THOMAS®

Repair Manual

Publication No. 41075

SN: LE006075
To LE008449

FOREWORD

This repair manual provides information for the proper servicing and overhaul of Thomas Model T133S Compact Loaders.

This manual covers units produced from 05/96 onward. Special service instructions are identified by loader serial number or applicable production dates throughout the text.

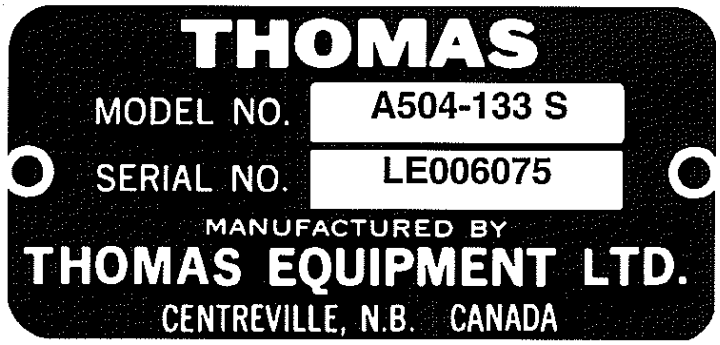
The manual is divided into 8 sections, each divided into subsections. Each subsection contains information on general operating principles, detailed inspection and overhaul and, where applicalbe, trouble shooting, special tools and specifications.

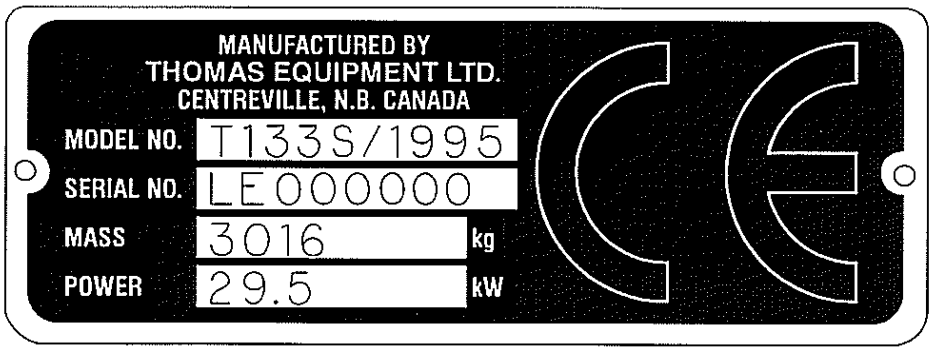
The material contained in this manual was correct at the time of publication, however, Thomas policy is one of continuous improvement and the right to change prices, specifications, equipment or design at anytime without notice is reserved. All data in this manual is subject to production variations, so overall dimensions and weights should be considered as approximate only and illustrations do not necessarily depict the unit to standard built specifications.

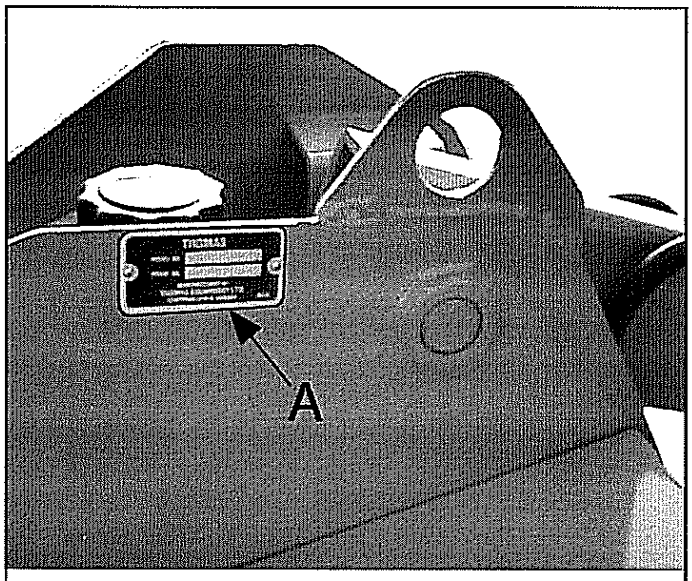
Thomas Equipment Ltd.

WARNING To avoid personal injury service repairs must be performed by an authorized Thomas dealer.

SERIAL NUMBERS







-326

Fig. 1

A vehicle identification plate is located on the inside of the hydraulic tank above the engine compartment cover at the rear of the machine (Fig. 1 Item A).

Whenever effecting repair or overhaul of the Thomas Compact Loader, the relevant information should be noted and used when referring to service bulletins or ordering parts.

This plate is stamped with the following information:

- Model number
- Serial number

It is important when ordering replacement parts or making a service inquiry to provide both the model number and serial number of your Thomas loader.

R.H and L.H. when mentioned in the manual is always referred from the drivers seat looking in a forward position.

SAFETY PRECAUTIONS

Practically all Service work involves the need to drive the loader. The Operator's Manual, supplied with each loader, contains detailed safety precautions relating to Driving, Operating and Servicing that loader. These precautions are as applicable to the service technician as they are to the operator, and should be read, understood and practiced by all personnel.

Prior to undertaking any maintenance, repair, overhaul, dismantling or re-assembly operations, whether within a workshop facility or out "in the field", consideration should be given to factors that may have an effect upon Safety, not only upon the mechanic carrying out the work, but also upon bystanders.

PERSONAL CONSIDERATIONS

- The wrong clothes or carelessness in dress can cause accidents. Check to see that you are suitably clothed. Some jobs require special protective equipment.

- **Skin Protection**

  Used motor oil may cause skin cancer. Follow work practises that minimize the amount of skin exposed and length of time used oil stays on skin.

- **Eye Protection**

  The smallest eye injury may cause loss of vision. Injury can be avoided by wearing eye protection when engaged in chiselling, grinding, discing, welding, painting, etc.

- **Breathing Protection**

  Fumes, dust and paint spray are unpleasant and harmful. These can be avoided by wearing respiratory protection.

- **Hearing Protection**

  Loud noise may damage your hearing and the greater the exposure the worse the damage. If you feel the noise excessive, wear ear protection.

  Hand Protection

  It is advisable to use a protective cream before work to prevent irritation and skin contamination. After work clean your hands with soap and water. Solvents such as white spirit, paraffin, etc., may harm the skin.

- **Foot Protection**

  Substantial or protective footwear with reinforced toecaps will protect your feet from falling objects.

  Additionally, oil-resistant soles will help to avoid slipping.

- **Special Clothing**

  For certain work it may be necessary to wear flame or acid-resistant clothing.

  Avoid injury through incorrect handling of components. Make sure you are capable of lifting the object. If in doubt get help.

EQUIPMENT CONSIDERATIONS

- **Machine Guards**

  Before using any machine, check to ensure that the machine guards are in position and serviceable. These guards not only prevent parts of the body or clothing coming in contact with the moving parts of the machine, but also ward off objects that might fly off the machine and cause injury.

  Lifting Appliances

  Always ensure that lifting equipment, such as chains, slings, lifting brackets, hooks and eyes are thoroughly checked before use. If in doubt, select stronger equipment than is necessary.

  Never stand under a suspended load or raised implement.

- **Compressed Air**

  The pressure from a compressed air line is often as high as 100 PSI (6.9 BAR). Any misuse may cause injury.

  Never use compressed air to blow dust, filing, dirt, etc., away from your work area unless the correct type of nozzle is fitted.

  Compressed air is not a cleaning agent, it will only move dust, etc., from one place to another. Look around before using an air hose as bystanders may get grit into their eyes, ears or skin

- **Hand Tools**

  Many cuts, abrasions and injuries, are caused by defective tools. Never use the wrong tool for the job, as this generally leads either to some injury, or to a poor job.

  Never use
  - A hammer with a loose head or split handle.
  - Spanners or wrenches with splayed or worn jaws.
  - Wrenches or files as hammers; or drills, or clevis pins or bolts as punches.

For removing or replacing hardened pins use a copper or brass drift rather than a hammer.

For dismantling, overhaul and assembly of major and sub components, always use the Special Service Tools recommended.

These will reduce the work effort, labor time and the repair cost.

Always keep tools clean and in good working order.

- **Electricity**

Electricity has become so familiar in day to day usage, that its potentially dangerous properties are often overlooked. Misuse of electrical equipment can endanger life.

Before using any electrical equipment -- particularly portable appliances -- make a visual check to make sure that the cable is not worn or frayed and that the plugs, sockets, etc., are intact. Make sure you know where the nearest isolating switch for your equipment is located.

GENERAL CONSIDERATIONS

- **Solvents**

Use only cleaning fluids and solvents that are known to be safe. Certain types of fluids can cause damage to components such as seals, etc., and can cause skin irritation. Solvents should be checked that they are suitable not only for the cleaning of components and individual parts, but also that they do not affect the personal safety of the user.

- **Housekeeping**

Many injuries result from tripping or slipping over, or on, objects or material left lying around by a careless worker. Prevent these accidents from occurring. If you notice a hazard, don't ignore it -- remove it.

A clean, hazard-free place of work improves the surroundings and daily environment for everybody.

- **Fire**

Fire has no respect for persons or property. The destruction that a fire can cause is not always fully realized. Everyone must be constantly on guard.

- Extinguish matches / cigars / cigarettes, etc., before throwing them away.
- Work cleanly, disposing of waste material into proper containers.
- Locate the fire extinguishers and find out how to operate them.
- Do not panic -- warn those near and raise the alarm.
- Do not allow or use an open flame near the loader fuel tank, battery or component parts.

- **First Aid**

In the type of work that mechanics are engaged in, dirt, grease, fine dusts, etc., all settle upon the skin and clothing. If a cut, abrasion or burn is disregarded it may be found that a septic condition has formed within a short time. What appears at first to be trivial could become painful and injurious. It only takes a few minutes to have a fresh cut dressed, but it will take longer if you neglect it. Make sure you know where the First Aid box is located.

- **Cleanliness**

Cleanliness of the loader hydraulic system is essential for optimum performance. When carrying out service and repairs plug all hose ends and component connections to prevent dirt entry.

Clean the exterior of all components before carrying out any form of repair. Dirt and abrasive dust can reduce the efficiency and working life of a component and lead to costly replacement. Use of a high pressure washer or steam cleaner is recommended.

OPERATIONAL CONSIDERATIONS

- Stop the engine, if at all possible, before performing any service.
- Place a warning sign on loaders which, due to service or overhaul, would be dangerous to start. Disconnect the battery leads if leaving such a unit unattended.
- Do not attempt to start the engine while standing beside the loader or attempt to by-pass the safety start system.
- Avoid prolonged running of the engine in a closed building or in an area with inadequate ventilation as exhaust fumes are highly toxic.
- Always turn the radiator cap to the first stop, to allow pressure in the system to dissipate when the coolant is hot.
- Never work beneath a loader which is on soft ground. Always take the unit to an area which has a hard working surface -- preferably concrete.
- If it is found necessary to raise the loader for ease of servicing or repair, make sure that safe and stable supports are installed, beneath the main frame, before commencing work.
- Use footsteps or working platforms when servicing those areas of a loader that are not within easy reach.•

- Before loosening any hoses or tubes, switch off the engine, remove all pressure in the lines by operating the foot pedals several times. This will remove the danger of personal injury by oil pressure.

- Prior to pressure testing, make sure all hoses and connectors not only of the loader, but also those of the test equipment, are in good condition and tightly sealed. Pressure readings must be taken with the gauges specified. The correct procedure should be rigidly observed to prevent damage to the system or the equipment, and to eliminate the possibility of personal injury.

- Always lower equipment to the ground when leaving the loader.

- If high lift attachments are installed on a loader beware of overhead power, electric or telephone cables when traveling. Drop attachment near to ground level to increase stability and minimize risks.

- Do not park or attempt to service a loader on an incline. If unavoidable , take extra care and block all wheels.

- Escaping hydraulic/diesel fluid under pressure can penetrate the skin causing serious injury. Do not use your hand to check for leaks. Use a piece of cardboard or paper to search for leaks. Stop engine and relieve pressure before connecting or disconnecting lines. Tighten all connections before starting engine or pressurizing lines. If any fluid is injected into the skin, obtain medical attention immediately or gangrene may result.

- Prior to removing wheels and tires from a loader, check to determine whether additional ballast (liquid or weights) has been added. Seek assistance and use suitable equipment to support the weight of the wheel assembly.

- When inflating tires beware of over inflation -- constantly check the pressure. Over inflation can cause tires to burst and result in personal injury.

  Safety precautions are very seldom the figment of someone's imagination. They are the result of sad experience, where most likely someone has paid dearly through personal injury.

  Heed these precautions and you will protect yourself accordingly. Disregard them and you may duplicate the sad experience of others.

SERVICE TECHNIQUES

A. Service Safety

Appropriate service methods and proper repair procedures are essential for the safe, reliable operation of all motor vehicles as well as the personal safety of the individual doing the work. This shop manual provides general directions for accomplishing service and repair work with tested effective techniques. Following them will help assure reliability.

There are numerous variations in procedures, techniques, tools, and parts for servicing vehicles, as well as in the skill of the individual doing the work.This Manual cannot possibly anticipate all such variations and provide advice or cautions as to each. Accordingly, anyone who departs from the instructions provided in this Manual must first establish that he compromises neither his personal safety nor the vehicle integrity by his choice of methods, tools or parts.

B. Service Techniques

Clean the exterior of all components before carrying out any form of repair. Dirt and abrasive dust can reduce the efficient working life of a component and lead to costly replacement.

Use cleaning fluids which are known to be safe. Certain types of fluid can cause damage to 'O' rings and cause skin irritation. Solvents should be checked that they are suitable for the cleaning of components and also that they do not risk the personal safety of the user.

Time spent on the preparation and cleanliness of working surfaces will pay dividends in making the job easier and safer and will result in overhauled components being more reliable and efficient in operation.

Replace 'O' rings, seals, or gaskets whenever they are disturbed. Never mix new and old seals or 'O' rings, regardless of condition. Always lubricate new seals and 'O' rings with hydraulic oil before installation.

When replacing component parts use the correct tool for the job.

HOSES AND TUBES

Always replace hoses and tubes if the end connections are damaged. Be sure any hose installed is not kinked or twisted.

When installing a new hose loosely connect each end and make sure the hose takes up the designed position before tightening the connection. Clamps should be tightened sufficiently to hold the hose without crushing and to prevent chafing.

The hoses are the arteries of the unit, be sure they are in good condition when carrying out repairs or maintenance otherwise the machines output and productivity will be affected.

After hose replacement to a moving component check the hose does not foul by moving the component through the complete range of travel.

Hose connections which are damaged, dented, crushed or leaking, restrict oil flow and the productivity of the components being served. Connectors which show signs of movement from the original swaged position have failed, and will ultimately separate completely.

A hose with a chafed outer cover will allow water entry. Concealed corrosion of the wire reinforcement will subsequently occur along the hose length with resultant hose failure.

Ballooning of the hose indicates an internal leakage due to structural failure. This condition rapidly deteriorates and total hose failure soon occurs.

Kinked, crushed, stretched or deformed hoses generally suffer internal structural damage which can result in oil restriction, a reduction in the speed of operation and ultimate hose failure.

Free-moving, unsupported hoses must never be allowed to touch each other or related working surfaces. This causes chafing which reduces hose life.

PRESSURE TESTING

Prior to pressure testing be sure all hoses are in good condition and all connections tight. Pressure readings must be taken with gauges of specified pressure ratings.

The correct procedure should be rigidly observed to prevent damage to the system or the equipment and to eliminate the possibility of personal injury.

BEARINGS

Bearings which are considered suitable for further service should be cleaned in a suitable solvent and immersed in clean lubricating oil until required.

Installation of a bearing can be classified in two ways: press fit on rotating parts such as shafts, and gears, and push fit into static locations such as reduction gear housings. Where possible, always install the bearing onto the rotating component first.

Use the correct tools or a press, to install a bearing or bushing. In the absence of the correct tools or press, heat the bearings and/or the casing in hot oil to assist the installation of the bearing.

When bearings or bushings are removed always carefully check that the bearing is free from discoloration and signs of over-heating. Also check for mechanical damage such as excessive clearance, nicks and scuffing. If in doubt replace the bearings or bushings.

Bearings should never be removed unless absolutely necessary. Always use the recommended puller to reduce the risk of bearing or related component damage.

The reliability and durability of a unit depends on the effective operation of the many types of bearings and bushings which are incorporated in the complete assembly.

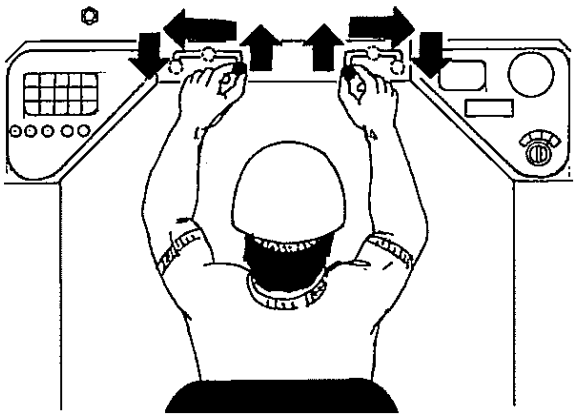
These bearings and bushings are subjected, in normal operation, to high working loads and adverse conditions.

Be sure during normal routine servicing, maintenance or repair that bearings are given the right attention and are installed with care.

BOOM LOCKS

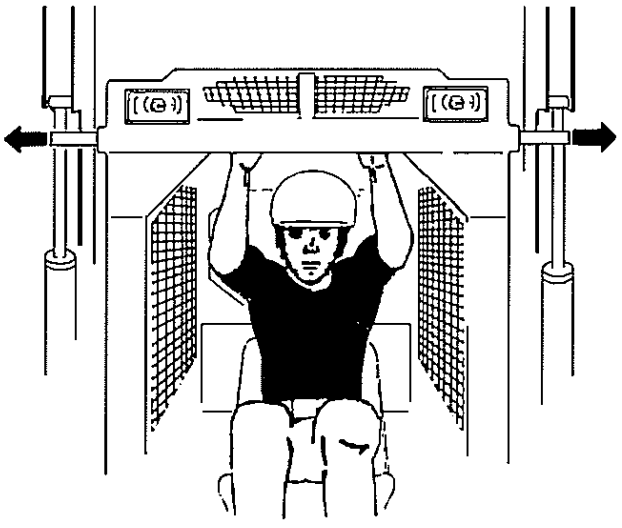
WARNING

To avoid personal injury service the loader with the boom arms down and the bucket or attachment on the ground. If it is necessary to service the loader with the boom arms raised be sure to engage the boom locks (fig. A & B). Never work under or around a loader with raised boom arms without boom locks engaged.



C-320

Fig. A

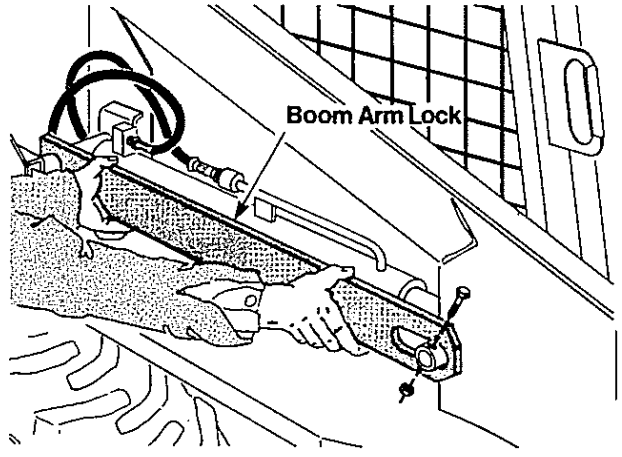


C-321 Fig. B

NOTE: The boom lock down must be engaged in the locked position when operating the loader with a backhoe or cold planer attachment. Boom lock down bars must also be used whe operating the above attachments (Fig. E).

The boom lock down is intended to lock the loaders boom arms in the down position for safe entry and exit of the loader cab. To oper-ate the boom lock down, lower the boom arms fully down and shut off the engine. Lower the bucket or attachment fully down on the ground and engage the parking brake. Engage the boom lock down by moving the boom lock down handle upwards to the lock position (Fig. D).

Check to ensure the boom lock down is fully engaged at the loaders lift arm and that the foot pedals are locked before getting out of the loader.



C-610

INDEX

INDEX (con't)

SECTION 1
HYDRAULIC SYSTEM

1.1 HYDRAULIC CIRCUITS

1.1.1 SPECIFICATIONS

Pump type .....Gear
Capacity (at rated RPM and Pressure).....15.8 GPM (59.9 L/ M)
Rated RPM.....2800
Rated Pressure.....2450 PSI (1655 BAR)
Reservoir Capacity.....8 gal. (30.3 l.)
Fluid type.....10W30 API class SE, CD oil
Filtration.....10 Micron
Filtration, reservoir.....One, 100 micron elements
Control valve, type.....Series type with float on lift and detent on auxiliary
Oil cooler.....440 BTU (116 KCAL)

Cylinders.....	LIFT	TILT
Type.....	Double Acting	Double Acting
Qty. per machine.....	2	2
Bore dia.....	2 in.	2.5 in.
Rod dia.....	1.25 in.	1.125 in.
Stroke.....	27.125 in.	13.375 in.

1.1.2 GENERAL INFORMATION - HYDRAULIC SYSTEM

Operation:

(Refer to illustration 1.1.2)

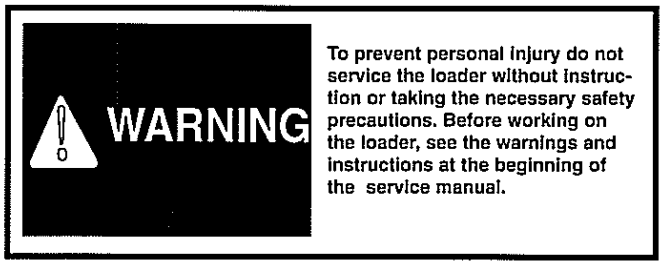
Oil flows from the hydraulic reservoir through a 100 micron element located in the reservoir to the hydraulic pump.

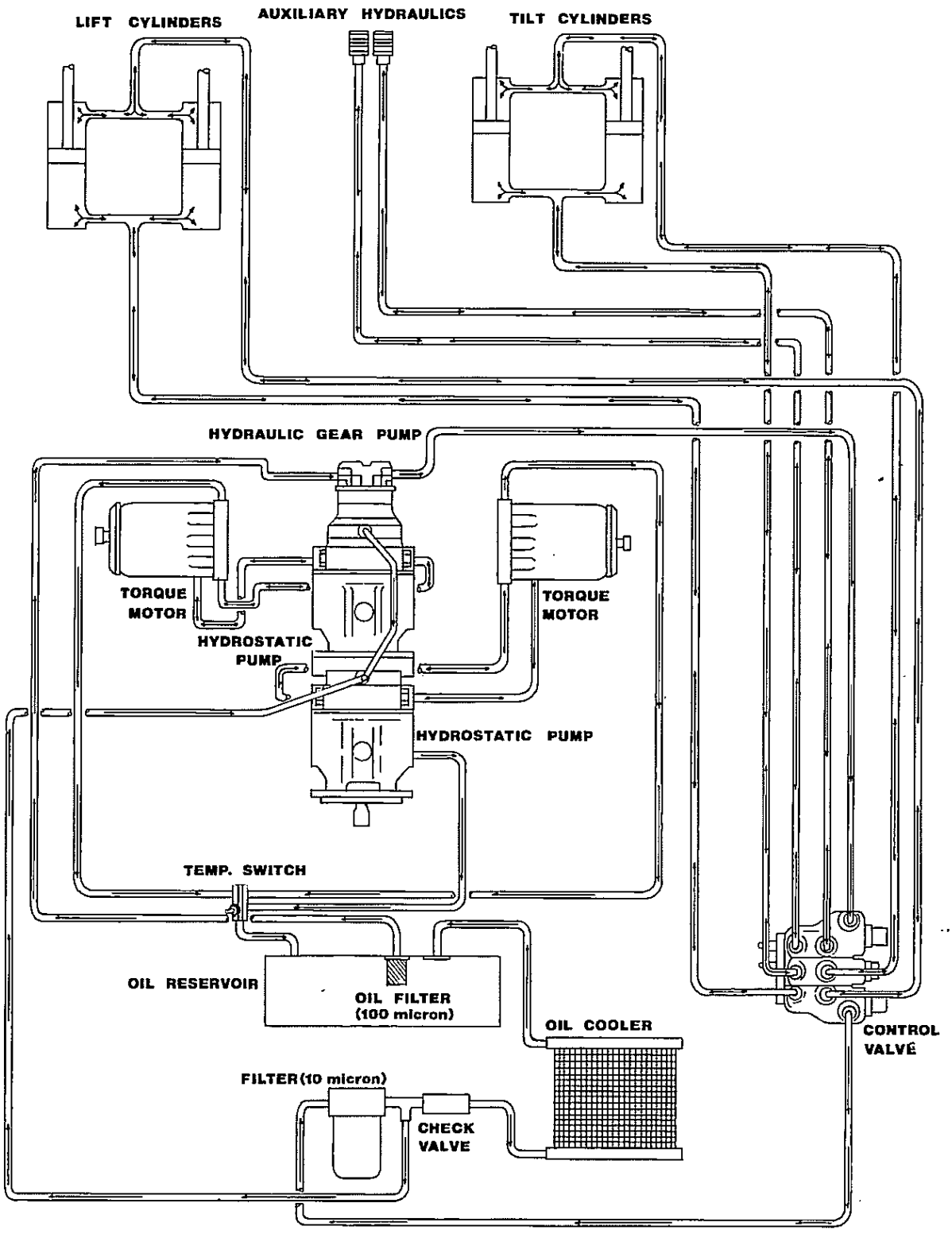
The hydraulic pump is a gear type pump which is driven by a shaft through the hydrostatic drive pumps at engine speed. The hydraulic pump capacity is directly related to engine speed. Oil goes from the hydraulic pump to the hydraulic control valve.

The hydraulic control valve is equipped with an adjustable relief valve which is set at 2450 PSI (165.5 BAR). The hydraulic control valve is a 3 spool sectional series type valve. The third spool provides hydraulic flow to the two bucket cylinders. The center spool provides flow to the auxiliary hydraulic circuit allowing operation of hydraulic attachments and tools. The center spool is equipped with a detent position to allow constant flow to the auxiliary hydraulic circuit. The first spool provides hydraulic flow to the two boom lift cylinders. The lift section spool is equipped with a float position.

Oil flows from the control valve to the hydraulic filter The hydraulic filter has a replaceable 10 micron element with a built in by-pass valve to allow the hydraulic fluid to flow if the element is plugged.

Oil flows from the hydraulic filter through a check valve which in turn supplies charge pressure to the tandem pump, and from the diverter valve on through the hydraulic oil cooler. Oil flows from the hydraulic oil cooler to the hydraulic reservoir. All hydraulic oil flowing to the hydrostatic drive pumps passes first through the 10 micron hydraulic filter.





NOTE: Hydraulic system for S/N LE006075 onward illustrated. On machines prior to this S/N refer to publication number 30232.

Fig. 1.1.2

1.1.3 CONTROL FUNCTIONS

Operation of the loader hydraulic functions are controlled by three foot pedals (fig. 1.1.3a).

* *with equipment specified in Section 8*

Boom Lift - The L.H.pedal is the boom lift control (fig. 1.1.3a). To raise the boom press on the heel (2) of the pedal. To lower the boom press on the toe (1) of the pedal. Firm pressure on the toe (1) of the pedal will lock the boom in float position. This allows the bucket to follow the ground as the loader moves backwards.

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 places the valve in detent position providing a continuous flow of hydraulic oil to the attachment. Pressing on the heel of the pedal (4) provides hydraulic pressure to the male quick-connect coupling reversing the flow of hydraulic oil. When the auxiliary circuit is not in use return the foot pedal to neutral position otherwise starting the loader may be difficult or impossible and damage to the starter may occur.

WARNING

To prevent personal injury do not start the engine unless you are in the seat with the seat belt fastened around you

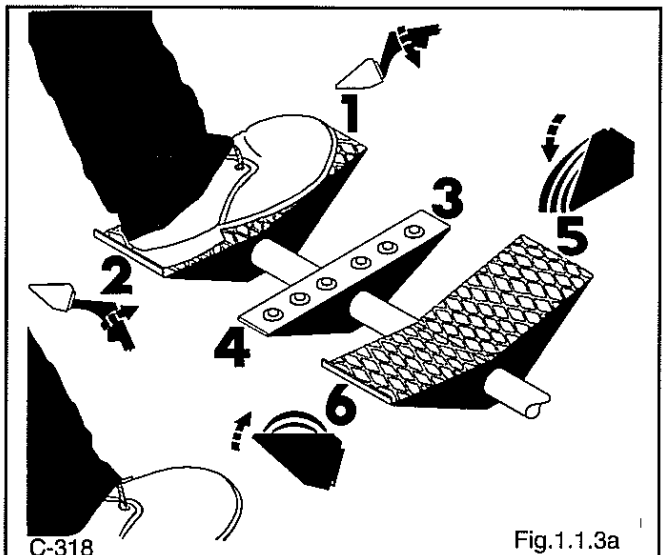
IMPORTANT

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

WARNING

To prevent personal injury always keep feet on the foot pedal controls while operating the loader.

Bucket Tilt- The R.H. pedal is the bucket tilt (dump) control. Pressing on the toe (5) of the pedal will dump the bucket. Pressing on the heel (6) of the pedal will roll bucket back.



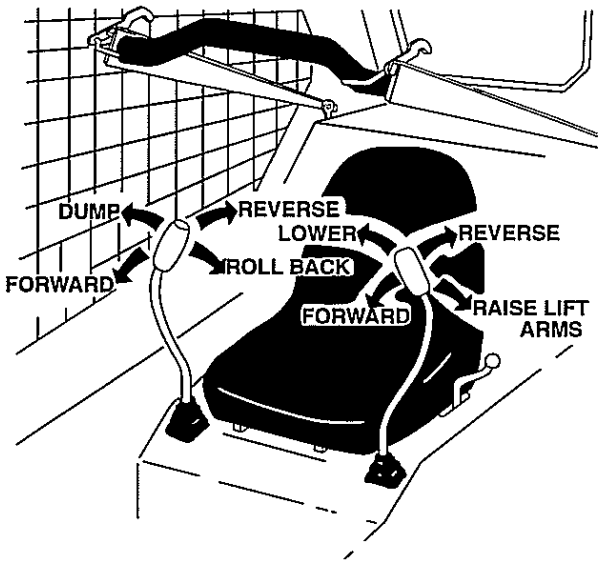
C-318 Fig.1.1.3a

1.1.4 HAND CONTROLS

Hand controls to operate the loaders boom and bucket hydraulic system as well as the loaders travel speed and direction are available as a factory installed option.

Bucket Control

The right hand lever controls the bucket tilt cylinders. Moving the left control lever to the left will cause the boom cylinders to extend, raising the loaders boom arms. Moving the control lever to the right causes the boom cylinders to retract, lowering the boom. Moving the control lever to the extreme right will place the boom in float position. This allows the bucket to follow the contour of the ground as the loader moves backward.



C-633 fig. 1.1.4

When the control levers are released they will automatically return to the neutral position stopping all hydraulic movement and travel speed. Before exiting the loader, shut off the engine and lower the boom completely down to the frame and ground the attachment. Raise the seat bar to the lock position. Move both control levers forward and backward to ensure the steering controls are locked and move both levers to the left and right to ensure the hydraulic controls are locked before you get out of the loader

Auxiliary Hydraulics

The foot pedal is used to engage the loaders auxiliary hydraulic circuit to power an attachment such as a post hole auger. Pressing on the toe of the pedal provides hydraulic flow to the female quick-connect coupling located at the front of the boom arms. Firm pressure on the toe of the pedal will lock it into detent position providing a continuous flow of hydraulic oil to the attachment. Pressing on the heel of the pedal provides hydraulic flow to the quick-connect coupling reversing the flow of hydraulic oil. If not locked in detent position, releasing the pedal will cause it to return to the neutral position stopping all hydraulic flow. Once the pedal is locked in detent, it can be returned to neutral by tapping the heel of the pedal.

When the auxiliary hydraulic system is not in use return the pedal to neutral position otherwise starting the loader may be difficult or impossible and damage to starter may occur.

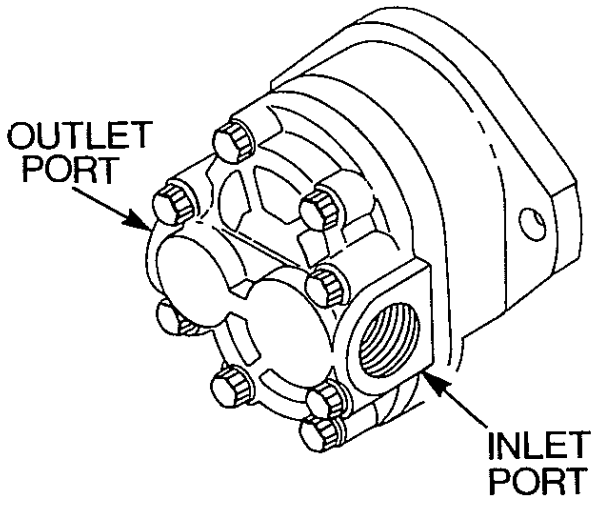
1.1.5 MAINTENANCE SCHEDULE

	First (Hours)	Every (Hours)
Oil level, check	8	8
Oil filter, change	50	150
Oil cooler, clean	8	8
General system check (leaks etc.)	8	8
Cylinders, lubricate	8	8
Reservoir filters, change	1000	1000
Hydraulic oil, change	1000	1000

1.2 GEAR PUMP

1.2.1 SPECIFICATIONS

Pump, type.....Gear
Displacement.....1.69 cu. in (27.69 c.c.)
Capacity (at rated speed and pressure).....15.8 GPM (59.9 L/M)
Rated speed (RPM).....2800
Rated pressure.....2450 PSI (165.5 BAR)
Rotation .....R.H. (viewed from shaft end)
Tie bolt torque.....25-28 ft. lbs. (34-38 N.M.)



C-327 Fig. 1.2.2

1.2.2 GENERAL INFORMATION

The hydraulic gear pump (fig. 1.2.2) is mounted at the end of the two hydrostatic piston drive pumps. The splined shaft of the hydraulic gear pump is driven by the internal splined shaft of the front hydrostatic pump at engine crankshaft speed. The output flow of the hydraulic gear pump is directly related to engine speed. Maximum output will be at full rated engine R.P.M.

Oil is drawn from the hydraulic oil reservoir and enters the hydraulic gear pump at the inlet port. The oil is pressurized and is directed through the outlet port to the hydraulic control valve for boom, bucket and auxiliary hydraulic functions.

1.2.3 TESTING GEAR PUMP

Use test equipment which will meet the following performance figures when performing the test:

Hose Assembly - Capable of a minimum burst pressure of 3000 PSI.

Flow Meter - Capable of reading up to 30 GPM (114 l/m) and equipped with a flow control valve.

Shut off valve - Capable of minimum 3000 PSI burst pressure.

Pressure Gauge - Capable of reading up to 3000 PSI (206.9 BAR).

SECTION 1 HYDRAULICS

WARNING

To prevent personal injury never repair or tighten hydraulic hoses or fittings with the engine running or the system under pressure.

IMPORTANT

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

IMPORTANT

There is no relief valve protecting the pump when the tester is connected. To prevent pump damage do not close the valve on the tester all the way or exceed 2450 PSI (165.5 BAR)

1.2.4 GEAR PUMP REMOVAL AND REPLACEMENT

1. Remove attachment and engage boom locks.
2. Disconnect the line between the hydraulic oil reservoir (fig. 1.2.4a) and the hydraulic gear pump at the gear pump inlet port. Cap the hose with a 1 inch N.P.T. cap to prevent loss of hydraulic oil.
3. Disconnect the line between the hydraulic gear pump and hydraulic control valve (fig. 1.2.4a).
4. Remove the two (2) bolts which hold the hydraulic gear pump to the hydrostatic pump (fig. 1.2.4b).
5. Remove the hydraulic gear pump from the hydrostatic pump (fig. 1.2.4b).

WARNING

To prevent personal injury do not work on a loader with the boom arms in a raised position unless the boom locks are engaged.

IMPORTANT

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

Reassembly:

WARNING

To prevent personal injury never repair or tighten hydraulic hoses or fittings with the engine running or the system under pressure.

1. Install a new O-ring on the mounting flange of the hydraulic gear pump (fig. 1.2.4c).
2. Install the hydraulic gear pump on the hydrostatic pump.
3. Install the two (2) mounting bolts and torque to 27-31 ft.lbs. (36.6-42 N.M.) (fig. 1.2.4d).
4. Install the hydraulic line between the gear pump and hydraulic control valve.
5. Install the hydraulic hose from the oil reservoir at the rear of the pump inlet.
6. Replace seat and plate assembly.

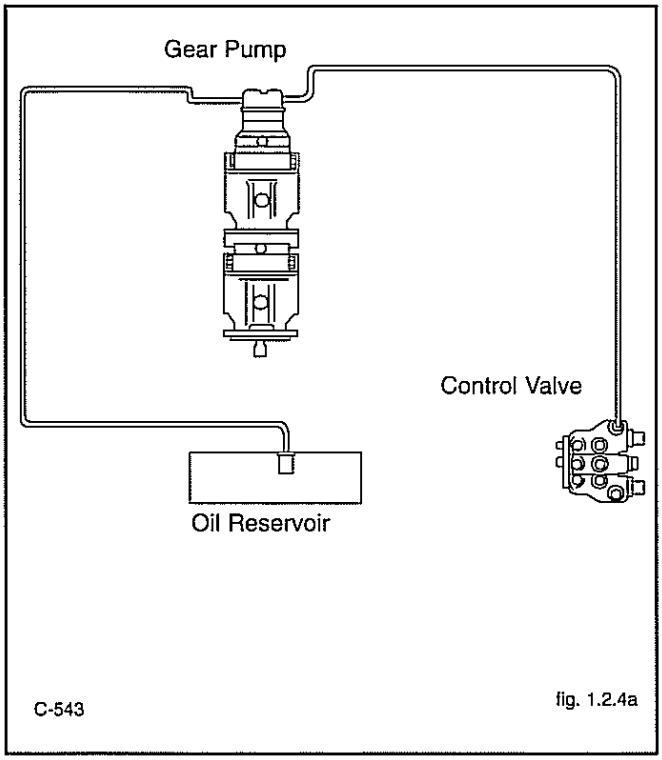
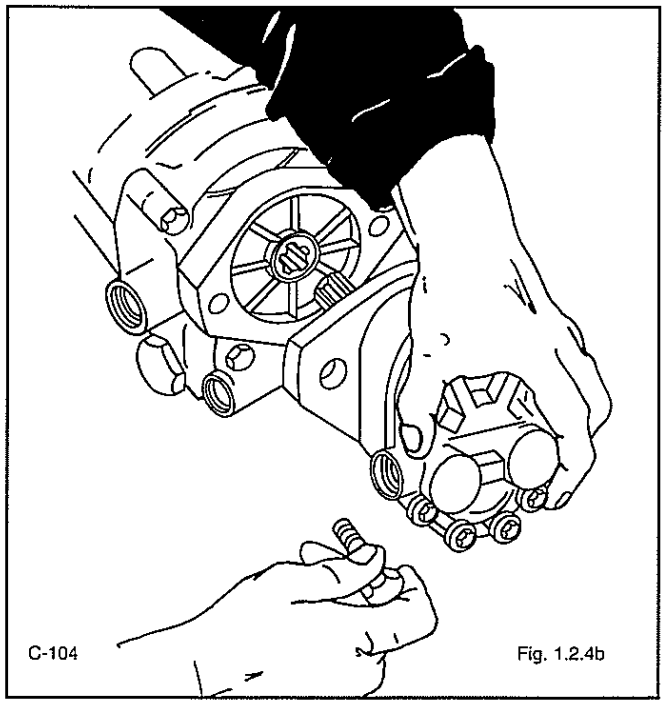
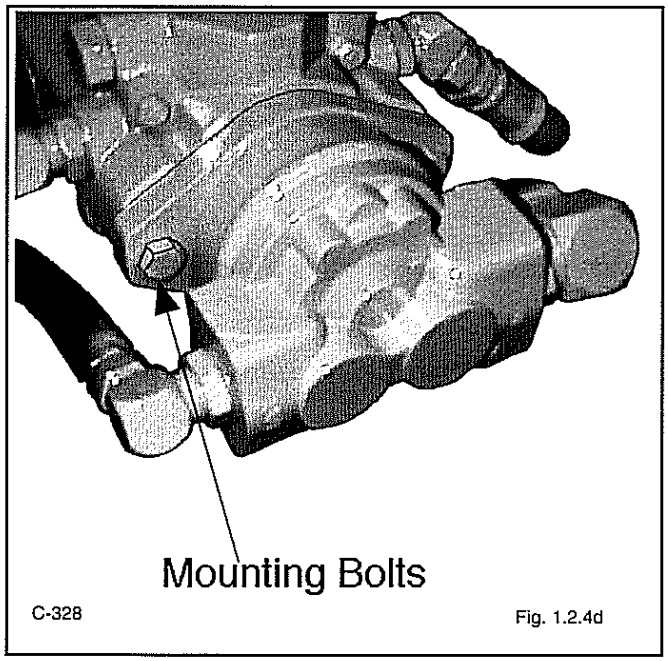
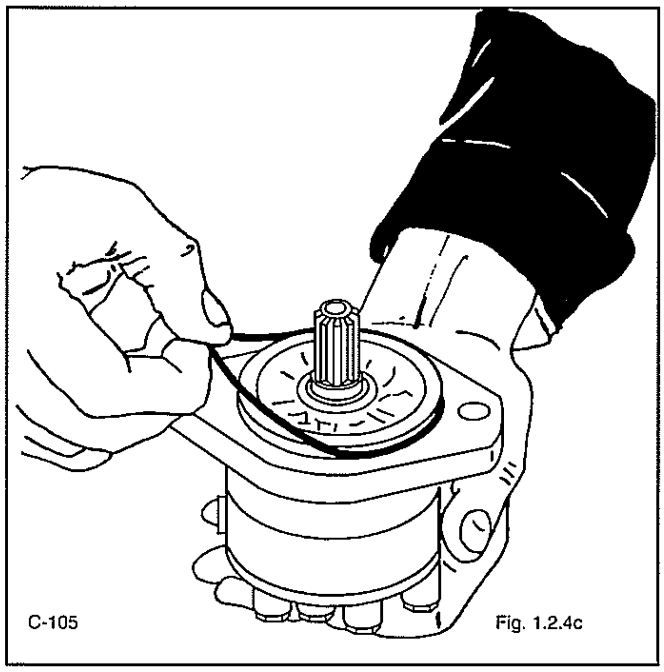


fig. 1.2.4a


C-104 Fig. 1.2.4b



C-328 Fig. 1.2.4d


C-105 Fig. 1.2.4c

1.2.5 DISASSEMBLY AND INSPECTION

Before disassembling the pump, clean the body with a suitable solvent and dry with compressed air. Ensure all openings are plugged to prevent solvent entering the pump. Mark the pump across the front plate, body and back plate to assist reassembly (See Fig. 1.2.5)

IMPORTANT **To prevent damage after removal or repair of hydraulic components refer to start up procedure section 1.2.6**

Disassembly:

1. Remove the eight tie bolts.
2. Hold the pump in both hands and tap the drive shaft with a rubber hammer to separate the front plate from the back plate. The body will remain with either the front plate or the back plate.
3. To separate the body from the section it remains with, place the drive gear in the body and tap the protruding end of the gear shaft with a plastic mallet.
4. Remove the O-Ring from the back plate and discard.
5. Remove the wear plate from the front plate.

1. Back Plate
2. O-Ring
3. Body
4. Drive Gear
5. Idler Gear
6. Wear Plate
7. Seal Bearing
8. Molded Seal
9. Back Up Gasket
10. O-Ring
11. Front Plate
12. Washer
13. Shaft Seal
14. Cap Screws

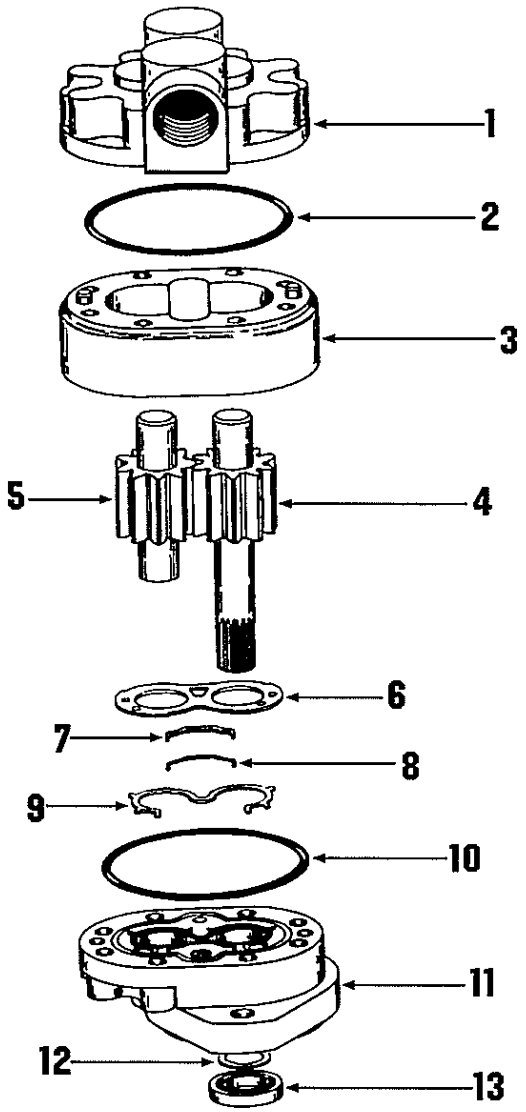


Fig. 1.2.5

6. Remove and discard the bearing seal , molded seal and the back-up gasket from the front plate.

7. Remove and discard the shaft seal from the front plate.

Inspection:

1. Thoroughly clean and dry all parts.

2. Inspect the shaft and gear assemblies for roughness or excessive wear at the bearing and seal areas.

3. Inspect the gear faces for scoring or excessive wear. Carefully remove any sharp areas on the gear teeth with emery cloth.

