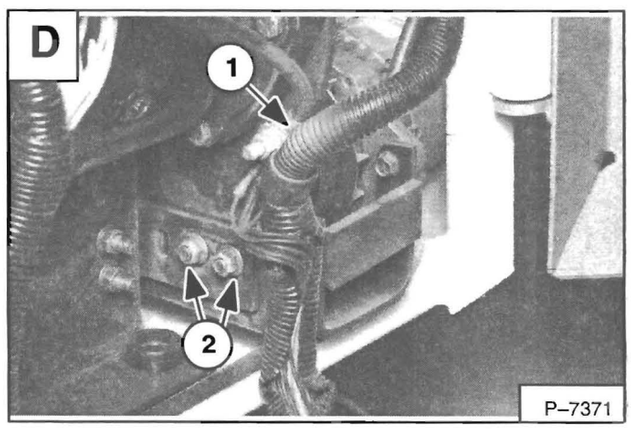


Remove the electrical wires (Item 1) **[C]** from the starter solenoid.



Disconnect the engine ground wires (Item 1) **[D]**.

Loosen the alternator adjustment bolts (Item 2) **[D]**.

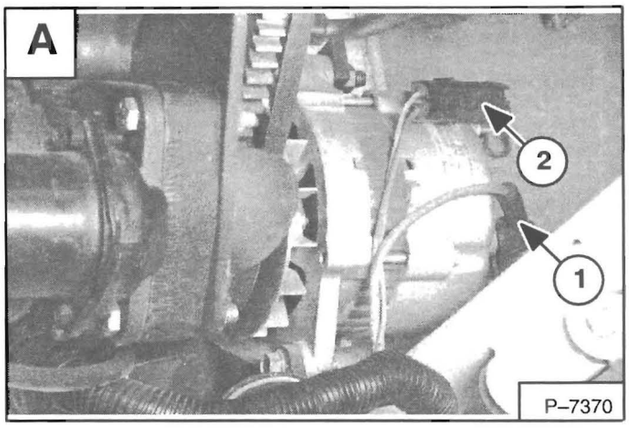


Removal and Installation (Cont'd)

NOTE: Remove the alternator for engine removal.

Remove the wire (Item 1) **[A]** from the alternator.

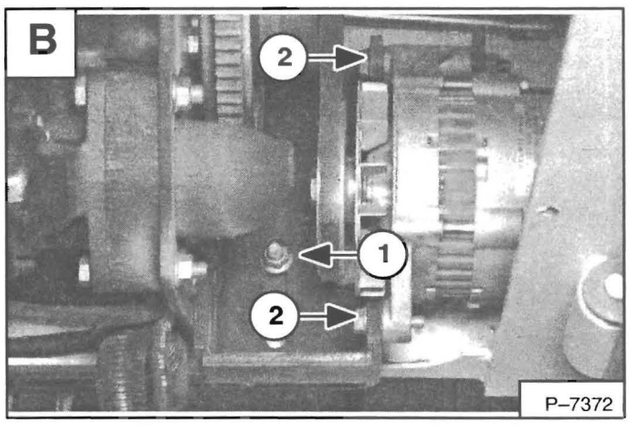
Disconnect the electrical connector (Item 2) **[A]** from the alternator.



Loosen the alternator adjustment bolt (Item 1) **[B]**.

Remove the alternator belt.

Remove the alternator mounting bolts (Item 2) **[B]**.



Lower the operator cab. (See Page 1–1.)

Install a chain with a hook on each end, to each lift eye (Item 1) **[C]** on the engine.

Install a 3/8" bolt (Item 2) **[C]** in the chain below the hoist hook to control the lift of the engine during removal and installation.

Lift the engine slowly with the chain hoist until the engine mount clears the rear lip of the loader frame.

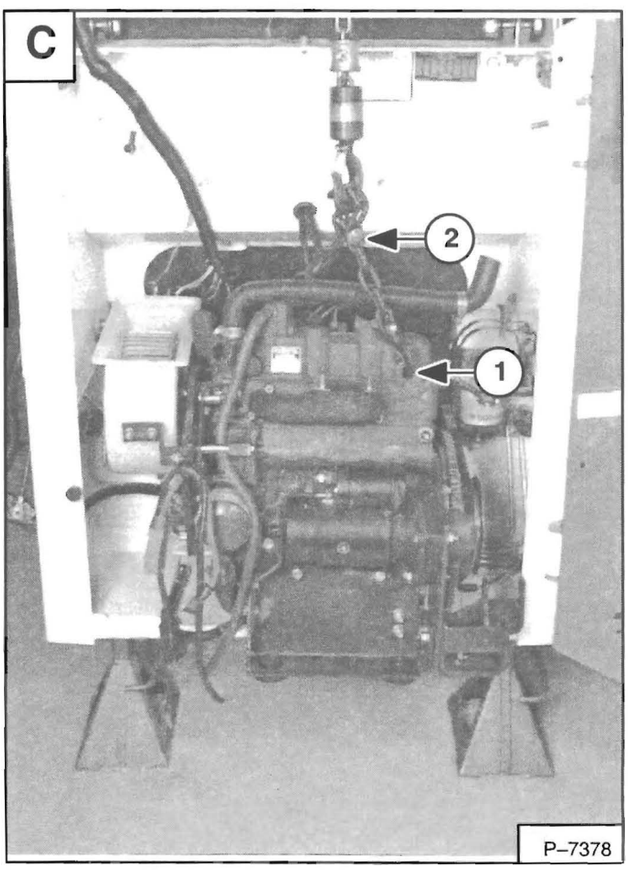
Pull the engine slowly to the rear of the loader while checking to be sure hydrostatic pump hoses and other attached parts are clear for removal.

Continue to remove the engine and hydrostatic pump assembly from the loader.

Replace engine mounts if they are damaged.

Reverse the removal procedure to install the engine and hydrostatic pump in the loader.

NOTE: To remove the hydrostatic pump assembly from the engine. (See Page 3–1.)



FLYWHEEL

Removal and Installation

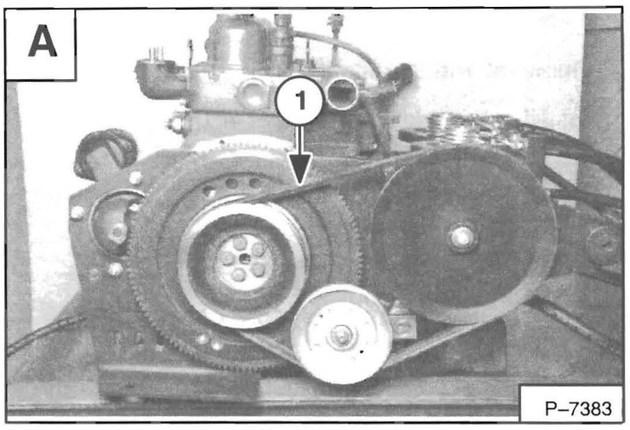
Install jackstands under the rear of the loader. (See Page 1–1.)

Raise the lift arms and install the lift arm support device. (See Page 1–1.)

Raise the operator cab. (See Page 1–1.)

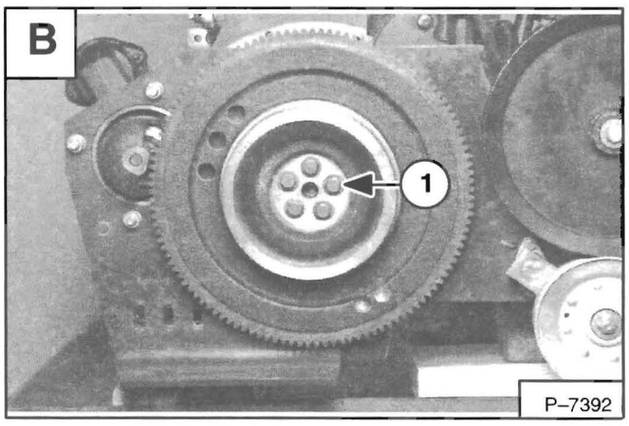
Remove the engine and hydrostatic pump assembly from the loader. (See Page 7B–14.)

Remove the hydrostatic pump drive belt (Item 1) **[A]**.



Remove the five (5) mounting bolts (Item 1) **[B]** from the flywheel.

Installation: Apply liquid adhesive (LOCTITE #242) to the mounting bolts and tighten to 40–45 ft.–lbs. (54–61 Nm) torque.



Remove the hydrostatic pump pulley and the idler pulley from the hydrostatic pump shaft. (See Page 3–1.)

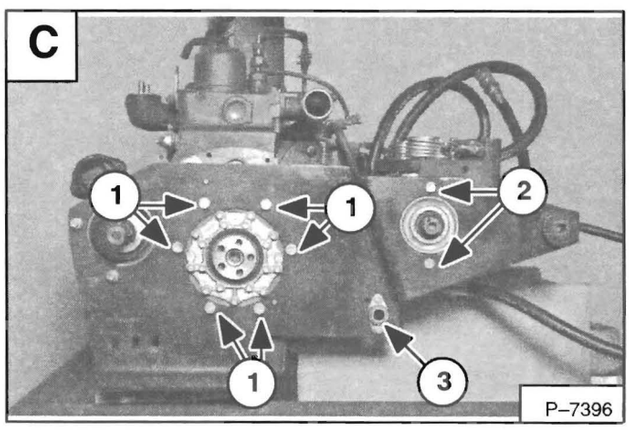
Remove the bolts (Item 1) **[C]** from the end plate.

Installation: Tighten the bolts to 29–33 ft.–lbs. (39–45 Nm) torque.

Remove the bolts (Item 2) **[C]** from the hydrostatic pump. (See Page 3–1.)

Remove the tension spring (Item 3) **[C]**. (See Page 3–1.)

Remove the end plate.



FAN

Removal and Installation

Install jackstands under the rear of the loader. (See Page 1–1.)

Raise the lift arms and install the lift arm support device. (See Page 1–1.)

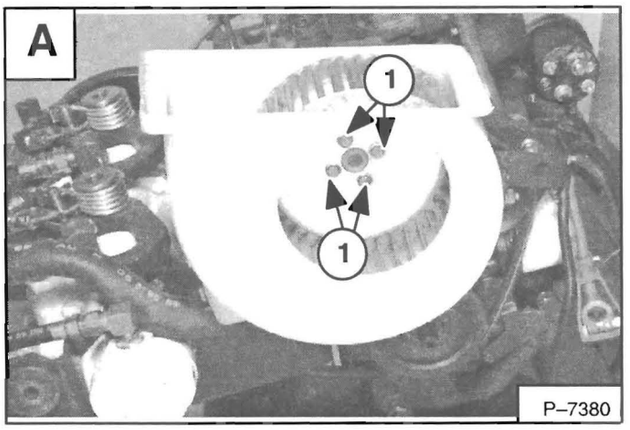
Raise the operator cab. (See Page 1–1.)

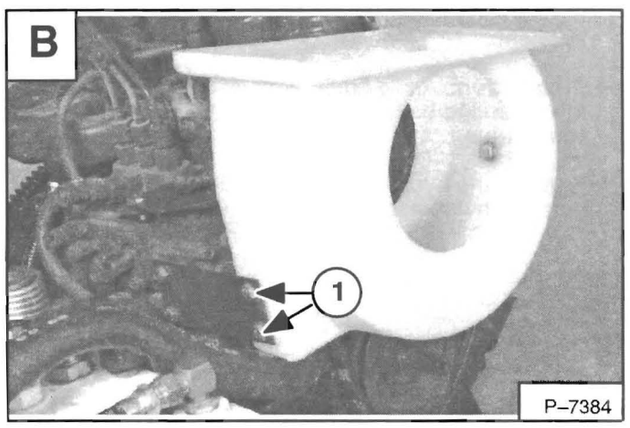
Remove the engine and hydrostatic pump assembly from the loader. (See Page 7B–14.)

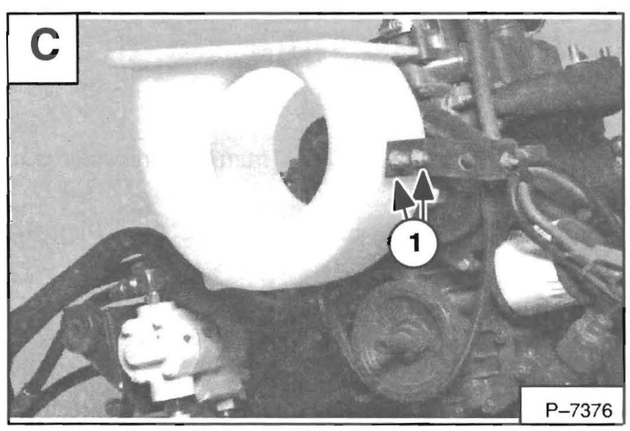
Remove the mounting bolts (Item 1) **[A]** from the fan. Remove the fan and water pump pulley.

Installation: Apply liquid adhesive (LOCTITE #242) to the mounting bolts and tighten to 85–92 in–lbs. (9.5–10.5 Nm) torque.

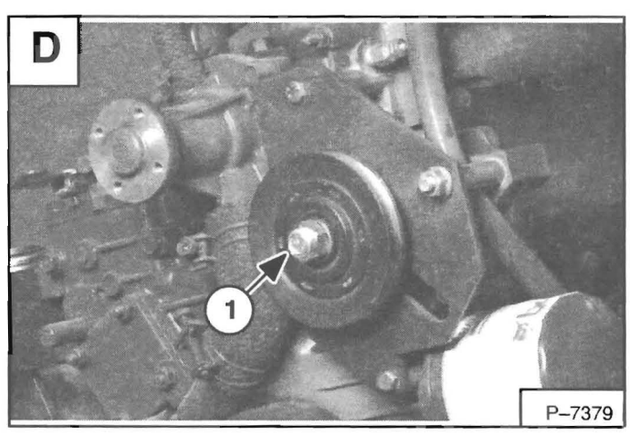
Remove the mounting bolts (Item 1) **[B]** & **[C]** to remove the fan shroud.







Remove the bolt and nut (Item 1) **[D]** to remove the water pump idler pulley.



CYLINDER HEAD

Removing the Cylinder Head

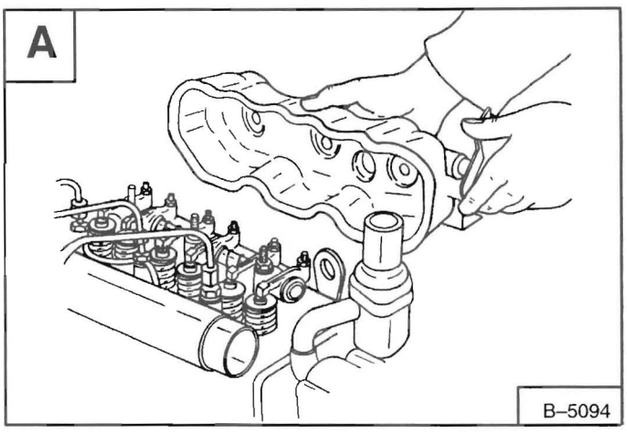
NOTE: For easier removal of the cylinder head the engine can be removed from the loader. (See Page 7B–14.)

The tool listed will be needed to do the following procedure:

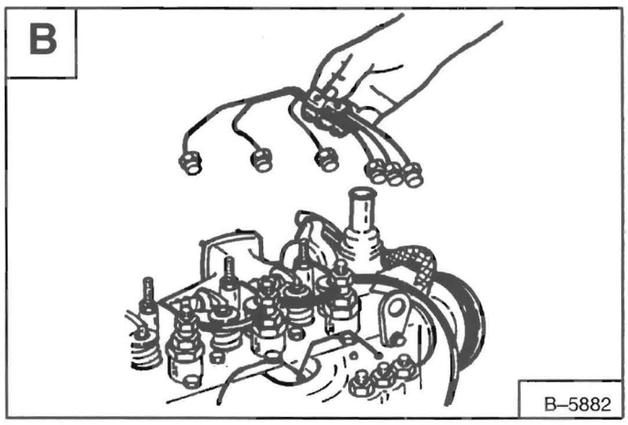
MEL1180 – Nozzle Socket

Remove the nuts from the valve cover.

Remove the valve cover **[A]**.



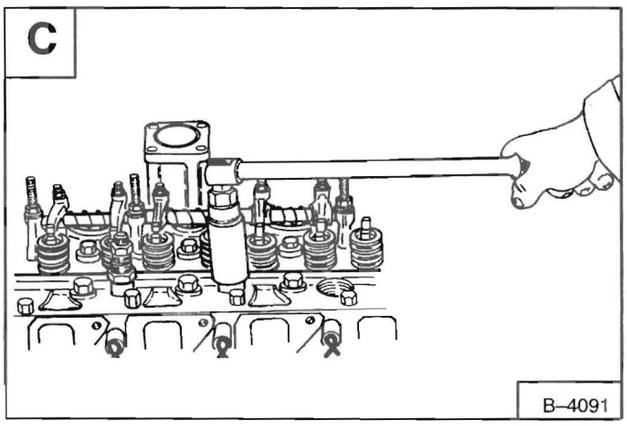
Disconnect and remove the fuel injection tubelines **[B]**.



Remove the injector nozzles and the copper gaskets **[C]**.

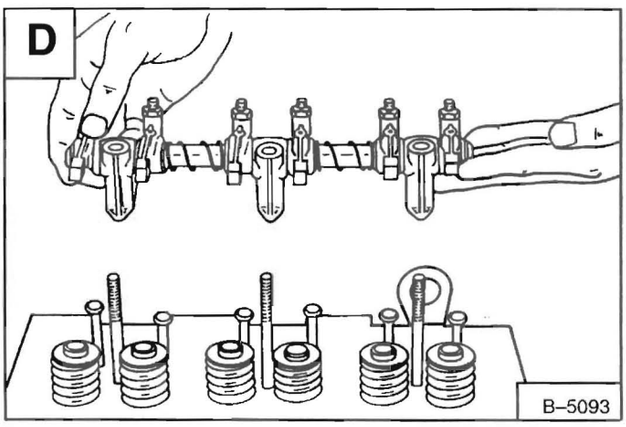
Remove the intake manifold.

Remove the blower fan and shrouding. (See Page 7B–20.)



Remove the rocker arms **[D]**.

Remove the valve rotators.



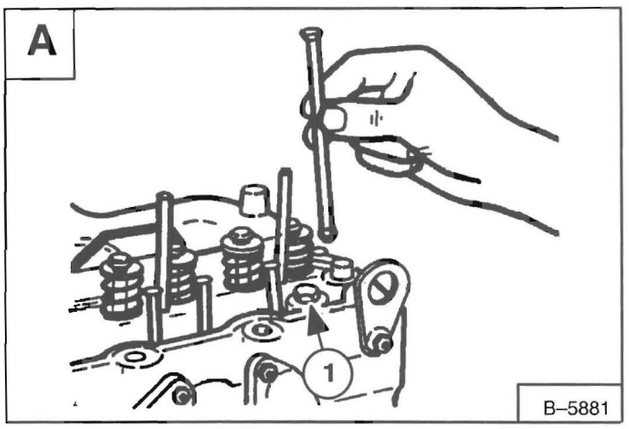
Removing the Cylinder Head (Cont'd)

Remove the push rods **[A]**.

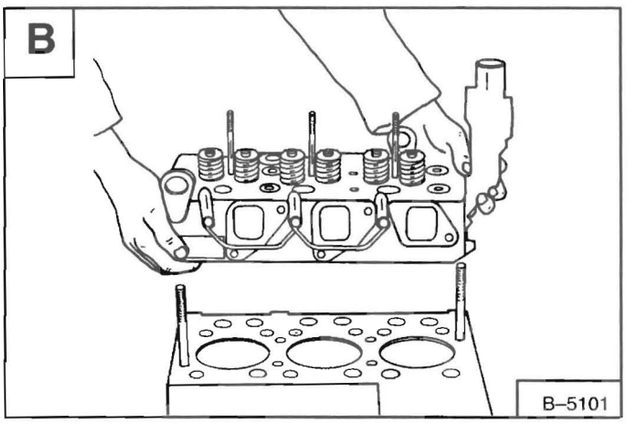
Mark the push rods so they will be returned to their original position.

Remove the cylinder head bolts (Item 1) **[A]**.

Installation: Tighten the cylinder head bolts and nut to 29–33 ft.–lbs. (40–45 Nm) torque. (See Page 7B–26 for tightening sequence.)

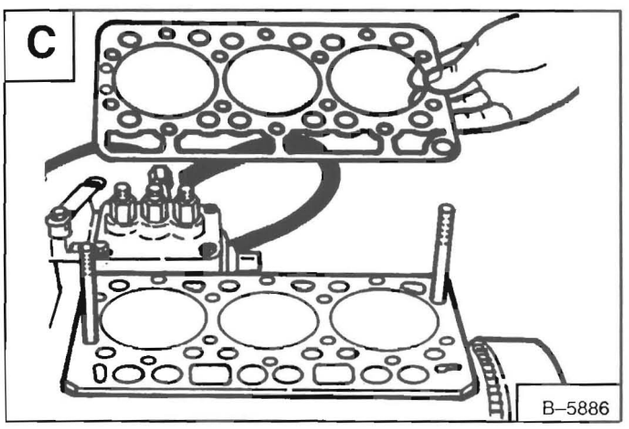


Remove the cylinder head from the engine block **[B]**.

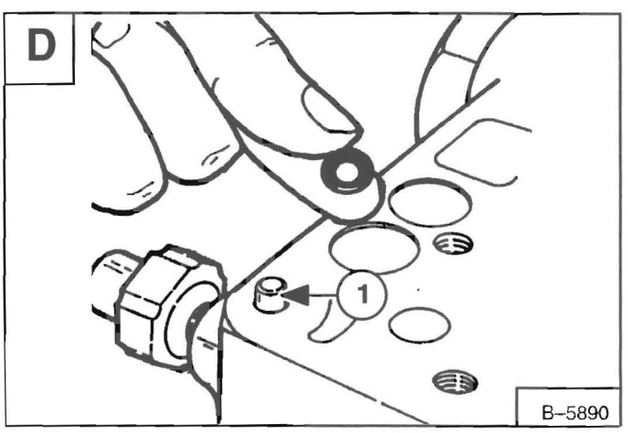


Remove the head gasket **[C]**.

NOTE: Some engines may use a shim. If a shim is present it must be used during reassembly. The shim (if used) must be installed between the cylinder head and gasket.



Remove the O–ring from the oil pipe (Item 1) **[D]**.

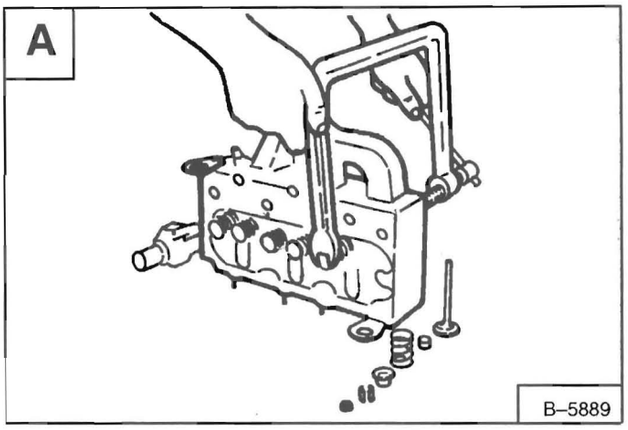


Disassembly of the Cylinder Head

The tool listed will be needed to do the following procedure:

MEL10121 – Valve Tool

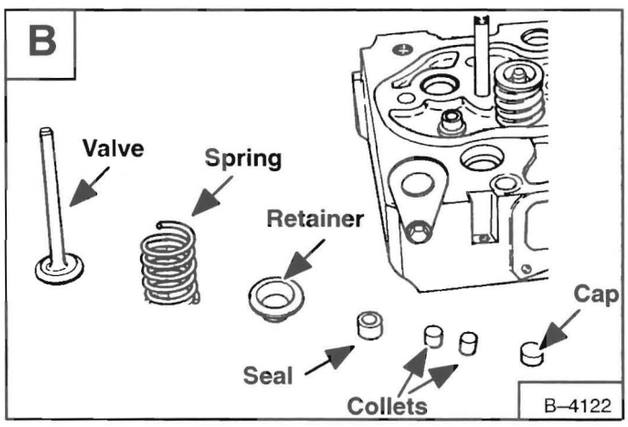
Using the valve compression tool **[A]**, remove the valve cap and the valve spring collet **[B]**.



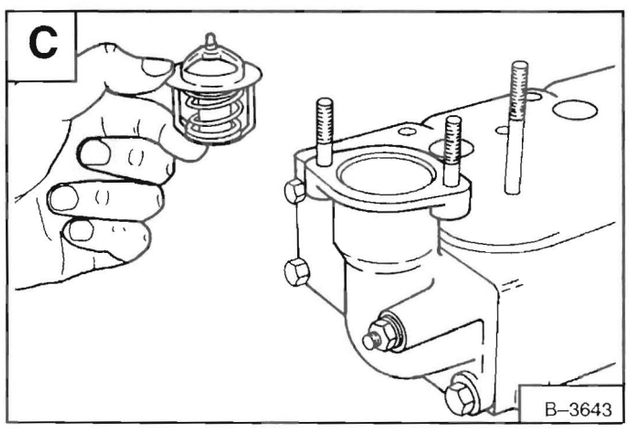
Remove the valve spring **[B]**.

Remove the seal on the valve and remove the valve from the cylinder head **[B]**.

Repeat this procedure for all the valves. Mark the valves so they will be returned to their original position.



Remove the thermostat housing and the thermostat from the cylinder head **[C]**.



CYLINDER HEAD (Cont'd)

Servicing the Cylinder Head

Clean the surface of the cylinder head.

Put a straight edge on the cylinder head **[A]**.

NOTE: Do not put the straight edge across the combustion chamber.

Put a feeler gauge between the straight edge and the surface of the cylinder head.

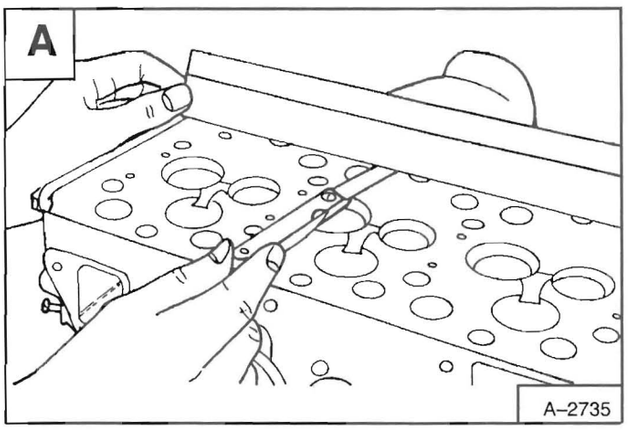
The maximum distortion of the cylinder head surface is ± 0.002 inch (± 0,05 mm).

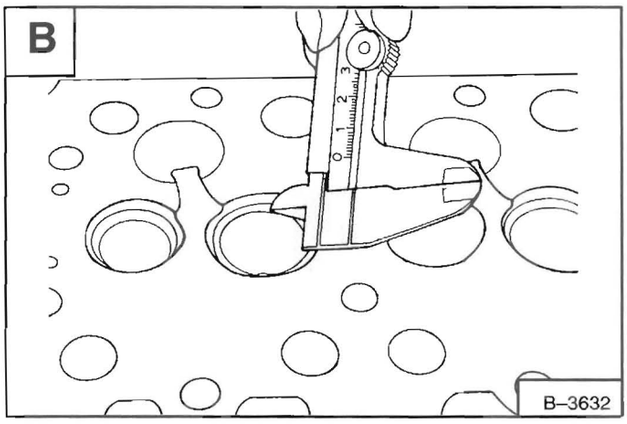
If the measurement is more than the specification, remove the combustion chambers then grind the cylinder head. Remove the same amount of material from the bottom of the combustion chambers as was removed from the head.

Clean the surface of the valve seat area.

Measure the width of the valve seat **[B]**.

The correct width of the valve seat is 0.083 inch (2,1 mm) and the seat angle is 45 degrees.





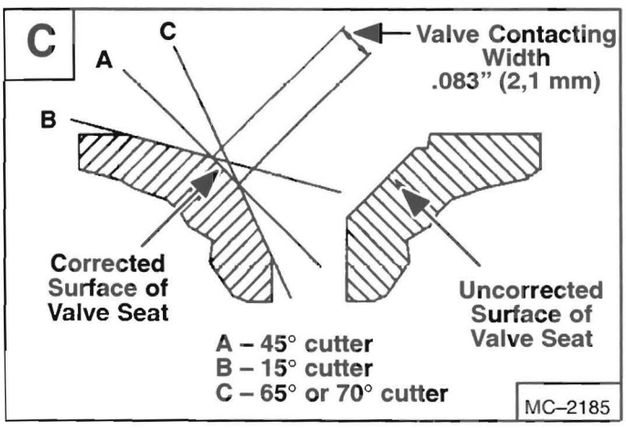
Use the following steps to grind the valve seats **[C]**.

Item A – Use a 45° cutter to grind the front surface of the valve seat.

Item B – Use a 15° cutter to grind the front surface of the valve seat.

Item C – Use A 65° or 70° cutter to grind the rear surface of the valve seat to finish the seat of a 0.083 inch (2,1 mm) width.

