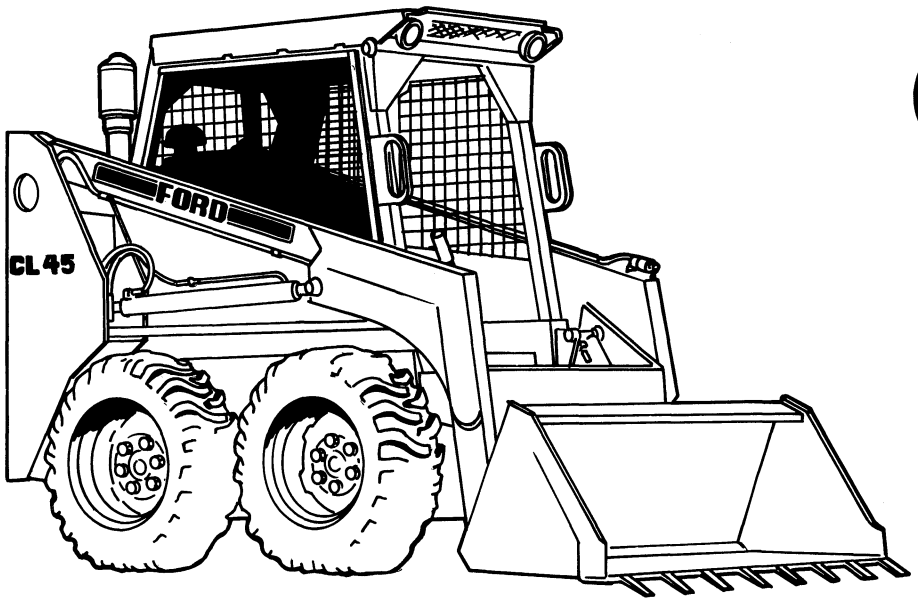
FORD

Compact Loader

CL-35
CL-45

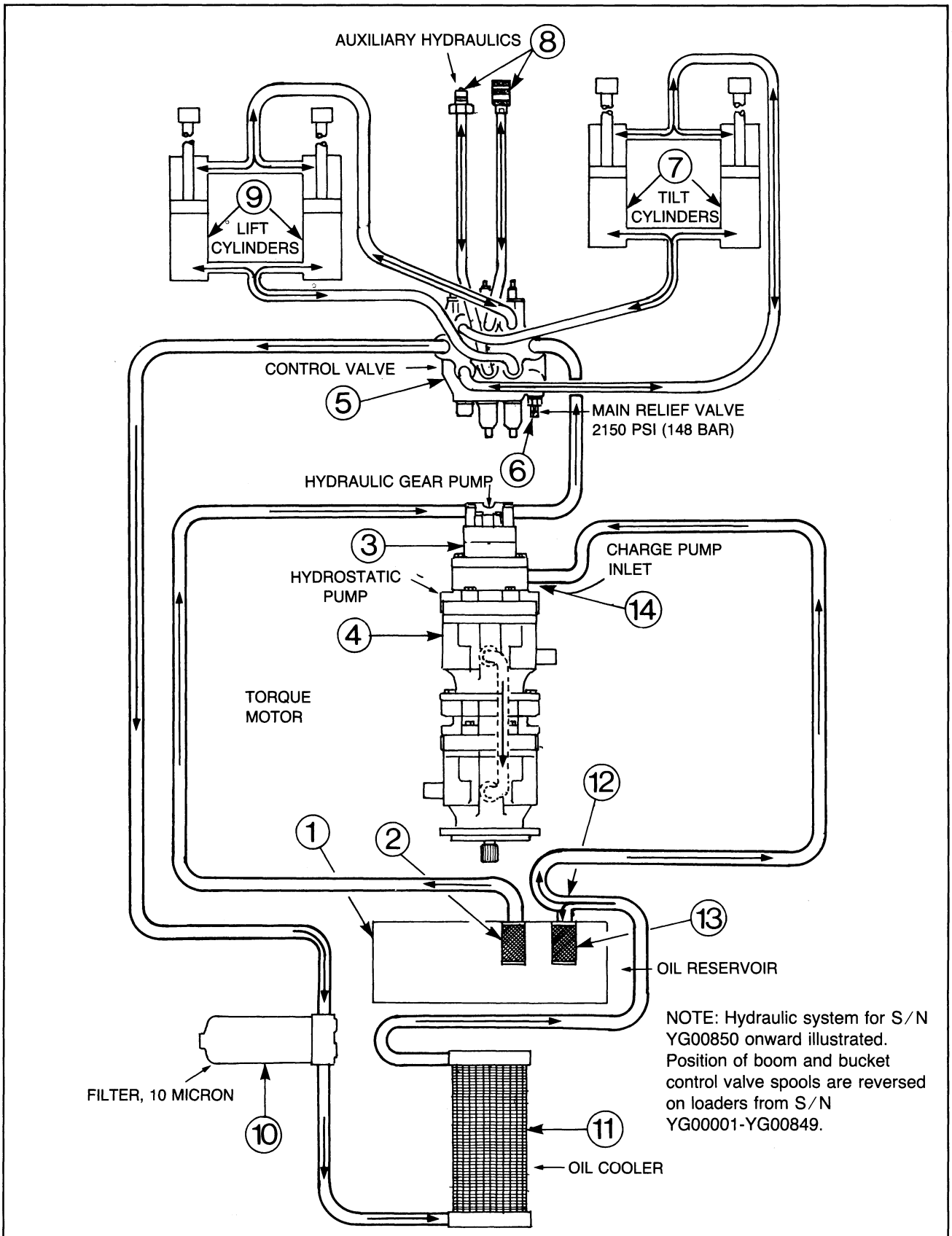


repair manual

40003510

Reprinted

HYDRAULIC/HYDROSTATIC CIRCUIT



1309

Fig. 1.1.2

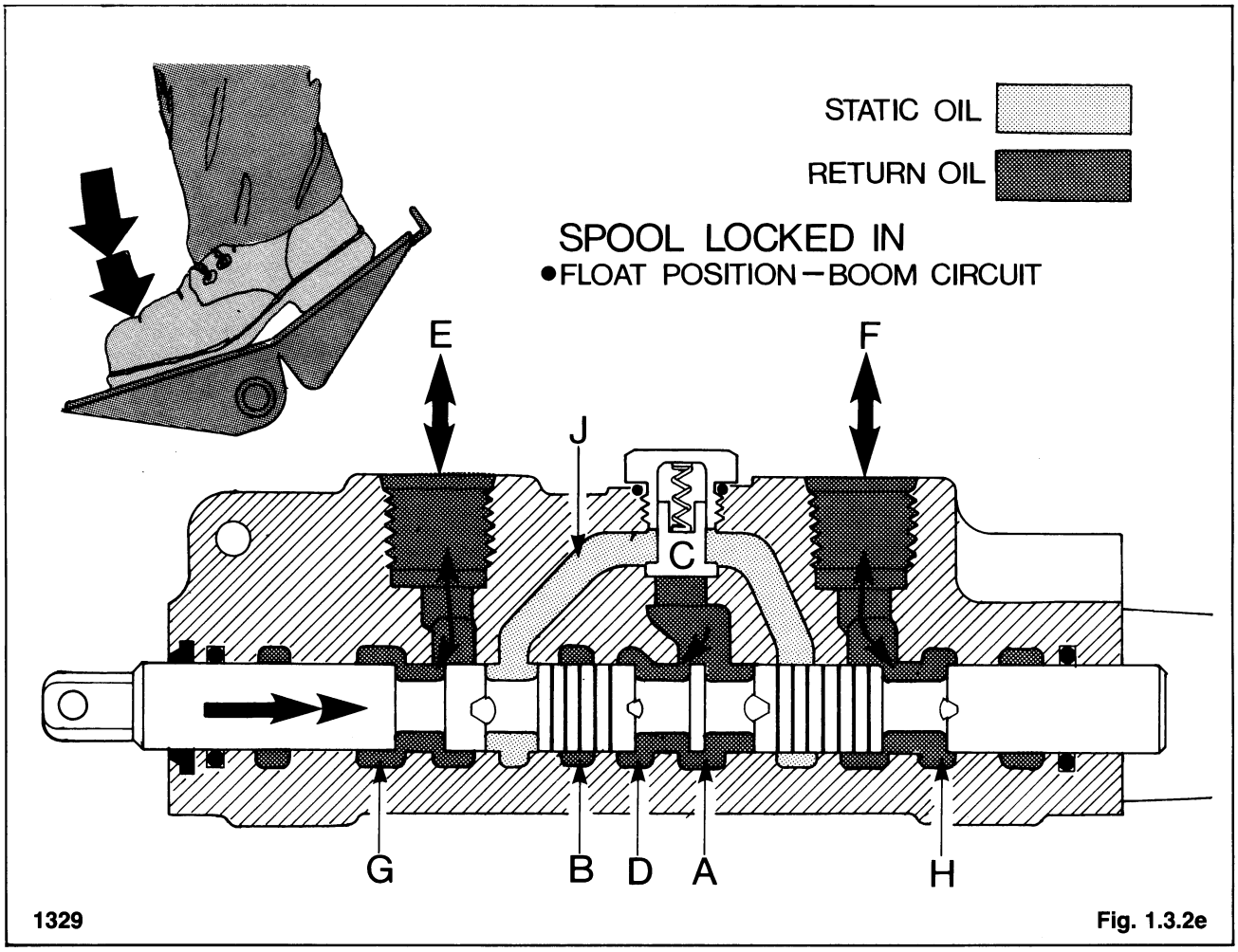


Fig. 1.3.2e

1.3.3 Testing and Adjusting the Relief Valve

TESTING — SYSTEM RELIEF VALVE

Use a pressure gauge capable of reading up to 3000 PSI (206.8 BAR) and hose and fittings capable of 3000 PSI (206.8 BAR) continuous pressure when performing the test.

1. Operate the loader until the hydraulic oil is warm. Shut off the engine.
2. This test must be performed with the engine running. Before performing the test remove any attachment and block the loader securely with all four wheels clear of the ground.
3. Connect a pressure gauge in the female quick-connect coupling on the auxiliary hydraulic circuit located at the front of the boom arm (fig. 1.3.3a).
4. Start the engine.
5. Press the toe of the auxiliary (center) pedal to activate the auxiliary hydraulic circuit.
6. Pressure must be 2150 PSI (148 B) ± 50 PSI (± 3.4 BAR).
7. Shut off the engine and cycle the foot pedal to relieve pressure at the gauge.

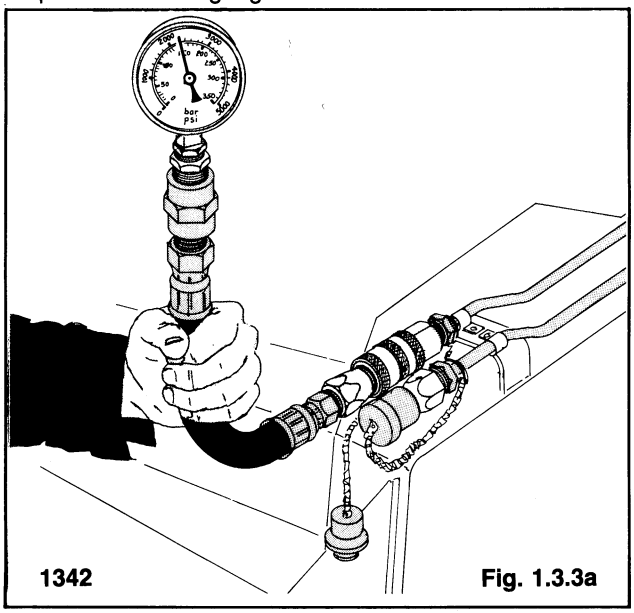
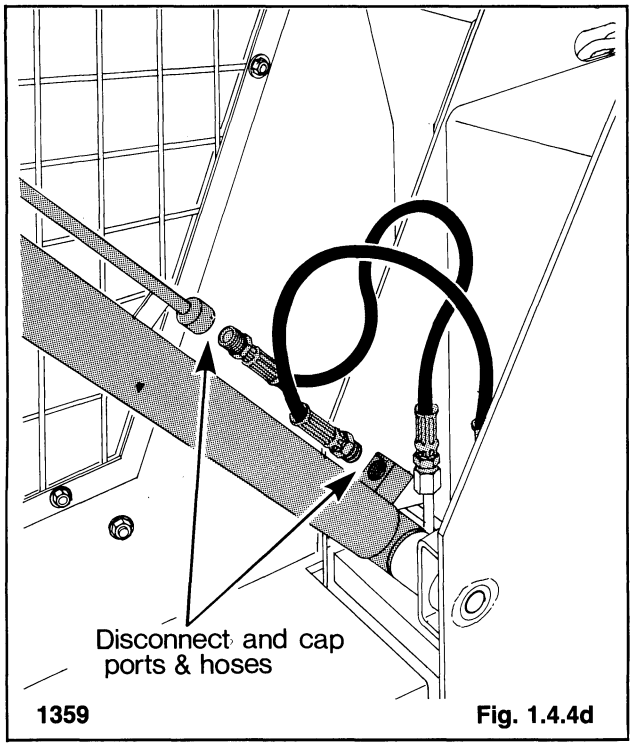
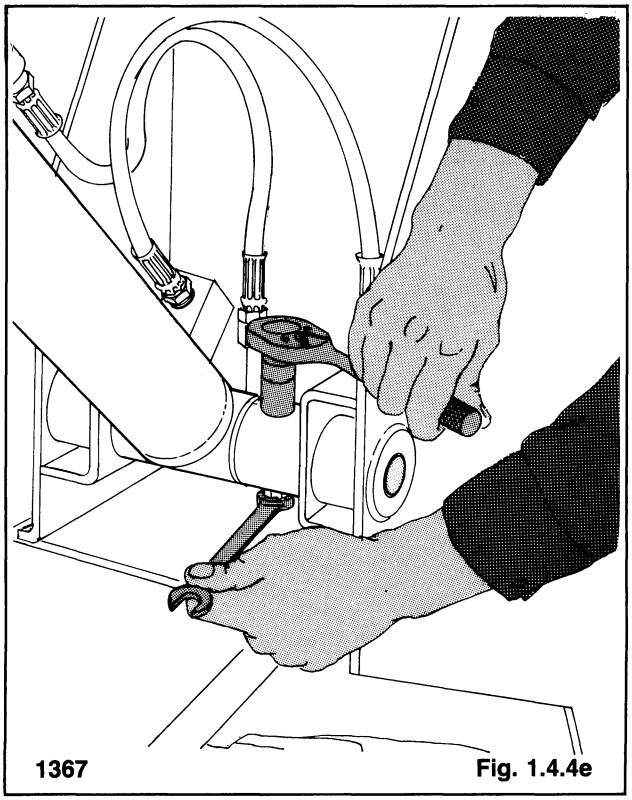


Fig. 1.3.3a

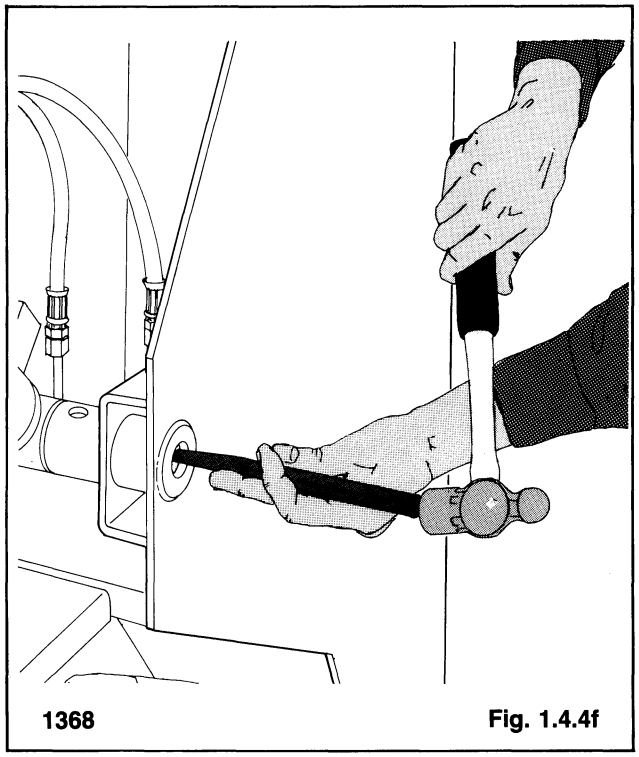


1359 Fig. 1.4.4d

7. Remove the hydraulic hose from the front and rear ports on the boom cylinder (fig. 1.4.4d). Cap cylinder ports and hoses.
8. Remove the locknut, washer and bolt at the base of the cylinder (fig. 1.4.4e).