4. Inspect the bearings in the front and back plate. The bearings are an integral part of the front and back plate and are not serviced separately. The complete plate should be changed if the following conditions are not met:

   (a) The bearings in the front plate should be flush with the face of the front plate.
   (b) The oil grooves in the bearings should line up with the dowl pin holes and be 180° apart for both front and back plates.
   (c) The inside diameter of each bearing should not exceed .879 in. (22.33 mm).

5. Inspect the gear pockets of the body and wear plate for excessive scoring or wear. Replace if wear exceeds .0015 in. (.038mm).

6. Check body inside gear pockets for excessive scoring or wear.

7. Replace body if I.D. of gear pockets exceeds 2.108 in. (53.54mm).

Reassembly:

Replace all gaskets, seals, wear plates and moulded O-rings.

1. Using a dull tool, fit the back up gasket groove in the front plate.

2. Install back up gasket in front plate.

3. Place moulded O-ring in front plate groove. Place bearing seal over moulded O-ring.

4. Place pump body onto front plate.

5. Place wear plate on top of back up gasket with bronze face up.

6. Lubricate and slip gear assemblies into gear pockets.

7. Install adaptor plate.

8. Install rear body and wear plate.

9. Slide the back plate over the gear shafts until the dowel pins are engaged.

10. Install and evenly tighten the eight tie bolts. Torque to 25-28 ft.lbs. (34-38 N.M.).

11. Dip the shaft seal in system fluid and install it on the drive shaft being careful not to cut the rubber sealing lip. Fully seat the seal into the recessed bore in the front plate.

12. Rotate the pump shaft by hand. A small amount of resistance should be felt, however, the pump should turn freely after a short period of use.

IMPORTANT

To prevent damage after removal or repair of hydraulic components refer to start up procedure section 1.2.6

1.2.6 START UP AFTER REPAIR

To prevent damage on start-up, after draining the hydraulic oil reservoir or replacing major hydraulic or hydrostatic components, follow the procedure below.

1. Fill the hydraulic oil reservoir to the correct level with 10W30 API classification SE, CD oil. Refer to section 1.7.3 for procedure and capacities.

2. On diesel engines with the throttle lever set in the off position, intermittently turn the engine over with the starter motor for approximately two (2) minutes. This allows both the gear pump and hydrostatic drive pump to draw oil from the reservoir ensuring the system is full on start-up.

3. Start the engine and run it at half throttle with no hydraulics engaged for several minutes.

4. With the engine running at half throttle, operate the hydraulic control valve to build up pressure at 3 second intervals for approximately three (3) minutes.

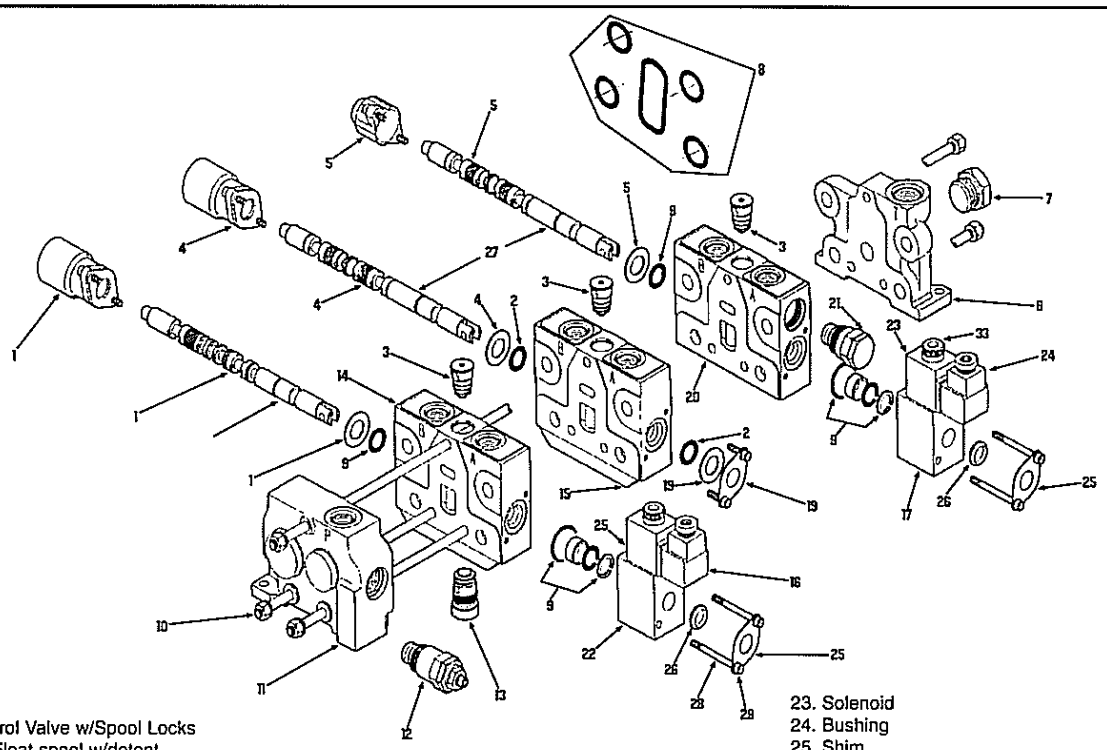
5. Increase the engine speed to full throttle, operate the hydraulic control valve to build up pressure at three second intervals for approximately three (3) minutes.

6. Idle the engine and check for leaks.

SECTION 1 HYDRAULICS

1.3 CONTROL VALVE

C-544 fig. 1.3



Control Valve w/Spool Locks
1. Float spool w/detent
2. Spool 'O' ring kit
3. Check valve
4. Double acting spool w/detent
5. Double acting spool spring center
6. Outlet section
7. Plug, outlet side
8. 'O' ring kit section
9. 'O' ring kit
10. Tie rod kit
11. Inlet section
12. Main relief valve
13. Special check valve
14. Series section
15. Auxiliary section
16. Connection solenoid
17. Block for spool lock
19. Dustcover plate kit
20. Handle section
21. Anticavitation valve
22. Spool locking device
23. Solenoid
24. Bushing
25. Shim
26. Scraper
27. Spool end
28. Screw
29. Spring washer
30. 'O' ring
31. Spacer
32. 'O' ring
33. Nut, Knyrled solenoid
34. Seal kit, valve only

1.3.1 SPECIFICATIONS

Model..... VD08A
Valve Type.....3 spool, sectional, series type with float on boom and aux. detent
Flow Capacity.....20 GPM (75.7 l/m)
Main Relief, Type.....adjustable

Main Relief, Setting.....2450 PSI (165.5 BAR)
Load Check.....one per valve circuit

WARNING

To avoid personal injury stop the engine, engage the parking brake, and cycle the foot pedals to ensure they are locked before getting out of the loader.

1.3.2 GENERAL INFORMATION

Loader Control Valve

The loader hydraulic control valve is a series parallel type, sectional valve. The valve contains three spools which control loader bucket, auxiliary hydraulic and boom operations.

The spools are hardened, ground and chrome plated steel. Each spool is selectively fitted to the section spool bore. Because of this selective fitting, the spools are not interchangable or serviced individually. Each spool is sealed at the rear with an O-Ring and at the front with an O-Ring and rod wiper.

When the spools are in neutral, oil flows from the hydraulic gear pump, through the control valve, and returns to the hydraulic reservoir. As a spool is moved, oil is directed to one end of the cylinders. Oil returning from the cylinders is ported to the next valve circuit which allows operation of more than one function at the same time.

Each spool end contains a centering spring which returns the spool to neutral position if the foot pedal control is released. The auxiliary section contains a detent mechanism to hold the spool in position, providing constant flow to the auxiliary hydraulic circuit when required

The boom section has a detent mechanism to hold the spool in position, when float is desired. Port 'A' to slow the boom down cycle time.

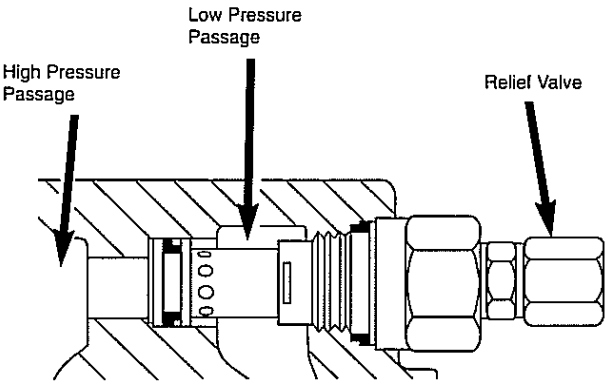
When a spool is moved, oil is directed to one end of the cylinders. If the cylinders are restricted, or reach the limit of their travel, oil pressure builds up in the system. To protect against the pressure increase, the relief valve opens and allows high pressure oil to return to the reservoir. The system relief valve is adjustable. Refer to section 1.3.3. The relief valve is preset at 2450 PSI (165.5 BAR).

System Relief Valve Operation

The system relief valve (fig. 1.3.2a) is located at the rear of the valve near the inlet port between the high pressure passage and the low pressure passage.

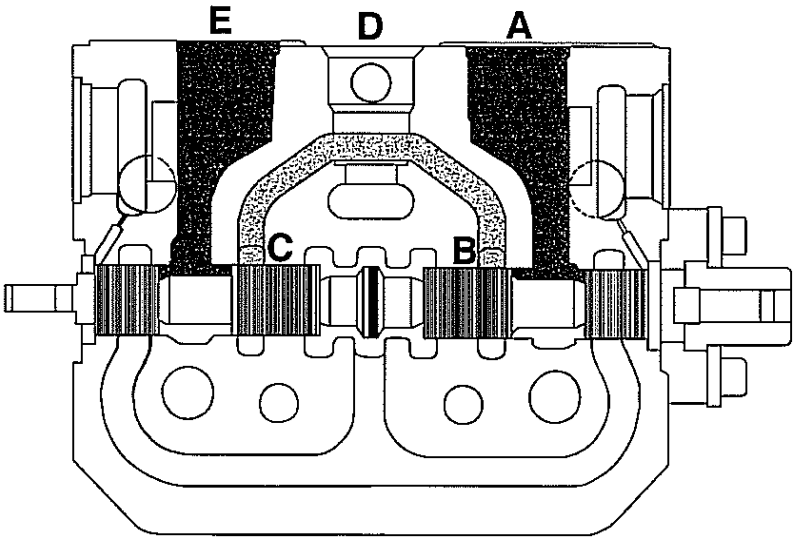
WARNING

To prevent personal injury do not start the engine unless you are in the seat with the seat belt fastened around you.



C-545

fig. 1.3.2a



C-421

fig. 1.3.2b

Load Check Valve Operation

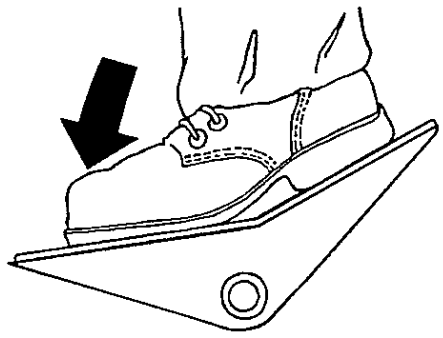
Load check valves are located between the ports of each spool circuit. The function of the check valve is to hold the boom arms or bucket in position during spool movement.

In operation, the check valve (fig. 1.3.2b) is retained on its seat by spring force. At initial spool movement, the natural tendency is for the oil, which is being pressurized by the closing of the open center passage to flow to an area of lower pressure. As the open center passage is being blocked, the oil would then attempt to flow past the open spool. This oil is held at the check valve until the pumped oil overcomes the force holding the check valve on its seat. As the pressure increases, the oil pressure unseats the check valve and pressurized oil flows to the cylinder.

Operation Spool-In

Fig. 1.3.2c illustrates oil flow through the valve to the cylinder hose ports. Pushing the spool in causes the boom to lower in the boom spool section, the bucket to dump in the bucket spool section and oil to flow to the female quick-connect coupling on the auxiliary hydraulic spool section.

Oil enters the inlet section at A and B. The spool land blocks the oil from flowing to port C. All pumped oil is directed through passage A, the pressure increases until the load check valve D is unseated. Oil passes by the load check valve and out hose port E to one end of the cylinders.



C-626

fig. 1.3.2c

Oil forced out of the cylinders by the piston, enters the valve through hose port F and flows to the reservoir through passage G.

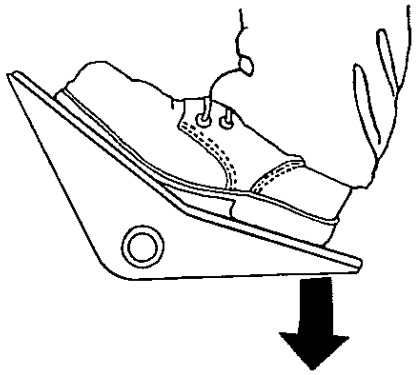
The auxiliary hydraulic spool has a detent mechanism to hold the spool in this position if a constant flow of oil to the auxiliary circuit is required.

Operation Spool-Out

Fig. 1.3.2d illustrates oil flow through the valve to the cylinder hose ports when the spools are out. Pulling the spool out in the boom section causes the boom to raise, in the bucket section the bucket to roll back and in the auxiliary section oil to flow to the male quick-connect coupling.

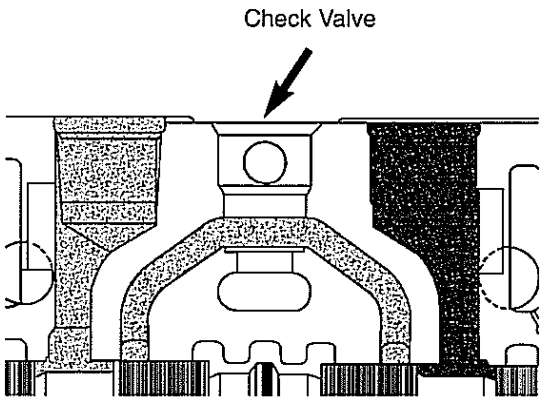
Oil enters the inlet valve section at A and B. The spool land blocks the oil from flowing to passage C. All pumped oil is directed through passage A where it is blocked by the load check D. The pressure increases until it overcomes the force holding the check valve in its seat. The oil pressure unseats check valve D and flows out hose port E to one end of the cylinder.

Oil forced out of the cylinders by the pistons, enters the valve through hose port F and flows to the reservoir through passage G.



C-627

fig. 1.3.2d

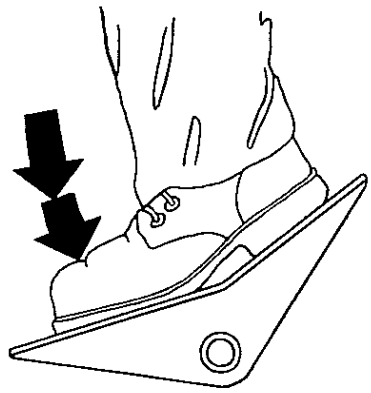


C-546 fig. 1.3.2b

Operation Boom Float Position

Incorporated at the end of the boom spool is a detent locking device that holds the spool in float position. With the spool in this position, oil is permitted to flow freely between the rod and piston end of the boom cylinders as illustrated in fig. 1.3.2e. As the working surface varies the boom arms 'float' with the ground contour.

Oil travels through passages A and B to passage D which is connected to the reservoir and to passages G and H.



C-628 fig. 1.3.2e

Oil being displaced or forced out of one cylinder end circulates to the other cylinder end through hose port E or F, depending on whether raising or lowering conditions occur.

The load check valve C will not unseat as passage J is blocked by the spool land.

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 approximately 160°F. 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.

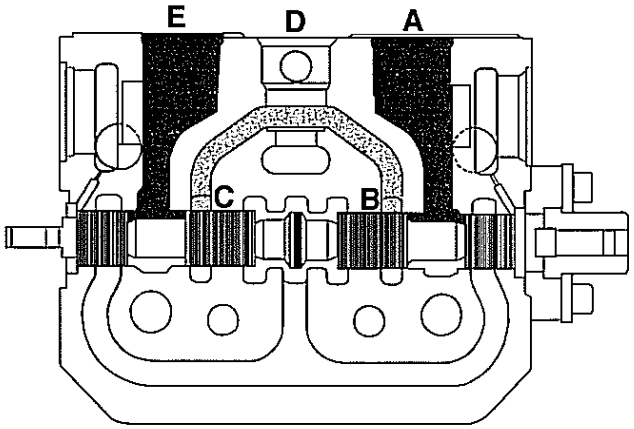
3. Connect a pressure gauge in the female quick-connect coupling on the auxiliary hydraulic circuit located at the front of the boom arm (fig. 1.3.3a).

4. Start the engine.

5. Press the toe of the auxiliary (center) pedal to activate the auxiliary hydraulic circuit.

6. Pressure must be 2450 PSI (165.5 B).

7. Shut off the engine and cycle the foot pedal to relieve pressure at the guage.



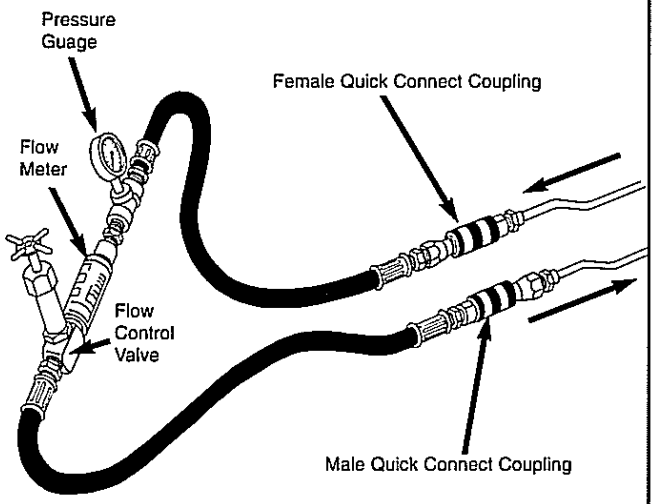
C-421 fig. 1.3.3

Adjustment System Relief Valve

Flow Meter - Capable of reading up to 30 G.P.M. (114 L/M) and equipped with a flow control valve.

Pressure Gauge - Liquid filled gauge of reading up to 3000 PSI (206.8 BAR).

Caution - Should you adjust relief valve pressure too high, serious damage to the gear pump could occur.



C-571

fig. 1.3.3 a

1. This test must be performed with the engine running and hydraulic oil at working temperature of 160° approximately.

2. Connect the hydraulic tester between the male and female quick couplers on the boom. The inlet hose from the tester connects to the outlet port of the quick coupler and the outlet hose from the tester connects to the return port of the quick coupler.

3. With the flow control on the tester fully open, start the engine and run it until it reaches normal operating temperature.

4. Increase engine speed to full R.P.M. (2800) gradually turn the flow control clockwise. Decreasing the flow, carefully watch the pressure gauge as it rises, if the pressure reaches 2450 PSI and flow remains, pressure has been set too high and must be adjusted down at the relief valve.

WARNING

To prevent personal injury do not work a loader with the boom arms in a raised position unless the boom locks are engaged.

5. Open flow control valve to full flow. Loosen the jam nut on the relief valve adjusting screw and turn the screw clockwise until it bottoms out.

6. Gradually turn the adjusting screw counterclockwise 2 complete turns, relock lock-nut and return to step 5 of this procedure.

WARNING

To prevent personal injury do not start the engine unless you are in the seat with the seat belt fastened around you.

7. Gradually stop flow completely read the pressure at no flow should be 2450 PSI. Remember the relief valve adjustment is very sensitive and will require only a 1/8 turn to affect pressure.

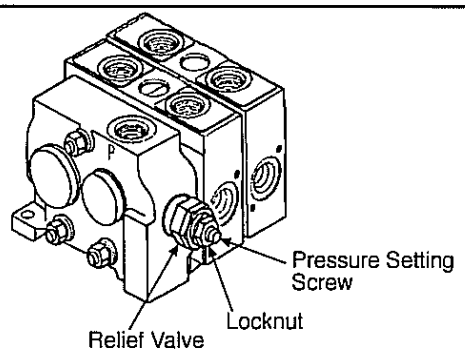
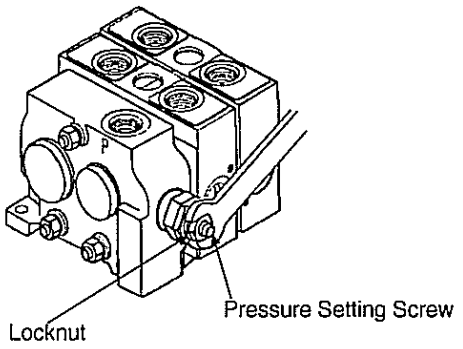
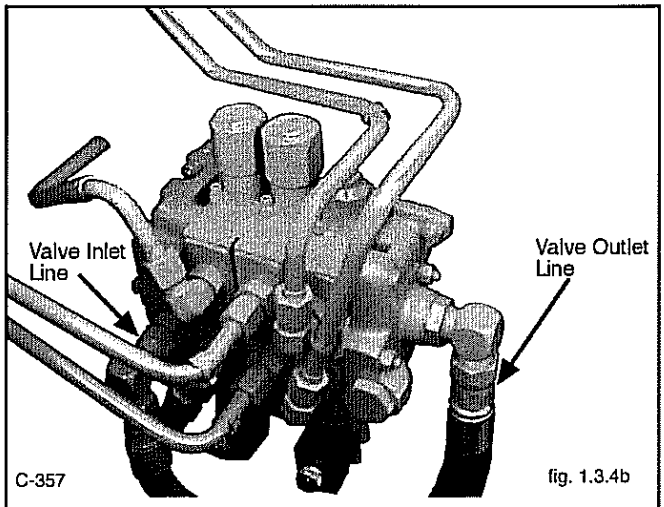


fig. 1.3.3b

C-353



C-354 fig. 1.3.3c



C-357 fig. 1.3.4b

1.3.4 CONTROL VALVE REMOVAL, REPLACEMENT

Removal

1. Remove any attachment. Raise the boom arms and engage the boom locks. Shut off the engine.
2. Drain the oil from the hydraulic reservoir. Refer to section 1.7.3.
3. Disconnect control cables and solenoid electrical wires.
4. Disconnect the line between the hydraulic gear pump outlet and control valve inlet (fig. 1.3.4b). Cap the hydraulic line and plug the control valve port.

IMPORTANT

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

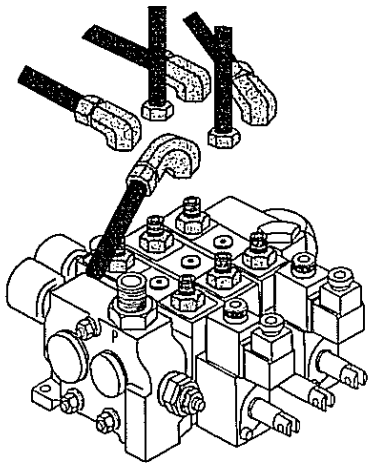
WARNING

To prevent personal injury do not work on a loader with the boom arms in a raised position unless the boom locks are engaged.

IMPORTANT

Do not set the relief pressure above 2450 PSI (169 BAR) to prevent damage to the hydraulic system components.

5. Disconnect the line from the control valve outlet port (fig. 1.3.4b). Cap the hydraulic line and plug the control valve outlet port.
6. Disconnect all six lines going to bucket, boom and auxiliary hydraulic circuits at the control valve (fig. 1.3.4c). Cap all six hydraulic lines and hose ports on the control valve.
7. Remove the three nuts which secure the hydraulic control valve to the valve mount and remove the hydraulic control valve.



C-422 fig. 1.3.4c

Replacement

1. Install the valve and secure with three nuts. Lock washer torque to 15 ft. lbs.
2. Connect the six hydraulic lines going to bucket, boom and auxiliary hydraulic circuits at the control valve.
3. Connect the hydraulic hose going to the oil filter at the hydraulic control valve outlet port.
4. Connect the hydraulic pipe going to the hydraulic gear pump at the hydraulic control valve inlet port.
5. Connect the foot pedal cables to the hydraulic control valve spools and reconnect solenoid electrical.

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

6. Fill the hydraulic reservoir to the correct level with 10W30 API Classification. Refer to section 1.7.3 for procedure and capacities.
7. Before start up refer to section 1.2.6 for correct procedure to prevent damage to the hydraulic system components.

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

1.3.5 CONTROL VALVE DISASSEMBLY AND INSPECTION

Disassembly

Before disassembling the hydraulic control valve, clean the body with a suitable solvent and dry with compressed air.

Ensure all openings are plugged to prevent solvent entering the valve. Refer to fig. 1.3.5a to assist in disassembly.

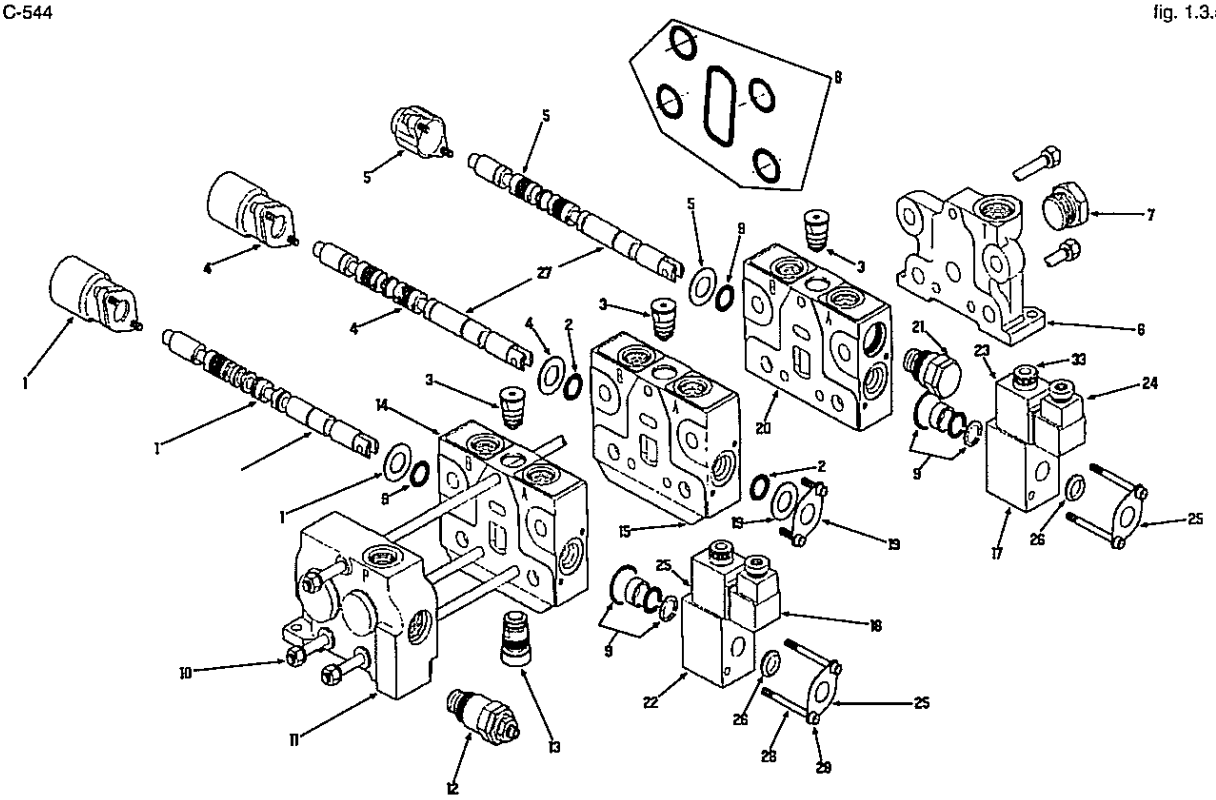
1. Remove the pressure relief valve. Discard O-Rings and back-up washers.
2. Remove three tie bolts holding valve assembly together.
3. Remove solenoid lock assembly.
4. Remove spool end caps.
5. Remove the spring spacer, spring and return washer.
6. Remove detent springs, detent balls and bucket spool from the spool end cap.
7. Remove the two end cap screws from the auxiliary spool end cap. Remove the end cap.
8. Remove the detent spool, spring spacer, spring and return washer from the auxiliary spool. Remove the auxiliary spool.

IMPORTANT To prevent damage after removal or repair of hydraulic components refer to start up procedure section 1.2.6

9. Remove the two detent plugs, detent springs and detent balls from the boom spool end cap.
10. Remove the two end cap screws from the boom spool end cap. Remove the boom spool end cap.
11. Remove the detent spool, spring spacer, spring and return washer from the boom spool. Remove the boom spool.
12. Remove and discard the six spool O-Rings. Be careful not to scratch the spool bores.

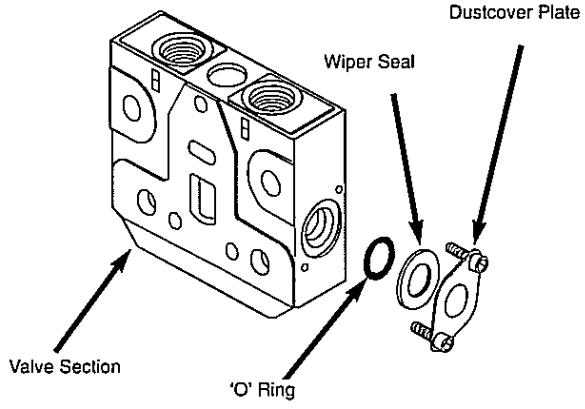
IMPORTANT When making repairs to the hydraulic system, keep all parts clean and remove dirt from the work area. Use caps and plugs on all lines and openings.

C-544 fig. 1.3.5A



1. Float Spool w/Detent
2. Spool O-Ring
3. Check Valve
4. Double Acting Spool w/Detent
5. Double Acting Spool Spring Center
6. Outlet Section SAE 12
7. Plug, Outlet Side
8. O-Ring Kit Sections
9. CESD O-Ring Kit
10. Tie Rod Kit
11. Inlet Section SAE 10
12. Main Relief Valve
13. Special Check Valve
14. Series Section SAE 10 A-B
15. Auxiliary Section
16. Connection Solenoid
17. Block for CESD Spool Lock
19. Dustcover Plate Kit
20. Handle Section SAE 10
21. Anticavitation Valve
22. Spool Locking Device
23. Solenoid 12V
24. Bushing
25. Shim
26. Scraper
27. Spool End
28. SHC Screw
29. Spring Washer
30. O-Ring
31. Spacer
32. O-Ring
33. Nut, Knurled Solenoid
34. Seal Kit, Valve Only

Inspection



C-565 fig. 1.3.5b

1. Thoroughly clean and dry all parts.
2. Inspect the load check valve springs (3) for breakage or loss of tension. Inspect the load check poppets (4) for scoring or wear (fig. 1.3.5b). To remove the load check poppets, simply remove the top tie rod from the valve assembly The poppets can then be removed as illustrated above (see Item 3). When reassembling, do not overtorque approximately 15 ft. lbs.
3. Inspect the check valve seats inside the valve body for scoring. Scoring on the check valve seat will allow leakage and may result in the boom or bucket being unable to hold their position when the spools are in neutral or at initial spool movement.
4. Check the spools for scoring or wear.
5. Inspect the spool bores in the control valve body for scoring or wear.

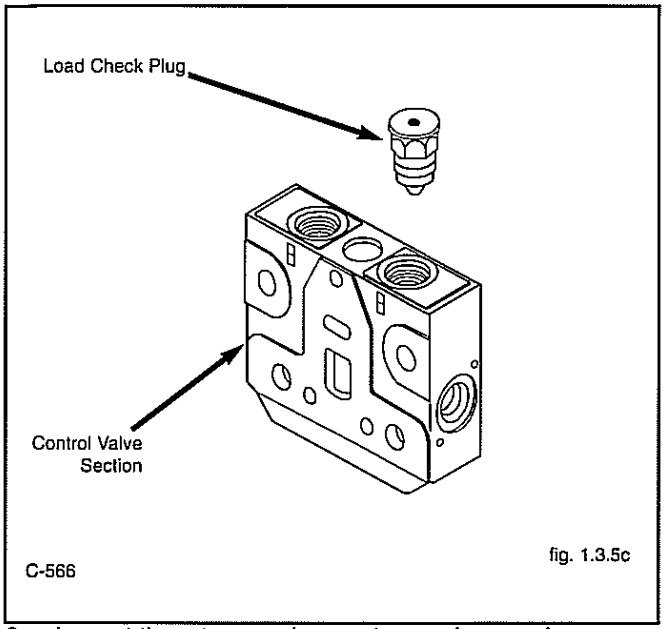


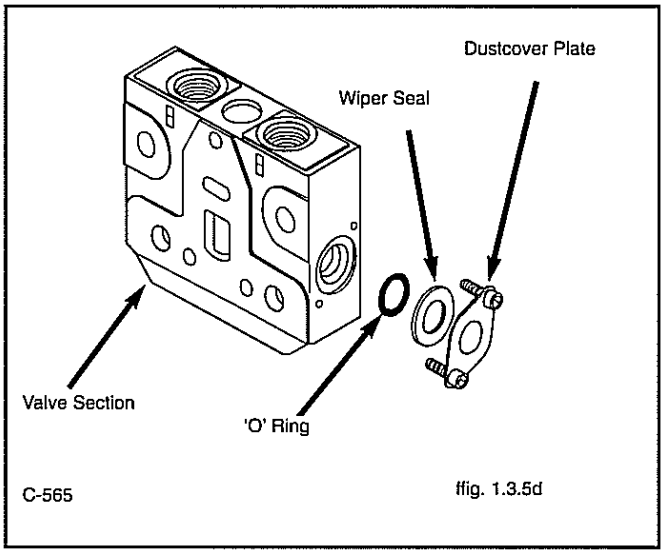
fig. 1.3.5c

6. Inspect the return washers, return springs, spring spacers and the detent spools for damage or wear.

7. Check the relief valve and relief valve seat in the control valve housing for score or wear.

Assembly

1. Install the three load check poppets, poppet springs and load check plug in the control valve housing.



ffig. 1.3.5d

Install a new O-ring on the load check plug and back up washers before assembly.

2. Install the relief valve in the control valve housing. Install new O-rings and back up washers on the relief valve before assembly.

3. Carefully insert each spool into its proper bore from the back of the valve housing, Rotate the spools as they pass through the front of the valve body. Pull the spools out of the front of the valve body until the back edge of the spool is in line with the back edge of the valve housing.

4. Lubricate with system oil, three spool O-rings and install them.

5. Install the return washer, spring, spring spacer on the end of the bucket spool and secure in place with the lockwasher and screw. Torque to 2-3 ft. lbs. (2.7- 4 N.M.).

6. Install the bucket spool end cap and secure with two end cap screws. Torque the end cap screws to 2-3 ft. lbs. (2.7-4 N.M.).

7. Install the return washers, springs, and spring spacer on the ends of both the auxiliary and boom spools.

8. Install the auxiliary and boom spool end caps and secure with end cap screws. Torque the end cap screws 2-3 ft. lbs. (2.7-4 N.M.).

1.3.6 SPOOL SEAL REPLACEMENT

It is not necessary to remove the hydraulic control valve from the loader or to remove the spools from the valve body to replace the spool seals.

The spool is sealed on both ends with an O-ring (fig. 1.3.6a).

The following instructions refer to replacement of the spool seals on the boom lift spool.

The procedure on the other two spools will be the same with the exception of removing the spring mechanism on the bucket spool.

Refer to section 1.3.5 for additional information:

1. Ground the attachment, lower the boom arms. Shut off the engine.

2. Disconnect the cable at the control valve spool (fig. 1.3.6b)

3. Remove the end cap (fig. 1.3.6c).

4. Remove the detent spool, spring spacer, spring and return washer from the end of the spool (fig. 1.3.6c).

5. Remove and discard old O-ring.

6. Carefully replace with new O-ring. Lubricate thoroughly with system oil.

7. Remove lock mechanism and old O-ring.

8. Lubricate and install new O-ring.

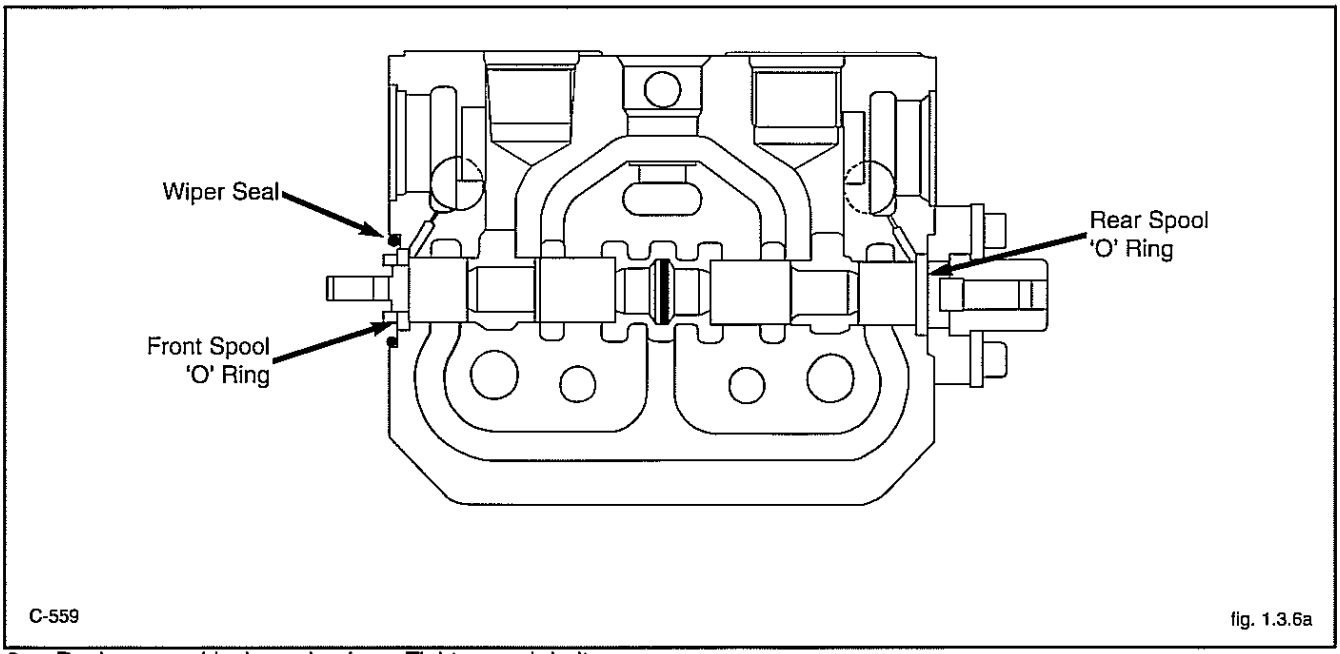


fig. 1.3.6a

9. Replace spool lock mechanism. Tighten each bolt evenly to prevent binding the lock.

10. Install the end cap and spring return parts in the reverse order of disassembly. Torque the end cap screws 2-3 ft.lbs. (2.7-4 N.M.).

11. Reconnect the foot pedal linkage.

IMPORTANT

Do not intermix parts from one spool with another. Keep spool parts seperate.

12. Start the engine and check for leaks.

IMPORTANT

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

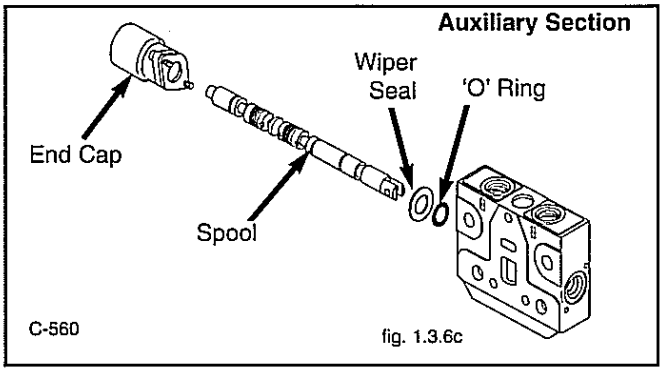


fig. 1.3.6c

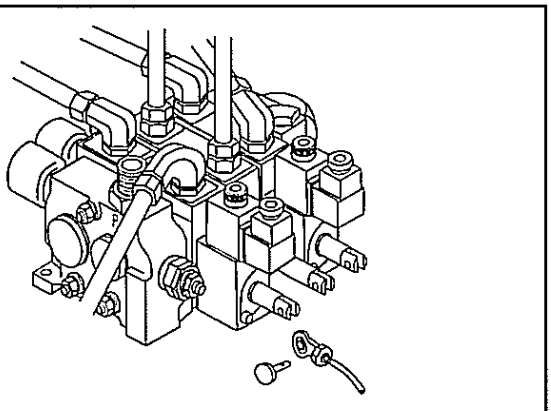


fig. 1.3.6b

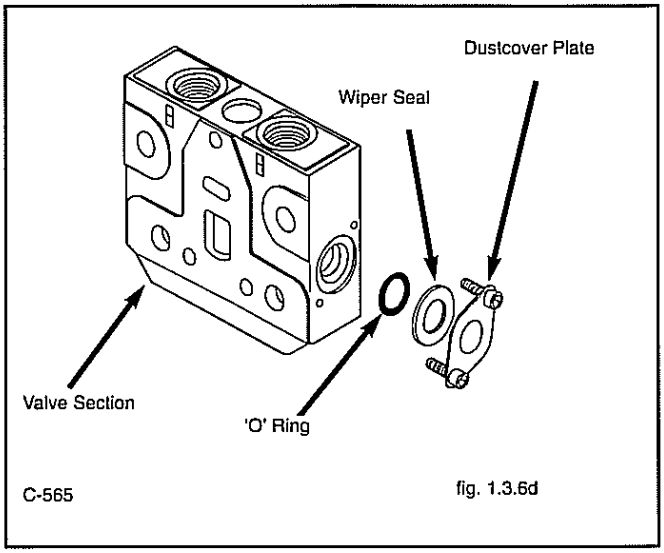


fig. 1.3.6d

SECTION 1 HYDRAULICS

1.4 HYDRAULIC CYLINDERS

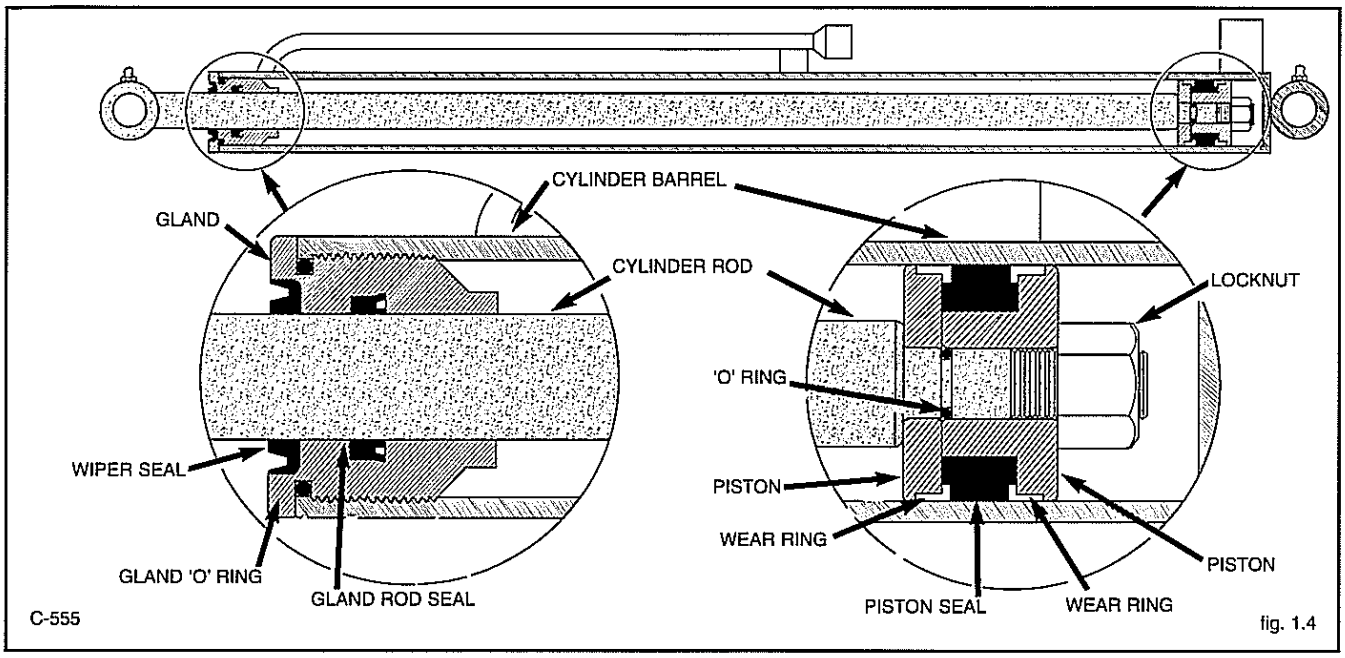


fig. 1.4

1.4.1 SPECIFICATIONS

	BOOM	BUCKET
Type.....	Double acting	Double acting
Qty. per model.....	2	2
Rod diameter....	1.25 in. (31.8mm)	1.125 in. (28.6 mm)
Bore diameter.....	2 in. (50.8 mm)	2.5 in. (63.5 mm)
Stroke.....	27.125 in. (689 mm)	13.375 in. (340 mm)

1.4.2 GENERAL INFORMATION

All cylinders are double acting being designed to both extend and retract under hydraulic pressure.