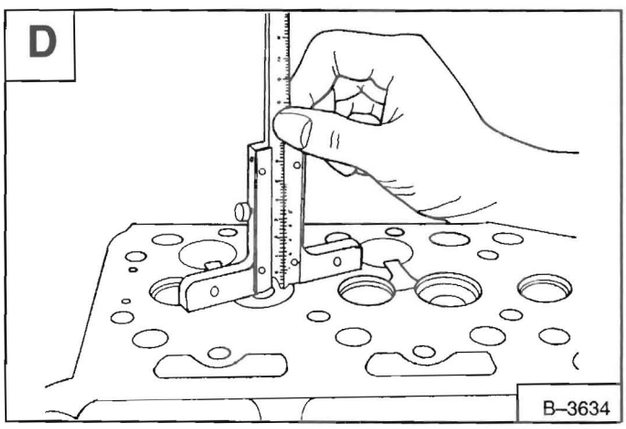
Grind the valve surface to a 45° angle.



Install the valve in the seat and check the depth **[D]**.

The specification for the depth of the valve is 0.035–0.043 inch (0,9–1,1 mm).

NOTE: If the measurement is more than the specifications add the correct thickness washer under the valve spring to keep the correct tension on the spring.



Servicing the Cylinder Head (Cont'd)

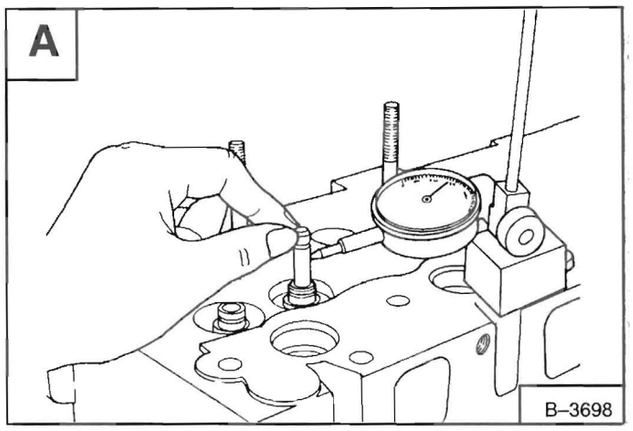
Clean the valve guide.

Install the valve in the cylinder head.

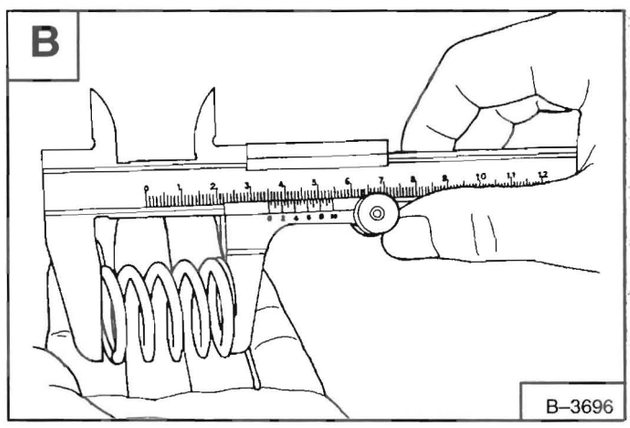
Install a dial indicator gauge.

Measure the clearance of the valve guide and the valve **[A]**.

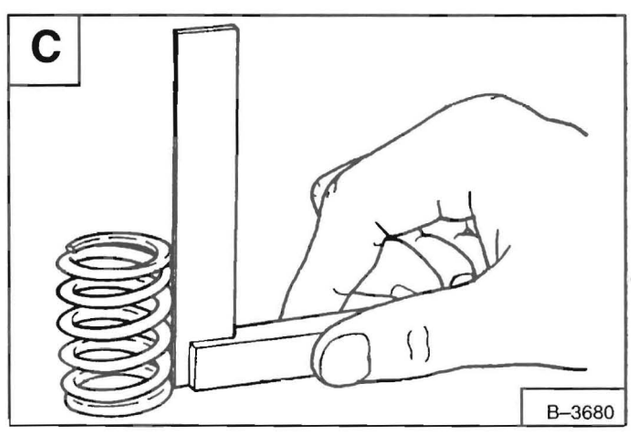
The measurement must be 0.0014–0.0026 inch (0,035–0,065 mm). Replace the valve guide and valves as needed. Make sure to ream the new guide to the correct dimensions.



Measure the valve spring **[B]**. The length of the spring must be 1.382–1.402 inch (35,1–35,6 mm). Replace the valve spring if it does not meet the specification.

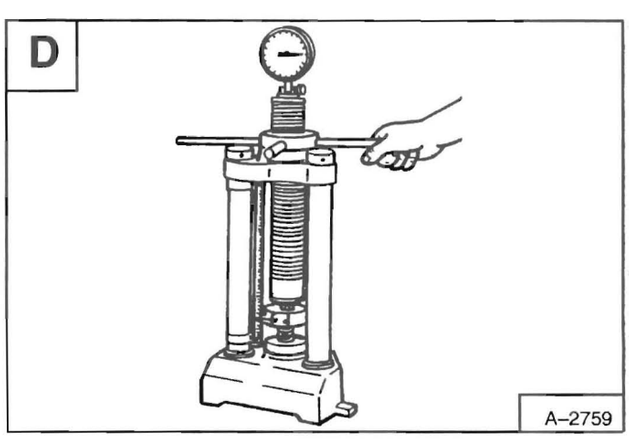


Check the valve spring with a straight edge to make sure it is straight **[C]**. Replace the spring if it is not straight.



Put the valve spring in a tester.

Push down on the spring 1.22 inch (31 mm). The compression load must be 16.5 lbs. (7,49 kg). Replace the valve spring if it does not meet these specifications.

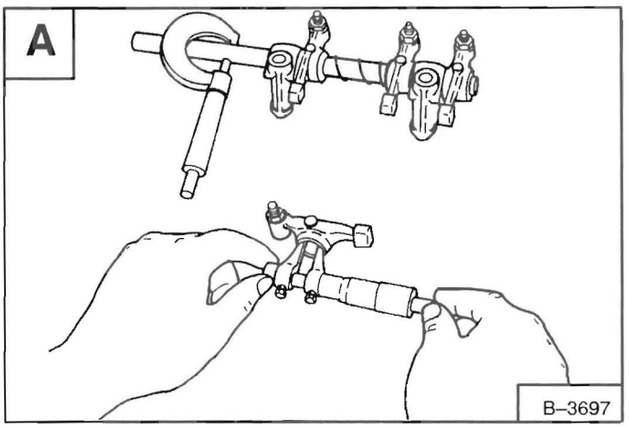


CYLINDER HEAD (Cont'd)

Servicing the Cylinder Head (Cont'd)

Measure the inside diameter of the rock arm bushing and the shaft diameter **[A]**.

The inside of the rocker arm bushing is 0.4330–04346 inch (10,997–11,038 mm). The rocker arm shaft diameter is 0.4320–0.4324 inch (10,973–10,984 mm). If the measurements are not within the specifications, replace the parts as needed.



Assembly of the Cylinder Head

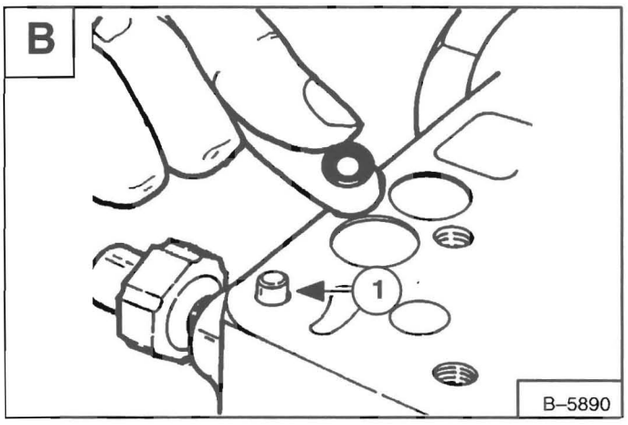
Install the valves.

Put oil on the valve seal and install the valve seal on the valve.

Install the valve spring and the retainer.

Install the thermostat.

Install a new gasket and the thermostat housing.

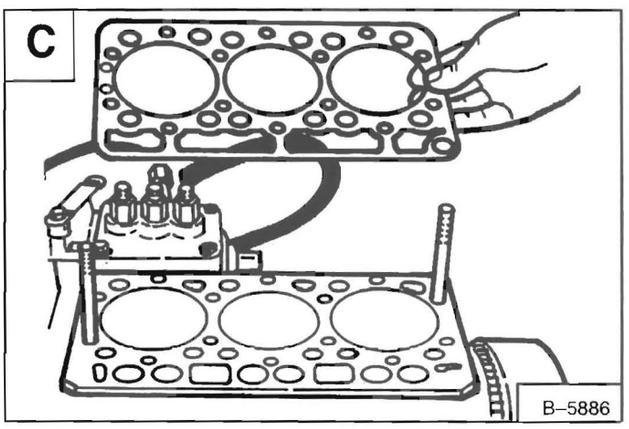


Installing the Cylinder Head

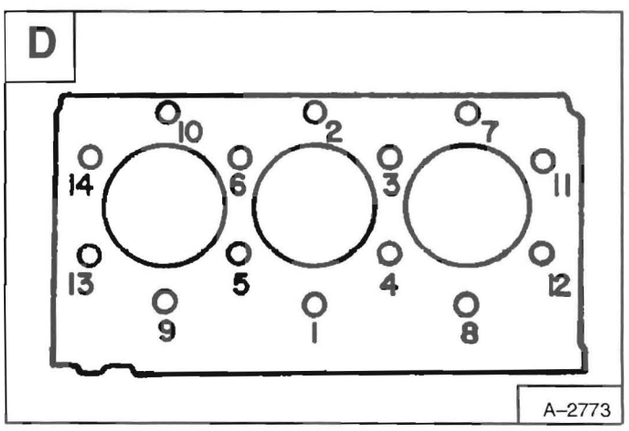
Install a new O–ring on the oil pipe (Item 1) **[B]**.

Install a new head gasket and shim if there was a shim present during disassembly **[C]**. The shim (when used) goes between the cylinder head and gasket.

Install the cylinder head on the engine block.



Put oil on the cylinder head bolts and nuts and tighten to 29–33 ft.–lbs. (40–45 Nm) torque. Use the tighten sequence shown in **[D]**.



Installing the Cylinder Head (Cont'd)

Lower the piston which is to be measured for the clearance between the cylinder head and the piston.

Put a piece of solder in the injector port **[A]**. Make sure the solder does not touch the valves.

Turn the engine with your hand until the piston goes over TDC.

Remove the solder and measure it. The thickness must be 0.0236–0.315 inch (0,6–0,8 mm). If the measurement is not in this specification, remove the cylinder head and install the correct shim between the cylinder head and the gasket.

Install the cylinder head and tighten the bolts and nuts to 29–33 ft.-lbs. (40–45 Nm) torque. (See Torque Sequence on Page 7B–26 **[D]**.)

Install the push rods.

Install the rocker arms.

Install the shrouding and blower fan. (See Page 7B–20.)

Install the injector nozzles with a new copper gasket. (See Page 7B–9.)

Install the injector high pressure tubelines.

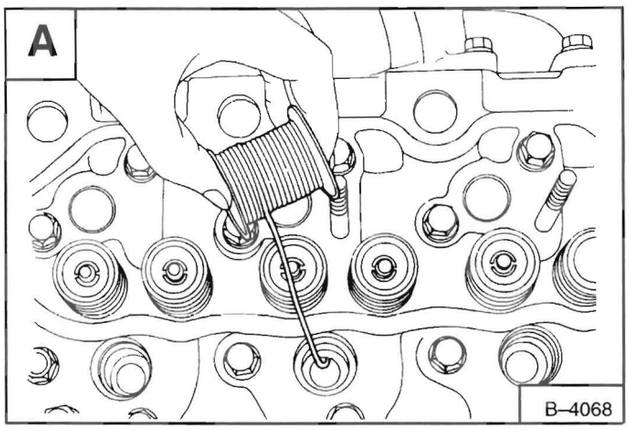
Install the intake manifold.

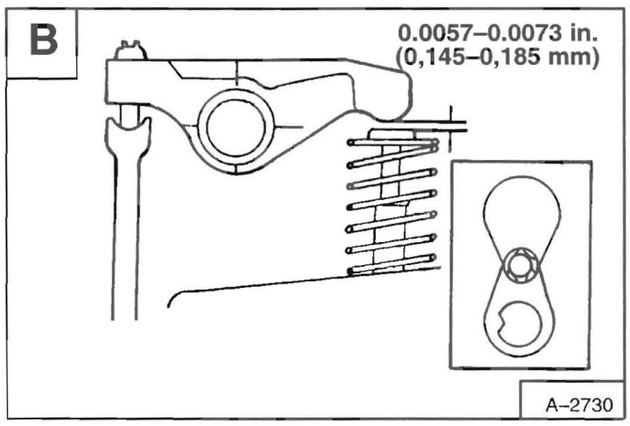
Make sure the piston is at TDC when adjusting the clearance at the valves. The correct clearance is 0.0057–0.0073 inch (0,145–0,185 mm) cold clearance **[B]**.

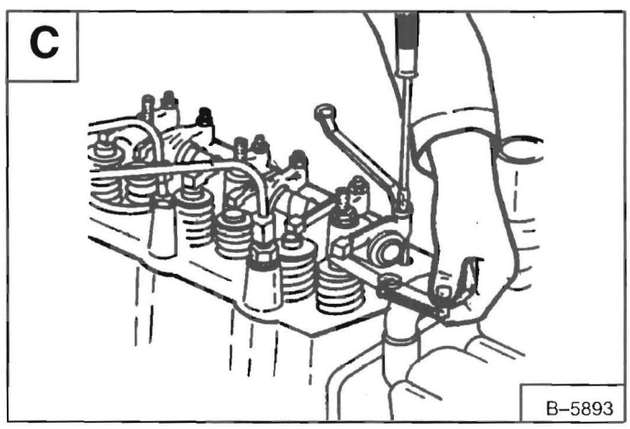
Adjust the valve clearance **[C]**.

Install the valve cover with a new gasket.

NOTE: Make sure to tighten the cylinder head bolts and nuts to the correct torque after the engine as been operated for 30 minutes.

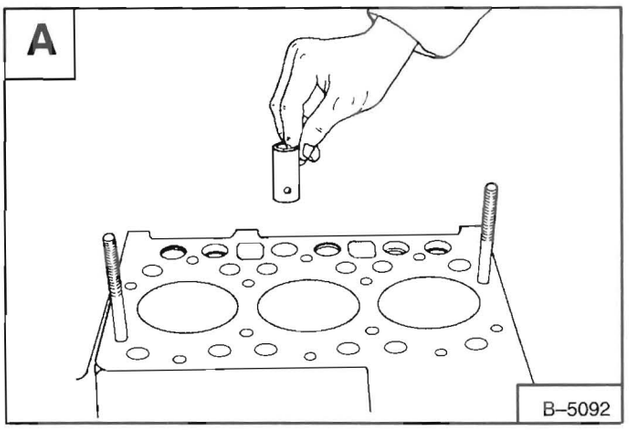






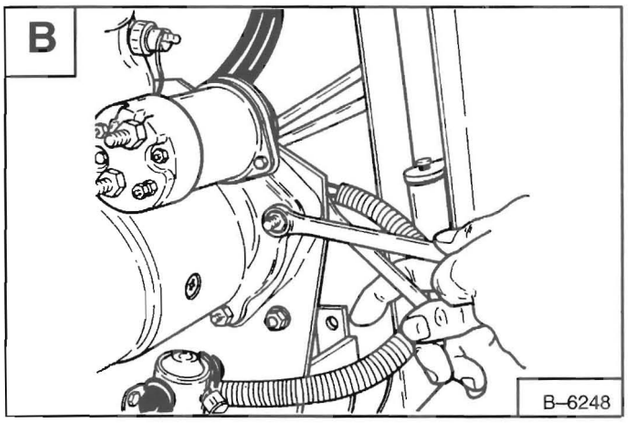
REPAIRING THE ENGINE

See Page 7B–21 to remove the cylinder head. Remove the tappets from the engine block **[A]**.



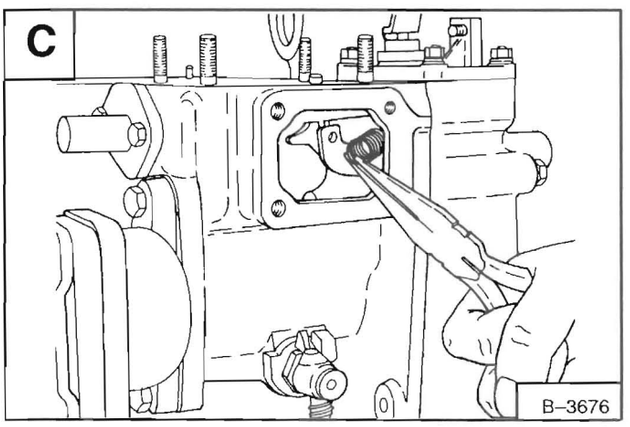
Remove the starter **[B]**. (See Page 6–1.)

See Page 7B–7 to remove the fuel injection pump.

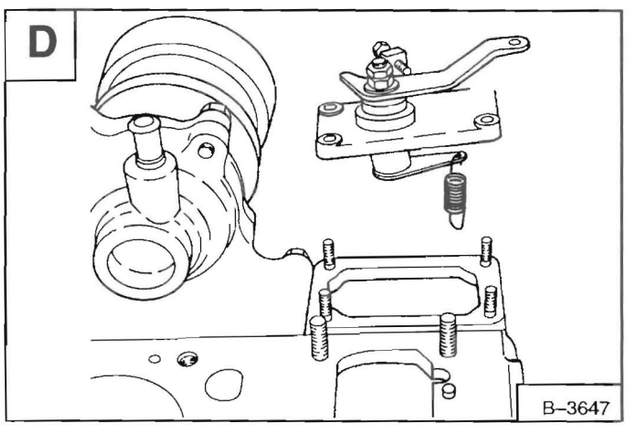


Removing the Gearcase

Remove the governor spring from the governor fork **[C]**.

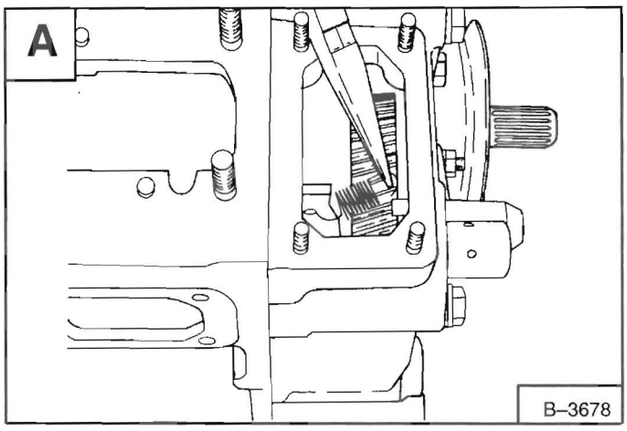


Remove the plate for the speed control and the governor spring **[D]**.



Removing the Gearcase (Cont'd)

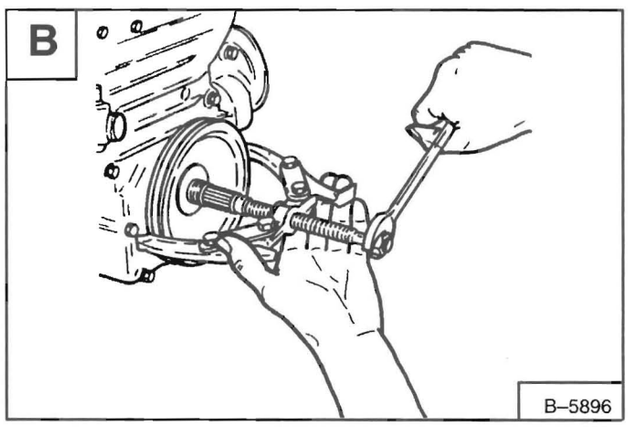
Remove the start spring from the gearcase **[A]**.



Straighten the washer on the crankshaft sheave. Remove the nut and washer.

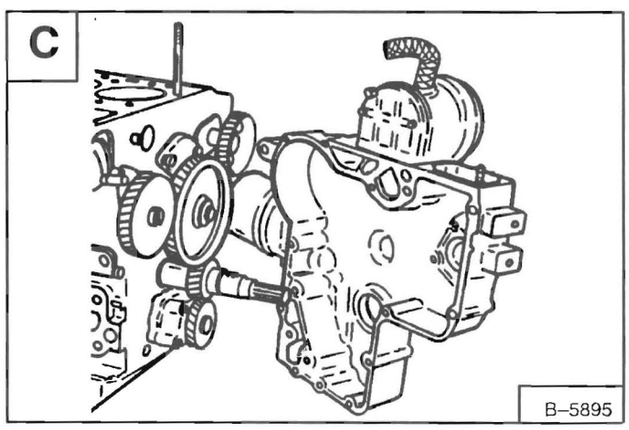
Use a puller and remove the crankshaft **[B]**.

Remove the key.



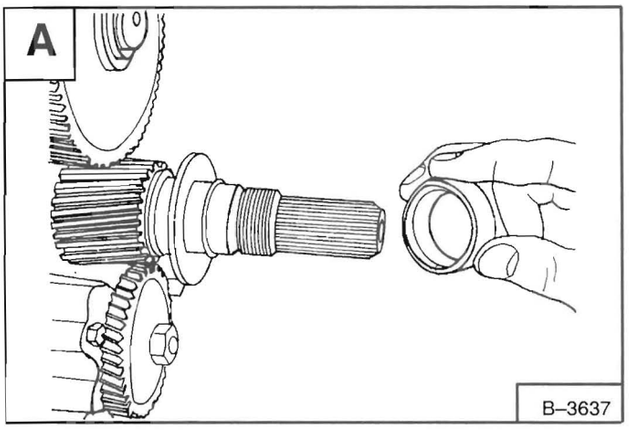
Remove the bolts from the gearcase.

Remove the gear case and the O–ring **[C]**.

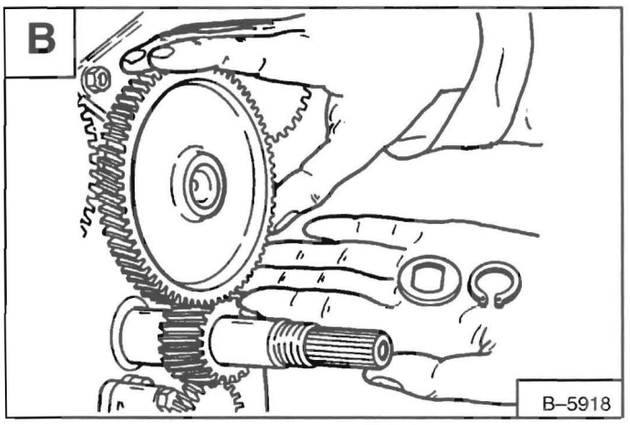


Removing the Timing Gear, Camshaft & Oil Pump

Remove the crankshaft collar, O–ring, oil slinger and the gear collar **[A]**.



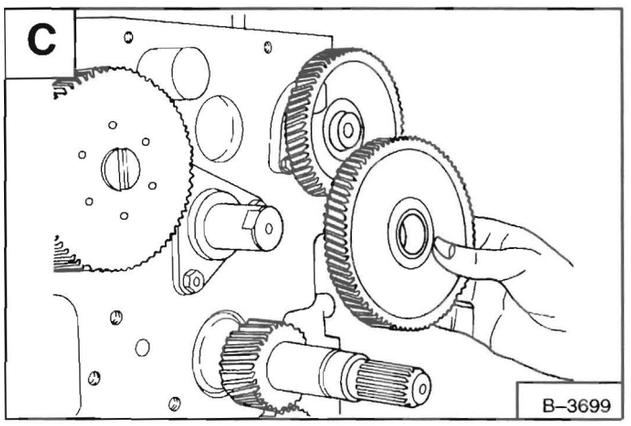
Remove the snap ring on the idler gear **[B]**.



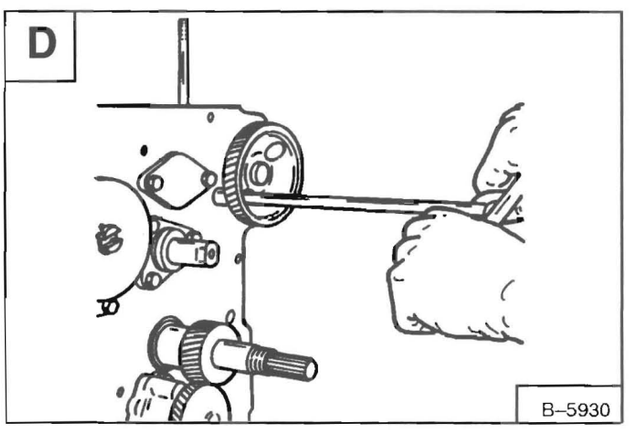
Remove the idler gear **[C]**.

Remove the idler collar from the shaft.

Align the hole in the gear on the camshaft with the stop plate bolts.

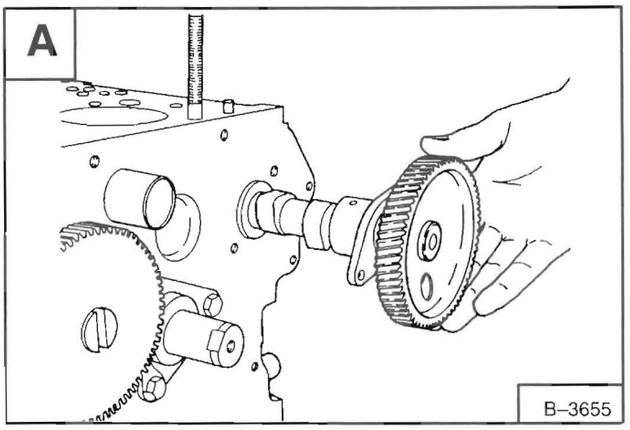


Remove the bolts from the camshaft stop **[D]**.



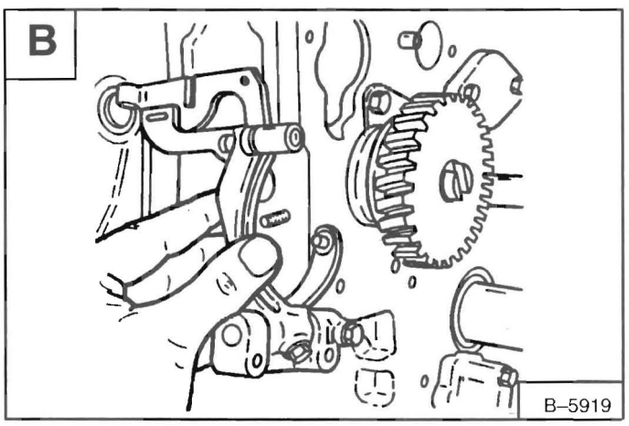
Removing the Timing Gear, Camshaft & Oil Pump

Remove the camshaft **[A]**.



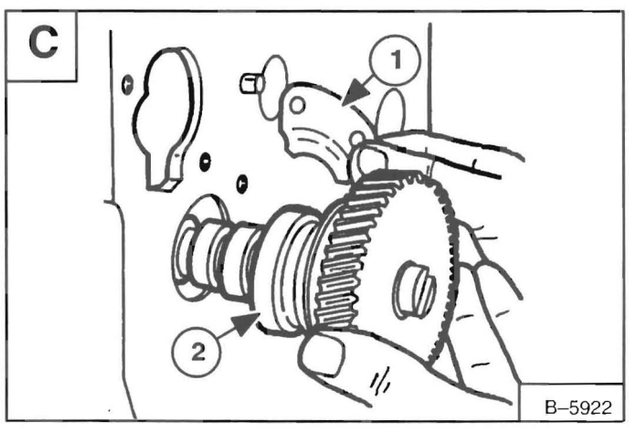
Remove the 2 bolts that hold the fork lever on the fuel camshaft.

Remove the fork lever **[B]**.



Remove the stop for the fuel camshaft (Item 1) **[C]**.

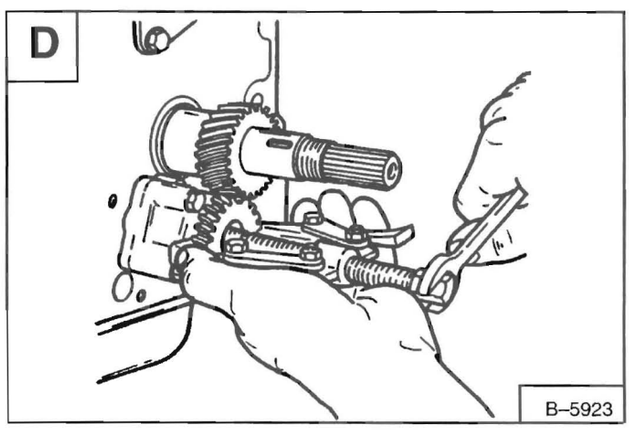
Remove the fuel camshaft and gear (Item 2) **[C]**.



Straighten the washer on the gear of the oil pump.

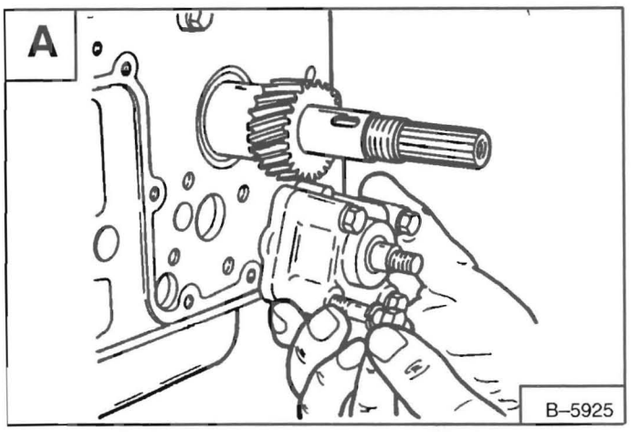
Remove the bolt from the oil pump gear.