1367 Fig. 1.4.4e



1368 Fig. 1.4.4f

9. Remove the pivot pin (fig. 1.4.4f).
10. Remove the boom cylinder from the loader.
11. Lower the boom arms and remove the floor jack.

BUCKET CYLINDER — REMOVAL:

1. Lower the boom arm, remove any attachment and extend the bucket cylinders (dump). Shut off the engine. Cycle the hydraulic pedals to release pressure.

WARNING

Do not work on a loader with the boom arms in a raised position unless the boom locks are engaged.

WARNING

Never repair or tighten hydraulic hoses or fittings with the engine running or the system under pressure.

NOTE: If the reservoir has been completely drained refer to the start up procedure section 1.2.6 to prevent damage to the hydraulic components.

DRAINING THE OIL RESERVOIR:

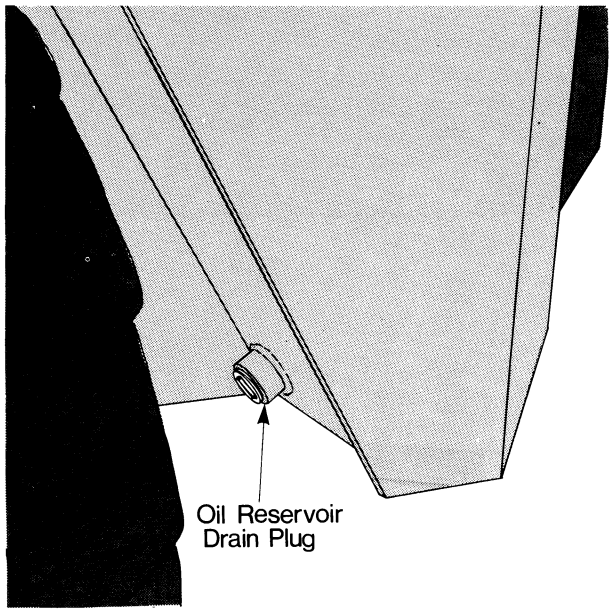
Change the hydraulic oil after 1000 operating hours or if the oil has become contaminated or after any major hydrostatic drive system repair.

1. Remove any attachment, raise the lift arms and engage the boom lock. Shut off the engine and engage the parking brake.

WARNING **Do not work on a loader with the boom arms in a raised position unless the boom locks are engaged.**

2. To drain; remove the drain plug located at the bottom of the hydraulic oil reservoir (fig. 1.7.3d).

When refilling use only 10W30 API Classification SE/CD engine oil or Ford Oil No. 48. Total reservoir capacity 8 gal. (30.3 l).



1375 **Fig. 1.7.3d**

NOTE: If the reservoir is completely drained refer to the start up procedure section 1.2.6 to prevent damage to the hydraulic components.

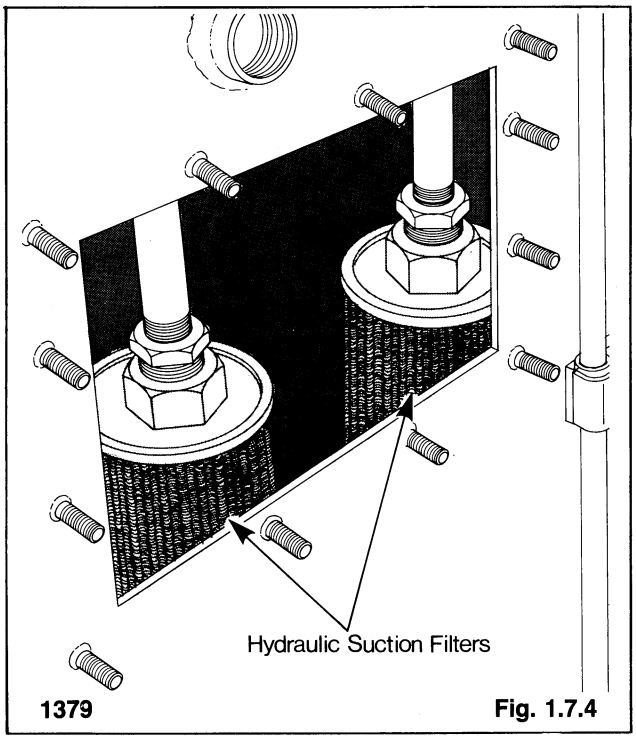
1.7.4 Filter Replacement:

The 100 micron hydraulic suction filters located inside the oil reservoir should be changed every 1000 operating hours or if the oil becomes contaminated or after a major hydrostatic drive system repair.

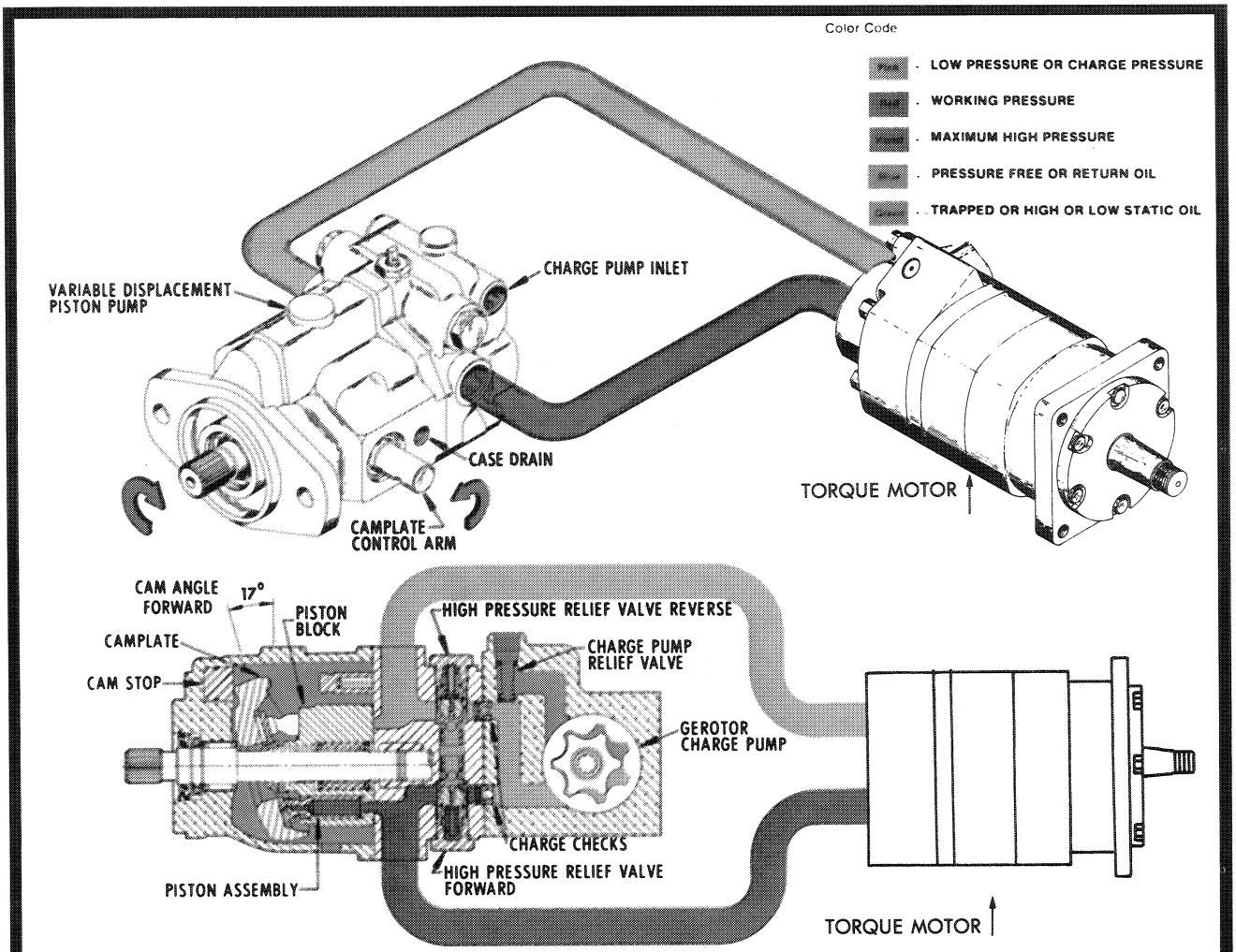
1. Drain the oil from the hydraulic oil reservoir (refer to section 1.7.3).
2. Open the rear door and clean the area around the oil reservoir inspection cover.

WARNING **Do not service the loader with the engine running.**

3. Remove the inspection cover.
4. Remove the two 100 micron suction filters (fig. 1.7.4).
5. Install two new suction filter elements.
6. Install the coverplate. Seal with silicon.
7. Refill the oil reservoir using 10W30 API Classification SE/CD or Ford Oil No. 48 only. Total reservoir capacity 8 gal. (30.3 l).



1379 **Fig. 1.7.4**



1386

Fig. 2.2.2C

CAM ANGLE FORWARD POSITION WITH RELIEF VALVES CROSS RELIEVING

speed through the drilled orifice in the relief valve cartridge, causing a pressure drop inside the relief valve. The surrounding pressure is now able to unseat the relief valve and bypass maximum volume of oil. The system relief valves function the same for both sides of the system.

When the steering lever is slowly moved to the reverse position, the vehicle starts a reverse movement (figure 2.2.2D). As the camplate begins to move, the piston assemblies start to reciprocate in the piston block. As the lever continues a reverse movement the cam angle increases, the pistons reciprocate further, more oil is being pumped and the speed of the vehicle is increased.

The steering lever can be moved in reverse until a full cam angle of 17° has been reached, which also achieves maximum volume of oil being discharged from the pump. When the camplate begins to move the charge check on the discharge or pressure side seats because of the higher pressure differential. The other charge check remains open on the intake or low pressure side to continue supplying the closed loop system with a charge of oil.

In the reverse position the pump shaft still rotates in the same direction, but the discharge of oil from the pump is reversed, thus reversing the rotation of the motor.

4. Remove the charge pump kit from the back plate assembly (fig. 2.2.5d, fig. 2.2.5e).

IMPORTANT

Do not attempt to check charge pump flow. Checking flow can cause cavitation and damage to the piston pumps.

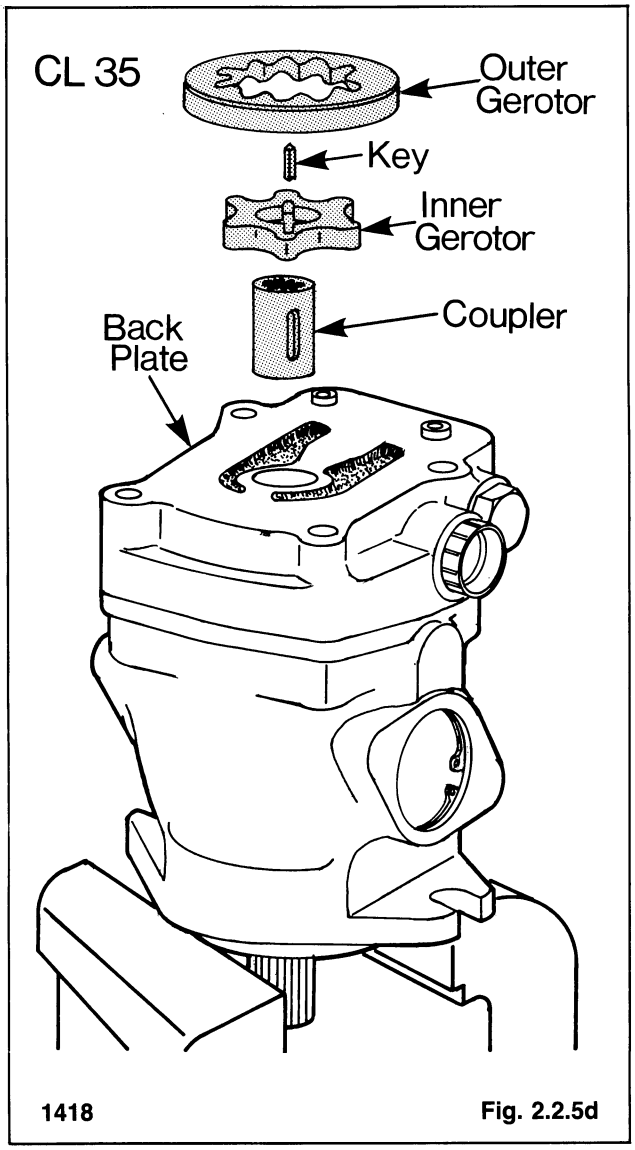


Fig. 2.2.5d

5. Using the two screw driver slots cast in the pump housing, separate the back plate from the housing (fig. 2.2.5f).
6. Remove and discard the gasket between the housing and back plate assembly.

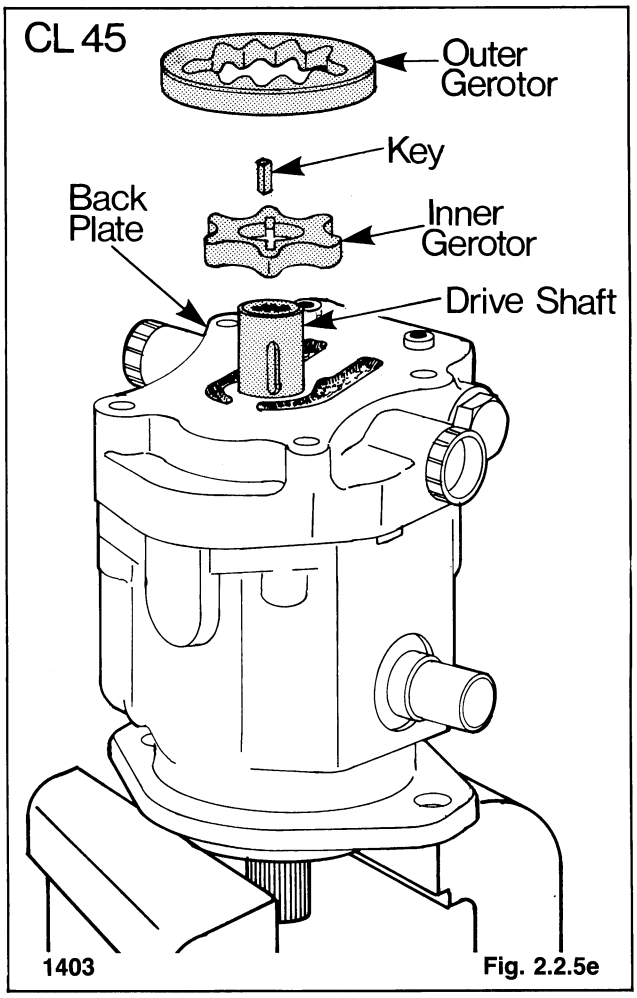


Fig. 2.2.5e

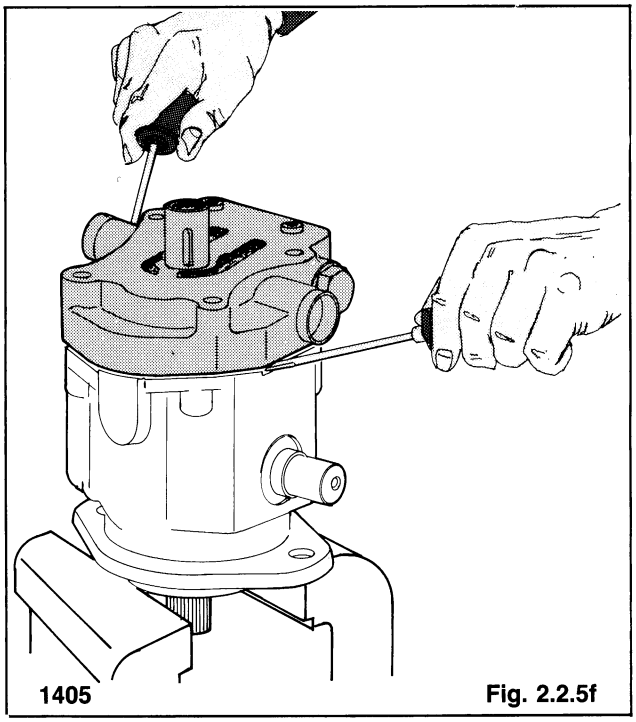


Fig. 2.2.5f

7. Remove the charge pump transfer line located between the front and rear hydrostatic pump (fig. 2.2.8c).

   Cap the transfer line and both transfer ports.