The piston rods, which are made of high strength distortion free material, are precision ground and hard chrome plated. The cylinder barrels are microhoned to close tolerance, straightness and smooth finish for long piston packing life.

All cylinders have a two piece piston assembly made of ductile iron and a polypac seal arrangement consisting of a piston seal and two wear rings.

The gland rod seal consists of a 'U' cup which faces the pressurized oil. The rod wiper keeps foreign matter from entering the cylinder by wiping the rod clean as the cylinder retracts.

Two types of outer gland seals are used. One type consists of an O-ring with a teflon back-up washer installed on the low pressure side of the O-ring. The other type consists of an O-ring which seals between the gland and the end of the cylinder barrel. The seal kit contains seals to service both types of glands.

1.4.3 TESTING, PISTON SEALS

If the boom or bucket cylinders drift down with the control valve in neutral position, and with no external leaks in the hydraulic system, the following test will indicate if oil is leaking by the cylinder piston seal. Before performing the test ensure the foot pedals are not binding and the hydraulic control valve spools are centering in neutral position.

Boom Cylinders

1. This test must be performed with the engine running. Remove any attachment and block the loader securely with all four wheels clear of the ground.

2. Lower the lift arms completely down. Shut off the engine and cycle the foot pedals to release hydraulic pressure.

3. Disconnect the hydraulic hose from the boom cylinder rear port (fig. 1.4.3a). Cap the hose.

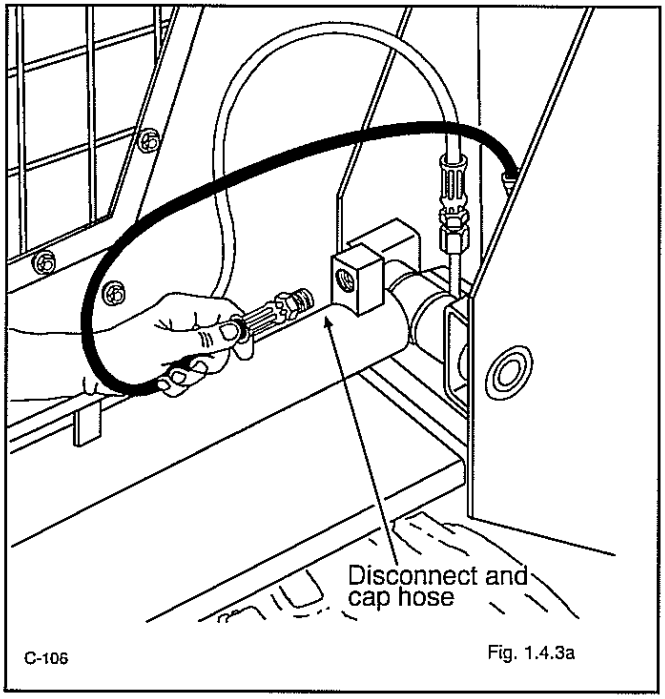
4. Start the engine. Push down on the toe of the boom foot control pedal (do not put in float position).

IMPORTANT

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

5. If oil leaks from the rear boom cylinder port, remove the cylinder or cylinders and make repairs as needed (see section 1.4.4 and 1.4.5). If there is no leakage from the rear boom cylinder port check for internal leakage at the control valve (section 1.3.5).

6. Connect the hydraulic hose to the rear port of the boom cylinder.



C-106 Fig. 1.4.3a

Bucket Cylinders

1. This test must be performed with the engine running. Remove any attachment and block the loader securely with all four wheels clear of the ground.

2. Retract the bucket cylinders fully (rollback) and stop the engine. Cycle the foot pedals to release hydraulic pressure.

3. Disconnect the hydraulic hose from the bucket cylinder rear port (fig. 1.4.3b). Cap the hose.

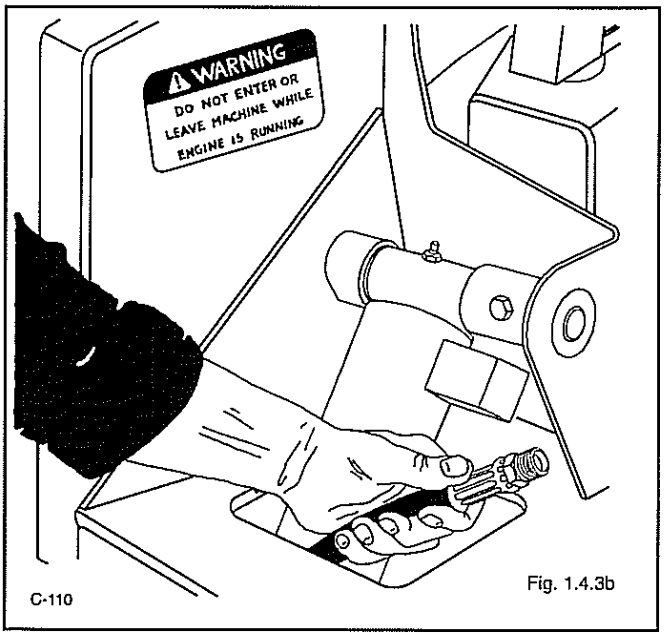
4. Start the engine. Push down on the heel of the bucket foot control pedal.

WARNING

To prevent personal injury never repair or tighten hydraulic hoses or fittings with the engine running or the system under pressure.

5. If oil leaks from the rear bucket cylinder port, remove the cylinder or cylinders and make repairs as needed (see section 1.4.4 and 1.4.5). If there is no leakage from the rear bucket cylinder port check for internal leakage at the control valve (section 1.3.5).

6. Connect the hydraulic hose to the rear port of the bucket cylinder.



C-110 Fig. 1.4.3b

1.4.4 CYLINDER REMOVAL

Boom Cylinder - Removal

1. Stop the engine and cycle the foot pedals to relieve any hydraulic pressure in the system.

2. Put a floor jack under the boom arms (fig. 1.4.4a).

3. Lock the boom lift foot pedal in float position by pushing firmly down on the toe of the pedal (see section 4.2.1).

4. Raise the boom arms with the floor jack until the pivot pins in the rod end of the boom cylinders can be removed.

5. Remove the locknut, washer and bolt from the pivot pin at the rod end of the boom cylinders (fig. 1.4.4b).

SECTION 1 HYDRAULICS

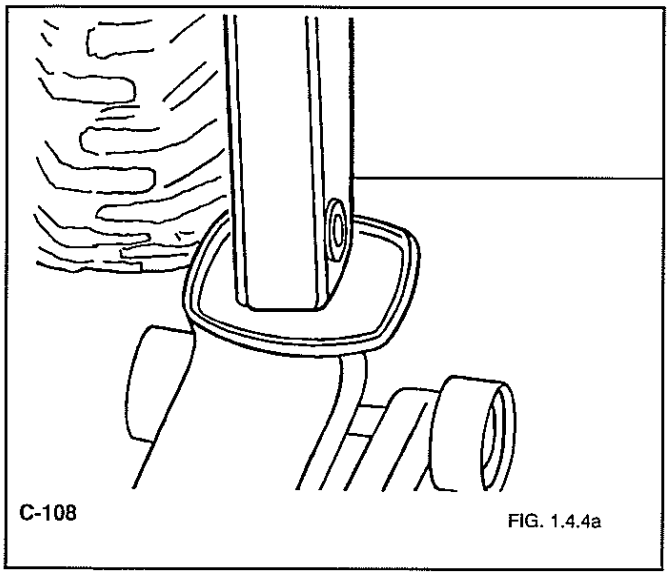


FIG. 1.4.4a

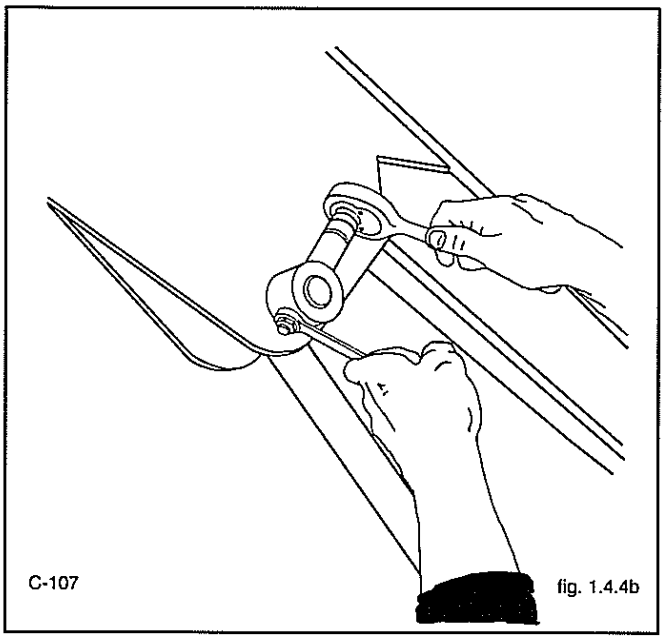


fig. 1.4.4b

6. Remove the pivot pins (fig. 1.4.4c). Place a support under the boom cylinder to prevent the cylinder from falling when the pivot pin is removed.

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).

WARNING

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

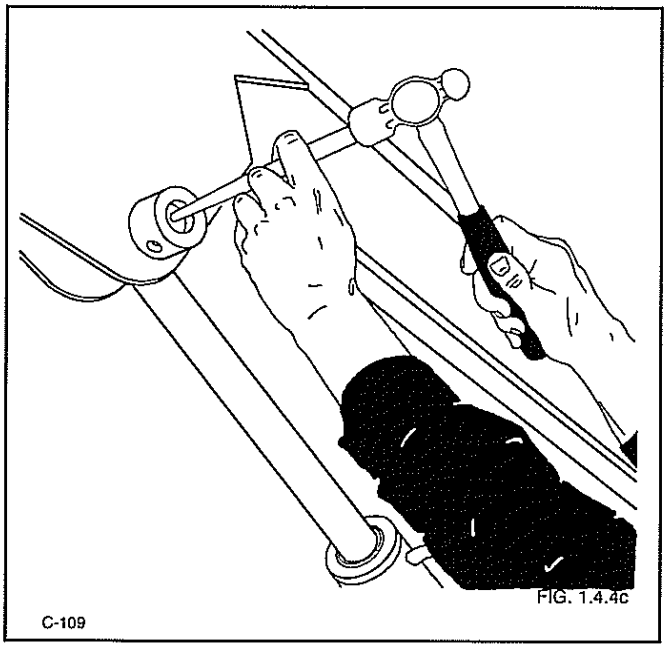


FIG. 1.4.4c

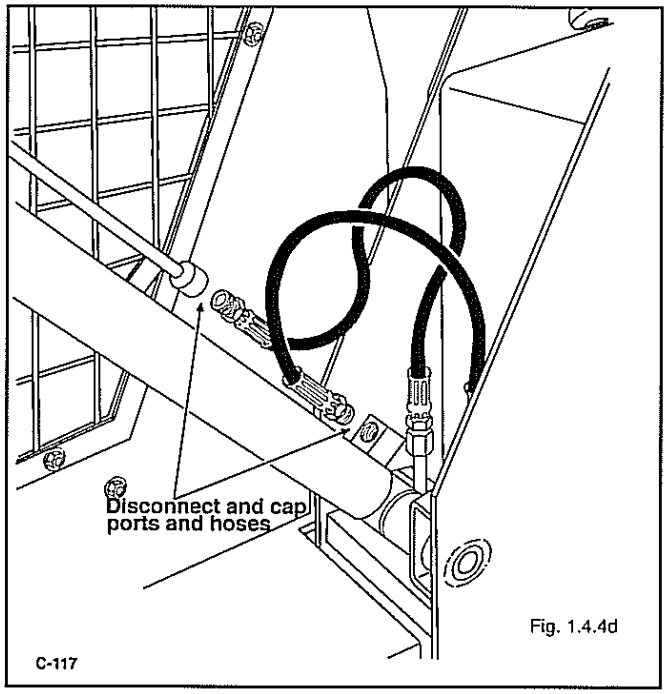


Fig. 1.4.4d

WARNING

To prevent personal injury never repair or tighten hydraulic hoses or fittings with the engine running or the system under pressure.

SECTION 1 HYDRAULICS

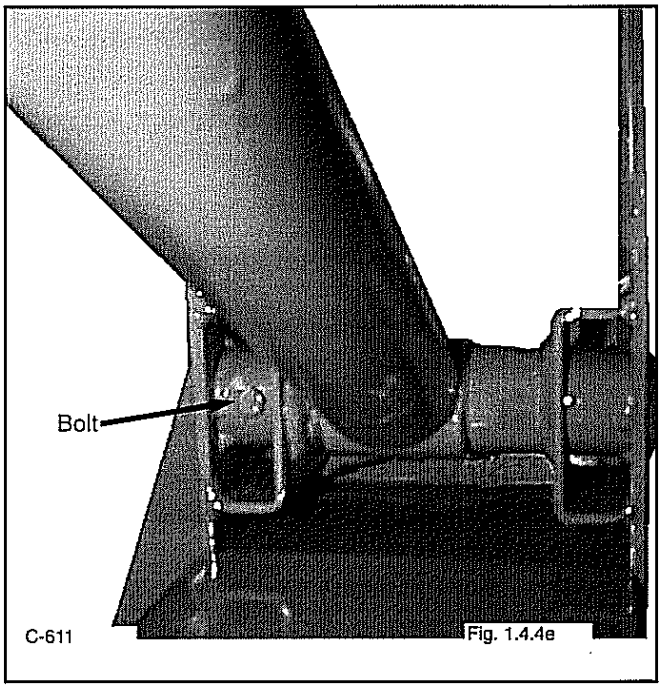


Fig. 1.4.4e

9. Remove the pivot pin (fig. 1.4.4f).

10. Remove the boom cylinder from the loader.

IMPORTANT

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

11. Lower the boom arms and remove the floor jack.

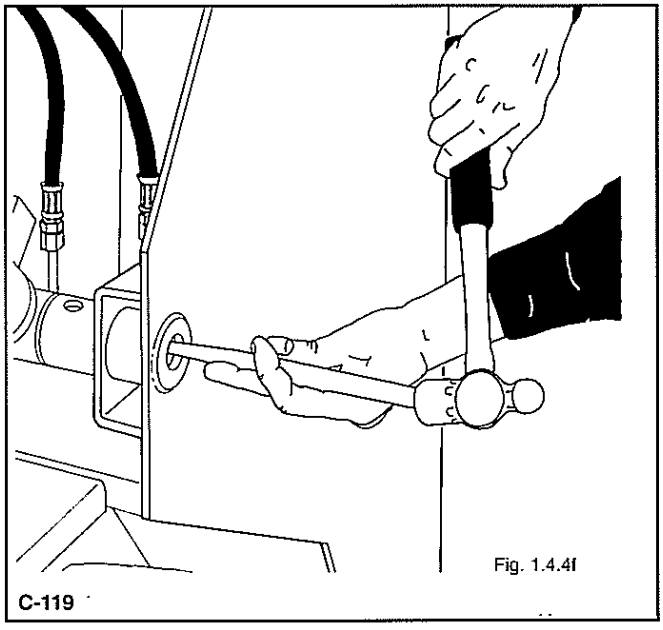


Fig. 1.4.4f

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

To prevent personal injury do not work on a loader with the boom arms in a raised position unless the boom locks are engaged.

WARNING

To prevent personal injury never repair or tighten hydraulic hoses or fittings with the engine running or the system under pressure.

2. Remove the hydraulic hose from the rear port of the bucket cylinder (fig. 1.4.4g). Plug the cylinder port and cap the hydraulic hose.

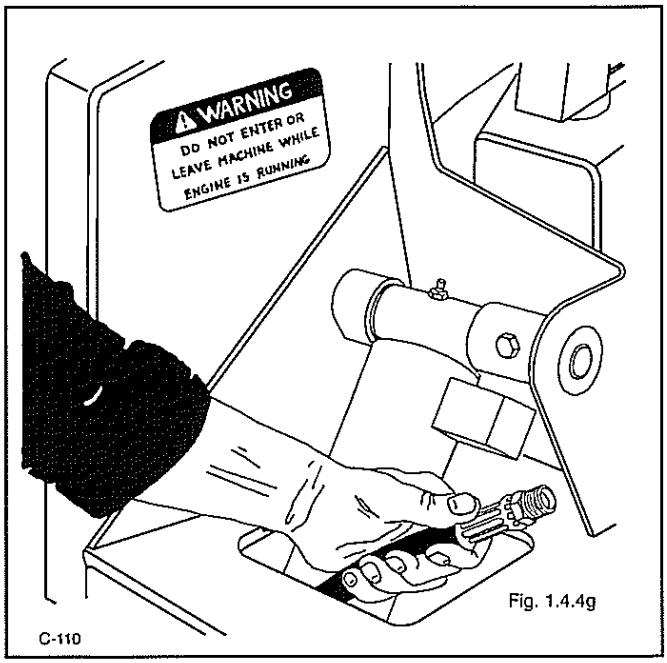


Fig. 1.4.4g

3. Remove the hydraulic hose from the rod end port of the bucket cylinder (fig. 1.4.4h). Plug the cylinder port and cap the hydraulic hose.

4. Remove the locknut, washer and bolt at the rod end of the cylinder (fig. 1.4.4j).

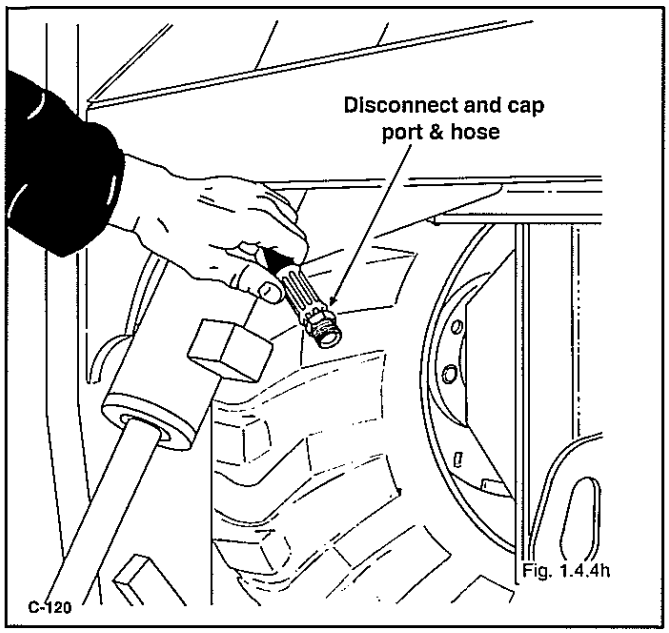


Fig. 1.4.4h

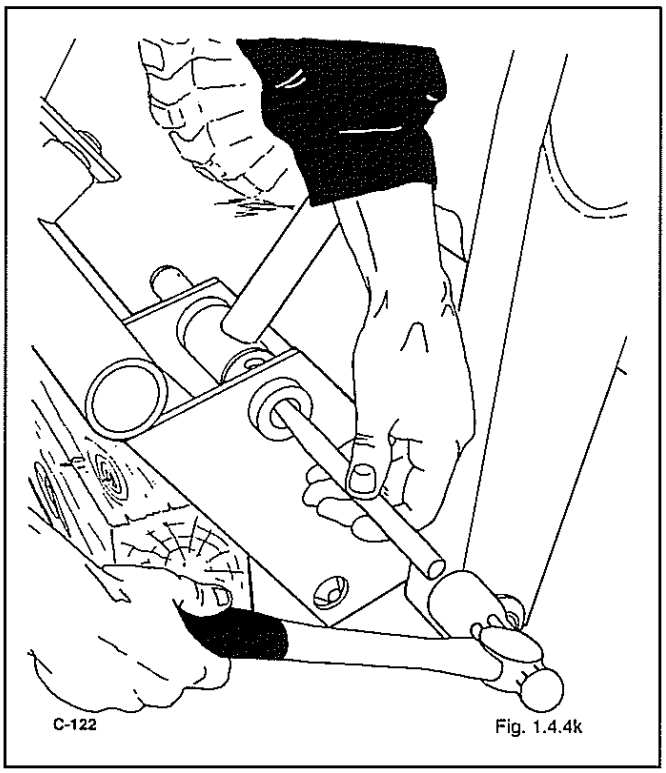


Fig. 1.4.4k

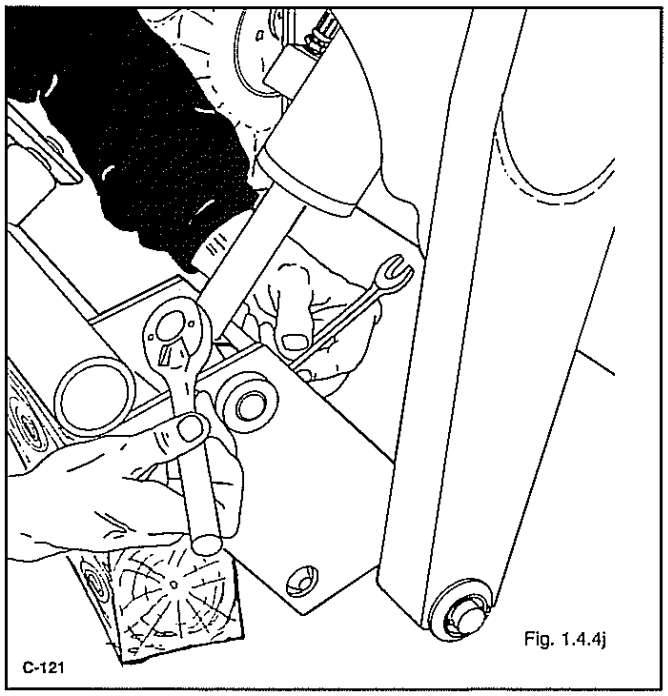


Fig. 1.4.4j

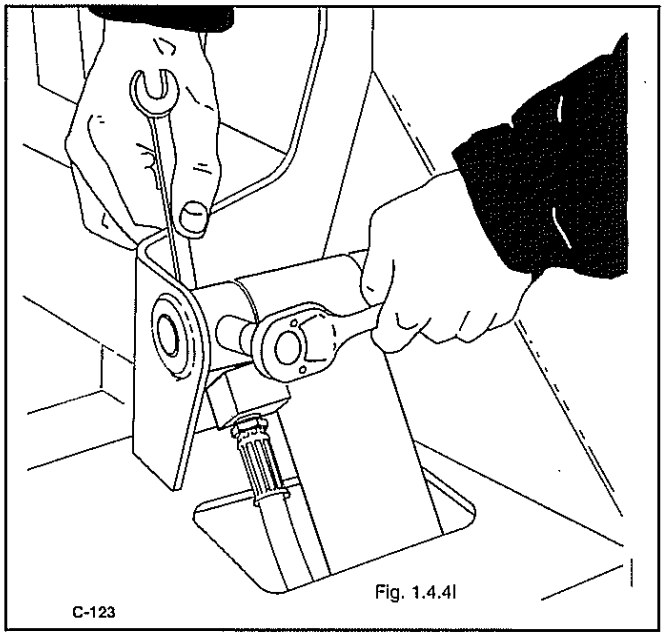


Fig. 1.4.4l

5. Remove the pivot pin (fig. 1.4.4k).

6. Remove the locknut, washer and bolt at the rear bushing of the bucket cylinder (fig. 1.4.4l).

7. Remove the pivot pin (fig. 1.4.4m). A hole is located on the boom arm side plate to allow driving out the pivot pin.

8. Remove the cylinder from the loader.

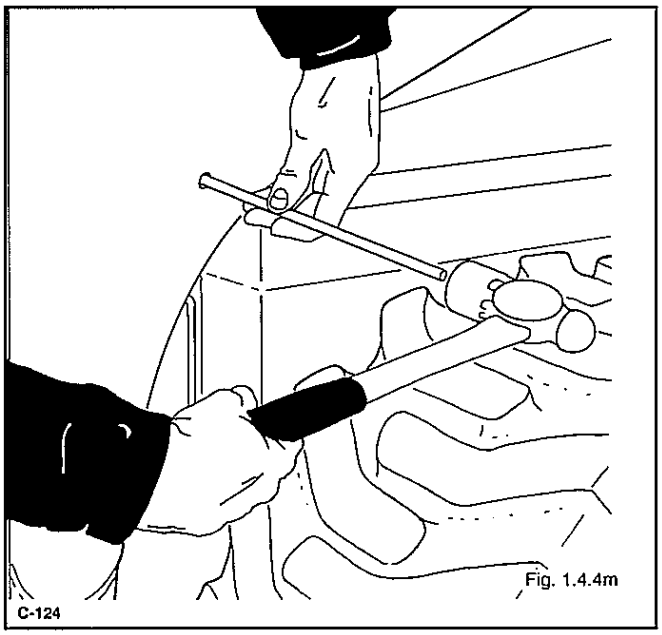


Fig. 1.4.4m

1.4.5 CYLINDER DISASSEMBLY AND INSPECTION

Before disassembling the hydraulic cylinder, clean the body with a suitable solvent. Ensure all openings are plugged to prevent solvent entering the cylinder.

IMPORTANT

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

Disassembly

1. Place the base end of the cylinder in a vice and support the front end of the body (fig. 1.4.5a). Remove the plugs from the hose ports.
2. Using a spanner wrench, unscrew the gland from the cylinder barrel (fig. 1.4.5a).
3. Remove the rod, gland and piston assembly from the cylinder barrel (fig. 1.4.5b).

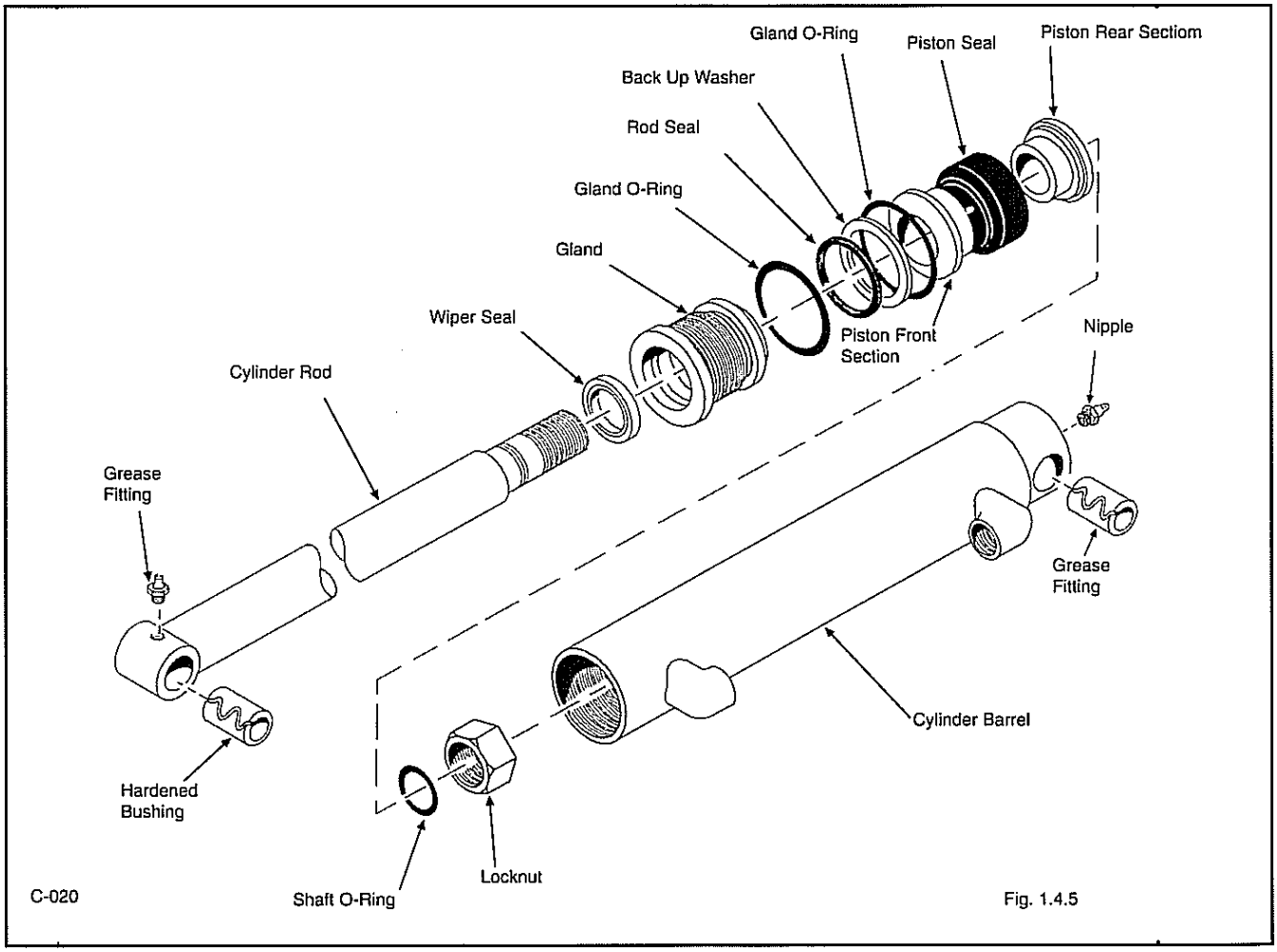


Fig. 1.4.5

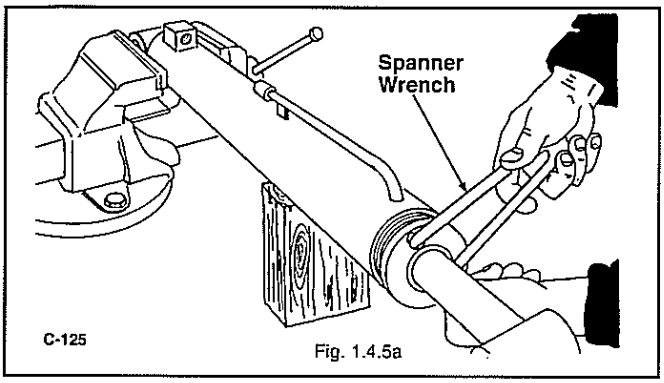


Fig. 1.4.5a

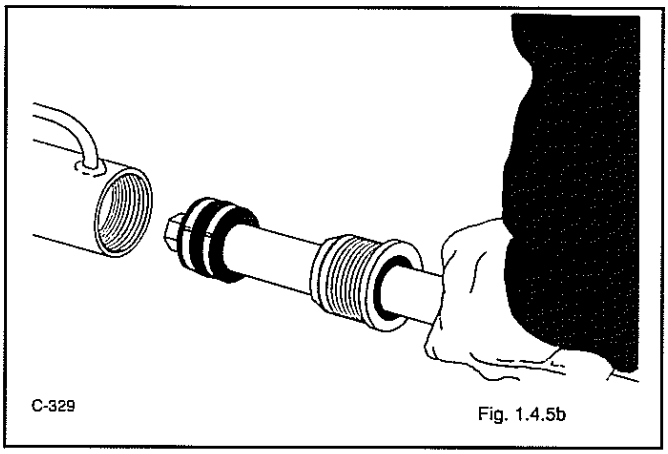


Fig. 1.4.5b

4. Place the rod end in a vice and remove the nut (fig. 1.4.5c).

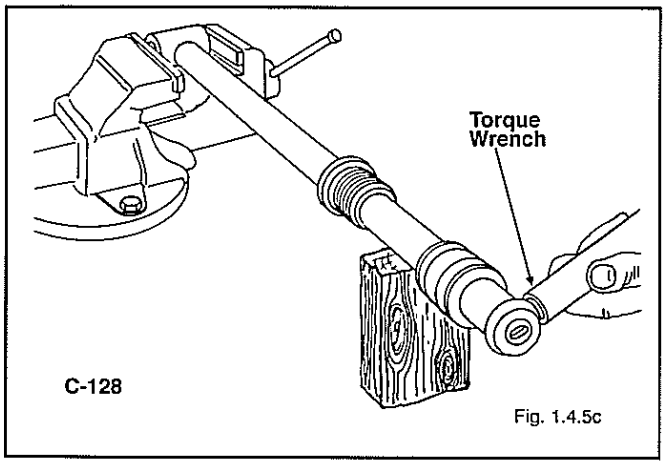


Fig. 1.4.5c

5. Remove two piece piston assembly from the cylinder rod (fig. 1.4.5d).

6. Remove and discard the O-ring from the end of the cylinder rod (fig. 1.4.5e).

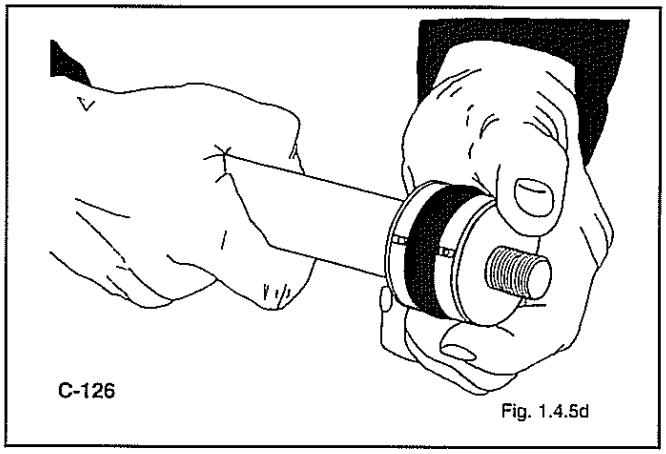


Fig. 1.4.5d

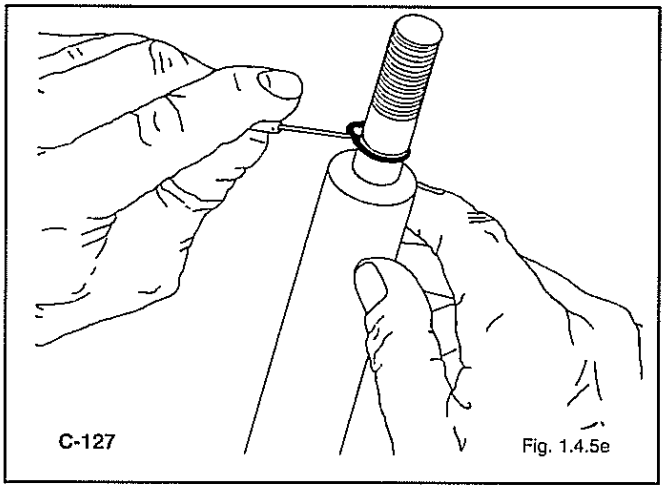


Fig. 1.4.5e

7. Remove the gland assembly from the cylinder rod (fig. 1.4.5f).

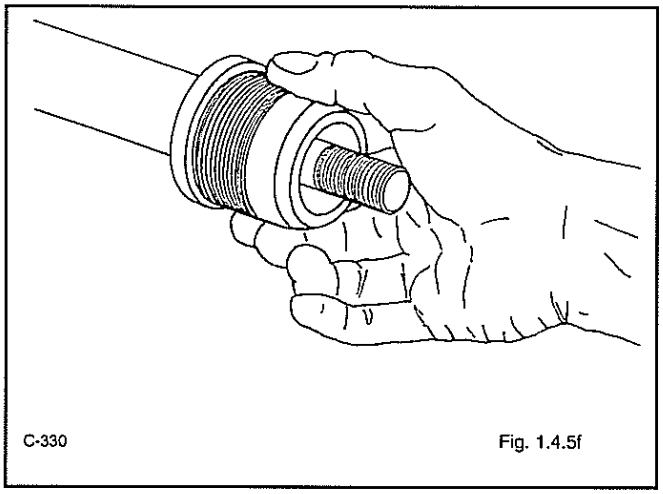


Fig. 1.4.5f

8. Remove and discard the wiper seal, rod seal and O-rings and teflon back-up washer from the gland assembly (fig. 1.4.5g).

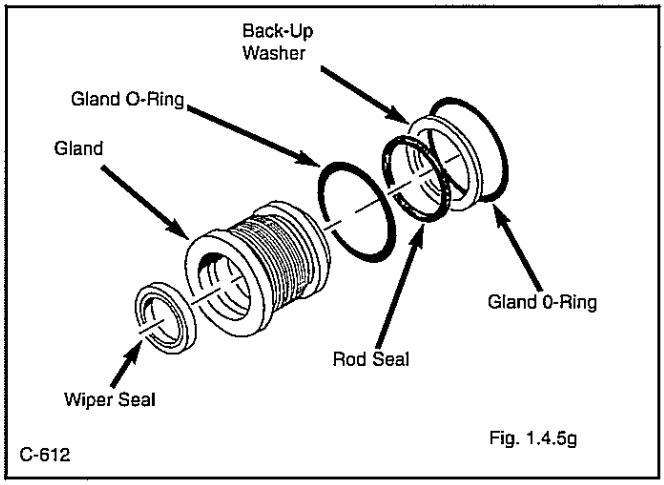


Fig. 1.4.5g

9. Remove and discard the wear rings and piston seal from the piston assembly (fig. 1.4.5h).

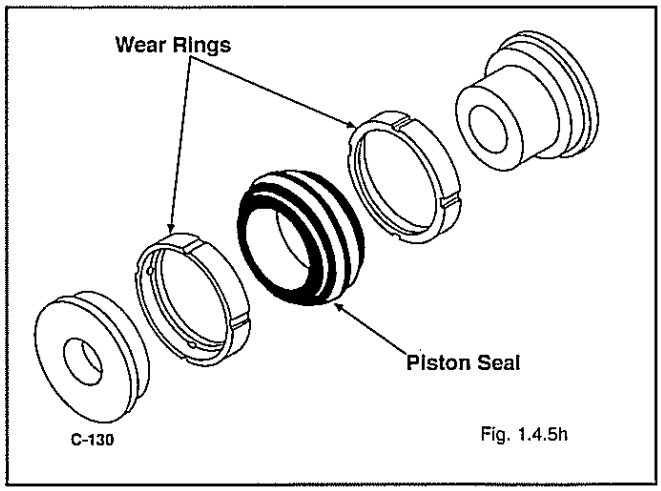


Fig. 1.4.5h

Inspection

1. Inspect the cylinder rod for scratches, dents and other damage. Minor rod damage may be repaired using a fine abrasive. Major scratches or dents are not repairable and the rod should be replaced. The chrome surface must be intact to provide a rust-resistant surface. Blemishes on the rod will damage the rod seal and wiper and will cause leaking after a short period of use.

2. Inspect the cylinder rod threads. The threads must be in good condition because of the high torque required to secure the piston assembly.

3. Inspect the gland for nicks, burrs or other damage. Minor damage can be repaired using a fine abrasive. Smooth down any sharp edges that could damage seals and cause leakage.

4. Inspect the gland threads for damage.

5. Inspect the piston assembly for damage. Remove minor scratches or damage with a fine abrasive.

6. Using a suitable light inspect the cylinder bore for scratches, dents, burrs or other damage. Install a new cylinder barrel if there is any evidence of damage.

7. Inspect the cylinder barrel threads for damage. The threads must be in good condition because of the high torque required to secure the gland assembly.

Assembly

1. Install a new gland rod seal by forming the seal into a 'U' shape, seating it in its groove, and straightening the seal back into its original shape (fig. 1.4.5i).

2. Install a new rod wiper seal in the gland (fig. 1.4.5i).

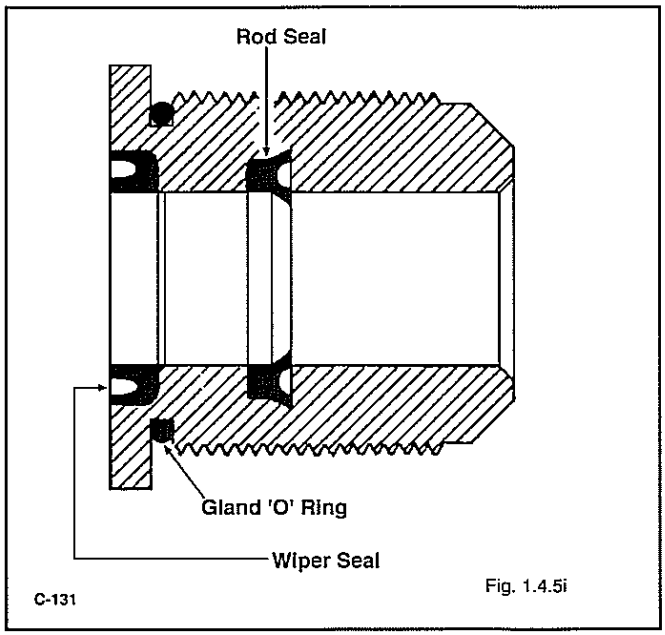


Fig. 1.4.5i

3. The gland sealing arrangements have been used on the boom lift and bucket tilt cylinders (fig. 1.4.5j).

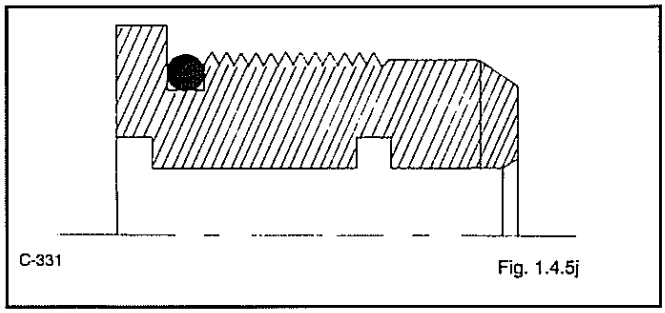
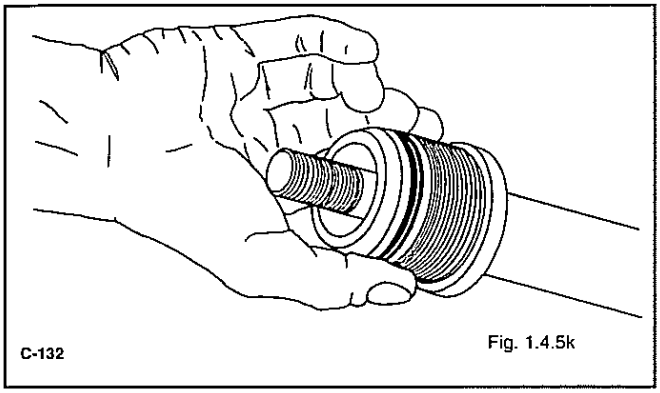


Fig. 1.4.5j

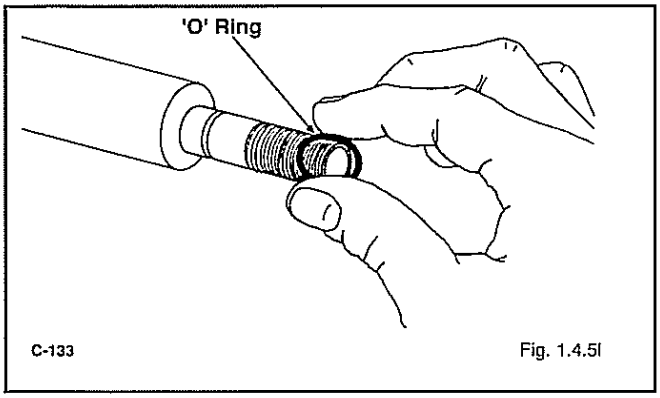
4. Install a new gland O-ring (fig. 1.4.5j).

5. Coat the cylinder rod with light oil and assemble the gland assembly (fig. 1.4.5k) on the rod.



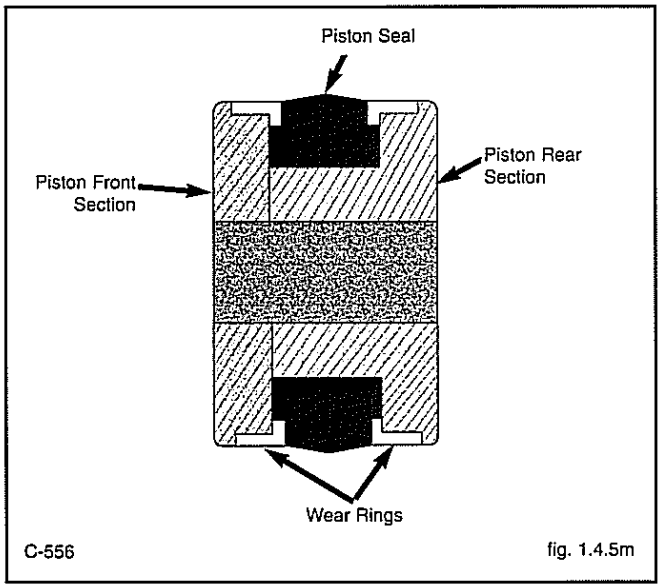
C-132 Fig. 1.4.5k

6. Install a new O-ring on the cylinder rod (fig. 1.4.5l).



C-133 Fig. 1.4.5l

7. Install new wear rings and piston seal on the two piece piston assembly (fig. 1.4.5m).



C-556 fig. 1.4.5m

1.5 HYDRAULIC OIL FILTER

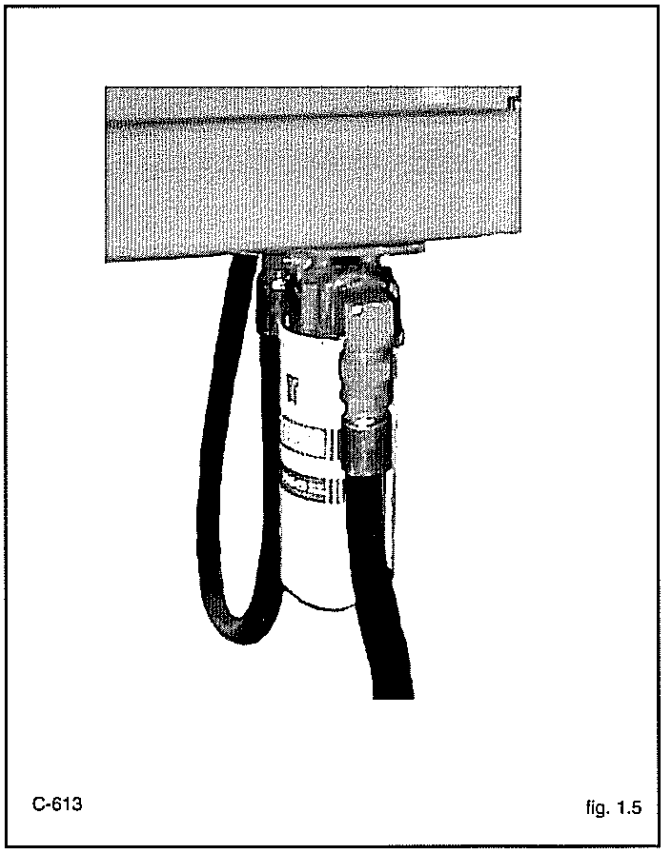
1.5.1 SPECIFICATIONS

The hydraulic oil filter (fig. 1.5) is located on the left hand side of the machine inside the engine compartment.