Remove the pump gear **[D]**.



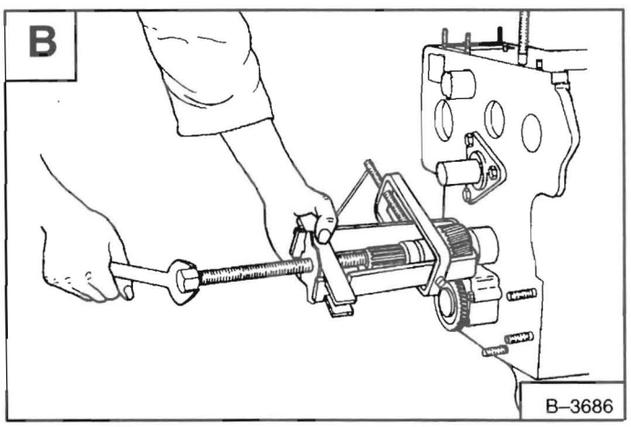
Removing the Timing Gear, Camshaft & Oil Pump (Cont'd)

Remove the oil pump bolts and the oil pump **[A]**.



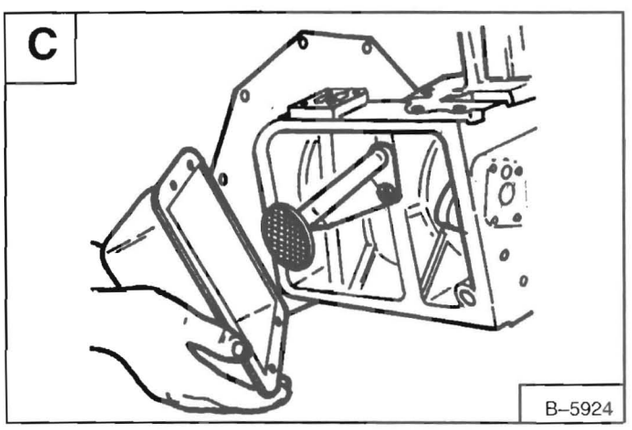
Remove the crankshaft gear with a puller **[B]**.

Remove the key.

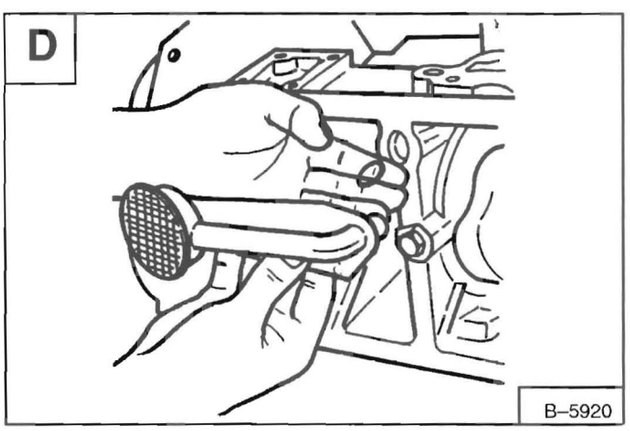


Removing Pistons & Crankshaft

Remove the oil pan **[C]**.



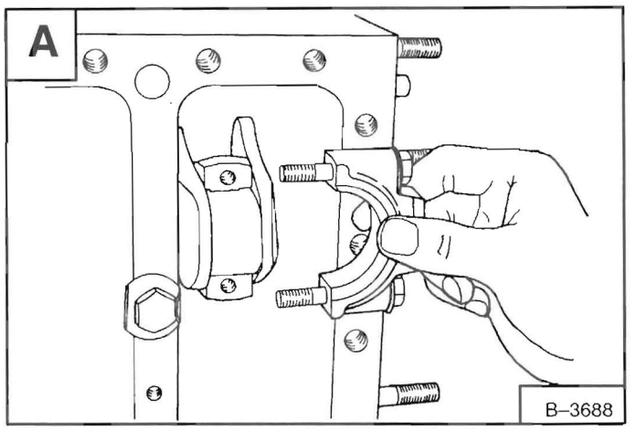
Remove the oil tube and screen **[D]**. DO NOT damage the O–ring.



Removing Pistons & Crankshaft (Cont'd)

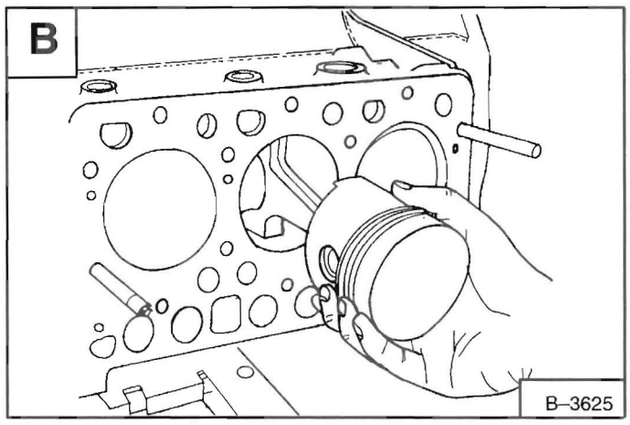
Remove the connecting rod bolts.

Remove the cap and the bearing from the connecting rod **[A]**.



Remove the piston from the engine block **[B]**.

NOTE: Make sure the pistons are marked so they will be returned to the same cylinder.



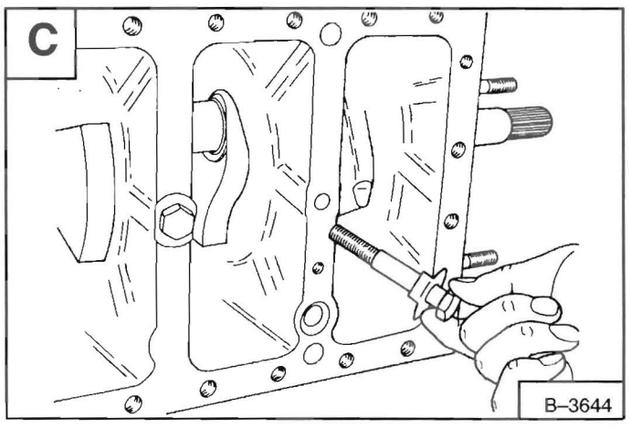
Straighten the washers on the flywheel bolts.

Remove the bolts from the flywheel.

Use a puller to remove the flywheel.

Straighten the washers on the bolts that hold the main bearing in position.

Remove the main bearing bolts from the engine block **[C]**.

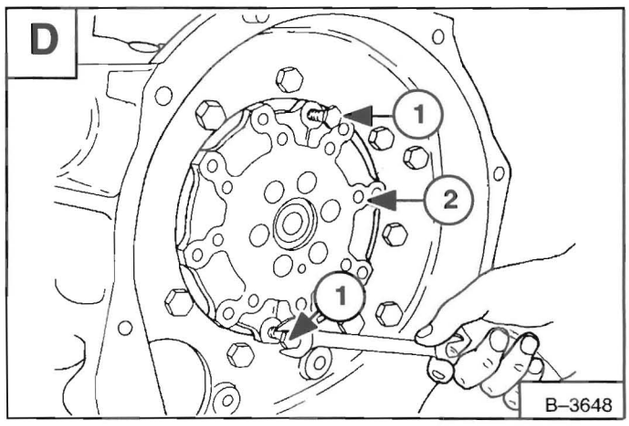


Straighten the washers on the bolts that hold the main bearing cover in position.

Remove the bolts (Item 1) **[D]**.

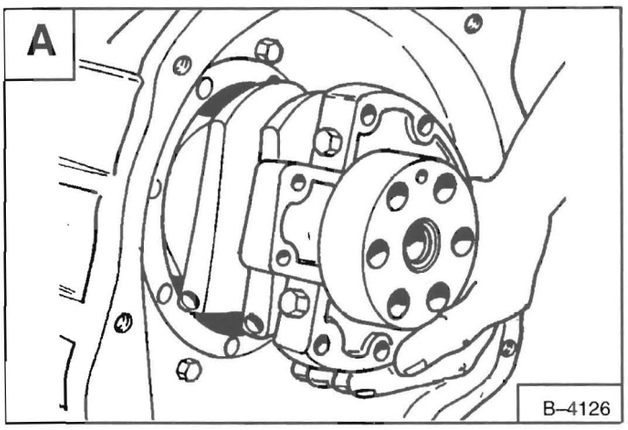
Install two bolts in the cover (Item 2) **[D]**.

Turn the bolts in to remove the cover.



Removing Pistons & Crankshaft (Cont'd)

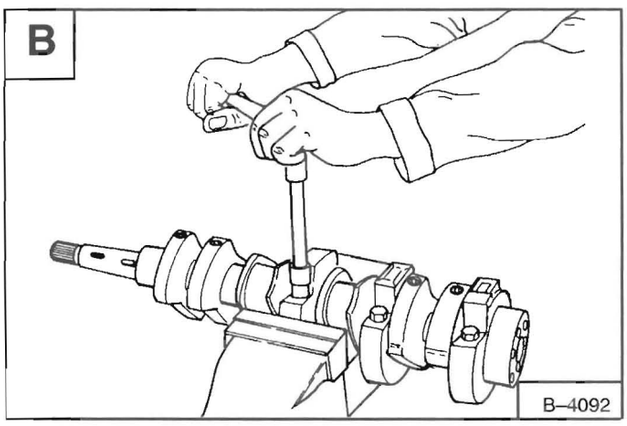
Remove the crankshaft from the rear of the engine **[A]**. Make sure you do not damage the crankshaft.



Straighten the washers on the bolts on the main bearings.

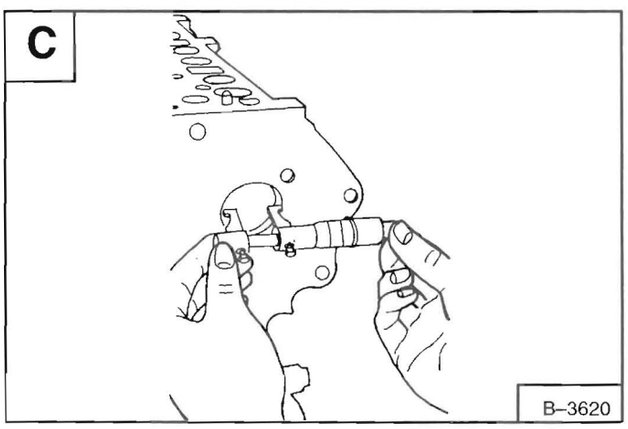
Remove the bolts **[B]**.

Remove the bearing halves of the main bearings.



Servicing the Timing Gear and Camshaft

Measure the camshaft bearing on the engine block **[C]**. The specifications are 1.2992–1.3002 inch (33,00–33,025 mm). The allowable wear limit is 0.002–0.0036 inch (0,05–0,09 mm).

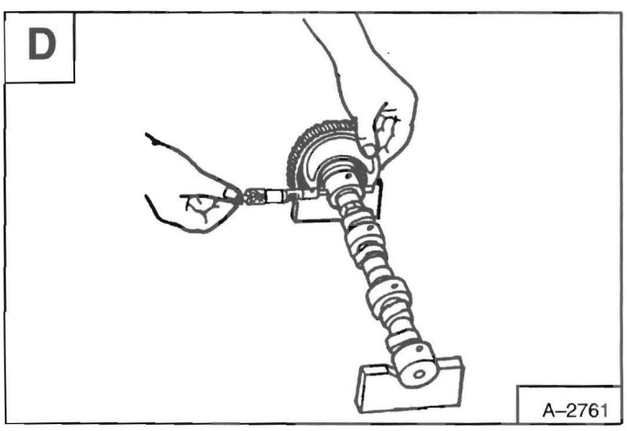


Measure the camshaft journals **[D]**. The specifications are 1.2966–1.2972 inch (32,934–32,950 mm). The allowable wear limit is 0.002–0.0036 inch (0,05–0,09 mm).

If the measurements are not within the specifications, replace the needed parts.

Put the camshaft on v–blocks.

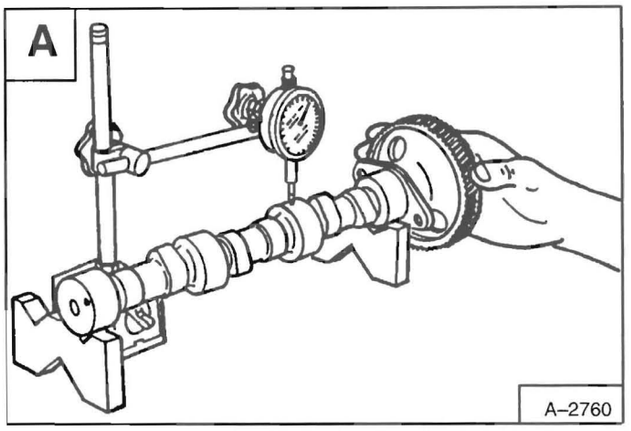
Put a dial gauge on the journal.



Servicing the Timing Gear and Camshaft (Cont'd)

Turn the camshaft at a slow rate **[A]**. The allowable wear limit is 0.0020 inch (0,05 mm).

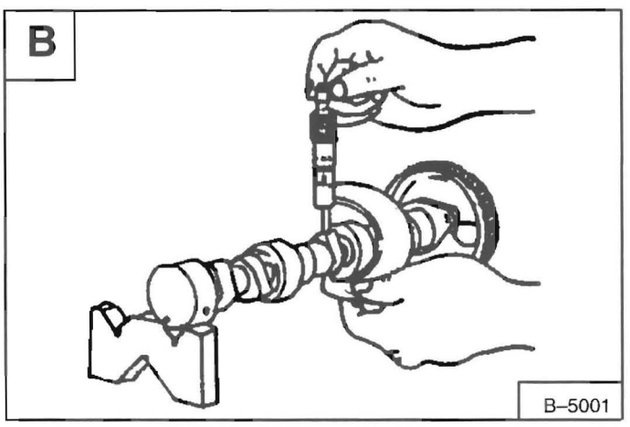
If the camshaft measurements exceed the allowable limit, replace the camshaft.



Measure the highest point on each lobe **[B]**.

The specifications are 1.058 inch (26,88 mm). The allowable wear limit is 1.0563 inch (26,83 mm).

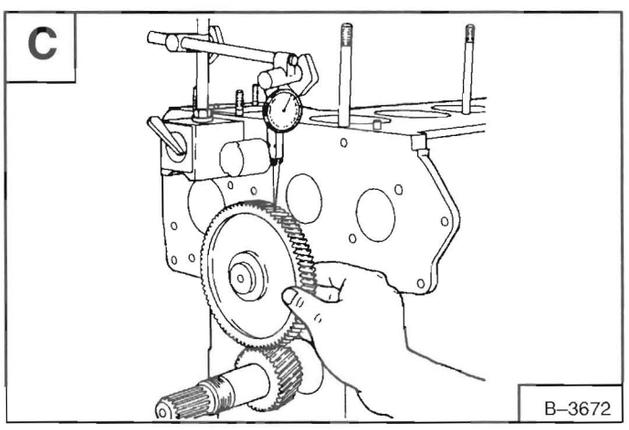
NOTE: After the crankshaft is installed, check the clearance for the camshaft gear.



Install a dial gauge on the camshaft gear **[C]**.

Hold the one gear while turning the other gear.

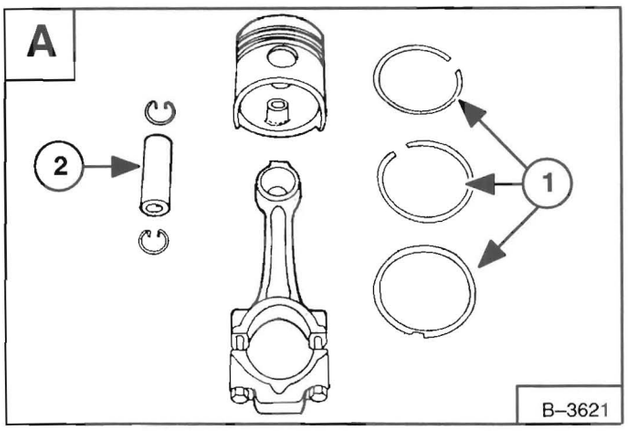
The specifications are 0.0017–0.0045 inch (0,042–0,115 mm). The allowable wear limit is 0.0079 inch (0,2 mm).



Servicing the Connecting Rods and Pistons

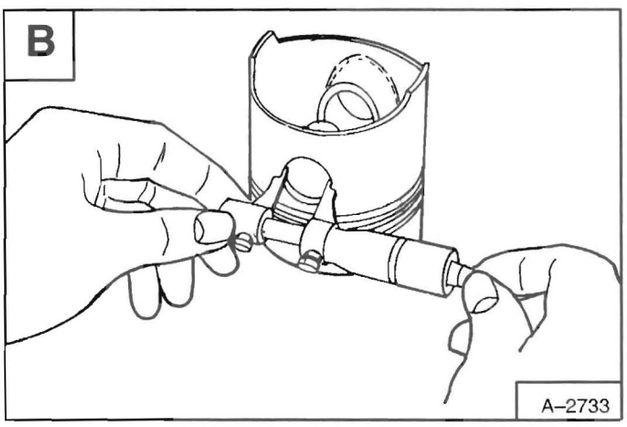
Remove the piston rings (Item 1) **[A]** and piston pin (Item 2) **[A]**.

NOTE: Make sure to mark the piston and the connecting rod so they are assembled correctly.



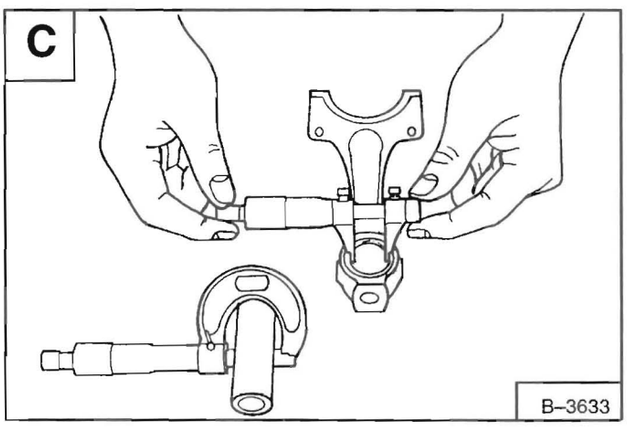
Measure the piston pin hole with a micrometer **[B]**.

The specifications are 0.7875–0.7879 inch (20,00–20,01 mm). The allowable wear limit is 0.7885 inch (20,03mm).



Measure the piston pin and connecting rod bushing with a micrometer **[C]**.

The specifications are 0.0006–0.0015 inch (0,014–0,038 mm). The allowable wear limit is 0.0059 inch (0,15 mm).



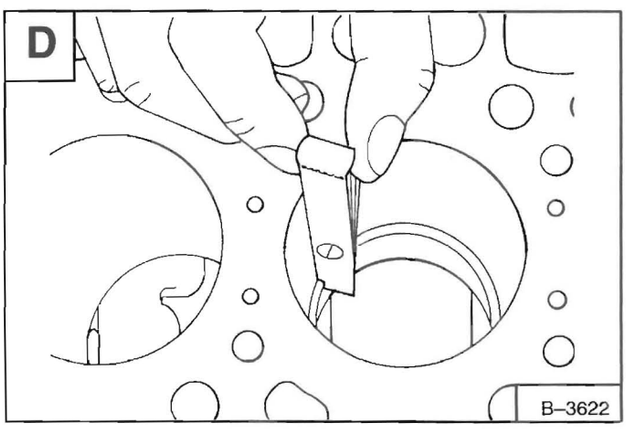
Put the piston ring in the engine block cylinder. Use a piston to push the ring to the bottom of the cylinder bore.

Measure the clearance with a feeler gauge **[D]**.

The specifications are as listed below:

Top Ring & Second Ring ..... 0.0098–0.015 inch (0,25–0,40 mm)
Oil Ring ..... 0.0078–0.015 inch (0,20–0,040 mm)

The allowable wear limit for all the rings is 0.0492 inch (1,25 mm).

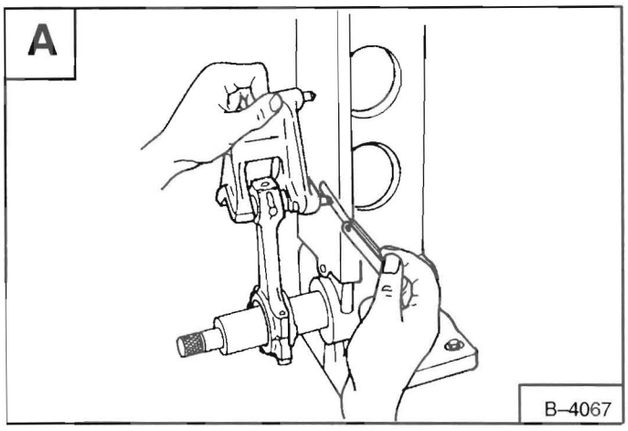


Servicing the Connecting Rods and Pistons (Cont'd)

Install the connecting rod on the tool and check for correct alignment **[A]**.

NOTE: Check the I.D. of the connecting rod bushing, make sure it is not worn.

The specifications are 0.0008 inch (0,02 mm). The allowable wear limit is 0.0020 inch (0,05 mm).

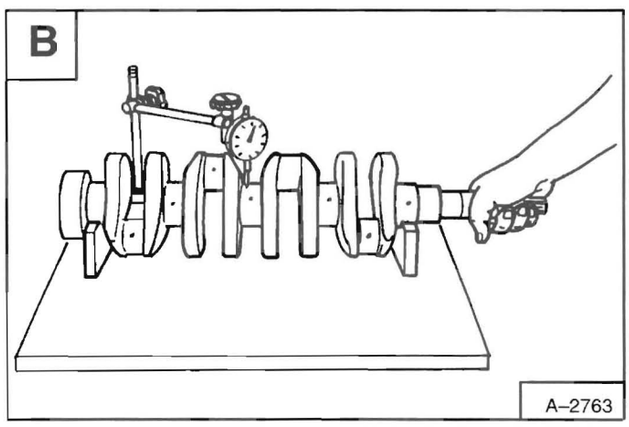


Servicing the Crankshaft

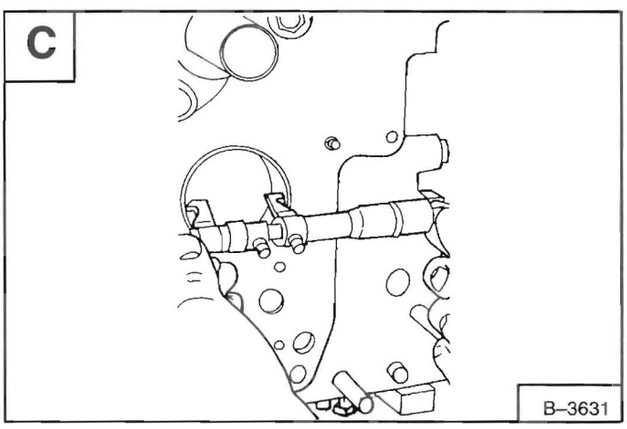
Put the crankshaft on v–blocks **[B]**.

Put a dial gauge on the center journal. Turn the crankshaft at a slow rate.

The specifications are 0.008 inch (0,02 mm). The allowable limit is 0.0031 inch (0,08 mm).

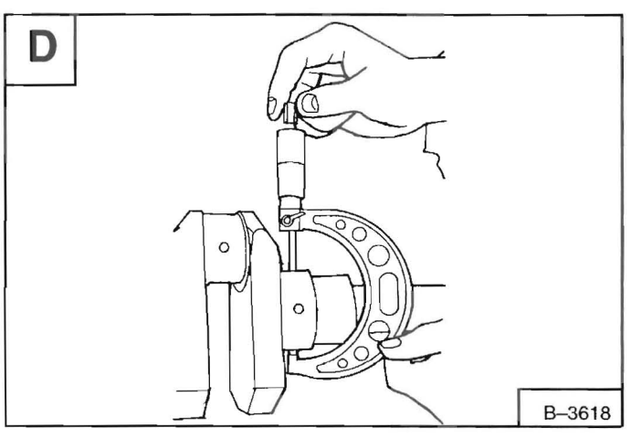


Measure the No. 1 main bearing **[C]**. The specifications are 1.7317–1.7339 inch (43,984–44,040 mm). The clearance between the bearing and the journal must be 0.0013–0.0042 inch (0,034–0,106 mm) and the allowable wear limit is 0.0079 inch (0,2 mm). Replace as needed.



Measure the outside diameter of the crankshaft journals **[D]**

Std. 1.7297–1.7303 inch (43,93–43,95 mm).



Servicing the Crankshaft (Cont'd)

Put a piece of plastic gauge on the crankshaft main bearing **[A]**.

Install the main bearing on the journal and tighten the bolts to 21–25 ft.–lbs. (29–34 Nm) torque.

NOTE: DO NOT turn the bearing.

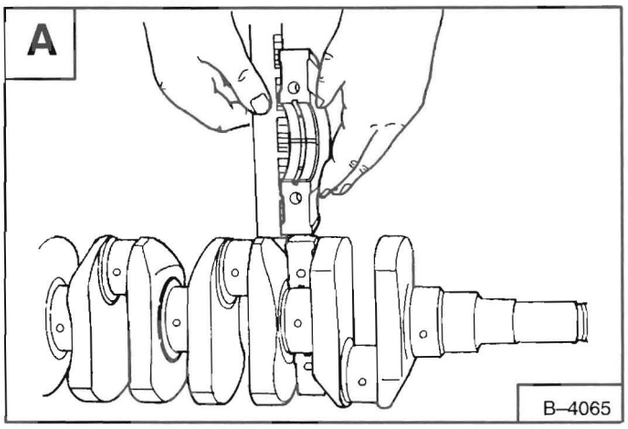
Remove the main bearing and measure the plastic gauge **[A]**. Measure the plastic gauge with the paper gauge and if the measurement is over the allowable limit, replace as needed.

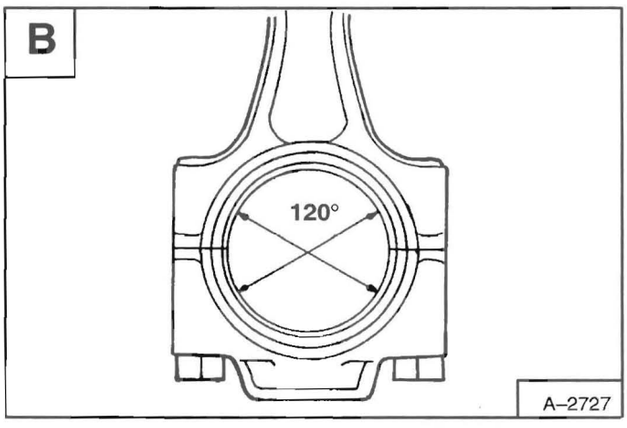
The specifications for the outside diameter of the crankshaft journal is: (Std.) 1.7297–1.7303 inch (43,93–43,95 mm). The inside diameter of the main bearings is: (Std.) 1.7317–1.7339 inch (43,98–44,04 mm). the minimum allowable wear limit between the two items is 0.0079 inch (0,20 mm).

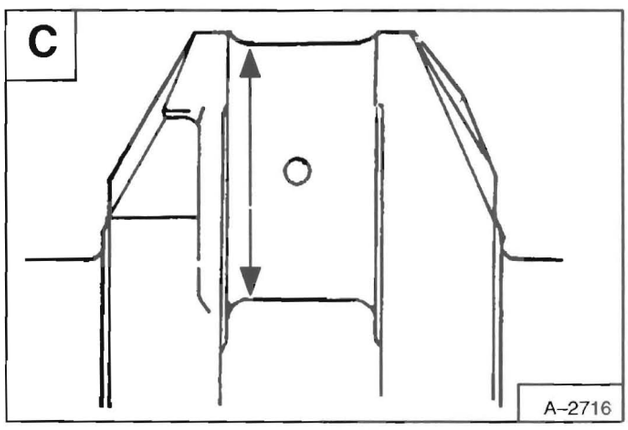
Measure the connecting rod bearings **[B]**. The specifications are 1.4569–1.4587 inch (37,005–37,050 mm).

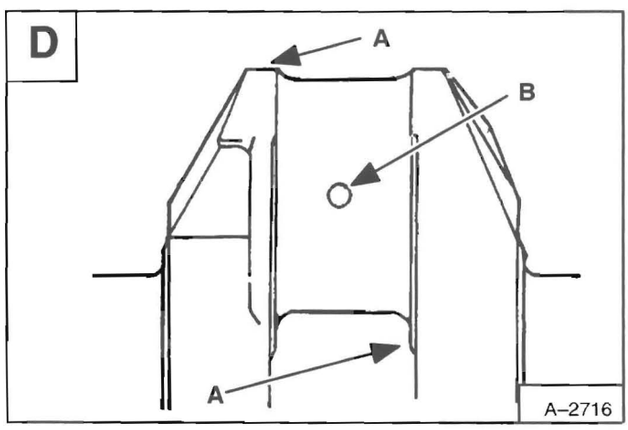
Measure the connecting rod journal **[C]**. The specifications are 1.4551–1.4557 inch (36,95–36,97 mm). The allowable wear limit between the two items is 0.0079 inch (0,2 mm).

If the journals are not specifications, grind the crankshaft. (See Section 9 for the correct specifications **[D]**.)