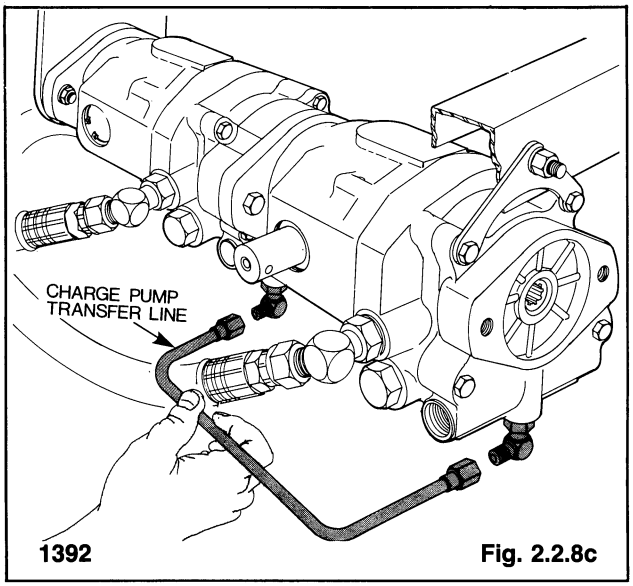


Fig. 2.2.8c

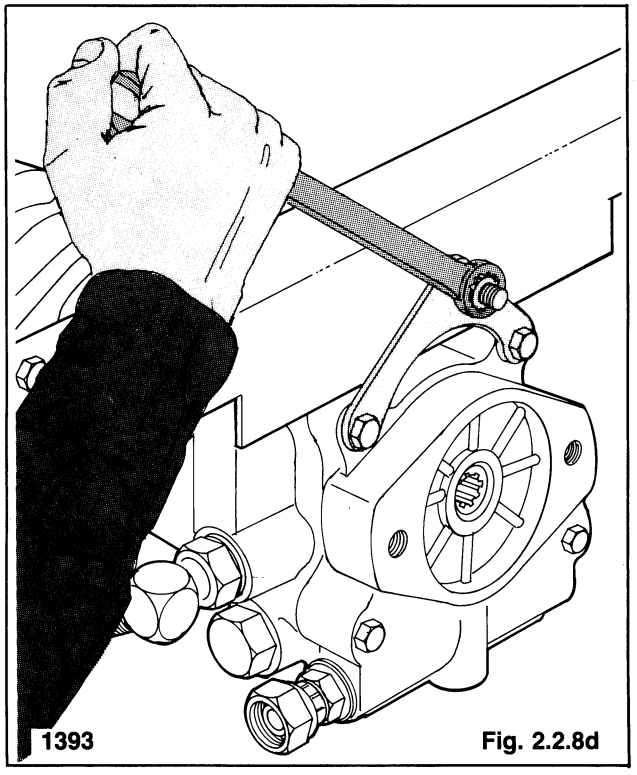


Fig. 2.2.8d

8. Remove the bolt from the front pump mounting bracket (fig. 2.2.8d).

9. Remove the four bolts and the pump mounting bracket from the front pump (fig. 2.2.8e).

   On reassembly torque the four bolts:
   CL35 . . . 17-20 ft. lbs. (23-27 N.M.)
   CL45 . . . 27-31 ft. lbs. (36.6-42 N.M.)

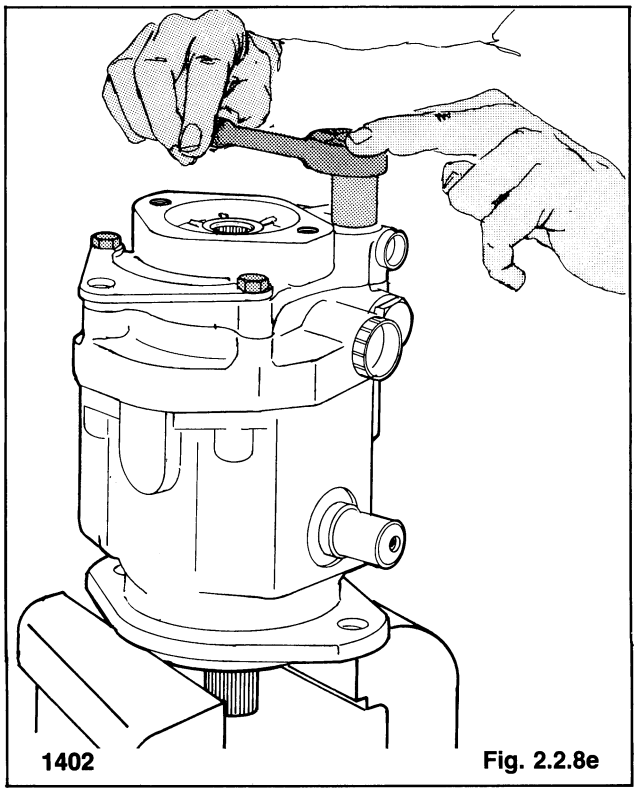


Fig. 2.2.8e

10. Use a plastic hammer and tap the adaptor plate to loosen it from the pump back plate (fig. 2.2.8f).

    Remove the adaptor plate from the pump assembly.

    On reassembly install a new O-ring on the adaptor plate.

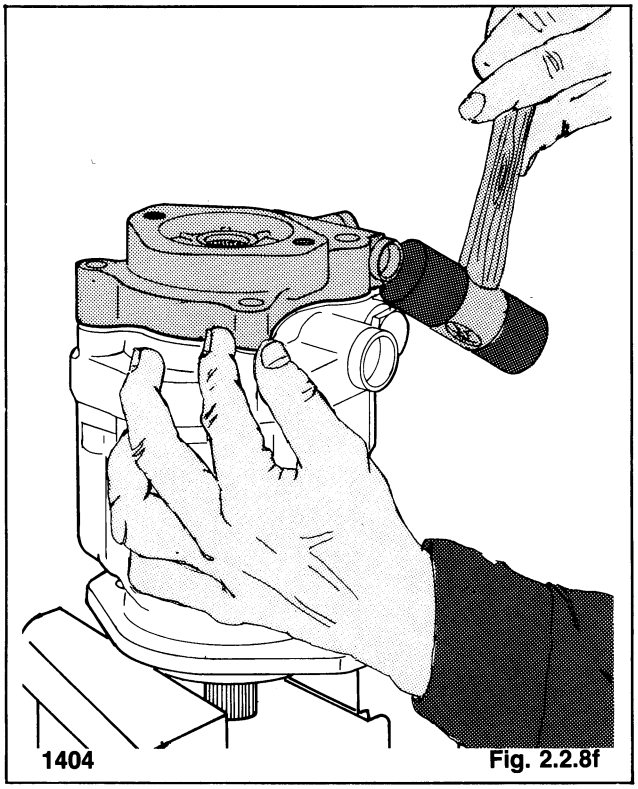


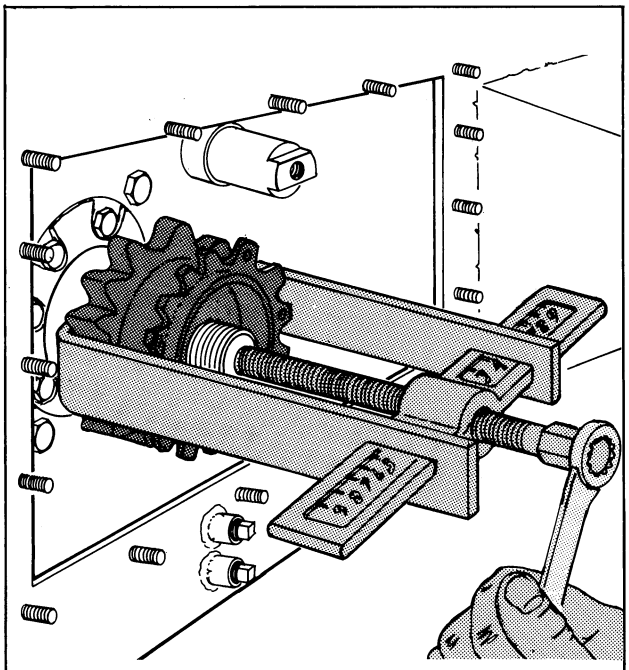
Fig. 2.2.8f

NOTE: On reassembly the cotter pin side of the connection link faces the inspection opening of the final drive housing.

13. Remove the drive chain from the final drive housing.

    On reassembly install a new connection link and cotter pins.

14. Using a proper gear puller, remove the sprocket and key from the torque motor shaft (fig. 2.3.3j) on the CL35. The CL45 torque motor can be removed with the sprocket attached.



1458 Fig. 2.3.3j

15. Disconnect and remove the two high pressure pipes between the pump and motor (fig. 2.3.3k).

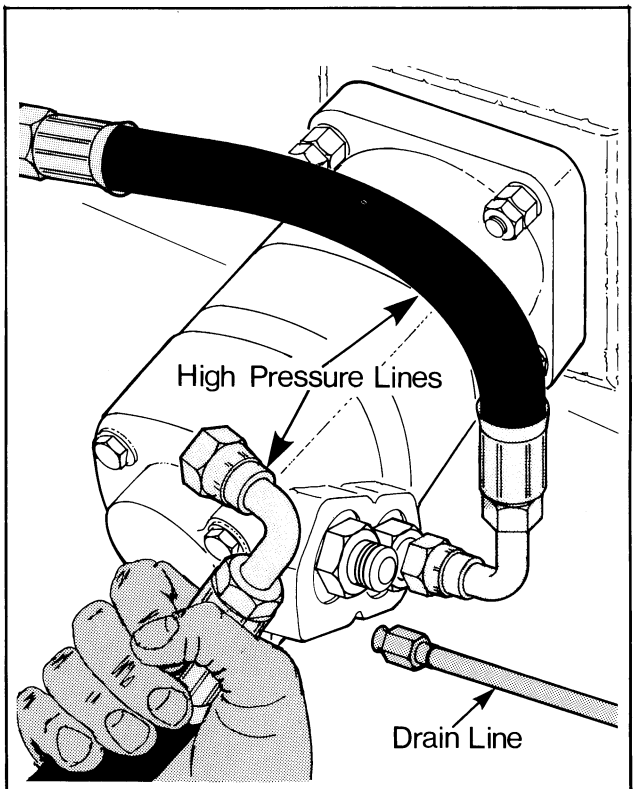
    If rubber high pressure lines are installed in the loader only the torque motor end needs to be disconnected.

    Cap the lines and plug the pump and torque motor port openings.

16. Disconnect and remove the drain line from the torque motor (fig. 2.3.3k). Cap the line and plug the motor drain port.

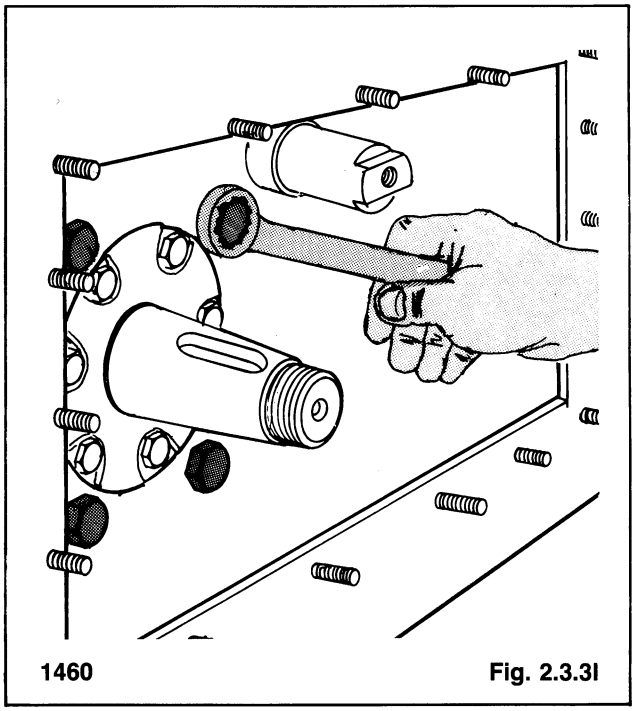
IMPORTANT

When making repairs to the hydrostatic system, keep all parts clean and remove dirt from the work area. Use caps and plugs on all lines and openings.



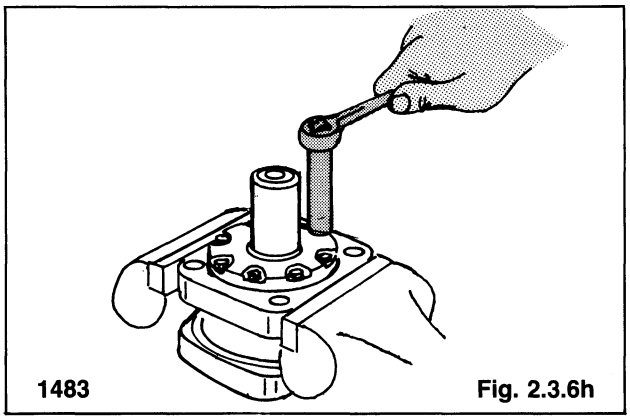
1454 Fig. 2.3.3k

17. Hold the torque motor mounting bolts from turning when the mounting nuts are loosened (fig. 2.3.3l).

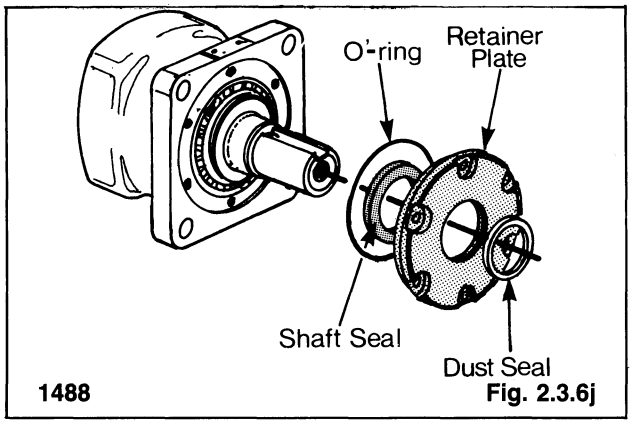


1460 Fig. 2.3.3l

7. Remove the geroler assembly (fig. 2.3.6g). Keep the rollers and the inner geroler in the outer geroler ring.
8. Remove the two drain seals from each side of the geroler ring (fig. 2.3.6g).
9. Remove the geroler drive and the seal from the bearing housing (fig. 2.3.6g).