1.5.2 GENERAL INFORMATION

The 10 micron, replaceable element filters all oil returning from the control valve before it enters the oil cooler and returns to the oil reservoir or enters the hydrostatic drive system charge pump.

The filter material is a resin impregnated cellulose which features an accordian pleated design to provide maximum filtering area.



C-613 fig. 1.5

A bypass relief valve built into the replaceable element diverts oil from the filter when more than 25 PSI (1.7 bar) differential pressure is required to force oil through the element.

1.5.3 FILTER REPLACEMENT

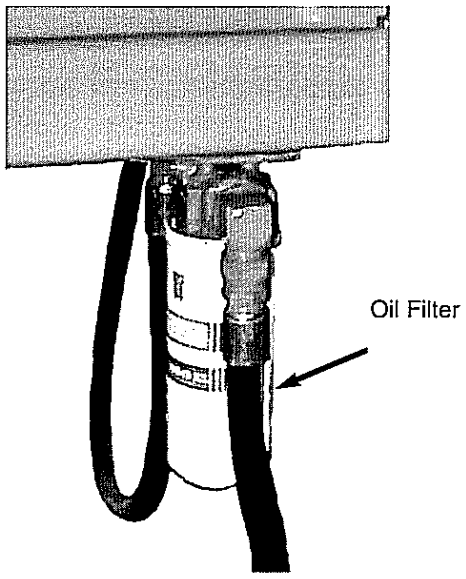
The hyraulic filter must be changed after the first 50 hours of operation and every 150 hours thereafter.

1. Shut off the engine, lower the boom arms, ground any attachment and set the parking brake.

WARNING

To avoid personal injury never repair or tighten hydraulic hoses or fittings with the engine running or the system under pressure.

2. Open the rear door. Turn filter cartridge counter-clockwise to remove.
3. Lubricate the new filter gasket with system fluid.
4. Turn the cartridge clockwise until snug against the sealing gasket.



C-613 Fig. 1.5.3

1.6 OIL COOLER

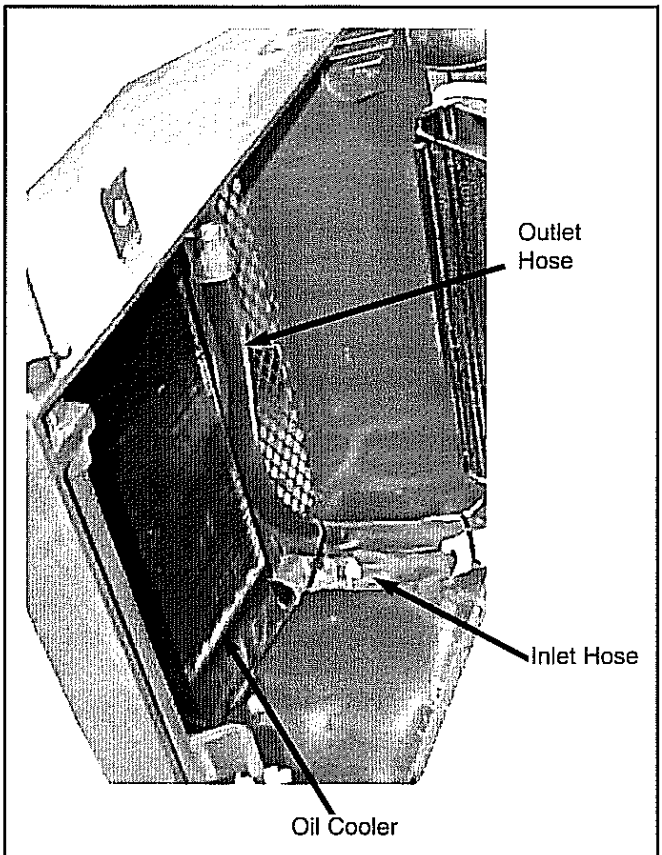
1.6.1 SPECIFICATIONS

Rating BTU per min	440
Max. work pressure	500 PSI (34.5 Bar)
Min. burst pressure	1500 PSI (103.4 Bar)
No. of tubes	14
No. of fins	7 per in. (25 mm)
Fin gauge	018 (.457 mm)
Core area	140 sq. in. (903 cm^2)

1.6.2 GENERAL INFORMATION

The hydraulic oil cooler (fig. 1.6.1) is mounted on the inside of the rear door.

All hydraulic oil returning from the hydraulic control valve circulates through the cooler before returning to the hydraulic reservoir or entering the hydrostatic drive system charge pump. Air forced through the oil cooler fins by the engine fan cools the oil.



C-614 Fig. 1.6.1

1.6.3 COOLER SERVICE

The hydraulic oil cooler should be checked daily for dirt buildup on the cooling fins. If the air flow through the cooling fins is blocked or restricted overheating of the hydraulic system will occur. Clean any dirt buildup on the cooling fins with compressed air.

1.7 OIL RESERVOIR

1.7.1 SPECIFICATIONS

Reservoir capacity.....8 gal. (30.3 l)
Oill type.....10W30API, SE, CD
No. of suction filters.....1
Suction filter rating.....100 micron
Breather cap filter.....10 micron
Filler inlet screen.....30 mesh
Change oil every.....1000 hours
Change suction filters every.....1000 hours

FIGURE 1.7

1. Oil reservoir
2. Filler cap assembly
3. Pump/motor drain ports
4. Max. oil check sight
5. Min. oil check gauge
6. Pump suction port
7. Temp. Sender
8. Suction elements
9. Hydraulic oil heater
10. Drain plug
11. Cover plate

1.7.2 GENERAL INFORMATION

The hydraulic oil reservoir is located at the rear of the loader on the left hand side (fig. 1.7). The reservoir is completely separate from all chain and gear drives to eliminate contamination. A magnetic drain plug is installed in the bottom of the reservoir to assist in removing metal particles from the oil.

The breather filler cap is located at the top of the tank and has a built in 10 micron filter to reduce contaminated air entering the reservoir as it breathes.

The filter is also equipped with a 30 mesh screen. Oil flowing to the hydraulic gear pump or returning to the reservoir from the oil cooler pass through one 100 micron suction filters located inside the hydraulic reservoir (fig. 1.7).

Oil level is checked through a sight gauge which indicates both maximum and minimum oil levels. To assist in cleaning or service work inside the reservoir there is a bolt on inspection cover. For cold weather operation an optional hydraulic oil heater is available.

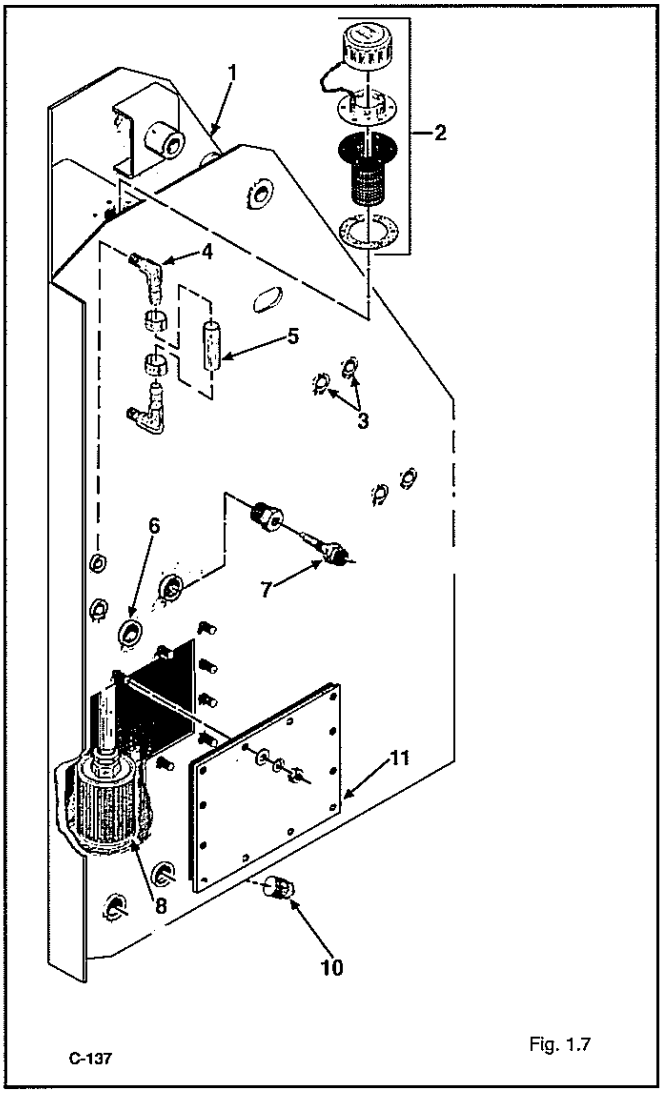


Fig. 1.7

1.7.3 CHECKING AND ADDING OIL

Oil Level Check

The oil level should be checked daily.

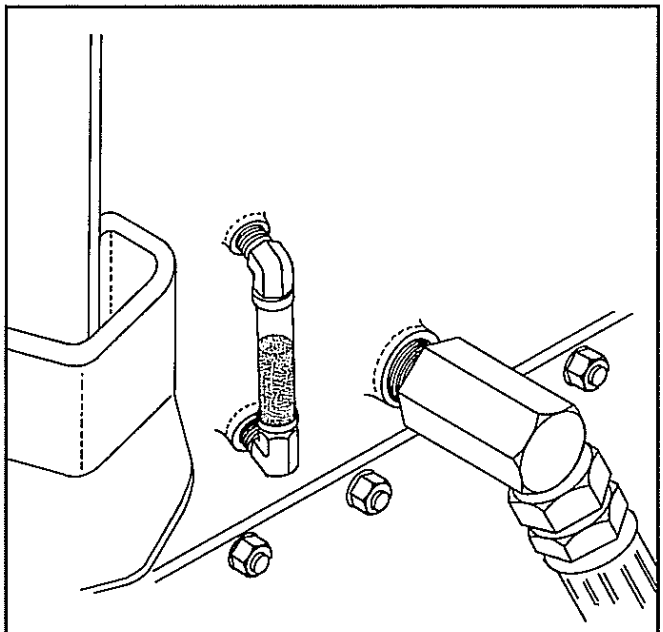
1. Check the oil level with the machine on level ground.

WARNING

To avoid personal injury do not service the loader with the engine running.

2. Shut off the engine, lower the boom arms, retract cylinders and engage the parking brake.

3. Open the rear door.



C-333

Fig. 1.7.3a

4. Check location of oil in the sight gauge (fig. 1.7.3a).

WARNING

To avoid personal injury do not service the loader with the engine running.

5. If oil is visible approximately mid-way the gauge, the level is correct.

Adding Oil

1. Open the oil filler cap (fig. 1.7.3b)

2. Inspect the filler screen in the filler neck for damage. If the filler screen is damaged replace it.

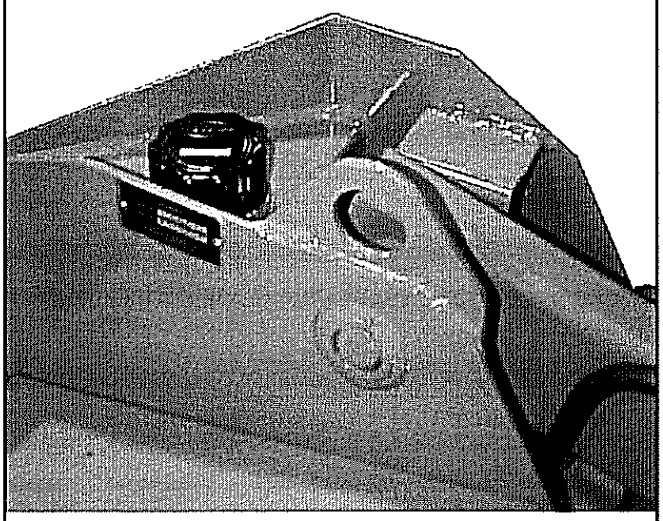
3. Using a clean container add 10W30 API Classification SE, CD Oil. Total reservoir capacity is 8 gal. (30.3 l).

4. Replace the filler cap.

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.

WARNING

To avoid personal injury do not work on a loader with the boom arms in a raised position unless the boom locks are engaged.



C-600

Fig. 1.7.3b

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. Shut off the engine and engage the parking brake.

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. Total reservoir capacity is 8 gal (30.3 l).

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

1.7.4 FILTER REPLACEMENT

The 100 micron 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).

WARNING

To avoid personal injury do not service the loader with the engine running.

2. Open the rear door and clean the area around the oil reservoir inspection cover.
3. Remove the inspection cover.
4. Remove the 100 micron suction filter (fig. 1.7.4).
5. Install new suction filter elements.
6. Install the coverplate. Seal with silicon.
7. Refill the oil reservoir using 10W30 API Classification SE/CD Oil only. Total reservoir capacity 8 gal. (30.3 l).

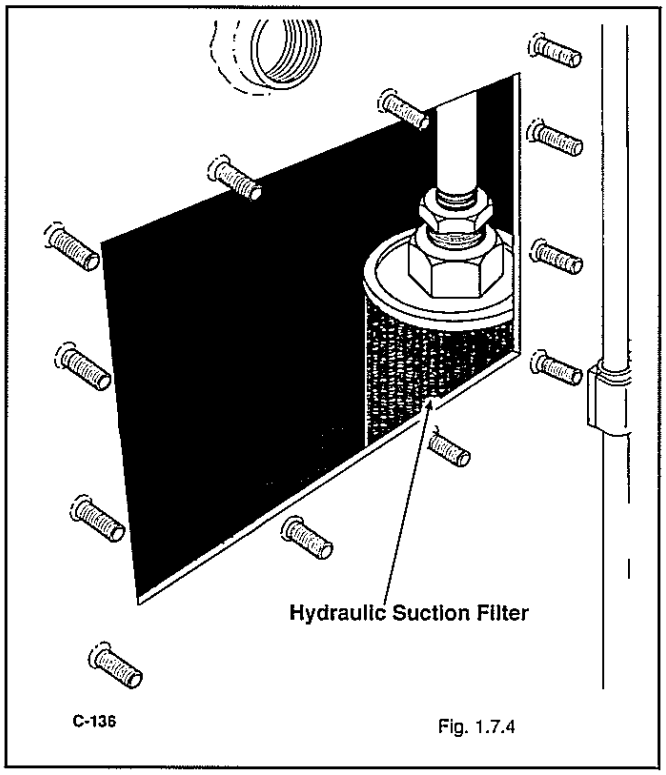


Fig. 1.7.4

1.8 TROUBLE SHOOTING- HYDRAULIC SYSTEM

Problem	Cause	Corrective Action	Section
Loss of hydraulic power (no flow from gear pump)	Reservoir low on oil	Check for leaks. Fill reservoir with 10W30 API, SE/CD oil	1.7.3
	Universal joint between engine and pump failure	Inspect and replace damaged parts. Check for misalignment	
	Gear pump not functioning	Inspect and replace damaged parts	1.2.4 1.2.5
	Spline coupling between front and rear hydrostatic pump failure	Inspect and replace damaged parts	2.2.6
Loss of hydraulic power (full flow from gear pump)	Auxiliary foot pedal engaged or switch on	Disengage	
	Foot pedal linkage disconnected or binding	Inspect and adjust or repair	4.2
	Relief valve failure or out of adjustment	Check pressure and adjust or repair	1.3.3
Hydraulic action jerky	Reservoir low on oil	Check for leaks. Fill with 10W30 API SE/ CD oil	1.7.3
	Foot pedal linkage worn or loose	Inspect and adjust or replace damaged parts	4.2
	Air in hydraulic system	Check for leaks between oil reservoir and pump. Bleed system by extending and retracting boom cylinders several times	
	Load check valve not functioning	Inspect and replace damaged parts	1.3.5
	Control valve spool spring return mechanism not functioning	Inspect and replace damaged parts	1.3.5

SECTION 1 HYDRAULICS

1.8 TROUBLE SHOOTING- HYDRAULIC SYSTEM

Problem	Cause	Corrective Action	Section
Boom raises slowly at full RPM	Reservoir low on oil	Check for leaks. Fill with 10W30 API SE/CD oil	1.7.3
	Foot pedal linkage binding	Inspect and adjust	4.2
	Auxiliary foot pedal engaged	Disengage	
	Attempting to lift more than rated capacity	Reduce load	
	Engine RPM too slow	Check engine RPM and reset	
Boom raises slowly at full RPM	Relief valve failure or out of adjustment	Check pressure and adjust or repair	1.3.3
	Oil bypassing one or both boom cylinder piston seals	Check piston seals for leakage and repair	1.4.3
	Internal leakage in gear pump	Test gear pump flow and repair	1.2.3 1.2.5
	Internal leakage in control valve	Inspect control valve and repair	1.3.5
Bucket or boom cylinders will not support a load (Leak down)	External leak between control valve and cylinders	Inspect and repair	
	Control valve spool not centering	Check foot pedals for binding repair	
		Check for damaged spring return mechanism on control valve spool	1.3.5
	Oil bypassing one or both cylinder piston seals	Check piston seals for leakage and repair	1.3.5

1.8 TROUBLE SHOOTING- HYDRAULIC SYSTEM

Problem	Cause	Corrective Action	Section
	Internal leakage in control valve	Inspect control valve and repair	1.3.5
Hydraulic oil overheating	Reservoir low on oil	Check for leaks and fill with 10W30 API SE/CD oil	1.7.3
	Oil cooler plugged or dirty (also check engine radiator)	Clean the cooling fins	1.6.3
	Auxiliary foot pedal engaged	Disengage	
	Engine RPM too slow	Check engine RPM and reset	
	Engine cooling fan reversed	Check fan and install correctly	
	Relief valve failure or out of adjustment	Check pressure and adjust	1.3.3
	Temperature sender defective	Replace	
	Wrong type of fluid	Replace	1.7.3

2 HYDROSTATIC DRIVE SYSTEM

2 HYDRAULIC DRIVE SYSTEM

2.1 HYDROSTATIC DRIVE CIRCUIT

2.1.1 SPECIFICATIONS

Pump type.....Hydrostatic, variable displacement, reversable piston
No. of drive pumps.....2
Mounting.....Tandem
Rotation (viewed from shaft end).....R.H.
Displacement.....2.48 in.3/REV (40.64 cm)
Operating speed.....2800
Relief valve setting..... 3750 PSI (258.5 BAR)
No. relief valves per pump.....2
Max. allowable case pressure.....25 PSI
Motor type.....Geroler, Torque Motor
Displacement.....29.9 cu. in. (489.9 cm)
Reservoir capacity.....8 gal. (30.3 l)
Fluid type.....10W30 API classification SE/CD
Filtration.....10 micron
Reservoir filtration.....One, 100 micron elements

2.1.2 GENERAL INFORMATION - HYDROSTATIC DRIVE CIRCUIT

The hydrostatic drive system (fig. 2.1.2) consists of two hydrostatic variable displacement piston pumps (5) and (6), mounted in tandem, and connected through high pressure lines to two fixed displacement torque motors (7). Hydrostatic pump (5) and the R.H. torque motor (7) provide power through a chain drive to the wheels on the R.H. side of the loader. The rear pump (6) and torque motor (7) provide drive power to the L.H. wheels.

The hydrostatic pumps (5) and (6) are connected directly to the engine through a double universal joint located between the rear pump (6) input shaft and the engine flywheel.

The steering levers, which control both the loaders speed and direction are connected through a mechanical linkage to the two hydrostatic pump camplate shafts (15) which control the flow of oil from both pumps. As the steering levers are moved, oil is pumped from the hydrostatic pumps to the torque motors (7) which in turn drive the loader wheels. Drive speed is controlled by the amount the steering levers are moved which controls the volume of oil pumped from the variable displacement pumps (5) and (6) to the fixed displacement torque motors (7).

The oil pumped under pressure from the hydrostatic pumps (5) and (6) returns from the torque motors (7) back to the hydrostatic pumps where it is repressurized. This creates a closed loop circuit. Each pump has two relief valves set at 3750 PSI (258.5 BAR) for circuit protection.

A certain amount of leakage oil occurs internally within the pumps and motors for lubrication as well as to remove some of the warm working oil from the closed loop circuit. This oil enters the pump and motor housings where it is drained through lines (16) back to the oil reservoir (1).

To replenish the leakage oil from the closed loop circuits a flow diverter valve has been placed just after the return filter. This valve allows return filtered oil to flow directly to the tandem pump until the charge pressure reaches 80 to 120 P.S.I.

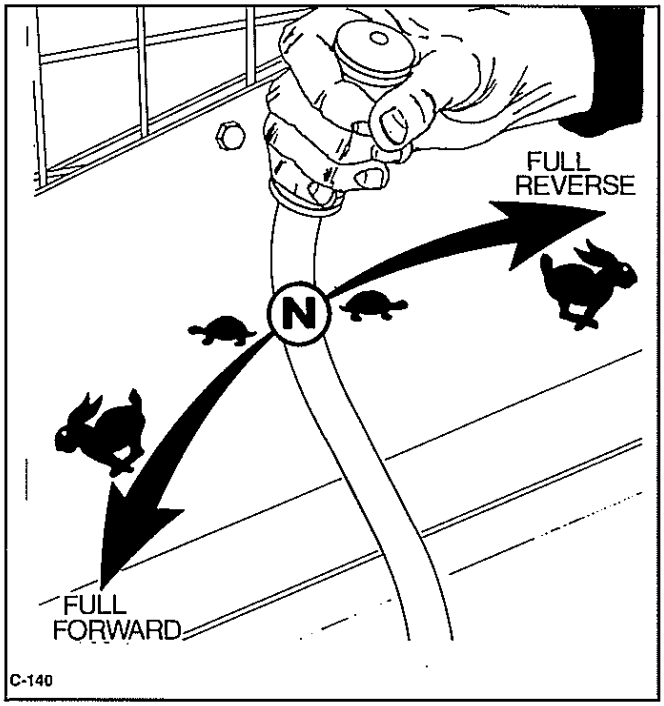
2.1.3 CONTROL FUNCTIONS

Two steering levers control speed direction and turn the loader. The R.H. lever controls the wheels on the R.H. side of the loader and the L.H. lever the L.H. wheels. Loader speed is controlled by the amount each lever is moved from center or neutral position (fig. 2.1.3).

WARNING

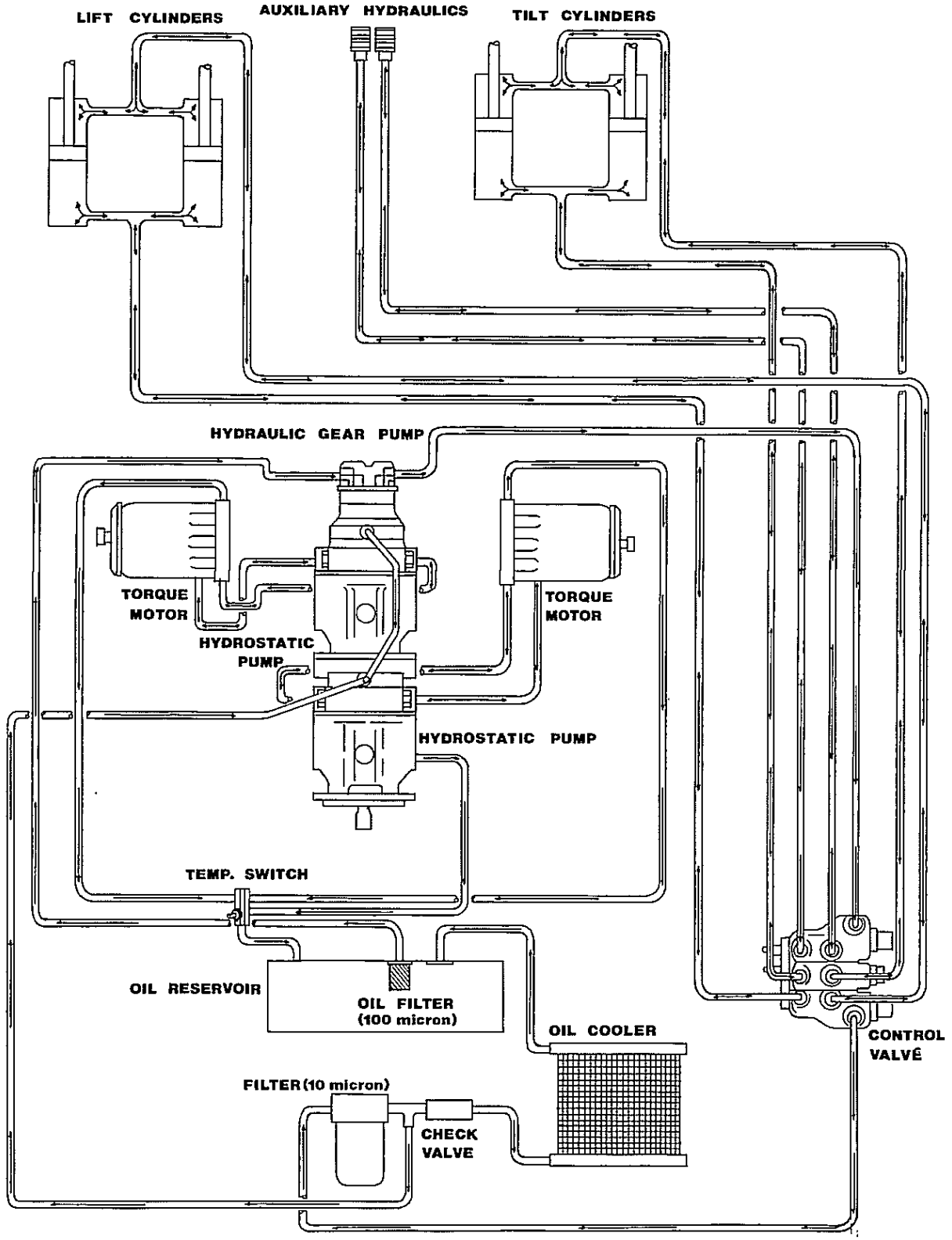
To avoid personal injury do not start the engine unless you are in the seat with the seat belt fastened around you.

The further away from neutral the faster the travel speed.



For maximum power and slow travel speed move the control levers only a small amount.

2 HYDRAULIC DRIVE SYSTEM



C-338

Fig. 2.1.2

2 HYDRAULIC DRIVE SYSTEM

To drive the loader forward in a straight line, move both control levers forward the same amount (fig. 2.1.3A).

To drive the loader in reverse in a straight line, move both control levers back the same amount (fig. 2.1.3B).

The loader is steered by moving one lever further forward than the other. To turn right move the left lever further than the right lever, to turn left move the right lever further than the left lever.

For the loader to turn or "skid steer" within its own length, one lever is moved forward and the other back. This causes the wheels on one side to turn forward and the wheels on the other side to reverse turning the loader (fig. 2.1.3 C&D).

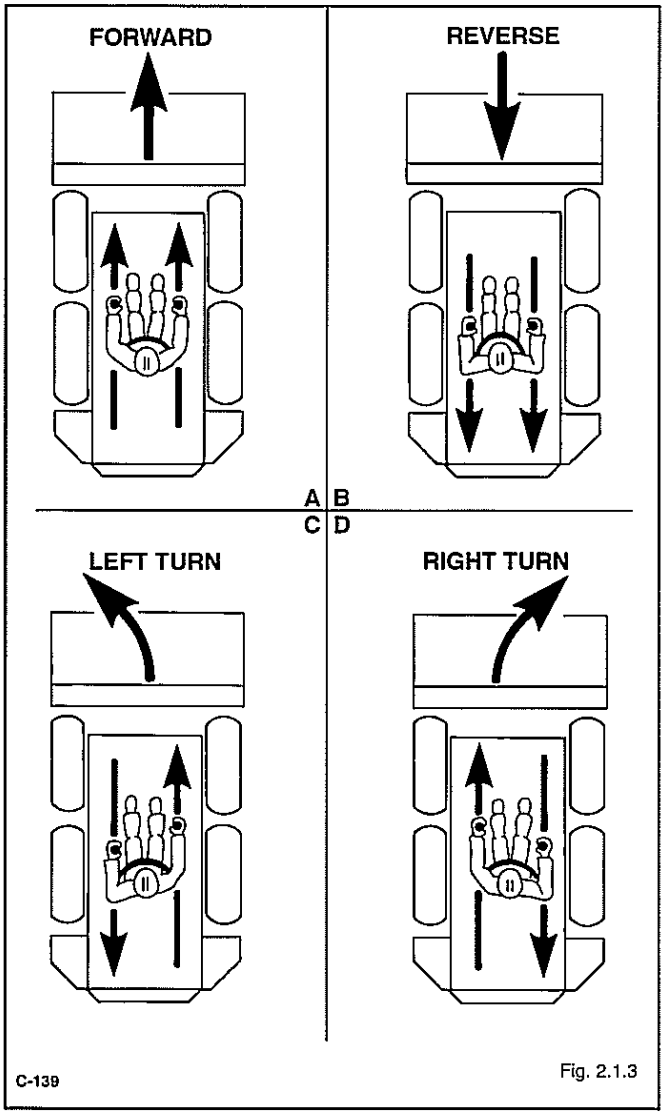


Fig. 2.1.3

2.2 HYDROSTATIC PUMPS

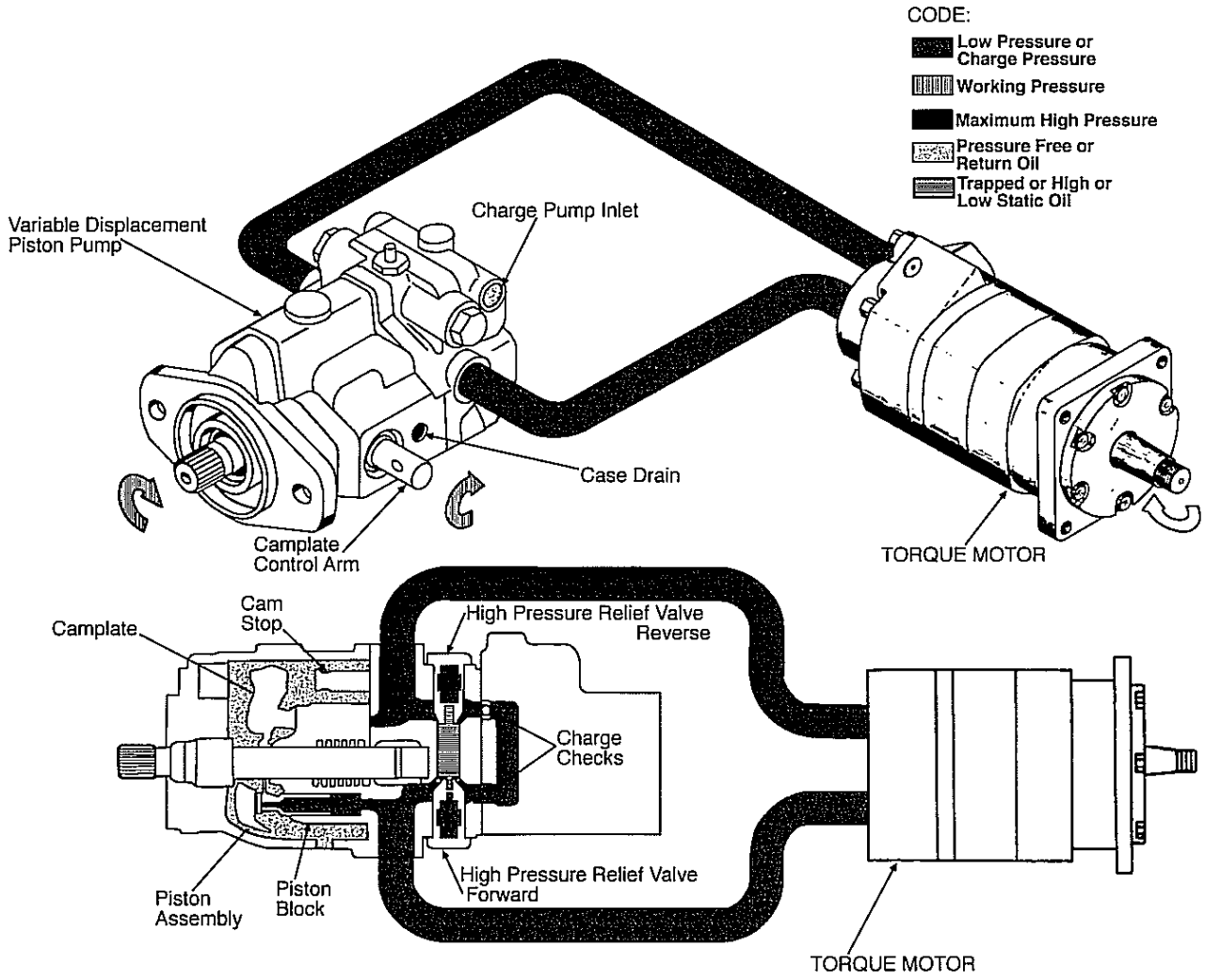
2.2.1 SPECIFICATIONS

Pump type.....Hydrostatic, variable displacement, reversal piston
No. of drive pumps.....2
Mounting.....Tandem
Rotation (viewed from shaft end).....R.H.
Displacement.....2.48 in.3/REV (40.64 cm3)
Operating speed.....2800
Relief valve setting.....3750 PSI (258.5 BAR)
No. relief valves per pump.....2
Max. allowable case pressure.....25 PSI (1.7 BAR)

2.2.2 GENERAL INFORMATION

The drive shaft of the piston pump is rotated by the engine. The piston block which is splined to the drive shaft also turns. The piston block contains nine piston assemblies which have free swiveling shoes swagged on the ball end of the piston assembly.. The shoe end of the piston rides against the smooth surface of the camplate. With the camplate in the neutral or 0° position (fig. 2.2.2A) the piston assemblies do not reciprocate in the piston block, but only rotate. No oil is drawn into or discharged from the pump. The pump is in a zero displacement position and the loader remains stationary.

With the camplate in the 0° or neutral position the pressure of the charge oil, which ranges from 80 to 120 PSI (4.1-10.3 BAR), is able to unseat both charge checks and supply oil to both sides of the pump because of the balance in pressure. There is very little internal leakage while the camplate is in the 0° position so the excess charge oil is bypassed and is recirculated back into the reservoir.



CAM ANGLE NEUTRAL POSITION

C-350

Fig. 2.2.2A

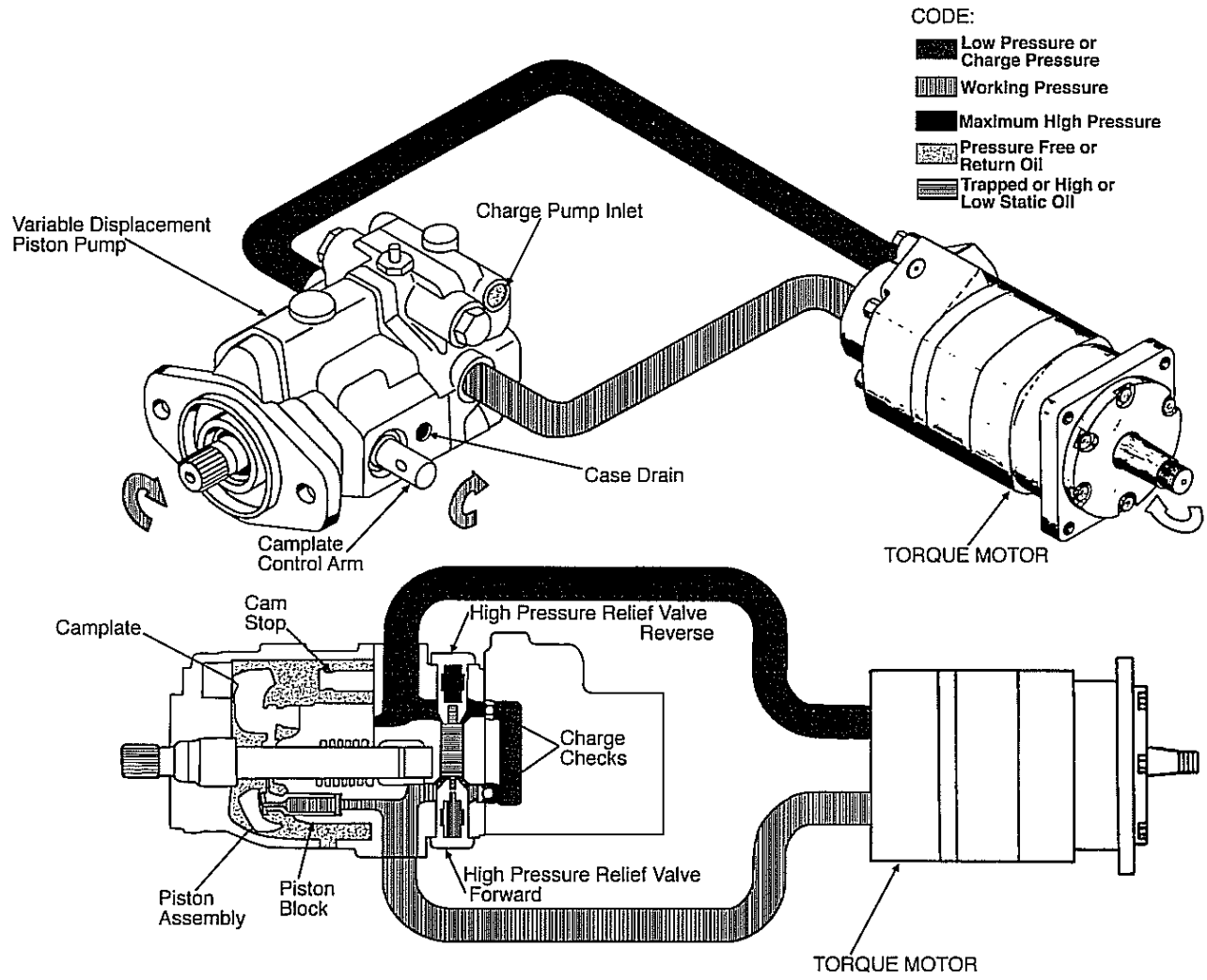
The oil that leaks internally in the pump and motor collects in their body housings and is returned to the reservoir by the case drains in each pump and motor housing. This leakage oil is the only oil returning to the reservoir in a closed loop system.

As the steering lever is moved forward the loader starts a forward movement (fig. 2.2.2B). As the camplate begins to move, the piston assemblies start to reciprocate in the piston block. As the steering lever continues a forward movement the cam angle increases, the pistons reciprocate further, more oil is being pumped and the speed of the loader is increased. The steering lever can be moved forward 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.

The motor, which is a fixed displacement type, delivers a constant output torque for a given pressure throughout the speed range of the motor.

The movement of the pump camplate from 0° to 17° in either forward or reverse position controls the direction of rotation of the motor.



CAM ANGLE FORWARD POSITION

C-351

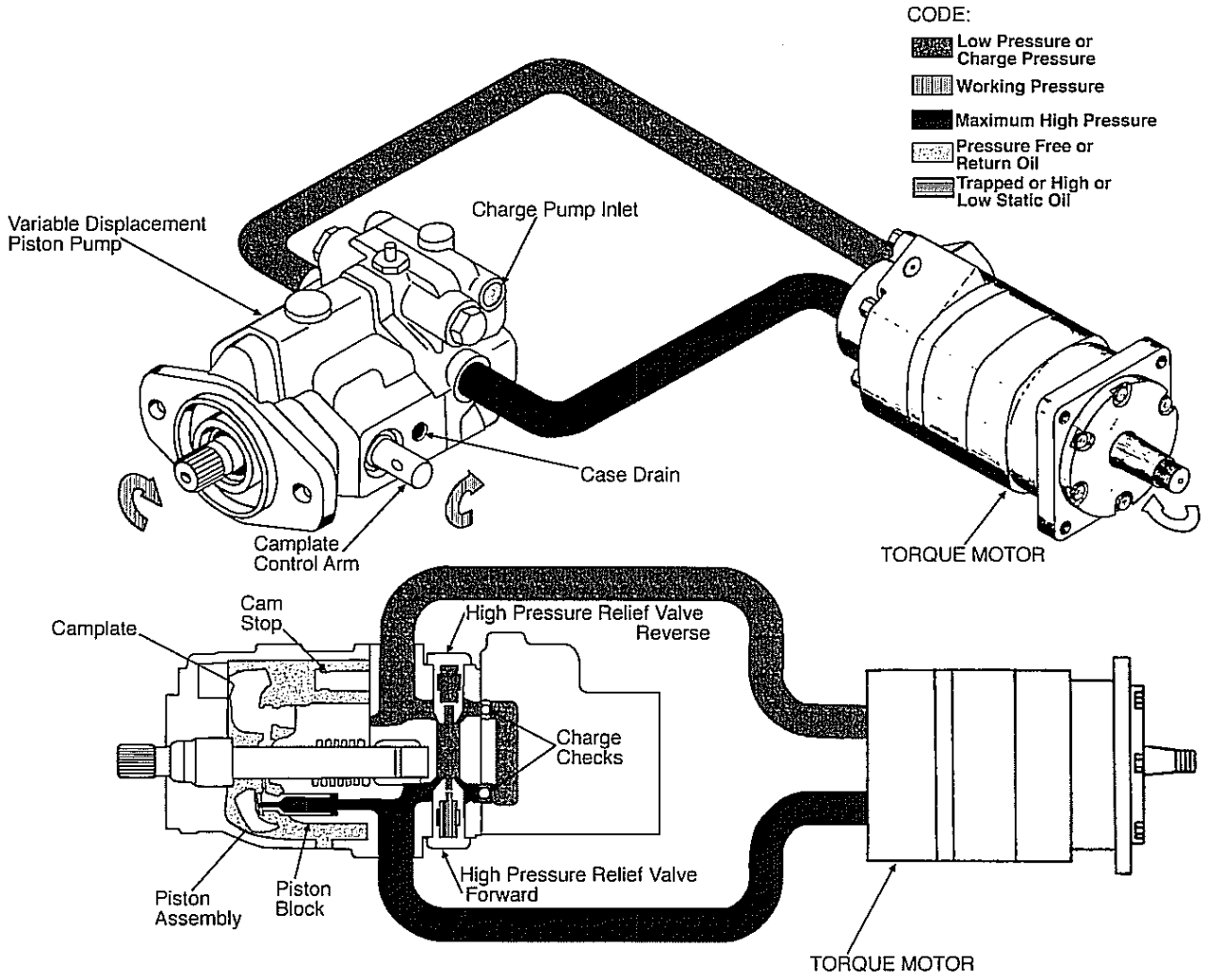
Fig. 2.2.2B

Figure 2.2.2C shows the camplate in the full 17° forward position with the relief valve cross relieving. The function of the system relief valve is to relieve the pressure side of the system of excessive high pressure when the loader encounters a heavy load or stalls out.

The high pressure surrounding the relief valve enters the relief valve body cavity through a drilled orifice in the cartridge. This pressurized oil that enters the relief valve starts to push on a spool, which is seated by spring tension and moves it forward, exposing the cross holes drilled in the end of the spool. A small volume of oil starts to flow across to the other relief valve. This relief valve is exposed to the low pressure on the intake side of the pump and is seated by the spring tension within the relief valve body.

The pressure of the small volume of oil being bypassed is enough to unseat the relief valve and let it recirculate back into the intake side of the pump. As the pressure continues to build on the pressure side, a larger volume of oil flows and at a greater 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.



CAM ANGLE FORWARD POSITION WITH RELIEF VALVES CROSSRELIEVING

C-352

Fig. 2.2.2C

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.