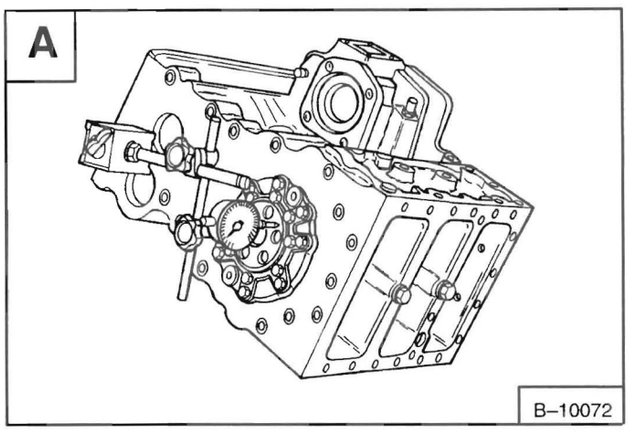






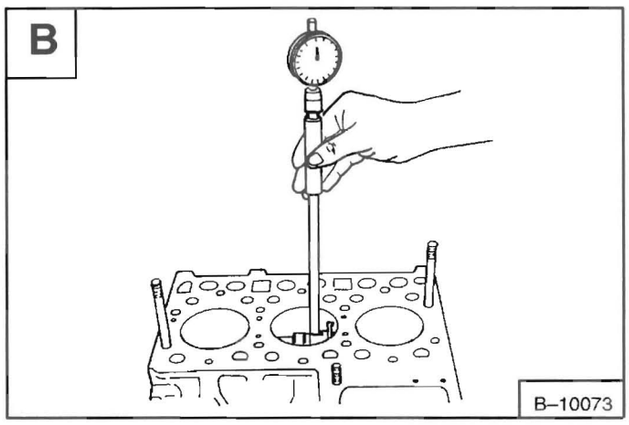
Servicing the Crankshaft (Cont'd)

When the crankshaft is installed, the end play must be checked **[A]**. If the end play is more than 0.0059–0.0122 inch (0,15–0,31 mm) replace the thrust bearing on the main bearing.



Servicing the Cylinder Liners

Use a micrometer to measure the inside of the cylinder liner **[B]**.



To find the maximum wear, measure the inside diameter of the cylinder liner in three different locations **[C]**. The inside diameter specifications on the cylinder liner is 2.6772–2.6779 inch (68,00–68,019 mm). The allowable wear limit is +0.0059 inch (+0,15 mm).

When the cylinder has more wear than the specifications, bore and hone the cylinder to an oversize diameter.

NOTE: Make sure you use the correct oversize pistons and rings.

When the cylinder wear is more than the wear limit, replace the cylinders. These are dry liners.

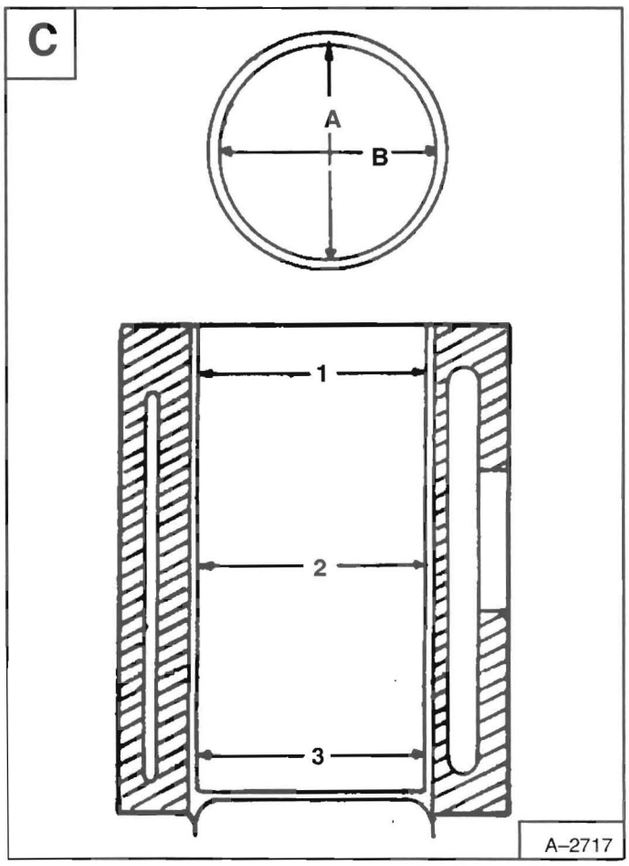
Remove the cylinder liners.

Clean and put oil in the bore of the engine block.

Clean and put oil on the outside of the cylinder liner.

Install the cylinder liner into the engine block with the chamfered end down.

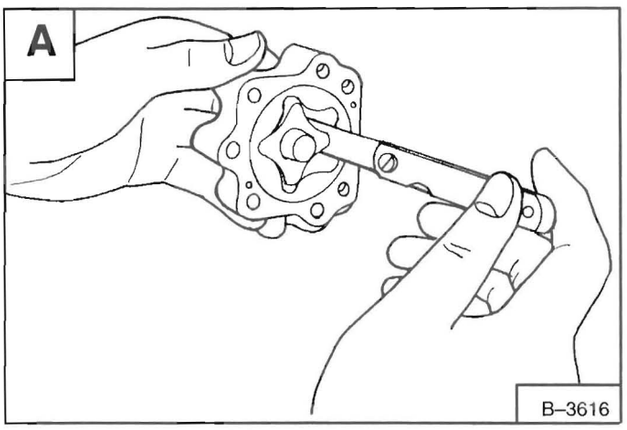
After installation of the cylinder liner, bore or hone the cylinder to standard size.



Servicing the Oil Pump

Use a feeler gauge to check the clearance between the inner and outer rotor **[A]**.

The clearance for the inner rotor is 0.0043–0.0059 inch (0,07–0,15 mm). The allowable wear limit is 0.0079 inch (0,2 mm).

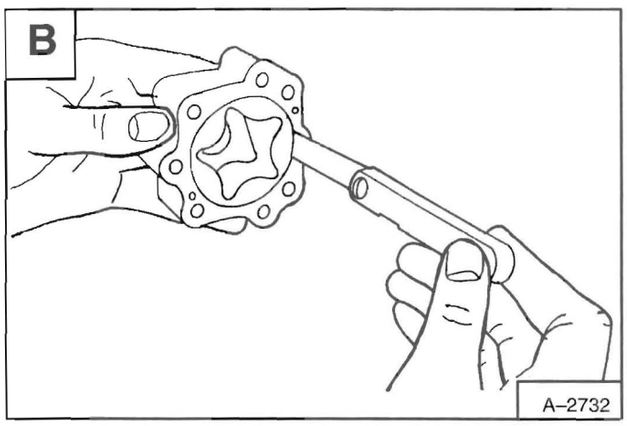


Use a feeler gauge to check the clearance between the outer rotor and the body of the oil pump **[B]**.

The clearance for the outer rotor is 0.0028–0.0059 inch (0,07–0,15 mm).

At rated engine RPM, the oil pump pressure is 28 to 64 PSI (196 to 441 kPa). It must not be any lower than 10 PSI (69 kPa) at engine idle RPM.

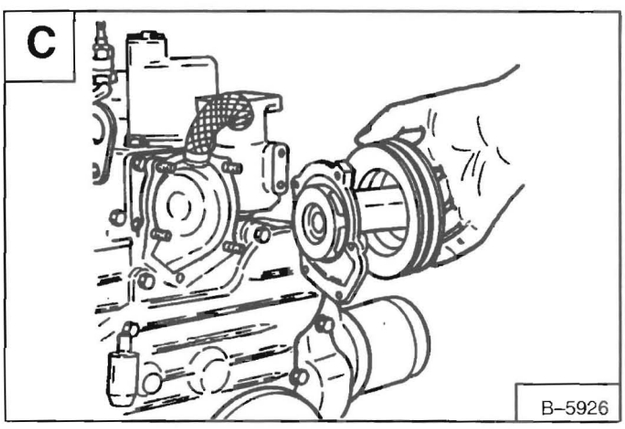
End clearance between rotor and cover is 0.0031–0.0051 inch (0,08–0,13 mm).



Servicing the Water Pump

Remove the water pump from the gearcase **[C]**.

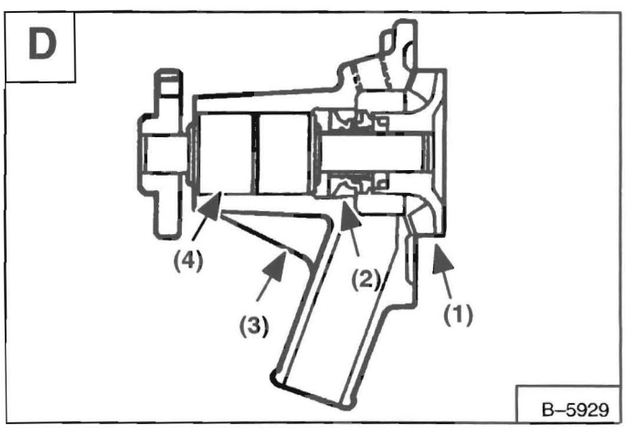
Put the water pump in a vise and remove the sheave.



Drive the shaft out the impeller side of the water pump **[D]**.

Remove the seal.

When installing the water pump on the engine use a new gasket.



ASSEMBLY OF THE ENGINE

Installing the Crankshaft

Install the main bearing cases on the crankshaft journals with the marks toward the flywheel. Tighten the bolts to 15–17 ft.–lbs. (20–24 Nm) torque.

Install the thrust bearing with the oil grooves to the outside.

Install the crankshaft in the engine. Make sure the holes in the main bearings are aligned with the holes in the engine block **[A]**.

Install the main bearing case bolts and tighten to 22–25 ft.–lbs. (30–34 Nm) torque **[A]**.

Install new seals on the crankshaft rear cover.

Install the rear cover and tighten the bolts to 84–108 in.–lbs. (9,5–12,2 Nm) torque.

Installing the Pistons

Assemble the connecting rod to the piston.

NOTE: Make sure the marks on the piston and connecting rod are in the same direction.

Install the rings on the piston **[B]**. Position the top ring gap toward the camshaft. Position the other rings so there is a gap every 120° with no gap toward the piston pin in the cylinder.

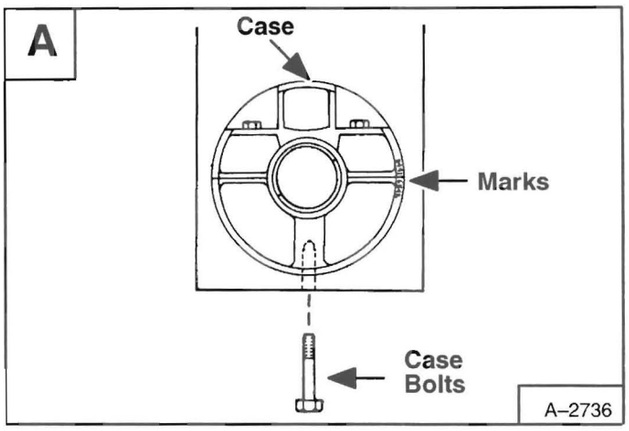
Install the pistons in the engine block using a ring compressor. The alignment marks must be opposite the camshaft.

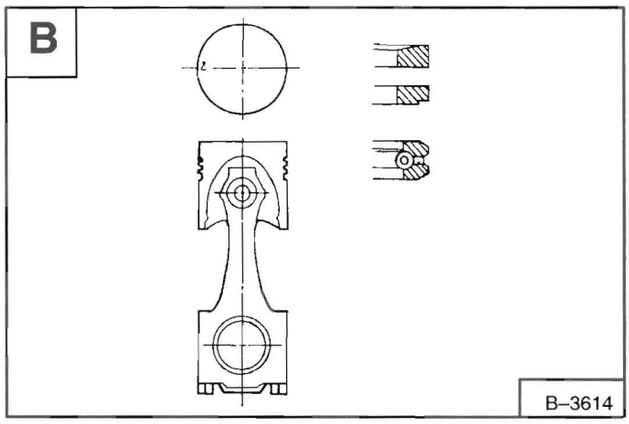
Align the bearing cap to the connecting rod **[C]**.

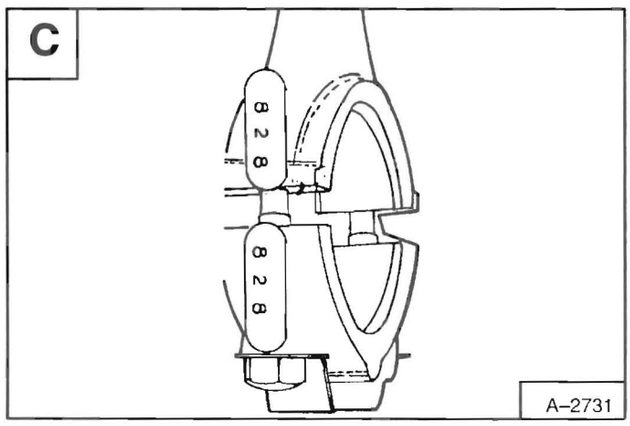
Put oil on the bolts and tighten to 20–22 ft.–lbs. (27–30 Nm) torque.

Install the oil pump tube and screen.

Put a new gasket on the oil pan and install the oil pan.





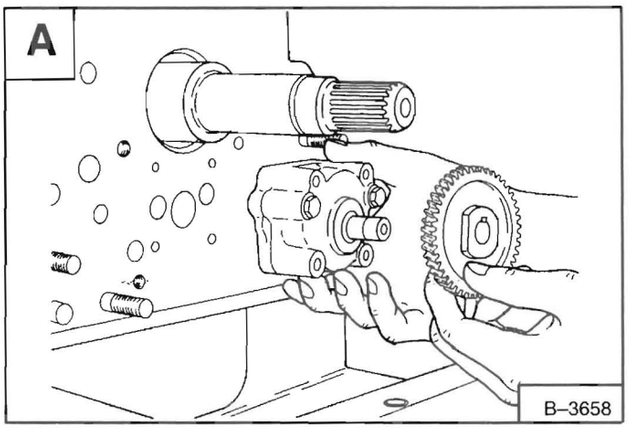


Installing the Camshaft and Timing Gears

Install the oil pump and tighten the bolts to 60–72 in.–lbs. (6,8–8,1 Nm) torque **[A]**.

Install the gear and tighten the nut.

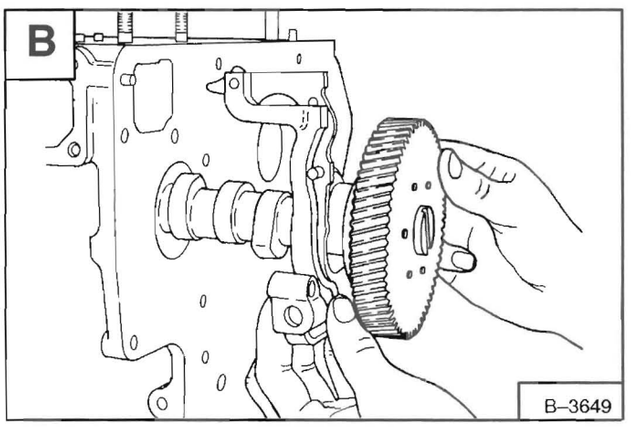
Install the key and gear on the camshaft.



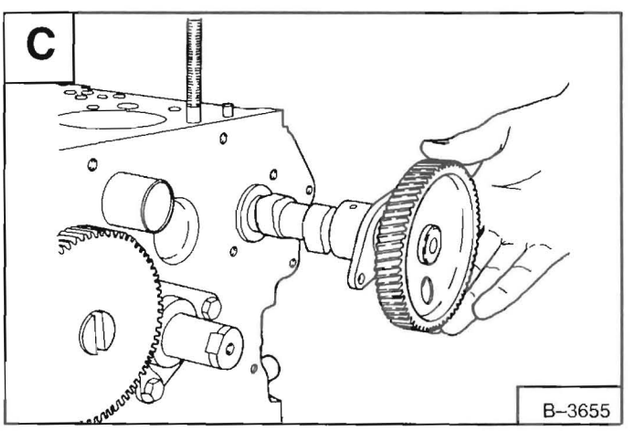
Install the fuel camshaft and fork lever **[B]**.

Install the stop bolt on the fork lever and tighten to 60–72 in.–lbs. (6,8–8,1 Nm) torque.

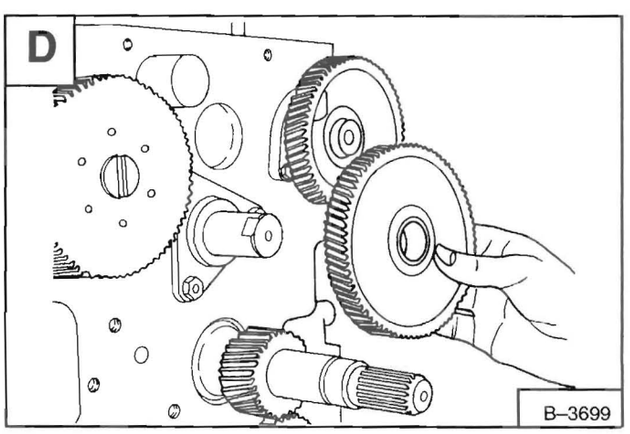
Install the bolts and tighten to 13–15 ft.–lbs. (18–21 Nm) torque.



Install the camshaft and tighten the bolts to 14–15 ft.–lbs. (18–21 Nm) torque **[C]**.



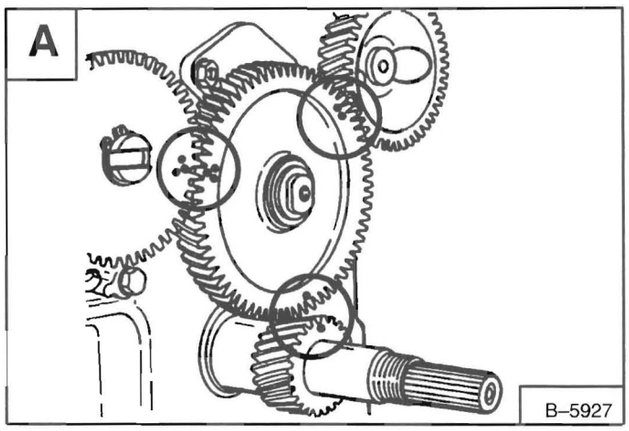
Install the idler gear **[D]**.



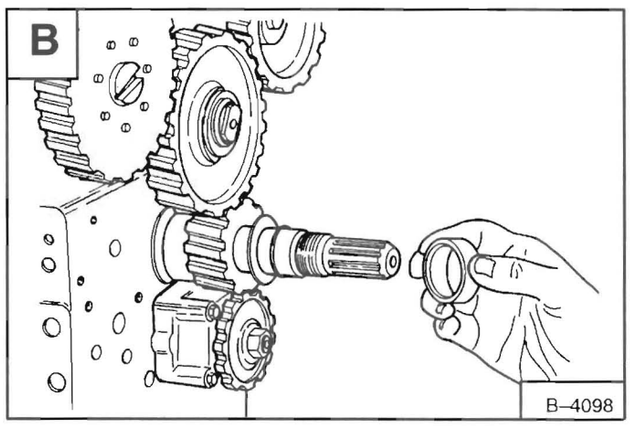
Installing the Camshaft and Timing Gears (Cont'd)

Make sure the timing marks are in correct alignment **[A]**.

Install the snap ring on the idler gear shaft.



Install the oil slinger. Put oil on the O–ring and install the O–ring and the collar **[B]**.

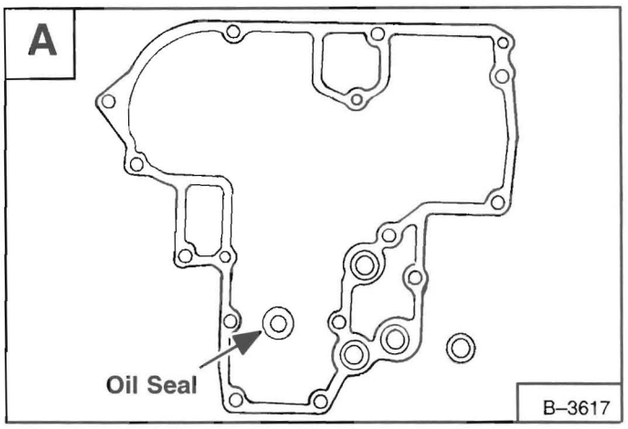


Installing the Gearcase Cover

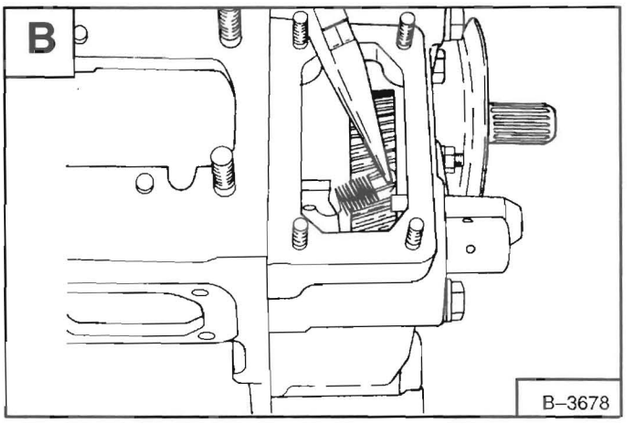
Install the three O–rings and the oil seal in the gearcase cover **[A]**. Put oil on the oil seal.

Put non–drying adhesive on the edge of the gearcase cover.

Install the gearcase cover and tighten the bolts to 13–15 ft.–lbs. (18–21 Nm) torque.

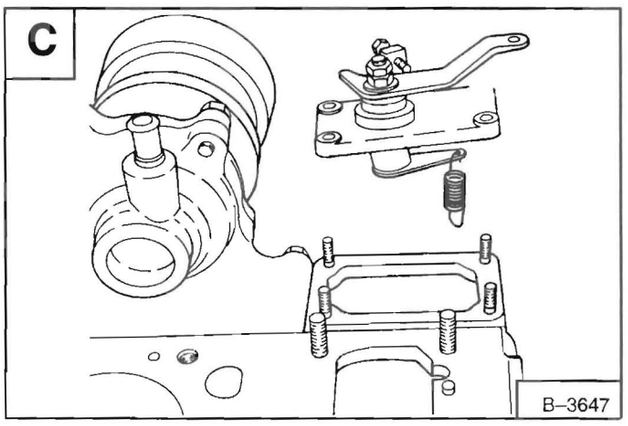


Install and connect the start spring **[B]**.



Install the speed control plate and the governor spring **[C]**.

NOTE: Make sure you do not drop the governor spring into the gearcase.

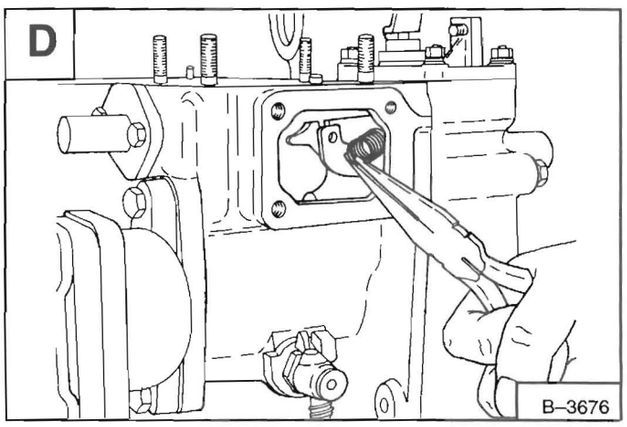


Connect the governor spring **[D]**.

See Page 7B–8 to install the fuel injection pump.

See Page 7B–26 to install the cylinder head on the engine block.

See Page 7B–14 to install the engine in the loader.



Page Number

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bobcat

BOBCAT INTERLOCK CONTROL SYSTEM (BICS™)

Inspecting the BICS™ System Controller (Engine STOPPED – Key ON)

Sit in the operator's seat. Turn key ON, lower the seat bar and disengage the parking brake. All five (5) BICS™ System Controller lights should be ON (Items 1, 2, 3, 4 & 5) **[A]**.

Engage the parking brake, raise the seat bar fully. Seat bar light (Item 2) **[A]**, valve light (Item 3) **[A]** and traction light (Item 4) should be OFF.

Raise up slightly off the seat. Seat light (Item 1) **[A]** should be OFF.

NOTE: Record what lights are blinking (if any) and number of blinks. Refer to Page 8–4.

Exit the loader and press traction lock override button. Traction light (Item 4) **[A]** should be ON. Press override button again and traction light (Item 4) **[A]** should be OFF.

Inspecting the Seat and Seat Bar Sensors (Engine RUNNING)

Sit in the operator's seat, lower the seat bar and engage the parking brake. Fasten the seat belt.

Start the engine and operate at low idle. While raising the lift arms, raise the seat bar fully. The lift arms should stop. Repeat using the tilt function.

NOTE: The auxiliary hydraulic functions are not affected by the Bobcat Interlock Control System (BICS™).

Inspecting the Traction Lock (Engine Running)

Sit in the operator's seat.

Fasten the seat belt, disengage the parking brake, and raise the seat bar fully. Move the steering levers slowly forward and backward. The traction lock should be engaged. Lower the seat bar.

Engage the parking brake pedal and move the steering levers slowly forward and backward. The traction lock should be engaged.

Inspecting the Lift Arm By–Pass Control

Raise the lift arms six (6) feet (2 m) off the ground. Stop the engine, pull and hold the by–pass control knob. Push the *toe* of the left foot pedal and the lift arms should lower slowly.

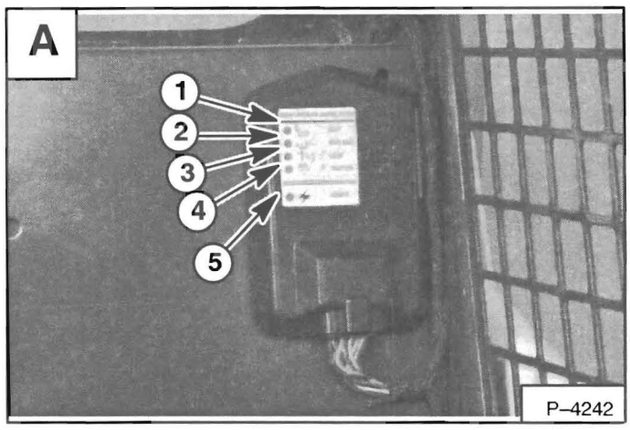
Maintenance

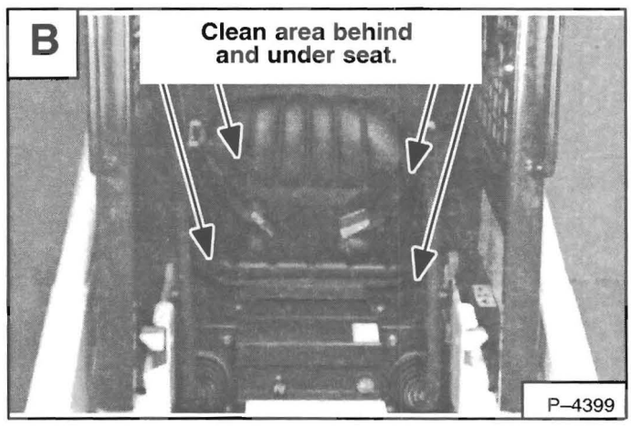
Clean any debris, dirt or objects from under or behind the operators seat **[B]** & **[C]**. The right side of the seat must move up and down.

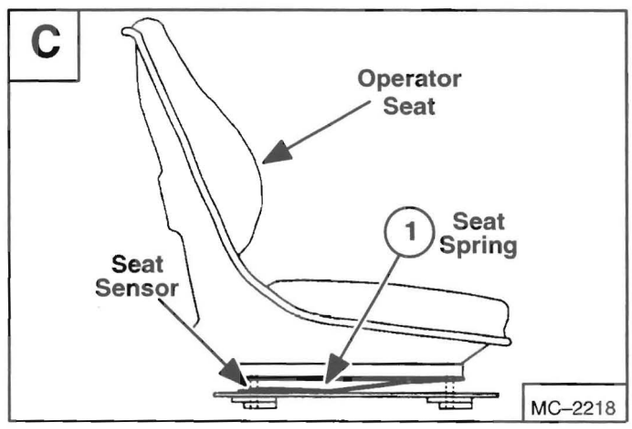
Clearance is necessary between the seat mount (Item 1) **[C]** and the seat pan, to allow the seat to move up and down freely. With adequate clearance, the seat sensor will be allowed to function properly.

Inspect seat bar pivot area for tight linkage bolts.

Replace parts that are damaged. Use only genuine Melroe replacement parts.







⚠ WARNING

AVOID INJURY OR DEATH

The Bobcat Interlock Control System (BICS) must deactivate the lift, tilt and traction drive functions. If it does not, contact your dealer for service. DO NOT modify the system.

W–2151–0394

BOBCAT INTERLOCK CONTROL SYSTEM (BICS™) (Cont'd)

Troubleshoot Chart

The following list shows the effects which can happen to the loader, and the probable causes when the BICS Controller lights are off or flashing. Have the service procedure performed ONLY BY QUALIFIED BOBCAT SERVICE PERSONNEL.