1483 Fig. 2.3.6h

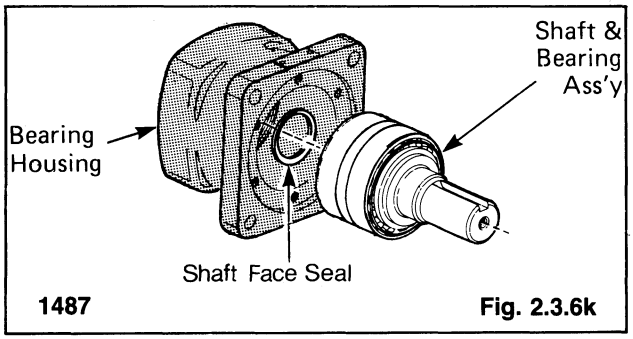


1488 Fig. 2.3.6j

10. Turn the bearing housing over in the vice and remove the six retainer plate bolts (fig. 2.3.6h).

    On reassembly torque the retainer plate bolts to 25 ft. lbs. (33.9 Bar). Follow the torque sequence as outlined in section 2.3.9.

11. Remove the retainer plate from the bearing housing (fig. 2.3.6j). The retainer plate may have to be pried free. Be careful not to damage the bearing housing or the retainer plate.



1487 Fig. 2.3.6k

12. Remove the dust seal, shaft seal and O-ring from the retainer plate (fig. 2.3.6j).
13. Remove the shaft and bearing assembly from the bearing housing (fig. 2.3.6k). The shaft may need to be pressed out.

    Remove the shaft face seal from the bore of the bearing housing (fig. 2.3.6k). Be careful not to damage the bore of the bearing housing.

NOTE: Individual parts of the shaft and bearing assembly are not sold or serviced separately and must be replaced as a complete unit.

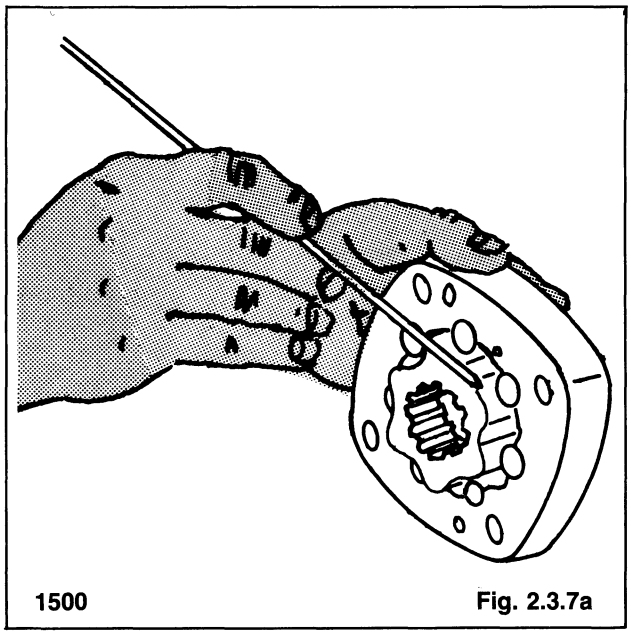
2.3.7 Torque Motor — Inspection:

Clean all parts in a suitable solvent and blow dry with air. Do not wipe dry with cloth or paper towels.

WARNING **To avoid eye injury use safety goggles when cleaning with compressed air.**

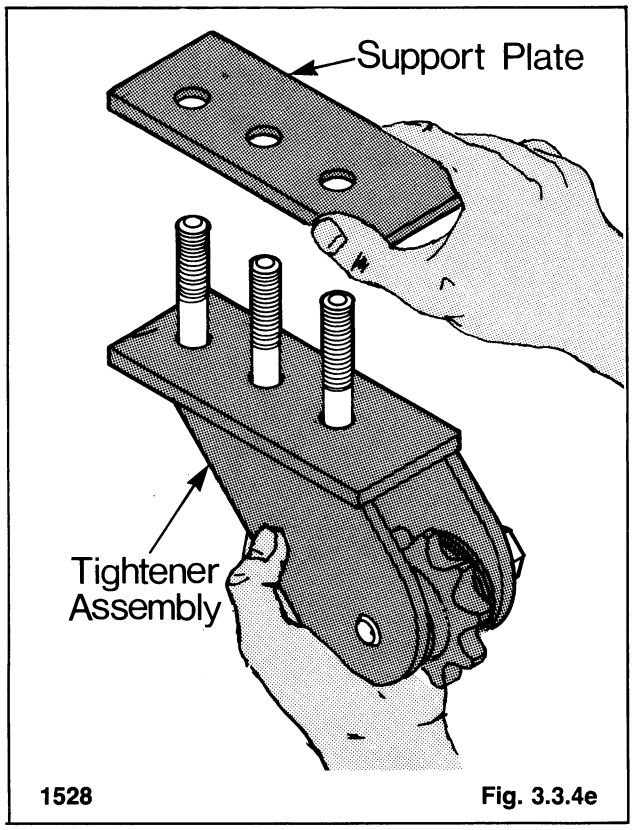
Do not use coarse grit or attempt to file or grind motor parts. Replace any parts that are scratched or have burrs that could cause leakage.

1. Inspect the geroler star (fig. 2.3.7a) for wear or damage.



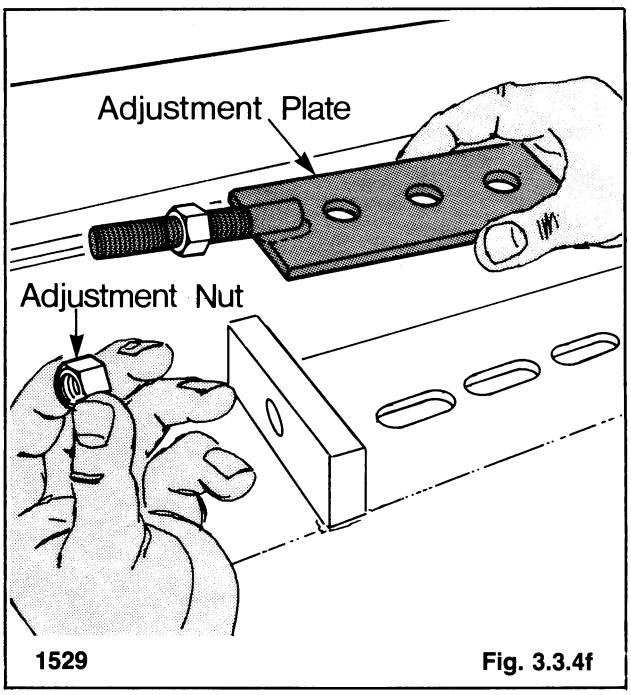
1500 Fig. 2.3.7a

Loss of drive power — both sides (also loss of hydraulic power)	Reservoir low on fluid	Check for leaks. Fill the reservoir with 10W30 API SE/CD oil or Ford no. 48.	1.7.3
	Universal joint between engine and pump failure	Inspect and repair or replace damaged parts	
	Drive coupling failure between front and rear pump	Inspect coupling and shafts for spline damage. Also check pump bearings.	2.2.7
	Charge pump shaft failure	Inspect and replace damaged parts	2.2.5
Loss of drive power — both sides (full hydraulic power	Charge pump failure	Inspect and replace damaged parts	2.2.8
	Charge pump relief valve failure	Inspect and replace damaged parts	2.2.5
	Excessive internal leakage or damage in pumps and/or motors	Inspect and repair defective parts	2.2.5 2.3.5 2.3.6
Gradual loss of power as the machine warms up	Excessive internal leakage in pumps or motors	Inspect and repair defective parts	2.2.5 2.3.5 2.3.6
System erratic and/or noisy	Air in system due to low oil level in reservoir	Fill reservoir with 10W30 API SE/CD oil or Ford no. 48	1.7.3
	Air in system due to leaks at suction fitting	Check fittings and tighten	
	Excessive free play in steering linkage	Inspect linkage and tighten or replace worn parts	4.1
	Drive chain out of adjustment	Adjust	3.3.1

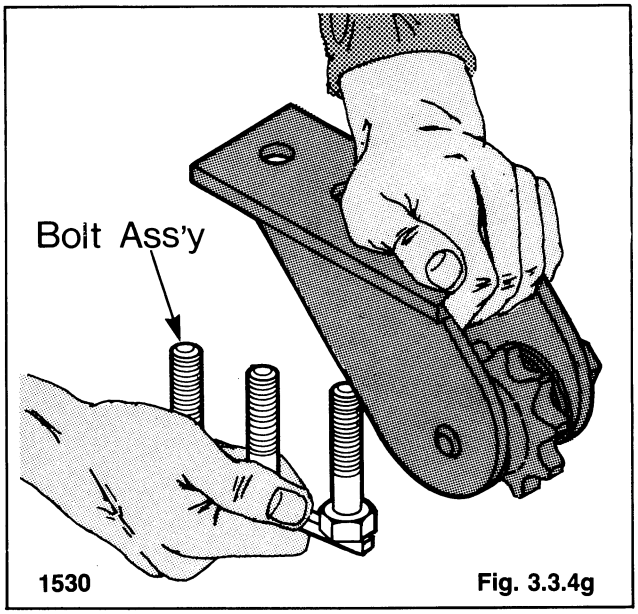


1528 Fig. 3.3.4e

10. Remove the chain tightener assembly and support plate from the final drive housing (fig. 3.3.4e).
11. Remove the front adjustment nut from the adjustment plate and remove the adjustment plate from the loader (fig. 3.3.4f).



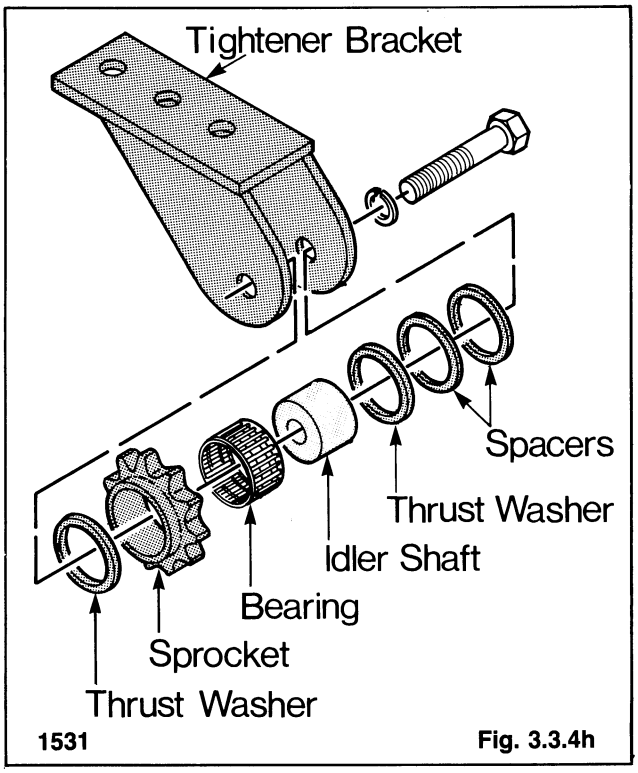
1529 Fig. 3.3.4f



1530 Fig. 3.3.4g

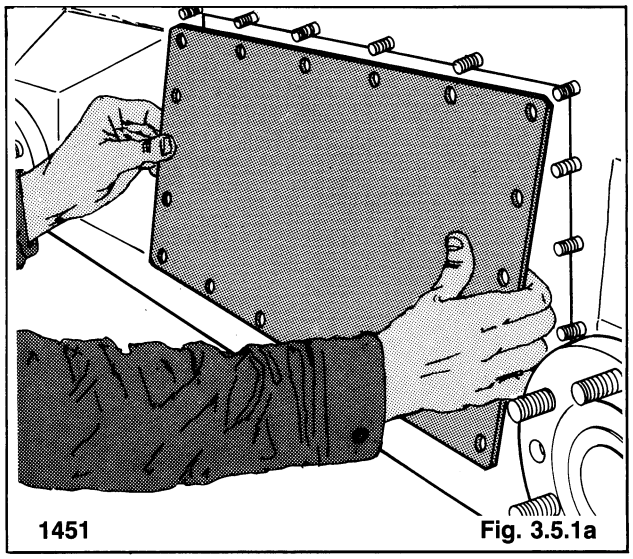
12. Remove the bolt assembly from the chain tightener (fig. 3.3.4g).
13. Remove the bolt and spring washer (fig. 3.3.4h) from the tightener bracket. On reassembly apply Locktite No. RC609 to the bolt threads.
14. Remove the sprocket, bearing, idler shaft, thrust washers (2) and spacers (2) from the tightener bracket (fig. 3.3.4h).

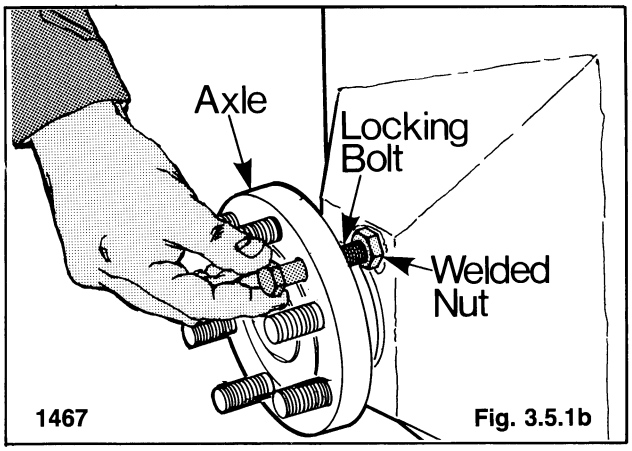
NOTE: The chain tightener bearing on the CL35 is an oilite bearing.



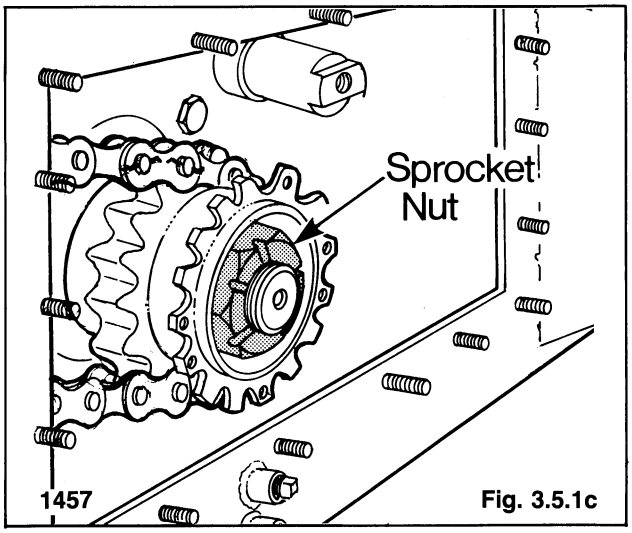
1531 Fig. 3.3.4h

5. Remove the final drive inspection cover plate (fig. 3.5.1a) located between the axles on the final drive housing.
6. Remove the parking brake assembly from the final drive housing. Refer to section 4.5 for procedure.


1451 Fig. 3.5.1a



1467 Fig. 3.5.1b

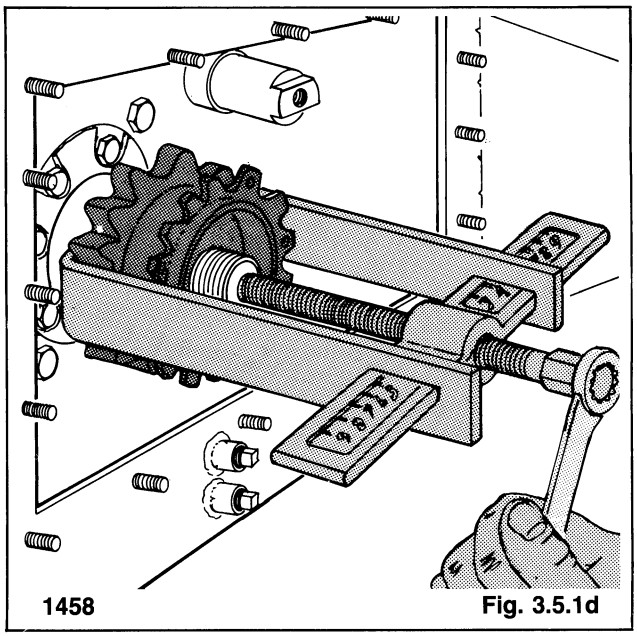


1457 Fig. 3.5.1c

7. Place a bolt through one of the holes in the axle flange to prevent the torque motor shaft from turning as the sprocket nut is removed (fig. 3.5.1b).
8. Remove the torque motor sprocket nut (fig. 3.5.1c).