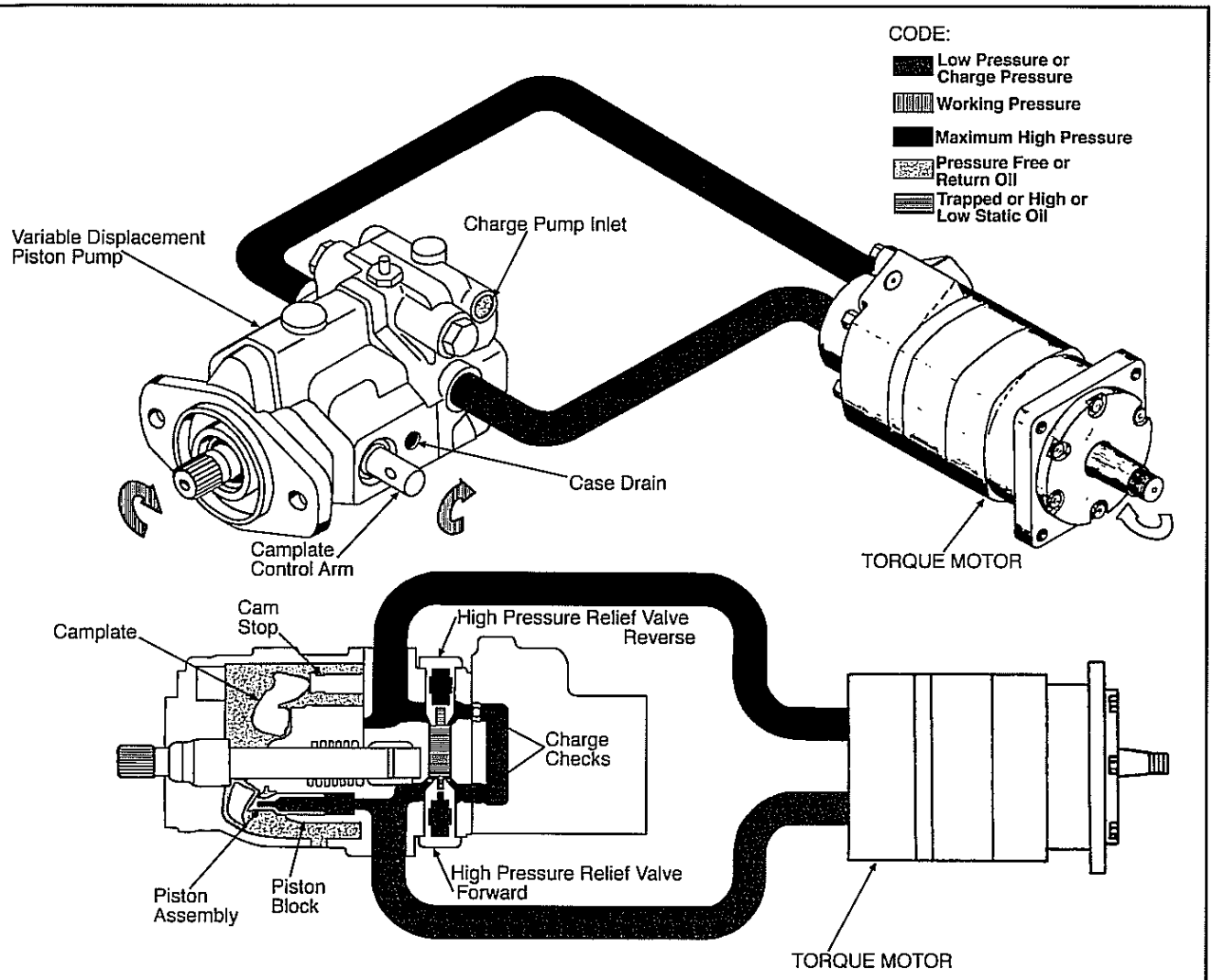
In the reverse position the pump shaft still rotates in the same direction, but the discharge of oil from the pump is reversed, thus reversing the rotation of the motor.

WARNING

To avoid personal injury never repair or tighten hydraulic hoses or fittings with the engine running or the system under pressure

WARNING

To avoid personal injury do not work on a loader with the boom arms in a raised position unless the boom locks are engaged.



C-348

CAM ANGLE REVERSE POSITION

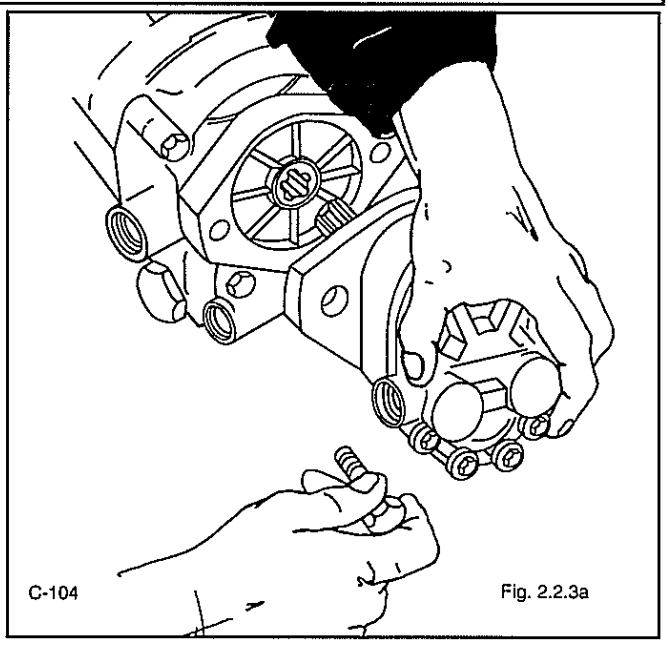
Fig. 2.2.2D

2.2.3 HYDROSTATIC PUMP, REMOVAL

1. Remove any attachment, raise the boom arms and engage the boom lock. Shut off the engine.
2. Drain the hydraulic oil from the hydraulic oil reservoir. Refer to section 1.7.3 for procedure.
3. Remove the seat.
4. Disconnect the hydraulic lines from the hydraulic gear pump and remove the gear pump from the loader (fig. 2.2.3a). Refer to section 1.2.4 for procedure.

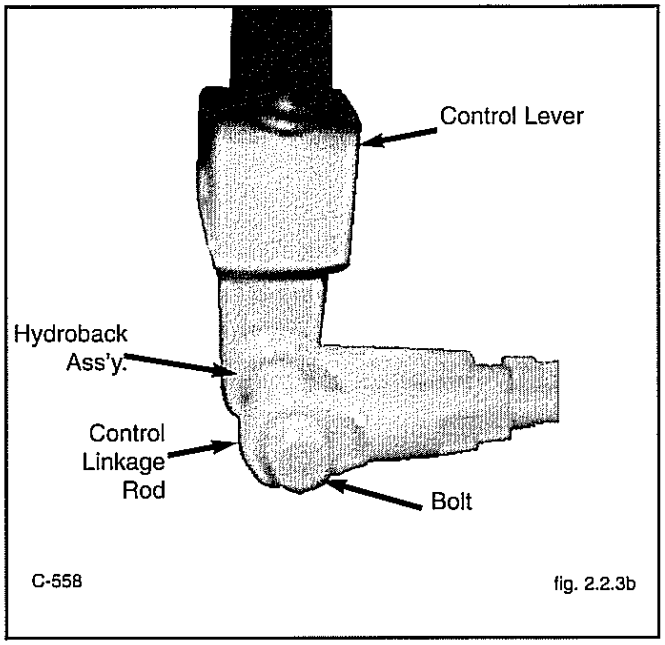
IMPORTANT

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

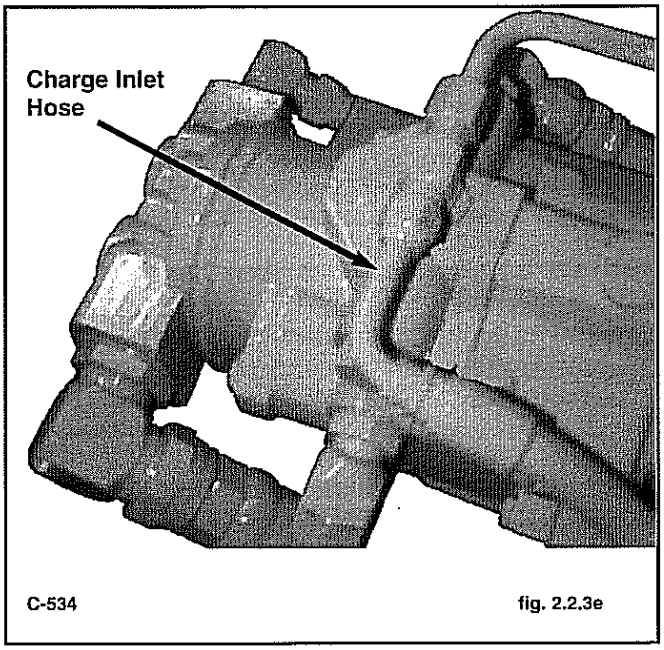


C-104

Fig. 2.2.3a

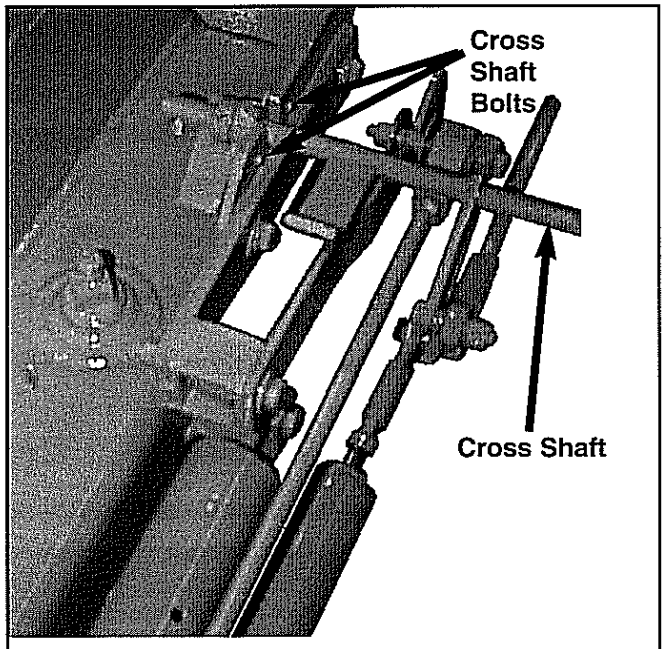


C-558 fig. 2.2.3b

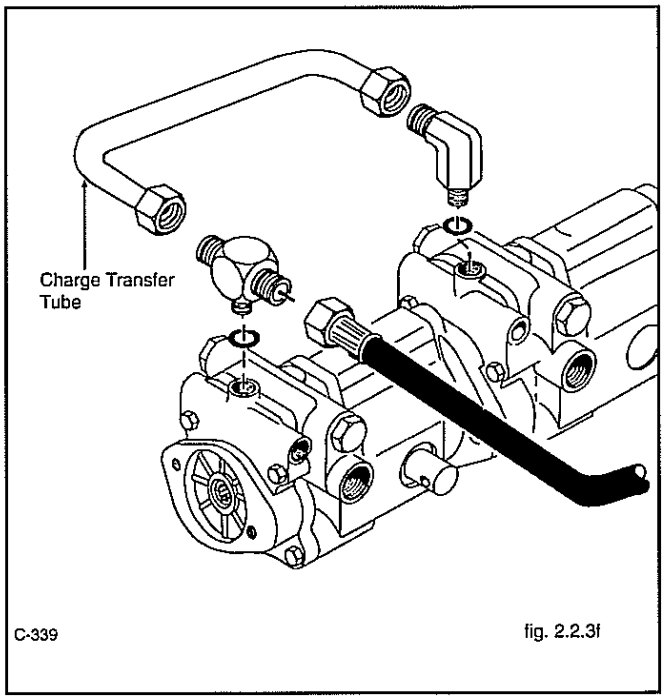


C-534 fig. 2.2.3e

5. Plug all openings in gear pump and control valve and cap all hydraulic lines.



C-533 fig. 2.2.3c



C-339 fig. 2.2.3f

6. Remove the two seat supports.

7. Disconnect the control linkage rod and hydroback (fig. 2.2.3c).

8. Remove the pintle unlock linkage and cross shaft (fig. 2.2.3d).

9. Remove the hydraulic hose from the inlet port (fig. 2.2.3e). Plug the inlet port and cap the hydraulic line.

10. Disconnect and remove the transfer line between the front and rear hydrostatic pump (fig. 2.2.3f). Cap the line and plug both transfer ports.

11. Disconnect both the front and rear pump drain lines from the pumps (fig. 2.2.3g). Cap the drain lines and plug the pump drain line ports.

12. Disconnect and remove the high pressure hose between the front pump and torgue motor (fig. 2.2.3h). If the rear pump is to be removed, disconnect the rear pump high pressure hoses. Plug the pump and motor ports and cap both ends of the high pressure hoses.

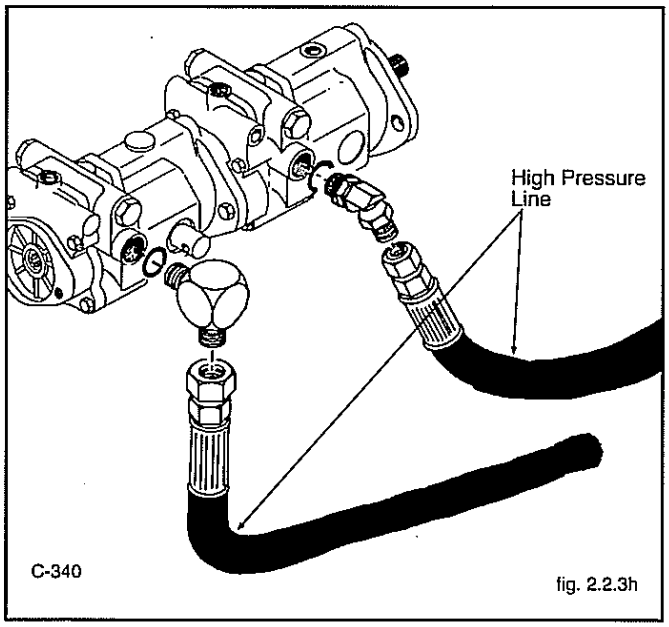


fig. 2.2.3h

13. Disconnect the steering control linkages and shock absorber from the front pump pintle lever (fig. 2.2.3i). If the rear pump is to be removed disconnect the steering linkage from the rear pump pintle lever.

WARNING

To avoid back injury, do not attempt to lift heavy objects without assistance.

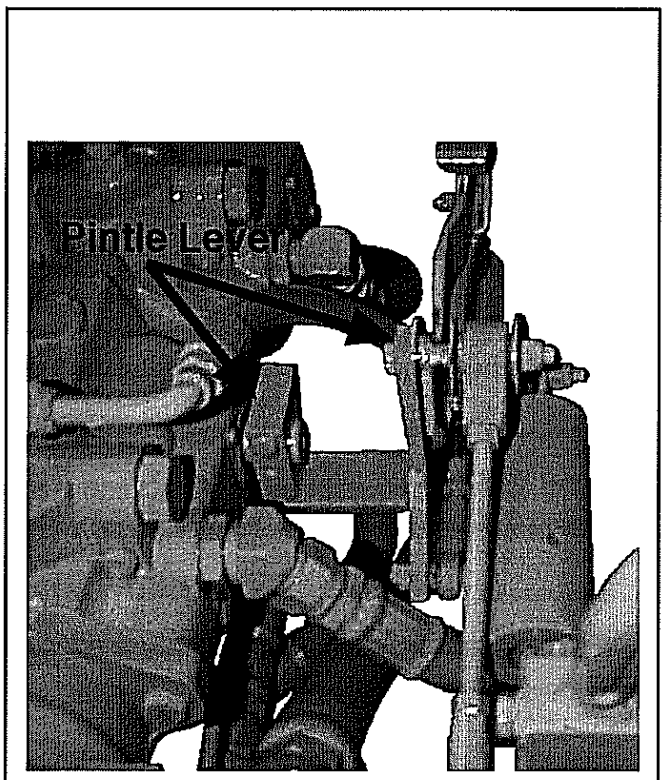


fig. 2.2.3i

14. Disconnect the front pump mounting bracket (fig. 2.2.3j).

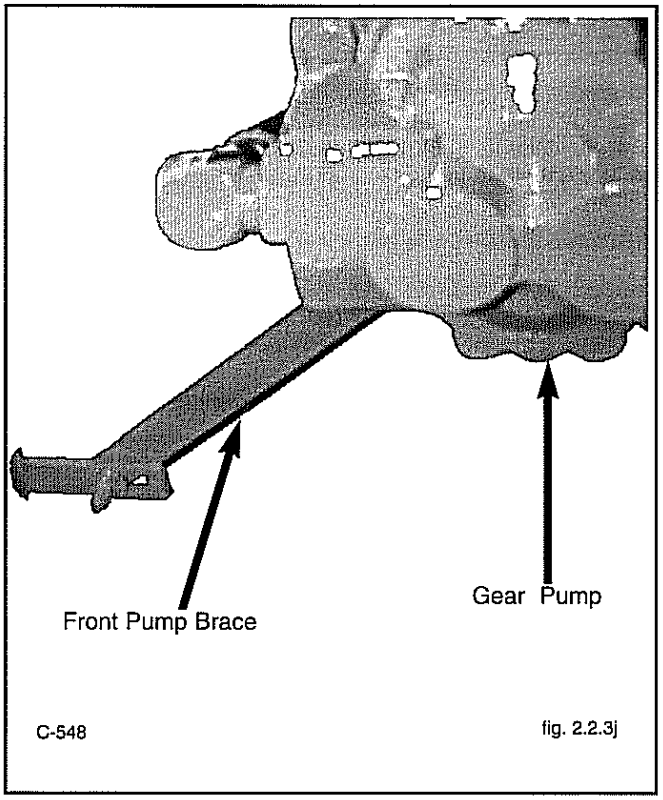
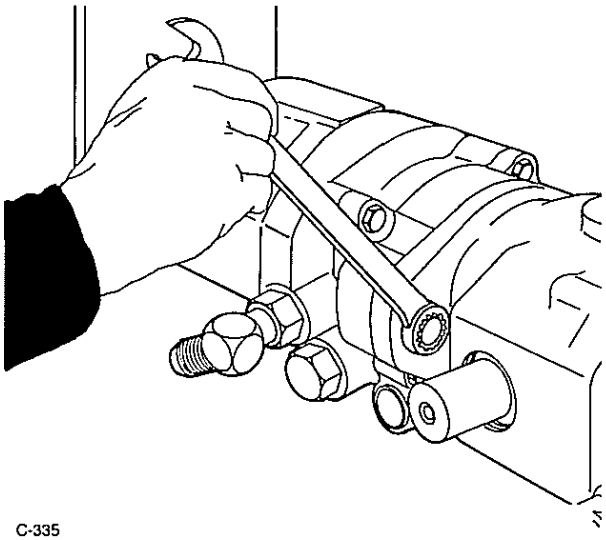


fig. 2.2.3j

15. Remove the mounting bolts which secure the front pump to the rear pump (fig. 2.2.3k)

16. Remove the front pump from the loader.



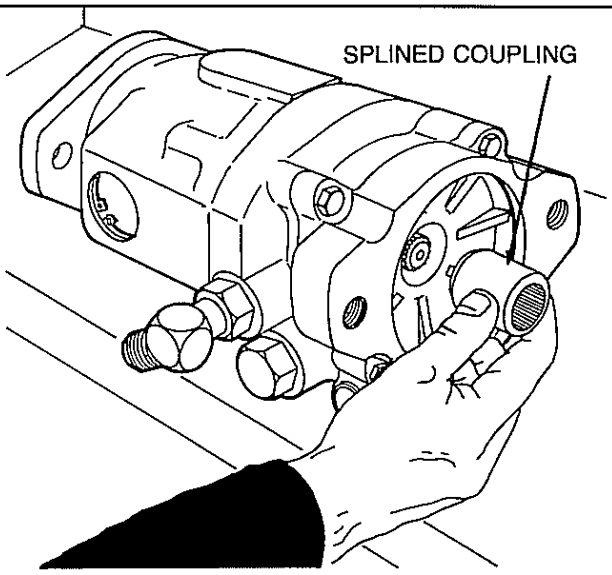
C-335

fig. 2.2.3k

17. Remove the splined drive coupling from the rear pump (fig. 2.2.3l).

18. Remove the mounting bolts which secure the rear pump to the bulkhead.

19. Remove the rear pump from the loader.

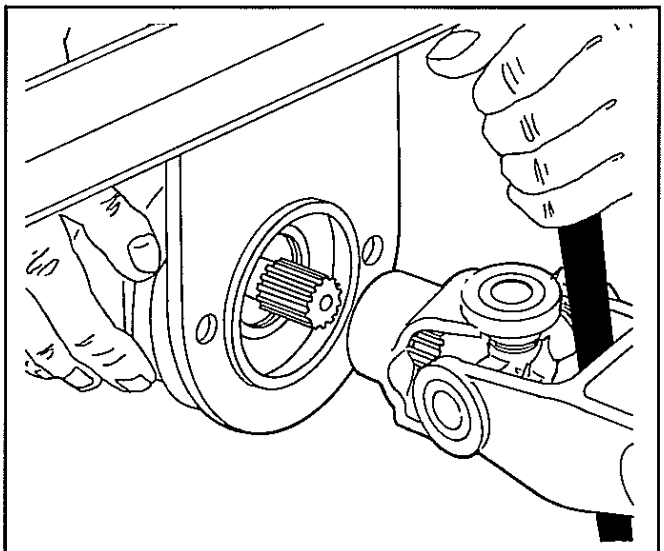


C-334

fig. 2.2.3l

2.2.4 HYDROSTATIC PUMP REPLACEMENT

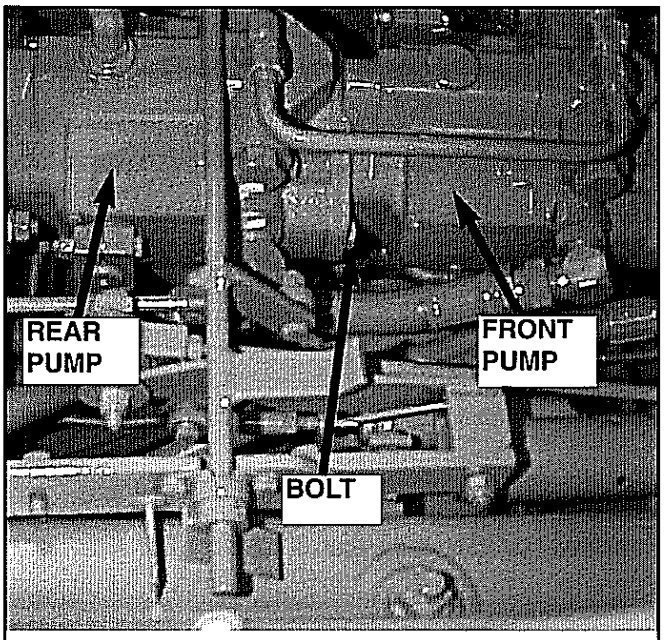
1. Line up the universal joint with the splines on the rear pump shaft and install the rear pump in the loader (fig. 2.2.4a). Install the rear pump mounting bolts which fasten the pump to the bulkhead.



C-336

fig. 2.2.4a

2. Install the front pump in the machine. Tighten the mounting bolts which fasten the front pump to the rear pump to the following torque (fig. 2.2.4b): 55-60 ft lbs. (3.8 - 4.1 BAR).

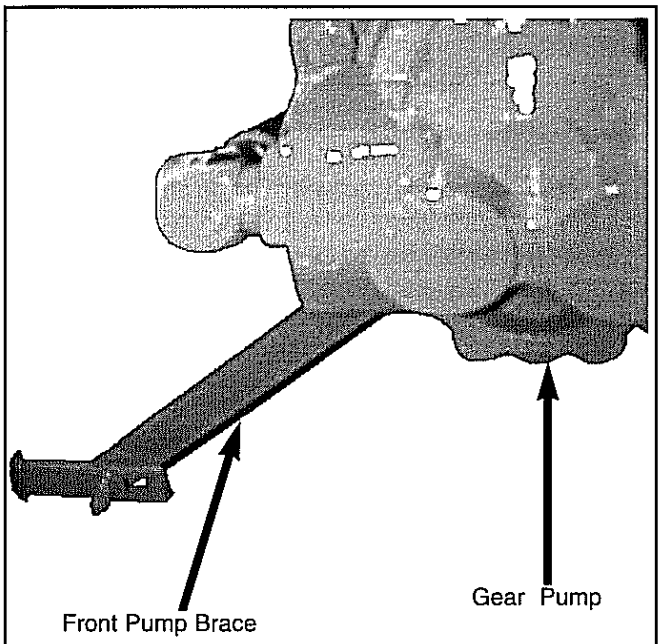


C-532

fig. 2.2.4b

2 HYDRAULIC DRIVE SYSTEM

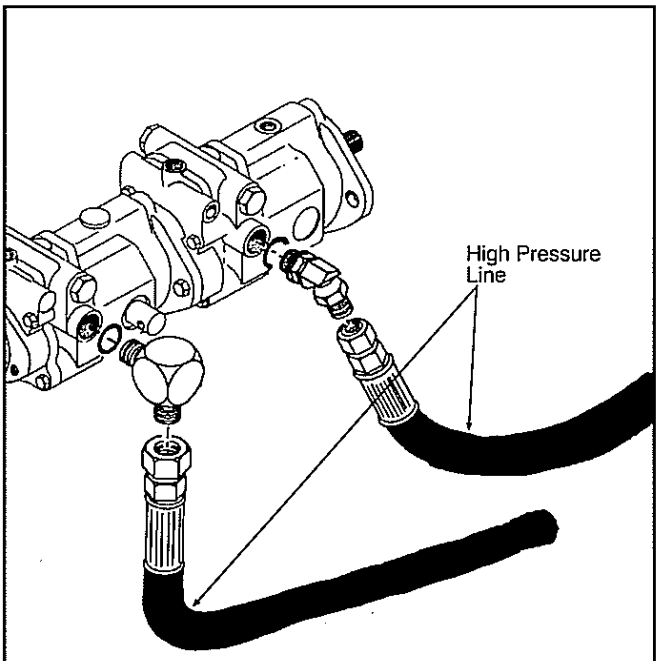
3. Install the front pump mounting bracket (fig. 2.2.4)



C-548 fig. 2.2.4

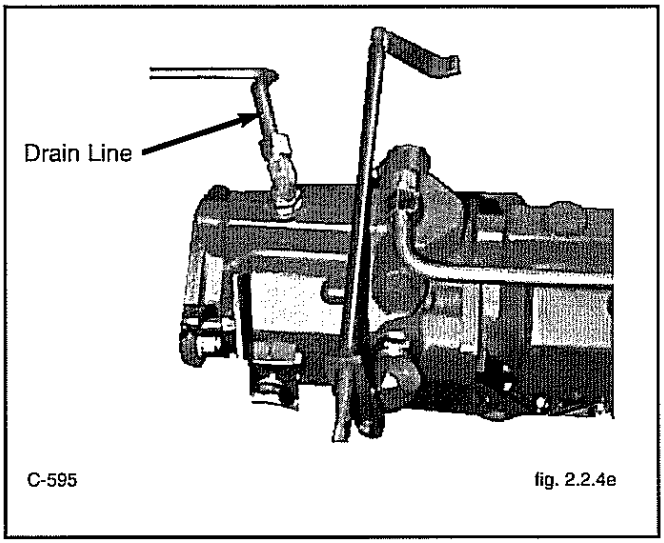
C-502 fig. 2.2.4c

4. Reconnect the steering control linkages and shock absorbers to the front and rear pump pintle levers (fig. 2.2.4c). On start up it may be necessary to adjust the steering linkage. Refer to section 4.1.



C-340 fig. 2.2.4d

5. Install the four high pressure hoses between the pumps and motor (fig. 2.2.4d).



C-595 fig. 2.2.4e

6. Install the front and rear pump drain lines (fig. 2.2.4e).

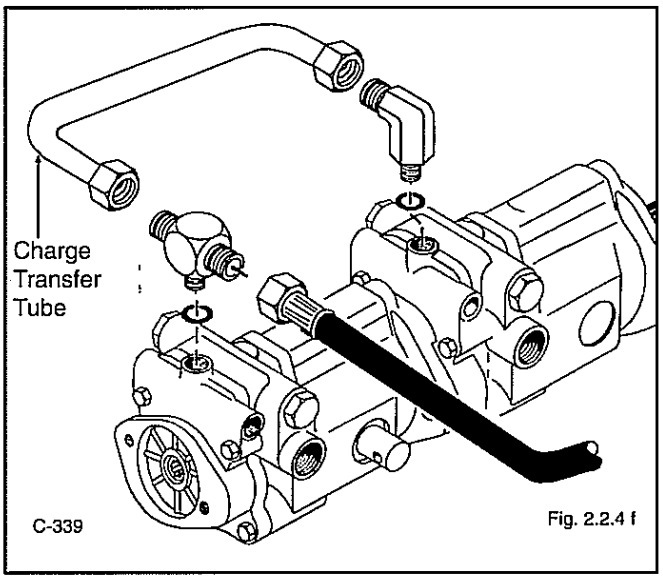


Fig. 2.2.4 f

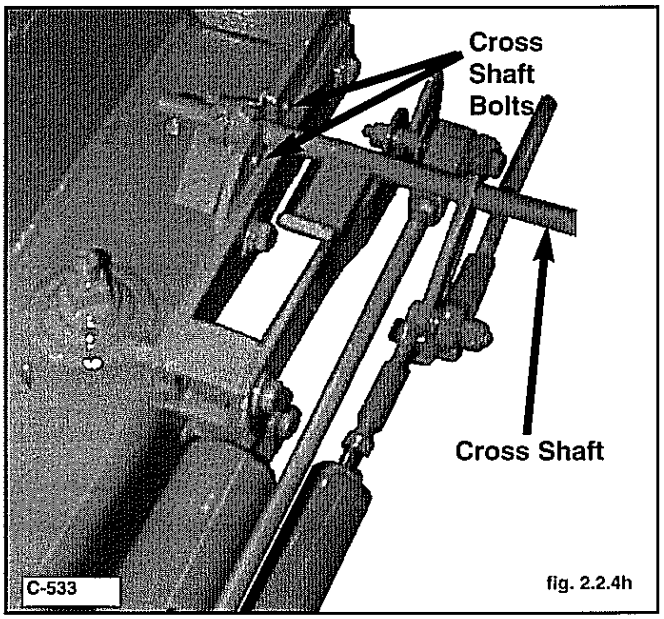


fig. 2.2.4h

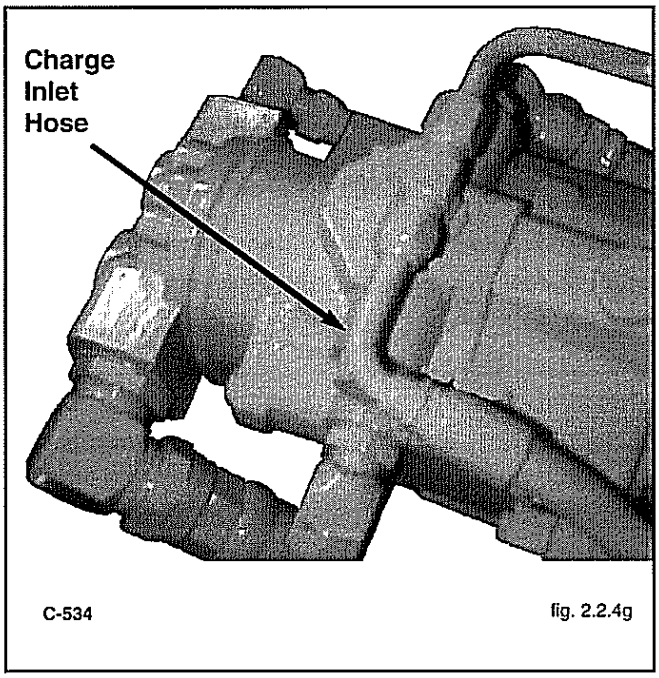


fig. 2.2.4g

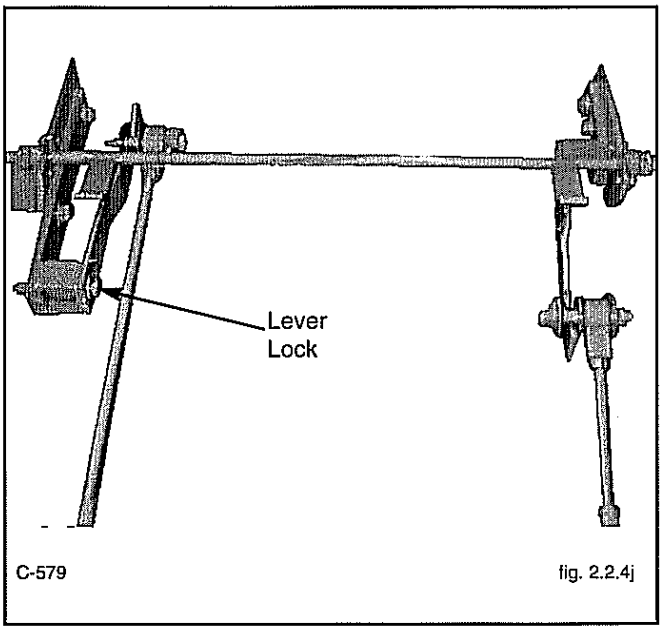


fig. 2.2.4j

7. Install the charge transfer line between the front and rear pump (fig. 2.2.4f).

8. Install the hydraulic hose from the check valve at the filter, to the inlet port (fig. 2.2.4f).

9. Raise the steering lock cross shaft up into place and install the bearing mounting bolts (fig. 2.2.4h).

10. Install the lock guides on the steering lock cross shaft (fig. 2.2.4j).

11. Install the hydraulic gear pump on the hydrostatic pump and reconnect the gear pump inlet hose and the hydraulic line between the gear pump and control valve (fig. 2.2.4g). Refer to section 1.2.4 for procedure. Tighten the hydraulic gear pump mounting bolts 27-31 ft. lbs. (36.6 - 42 N.M.).

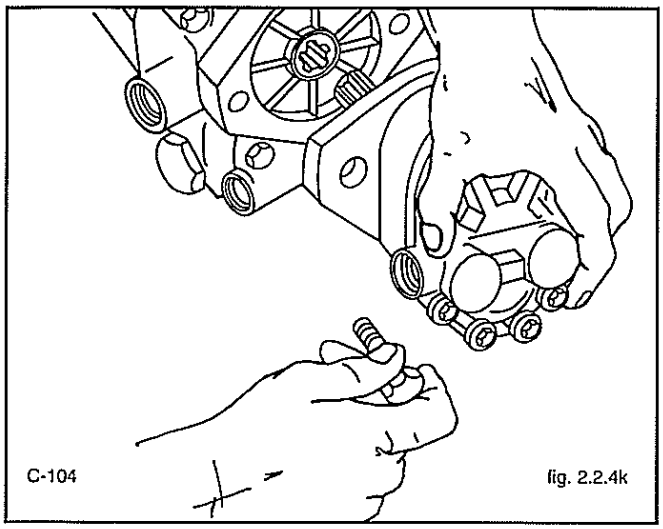
12. Refill the hydraulic reservoir to the proper level with 10W30 API classification SE/CD oil.

13. Before starting the loader refer to the start-up procedure in section 1.2.6 to prevent damage to the hydraulic or hydrostatic components.

2 HYDRAULIC DRIVE SYSTEM

IMPORTANT

To prevent damage after removal or repair of hydraulic components refer to start up procedure section 1.2.6



C-104 fig. 2.2.4k

2.2.5 HYDROSTATIC PUMP DISASSEMBLY

Before disassembling the pump, clean the body with a suitable solvent and dry with compressed air. Be sure all openings are plugged to prevent solvent entering the pump.

Disassembly instructions are given for the front pump. Disassembly of the rear pump is identical unless otherwise noted.

WARNING

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

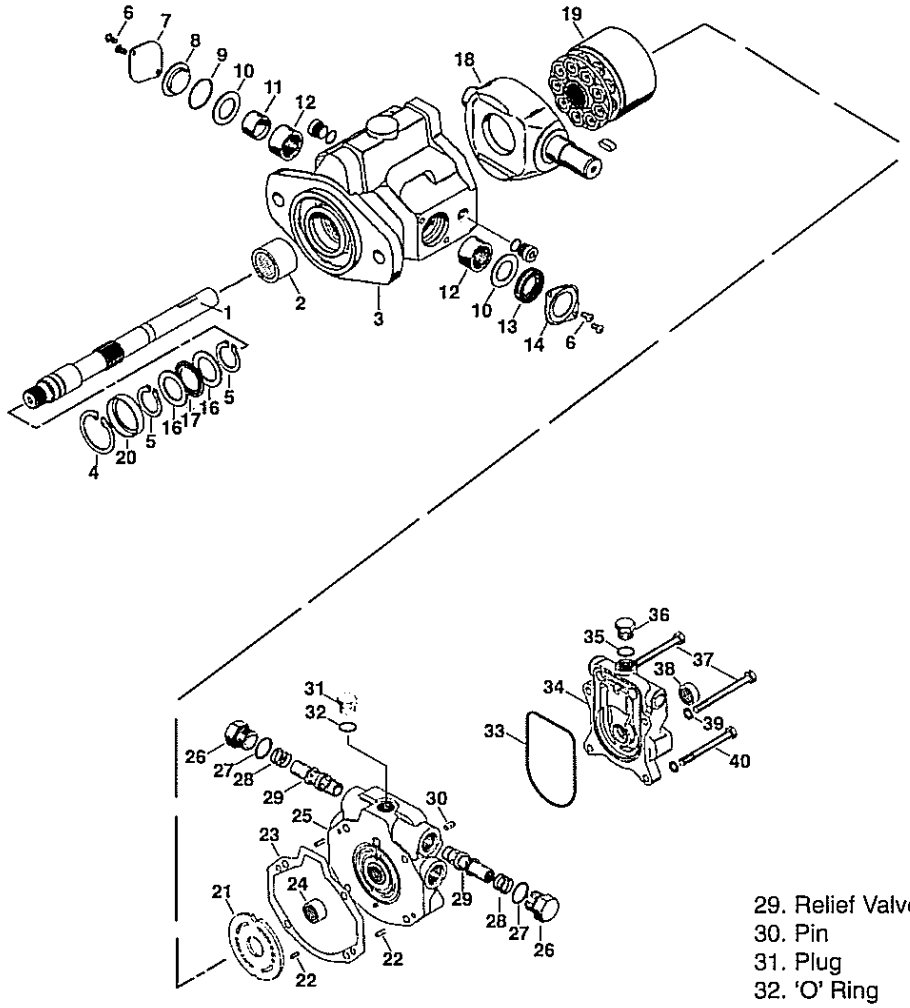
IMPORTANT

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

2 HYDRAULIC DRIVE SYSTEM

C-564

fig. 2.2.5



1. Shaft Ass'y
2. Bearing
3. Housing
4. Snap Ring
5. Retaining Ring
6. Screw
7. Trunion Cover
8. 'O' Ring Cover
9. 'O' Ring
10. Washer
11. Inner Face
12. Bearing
13. Shaft Seal
14. Seal Cover
16. Thust Washer
17. Thrust Bearing
18. Cam Plate
19. Rotating Group
20. Shaft Seal
21. Valve Plate
22. Pin
23. Gasket
24. Bearing
25. Back Plate Ass'y
26. Plug Ass'y
27. 'O' Ring
28. Spring
29. Relief Valve
30. Pin
31. Plug
32. 'O' Ring
33. 'O' Ring
34. Adaptor Plate
35. 'O' Ring
36. Plug
37. Tie Bolt
38. Bearing
39. Washer
40. Tie Bolt

IMPORTANT

Do not intermix parts from one pump with another. Keep all pump parts seperate.

1. From the backplate, remove the plugs and relief valve assemblies.

NOTE: Mark the relief valve in relationship to the cavity it was removed from, for reassembly purposes. Check the bearing (pressfit) in backplate. If needles remain in cage, and move freely, removal is not required (fig. 2.2.5c).

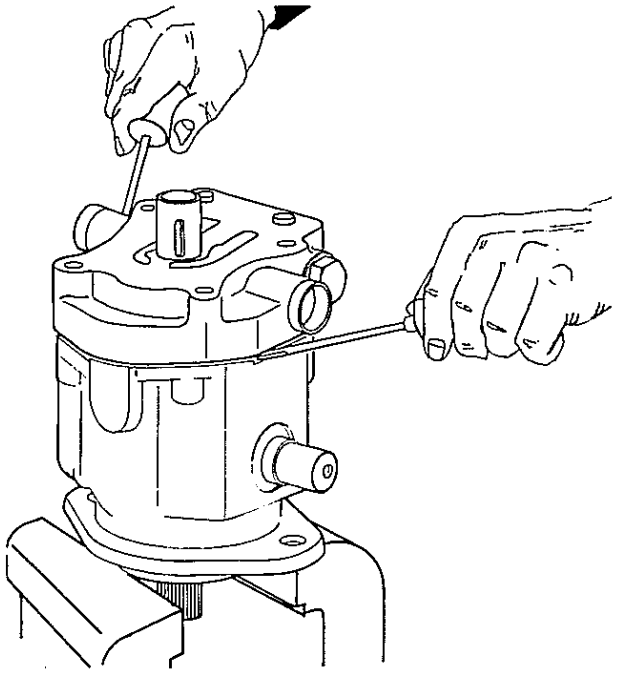
2 HYDRAULIC DRIVE SYSTEM

2. Remove housing gasket from housing.

IMPORTANT

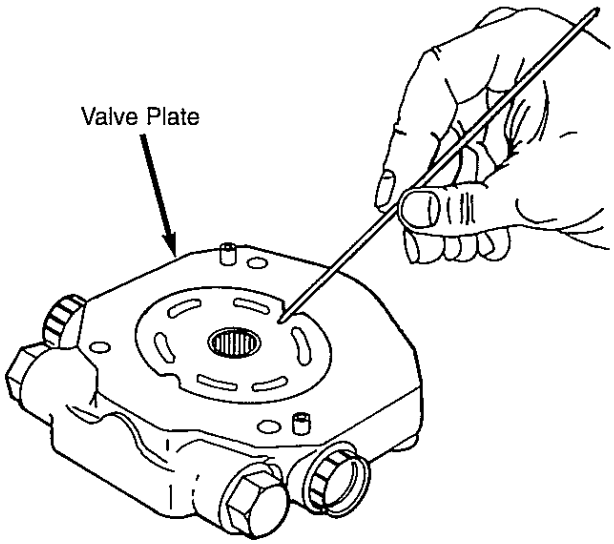
Do not attempt to check charge pump flow. Checking flow can cause cavitation and damage to the piston pumps.

3. Remove rotating kit assembly from housing, by turning housing up and allowing rotating kit to slide down (fig. 2.2.5h).



C-424

fig. 2.2.5e

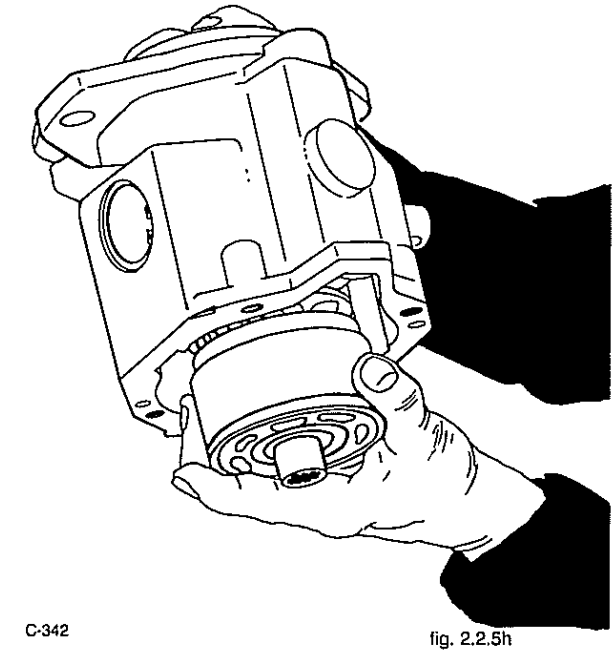


C-561

fig. 2.2.5g

4. The piston block assembly does not require to be disassembled unless the pins or spring are damaged. (fig. 2.2.5h).

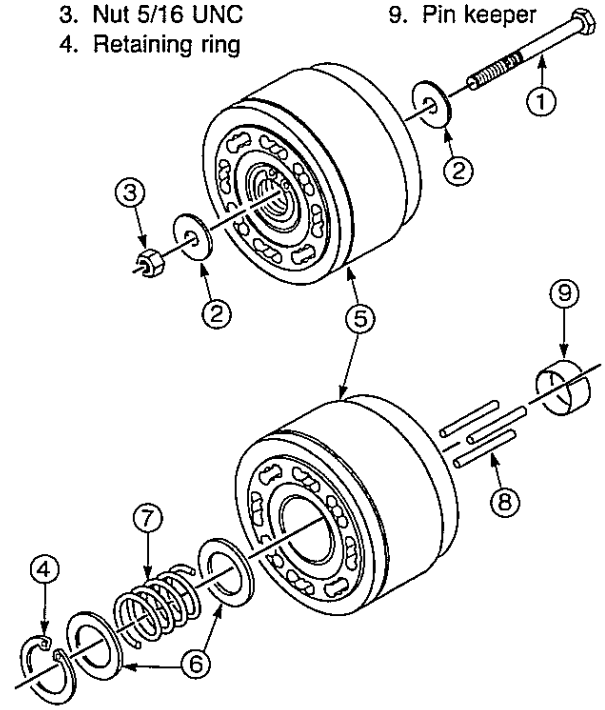
If the piston block spring needs to be removed use the following procedure (fig. 2.2.5i).



C-342

fig. 2.2.5h

1. Cap screw 5/16 UNC x 2 7/8 L
2. Washer 5/16 I.D. x 5/16 O.D. (2)
3. Nut 5/16 UNC
4. Retaining ring
5. Piston block
6. Washer (2)
7. Spring
8. Pins (3)
9. Pin keeper



C-141 fig. 2.2.5i

(a) Place a 5/16" flat washer over the 5/16" x 2 7/8" cap screw and insert the cap screw through the center of the piston block.

(b) Place a 5/16" flat washer over the end of the cap screw and screw on the 5/16" UNC nut.