Indicator Light	Light ON	Light OFF	Effect on Operation of Loader When Light Is OFF	Flashing Indicator Means System Problem (See Your Bobcat Dealer for Service)	
				Number of Flashes	Cause
Seat 	Operator in Seat	No Operator in Seat	Lift and tilt functions will not operate.	2	Seat sensor circuit shorted to battery.
				3	Seat sensor circuit shorted to ground.
Seat Bar 	Seat Bar Down	Seat Bar Up	Lift, tilt and traction functions will not operate.	2	Seat bar sensor circuit shorted to battery.
				3	Seat bar sensor circuit shorted to ground.
Valve 	Control Valve Can Be Used	Control Valve Cannot Be Used	Lift and tilt functions will not operate.	1	Valve output is open.
				2	Valve output circuit shorted to battery.
				3	Valve output circuit shorted to ground.
				3	Valve output circuit is not grounded.
Traction 	Loader can be moved forward & backward.	Loader cannot be moved forward and backward.	Loader cannot be moved forward and backward.	1	Traction lock hold coil circuit is open.
				2	Traction lock hold coil circuit shorted to battery.
				3	Traction lock hold coil circuit shorted to ground.
				4	Traction lock pull coil circuit is open.
				5	Traction lock pull coil circuit is shorted to battery.
				6	Traction lock pull coil circuit is shorted to ground.
Power 	BICS Controller is operating correctly.	BICS Controller is not operating correctly.	Lift, tilt and traction functions will not operate.		

NOTES:

(1) If the seat and/or seat bar sensor circuits are open, the corresponding lights will be OFF. If one of the lights stay OFF, check the circuit for continuity. See Inspection & Maintenance Instructions in Preventive Maintenance section.

(2) If all five lights flash repeatedly, the voltage supply is greater than 16 volts or less than 9 volts.

(3) Flashing patterns will repeat every 3.25 seconds.

(4) If seat indicator light does not go ON, check for debris, dirt or objects under or behind the seat.

NOTE: If the Seat Bar is lowered before the seat sensor is activated, a 10 second delay will occur before the valve and traction lights come on. (only loaders with BICS controller S/N's above 200,000 will have this delay.)

Troubleshooting Guide

The following troubleshooting guide is provided for assistance in locating and correcting BICS system problems. It is recommended that these procedures be done by authorized Bobcat Service Personnel only.

⚠ WARNING

Check for correct function after adjustments, repairs or service. Failure to make correct repairs or adjustments can cause injury or death.

W–2004–1285

BICS CONTROLLER

PROBLEM	SOLUTION #
Power indicator light does not come ON.	1, 2, 3, 6
All indicator lights flashing.	4
One of the indicator lights flashing.	5
Intermittent indicator lights.	6, 7, 8, 9

SOLUTION SUGGESTIONS

1. Check that ignition switch ON.
2. Check BICS 10 amp. fuse.
3. Check wiring and connections. Make sure the connector is securely connected to the controller. Remove controller and pull on connector to check.
4. Look at indicator light windows, if they are milky white in appearance it is most likely caused by moisture in the controller. Allow to dry or replace the controller.
5. Refer to BICS system controller troubleshooting chart. (See Page 8–4.)
6. Check wire connections to make sure connectors are locked into place.
7. Check pins in connectors for pins pushed back or bent.
8. Move the system wiring back and forth to help locate the area that may be causing the intermittent connection.
9. Use sensor tester MEL1428 to isolate problem between sensor and controller and wiring.

Troubleshooting Guide (Cont'd)

The following troubleshooting guide is provided for assistance in locating and correcting BICS system problems. It is recommended that these procedures be done by authorized Bobcat Service Personnel only.

⚠ WARNING

Check for correct function after adjustments, repairs or service. Failure to make correct repairs or adjustments can cause injury or death.

W–2004–1285

TRACTION LOCK

PROBLEM	SOLUTION #
Traction lock stays engaged.	1, 2, 3, 4, 5, 6, 7, 8
Intermittent activation of traction lock.	9, 10, 11

SOLUTION SUGGESTIONS

1. Check that controller power indicator light is ON.
2. Make sure brake pedal is not engaged.
3. Maneuver loader to allow brake discs to move and remove pressure on the brake wedge so it can retract.
4. If all lights indicate the brake should be released, but it is not, check the brake 25 amp. fuse.
5. When checking fuse, also check other fuses. Check the fuse block for correct orientation and location of fuses. (See Electrical System, Page 6–1.)
6. To test the solenoid, the pull coil should be .4 to .5 ohms and the hold coil 10.5 to 11.0 ohms.
7. Check brake solenoid and cover mounting hardware for the correct torque.
8. Remove brake cover and check wedges for binding in the wedge guides.
9. Check wire connections for loose connector body.
10. Check for loose or bent pins in connectors.
11. Check for loose spade connectors in fuse holder.

Troubleshooting Guide (Cont'd)

The following troubleshooting guide is provided for assistance in locating and correcting BICS system problems. It is recommended that these procedures be done by authorized Bobcat Service Personnel only.

⚠ WARNING

Check for correct function after adjustments, repairs or service. Failure to make correct repairs or adjustments can cause injury or death.

W–2004–1285

SEAT SENSOR

PROBLEM	SOLUTION #
Seat indicator light does not come ON with operator in seat..	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11
Seat indicator light stays ON when operator is out of seat.	2, 3, 6, 10, 11, 12, 13, 14
Intermittent indicator light during operation.	11, 15, 16, 17, 18

SOLUTION SUGGESTIONS

1. Check to make sure power indicator light is ON.
2. Check for debris under and around seat.
3. Look for any obstruction around seat.
4. Check to make sure seat rail lowers when weight is in seat.
5. Raise cab and check for magnet collar movement when weight is added to seat. (Magnet collar should extend approximately 3/8" beyond the sensor assembly with weight in the seat).
6. Use sensor tester to check operation of sensor and controller. Follow instructions on tester.
7. Check to make sure the magnet guide pin is in place.
8. Check for contamination on magnets such as metal particles or for shipping plate over magnets.
9. Check to make sure both magnets are in collar.
10. Check for binding of magnet collar or bushing with hex head on other side for binding.
11. Check for correct mounting. One spring for standard seat. Two springs for suspension seats. Thick washers should be under front seat mounting rails on both sides.
12. Check for loose hardware mounting magnet collar. Check to make sure the magnet collar bushing is threaded on all the way so it is contacting seat rail.
13. Check to make sure seat rail raises when weight is removed from the seat.
14. Raise cab and check for magnet collar movement when weight is removed from seat. (Magnet collar should extend approximately 1/8" beyond the sensor assembly without weight in seat).
15. With smaller operators that operate with the seat forward some mounting alterations may be required. (See solution suggestions 16, 17 and 18.)
16. Adjust suspension seat to lightest weight setting.
17. Check to make sure the seat rails move up and down freely when weight is added.
18. Add a washer between the magnetic collar bushing and the seat rail. This will reduce the amount of seat travel required to activate the system. **Must check**, with seat moved all the way back, that indicator light does not stay on with operator out of seat. If light does not go out with operator out of the seat, the washer must be removed.

Troubleshooting Guide (Cont'd)

The following troubleshooting guide is provided for assistance in locating and correcting BICS system problems. It is recommended that these procedures be done by authorized Bobcat Service Personnel only.

⚠ WARNING

Check for correct function after adjustments, repairs or service. Failure to make correct repairs or adjustments can cause injury or death.

W–2004–1285

SEAT BAR SENSOR

PROBLEM	SOLUTION #
Indicator light does not come ON when seat bar is lowered.	1, 2, 3, 4, 5, 6

SOLUTION SUGGESTIONS
1. Check controller power indicator light. It must be ON.
2. Check sensor wire connection.
3. Use the BICS sensor tester MEL1428 to check sensor and controller.
4. Check for loose hardware.
5. Check keyed bushing to make sure magnet collar rotates with seat bar.
6. Check magnet collar magnets for contamination such as metal particles.

Troubleshooting Guide (Cont'd)

The following troubleshooting guide is provided for assistance in locating and correcting BICS system problems. It is recommended that these procedures be done by authorized Bobcat Service Personnel only.

⚠ WARNING

Check for correct function after adjustments, repairs or service. Failure to make correct repairs or adjustments can cause injury or death.

W–2004–1285

LIFT LOCK BYPASS VALVE

PROBLEM	SOLUTION #
Bypass valve stuck.	1
Bypass valve stem bent or broke.	2

SOLUTION SUGGESTIONS
1. Rotate shaft.
2. Replace manual spool cartridge.

BICS™ SYSTEM CONTROLLER

Removal and Installation

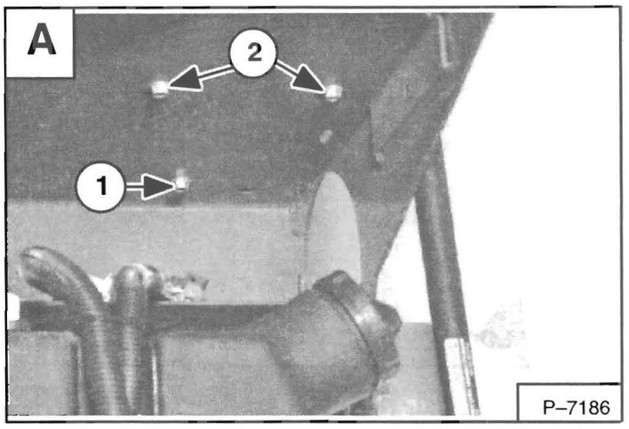
Raise the loader operator cab. (See Page 1–1.)

The controller mounting bolts are located on the back of the operator cab **[A]**.

Remove the top mounting bolt (Item 1) **[A]** from the controller.

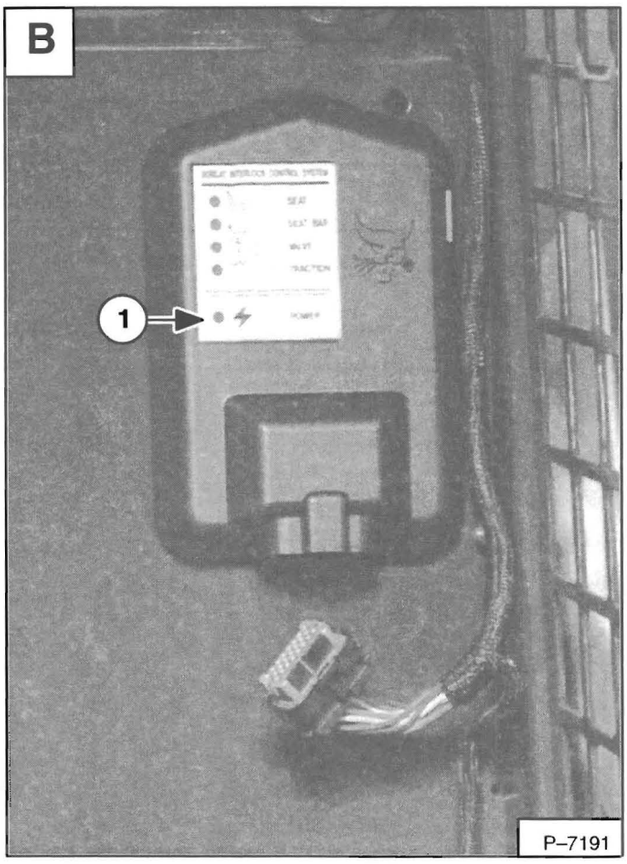
Loosen the (2) lower mounting bolts (Item 2) **[A]**.

Lower the operator cab.



Disconnect the electrical harness from the controller **[B]**.

Slide the controller (Item 1) **[B]** up and remove it from the back of the operator cab.



IMPORTANT

Be sure the connector to the BICS system controller is correctly engaged in the controller when installing the controller. An audible snap can be heard when the connector is correctly installed. Try to pull the connector out of the controller, if it cannot be removed it has been correctly installed.

I–2087–1095

Installation: Tighten the controller mounting bolts to 80–90 in.–lbs. (9–10 Nm) torque.

Reverse the removal procedure to install the controller.

BICS™ SYSTEM CONTROLLER (Cont'd)

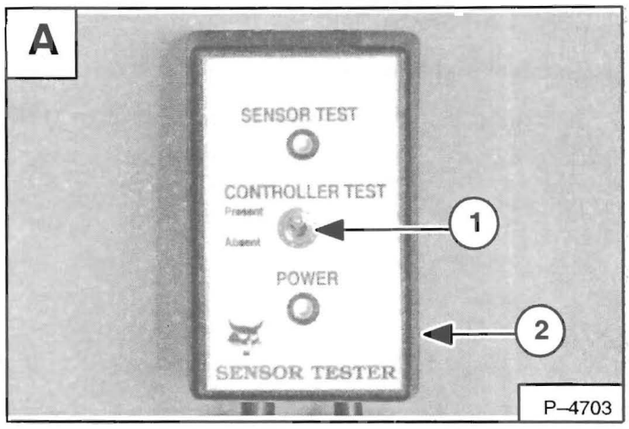
Controller Test

MEL1428 Sensor Tester is necessary for the following procedure:

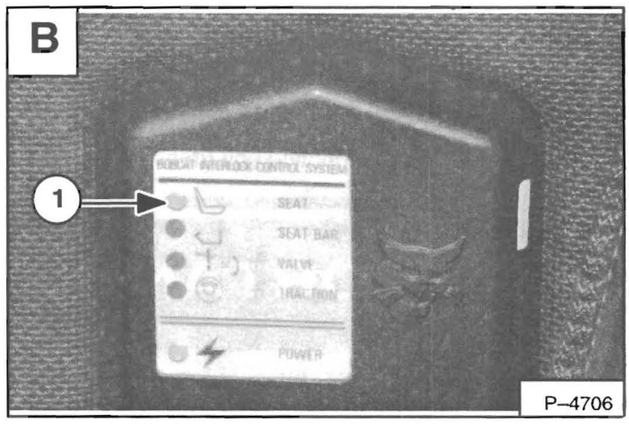
Turn the key to the ON position. **DO NOT START THE ENGINE.**

After completing the procedure for the Seat sensor test or the Seat Bar sensor test, do the Controller test. Refer to Page 8–13 or 8–15 for correct procedures to do the Seat Bar sensor test or the Seat sensor test.

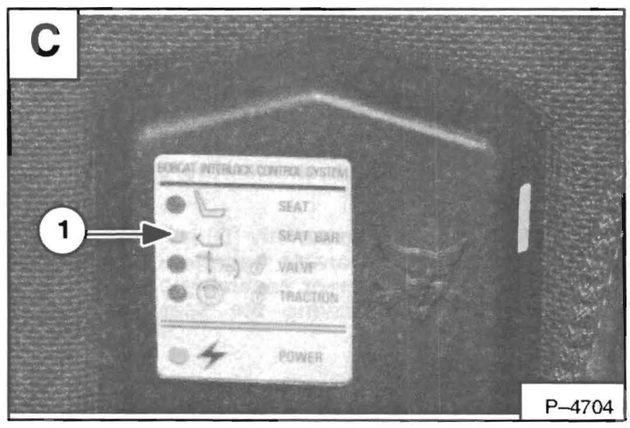
Move the toggle switch (Item 1) **[A]** on the sensor tester (Item 2) **[A]** to the **Present** position.



If the controller is working correctly, the Seat light (Item 1) **[B]** on the controller will illuminate when the tester is connected to the Seat sensor.



When the tester is connected to Seat Bar sensor, the Seat Bar light (Item 1) **[C]** will illuminate if the controller is working correctly.

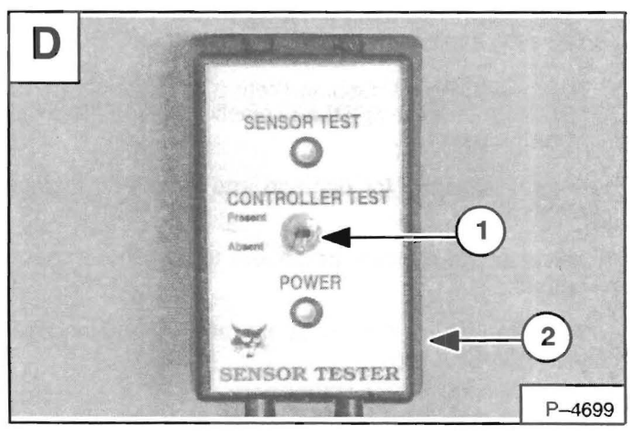


Move the toggle switch (Item 1) **[D]** on the sensor tester (Item 2) **[D]** to the **Absent** position.

The Seat light (Item 1) **[B]** or the Seat Bar light (Item 1) **[C]** should go off.

If the tests above fail, there is a problem with the BICS system controller or the wiring harness.

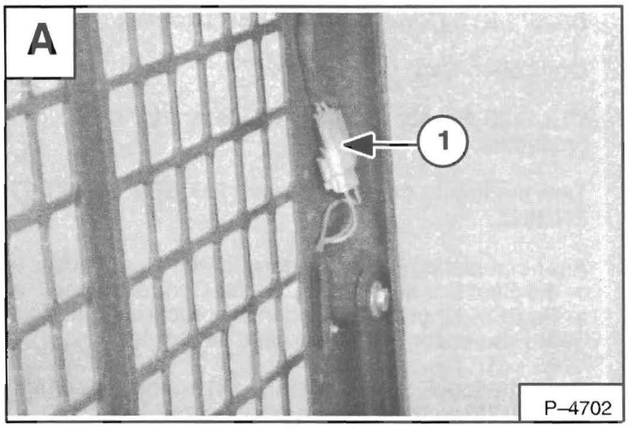
Refer to Page 8–3 for the correct procedure to inspect the BICS System Controller.



SEAT BAR SENSOR

Removal and Installation

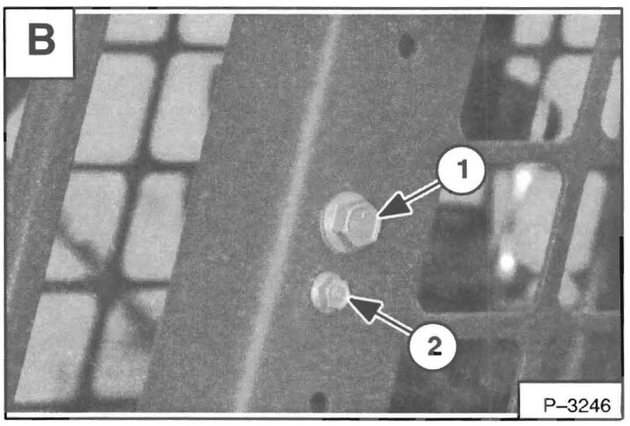
Disconnect the seat bar sensor connector (Item 1) **[A]**.



Remove the mounting bolt (Item 1) **[B]** from the pivot bushing.

Installation: Tighten the mounting bolt to 25–28 ft.–lbs. (34–38 Nm) torque.

Remove the sensor mounting bolt (Item 2) **[B]** and nut.

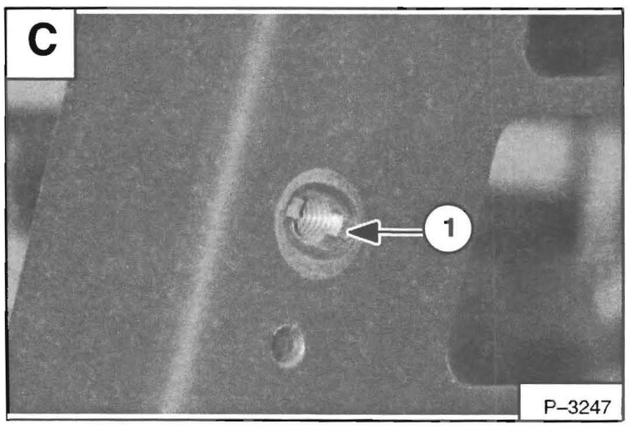


IMPORTANT

Be careful to not overtighten the sensor mounting bolt and nut to prevent breakage of the sensor.

I–2088–1095

Installation: Be sure the tabs on the pivot bushing are positioned in the slotted hole (Item 1) **[C]** of the operator cab as shown.

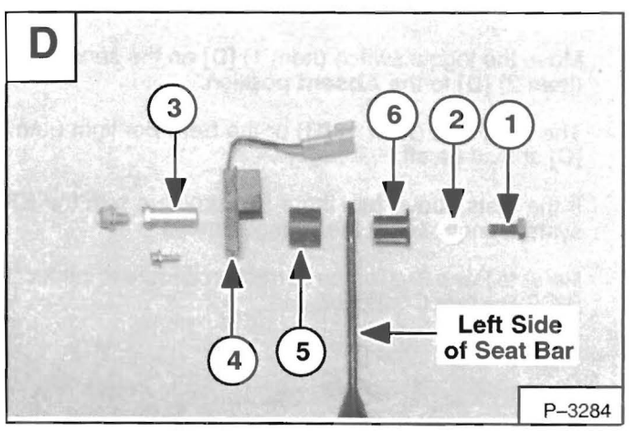


Pull the seat bar back and remove the assembly as follows:

NOTE: The sensor assembly [D] is shown removed from the operator cab for clarity purpose only. The sensor assembly can be removed without removing the seat bar from the operator cab.

Remove the pivot bushing mounting bolt (Item 1) **[D]** and washer (Item 2) **[D]** from the pivot bushing (Item 3) **[D]**.

Installation: Tighten the pivot bushing mounting bolt to 180–200 in.–lbs. (21–23 Nm) torque.



Remove the pivot bushing (Item 3) **[D]**, sensor (Item 4) **[D]**, magnet (Item 5) **[D]** and plastic bushing (Item 6) **[D]** from the seat bar.

Inspect all parts for damage and wear and replace if necessary.

Reverse the removal procedure to install the seat bar sensor.

Refer to Page 5–1 for seat bar removal and installation procedure.

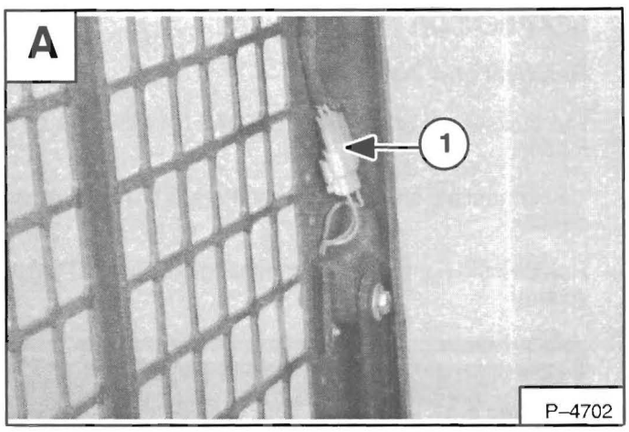
SEAT BAR SENSOR (Cont'd)

Seat Bar Sensor Test

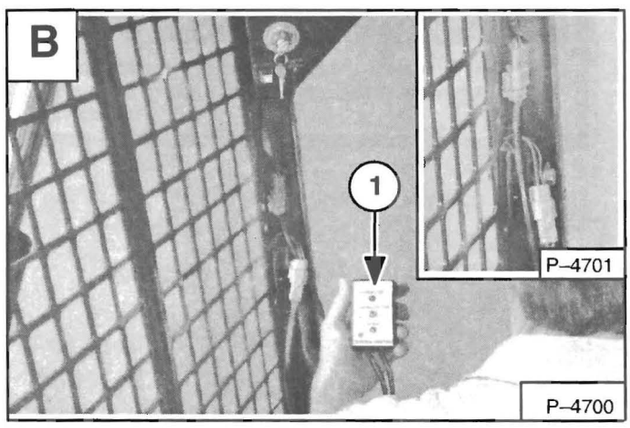
Use MEL1428 Sensor Tester for the following procedure:

Turn the key to the ON position. **DO NOT START THE ENGINE.**

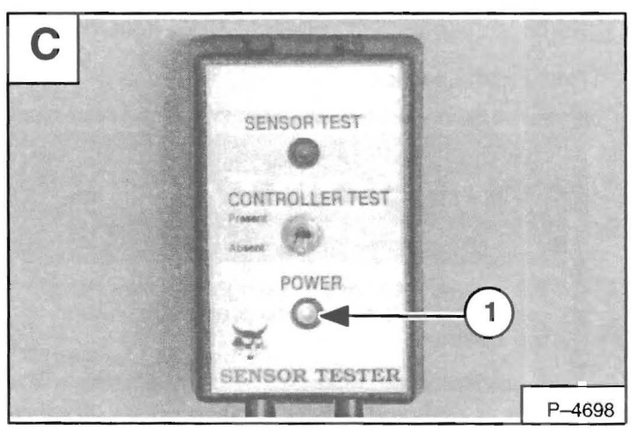
Disconnect the seat bar sensor connector (Item 1) **[A]**.



Connect MEL1428 Sensor Tester (Item 1) **[B]** inline as shown to the seat bar sensor connectors. Also see inset **[B]**.



The power light (Item 1) **[C]** on the sensor tester will illuminate.



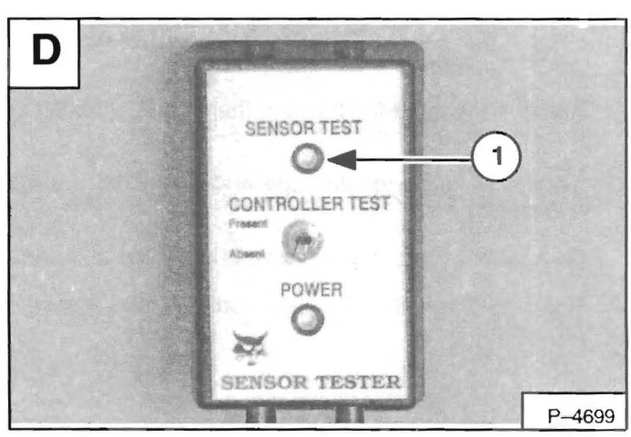
Lower the seat bar. The sensor test light (Item 1) **[D]** should illuminate.

Raise the seat bar. The sensor test light (Item 1) **[D]** should go off.

If the above test fails, there is a problem with the seat bar sensor.

Refer to Page 8–3 for the correct procedure to inspect the Seat Bar Sensor.

Refer to Page 5–1 for seat bar removal and installation procedure.



SEAT SENSOR

Removal and Installation

Put jackstands under the front and rear corners of the loader.

Disconnect the electrical socket (Item 1) **[A]** from the seat sensor.

Remove the right rear seat mounting bolt (Item 2) **[A]** and washer.

IMPORTANT

DO NOT overtighten the magnet mounting bolt to prevent damage to the magnet.

I–2089–1095

Remove the magnet collar (Item 1) **[B]** from the seat sensor.

Remove the mounting bolt (Item 1) **[C]** from the sensor.

Remove the sensor.

IMPORTANT

Be careful to not overtighten the sensor mounting bolt and nut to prevent breakage of the sensor.

I–2088–1095

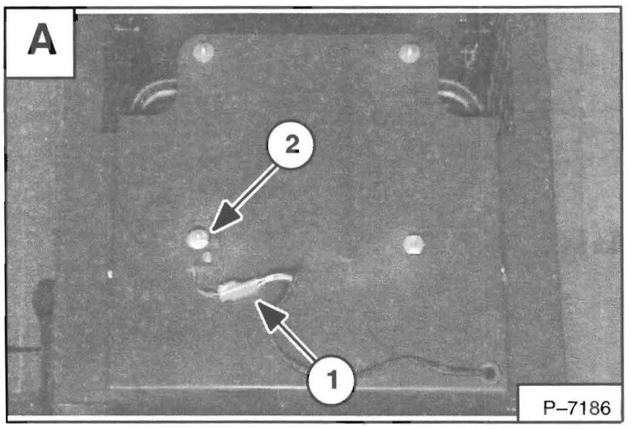
NOTE: Be sure not to lose the magnet collar alignment pin (Item 1) [D] which is located in the sensor (Item 2) [D] when removing the sensor.

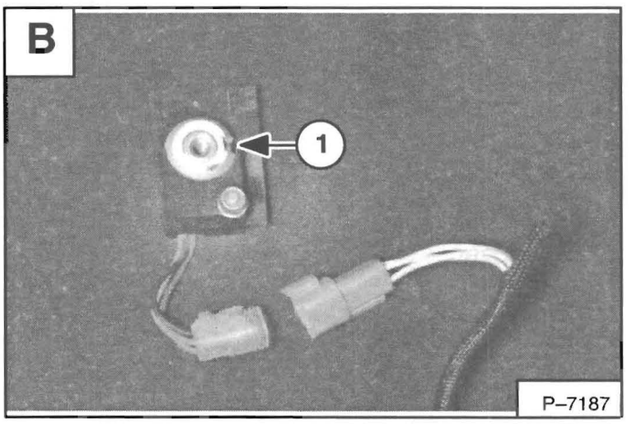
Remove the threaded bushing (Item 3) **[D]** from the seat track mounting bolt. (See Page 5–1.)

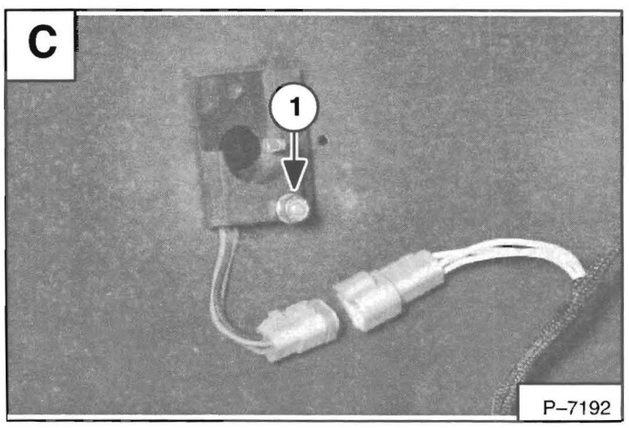
Inspect all parts for damage and wear and replace if necessary.