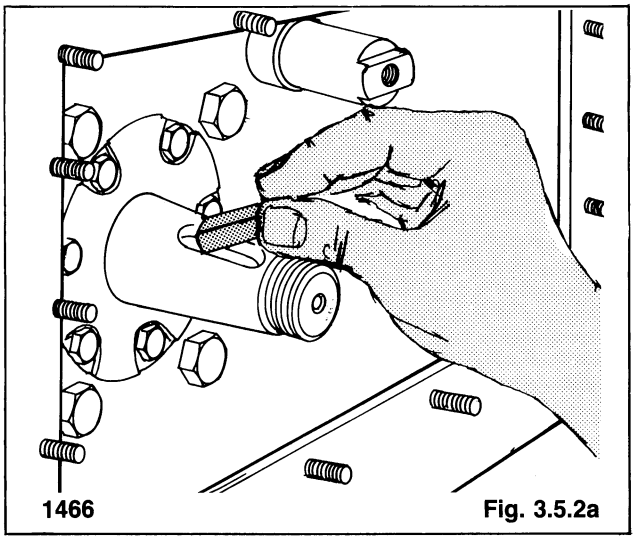
   On reassembly torque to 350 ft. lbs. (474.5 N.M.).
9. Remove the drive chain. Refer to section 3.3.2 for procedure.
10. Using a proper gear puller, remove the sprocket and key from the torque motor shaft (fig. 3.5.1d).

NOTE: The CL45 torque motor can be removed from the final drive housing without removing the sprocket.

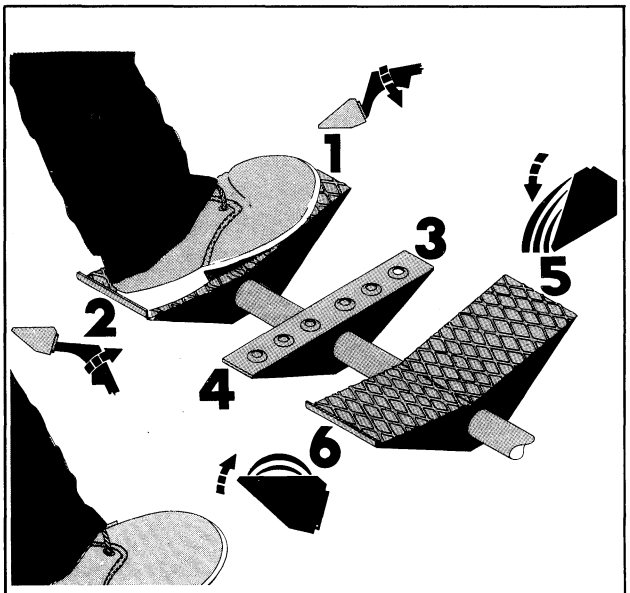

1458 Fig. 3.5.1d

3.5.2 Sprocket Installation:

1. Install the key on the torque motor shaft (fig. 3.5.2a).


1466 Fig. 3.5.2a

4.2 FOOT PEDALS



1281 Fig. 4.2.1

4.2.1 Operation:

Operation of the boom lift cylinders, auxiliary hydraulic circuit and bucket tilt cylinders are controlled by three foot pedals (fig. 4.2.1).

The foot pedals are connected through a mechanical linkage to a series type control valve which allows simultaneous use of both the boom lift and bucket tilt circuits.

BUCKET TILT OPERATION:

The R.H. pedal is the bucket tilt (dump) control. Pressing on the toe 5 will dump the bucket. Pressing on the heel 6 of the pedal will roll the bucket back. Releasing pressure on the pedal will cause the control valve to return to neutral position.

BOOM LIFT OPERATION:

The L.H. pedal is the boom lift control (fig. 4.2.1). To raise the boom press on the heel of the pedal 2. To lower the boom, press on the toe of the pedal 1. Firm pressure on the toe 1 will lock the pedal in float position. This allows the bucket to follow the ground as the loader moves backward. Releasing pressure on the pedal will cause the control valve to return to neutral position.

WARNING **To avoid loader overturn always carry load low.**

AUXILIARY HYDRAULICS:

The center pedal is used to engage the auxiliary hydraulic circuit to power an attachment such as a back hoe. Pressing on the toe 3 of the pedal provides hydraulic pressure to the female quick-connect coupling located at the front of the boom arms. Firm pressure on the toe 3 of the pedal will lock the pedal in detent position allowing a continuous flow of hydraulic oil to an attachment. Pressing the heel 4 of fthe pedal provides hydraulic power to the male quick-connect coupling, located at the front of the boom arms, reversing the flow of hydraulic oil. Releasing pressure on the pedal will cause the control valve to return to neutral position unless the pedal is locked in detent position. When the auxiliary hydraulic circuit is not in use return the foot pedal to neutral position by pressing on the heel 4 of the pedal. If the pedal is left in detent position starting the loader may be difficult or impossible and damage to the starter may occur.

IMPORTANT **Return auxiliary hydraulic foot pedal to neutral position when not in use.**

SAFETY EQUIPMENT:

The Ford CL35 and CL45 loaders have been equipped with two types of foot pedal safety systems to prevent accidental cycling of the foot pedals while entering or exiting the loader.

SERIAL NO. YG00001 TO YG00849:

The above loaders are equipped with a foot pedal shield which completely covers the pedals when entering or exiting the loader. The shield is operated by the raising and lowering of the seat bar. As the seat bar is raised the foot pedal shield lowers completely covering the foot pedals (fig. 4.2.1a). At the same time the steering levers are returned to and locked in neutral position.

For operator protection during starting the loader starter circuit is designed so that the engine must be started with the seat bar up, foot pedal shield down covering the pedals and the steering levers centered in neutral. A safety start switch activated by the foot pedal shield disengages the starter circuit when the seat bar is in the down position. For emergency starting with the seat bar in the down position the loaders are equipped with an over-ride start switch (refer to section 5).

WARNING **Stop the engine, lower the boom arms and engage the parking brake before getting out of loader.**

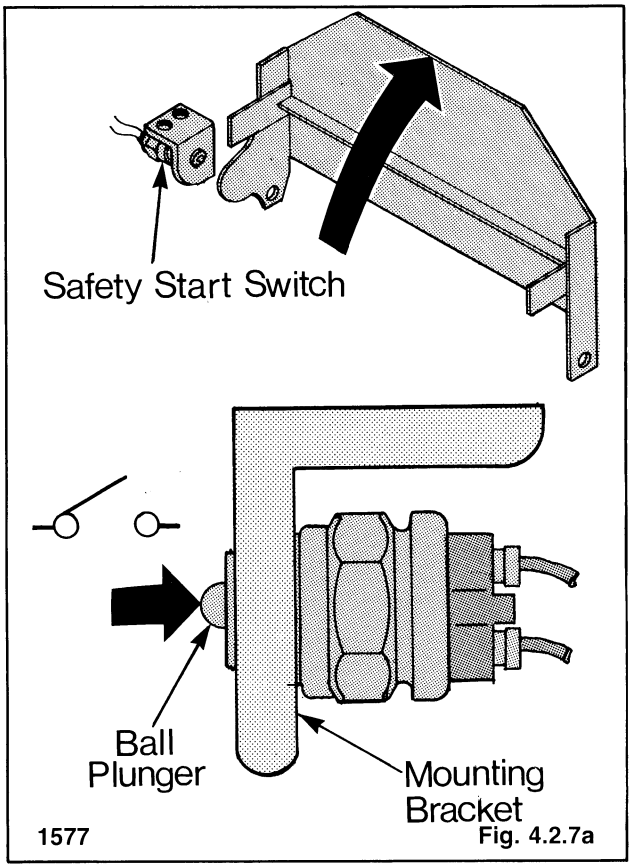


Fig. 4.2.7a

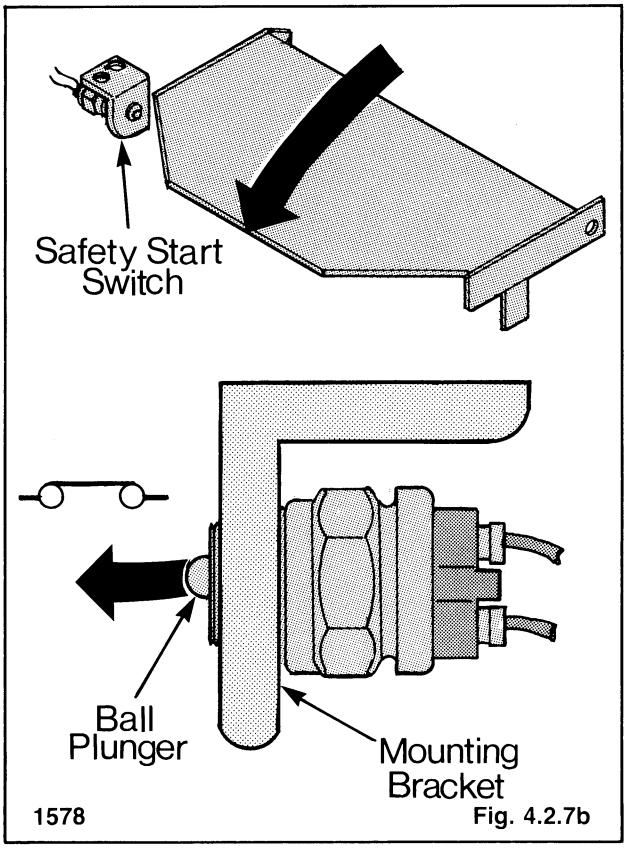


Fig. 4.2.7b

WARNING Do not work on a loader with the boom arms in a raised position unless the boom locks are engaged.

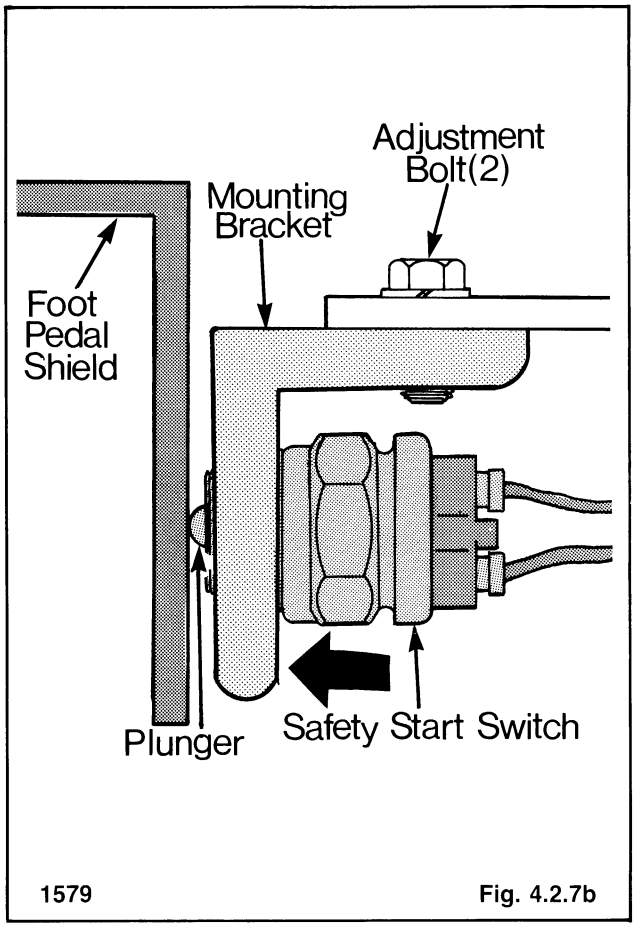
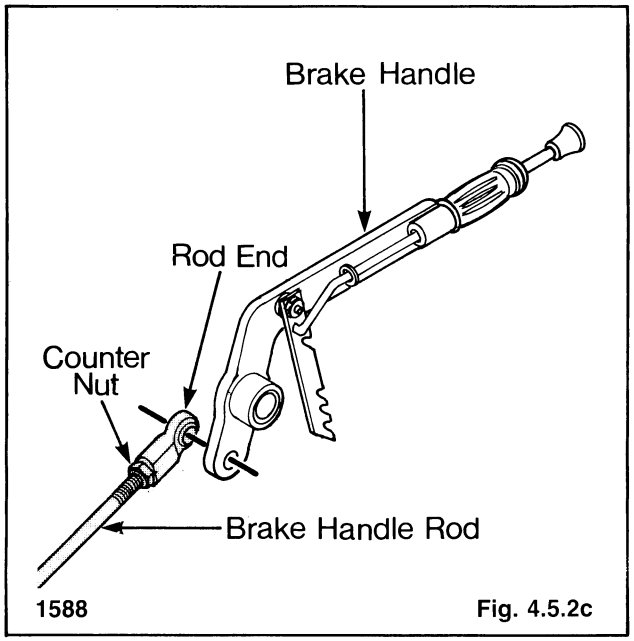


Fig. 4.2.7b

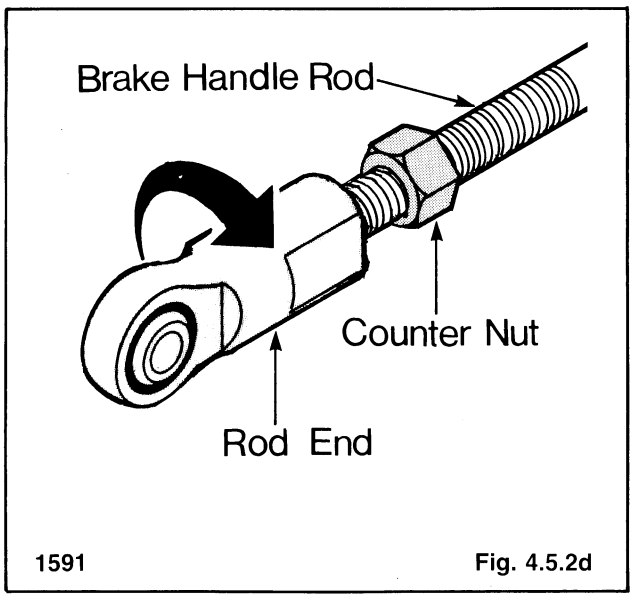
2. Check to ensure the safety start switch is fully screwed into the mounting bracket (fig. 4.2.7c).
3. With the foot pedal shield in the full down position, loosen the two adjustment bolts which secure the safety start switch mounting bracket.
4. Move the mounting bracket toward the foot pedal shield until the plunger on the end of the safety start switch is fully depressed.
5. Tighten the two mounting bracket adjustment bolts.

NOTE: Loaders after S/N YG00849 do not require adjustment other than ensuring the safety start switch is fully screwed into the mounting bracket.



1588 Fig. 4.5.2c

3. Disengage the brake handle and place it in the off position (fig. 4.5.2c).
4. Disconnect the brake handle rod where it connects to the brake handle (fig. 4.5.2c).
5. To increase the amount of handle force, back-off the rod end counternut. Turn the rod end clockwise two or three turns (fig. 4.5.2d).
6. Reconnect the brake handle rod to the brake lever and recheck the amount of handle effort required to move the brake lock from the second to the third notch. If necessary repeat steps 3 to 6. When the correct handle effort is achieved tighten the rod end counternut on the brake handle rod.