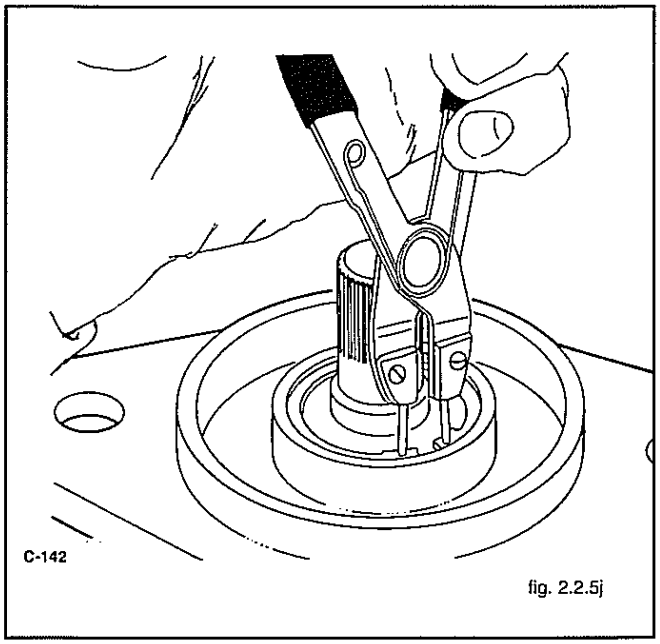
(c) Tighten the nut and compress the spring.

(d) Remove the retaining ring.

(e) Slowly back off the 5/16" nut relieving the compression on the spring.

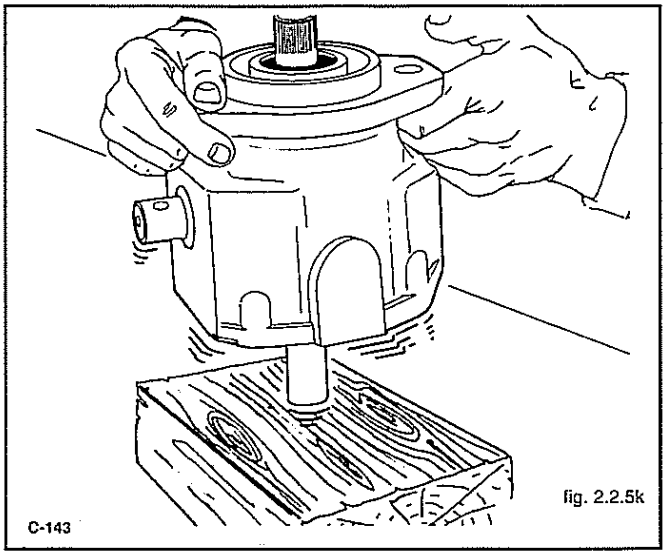
(f) Remove the two washers, spring and three pins from the piston block.

5. Remove the retaining ring from the housing (fig. 2.2.5j).



C-142 fig. 2.2.5j

6. Tap the end of the shaft against a wooden block to remove the shaft, seal and bearing assembly from the housing (fig. 2.2.5k).
7. Remove the seal, spacer, retaining ring, thrust bearing and races from the pump shaft (fig. 2.2.5l).



C-143 fig. 2.2.5k

2 HYDRAULIC DRIVE SYSTEM

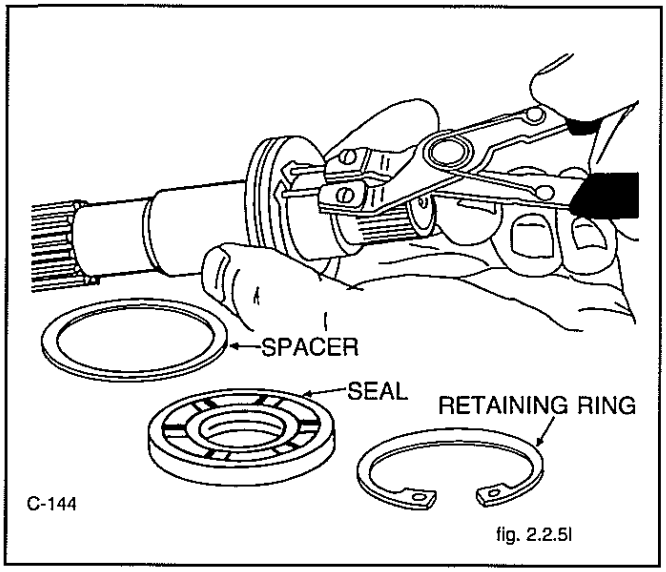


fig. 2.2.5l

8. Remove the retaining screw and the camplate cover (fig. 2.2.5m).

9. Remove the camplate cover plate O-ring.

10. Remove the retaining ring, camplate cover and seal from the opposite side of the pump housing (fig. 2.2.5o).

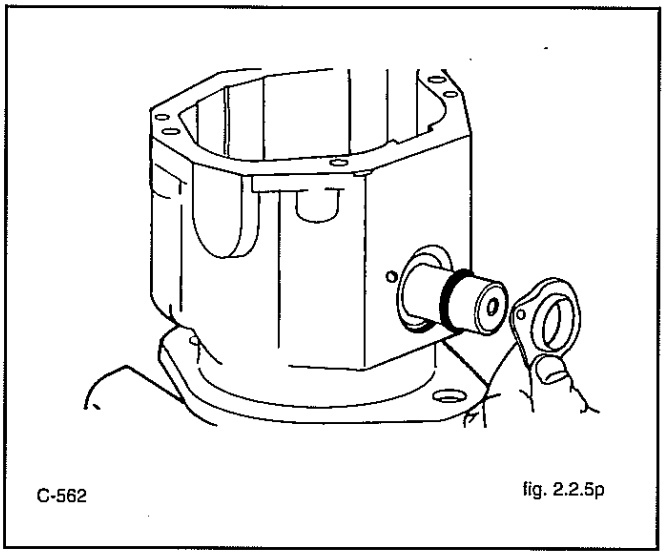


fig. 2.2.5p

11. Remove the camplate bearings and races from the housing. The camplate bearings are a loose, slip fit into the housing (fig. 2.2.5p).

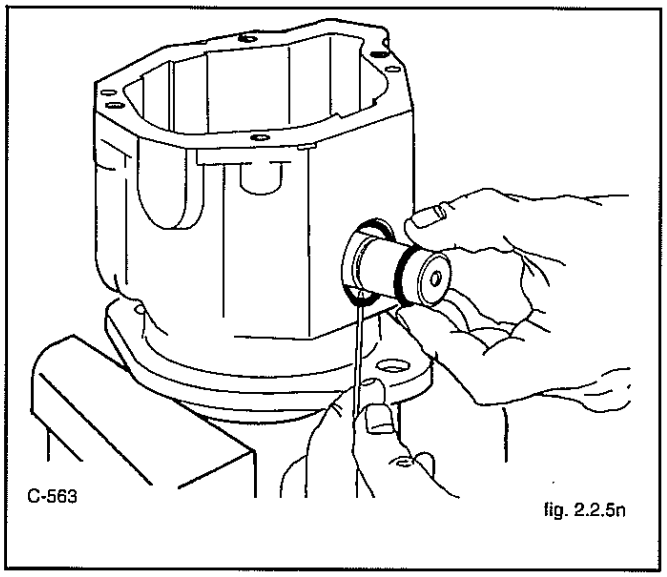


fig. 2.2.5n

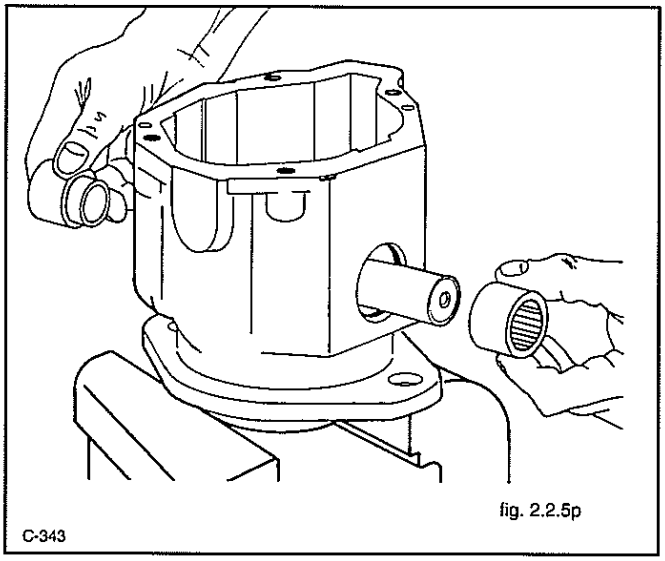


fig. 2.2.5p

12. Remove the camplate from the housings (fig. 2.2.5q).

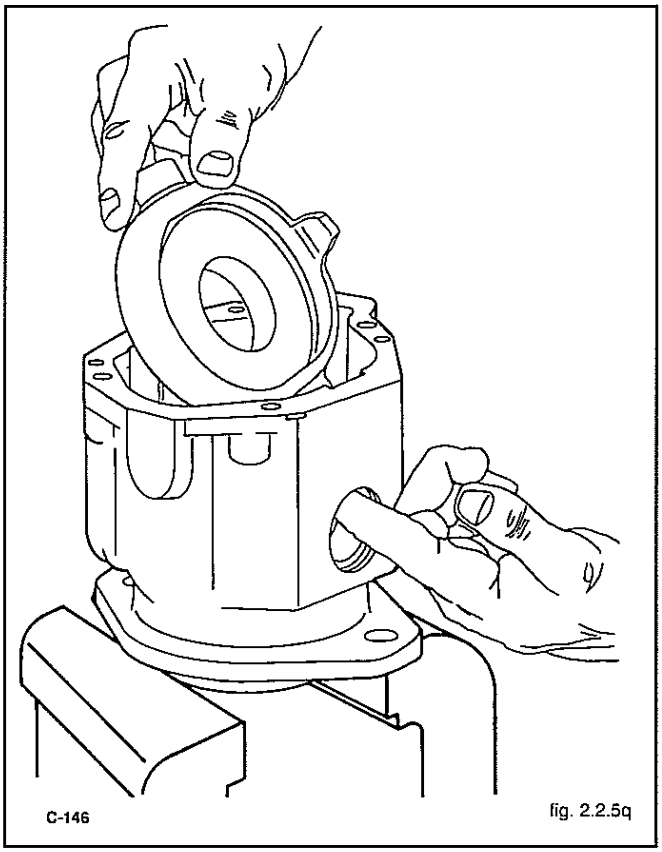

C-146

fig. 2.2.5q

2.2.6 HYDROSTATIC PUMP, INSPECTION

IMPORTANT

Do not intermix parts from one pump with another. Keep all pump parts seperate.

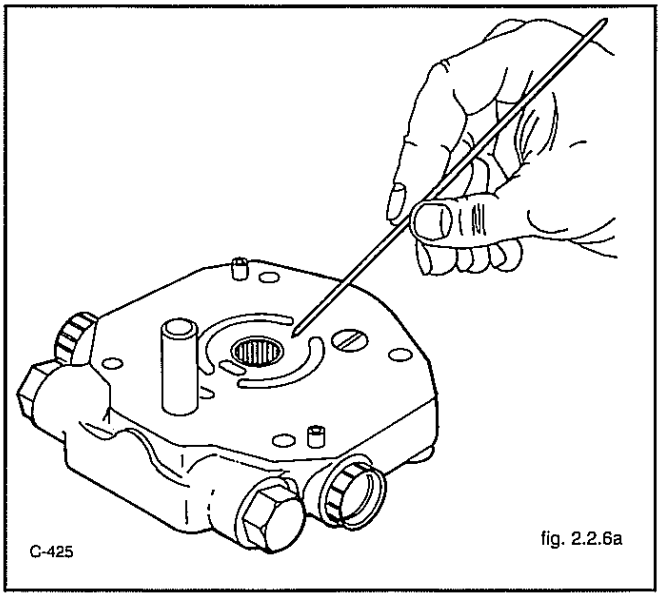

C-425

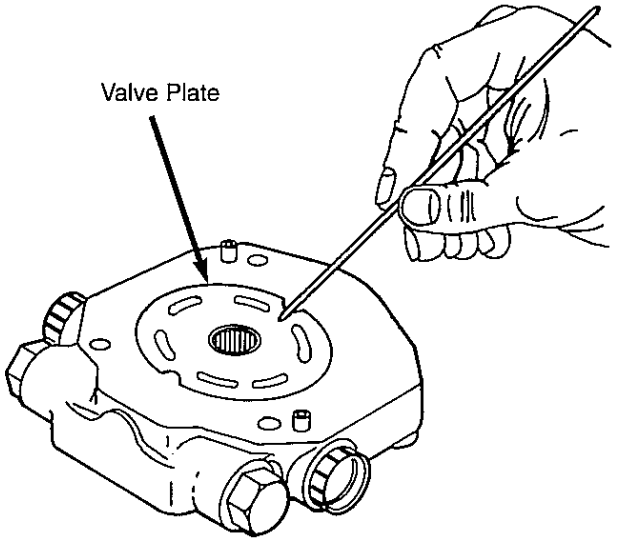
fig. 2.2.6a

1. Inspect the needle bearing inside the adaptor housing. If the needles are free from excessive play and remain in the bearing cage there is no need to replace the bearing.

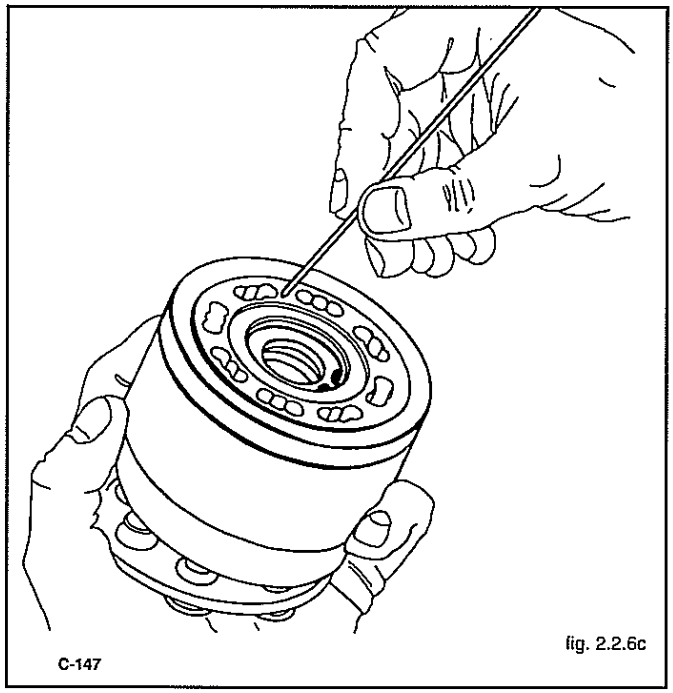
2. Inspect the face of the wearplate for scoring or wear. The plate should be smooth and free of grooves. If not, replace (fig. 2.2.6a).

3. Inspect the face of the valve plate for score or wear. The plate should be smooth and free of grooves (fig. 2.2.6b).

2 HYDRAULIC DRIVE SYSTEM



C-561 fig. 2.2.6b



C-147 fig. 2.2.6c

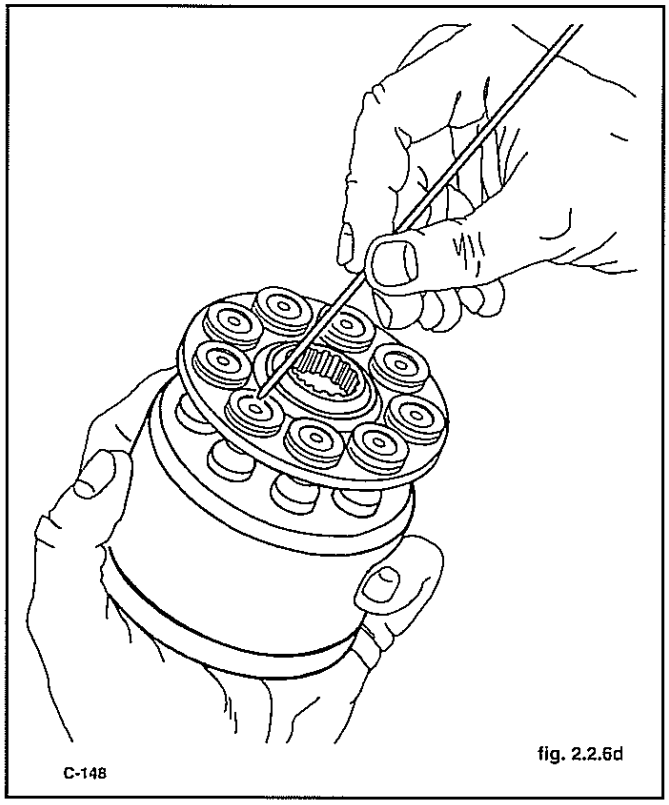
4. Inspect the piston block (fig. 2.2.6c). The face that contacts the back plate should be smooth and free from grooves.

5. Inspect the piston block spring and the three pins for damage.

IMPORTANT

The piston block spring is highly compressed and the retaining ring should not be removed without first compressing the spring.

6. Check that the pistons move freely in the piston block bore (fig. 2.2.6d). If they are sticky in the bore, check the bore for scoring or contamination.



C-148 fig. 2.2.6d

7. Inspect the piston shoes (fig. 2.2.6d). The flat surface of the shoe should be flat and smooth. The corners of the piston shoe should be square and not rounded.

8. Inspect the finish on the outside diameter of the pistons. The surface should be free from scratches or wear.

9. Inspect the spider pivot (fig. 2.2.6e). It should be smooth and show no signs of wear.

10. Inspect the spider (fig. 2.2.6e). It should be flat with no cracks or any signs of wear in the pivot area.

11. Inspect the polished surface of the camplate for scoring (fig. 2.2.6f).

12. Inspect the pump drive shaft bearing surfaces and splines for signs of scoring, wear or any damage (fig. 2.2.6g).

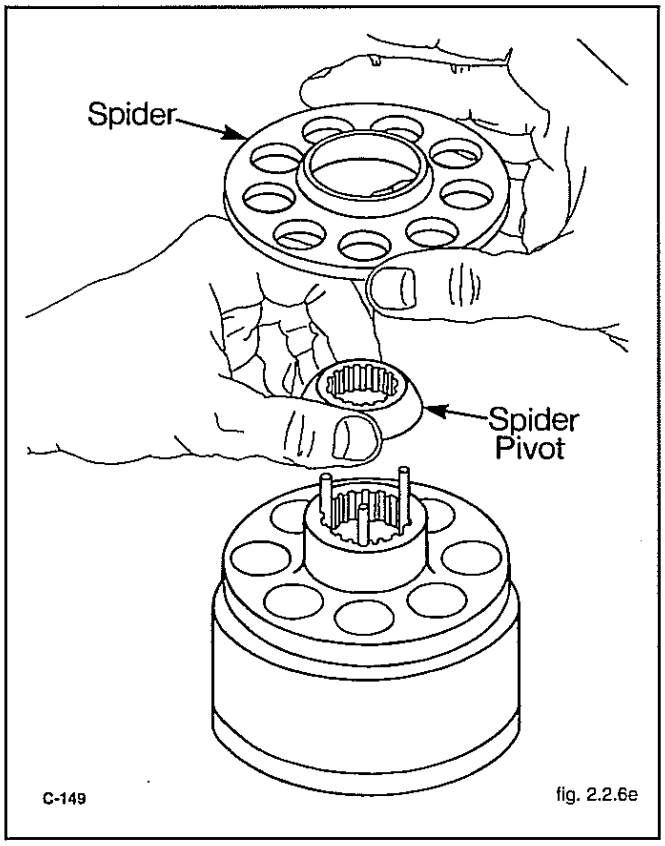


fig. 2.2.6e

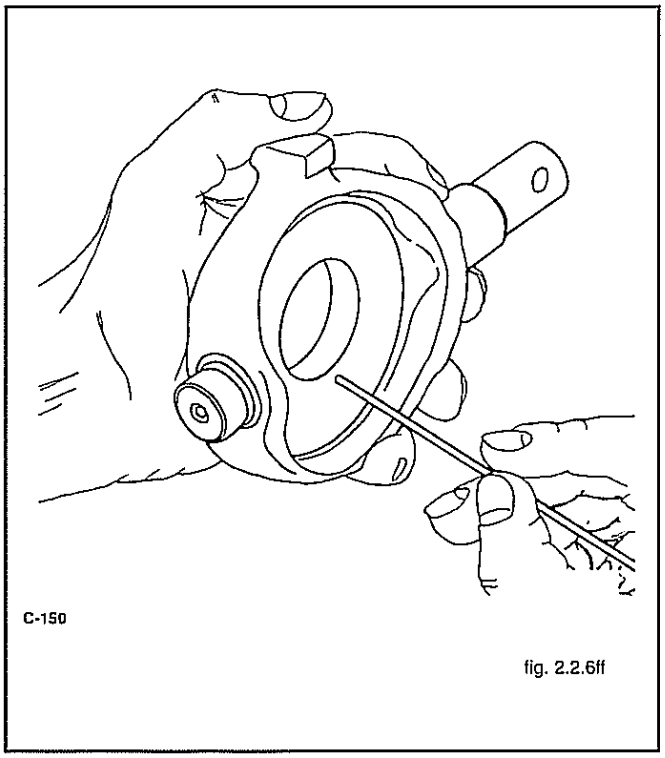


fig. 2.2.6ff

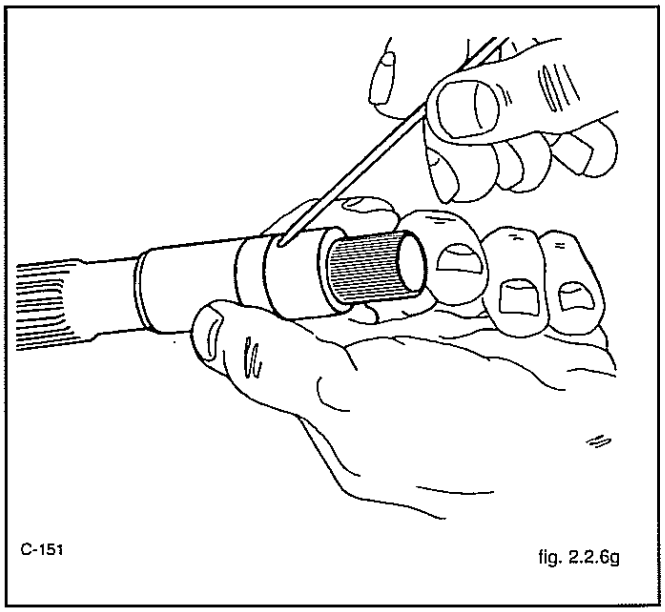


fig. 2.2.6g

13. Inspect the thrust bearing and washers for wear.

14. Inspect the needle bearing in the housing assembly.

If the needles are free of excessive play and remain in the bearing cage there is no need to replace the bearing.

IMPORTANT

Do not intermix parts from one pump with another. Keep all pump parts seperate.

2 HYDRAULIC DRIVE SYSTEM

2.2.7 HYDROSTATIC PUMP, REASSEMBLY

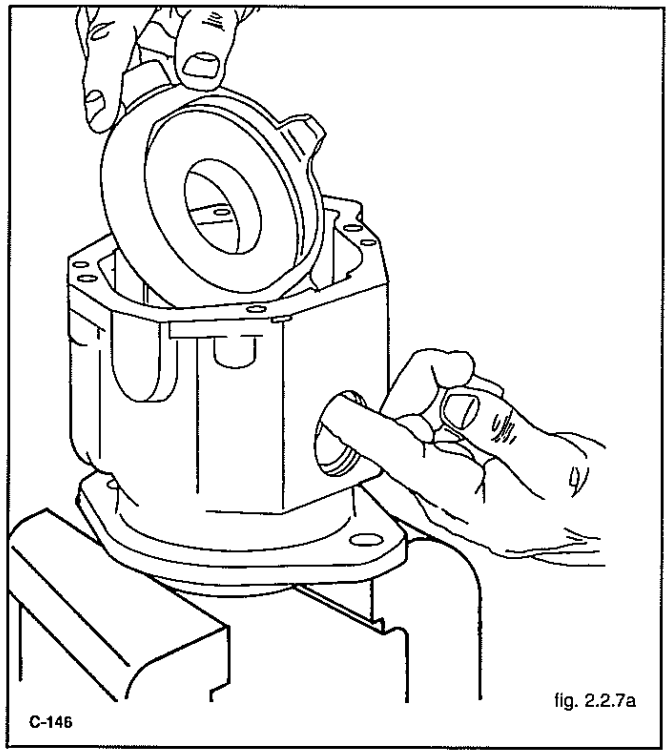


fig. 2.2.7a

Discard all old gaskets, seals and O-rings and replace with new ones on reassembly.

Clean all parts in a suitable solvent and lubricate with system oil before reassembly.

1. Install the camplate in the pump housing (fig. 2.2.7a)

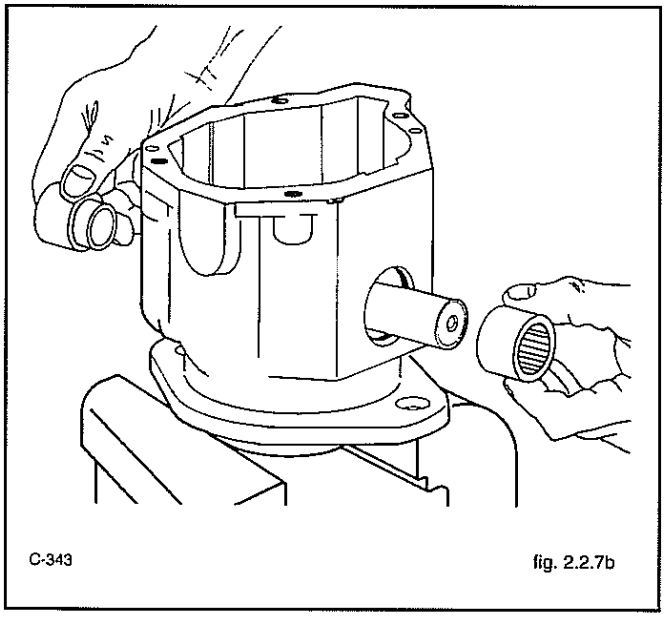
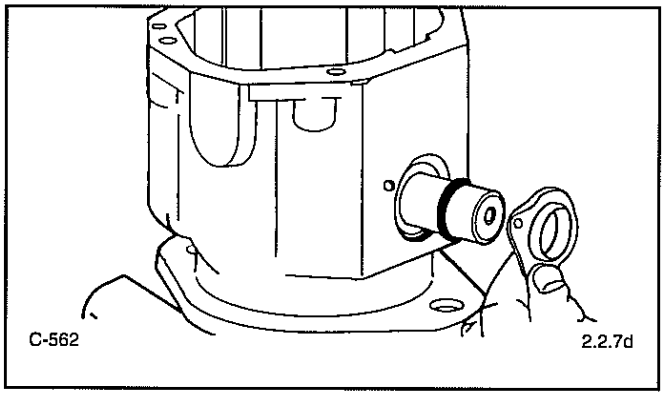


fig. 2.2.7b

2. Insert the needle bearings and inner races over the camplate shafts and slide them into the housing (fig. 2.2.7b). The numbered end of both the bearings and races should face outward and the chamfered I.D. of the races should face inward.



2.2.7d

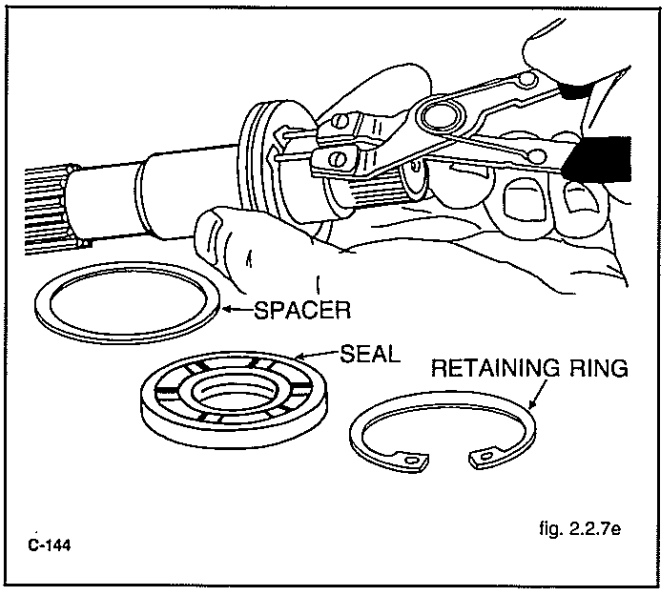


fig. 2.2.7e

3. Install the washer and new shaft seal on the camplate

4. Install the seal cover (fig. 2.2.7d).

5. Install the washer, new O-ring, O-ring cover and trunnion cover on the opposite side of the pump housing. Torque the screws 3 to 4 ft. lbs. (4 to 5 N.M).

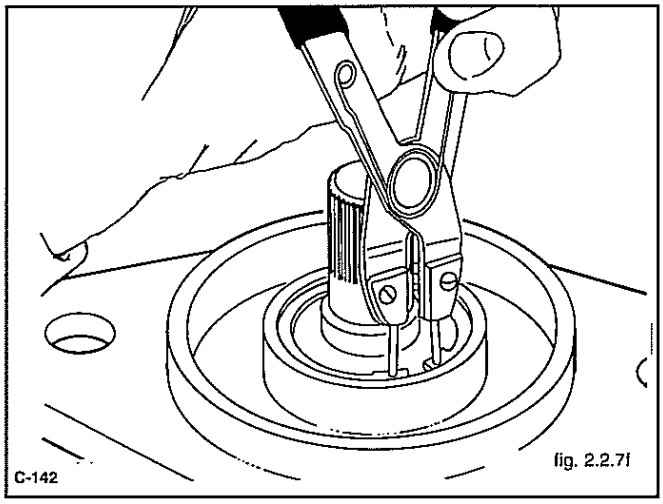


fig. 2.2.7f

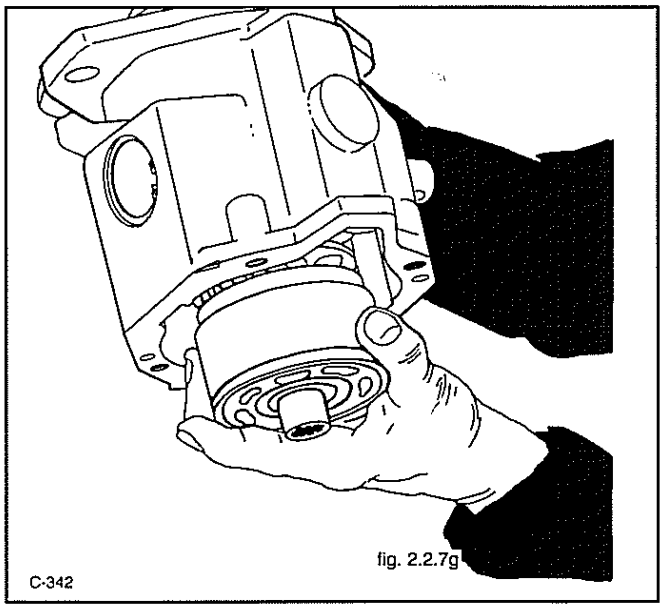


fig. 2.2.7g

WARNING

To prevent personal injury the piston block spring is highly compressed and ther retaining ring should not be removed without first compressing the spring.

6. If the piston block has been disassembled, install the 3 pins, washers and spring. Compress the spring and install the retaining ring.

7. Install the spider pivot, spider and nine pistons in the piston block. Install the piston block in the housing (fig. 2.2.7g). Line up the spline on the piston block with the spline on the pump shaft.

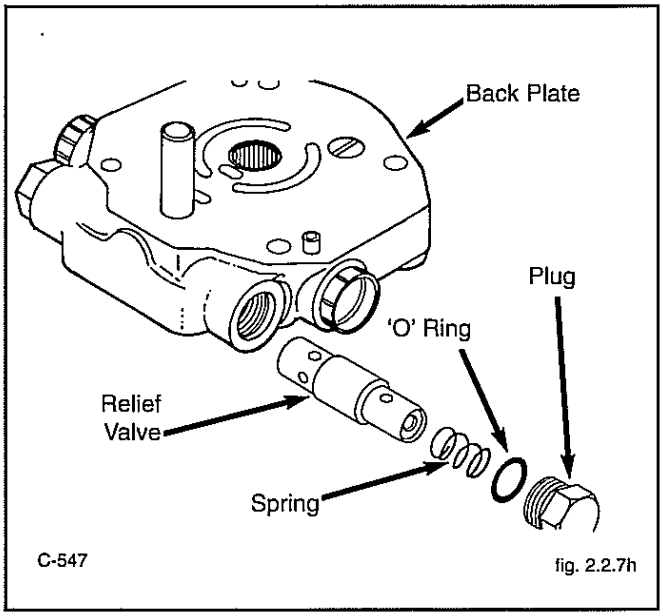


fig. 2.2.7h

8. Ensure the piston shoes come in contact with the cam-plate. The piston block will extend slightly beyond the housing when installed.

9. Install a new gasket on the housing.

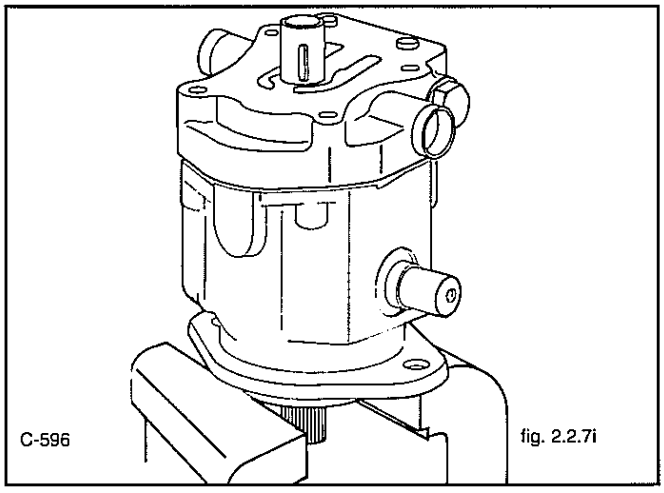


fig. 2.2.7i

2 HYDRAULIC DRIVE SYSTEM

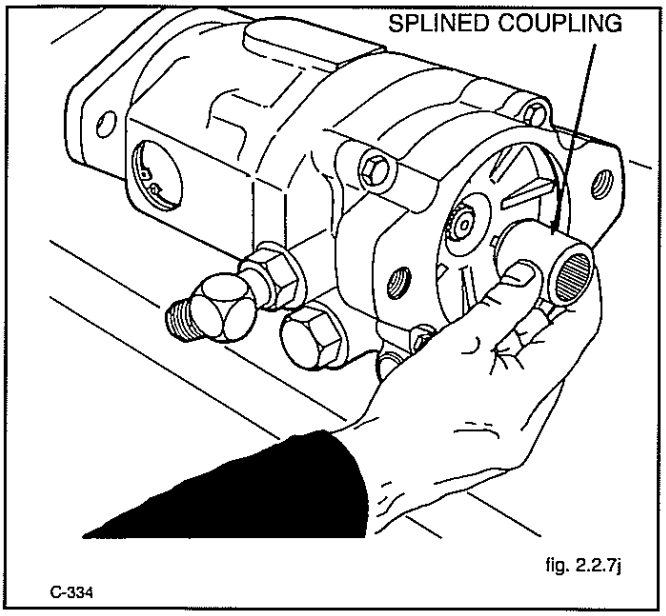


fig. 2.2.7j

C-334

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.

10. Install the two relief valves and springs into the back plate assembly (fig. 2.2.7h). Place a new O-ring on the plugs and torque plugs to 55 - 60 ft. lbs. (75-81.3 N.M).

11. Install the back plate on the housing being careful not to damage the gasket (fig. 2.2.7i). When installed there will be a slight gap between the back plate and housing.

12. Install the splined drive coupler in the rear piston pump (fig. 2.2.7j).

WARNING

To prevent personal injury do not work on a loader with the boom arms in a raised position unless the boom locks are engaged.

WARNING

To prevent personal injury never repair or tighten hydraulic hoses or fittings with the engine running or the system under pressure.

2.2.8 CHARGE PRESSURE VALVE

Thomas S series loaders are now equipped with a charge pressure check valve located just after the hydrostatic oil filter. This valve is pre-set and will divert charge oil to the hydrostatic pumps. Charge pressure may be checked at the valve or at the transfer line between the two pumps. Charge pressure should be approximately 60 to 120 PSI.

2.2.9 CAMPLATE SEAL REPLACEMENT

The hydrostatic pump camplate seals can be replaced without removing the hydrostatic pump from the loader.

Discard all seals and replace as new upon reassembly.

1. Remove any attachment, raise the boom arms and engage the boom locks. Shut off the engine.

WARNING

To prevent personal injury do not work on a loader with the boom arms in a raised position unless the boom locks are engaged.

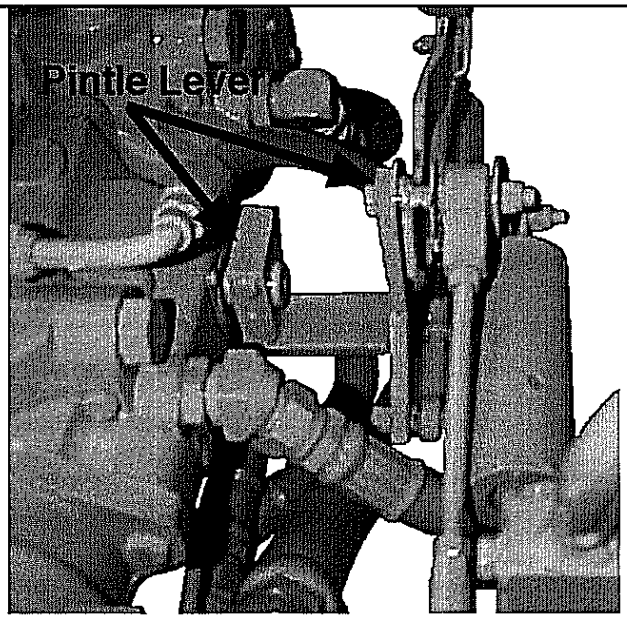
WARNING

To prevent personal injury never repair or tighten hydraulic hoses or fittings with the engine running or the system under pressure.

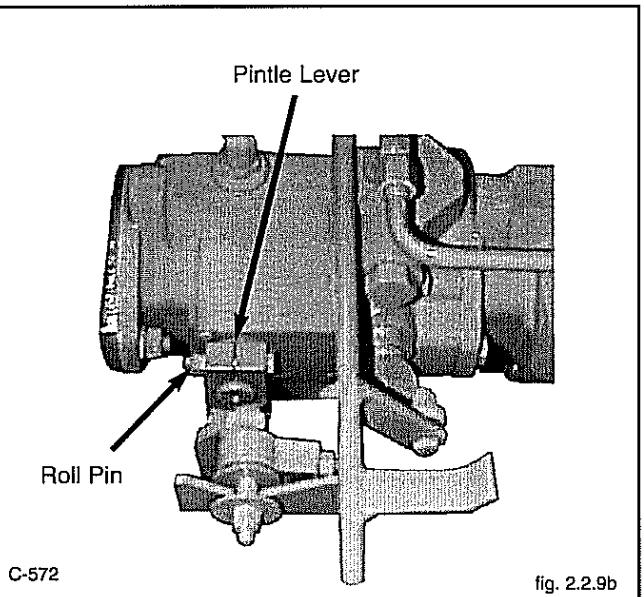
2. Remove the seat and the hydrostatic shield.

IMPORTANT

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

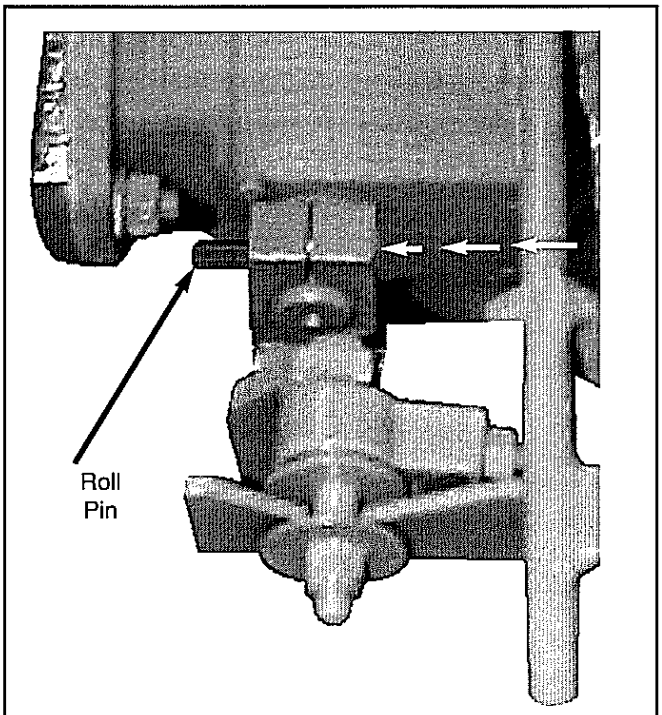


C-502 fig. 2.2.9a



C-572 fig. 2.2.9b

3. Disconnect the steering control linkage and the shock absorber from the pump pintle lever (fig. 2.2.9a).



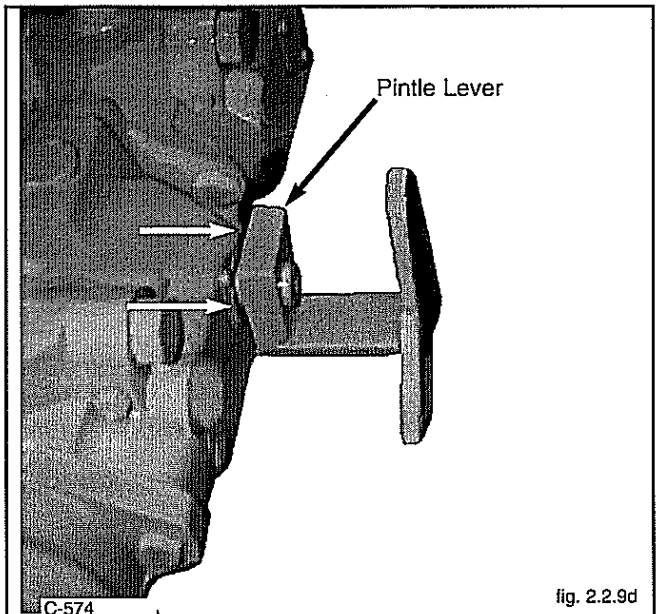
C-573 fig. 2.2.9c

4. Remove the clamp bolt from the botton of the pintle lever (fig. 2.29b).

5. Remove the roll pin from the pintle lever (fig. 2.2.9c).

6. Remove the pintle lever from the camplate shaft (fig. 2.2.9d).

7. Remove the two screws holding the seal cover in place and remove the seal cover (fig. 2.2.9e). On reassembly torque the screws 3 to 4 ft. lbs. (4 to 5 N.M).



C-574 fig. 2.2.9d

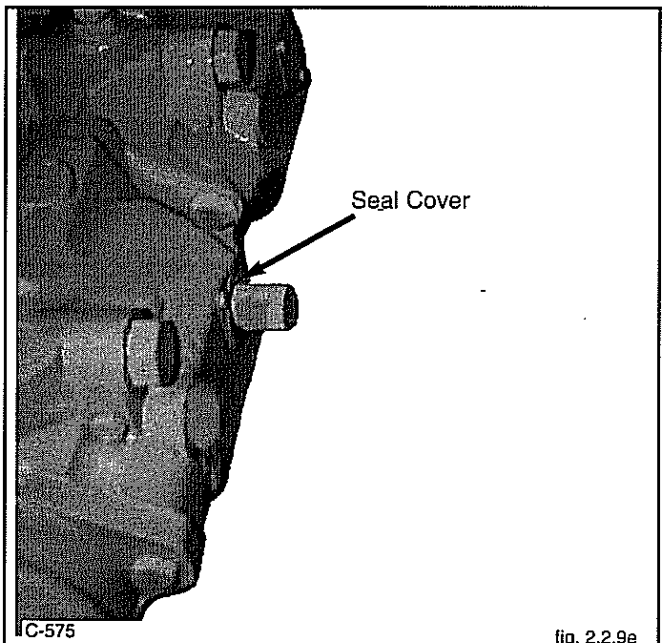


fig. 2.2.9e

8. Remove the shaft seal. On reassembly install a new shaft seal.

9. Remove the two screws, trunnion cover, O-ring cover and O-ring from the opposite side of the pump housing. On reassembly torque screws 3 to 4 ft. lbs. (4 to 5 N.M.). On reassembly install a new O-ring.