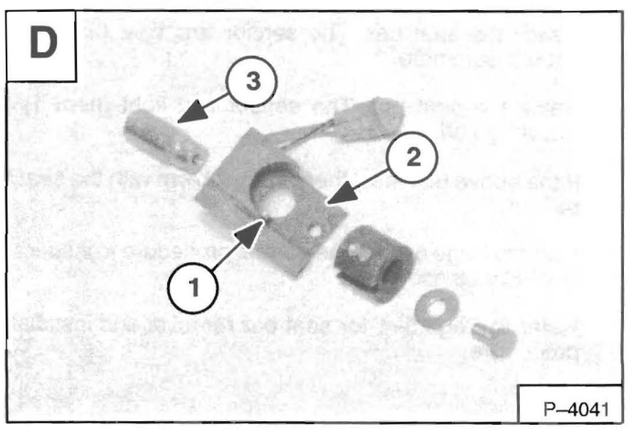
Reverse the removal procedure to install the seat sensor.

Refer to Page 5–1 for seat removal and installation procedure.









SEAT SENSOR (Cont'd)

Seat Sensor Test

Use MEL1428 Sensor Tester for the following procedure:

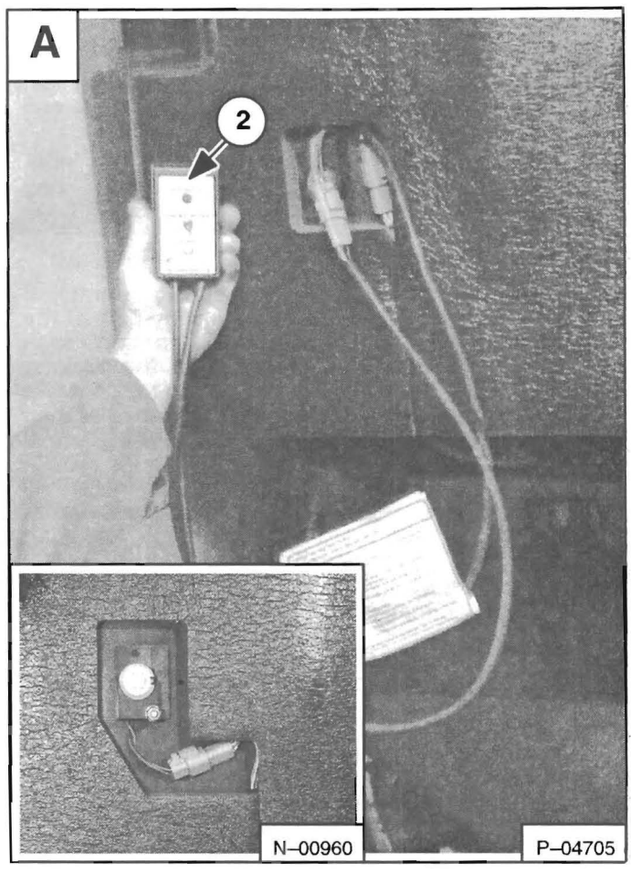
Raise the operator seat. (See Page 1–1.)

Install the remote start switch. (See Page 1–1.)

Turn the key to the ON position. **DO NOT START THE ENGINE.**

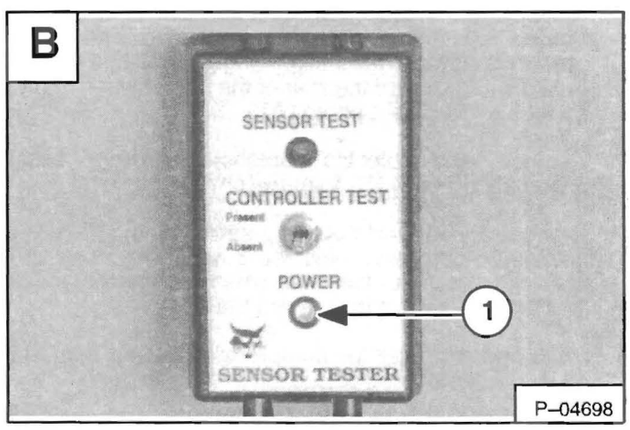
Disconnect the seat sensor connector (Item 1 – Inset) **[A]**.

Connect MEL1428 Sensor Tester (Item 2) **[A]** inline as shown to the seat sensor.



The power light (Item 1) **[B]** on the sensor tester will illuminate.

NOTE: The loader models may not be exactly the same as [A], but the connection for the seat sensor test is the same for all seat sensors.



Sit on the operator seat. The sensor test light (Item 1) **[C]** should illuminate.

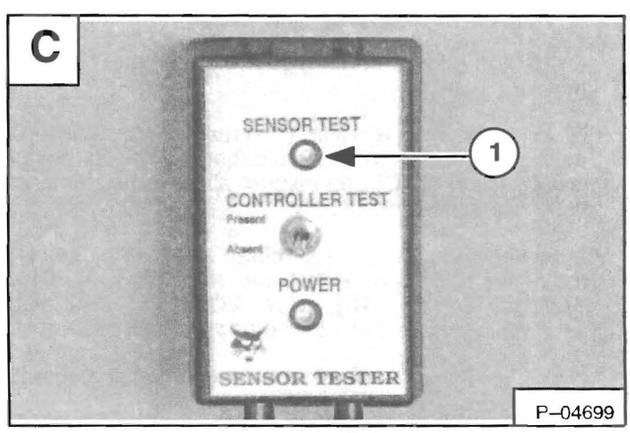
Get off the operator seat. The sensor test light (Item 1) **[C]** should go off.

If the above tests fail, there is a problem with the seat sensor.

If the seat sensor replacement is required, refer to Service Letter, dated Aug. 19, 1995 for positioning.

Refer to Page 8–3 for the correct procedure to inspect the Seat Sensor.

Refer to Page 5–1 for seat removal and installation procedure.



TRACTION LOCK

Removal and Installation

⚠ WARNING

AVOID INJURY OR DEATH

Do not modify the electrical wiring connected to the traction lock solenoid or any part of the traction lock system. The traction lock provides the locking function of the parking brake. Service work on the traction lock system should only be performed by a qualified technician. Use only genuine Melroe parts if repair is necessary.

W–2165–0195

Raise the loader operator cab. (See Page 1–1.)

Remove the center shield. (See Page 3–1.)

Remove the Do Not Modify sta–strap (P/N 6665527) from the electric solenoid connector (Item 1) **[A]**.

Installation: Install a new Do Not Modify sta–strap (P/N 6665527) on the electric solenoid connector.

Remove the two mounting bolts (Item 2) **[A]** from the electric solenoid mounting bracket.

Installation: Tighten the mounting bolts to 25–28 ft.–lbs. (34–38 Nm) torque. Be sure the solenoid mounting bracket is installed in the same position. The solenoid mounting surface has a slight angle which tips the top of the solenoid toward the rear of the loader when installed correctly. (See inset photo **[A]**.)

Remove the electric solenoid/mounting bracket assembly (Item 1) **[B]** from the chaincase cover.

Remove and inspect the compression spring (Item 2) **[B]** for wear or damage. Replace if necessary. The spring may also stay with the shaft when the electric solenoid and bracket are removed from the chaincase.

Installation: Install the compression spring (Item 2) **[B]** on the collar located on the electric solenoid.

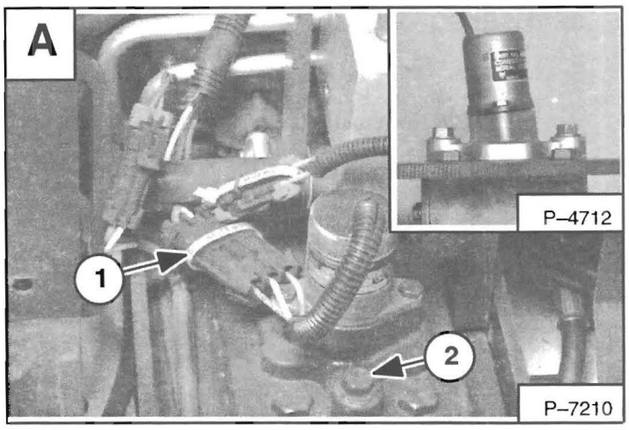
Remove the traction lock assembly (Item 3) **[B]** from the chaincase.

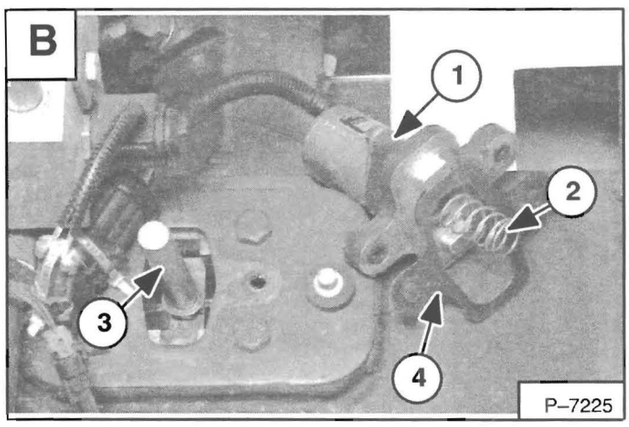
Check the gasket (Item 4) **[B]** condition and replace as needed.

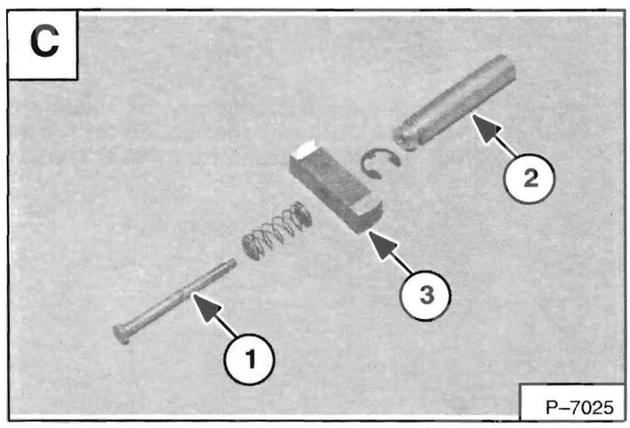
Remove the shaft mounting bolt (Item 1) **[C]**, washer and spring from the assembly shaft (Item 2) **[C]**. Remove the wedge (Item 3) **[C]** and inspect all parts for damage or wear. Replace if necessary.

Installation: Thoroughly clean and dry the shaft mounting bolt (Item 1) **[C]**, the shaft (Item 2) **[C]** and wedge (Item 3) **[C]**. Use LOCTITE #242 when assembling these parts to the traction lock assembly.

Refer to Page 8–3 for the traction lock inspection procedure.







IMPORTANT

Failure to use LOCTITE may allow the traction lock assembly to loosen up which can cause damage to the traction lock system.

I–2090–1095

LIFT ARM BY–PASS BLOCK

Removal And Installation

Put jackstands under the rear corners of the loader.

Raise the lift arms and install an approved lift arm support device. (See Page 1–1).

⚠ WARNING

Never work on a machine with the lift arms up unless the lift arms are secured by an approved lift arm support device. Failure to use an approved lift arm support device can allow the lift arms or attachment to fall and cause injury or death.

W–2059–0598

Raise the operator cab. (See Page 1–1).

⚠ WARNING

Before the cab or the lift arms are raised for service, jackstands must be put under the rear corners of the frame. Failure to use jackstands can allow the machine to tip backward causing injury or death.

W–2014–0895

Remove the center shield and the steering lever panels. (See Page 3–1.)

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.

I–2003–0888

Install caps and plugs on hoses, tubelines and fittings.

Remove the tubelines and hose from the top of the by–pass block **[A]**.

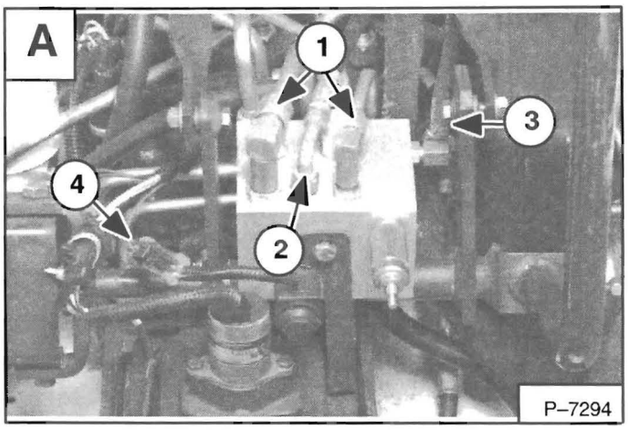
Remove the return hose (Item 1) **[A]**.

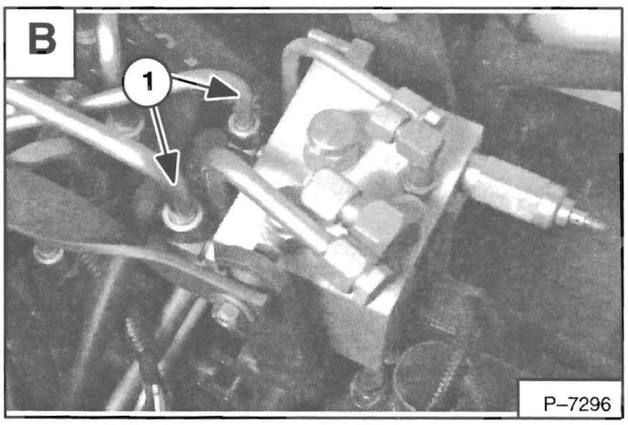
Disconnect the electric solenoid (Item 2) **[A]** from the loader harness.

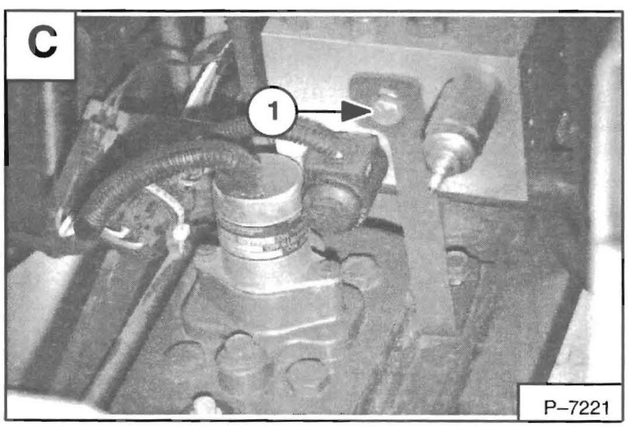
Remove the tubelines (Item 1) **[B]** from the rear of the block.

Remove the bolt (Item 1) **[C]** from the mounting bracket.

Remove the lift arm by–pass block.



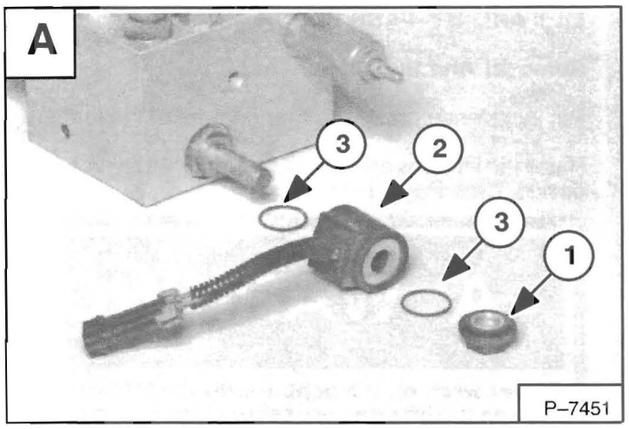




LIFT AND TILT LOCK BY–PASS VALVE (Cont'd)

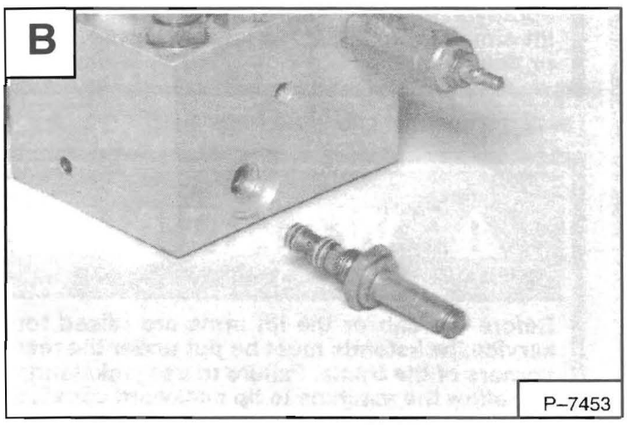
Disassembly and Assembly

Remove the nut (Item 1) **[A]**, the solenoid (Item 2) **[A]** and the O–rings (Item 3) **[A]** from the electric solenoid spool.

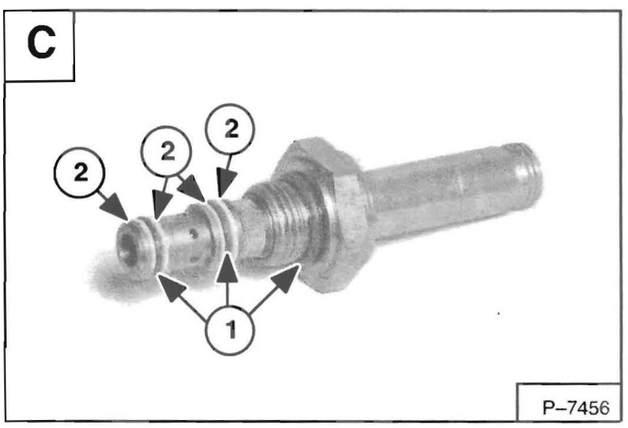


Remove the spool **[B]**.

Replace the spool if damaged.

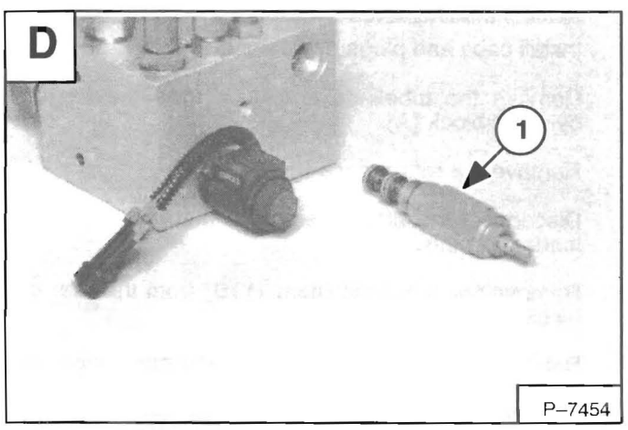


Remove the damaged O–rings (Item 1) **[C]** and backup washers (Item 2) **[C]** from the spool.



Remove the lift by–pass valve (Item 1) **[D]** from the block.

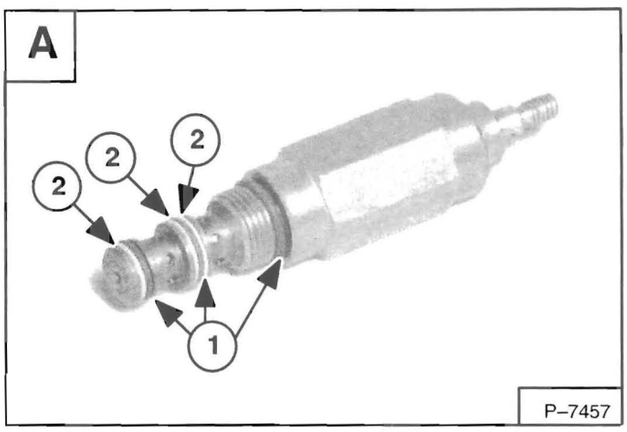
Replace damaged by–pass valve.



LIFT AND TILT LOCK BY–PASS VALVE (Cont'd)

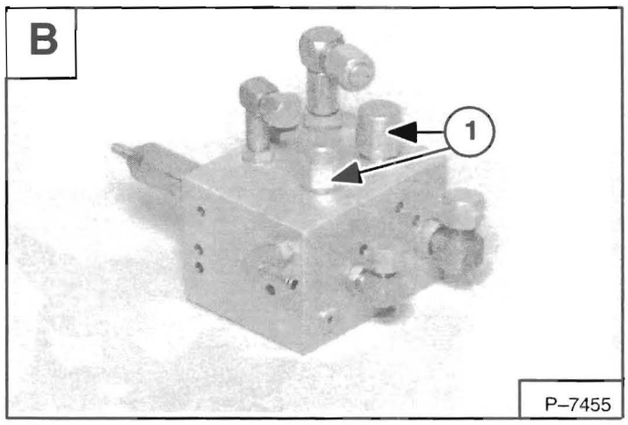
Disassembly and Assembly (Cont'd)

Remove the damaged O–rings (Item 1) **[A]** and backup washers (Item 2) **[A]** from the by–pass valve.

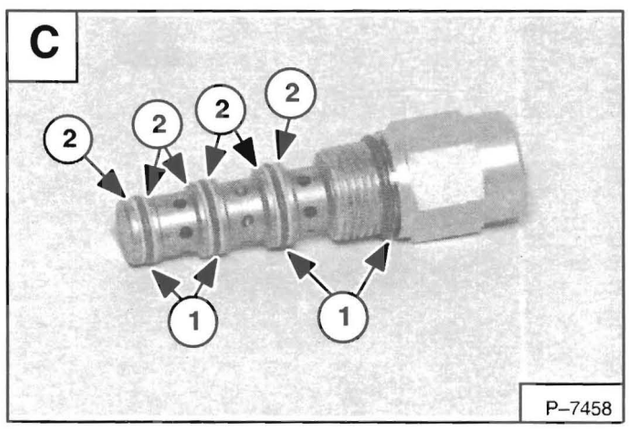


Remove the check valves (Item 1) **[B]** from the by–pass block.

Replace damaged check valves.



Remove the damaged O–rings (Item 1) **[C]** and backup washers (Item 2) **[C]** from the check valve.




bobcat

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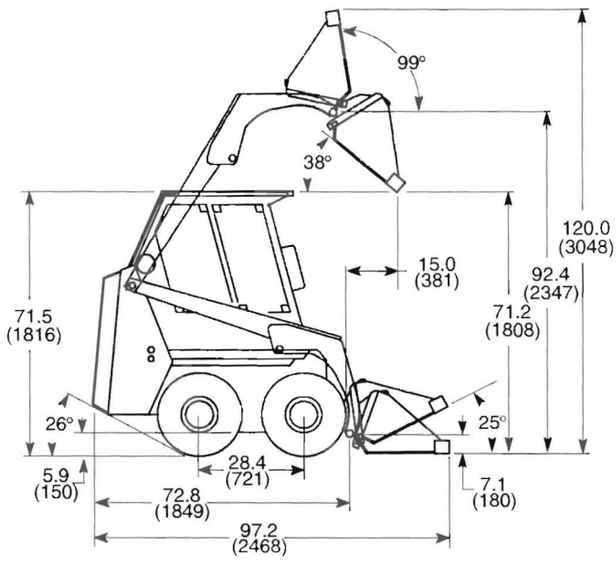
U.S. TO METRIC CONVERSION
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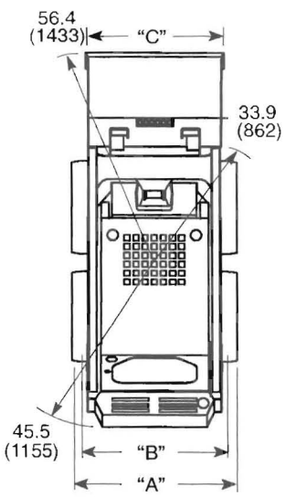

bobcat

LOADER SPECIFICATIONS

Specifications

- Dimensions are given for loader equipped with standard tires and dirt bucket and may vary with other bucket types. All dimensions are shown in inches. Respective metric dimensions are given in millimeters enclosed by parentheses.
- Where applicable, specification conform to SAE or ISO standards and are subject to change without notice.





6708828

"A" STD. TIRES – 35.4 (900) FLOTATON – 43.3 (1100)

"B" STD. TIRES – 29.4 (747) FLOTATION – 34.8 (884)

"C" 36 in. BUCKET WIDTH – 35.5 in. (901 mm)

Changesofstructureorweightdistributionoftheloadercancausechangesincontrolandsteeringresponse and can cause failure of the loader parts.

	450
PERFORMANCE	
Rated Operating Capacity (SAE)	600 lbs. (272 kg)
Tipping Load (SAE Rating)	1217 lbs. (552 kg)
Operating Weight	2195 lbs. (996 kg)
SAE Breakout Force – Lift	1150 lbs. (522 kg)
– Tilt	1050 lbs. (476 kg)
Axle Torque	1775 ft.–lbs. (2407 Nm)
Travel Speed	0–5.2 MPH (8,4 km/hr.)
CONTROLS	
Vehicle Steering	Direction and Speed controlled by two hand levers.
Loader Hydraulics	
Lift and Tilt	Controlled by separate foot pedals.
Front Auxiliary (optional)	Controlled by lateral movement of RH steering lever.
Engine	Hand lever throttle; Key Type starter switch and shutdown.
Starting Aid	Push/Pull manual cable choke.
Service Brake	Two independent hydrostatic systems controlled by two hand operated steering levers.
Secondary Brake	One of the hydrostatic transmissions
Parking Brake	Mechanical Disc, foot operated pedal.
ENGINE	
Make/Model	Kohler/M18QS
Fuel/Cooling	Gasoline/Air
Horsepower (SAE Gross)	16.5 HP (12,3 kW)
(SAE Net)	–
Maximum Governed RPM	3000 RPM
Torque (SAE Gross)	30.5 ft.–lbs.(41,4 Nm)@ 2250 RPM
(SAE Net)	–
Number of Cylinders	Two
Displacement	42.19 cu.–in. (691,4 cm^3)
Bore/Stroke	3.125/2.75 (79,38/69,85)
Lubrication	Pressure System W/Filter
Crankcase Ventilation	Closed Breathing
Air Cleaner	Dry replaceable paper cartridge
Ignition	12 Volt Solid State

SPECIFICATIONS (Cont'd)

	450
HYDRAULIC SYSTEM	
Pump	Engine driven, Gear type
Pump Capacity	6.8 GPM (25,7 L/min.) @ 3200 RPM
System Relief at Quick Couplers	1400 to 1450 PSI (9653 to 9997,8 kPa)
Filter	10 micron replaceable cartridge in the hydrostatic pump charge line.
Hydraulic Cylinders	Double–acting
Bore Diameter:	
Lift Cylinder (2)	2.00 (50,8)
Tilt Cylinder (1)	3.00 (76,2)
Rod Diameter:	
Lift Cylinder (2)	1.00 (25,4)
Tilt Cylinder (1)	1.25 (31,8)
Stroke:	
Lift Cylinder (2)	21.88 (555,8)
Tilt Cylinder (1)	10.94 (277,9)
Control Valve	3–Spool series type, open center w/float detent on lift and detent on auxiliary.
Fluid Lines	SAE standard tubes, hoses & fittings
Fluid Type	Bobcat Fluid (P/N 6563328) if fluid is not available, use 10W–30/10W40 Class SE motor oil for temperature above 0°F (–18°C) 5W–30 Motor Oil for temperatures below 0°F (–18° C).
Hydraulic Function Time:	
Raise Lift Arms	5.0 Seconds
Lower Lift Arms	4.0 Seconds
Bucket Dump	3.0 Seconds
Bucket Rollback	2.5 Seconds
ELECTRICAL	
Alternator	15 amp Flywheel
Battery	12 Volt, 425 cold cranking amps @ 0° F (–18° C), 106 minute reserve capacity
Starter	12 Volt
Instrumentation	**Gauges:** Hourmeter (In engine compartment)
DRIVE SYSTEM	
Main Drive	Hydrostatic 4 wheel drive
Transmission	Infinitely variable tandem hydrostatic piston pumps, driving two fully reversing hydrostatic motors
Final Drive	#60 endless roller chain & sprockets in sealed chaincase with oil lubrication
Total Engine to Wheel Reduction	38.49:1
Axle Size	1.5 (38,1)
Wheel Bolts	(5) 7/16"
CAPACITIES	
Cooling System	Air cooled
Fuel	6.5 gals. (24,6 L)
Engine Oil W/Filter	4.0 pts. (1,9 L)
Hydraulic Reservoir	5.3 qts. (5,0 L)
Hydraulic/Hydrostatic System	4.0 gals. (15,1 L)
Chaincase Reservoir	4.0 gals. (15,1 L)
TIRES	
Standard	5.70–12, 4 ply rating
Flotation	23 x 8.5–12, 4 or 6 ply rating
Recommended Pressure	Inflate tires to MAXIMUM pressure shown on the side wall of the tire. DO NOT mix brands of tires used on the same loader

ENGINE SPECIFICATIONS – 450 (KOHLER)

All dimensions are given in inches. Respective metric dimensions are given in millimeters enclosed by parentheses.