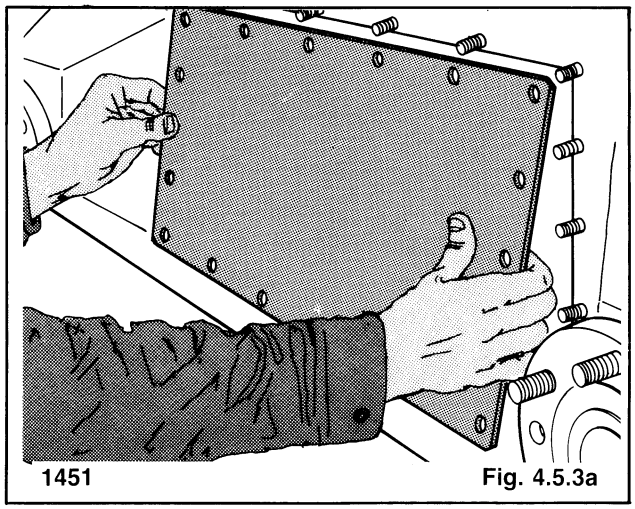
1591 Fig. 4.5.2d

4.5.3 Parking Brake Removal:

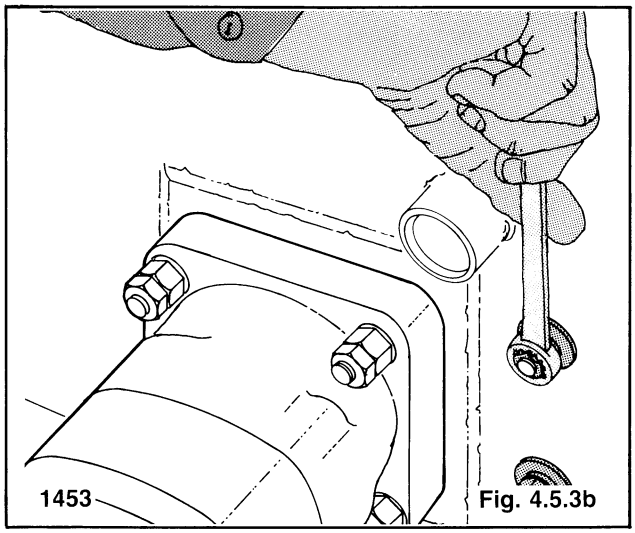
WARNING

Do not work on a loader with the boom arms in a raised position unless the boom locks are engaged.

1. Remove any attachment, raise the boom arms and engage the boom lock. Shut off the engine.
2. Raise the seat and remove the hydrostatic shield.
3. Block the loader securely with all four wheels clear of the ground.
4. Remove the wheels. On reassembly torque the wheel nuts 100-110 ft. lbs. (136-149 N.M.).
5. Remove the final drive inspection cover (fig. 4.5.3a) located between the axles on the final drive housing. On reassembly apply silicon to the inspection cover to prevent leakage of the drive lubricating oil.



1451 Fig. 4.5.3a



1453 Fig. 4.5.3b

5 ELECTRICAL

4. Acid must not be stored in excessively warm locations or in direct sunlight.
5. In case of acid contact with skin, eyes, or clothing, FLUSH IMMEDIATELY WITH WATER FOR A MINIMUM OF FIVE MINUTES. Get emergency medical attention for acid burns.
6. Hydrogen and oxygen gases are produced during normal battery operation. This gas mixture can explode if flames or sparks are brought near the battery. Manufacturer's recommendations should be closely followed to hold the charging rate at a limit that prevents rapid generation of hydrogen gas. When charging or using a battery in an enclosed space, always provide adequate ventilation.
7. Exercise care to avoid tools or metallic objects from falling across the battery terminals.
8. Never break a live circuit at the battery terminals. An arc could occur whenever charger leads or booster cable leads are disconnected. Any arc could ignite the accumulated hydrogen gas! Always disconnect the ground cable first at a point away from the battery terminals.
9. Remove cell caps when charging or using jumper cables.

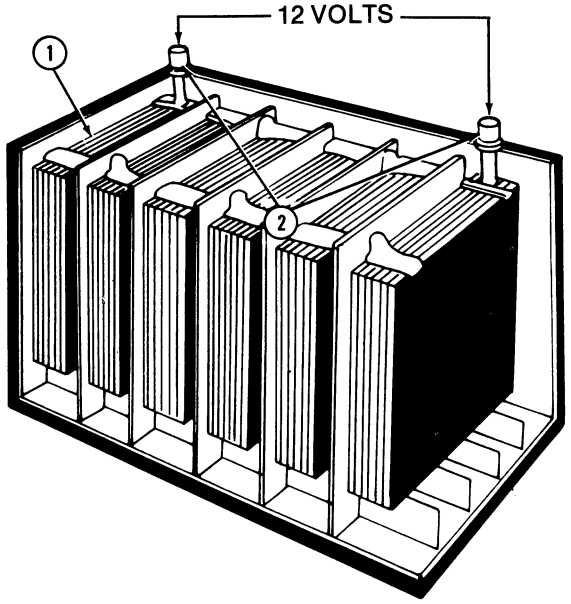
5.3.1 Operation:

The 12-volt maintenance free battery, Fig. 5.3.1A, is rated at 140 ampere-hours and is negatively grounded. The battery is constructed with six lead acid cells connected in series. Each cell contains positive and negative plates placed alternately next to each other and separated from each other by a insulated separator plate. If any of the positive plates should make contact with a negative plate within a cell a short will develop and cause irreparable damage to the battery. All positive plates are welded together and all negative plates are welded together. The positive plates and negative plates are connected to an external position and negative terminal post.

When the battery cells are submerged in a liquid electrolyte solution of sulphuric acid, Fig. 5.3.2B, the acid and water combines chemically with the lead peroxide on the positive plate and with the sponge lead on the negative plate causing a transfer of electrons between plates. One plate will lose electrons and become positively charged while the other plate will gain electrons and become negatively charged. When the battery is connected to a lead the surplus electrons at the negative post flow through the circuit to the positive post. The battery is now converting chemical energy to electrical energy.

This process continues until the greater part of the active material on both plates has been converted to lead sulphate, and much of the acid has been reduced to water. When most of the plate surfaces have reacted with the acid the battery will no longer be able to produce current and is therefore discharged.

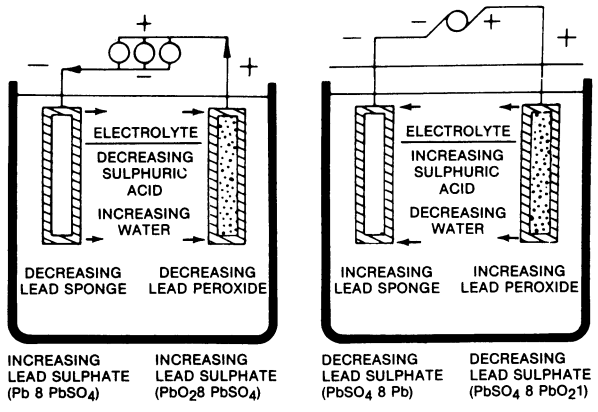
Recharging is accomplished by passing a current from an outside source through the battery in the opposite direction to the current flow during discharge. Reversal of the chemical action, by charging, restores the battery to a fully charged condition.



Battery Construction

1. Battery Cells
2. Terminal Posts

1691 **Fig. 5.3.1A**

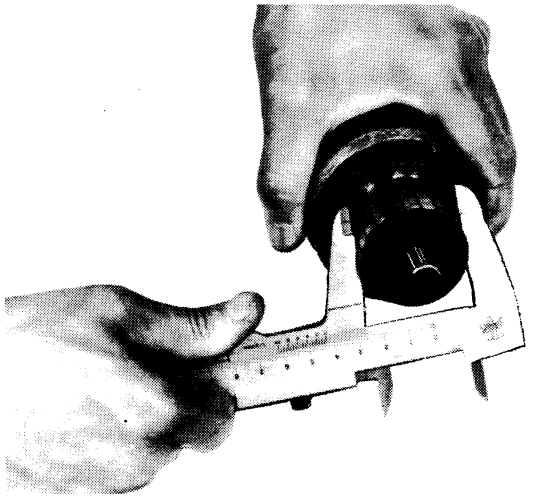


Battery Chemical Action

1692 **Fig. 5.3.1B**

13. Measure the commutator diameter (Fig. 5.4.4c). Replace the armature if worn beyond the following specifications.

MODEL	NEW	WEAR LIMIT
CL35	1.3 in. (33 mm)	1.22 in. (31 mm)
CL45	1.69 in. (43 mm)	1.57 in. (40 mm)



Armature Wear Check

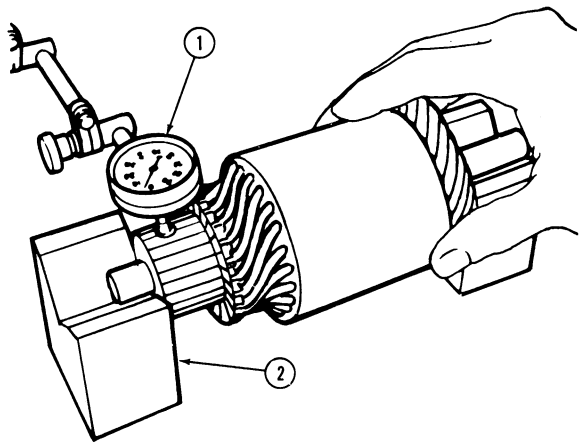
1715 **Fig. 5.4.4c**

14. Position the armature in v-blocks and measure the commutator runout (Fig. 5.4.4d). If the commutator runout exceeds .015 in. (0.4 mm), the commutator may be turned on a lathe.

NOTE: Do not reduce the diameter below the minimum diameter specifications.

MODEL	STANDARD DIAM.	MINIMUM DIA.
CL35	1.3 in. (33 mm)	1.26 in. (32 mm)
CL45	1.69 in. (43 mm)	1.57 in. (40 mm)

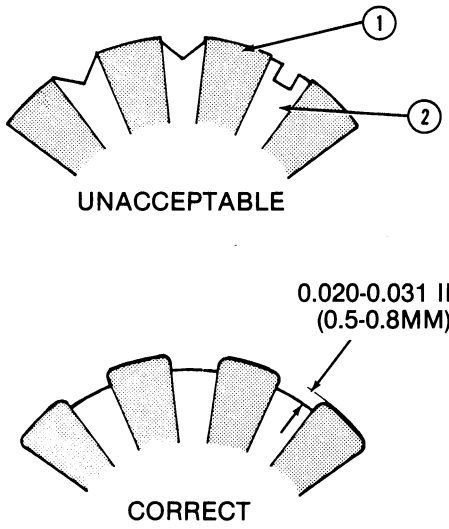
15. Measure the distance from the top of the mica insulator to the top of the commutator segment. If the distance is less than .008 in. (0.2 mm), using a suitable tool to undercut the mica to the specifications shown in (Fig. 5.4.4e). If the insulator cannot be properly undercut, replace the armature.



Armature Runout Check

1. Dial Indicator 2. "V" Blocks

1716 **Fig. 5.4.4d**



Commutator Insulation Check

1. Commutator Segment
2. Insulator

1717 **Fig. 5.4.4e**

REGULATOR CIRCUIT TESTS

REGULATOR "N" CIRCUIT CONTINUITY TEST
Reference-Figures 5.5.2D & E

1. Disconnect the regulator from the wiring harness (Fig. 5.5.2D).
2. Connect one ohmmeter lead to the "N" terminal (Fig. 5.5.2E).
3. Connect the remaining ohmmeter lead to the "E" terminal and observe the ohmmeter reading.

Test Results

High resistance reading = Faulty regulator — replace. (over 32 ohms)

Low resistance reading = Perform regulator "F" circuit continuity test.

REGULATOR "F" CIRCUIT CONTINUITY TEST
Reference-Figure 5.5.2F

1. Disconnect the regulator from the wiring harness (Fig. 5.5.2D).
2. Connect one ohmmeter lead to the regulator "F" terminal (Fig. 5.5.2F).

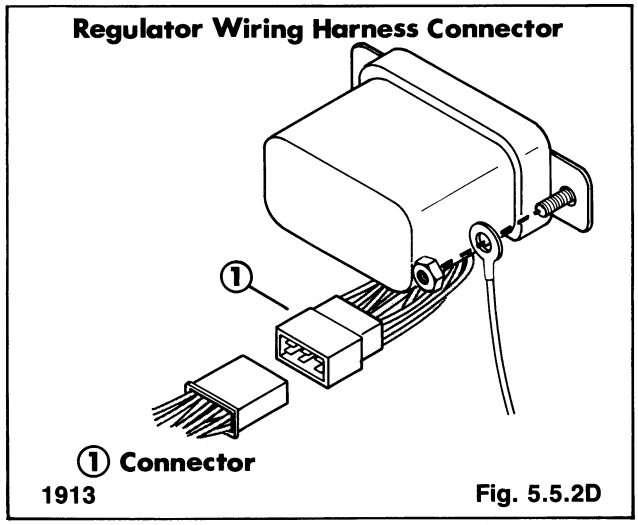


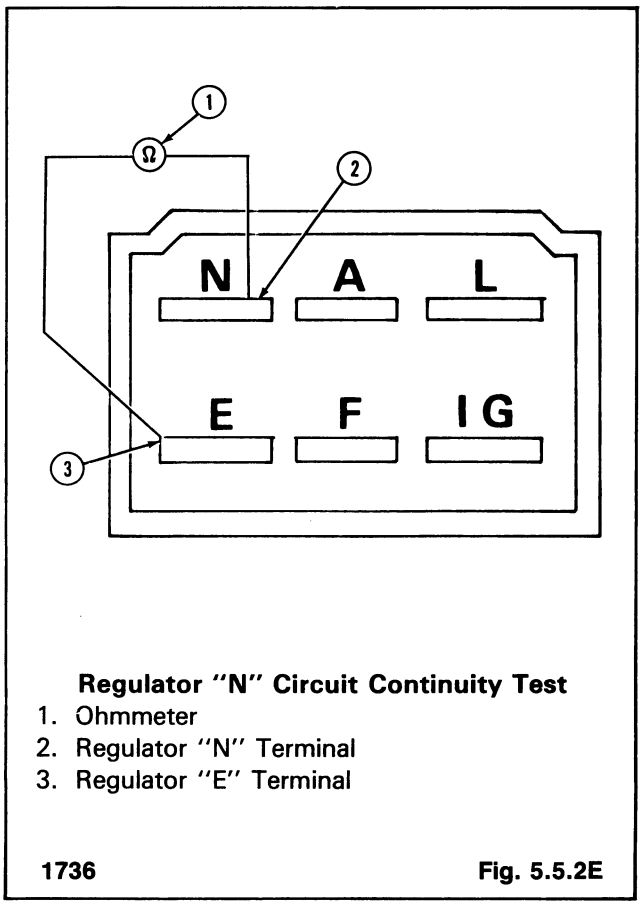
Fig. 5.5.2D

3. Connect the remaining ohmmeter lead to the "IG" terminal and observe the ohmmeter reading.

Test Results

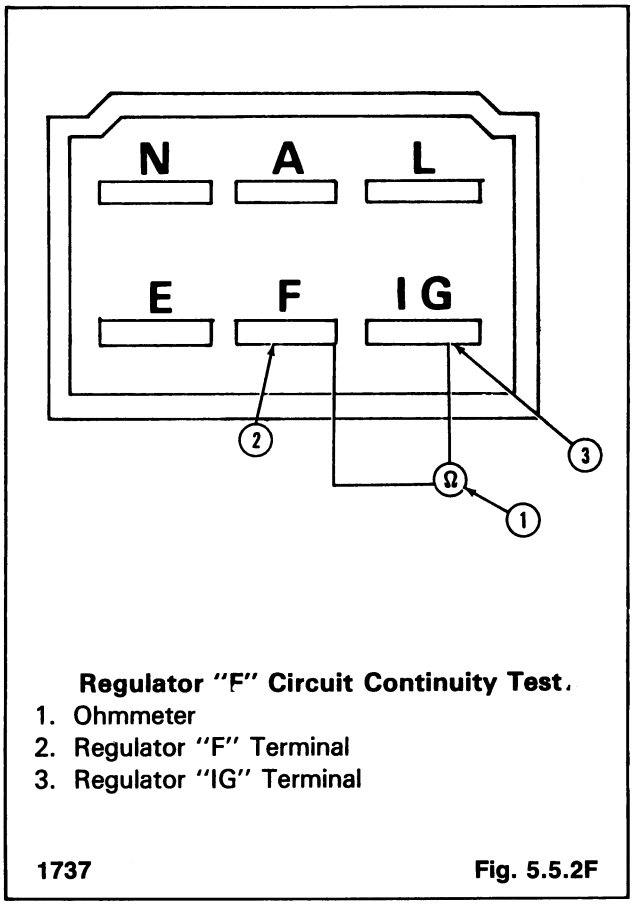
High resistance reading = Faulty regulator — replace.