2.2.10 REAR PUMP - SHAFT SEAL REPLACEMENT

1. Disconnect exhaust pipe and air intake from the engine.

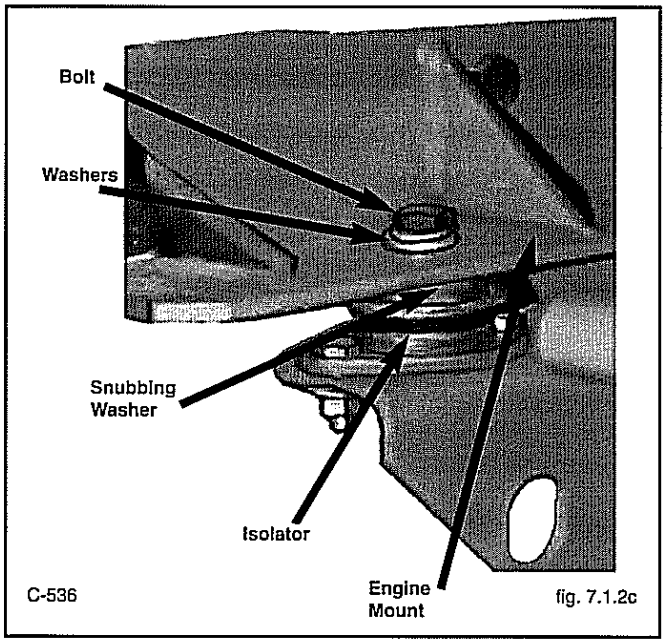


fig. 7.1.2c

2. Remove the engine mounting bolts and counternuts from the engine (fig. 2.2.10a).

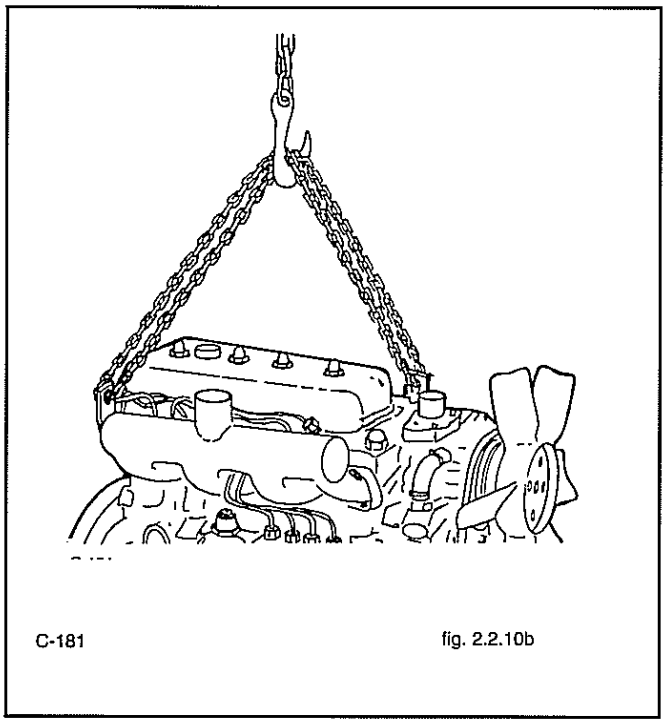


fig. 2.2.10b

3. Connect chains to the two lifting hooks located on the front and rear of the engine (fig. 2.2.10b).

4. Using a chain hoist lift the engine and move it toward the rear of the loader until the universal joint slides off the end of the rear pump shaft (fig. 2.2.10c).

5. Remove the retaining ring from the hydrostatic pump (fig. 2.2.10d).

6. Remove the pump shaft seal (fig. 2.2.10e).

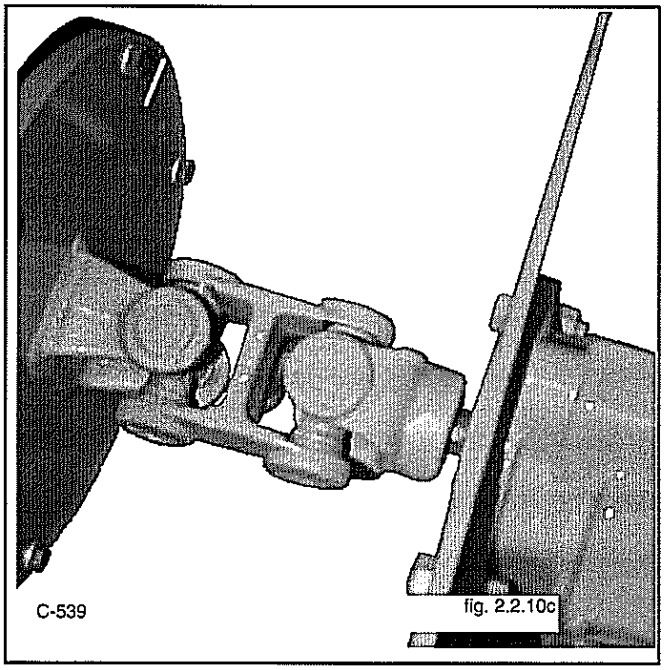


fig. 2.2.10c

NOTE: The back up washer may come out when the shaft seal is removed. Ensure the washer is reinstalled before installing a new pump shaft seal.

7. Lubricate a new pump shaft seal with system fluid and reinstall it in the pump.

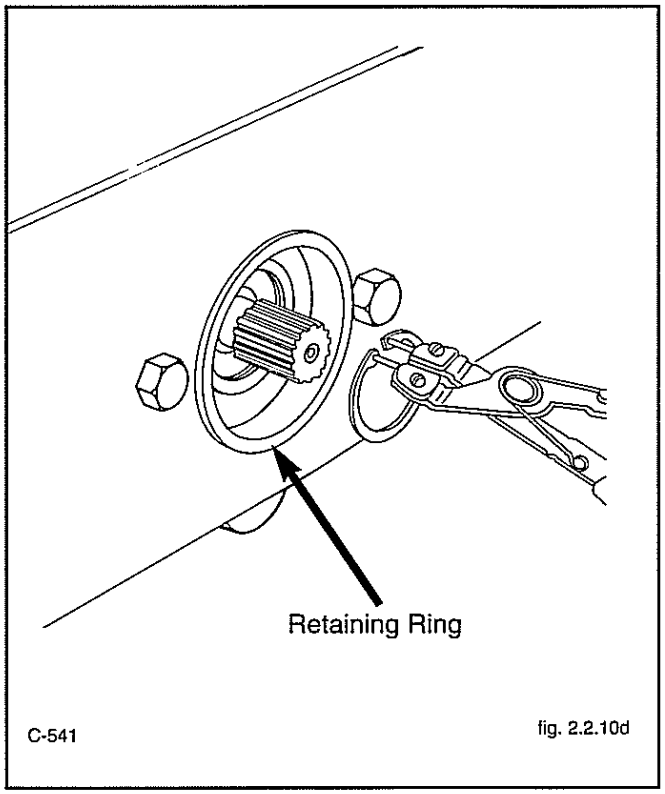


fig. 2.2.10d

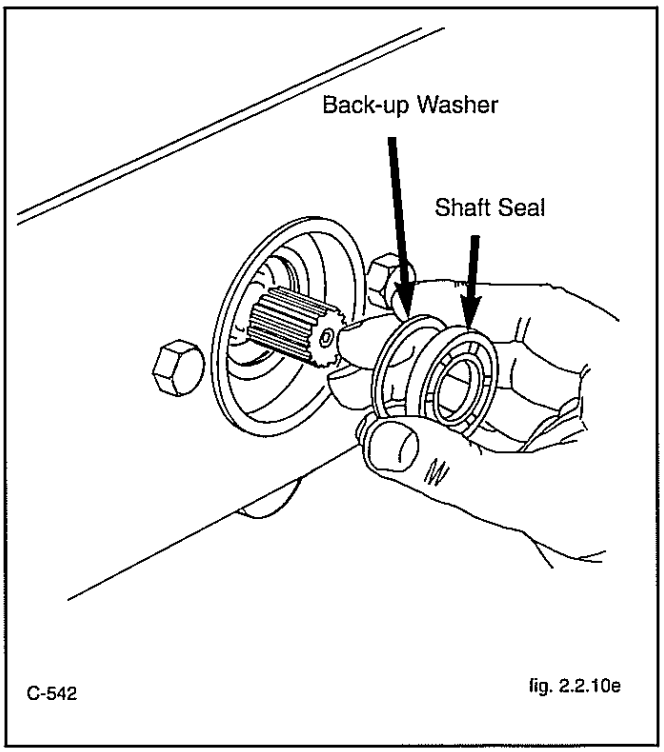
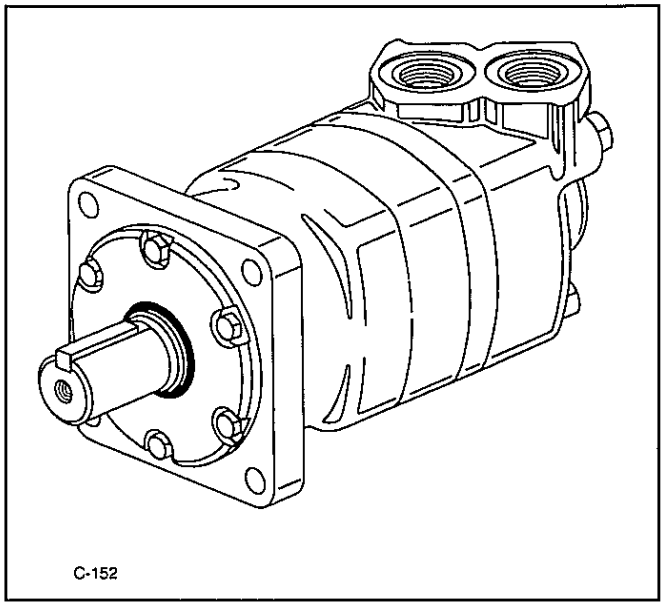


fig. 2.2.10e

2.3 TORQUE MOTOR



2.3.1 SPECIFICATIONS

Motor type.....Geroler
Displacement.....29.9 cu. in (489.9 cm³)
Rotation.....Dual
Section bolt torque.....62.5 ft. lbs. (84.7 N.M.)
Retainer cover bolt torque.....25 ft.lbs. (33.9 N.M.)
Mounting nut torque (to frame).....100-110 ft.lbs. (136-149 N.M.)
Sprocket nut torque.....350 ft. lbs. (475 N.M.)

2.3.2 GENERAL INFORMATION

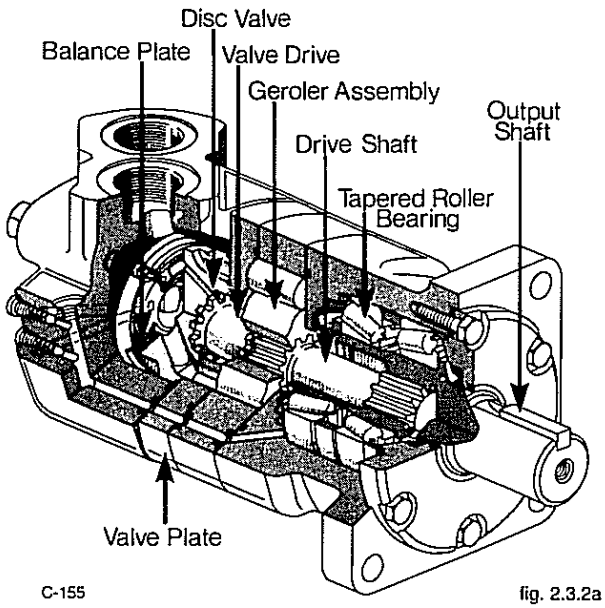
The basic geroler design uses a combination of mechanical and hydraulic principles that are utilized in the high torque, low speed motors.

The outer ring (fig. 2.3.2b) of the geroler assembly is similar to an internal gear that is held in a fixed position by securing it to the motor housing. The rotating inner gear, called a star, orbits inside the secured outer ring.

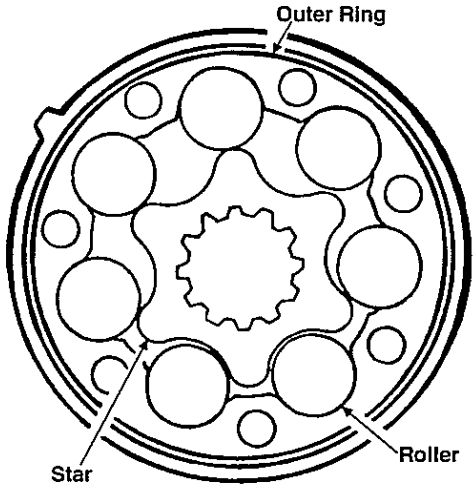
Because of the different number of teeth on the star and outer ring, the star rotates in an eccentric circular orbiting motion from the housing center line (fig. 2.3.2c).

A drive shaft is used to transmit the rotation of the star to the output shaft. The drive shaft has crowned external splines to match the internal splines in the star and output shaft. This type of drive is used because the star center line continuously changes during rotation.

2 HYDRAULIC DRIVE SYSTEM



C-155 fig. 2.3.2a



C-153 fig. 2.3.2b

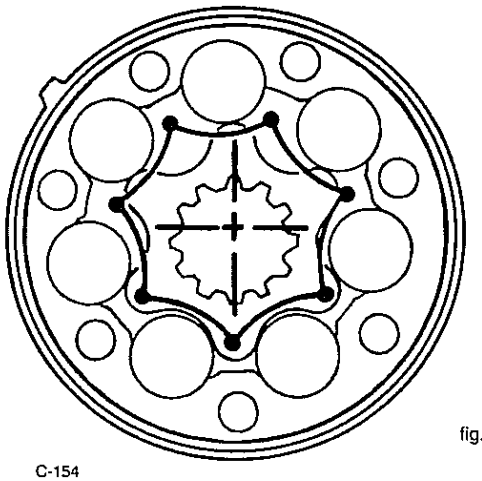
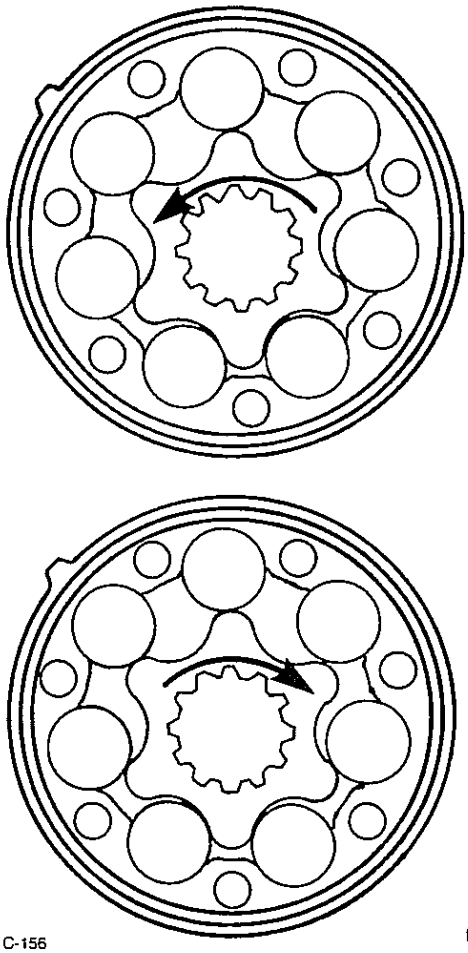


fig.2.3.2c C-154

As the star orbits it, it causes a continuous opening and closing of the outer ring fluid pockets. Half of these fluid pockets are subject to fluid pressure, causing star rotation, and the opposing half are connected to a return line.

When pressure is introduced into the fluid pockets on the right side of the star (fig. 2.3.2d) the output rotation will be counterclockwise. When the fluid pockets on the left side of the star are pressurized the output rotation will be clockwise.



C-156 fig. 2.3.2d

To seal the fluid pockets the torque motor incorporates a rotating roller type seal (fig. 2.3.2e). This type of a rolling seal reduces friction at the star points providing increased efficiency and reduced component wear.

The geroler (fig. 2.3.2f), is both a fluid displacement motor and a gear reducer. It provides six times (the number of star points) greater power per revolution than a gear, vane or piston type motor. This means that six times greater torque can be developed at one-sixth the speed without further gear reduction.

Shown in figure 2.3.2g is one complete star orbit, or one-sixth of the output shaft rotation. The star must travel through six complete orbits for each single rotation of the output shaft creating a speed reduction of six to one.

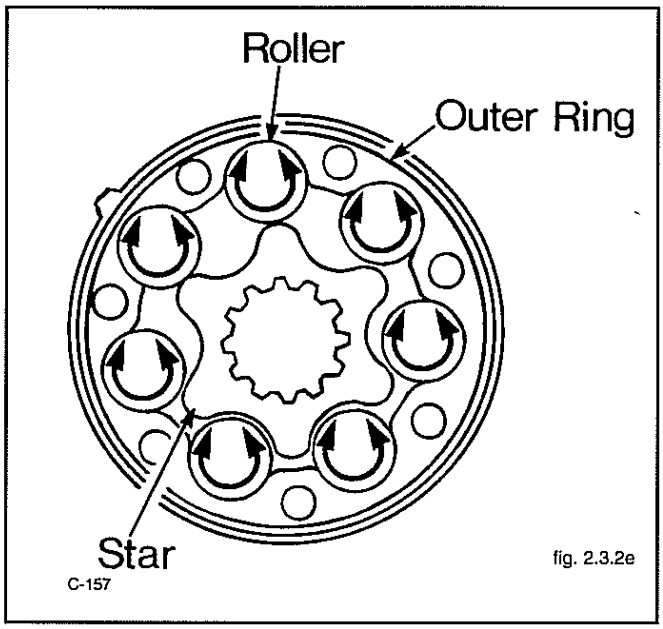


fig. 2.3.2e

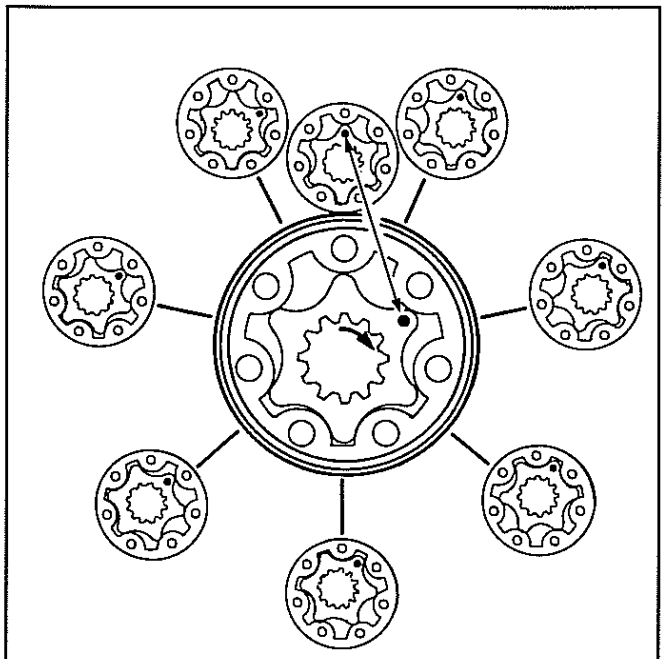


fig. 2.3.2h

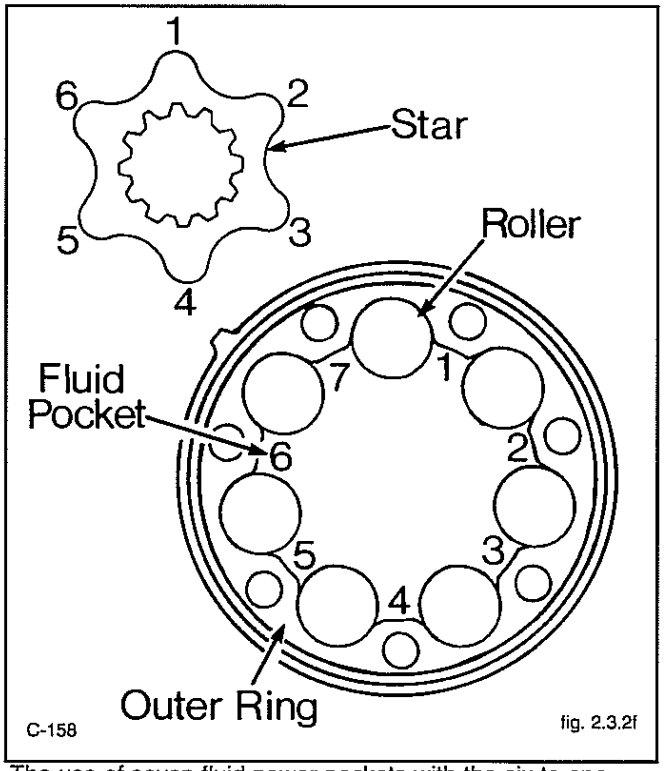


fig. 2.3.2f

The use of seven fluid power pockets with the six to one ratio provides forty-two fluid power cycles per each complete shaft rotation.

For smooth and continuous motor output rotation, the torque motor utilizes a disc value which operates in synchronization with the geroler star. The disc valve arrangement consists of a stationary balance plate, rotating disc valve and a stationary valve plate (fig. 2.3.2h).

The disc valve contains an inlet fluid passage port for each star valley area and a return fluid passage port.

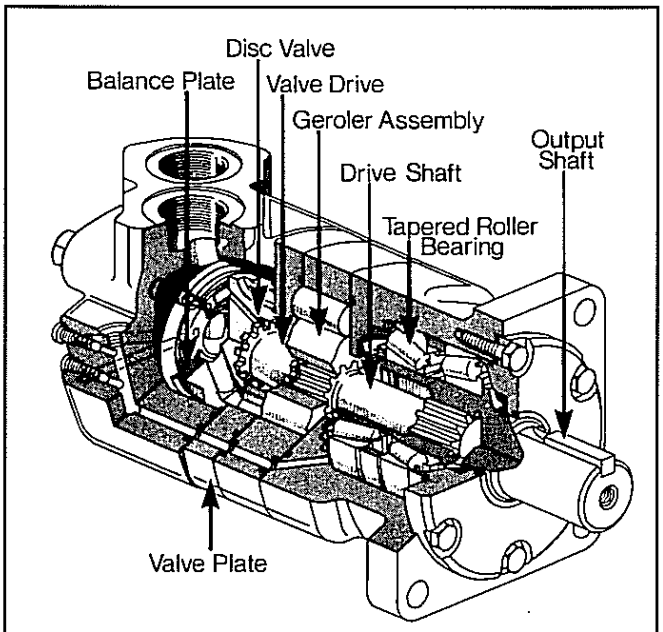
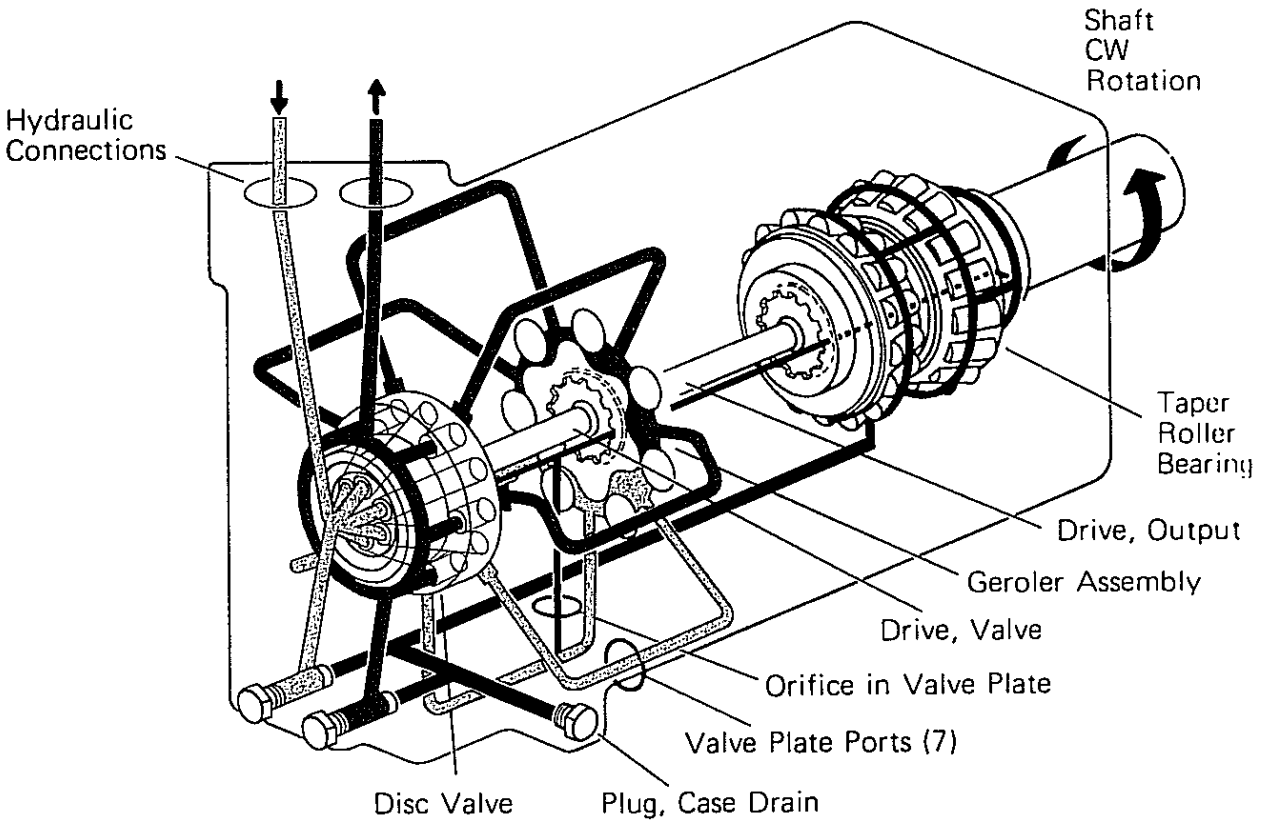


fig. 2.3.2h

2 HYDRAULIC DRIVE SYSTEM



C-167

fig. 2.3.2j

A separate crowned drive shaft is used to synchronize the disc valve and geroler star so that they turn as one. To accept fluid from the disc valve, the valve plate also contains internal porting passages to each outer ring pocket area.

Figure 2.3.2j illustrates the fluid flow through the torque motor for clockwise rotation.

Fluid enters the housing through the inlet port and is directed to the balance plate. The balance plate contains an inner and outer seal to separate the high and low pressure fluid passages. Fluid passes through the stationary balance plate to the rotating disc valve. The rotating disc valve ports the fluid to the stationary valve plate and proper side of the geroler pockets causing the rotor star to turn.

As the rotor star rotates, and each fluid pocket reaches its full open position, the return porting in the rotating disc valve opens to allow the fluid in the pocket area to pass back through the valve plate, disc valve, balance plate and out through the housing return port, as the pocket closes.

The disc valve is timed to the geroler rotor star to govern the inlet fluid flow to output shaft rotation. If the timing of the disc valve to geroler star is off one tooth, the relationship of input fluid flow to output motor shaft rotation will be reversed.

2.3.3 TORQUE MOTOR REMOVAL

1. Remove any attachment, raise the boom arms and engage the boom locks. Shut off the engine.

WARNING

To avoid personal injury do not work on a loader with the boom arms in a raised position unless the boom locks are engaged.

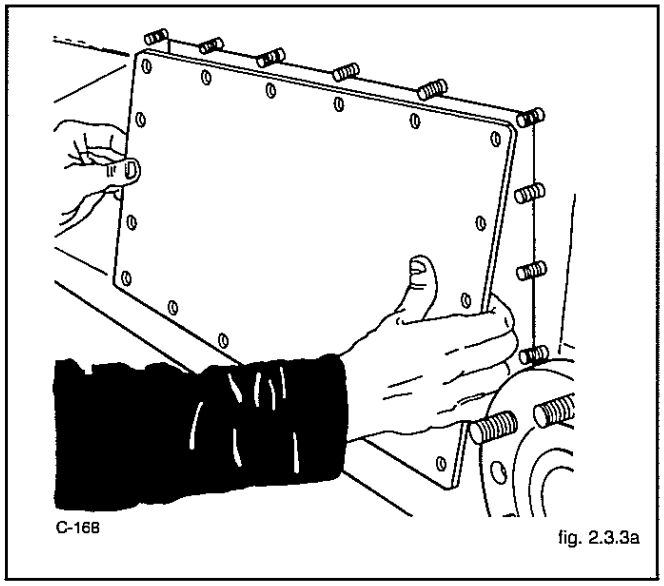

C-168

fig. 2.3.3a

2. Block the loader securely with all four wheels clear of the ground.

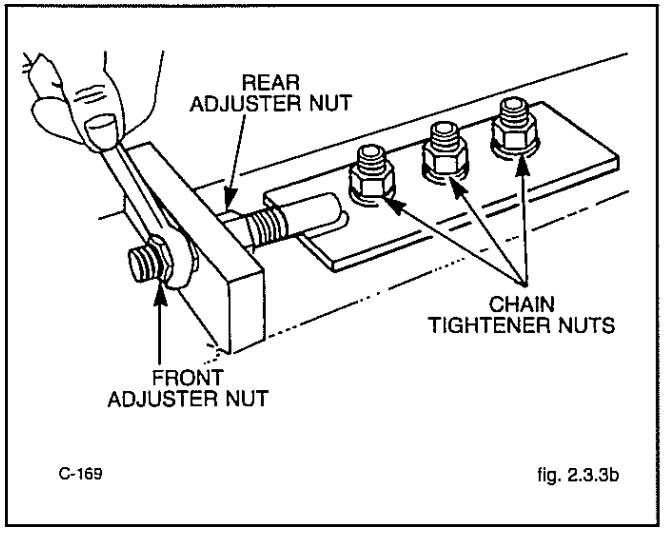
3. Remove the wheels on the side of the machine that the torque motor is to be removed from.

4. Drain the hydraulic reservoir. (Refer to section 1.7.3 for procedure).

5. Drain the lubricating oil from the final drive housing. (Refer to section 3.2.2 for procedure).

6. Remove the final drive inspection plate cover (fig. 2.3.3a) located between the axles on the final drive housing.

7. Loosen the three chain tightener nuts (fig 2.3.3b). Back off the front and rear adjuster nuts. Move the chain tightener plate back to loosen the chain.



C-169

fig. 2.3.3b

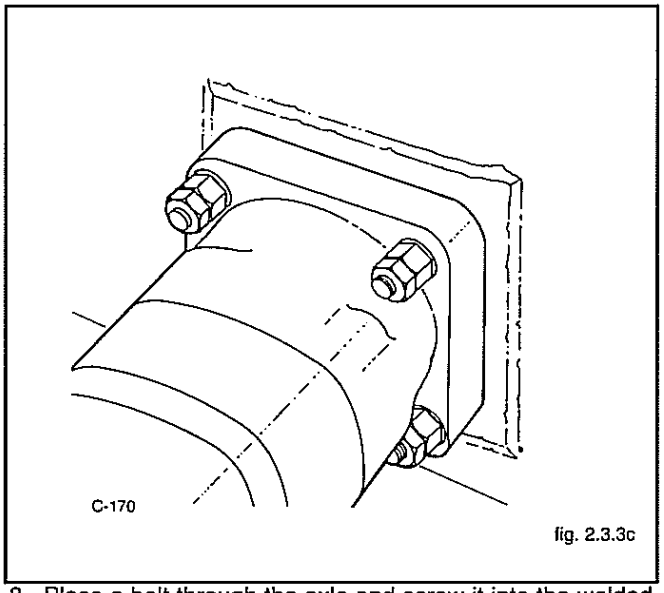
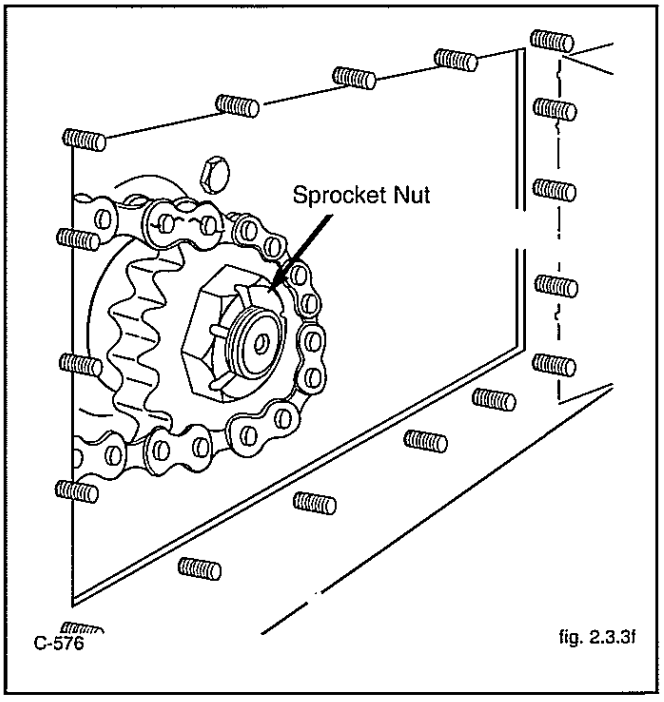

C-170

fig. 2.3.3c

8. Place a bolt through the axle and screw it into the welded nut located on the final drive housing to prevent the torque motor shaft turning as the sprocket nut is loosened.

Remove the torque motor sprocket nut (fig. 2.3.3f).



C-576

fig. 2.3.3f

The torque motor can be removed with the sprocket and nut in place.

On reassembly torque the nut to 350 ft. lbs. (474.5 N.M.).

9. Straighten and remove the chain connection link cotter pin (fig. 2.3.3g and 2.3.3h) and remove the connection link

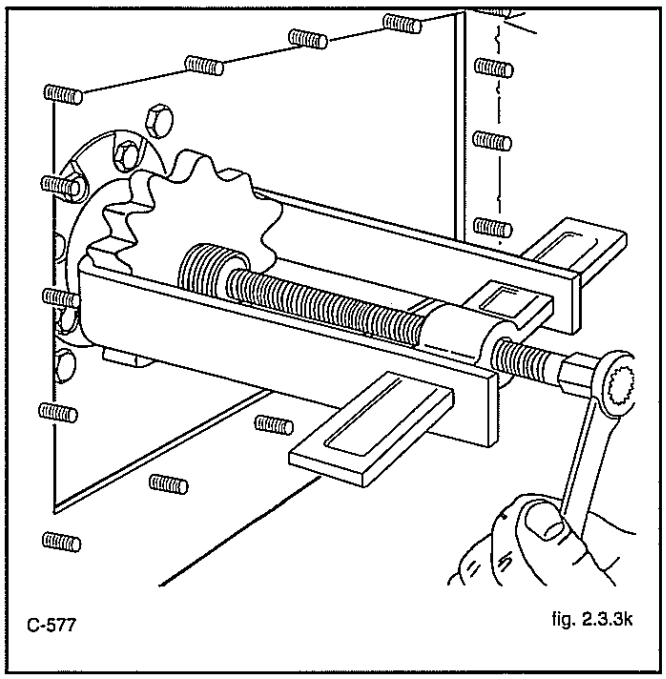
2 HYDRAULIC DRIVE SYSTEM

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

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

    On reassembly install a new connection link and cotter pins.

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



C-577 fig. 2.3.3k

12. Disconnect and remove the high pressure hose between the pump and the motor (fig. 2.3.3k).

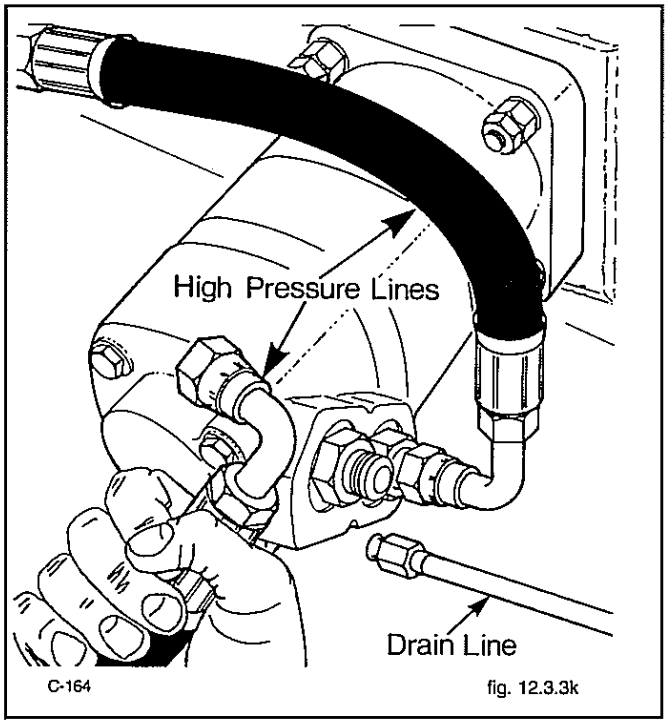
    If rubber high pressure lines are installed in the loader only the torque motor needs to be disconnected.

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

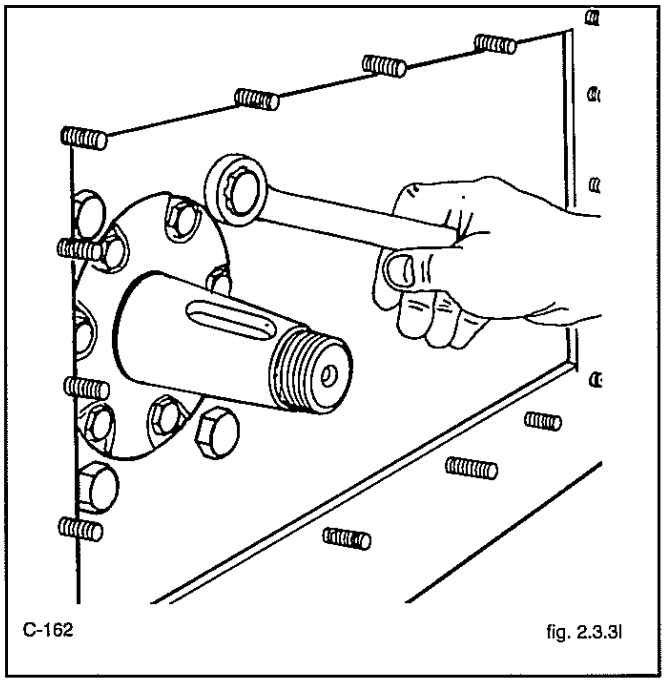
IMPORTANT

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.

13. Disconnect and remove the drain line from the torque motor (fig. 2.3.3k). Cap the line and plug the motor drain port.
14. Hold the torque motor mounting bolts from turning when the mounting nuts are loosened. (fig. 2.3.3l).



C-164 fig. 12.3.3k



C-162 fig. 2.3.3l

16. Remove the jam nuts, mounting nuts and lockwashers from the torque motor (fig. 2.3.3m).

    On reassembly torque the mounting nuts 85- 90 ft.lbs. (115-122 N.M.). Torque the jam nuts against the mounting nuts 40 - 60 ft.lbs. (54-81 N.M.).

17. Remove the torque motor from the final drive housing (fig. 2.3.3n).

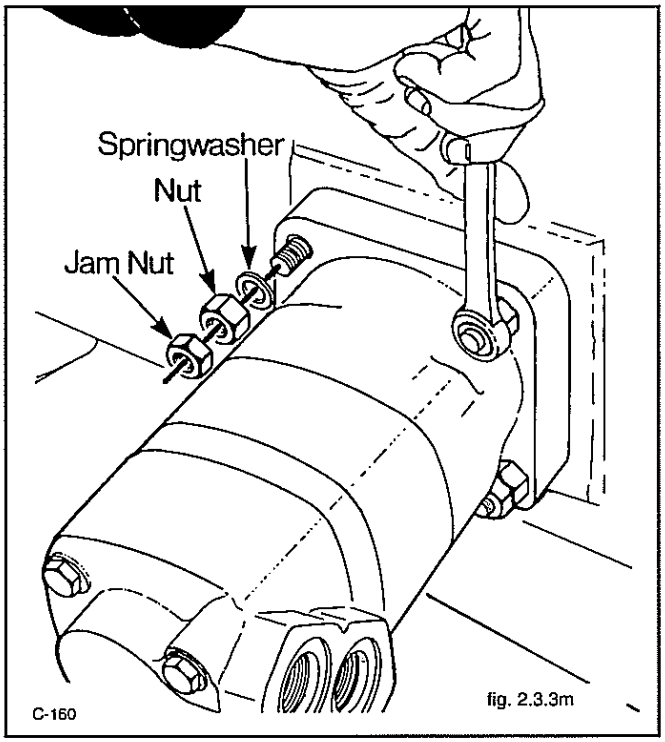


fig. 2.3.3m

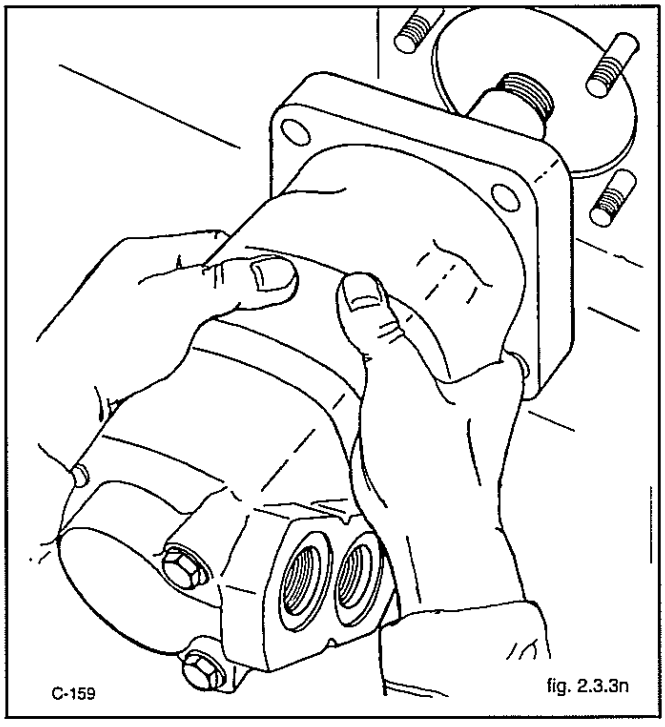


fig. 2.3.3n

2.3.4 TORQUE MOTOR REPLACEMENT

1. Apply silicon sealant around the torque motor flange (fig. 2.3.4a) to prevent oil leakage from the final drive housing.

2. Install the torque motor in the final drive housing (fig. 2.3.4c).

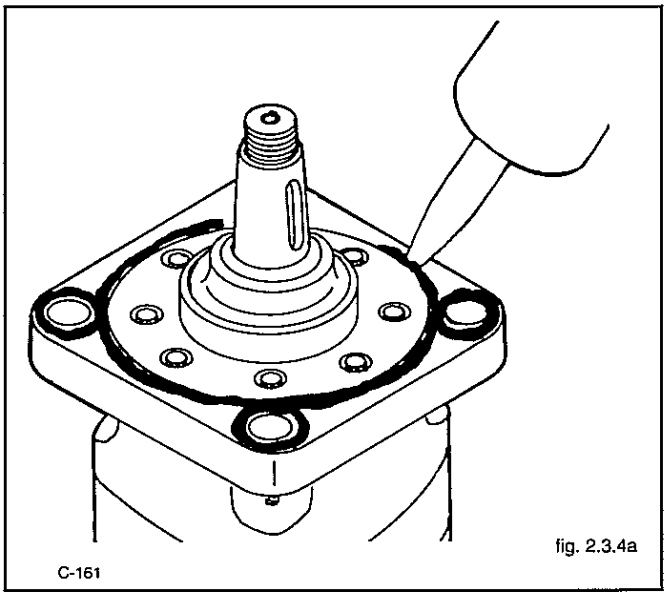


fig. 2.3.4a

3. Install the lockwashers, mounting nuts and jam nuts which secure the motor to the housing (fig. 2.3.4d).

   Torque the mounting nuts 85-90 ft. lbs. (115-122 N.M). Torque the jam nuts 40-60 ft. lbs. (54-81 N.M.)

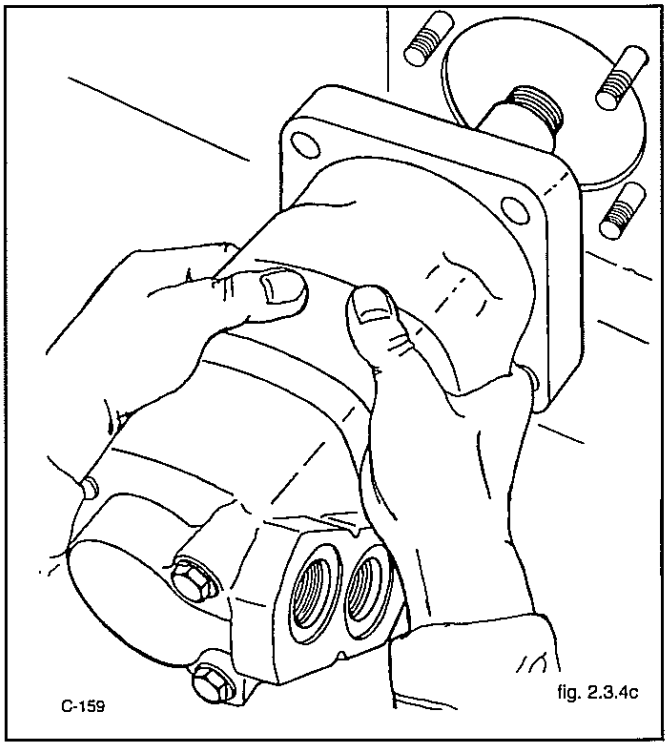


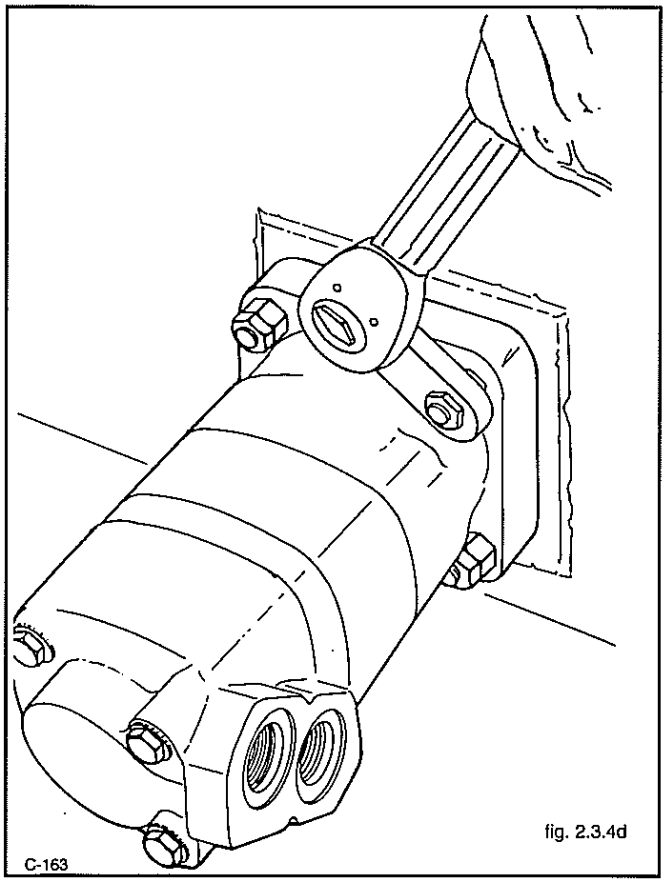
fig. 2.3.4c

4. Install the torque motor drain line (fig 2.3.4e).

   Install the two high pressure lines between the hydrostatic pump and torque motor (fig. 2.3.4e).