Engine (General)

Coil Shoe Air Gap	0.010 (0,25)
Spark Plug Gap	0.035 (0,89)
Compression at Cranking Speed	100–120 PSI (689–827 kPa)
High Idle No Load	3200 RPM
Low Idle No Load	1200 RPM
Oil Pressure (Idle RPM)	40–50 PSI (276–345 kPa)

Cylinder Bore

New Diameter	3.125 (79,38)
Wear Diameter (Maximum)	3.128 (79,45)
Taper (Maximum)	0.0015 (0,038)
Out–of–Round (Maximum)	0.003 (0,076)

Crankshaft

End Play	0.002–0.014 (0,051–0,355)
Crankpin–New Diameter	1.3733–1.3738 (34,89–34,90)
Crankpin–Out–of–Round (Maximum)	0.0005 (0,013)
Crankpin–Taper (Maximum)	0.001 (0,025)
Sleeve Bearing–Running Clearance	0.0049 (0,124)
Bearing Diameter (Minimum)	1.7439–1.7461 (44,30–44,35)

Camshaft

End Play	0.003–0.013 (0,076–0,330)
Shaft to Bearing Clearance	0.0010–0.0025 (0,025–0,063)

Connecting Rod

Big End–New Diameter	1.3750–1.3755 (34,93–34,94)
Big End–Wear Diameter (Maximum)	1.376 (34,95)
Small End–New Diameter	0.62565 (15,891)
Rod to Piston Pin–Clearance	0.0006–0.0011 (0,015–0,027)
Side Play on Crankpin	0.005–0.016 (0,13–0,41)
Crankpin Running Clearance	0.0012–0.0024 (0,030–0,0609)

Piston, Pin & Rings

*Thrust Face–Wear Diameter (Maximum)	3.1181 (79,20)
*Thrust Face to Bore Running (@Gauge Dia.)	0.0035–0.0052 (0,088–0,132)
Ring–Side Clearance	0.006 (0,15)
Ring–End Gap	0.010–0.023 (0,25–0,58)
Wrist Pin to Boss (Maximum)	0.0006–0.0011 (0,015–0,027)

Valves, Guides & Tappet

Intake Valve to Tappet Clearance (Cold)	0.003–0.006 (0,076–0,152)
Exhaust Valve to Tappet Clearance (Cold)	0.011–0.014 (0,27–0,35)
Intake Valve Minimum Stem O.D.	0.3103 (7,88)
Exhaust Valve Minimum Stem O.D.	0.3088 (7,84)
Intake Valve Guide I.D. Max. Wear Limit	0.005 (0,127)
Exhaust Valve Guide I.D. Max. Wear Limit	0.007 (0,177)
Valve Lift–Zero Clearance (Intake & Exhuast)	0.274 (6,95)
Valve Guide Interference Fit	0.002–0.005 (0,05–0,13)
Valve Guide Ream Diameter	0.3125 (7,937)

*Measured just below oil ring at right angles to the pin.

All dimensions are given in inches. Respective metric dimensions are given in millimeters enclosed by parentheses.

Oil Pump

Pump Shaft to Crankcase Running	0.0010–0.0025 (0,025–0,063)
Pump Drive Gear End Play	0.010–0.029 (0,254–0,736)

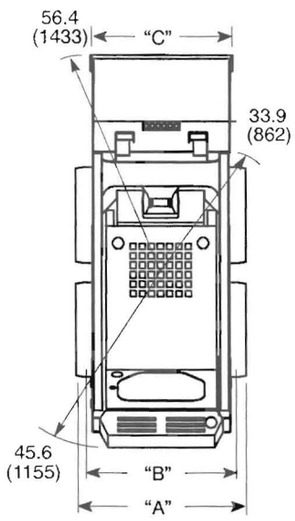
Engine Torque

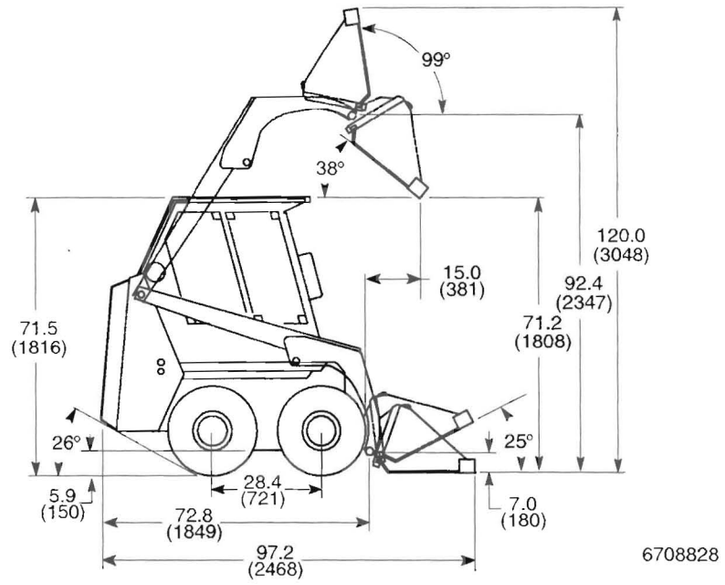
Spark Plugs	10–15 ft.–lbs. (14–20 Nm)
Flywheel Bolt	40 ft.–lbs. (54 Nm)
Manifold Bolts	150 in–lbs. (17 Nm)
Closure Plate Bolts	150 in.–lbs. (17 Nm)
*Cylinder Head Bolts	15–20 ft.–lbs. (20–27 Nm)
Cylinder Barrel Stud Nuts	100 in.–lbs. (11,3 Nm)
*Connecting Rod Nuts (New Rod)	140 in.–lbs. (16 Nm)
(Used Rod)	100 in.–lbs. (11,3 Nm)
Crankcase Stud Nuts	(refer to Page 7A–1)

*Lubricate with oil at assembly.

SKID STEER LOADER SPECIFICATIONS

- Dimensions are given for loader equipped with standard tires and dirt bucket and may vary with other bucket types. All dimensions are shown in inches. Respective metric dimensions are given in millimeters enclosed by parentheses.
- Where applicable, specification conform to SAE or ISO standards and are subject to change without notice.





"A" STD. TIRES – 35.4 (900)
FLOTATON – 43.3 (1100)

"B" STD. TIRES – 29.4 (747)
FLOTATION – 34.8 (884)

"C" 36 in. BUCKET WIDTH – 35.48 in. (901 mm)
44 in. BUCKET WIDTH – 44.5 in. (1130 mm)

Changes of structure or weight distribution of the loader can cause changes in control and steering response and can cause failure of the loader parts.

SPECIFICATIONS	453
PERFORMANCE	
Rated Operating Capacity (SAE)	600 lbs. (272 kg)
Tipping Load (SAE Rating)	1410 lbs. (641 kg)
Operating Weight	2513 lbs. (1140 kg)
SAE Breakout Force – Lift	1200 lbs. (544 kg)
– Tilt	1150 lbs. (522 kg)
Axle Torque	1775 ft.–lbs. (2407 Nm)
Travel Speed	0–5.2 MPH (8,4 km/hr.)
CONTROLS	
Vehicle Steering	Direction and Speed controlled by two hand levers.
Loader Hydraulics:	
Lift and Tilt	Controlled by separate foot pedals.
Front Auxiliary (optional)	Controlled by lateral movement of RH steering lever.
Engine	Hand lever throttle; Key Type starter switch and shutdown.
Starting Aid	Key activated glow plugs.
Service Brake	Two independent hydrostatic systems controlled by two hand operated steering levers.
Secondary Brake	One of the hydrostatic transmissions
Parking Brake	Mechanical Disc, foot operated pedal.
ENGINE	
Make/Model	Kubota/D750–B
Fuel/Cooling	Diesel/Liquid
Horsepower (SAE Gross)	16.5 HP (12,3 kW)
(SAE Net)	15.0 HP (11,2 kW)
Maximum Governed RPM	3000 RPM
Torque (SAE Gross)	33 ft.–lbs.(44,7 Nm)@ 1800 RPM
(SAE Net)	31 ft.–lbs.(42 Nm)@ 1800 RPM
Number of Cylinders	Three
Displacement	46.5 cu.–in (762 cm^3)
Bore/Stroke	2.64/2.76 (68/70)
Lubrication	Pressure System W/Filter
Crankcase Ventilation	External
Air Cleaner	Dry replaceable paper cartridge
Ignition	Compression Diesel

SPECIFICATIONS (Cont'd)

	453
HYDRAULIC SYSTEM	
Pump	Engine driven, Gear type
Pump Capacity	6.8 GPM (25,7 L/min.) @ 3200 RPM
System Relief at Quick Couplers	1400–1450 PSI (9653–9997,8 kPa)
Filter	10 micron replaceable cartridge in the hydrostatic pump charge line.
Hydraulic Cylinders	Double–acting
Bore Diameter:	
Lift Cylinder (2)	2.00 (50,8)
Tilt Cylinder (1)	3.00 (76,2)
Rod Diameter:	
Lift Cylinder (2)	1.00 (25,4)
Tilt Cylinder (1)	1.25 (31,8)
Stroke:	
Lift Cylinder (2)	21.88 (555,8)
Tilt Cylinder (1)	10.94 (277,9)
Control Valve	3–Spool series type, open center w/float detent on lift and detent on auxiliary.
Fluid Lines	SAE standard tubes, hoses & fittings
Fluid Type	Bobcat Fluid (P/N 6563328) if fluid is not available, use 10W–30/10W40 Class SE motor oil for temperature above 0°F (–18°C) 5W–30 Motor Oil for temperatures below 0°F (–18° C).
Hydraulic Function Time:	
Raise Lift Arms	5.0 Seconds
Lower Lift Arms	4.0 Seconds
Bucket Dump	3.0 Seconds
Bucket Rollback	2.5 Seconds
ELECTRICAL	
Alternator	37 amp open
Battery	12 Volt, 370 cold cranking amps @ 0° F (–18° C), 106 minute reserve capacity
Starter	12 Volt Straight Drive
Instrumentation	**Gauges:** Hourmeter, Voltmeter Eng. Temp. & Fuel (on tank) **Warning Lights:** Engine Oil Pressure & Temperature, Hyd. Oil Temp. & Pressure.
DRIVE SYSTEM	
Main Drive	Hydrostatic 4 wheel drive
Transmission	Infinitely variable tandem hydrostatic piston pumps, driving two fully reversing hydrostatic motors
Final Drive	#60 endless roller chain & sprockets in sealed chaincase with oil lubrication
Total Engine to Wheel Reduction	38.49:1
Axle Size	1.5 (38,1)
Wheel Bolts	(5) 7/16"
CAPACITIES	
Cooling System	7 qts. (6,6 L)
Fuel	6.5 gals. (24,6 L)
Engine Oil W/Filter	4.0 qts. (3,8 L)
Hydraulic Reservoir	5.3 qts. (5,0 L)
Hydraulic/Hydrostatic System	4.0 gals. (15,1 L)
Chaincase Reservoir	3.0 gals. (11,4 L)
TIRES	
Standard	5.70–12, 4 ply rating
Flotation	23 x 8.5–12, 4 or 6 ply rating
Recommended Pressure	Inflate tires to MAXIMUM pressure shown on the side wall of the tire. DO NOT mix brands of tires used on the same loader.

ENGINE SPECIFICATIONS – 453 (KUBOTA)

All dimensions are given in inches. Respective metric dimensions are given in millimeters enclosed by parentheses.

Engine compression @200–300 RPM (Operating Temperature) ..... 450 PSI (3103 kPa)

Fuel Injector Nozzles

Opening Pressure ..... 1990–2133 PSI (13721–14707 kPa)
Fuel Tightness Nozzle Seat ..... 1848 PSI (12742 kPa) Dry Nozzle

Fuel Injection Pump

Fuel Tightness of the Plunger ..... 8 Sec.: initial pressure drop from 1237–1031 PSI (8530–7110 kPa)
Limit Permitted ..... 4 Sec. or Less
Fuel Tightness of Delivery Valve ..... 10 Sec.: initial pressure drop from 1422–71 PSI (9805–490 kPa)
Limit Permitted ..... 5 Sec. or Less
Injection Timing ..... 23–25 degrees B.T.D.C.

Cylinder Head

Cylinder Distortion Limit ..... 0.0020 (0,05) in 4 (100) of length of the cylinder head surfaces.
Thickness of Gasket 0.0413–0.0453 (1,05–1,15)
Thickness of Gasket Shim 0.0079 (0,2)
Top Clearance 0.0236–0.0315 (0,6–0,8)
Head Bolt Torque ..... 29–33 ft.–lbs. (39–45 Nm)

Valves

Valve Seat Width 0.083 (2,1)
Valve Seat Angle ..... 45 degrees
O.D. of the Valve Stem 0.2740–0.2746 (6,96–6,975)
I.D. of the Valve Guides 0.2759–0.2765 (7,010–7,025)
Clearance between Valve Stem & Guide 0.0014–0.0026 (0,035–0,065)
Limit Permitted 0.004 (0,1)
Depth of Valve 0.035–0.043 (0,9–1,1)
Limit Permitted 0.051 (1,3)
Valve Clearance (Cold) 0.0057–0.0073 (0,145–0,185)

Valve Springs

Free Length 1.382–1.402 (35,1–35,6)
Limit Permitted 1.37 (34,8)
Fitted Length 1.2201 (30,99)
Load to Compress to Fitted Length ..... 16.5 lbs. (7,49 kg)
Limit Permitted ..... 14 lbs. (6,36 kg)
Limit Permitted for Spring being Straight 0.051 (1,3)

Rocker Arms

O.D. of Rocker Arm Shaft 0.4320–0.4324 (10,97–10,98)
I.D. of Rocker Arm Bushings 0.4330–0.4345 (10,99–11,038)
Clearance between Rocker Arm Shaft & Bushings 0.0005–0.0026 (0,013–0,065)
Limit Permitted 0.0047 (0,12)

Camshaft

O.D. of Camshaft Bearing Journal 1.2966–1.2972 (32,93–32,95)
I.D. of Camshaft Bearing 1.2992–1.3002 (33,00–33,02)
Clearance between Camshaft Bearing & Journal 0.0020–0.0036 (0,05–0,09)
Limit Permitted 0.0059 (0,15)
Alignment of the Camshaft 0.0020 (0,05)
Cam Lobe Height 1.0583 (26,88)
Limit Permitted 1.0563 (26,83)
Gear Backlash 0.0017–0.0045 (0,042–0,115)
Limit Permitted 0.0079 (0,2)

ENGINE SPECIFICATIONS – 453 (KUBOTA) (Cont'd)

All dimensions are given in inches. Respective metric dimensions are given in millimeters enclosed by parentheses.

Cylinders

I.D. of Cylinder Liner	2.6772–2.6779 (68,00–68,02)
Limit Permitted	+0.00 59(+0,015)

Piston Rings

Ring Gap, Top & 2nd Ring	0.0098–0.01 58(0,25–0,40)
Ring Gap, Oil Ring	0.0078–0.01 58(0,20–0,40)
Limit Permitted	0.04 92(1,25)
Side Clearance of Ring in Groove	
Top Ring	0. 00(0,0)
2nd Ring	0.0033–0.00 44(0,085–0,112)
Oil ring	0.0008–0.00 20(0,020–0,051)
Oversize of Piston & Ring	0.0197 (0,5)

Pistons

I.D. of Piston Bosses	0.7874–0.78 79(20,0–20,013)
Limit Permitted	0.78 85(20,03)
O.D. of Piston Pin	0.7875–0.78 78(20,00–20,01)
I.D. of Connecting Rod Bushing (Small End, Fitted)	0.7884–0.78 90(20,02–20.04)
Clearance between Piston Pin & Bushing	0.0006–0.00 15(0,015–0,038)
Limit Permitted	0.00 59(0,15)
Connecting Rod Alignment	0.00 08(0,02)
Limit Permitted	0.0 02(0,05)

Crankshaft

Crankshaft Alignment	0.00 08(0,02)
O.D. of Crankshaft Journals	1.7297–1.73 03(43,93–43,95)
I.D. of Crankshaft Bearing No. 1	1.7317–1.73 39(43,98–44,04)
Clearance between Crankshaft Journal & Bearing No. 1	0.0013–0.00 42(0,034–0,106)
Limit Permitted	0.00 79 (0,2)
Clearance between Crankshaft Journals & Bearing No. 2	0.0013"–0.00 36(0,034–0,092)
Limit Permitted	0.00 79(0,2)
O.D. of Connecting Rod Journals	1.4551–1.45 57(36,95–36,97)
I.D. of Connecting Rod Bearings	1.4569–1.45 87(37,00–37,05)
Clearance between Connecting Rod Journal & Bearing	0.0011–0.00 36(0,027–0,091)
Limit Permitted	0.00 79(0,20)
Crankshaft End Play	0.0059–0.01 22(0,15–0,31)
Limit Permitted	0.01 97(0,5)

Oil Pump

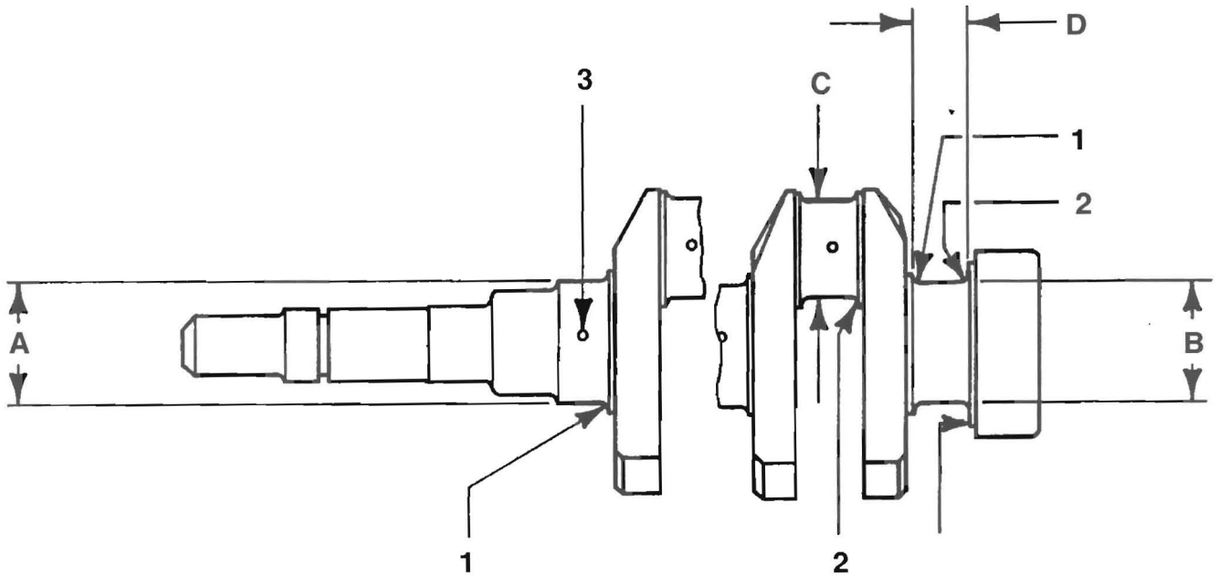
Oil Pressure @ Rated RPM	28–63 PSI (193–434 kPa)
Limit Permitted	28 PSI (193 kPa)
Oil Pressure @ Idle Speed	10 PSI (69 kPa)
Rotor Lobe Clearance	0.0043–0.00 59(0,11–0,15)
Limit Permitted	0.00 79(0,20)
Clearance between Outer Rotor & Pump Body	0.0028–0.00 59(0,07–0,15)
Limit Permitted	0.00 98(0,25)
End Clearance Between Rotor & Cover	0.0031–0.00 51(0,08–0,13)
Limit Permitted	0.00 79(0,20)

Thermostat

Opening Temperature (Starting)	176.9°–182.3°F (80,5°–83,5°C)
(Full Open)	203°F (95°C)
Distance of Lift	0.31 5 (8)

Crankshaft Re–Grind Data

If the standard size bearing cannot be used due to excessive wear of the crankpin and crank journals, use undersize or oversize bearings.



B–5928

REF.	SIZE	CODE NUMBER	DESCRIPTION	DIMENSION	MARK
A	0.008 in. (0,2) U/S	15261–2391–1	Crankshaft Bearing #1	1.7218–17224 in. (43,743–43,750)	020US
	0.016 in. (0,4) U/S	15261–2392–1	Crankshaft Bearing #1	1.7139–1.7146 in. (43,534–43,550)	040US
B	0.008 in (0,2) U/S	15261–2393–1	Crankshaft Bearing #1	1.7218–1.7224 in. (43,734–43,750)	020US
	0.016 in. (0,4) U/S	15261–2394–1	Crankshaft Bearing #1	1.7139–17146 in. (43,534–43,550)	040US
C	0.008 in. (0,2) U/S	15531–2297–1	Crankpin Bearing	1.4472–1.4478 in. (36,759–36,775)	020US
	0.016 in. (0,4) U/S	15531–2298–1	Crankpin Bearing	1.4393–1.4400 in. (36,559–36,575)	040US
D	0,008 in. (0,2) O/S	15261–2397–1 15261–2395–1	Crankshaft Thrust Bearing	0.9528–0.9547 in. (24,20–24,25)	0.20 OS
	0.016 in. (0,4) O/S	15261–2398–1 15261–2396–1	Crankshaft Thrust Bearing	0.9606–0.9626 in. (24,40–24,45)	0.40 OS
1	Radius – .13 – .1457 in (3,3 – 3,7)			0.1300–0.1457 in. (3,3–3,7)	
2	Radius – .1102 – .1260 in. (2,8 – 3,2)			0.1102–0.1260 in. (2,8–3,2)	
3	**IMPORTANT: Oil hoses must have a 0.0394 – 0.0591 in. (1 – 1,5) chamfer. Use on oil stone to chamfer the oil hole.**				

Engine Torque

Bolt material grades are shown by numbers punched on the bolt heads.

Before tightening, check the numbers shown below.

PUNCHED NUMBER	BOLT MATERIAL GRADE	
None	Standard	S41, S20C
7	Special Bolts	S43C, S48C (Refined)
9	Special Bolts	SCM3, SCR3 (Refined)

BOLT TORQUES			
MATERIAL GRADE	STANDARD BOLT	SPECIAL BOLT	SPECIAL BOLT
NOMINAL DIAMETER	SS41, S20C	S43C, S48C (Refined)	SCR3, SCM3 (Refined)
M6	5.8 to 6.9 ft.–lbs. (7.8 to 9.3 Nm)	7.2 to 8.3 ft.–lbs. (9.8 to 11.3 Nm)	9.0 to 10.5 ft.–lbs. (12.3 to 14.2 Nm)
M8	13.0 to 15.2 ft.–lbs. (17.7 to 20.6 Nm)	174. to 20.3 ft.–lbs. (23.5 to 27.5 Nm)	21.7 to 25.3 ft.–lbs. (29.4 to 34.3 Nm)
M10	28.9 to 33.3 ft.–lbs. (39.2 to 45.1 Nm)	35.4 to 41.2 ft.–lbs. (48.0 to 55.9 Nm)	44.8 to 52.1 ft.–lbs. (60.8 to 70.6 Nm)
M12	46.3 to 53.5 ft.–lbs. (62.8 to 72.6 Nm)	57.1 to 66.5 ft.–lbs. (77.5 to 90.2 Nm)	75.9 to 86.8 ft.–lbs. (103.0 to 117.7 Nm)
M14	79.6 to 92.6 ft.–lbs. (107.9 to 125.5 Nm)	91.1 to 108.5 ft.–lbs. (123.6 to 147.1 Nm)	123.0 to 144.7 ft.–lbs. (166.7 to 196.1 Nm)
M16	123.0 to 141.0 ft.–lbs (166.7 to 191.2 Nm)	144.7 to 166.4 ft.–lbs. (196.1 to 225.5 Nm)	191.7 to 224.2 ft.–lbs. (259.9 to 304.0 Nm)
M18	180.8 to 209.8 ft.–lbs. (245.2 to 284.4 Nm)	202.5 to 235.1 ft.–lbs. (274.6 to 318.7 Nm)	253.2 to 296.5 ft.–lbs. (343.2 to 402.0 Nm)
M20	145.9 to 289.3 ft.–lbs. (333.4 to 392.2 Nm)	271.2 to 318.2 ft.–lbs. (367.7 to 431.5 Nm)	361.6 to 419.5 ft.–lbs. (490.3 to 568.7 Nm)

*Cylinder Head Bolts and Nuts ..... 28.7–32.5 ft.–lbs. (38,9–44,1 Nm)
*Main Bearing Bolts ..... 15–17 ft.–lbs. (20.24 Nm)
*Main Bearing Case Bolts ..... 22–25 ft.–lbs. (29–34 Nm)
*Flywheel Bolts ..... 40–43 ft.–lbs. (54–59 Nm)
*Connecting Rod Bolts ..... 20–22 ft.–lbs. (27–30 Nm)
*Rocker Arm Bracket Studs ..... 12–15 ft.–lbs. (17–21 Nm)
*Idler Gear Shaft Bolts ..... 7–8 ft.–lbs. (9–11 Nm)
Glow Plugs ..... 15–18 ft.–lbs. (2–25 Nm)
Drain Plugs ..... 30–36 ft.–lbs. (39–49 Nm)
Nozzle Holders ..... 22–36 ft.–lbs. (29–49 Nm)
Oil Switch ..... 11–15 ft.–lbs. (15–20 Nm)
Fuel Injection Tubeline Fittings ..... 11–19 ft.–lbs. (15–26 Nm)
Crankshaft Nut ..... 101–116 ft.–lbs. (137–157 Nm)
Injection Pump Vent Screw ..... 10–13 ft.–lbs. (14–18 Nm)

*Lightly Oiled Threads

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 Melroe that have zinc phosphate coating are specified by the letter "H" following the part number.

	THREAD SIZE	SAE GRADE 5	SAE GRADE 8
INCH. LBS. (Nm)	.250	80–90 (9–10)	110–120 (13–14)
	.3125	180–200 (21–23)	215–240 (24–27)
FOOT LBS. (Nm)	.375	25–28 (34–38)	35–40 (48–54)
	.4375	40–45 (54–61)	60–65 (82–88)
	.500	65–70 (88–95)	90–100 (125–135)
	.5625	90–100 (125–135)	125–140 (170–190)
	.625	125–140 (170–190)	175–190 (240–260)
	.750	220–245 (300–330)	300–330 (410–450)
	.875	330–360 (450–490)	475–525 (645–710)
	1.000	475–525 (645–710)	725–800 (985–1085)
	1.125	650–720 (880–975)	1050–1175 (1425–1600)
	1.250	900–1000 (1200–1360)	1475–1625 (2000–2200)
	1.375	1200–1350 (1630–1830)	2000–2200 (2720–2980)
	1.500	1500–1650 (2040–2240)	2600–2850 (3530–3870)
	1.625	2000–2800 (2720–2980)	3450–3800 (4680–5150)
	1.750	2500–2750 (3390–3730)	4300–4800 (5830–6500)
	1.875	3150–3500 (4270–4750)	5500–6100 (7450–8300)
	2.000	3800–4200 (5150–5700)	6500–7200 (8800–9800)

TORQUE SPECIFICATIONS FOR BOLTS (Cont'd)

Torque For General Metric Bolts

Thread Size (Dia. x Pitch)	Material		
	Head Mark 4	Head Mark 7	Head Mark 10
M 5 x 0.8		3–4 ft.–lbs. (4–5 Nm)	
M 6 x 1.0		6–7 ft.–lbs. (8–9 Nm)	6–9 ft.–lbs. (8–12 Nm)
M 8 x 1.25	6–9 ft.–lbs. (8–12 Nm)	11–16 ft.–lbs. (15–22 Nm)	18–25 ft.–lbs. (24–34 Nm)
M 10 x 1.25	13–18 ft.–lbs. (18–24 Nm)	22–30 ft.–lbs. (30–41 Nm)	36–50 ft.–lbs. (49–68 Nm)
M 12 x 1.25	22–30 ft.–lbs. (30–41 Nm)	40–54 ft.–lbs. (54–73 Nm)	69–87 ft.–lbs. (94–118 Nm)
M 14 x 1.5	36–50 ft.–lbs. (49–68 Nm)	58–80 ft.–lbs. (79–108 Nm)	116–137 ft.–lbs. (157–186 Nm)

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.

I–2003–0888

O–ring Face Seal Connection

When the fitting is tightened, you can *feel* when the fitting is tight to eliminate leakage caused by under or over torqued fittings. Use vaseline petroleum jelly to hold the O–ring in position until the fittings are assembled **[A]**.

Straight Thread O–ring Fitting

Lubricate the O–ring before installing the fitting. Loosen the jam nut and install the fitting. Tighten the jam nut until the washer is tight against the surface **[B]**.

Tubelines And Hoses

Replace any tubelines that are bent or flattened. They will restrict flow, which will slow hydraulic action and cause heat.

Replace hoses which show signs of wear, damage or weather cracked rubber.

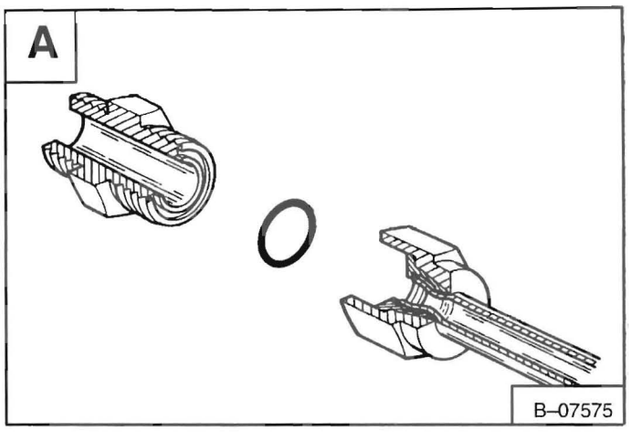
Always use two wrenches when loosening and tightening hose or tubeline fittings.