Low resistance reading = Perform "L" circuit continuity test.



Regulator "N" Circuit Continuity Test
1. Ohmmeter
2. Regulator "N" Terminal
3. Regulator "E" Terminal

Fig. 5.5.2E



Regulator "F" Circuit Continuity Test.
1. Ohmmeter
2. Regulator "F" Terminal
3. Regulator "IG" Terminal

Fig. 5.5.2F

5.6 TROUBLE SHOOTING

STARTING SYSTEM

Problem	Cause	Corrective Action	Refer to Section
Starter will not engage.	Seat bar down, safety start switch disengaged.	Raise safety bar to engage safety start switch. If starter still won't engage check safety start switch.	5.4.6
		Press over-ride starting switch.	5.2.9
	Battery discharged.	Check and charge battery or replace.	5.3
	Loose or disconnected wiring.	Check and repair.	
	Defective starter switch.	Check and if necessary replace.	5.2.8
	Defective solenoid.	Check and if necessary replace.	5.4.4
	Defective starter.	Check and if necessary replace.	5.4.4
Starter motor engages but engine does not turn over.	Defective overrunning clutch.	Replace.	5.4
Pinion engages but starter motor does not turn over.	Defective starter.	Check and if necessary repair orreplace.	5.4.4
	Defective solenoid.	Check and if necessary replace.	5.4.4
Starter motor rotates at full speed before pinion engages.	Defective pinion spring.	Replace.	
Starter does not disengage after engine starts.	Faulty ignition switch.	Check and if necessary replace.	5.2.8
	Defective solenoid.	Check and if necessary replace.	5.4.4

CHARGING SYSTEM

Battery low in charge or discharged.	Drive belt slipping.	Adjust.	5.7.7
	Defective battery.	Check and if necessary replace.	5.3
	Faulty wiring or connections.	Check and repair.	
	Defective regulator.	Check and if necessary replace.	5.5.2
	Dirty alternator slip rings or brushes.	Check and repair.	5.5.4 5.5.5
Alternator overcharging and battery overheats.	Defective battery.	Check and if necessary replace.	5.3
	Defective voltage regulator.	Check and if necessary replace.	5.5.2
	Defective alternator.	Check and if necessary replace.	5.5.2
Low or no output from alternator.	Drive belt slipping.	Adjust.	5.7.7
	Faulty wiring or connections.	Check and repair.	
	Defective voltage regulator.	Check and if necessary replace.	5.2.2
	Defective alternator.	Check and if necessary repair or replace.	5.2.2
	Defective rectifier.	Check and if necessary replace.	5.5.5
Charge indicator lamp dims.	Faulty wiring or connections.	Check and repair.	
	Dirty slip rings or brushes.	Check and repair.	5.5.4 5.5.5
Charge indicator goes out but becomes brighter with increased speed.	Faulty wiring or connections.	Check and repair.	
	Faulty rectifier.	Check and if necessary replace.	5.5.5
Charge indicator lamp is "ON" with engine running.	Drive belt slipping.	Adjust.	5.7.7
		Perform alternator voltage output test.	5.5.2
		Perform alternator current output test.	5.5.2
	Defective alternator or regulator.	Perform alternator "N" circuit voltage test.	5.5.2
		Perform regulator "N" circuit continuity test.	5.5.2
		Perform alternator "E" circuit continuity test.	5.5.2
		Perform alternator "F" circuit continuity test.	5.5.2
		Perform regulator "F" circuit continuity test.	5.5.2
		Perform alternator "A" circuit continuity test.	5.5.2
Charge indicator lamp is "OFF" when starter switch is "ON", but engine is not running.	Defective indication lamp.	Check and if necessary replace.	
	Defective wiring.	Check wiring continuity between lamp and ignition switch.	
		Check wiring continuity between lamp and regulator "L" terminal.	
		Check "L" circuit continuity between regulator "L" and "E".	5.5.2

10. Remove the locknuts and lock bolts from the rear boom pivot pins (Fig. 6.2.1E).

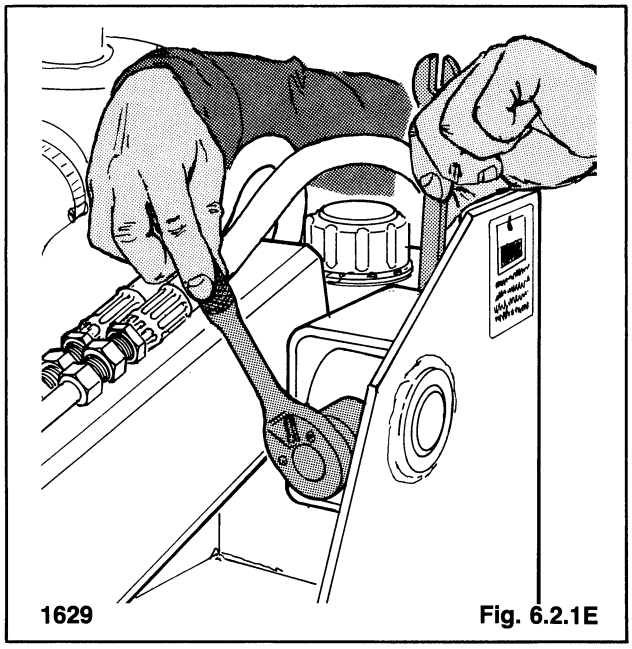


Fig. 6.2.1E

WARNING

To avoid eye injury wear safety glasses and always use a brass drift and hammer to remove or install pins.

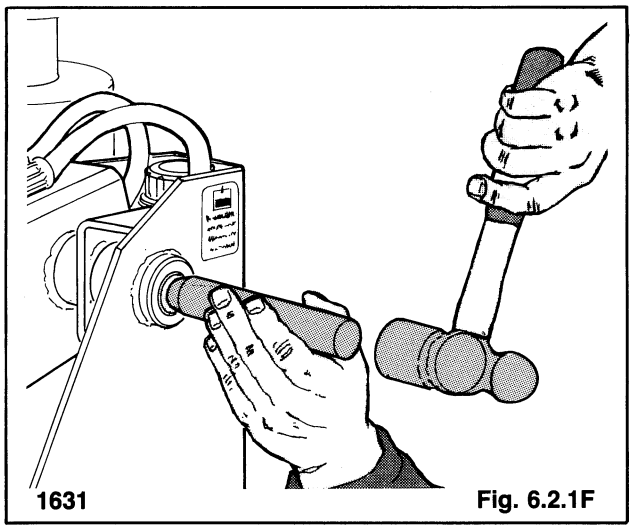


Fig. 6.2.1F

11. Tighten the chain hoist and remove the rear boom pivot pins (Fig. 6.2.1F).
12. Raise the boom arms with the chain hoist and remove from the loader.

6.2.2 Boom Arms — Installation:

1. With a chain hoist, position the boom arms on the loader and align the boom arm and main frame pivot bushings.

WARNING

To avoid eye injury wear safety glasses and always use a brass drift and hammer to remove or install pins.

2. Install the pivot pins in the main frame and boom arms.
3. Install the locknuts and bolts (Fig. 6.2.2A) in the boom pivot pins.
4. Lower the boom arms and remove the chain hoist and chains from the boom arms.
5. Align the lift cylinder rod end bushing and the boom arm pivot bushings.

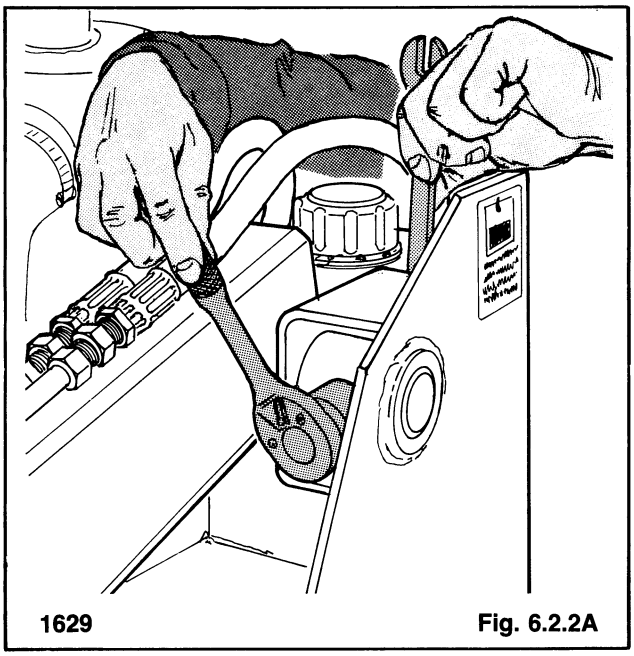
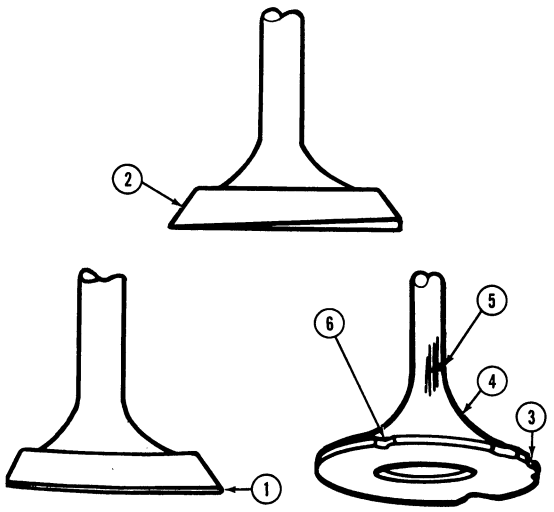


Fig. 6.2.2A

WARNING

To avoid eye injury wear safety glasses and always use a brass drift and hammer to remove or install pins.

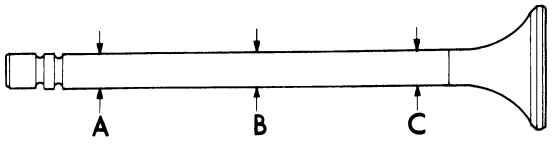
7 ENGINE



Valve Defect Inspection

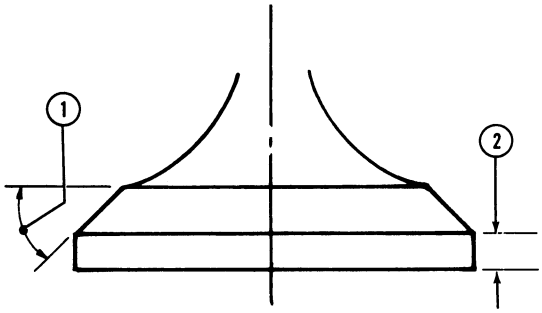
1. Margin Too Thin — Min. .0393 in. (1.0 mm)
2. Bent Valve
3. Pitting
4. Indented
5. Wear or Necking
6. Burned

1775 Fig. 7.2.2E



Valve Stem Wear Points

1776 Fig. 7.2.2F



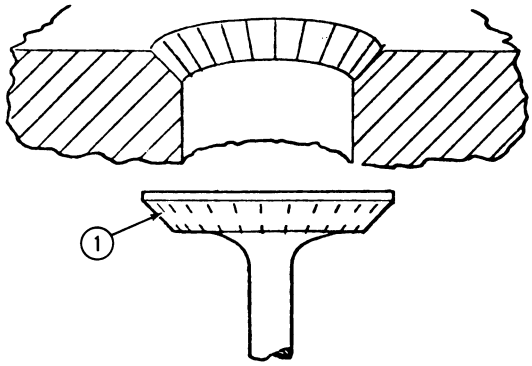
Valve Correctly Ground

1. 45° Angle Seat
2. Minimum Valve Margin

1777 Fig. 7.2.2G

IMPORTANT: After grinding the valve and seat, check to assure that the seat contacts the center of the valve face. Using Prussian Blue, lightly coat the valve seat, place the valve in position and rotate the valve slightly while holding a light pressure against the valve. If the blue is transferred to the center of the valve face, the contact is correct.

If Prussian Blue is not available, mark the valve face or seat with a soft lead pencil as shown (Fig. 7.2.2H). Rotate the valve slightly in the seat. The penciled lines will be broken at the seat contact area.



Valve Seat Contact Location

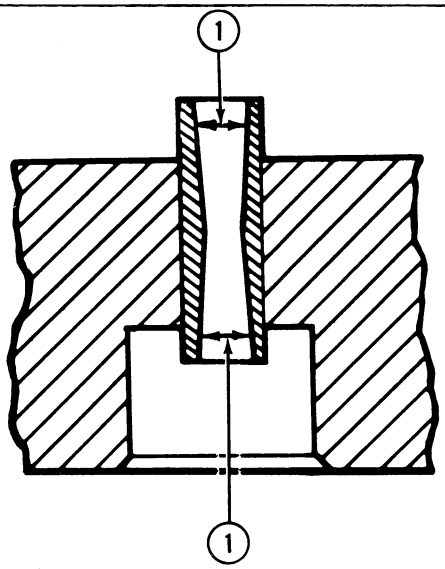
1. Seat Contact

1778 Fig. 7.2.2H

VALVE GUIDES

Clean the valve guides thoroughly before attempting to check for guide wear.

1. Using a small hole gauge, measure the valve guide bore at the top and bottom wear points, (Fig. 7.2.2J).



Valve Guide Wear Check

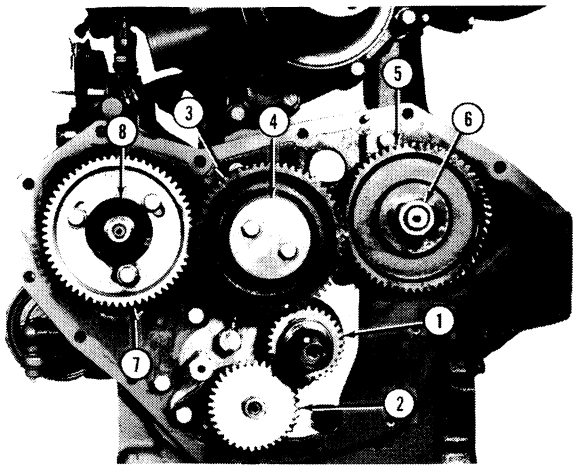
1. Wear Point

1779 Fig. 7.2.2.J

7.2.7 Oil Pump – Removal:

If not previously removed, remove the timing gear cover. Refer to section 7.2.4 for procedure.

1. Remove the oil pump drive gear retaining nut and remove the drive gear (Fig. 7.2.7A).



Timing Gears & Oil Pump Removal

1. Crankshaft Gear
2. Oil Pump Drive Gear
3. Idler Gear
4. Retaining Plate
5. Camshaft Gear
6. Retaining Nut
7. Injection Pump Drive Gear
8. Pump Drive Coupling

1794 Fig. 7.2.7A

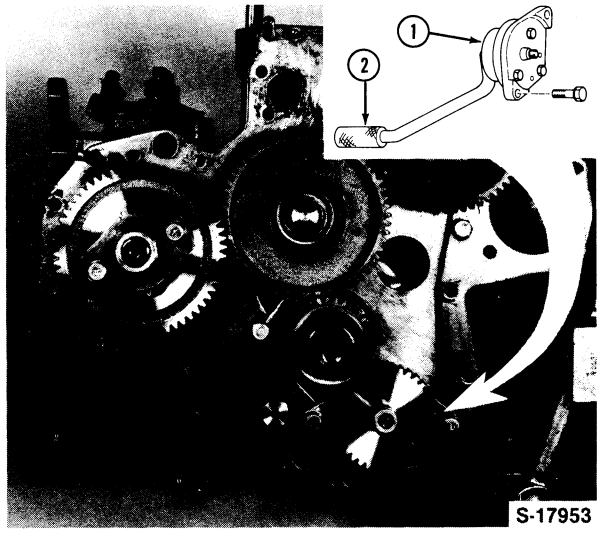
On reassembly tighten the drive gear retaining nut to 22-25 ft. lbs. (29-34 N.m).

2. (CL35 ONLY)
Remove the oil pump mounting bolts and remove the oil pump from the engine block (Fig. 7.2.7B).

2. (CL45 ONLY)
Remove the five pump cover bolts (Fig. 7.2.7C). Remove the pump cover, pump shaft and gear set from the pump body.

If the oil pump body requires removal proceed as follows:

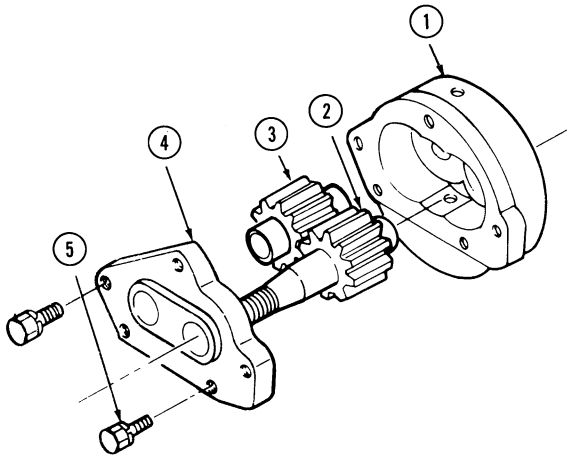
- Remove the oil pan
- Remove the oil pick-up tube and adaptor (Fig. 7.2.7D) from the back of the pump body.
- Remove the pump body.



Engine Oil Pump Removal
Model CL35

1. Oil Pump Assembly
2. Pick-Up Tube and Screen

1803 Fig. 7.2.7B



CL45 Oil Pump Removal

1 Pump Body
2 Shaft
3 Gear
4 Cover
5 Bolt

1804 Fig. 7.2.7C

The flange should protrude 0-.004 in. (0-.1 mm) above.

- In the same manner, measure the protrusion of the sleeve lip above the face of the block.

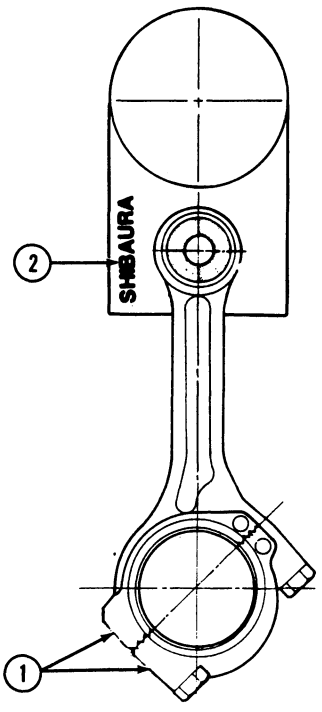
  The lip should protrude .036-.041 in. (0.9-1.05 mm) above.

If necessary, install shims under the sleeve flange to obtain the minimum protrusion, or machine the block counterbore to correct excessive protrusion height.

If the lip protrudes more than .041 in. (1.05 mm) and the sleeve flange dimension is correct, surface grind the sleeve lip to correct the lip height.

2. Assemble the connecting rods to the pistons matching the reference marks made in step 10, Removal, section 7.2.10.

   CL35 — If the reference marks are not present assemble the pistons and connecting rods with the matching marks on the rods on the same side as the trade name "Shibaura" embossed on the inside of the piston skirt (Fig. 7.2.12C).

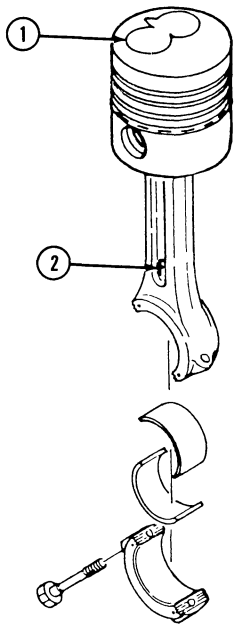


Model CL35
Piston Assembly

1. Matching Marks
2. Trade Name (SHIBAURA)

1829 Fig. 7.2.12C

CL45 — If the reference marks are not present, position the piston in the block with the valve-head pattern facing the injection pump side and the "F" stamp on the connecting rod facing forward (Fig. 7.2.12D).



Model CL45
Piston and Rod Installation

1. Valve Head Pattern — to Injection Pump Side
2. "F" Stamping — to Face Forward

1830 Fig. 7.2.12D

3. Install the piston pin and retaining rings.

   NOTE: Be sure that the retaining rings are correctly seated in the piston groove.

4. Thoroughly lubricate the piston ring grooves and rings. Use a suitable ring expander tool and install the rings. Position ring gaps approximately 90° from each other. Do not position a ring gap over the piston pin bore.

5. Using a suitable ring compressor, install the piston and rod assemblies in their respective cylinder bores.

   NOTE: CL35 position the pistons and rod assembly in the block (Fig. 7.2.12E) with the connecting rod matching marks facing the injection pump side of the engine.

   NOTE: CL45 position the pistons and rod assemblies in the block with the connecting rod "F" mark facing forward (7.2.12D).

3. Loosen the radiator upper and lower hose clamps and remove the hoses from the radiator.
4. Remove the nuts attaching the radiator isolators to the engine mount (Fig. 7.3.2B).
5. Remove the nut attaching the upper radiator mount to the engine and remove the radiator from the loader (Fig. 7.3.2B).
6. Remove the upper radiator mount from the radiator (Fig. 7.3.2B).

7.3.3 Radiator — Inspection and Repair:

1. Inspect the radiator fins and be sure they are free from obstruction.
2. Check the radiator carefully for signs of coolant leakage and repair the radiator if required.

7.3.4 Radiator — Installation:

Installation of the radiator generally follows the removal procedure in reverse.

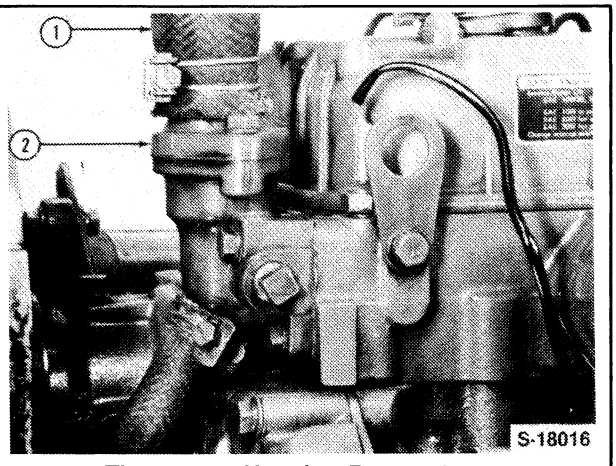
On installation, observe the following requirements:

Refill the radiator with the correct grade of anti-freeze mixture.

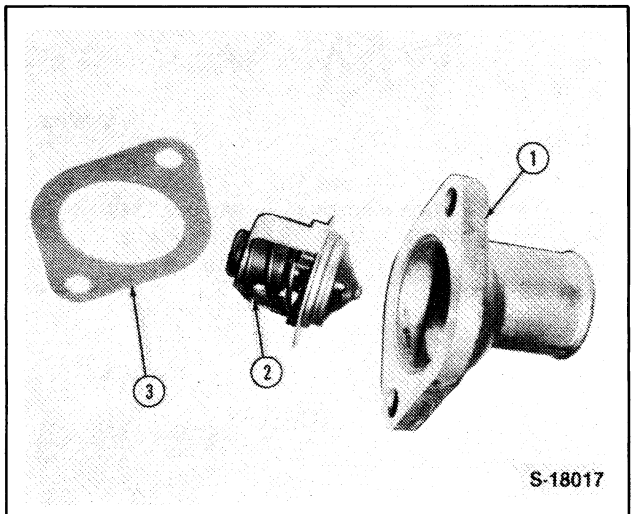
Run the engine for several minutes and check the hose connections for leaks.

7.3.5 Thermostat — Removal:

1. Remove the radiator cap.
2. Open the radiator and cylinder block drains and collect the coolant in a clean container.
3. Remove the radiator hose from the thermostat housing (Fig. 7.3.5A).



Thermostat Housing Removal
1. Upper Radiator Hose2. Thermostat Housing
1857 Fig. 7.3.5A

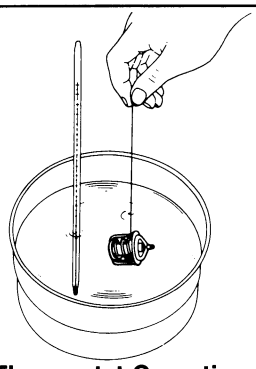


Thermostat Removal
1. Thermostat Housing 3. Gasket
2. Thermostat
1858 Fig. 7.3.5B

4. Remove the thermostat housing, thermostat and gasket (Fig. 7.3.5B).

7.3.6 Thermostat — Inspection and Repair:

1. Push down the thermostat valve and insert a string between the valve and the valve seat (Fig. 7.3.6A).



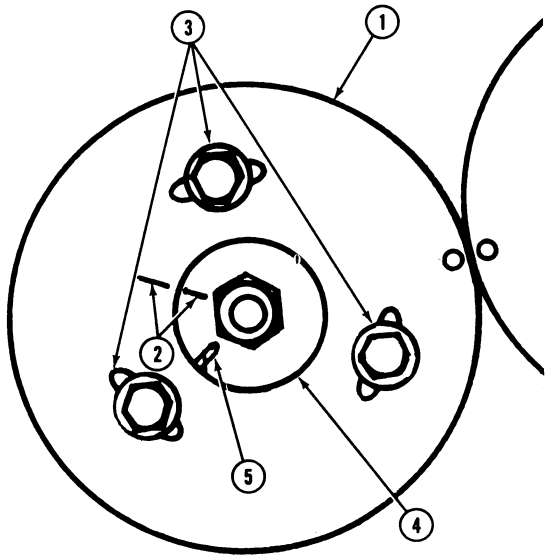
Thermostat Operation Check
1859 Fig. 7.3.6A

2. Place the thermostat and a thermometer in a container with water and gradually heat the water.
3. Hold the string to suspend the thermostat in the water. When the water temperature rises the valve will open allowing the thermostat to fall from the string.
4. Check the temperature at the point where the thermostat falls. Continue to heat the thermostat and note the temperature when the thermostat is fully open.

   Replace the thermostat if it fails to open at the specified temperature.
   Start to open ..... 160°F (71°C)
   Fully open ..... 185°F (85°C)

NOTE: Position the pump drive gear matching the timing marks on the idler gear as shown (Fig. 7.4.4C).

3. Align the pump drive gear and coupling marks (Fig. 7.4.4D), and install the three gear retaining bolts. Tighten the retaining bolts to the specified torque — 28.9-36.2 lbs. ft. (39.2-49 N.m.).
4. If necessary to check the pump timing adjustment, spill time the pump. See "spill timing" this section for procedure.



Pump Drive Gear and Coupling Installation

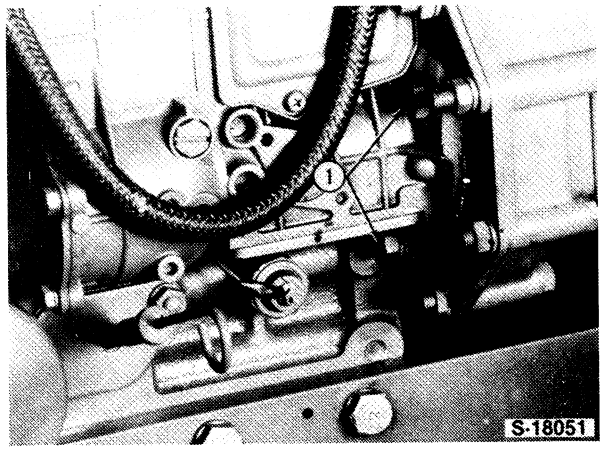
1. Pump Drive Gear
2. Coupling to Drive Gear Matching Marks
3. Gear Retaining Bolts
4. Coupling
5. Shaft Key Slot

1883 Fig. 7.4.4D

INSTALLATION — USING A NEW PUMP OR DRIVE COMPONENTS

1. Using a new mounting gasket, install the injection pump to the front engine plate. If pump is reused, match the pump to mounting plate marks (Fig. 7.4.4E).

   If a new pump is installed, use a sharp chisel and remark the pump and mounting plate for future reference.

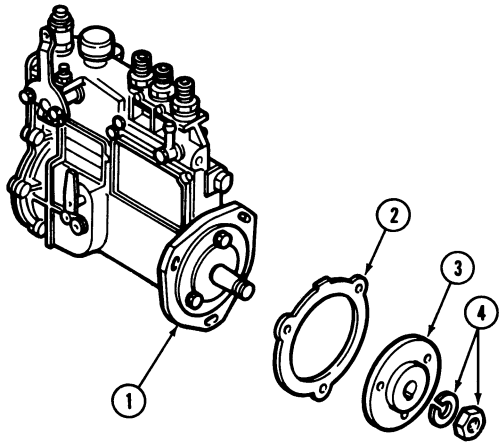


Injection Pump Removal
1. Pump Mounting Bolts

1880 Fig. 7.4.4E

2. Position the injection pump gear, drive coupling and key on the pump shaft (Fig. 7.4.4F). Install the retaining nut and washer. Tighten the nut to the specified torque.

   CL35 ..... 108.5-115 lbs. ft. (147-156 N.m.).
   CL45 ..... 29-33 lbs. ft. (39-44 N.m.)



Injection Pump Installation
1. Injection Pump
2. Gasket
3. Coupling
4. Retaining Nut and Washer

1881 Fig. 7.4.4F

Condition	Possible Causes
COOLANT LOSS — BOIL OVER	2. Quick shutdown after hard (hot) run. 3. Air in system resulting in occasional "burping" of coolant. 4. Insufficient anti-freeze in mixture allowing coolant boiling point to be too low. 5. Anti-freeze deteriorated because of age or contamination. 6. Leaks due to loose hose clamps, loose nuts, bolts, drain valve, faulty hoses, or defective radiator. 7. Faulty head gasket. 8. Cracked head, manifold, or block.
COOLANT ENTRY INTO CRANKCASE OR CYLINDER	1. Faulty head gasket. 2. Crack in head, manifold, or block. 3. Faulty cylinder liner O-Ring.
NOISE	1. Fan contacting shroud. 2. Loose water pump impeller. 3. Glazed fan belt. 4. Loose fan belt. 5. Rough surface on drive pulley. 6. Water pump bearing worn. 7. Belt alignment.
TEMPERATURE LAMP ON OR GAUGE READS HOT BUT TEMPERATURE IS OK	1. Wrong sending unit. 2. Sending wire shorted to ground.

NOTE: Immediately after shutdown, the engine enters a condition known as heat soak. This is caused by the cooling system being inoperative while the engine temperature is still high. If coolant temperature rises above the boiling point, expansion and pressure may push some coolant out of the radiator overflow tube. If this does not occur frequently, it is considered normal.

MAINTENANCE/SPECIFICATIONS 8