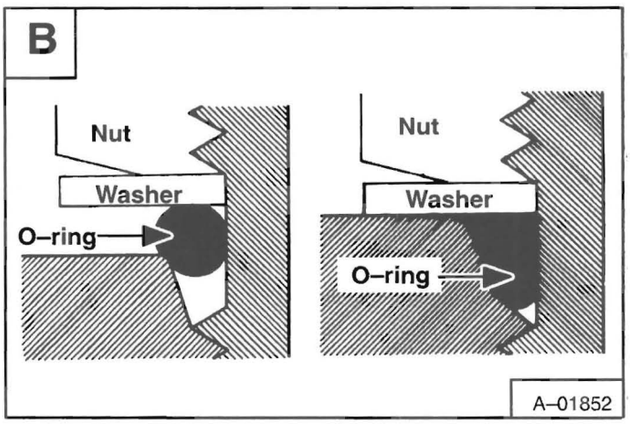
Flare Fitting

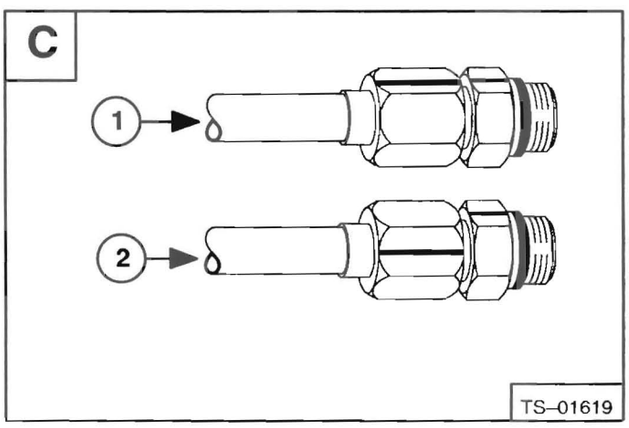
Use the following procedure to tighten the flare fitting:

Tighten the nut until it makes contact with the seat. Make a mark across the *flats* of both the male and female parts of the connection (Item 1) **[C]**.

Use the chart below to find the correct tightness needed (Item 2) **[C]**. If the fitting leaks after tightening, disconnect it and inspect the seat area for damage.







Flare Fitting Tightening Torque

Wrench Size	Tubeline Outside Diameter	Thread Size	TORQUE Ft.–lbs. (Nm)	NEW Rotate No. of Hex Flats	RE–ASSEMBLY Rotate No. of Hex Flats
5/8"	5/16"	1/2" – 20	17 (23)	2–1/2	1
11/16"	3/8"	9/16" – 18	22 (30)	2	1
7/8"	1/2"	3/4" – 16	40 (54)	2	1
1"	5/8"	7/8" – 14	60 (81)	1–1/2	1
1–1/4"	3/4"	1–1/16" – 12	84 (114)	1	3/4
1–3/8"	1"	1–5/16" – 12	118 (160)	3/4	3/4

O–ring Flare Fitting

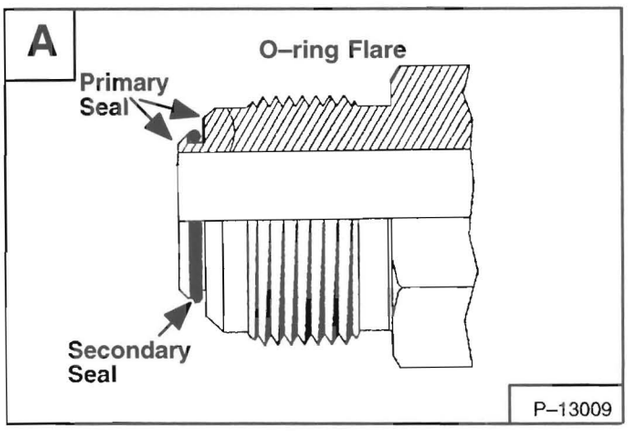
The flare is the primary seal, the O–ring is the secondary seal and helps absorb vibration and pressure pulses at the connection **[A]**.

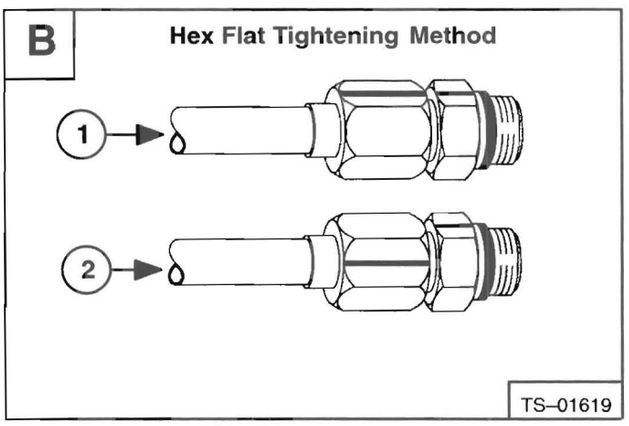
If necessary, the O–ring–flare fitting can be used without an O–ring.

Use the following procedure to tighten the O–ring flare fitting.

Tighten the nut until it contacts with the seat. Make a mark across the flats of both the male and female parts of the connection (Item 1) **[B]**.

Use the chart below to find the correct tightness needed (Item 2) **[B]**. If the fitting leaks after tightening, disconnect it and inspect the seat area for damage.





O–ring Flare Fitting Tightening Torque

Wrench Size	Tubeline Outside Diameter	Thread Size	TORQUE Ft.–lbs. (Nm) *	NEW Rotate No. of Hex Flats **	RE–ASSEMBLY Rotate No. of Hex Flats ***
5/8"	5/16"	1/2" – 20	17 (23)	2–1/2	1
11/16"	3/8"	9/16" – 18	22 (30)	2	1
7/8"	1/2"	3/4" – 16	40 (54)	2	1
1"	5/8"	7/8" – 14	60 (81)	1–1/2	1
1–1/4"	3/4"	1–1/16" – 12	84 (114)	1	3/4
1–3/8"	1"	1–5/16" – 12	118 (160)	3/4	3/4

* If a torque wrench is used to tighten a new fitting to a used hose/tubeline.

* If a torque wrench is used to tighten a used fitting to a new hose/tubeline.

* If a torque wrench is used to tighten a new fitting to a new hose/tubeline.

** If using the hex flat tightening method to tighten a new fitting to a new hose/tubeline.

** If using the hex flat tightening method to tighten a new fitting to a used hose/tubeline.

*** If using the hex flat tightening method to tighten a used fitting to a new hose/tubeline.

HYDRAULIC CONNECTION SPECIFICATIONS (Cont'd)

O–ring Flare Fitting (Cont'd)

NOTE: O–ring flare fittings are not recommended in all applications. Use the standard flare fittings in these applications.

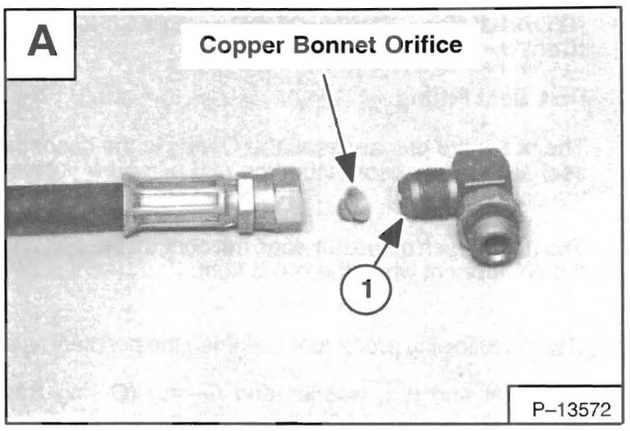
Do not use a O–ring flare fitting when a copper bonnet orifice is used. When tightened the connection at the bonnet may distort the flare face and prevent it from sealing.

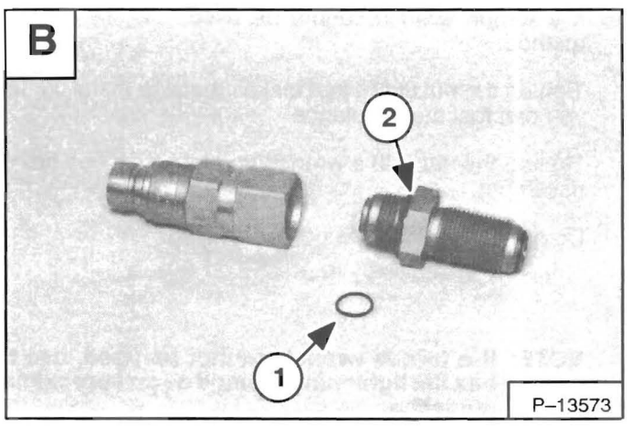
Use a standard flare fitting (Item 1) **[A]** as shown.

When a O–ring flare fitting is used as a straight thread port adapter the O–ring flare face is not used to seal. The O–ring may come off the fitting and enter the system.

Always remove the O–ring (Item 1) [B] from the flare face as shown.

An O–ring (Item 2) **[B]** is added to the flat boss of the fitting to seal the connection in this application.





Port Seal Fitting

The nut is the primary seal, the O–ring is the secondary seal and helps absorb vibration and pressure pulses at the connection **[A]**.

The hex portion of the nut does not contact the surface of the component when the nut is tight.

Use the following procedure to tighten the port seal fitting:

Port seal and nut, washer and O–ring (O–ring Boss) fittings use the same tightening torque valve chart.

If a torque wrench cannot be used, use the following method.

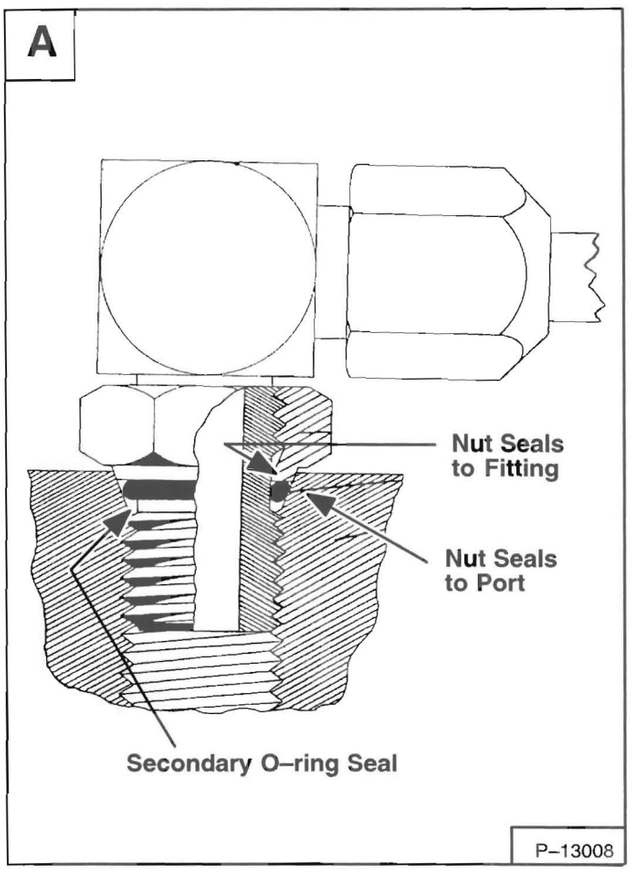
Tighten the nut until it just makes metal to metal contact, you can feel the resistance.

Tighten the nut with a wrench no more than one hex flat maximum.

Do not over tighten the port seal fitting.

NOTE: If a torque wrench cannot be used, use the hex flat tightening method as an approximate guideline.

NOTE: Port seal fittings are not recommended in all applications. Use O–ring boss fittings in these applications.



Port Seal and O–ring Boss Tightening Torque

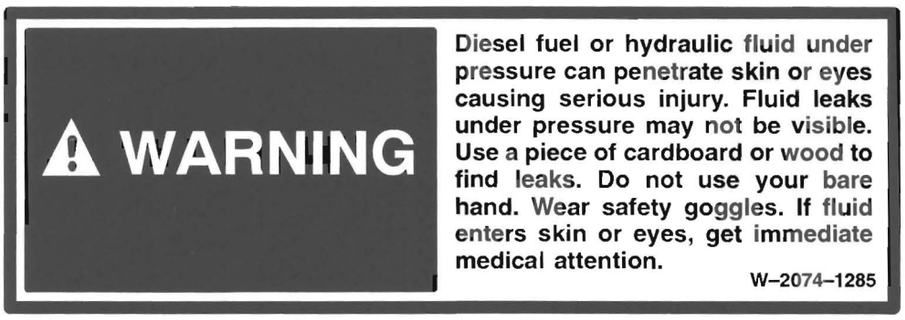
Fitting Nut Wrench Size	Thread Size	TORQUE Ft.–lbs. (Nm)
11/16"	9/16" – 18	22 (30)
15/16"	3/4" – 16	40 (54)
1–1/8"	7/8" – 14	60 (81)
1–1/4"	1–1/16" – 12	84 (114)
1–1/2"	1–5/16" – 12	118 (160)

HYDRAULIC/HYDROSTATIC FLUID SPECIFICATIONS

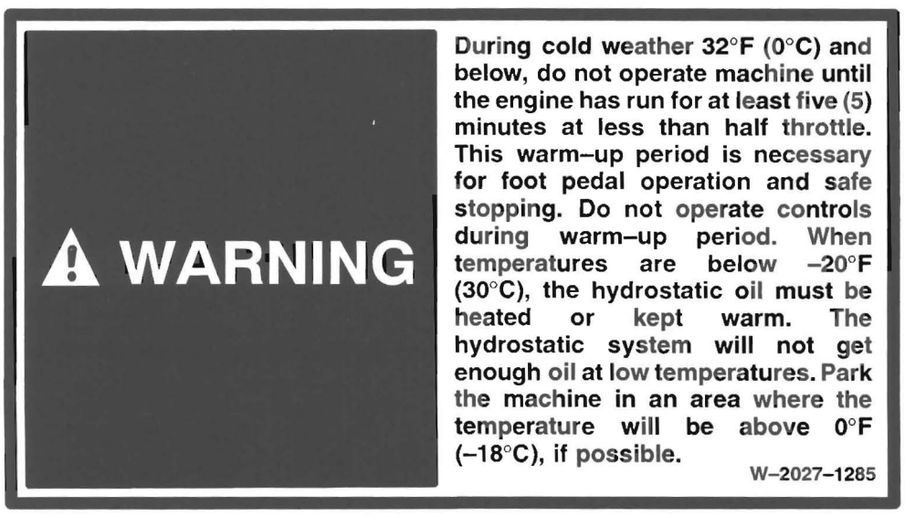
Specifications

Use Melroe hydraulic/hydrostatic transmission fluid (P/N 6563328). If this fluid is not available, use 10W–30 or 10W–40 SAE Motor Oil (5W–30 for 0°F [–18°C] and Below).

DO NOT use automatic transmission fluids in the loader or permanent damage to the transmission will result.



When temperatures below zero degree F (–18°C) are common, the loader must be kept in a warm building. Extra warm–up time must be used each time the loader is started during cold temperature conditions. Cold fluid will not flow easily and it makes action of the hydraulic function slower. Loss of fluid flow to the hydrostatic transmission pump (indicated by TRANS light ON) can cause transmission damage in less than 60 seconds.



DECIMAL AND MILLIMETER EQUIVALENTS

FRACTIONS	DECIMALS	MM
1/64	0.015625	0.397
1/32	0.03125	0.794
3/64	0.046875	1.191
1/16	0.0625	1.588
5/64	0.078125	1.984
3/32	0.09375	2.381
7/64	0.109375	2.778
1/8	0.1250	3.175
9/64	0.140625	3.572
5/32	0.15625	3.969
11/64	0.171875	4.366
3/16	0.1876	4.762
13/64	0.203125	5.159
7/32	0.21875	5.556
15/64	0.234375	5.953
1/4	0.2500	6.350
17/64	0.265625	6.747
9/32	0.28125	7.144
19/64	0.296875	7.541
5/16	0.3125	7.938
21/64	0.328125	8.334
11/32	0.34375	8.731
23/64	0.359375	9.128
3/8	0.3750	9.525
25/64	0.390625	9.922
13/32	0.40625	10.319
27/64	0.421875	10.716
7/16	0.4375	11.112
29/64	0.453125	11.509
15/32	0.46875	11.906
31/64	0.484375	12.303
1/2	0.5000	12.700

FRACTIONS	DECIMALS	MM
33/64	0.515625	13.097
17/32	0.53125	13.494
35/64	0.546875	13.891
9/16	0.5625	14.288
37/64	0.578125	14.684
19/32	0.59375	15.081
39/64	0.609375	15.478
5/8	0.6250	15.875
41/64	0.640625	16.272
21/32	0.65625	16.669
43/64	0.671875	17.066
11/16	0.6875	17.462
45/64	0.703125	17.859
23/32	0.71875	18.256
47/64	0.734375	18.653
3/4	0.7500	19.050
49/64	0.765625	19.447
25/32	0.78125	19.844
51/64	0.796875	20.241
13/16	0.8125	20.638
53/64	0.828125	21.034
27/32	0.84375	21.431
55/64	0.859375	21.828
7/8	0.8750	22.225
57/64	0.890625	22.622
29/32	0.90625	23.019
59/64	0.921875	23.416
15/16	0.9375	23.812
61/64	0.953125	24.209
31/32	0.96875	24.606
63/64	0.984375	25.003
1	1.000	25.400

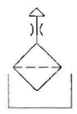
1 mm = 0.03937"

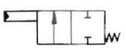
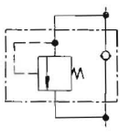
0.001 = 0.0254 mm

U.S. TO METRIC CONVERSION

	TO CONVERT	INTO	MULTIPLY BY
LINEAR MEASUREMENT	Miles	Kilometers	1.609
	Yards	Meters	0.9144
	Feet	Meters	0.3048
	Feet	Centimeters	30.48
	Inches	Meters	0.0254
	Inches	Centimeters	2.54
	Inches	Millimeters	25.4
AREA	Square Miles	Square Kilometers	2.59
	Square Feet	Square Meters	0.0929
	Square Inches	Square Centimeters	6.452
	Acre	Hectare	0.4047
VOLUME	Cubic Yards	Cubic Meters	0.7646
	Cubic Feet	Cubic Meters	0.02832
	Cubic Inches	Cubic Centimeters	16.39
WEIGHT	Tons (Short)	Metric Tons	0.9078
	Pounds	Kilograms	0.4536
	Ounces (Avdp.)	Grams	28.3495
PRESSURE	Pounds/Sq. In.	Kilopascal	6.895
WORK	Foot–Pounds	Newton–Meter	1.356
LIQUID VOLUME	Quarts	Liters	0.9463
	Gallons	Liters	3.785
LIQUID FLOW	Gallons/Minute	Liters/Minute	3.785
TEMPERATURE	Fahrenheit	Celsius	1.Subtract 32° 2. Multiply by 5/9

GLOSSARY OF HYDRAULIC SYMBOLS

SYMBOL	DESCRIPTION
	Vented and Filtered Reservoir
	Connected Junction of Oil Lines
	Oil Lines Crossing (NOT Connected)
	Closed Port or Closed Path
	Variable Adjustment
	Temperature Indicator or Temperature Control
	Spring
	Relief Valve
	Check Valve - Oil Flow Only in One Direction - Sometimes Used as Replenishing Valve, Load Check Valve or Anticavitation Valve
	Restriction
	One Way Restrictor Valve - Restriction in One Direction, Free Flow in the Other
	Coupler
	Fixed Displacement Pump
	Variable Displacement - Bidirectional Pump
	Motor
	Double Acting Hydraulic Cylinder - Unequal Displacement
	Double Acting Hydraulic Cylinder - Cushion on One End

SYMBOL	DESCRIPTION
	Filter
	Oil Cooler
	Shuttle Valve
	Control Valve Activated By a Lever (Manual)
	Control Valve Activated By a Push-Pull Button
	Control Valve Activated By a Pedal
	Control Valve Activated By Pilot Pressure
	Control Valve Activated By an Electric Solenoid
	Control Valve With Spring Return
	Spool With Detent (Holds Spool in Position)
	Solenoid Activated Two Position Spool
	Pilot Activated Two Position Spool
	Pilot Operated Relief Valve
	Pilot Operated Relief/ Replenishing Valve
	Differential Pressure Switch - Switch Activates When Pressure Difference Reaches Specified Level

Printed in U.S.A.

MC 2323TP (3-10-97)


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TAKE OUT	PUT IN
Wiring Diagram (P/N 6724521) Sheet 7 Of 8 BICS™ (BICS™ Controller Harness 6707495 Rev. B and 6710422) 453 BICS™, 450E BICS™, 453 BICS™ & 453E BICS™ Printed February 1996)	Wiring Diagram (P/N 6724521) Sheet 7 Of 8 BICS™ (BICS™ Controller Harness 6707495 Rev. B and 67104 453 BICS™, 450E BICS™, 453 BICS™ & 453E BICS™ (Printed April 1996)
Wiring Diagram (P/N 6724521) Sheet 8 Of 8 Operator Controls (Optional) 453 BICS™, 450E BICS™, 453 BICS™ & 453E BICS™ (Printed February 1996)	Wiring Diagram (P/N 6724521) Sheet 8 Of 8 Operator Controls (Optional) 453 BICS™, 450E BICS™, 453 BICS™ & 453E BICS™ (Printed April 1996)

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Revision Number
February 1996
Date

SERVICE MANUAL REVISION

ROUTE TO ATTENTION	
PARTS MANAGER	☐
SERVICE MANAGER	☒
SALES MANAGER	☐

AFFECTING:

Product BOBCAT LOADER

Model 450, 453

Manual No. 6724259 (1–96)

NOTICE **Insert This Sheet With The Appropriate Manual For Future Reference.**

The following pages are a revision to the 450, 453 Service Manual P/N 6724259 (1–96).

Take out the pages shown and put in the revised pages as follows:

TAKE OUT	PUT IN
Section 7A (Printed Jan. 96)	Section 7A (Revised Feb. 96)

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450/453–2
Revision Number
30 April 1996
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SERVICE MANUAL REVISION

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SERVICE MANAGER	☒
SALES MANAGER	☐

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Product BOBCAT LOADER

Model 450, 453

Manual No. 6724259 (1–96)

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TAKE OUT	PUT IN
Wiring Diagram (P/N 6724521) Sheet 1 Of 8 Operator Cab (Harness 6708235 Rev. B) 450 BICS™ (Printed February 1996)	Wiring Diagram (P/N 6724521) Sheet 1 Of 8 Operator Cab (Harness 6708235 Rev. B) 450 BICS™ (Printed April 1996)
Wiring Diagram (P/N 6724521) Sheet 2 Of 8 Operator Cab (Harness 6708825) 450E BICS™ (Printed February 1996)	Wiring Diagram (P/N 6724521) Sheet 2 Of 8 Operator Cab (Harness 6708825) 450E BICS™ (Printed April 1996)
Wiring Diagram (P/N 6724521) Sheet 3 Of 8 Operator Cab (Harness 6707498 Rev. C) 453 BICS™ 453E BICS™ (Printed February 1996)	Wiring Diagram (P/N 6724521) Sheet 3 Of 8 Operator Cab (Harness 6707498 Rev. C) 453 BICS™ 453E BICS™ (Printed April 1996)
Wiring Diagram (P/N 6724521) Sheet 4 Of 8 Engine (Harness 6708224 Rev. C) 450 BICS™ (S/N 561711001–11387) 450E BICS™ (S/N 562011001–11076) (Printed February 1996)	Wiring Diagram (P/N 6724521) Sheet 4 Of 8 Engine (Harness 6708224 Rev. C) 450 BICS™ (S/N 561711001–11387) 450E BICS™ (S/N 562011001–11076) (Printed April 1996)
Wiring Diagram (P/N 6724521) Sheet 5 Of 8 Engine (Harness 6709893) 450 BICS™ (S/N 561711388 & Above) 450E BICS™ (S/N 562011077 & Above) (Printed February 1996)	Wiring Diagram (P/N 6724521) Sheet 5 Of 8 Engine (Harness 6709893) 450 BICS™ (S/N 561711388 & Above) 450E BICS™ (S/N 562011077 & Above) (Printed April 1996)
Wiring Diagram (P/N 6724521) Sheet 6 Of 8 Engine (Harness 6707453) 453 BICS™ & 453E BICS™ (Printed February 1996)	Wiring Diagram (P/N 6724521) Sheet 6 Of 8 Engine (Harness 6707453) 453 BICS™ & 453E BICS™ (Printed April 1996)

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450/453–3
Revision Number
11 March 1997
Date

SERVICE MANUAL REVISION

ROUTE TO ATTENTION	
PARTS MANAGER	☐
SERVICE MANAGER	☒
SALES MANAGER	☐

AFFECTING:

Product BOBCAT LOADER

Model 450, 453

Manual No. 6724259 (1–96)

NOTICE **Insert This Sheet With The Appropriate Manual For Future Reference.**

The following pages are a revision to the 450, 453 Service Manual P/N 6724259 (1–96).

Take out the pages shown and put in the revised pages as follows:

TAKE OUT	PUT IN
COVER (1–96)	COVER (1–96)
HYDRAULIC/HYDROSTATIC SCHEMATIC & LEGEND (P/N 6724520) 450 BICS & 453 BICS (Printed January 1996)	HYDRAULIC/HYDROSTATIC SCHEMATIC & LEGEND (P/N 6724520) 450 BICS & 453 BICS (Printed Mar. 97)
vii, viii	vii (Revised Mar. 97), viii
1–1, 1–2	1–1 (Revised Mar. 97), 1–2 (Revised Mar. 97)
1–3, 1–4	1–3 (Revised Mar. 97), 1–4
1–19, 1–20	1–19, 1–20 (Revised Mar. 97)
1–21 thru 1–30	1–21 (Revised Mar. 97) thru 1–28 (Revised Mar. 97)
3–15, 3–16	3–15 (Revised Mar. 97), 3–16 (Revised Mar. 97)
4–3, 4–4	4–3, 4–4 (Revised Mar. 97)
4–5, 4–6	4–5 (Revised Mar. 97), 4–6 (Revised Mar. 97)
4–7, 4–8	4–7 (Revised Mar. 97),4–8
4–9, 4–10	4–9 (Revised Mar. 97), 4–10
6,3, 6–4	6–3, 6–4 (Revised Mar. 97)
6–7, 6–8	6–7,6–8 (Revised Mar. 97)
7A–7, 7A–8	7A–7 (Revised Mar. 97), 7A–8
7A–9, 7A–10	7A–9 (Revised Mar. 97), 7A–10
7A,–11, 7A–12	7A–11, 7A–12 (Revised Mar. 97)
7A–23, 7A–24	7A–23 (Revised Mar. 97), 7A–24
7A–25, 7A–26	7A–25 (Revised Mar. 97), 7A–26 (Revised Mar. 97)
7A–27, 7A–28	7A–27, 7A–28 (Revised Mar. 97)
7A–29, 7A–30	7A–29 (Revised Mar. 97), 7A–30 (Revised Mar. 97)
7A–33, 7A–34	7A–33 (Revised Mar. 97), 7A–34
7A–35, 7A–36	7A–35, 7A–36 (Revised Mar. 97)
7A–39 thru 7A–42	7A–39 (Revised Mar. 97) thru 7A–42 (Revised Mar. 97)
7A–45, 7A–46	7A–45 (Revised Mar. 97), 7A–46 (Revised Mar. 97)
7A–47, 7A–48	7A–47 (Revised Mar. 97), 7A–48
7B–23, 7B–24	7B–23, 7B–24 (Revised Mar. 97)
8–1, 8–2	8–1 (Revised Mar. 97), 8–2
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9–1, 9–2	9–1 (Revised Mar. 97), 9–2
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MELROE
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450/453–4
Revision Number
11 September 1997
Date

SERVICE MANUAL REVISION

ROUTE TO ATTENTION	
PARTS MANAGER	☐
SERVICE MANAGER	☒
SALES MANAGER	☐

AFFECTING:

Product BOBCAT LOADER

Model 450, 453

Manual No. 6724259 (1–96)

NOTICE **Insert This Sheet With The Appropriate Manual For Future Reference.**

The following pages are a revision to the 450, 453 Service Manual P/N 6724259 (1–96).

Take out the pages shown and put in the revised pages as follows:

TAKE OUT	PUT IN
Maintenance Safety (9–93)	Maintenance Safety (BICS 9–96)
v, vi	v (Revised Sept. 97), vi (Revised Sept. 97)
1–3 (Revised Mar. 97), 1–4 1–19, 1–20 (Revised Mar. 97) 1–23 (Revised Mar. 97), 1–24	1–3 (Revised Sept. 97), 1–4 (Revised Sept. 97) 1–19 (Revised Sept. 97), 1–20 (Revised Mar. 97) 1–23 (Revised Mar. 97), 1–24 (Revised Sept. 97)
2–17, 2–18	2–17, 2–18 (Revised Sept. 97)
3–11, 3–12	3–11 (Revised Sept. 97), 3–12
4–3, 4–4 4–5 (Revised Mar. 97), 4–6 (Revised Mar. 97) 4–7 (Revised Mar. 97), 4–8	4–3, 4–4 (Revised Sept. 97) 4–5 (Revised Sept. 97), 4–6 (Revised Mar. 97) 4–7 (Revised Sept. 97), 4–8

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October 8 1998
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SERVICE MANUAL REVISION

ROUTE TO ATTENTION

PARTS MANAGER	☐
SERVICE MANAGER	☒
SALES MANAGER	☐

AFFECTING:

Product BOBCAT LOADER

Model 450, 453

Manual No. 6724259 (1–96)

NOTICE **Insert This Sheet With The Above Listed Manual For Future Reference.**

The following pages are a revision to the above Service Manual.

Take out existing pages and put in the new pages as listed below:

TAKE OUT	PUT IN
	ALPHABETICAL INDEX
Maintenance Safety Page	Maintenance Safety Page
v thru vi	v thru vi
Section 1	Section 1
DO NOT REMOVE the Hydraulic Schematics in Section 2	
2–1 thru 2–4	2–1 thru 2–4
2–11 thru 2–12	2–11 thru 2–12
2–15 thru 2–22	2–15 thru 2–22
2–29 thru 2–32	2–29 thru 2–32
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7B–13 thru 7B–14	7B–13 thru 7B–14
8–17 thru 8–18	8–17 thru 8–18
9–1 thru 9–2	9–1 thru 9–2
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