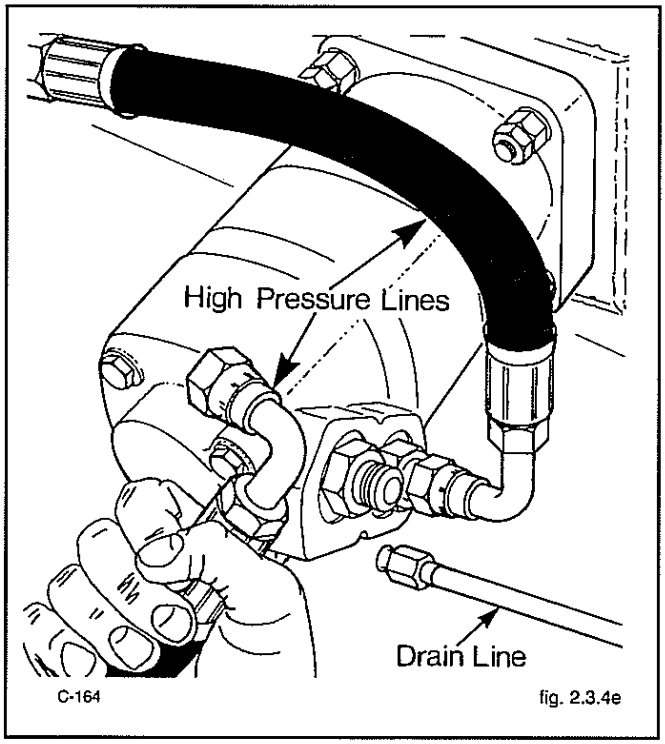
5. Install the key on the torque motor shaft (fig. 2.3.4f).

6. Line up the sprocket with the key and install the sprocket on the shaft.

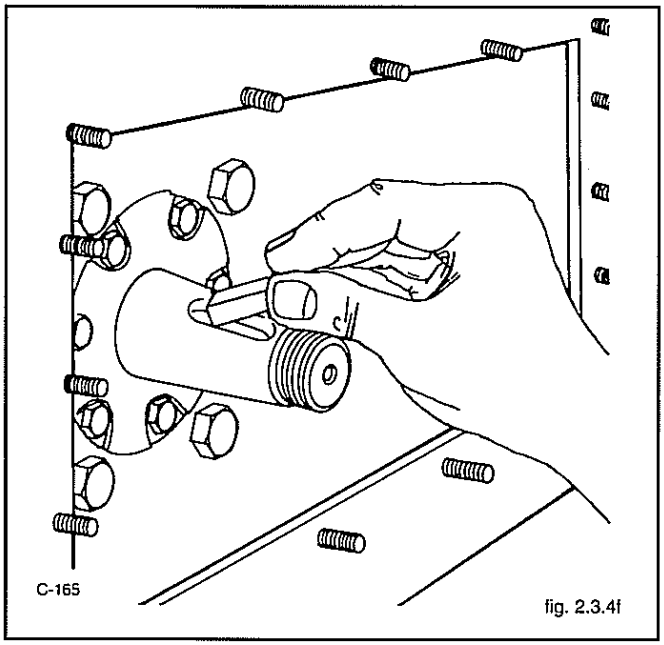


C-163 fig. 2.3.4d

7. Install the drive chain in the final drive housing. (Refer to section 3.3.3 for the correct procedure). Use new connection links and cotter pins.



C-164 fig. 2.3.4e



C-165 fig. 2.3.4f

2 HYDRAULIC DRIVE SYSTEM

8. Install a bolt through axle to prevent the torque motor shaft turning as the sprocket nut is tightened (fig. 2.3.4j)

IMPORTANT

To obtain correct brake performance it may be necessary to adjust the brake caliper assembly after removal or replacement of parts. Refer to section 4.5 for procedure.

9. Install the torque motor sprocket nut and torque to 350 ft.lbs. (474.5 N.M.) (fig. 2.3.4k).

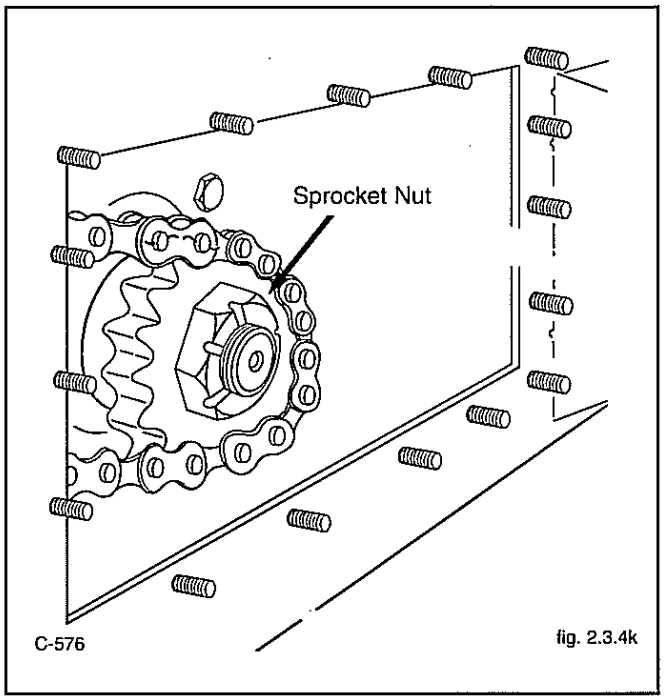
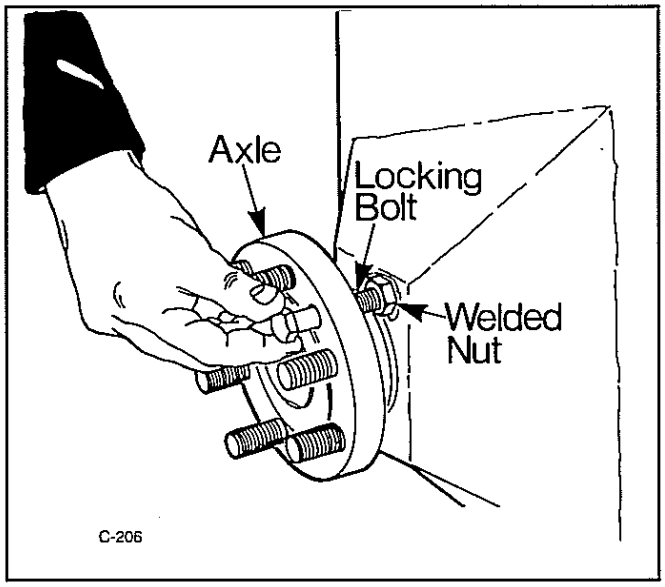


fig. 2.3.4k



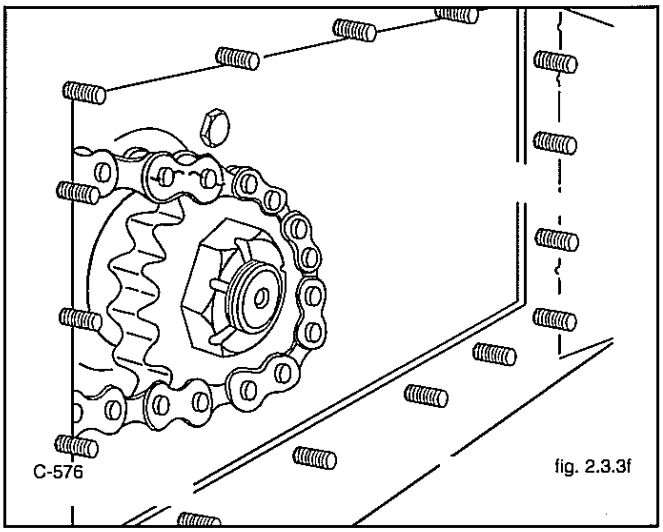


fig. 2.3.3f

10. Adjust the chain tension as shown in section 3.3.1.

11. Install the final drive housing drain plug and fill the housing with 10W30 API classification SE/CD oil to the correct level. Refer to section 3.2.

12. Apply silicon to the inspection cover and install the cover (fig. 2.3.4r).

13. Install the wheels. Torque the wheel nuts 100 - 110 ft. lbs. (135 - 149 N.M.).

14. Refill the oil reservoir to the correct level with 10W30 API classification, SE/CD oil. Refer to section 1.7.

IMPORTANT

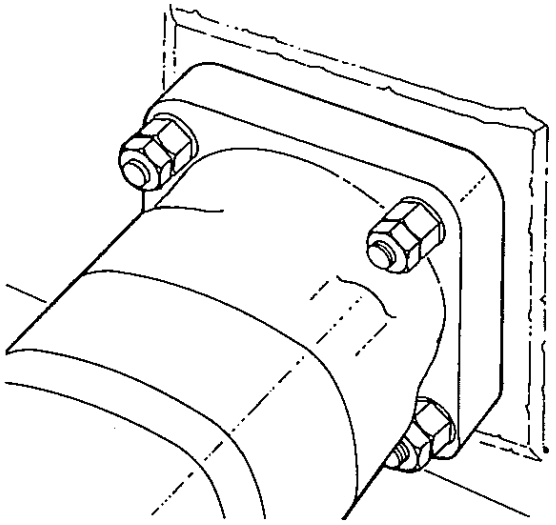
To obtain correct brake performance it may be necessary to readjust the brake assembly after removal or replacement of parts. Refer to section 4.5 for procedure.

IMPORTANT

To prevent damage after removal or repair of hydraulic components refer to start up procedure, section 1.2.6.

2 HYDRAULIC DRIVE SYSTEM

2.3.5 TORQUE MOTOR DISASSEMBLY



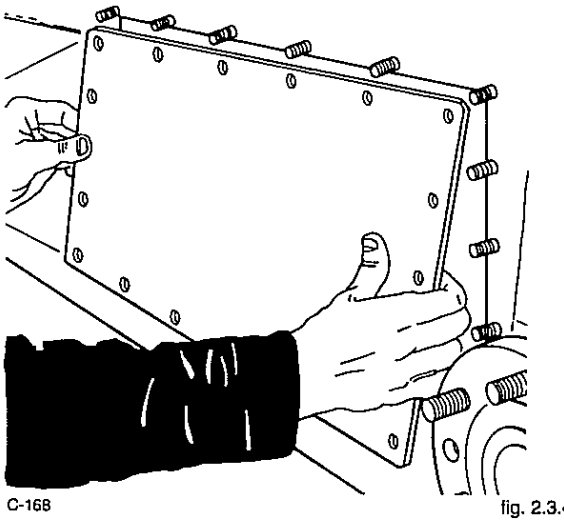
C-170 fig. 2.3.4n

1. bolt (6)
2. dust seal
3. retainer plate
4. shaft seal
5. o-ring
6. key
7. shaft & bearing assy.
8. shaft face seal
9. bearing housing
10. o-ring
11. drive, geroler
12. drain seal
13. geroler assembly
14. valve plate
15. valve drain
16. valve
17. balance ring
18. balance spring (3)
19. inner face seal
20. outer face seal
21. o-ring
22. valve housing
23. plug
24. sleeve
25. spring
26. poppet
27. piston
28. plug
29. stud
30. nut

Before disassembling the torque motor, clean the body with a suitable solvent and dry with compressed air. Be sure all openings are plugged to prevent solvent entering the torque motor.

Discard all old seals and on reassembly replace with new seals.

1. Place the motor in a vise with the output shaft facing down (fig. 2.3.6a). Do not damp the motor on the housing as excessive pressure will cause distortion.



C-168 fig. 2.3.4r

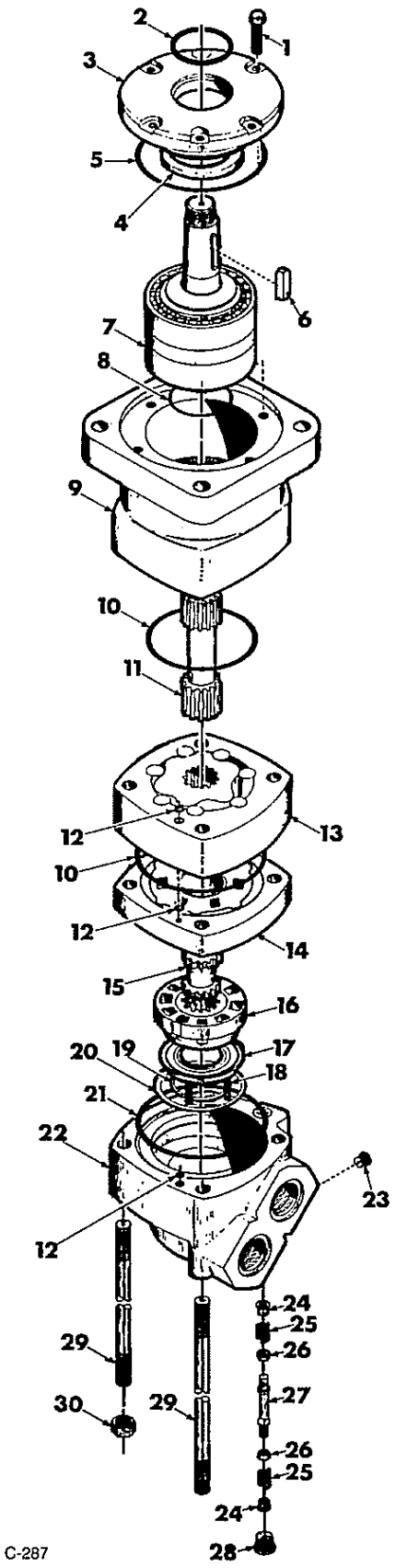
WARNING

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

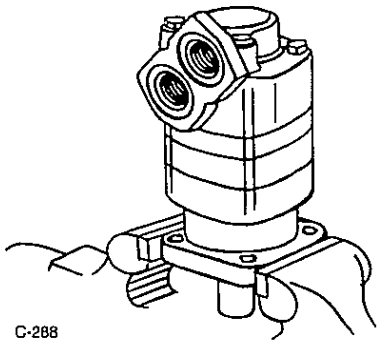
Mark the body sections to assist in reassembly.

IMPORTANT

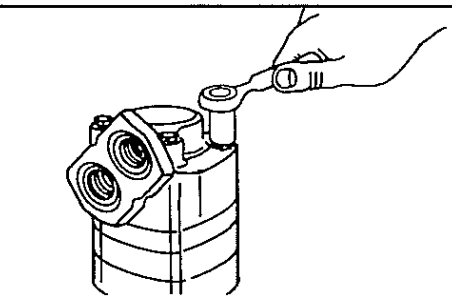
When making repairs to the torque motors, keep all parts clean and remove dirt from the work area. Use caps and plugs on all lines and openings.



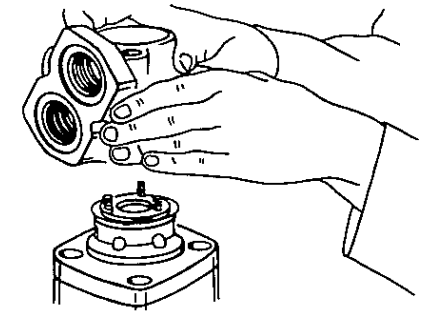
C-287 fig. 2.3.6



C-288 fig. 2.3.6a



C-252 fig. 2.3.6b



C-253 fig. 2.3.6c

2. Remove the four bolts from the motor valve housing (fig. 2.3.6b). On reassembly torque the mounting bolts to 62.5 ft. lbs. (84.7 N.M.). Follow the torque procedure outlined in section 2.3.9.

3. Carefully lift the valve housing straight up (fig. 2.3.6c). The balance ring subassembly and springs should remain on the valve.

2 HYDRAULIC DRIVE SYSTEM

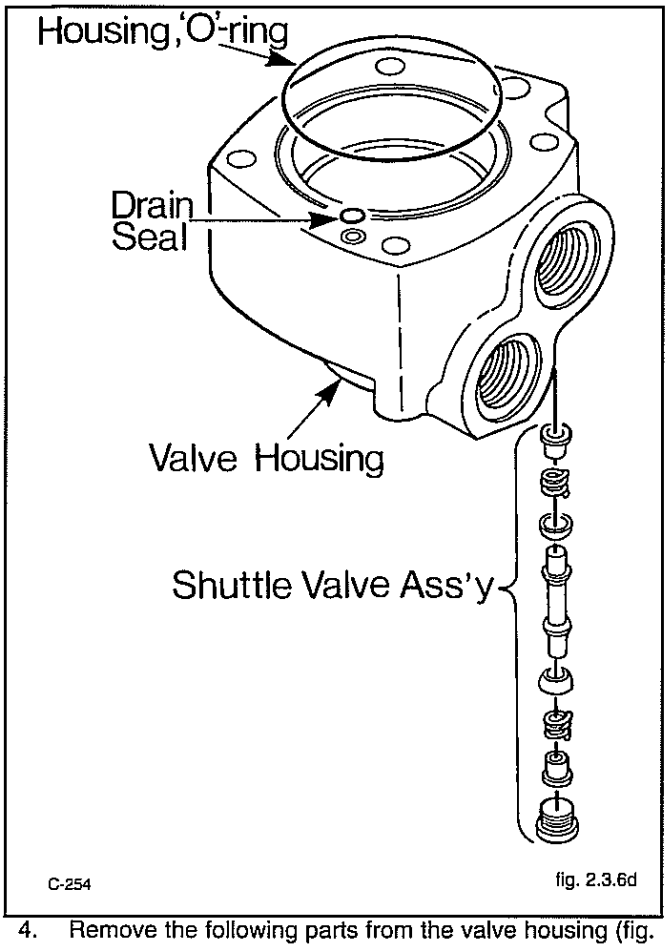


fig. 2.3.6d

4. Remove the following parts from the valve housing (fig. 2.3.6d).
   1 - housing seal
   1 - drain seal
   1 - shuttle valve assembly

5. Remove the three balance springs, balance ring and valve (fig. 2.3.6e). Remove both the inner and outer face seal from the balance ring.

6. Remove the valve plate, seal and valve drive (fig. 2.3.6f).

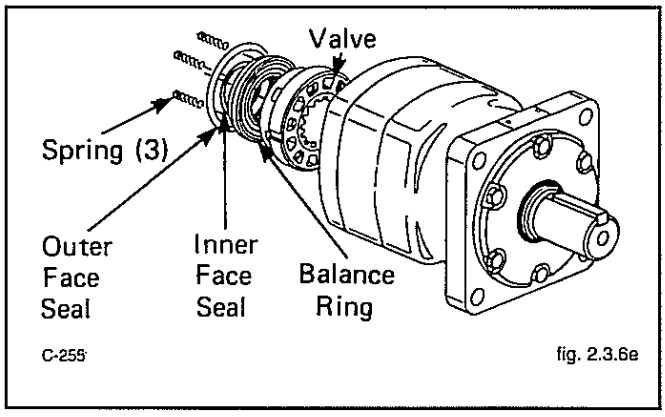


fig. 2.3.6e

7. Remove the geroler assembly (fig. 2.3.6g). Keep the rollers and the inner geroler in the outer geroler ring.

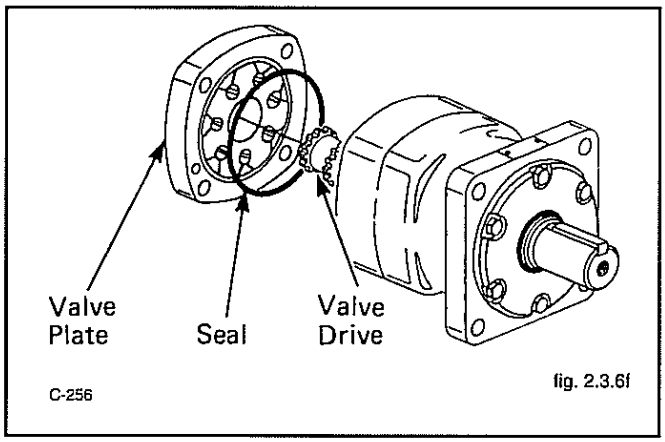


fig. 2.3.6f

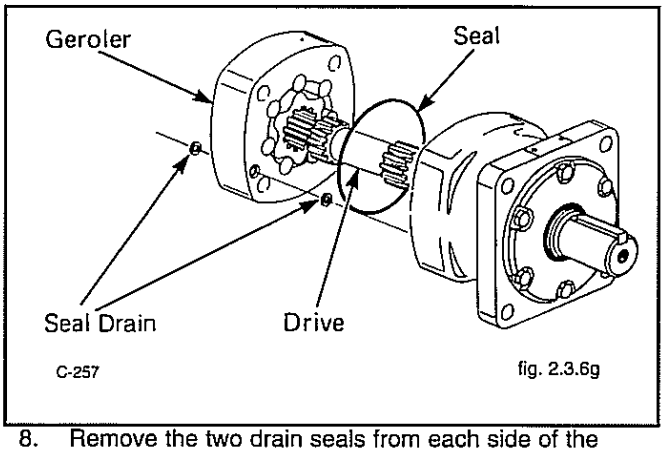


fig. 2.3.6g

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).

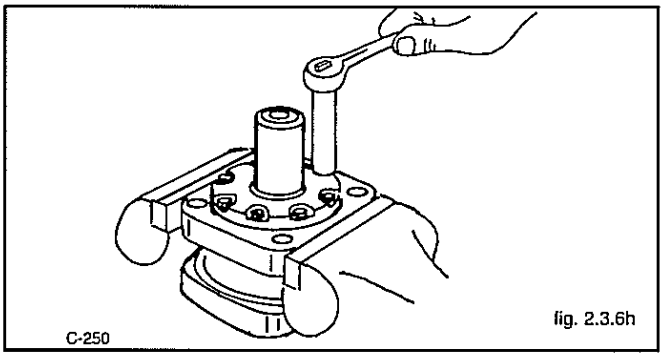


fig. 2.3.6h

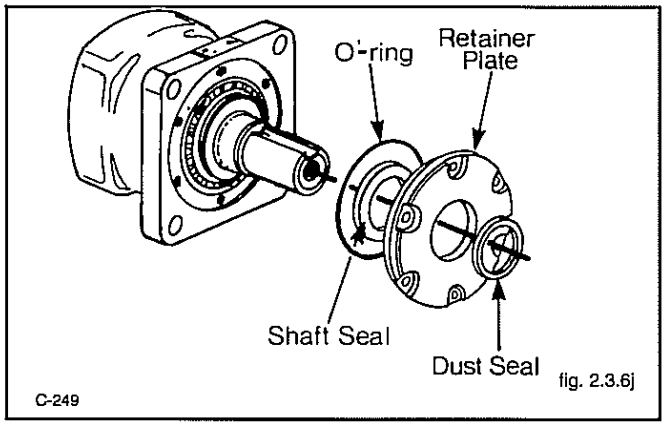


fig. 2.3.6j

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.

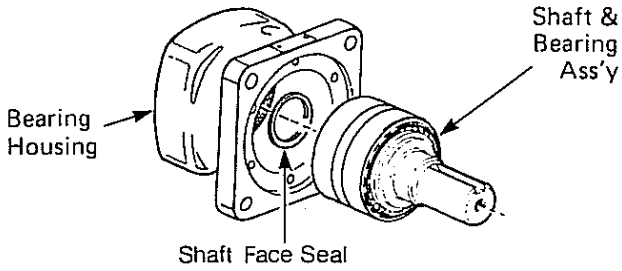


fig. 2.3.6k

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.

2.3.6 TORQUE MOTOR INSPECTION

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

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.

WARNING

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

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

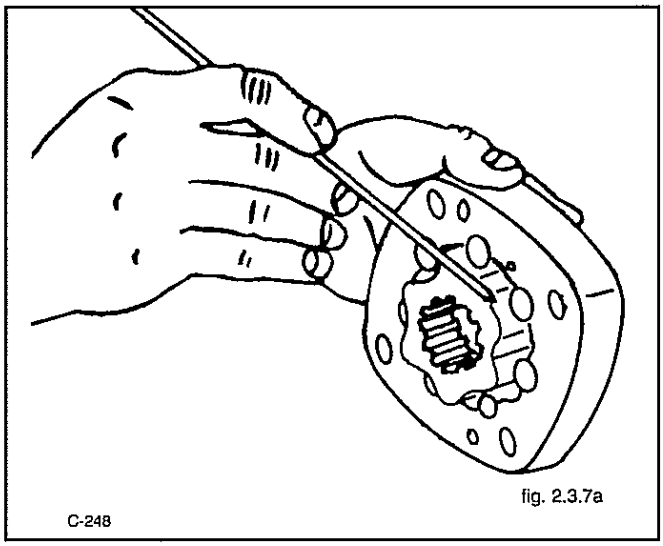


fig. 2.3.7a

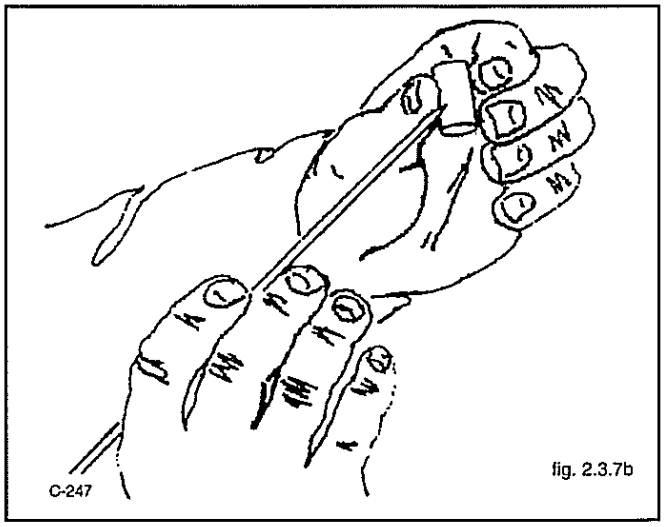


fig. 2.3.7b

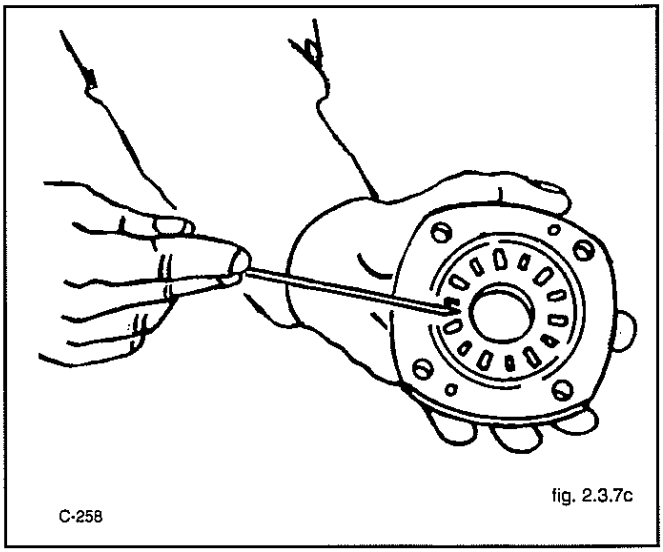


fig. 2.3.7c

2. Inspect the geroler rollers (fig. 2.3.7b) for wear or damage.

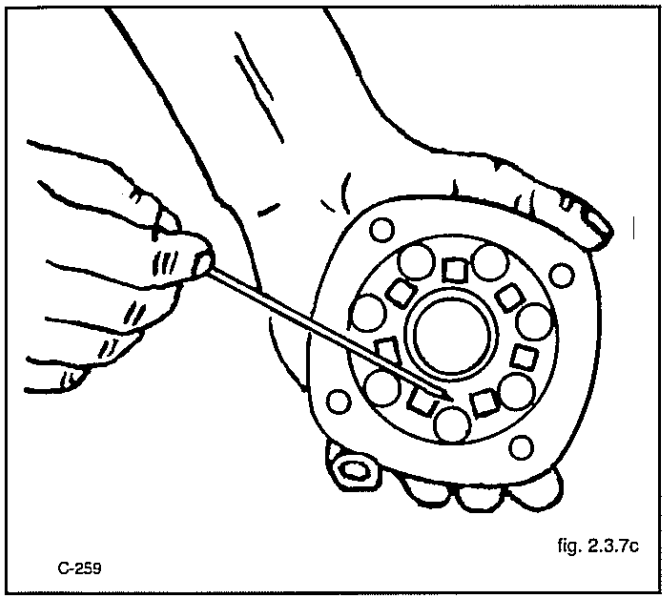


fig. 2.3.7c

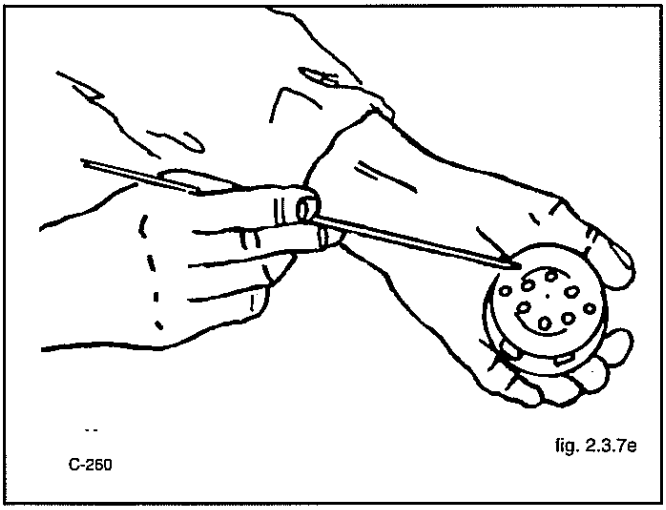


fig. 2.3.7e

3. Inspect the valve plate (fig. 2.3.7c and fig. 2.3.7d) for scratches or wear.

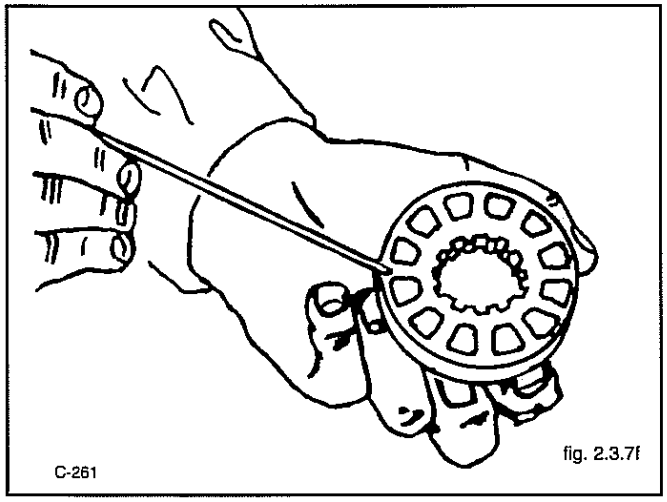


fig. 2.3.7f

4. Inspect the valve (fig. 2.3.7e and fig. 2.3.7f) for scratches or wear.

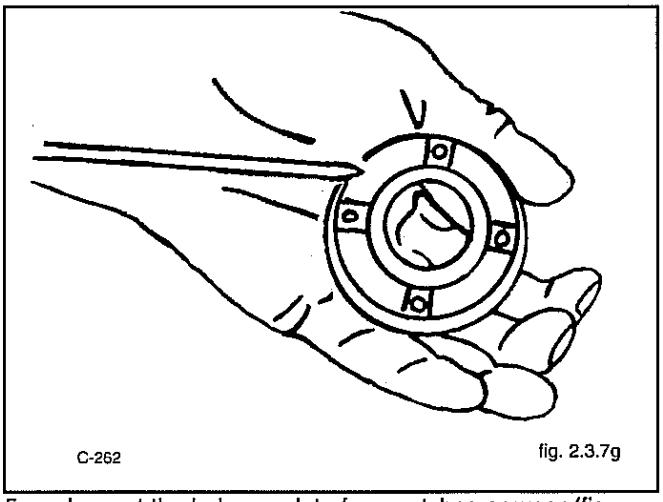


fig. 2.3.7g

5. Inspect the balance plate for scratches or wear (fig. 2.3.7g).

6. Inspect the splines on the valve drive and geroler drive for wear.

7. Inspect the keyway and chamfers on the output shaft for sharp edges or burrs which could damage the shaft seal.

8. Inspect the face of the bearing housing (fig. 2.3.7h) for scratches or wear.

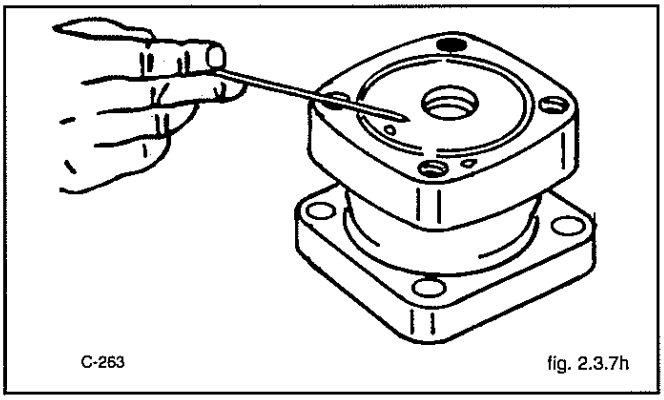


fig. 2.3.7h

2.3.7 TORQUE MOTOR REASSEMBLY

Install new seals when reassembling the torque motor.

Lubricate all seals with petroleum jelly such as vase ine prior to assembly.

1. Install the shaft face seal in the bearing housing using a suitable tool to seat the seal.

Place the bearing housing on a smooth, flat surface with the largest open end of the housing facing upward.

2 HYDRAULIC DRIVE SYSTEM

Align the small I.D. end of the seal installation tube with the seal seat in the housing (fig. 2.3.8a).

Apply petroleum jelly to the shaft face seal.

Install the seal in the bore of the installation tube as shown in fig. 2.3.8a.

Insert the seal driver in the tube and push the shaft face seal with a rotating action until it is sealed.

Check for correct installation. A damaged shaft face seal will cause loss of internal lubrication and result in parts wear.

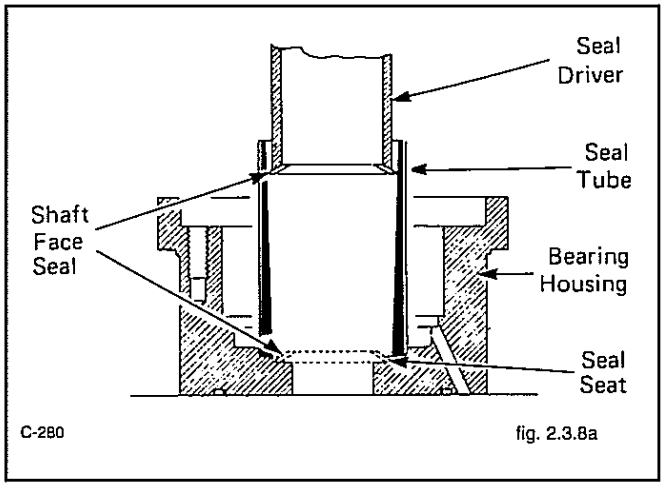


fig. 2.3.8a

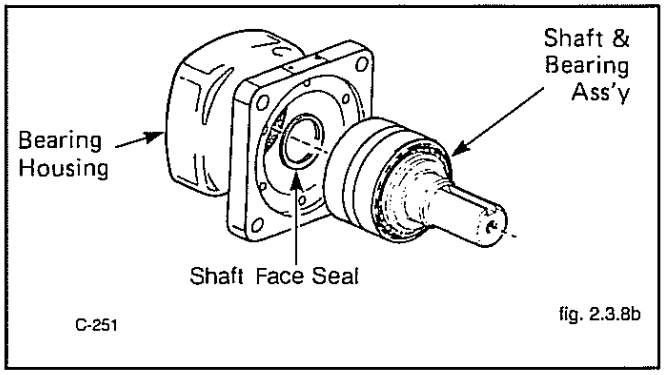


fig. 2.3.8b

2. Install the shaft and bearing assembly in the housing (fig. 2.3.8b). A press may be required to install the shaft and bearing assembly.

   Do not damage the shaft face seal in the bore of the housing.

3. Install the dust seal in the retainer plate (fig. 2.3.8c). The metal side of the dust seal must face upward.

4. Install the retainer seal and the shaft seal (fig. 2.3.8c). The smooth or flat side of the shaft seal must face toward the retainer (fig. 2.3.8d).

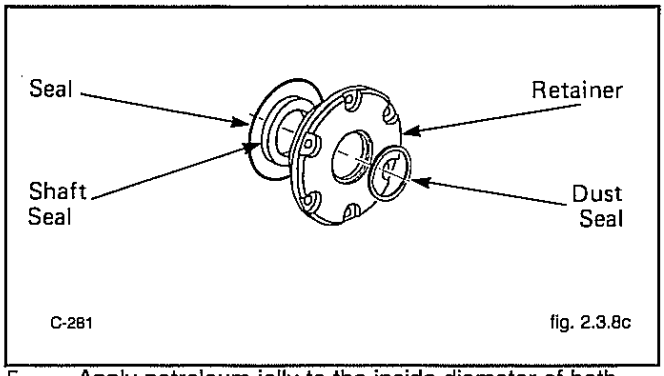


fig. 2.3.8c

5. Apply petroleum jelly to the inside diameter of both the dust seal and shaft seal.

6. Install the retainer cover over the shaft with a twisting motion (fig. 2.3.8e). Be careful not to distort or damage the shaft seal during assembly. Damage to the shaft seal will cause external leakage.

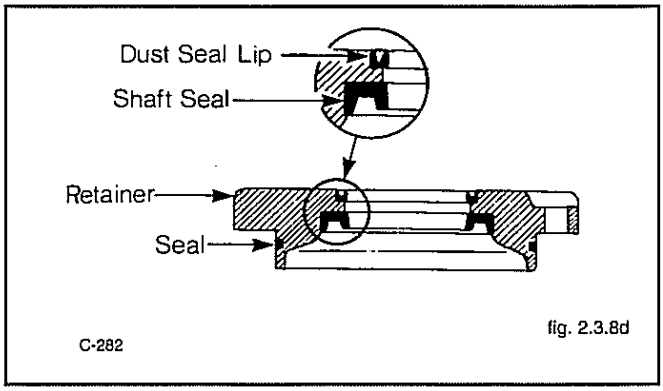


fig. 2.3.8d

7. Lubricate the threads of the six retainer cover bolts and finger tighten all bolts. Torque the bolts in sequence (fig. 2.3.8f) initially to 4 ft. lbs. (5.4 N.M.). Final torque the six bolts in sequence to 25 ft. lbs. (33.9 N.M.).

8. Reposition the bearing housing in a vise (fig. 2.3.8g) clamping across the edge of the flange.

9. Pour a small amount of system oil inside the output shaft.

2 HYDRAULIC DRIVE SYSTEM

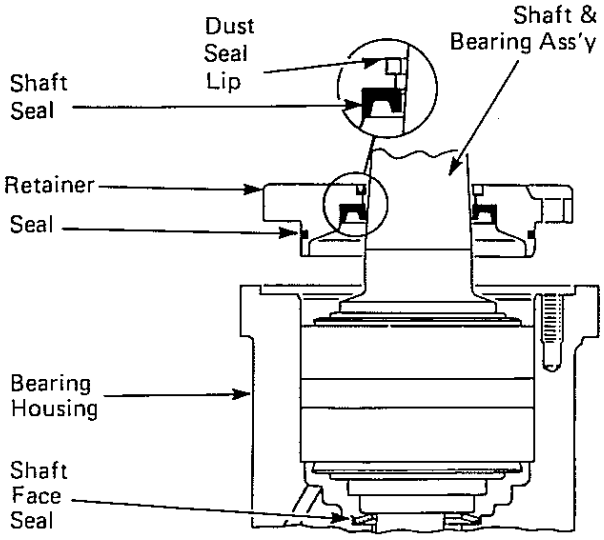


fig. 2.3.8e

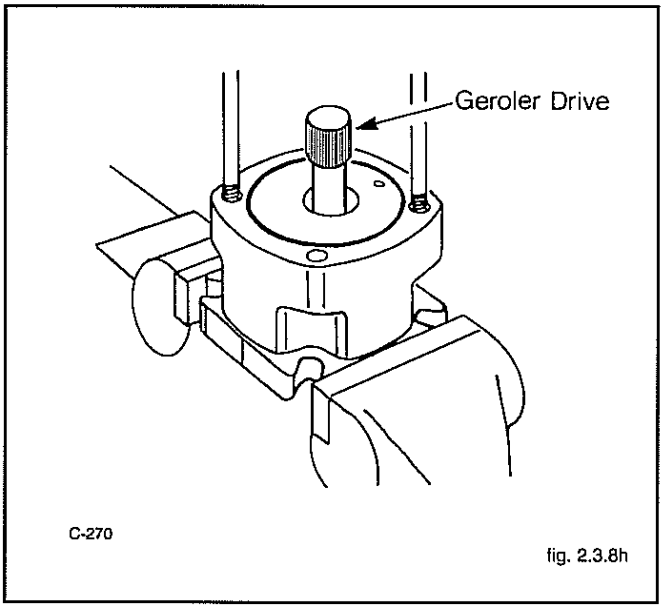


fig. 2.3.8h

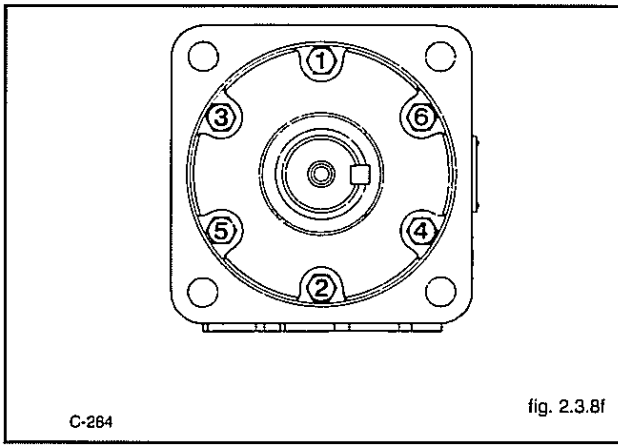


fig. 2.3.8f

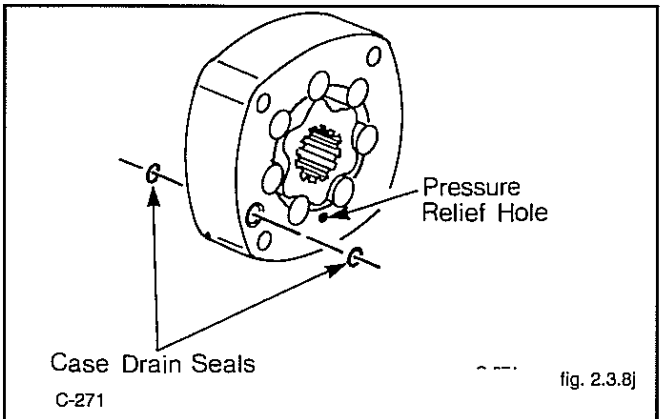


fig. 2.3.8j

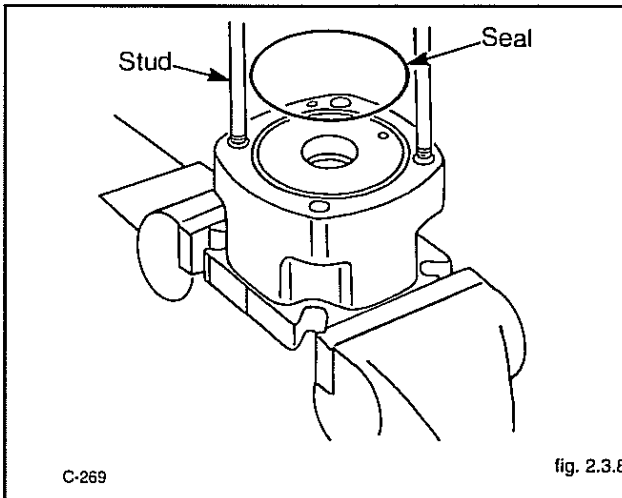


fig. 2.3.8g

IMPORTANT

To ensure the correct shaft rotation the torque motor must be times. Refer to instructions.

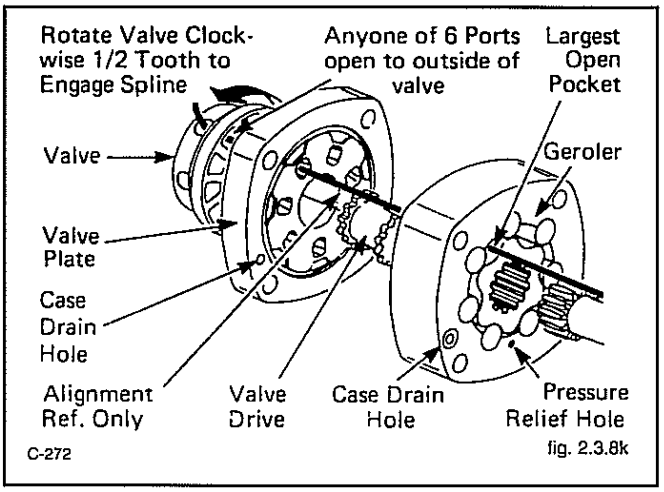


fig. 2.3.8k

10. If available, install two studs in the housing to assist in alignment of parts during assembly (fig. 2.3.8g).

11. Apply a light film of petroleum jelly on the housing seal and install the seal in the bearing housing (fig. 2.3.8g).

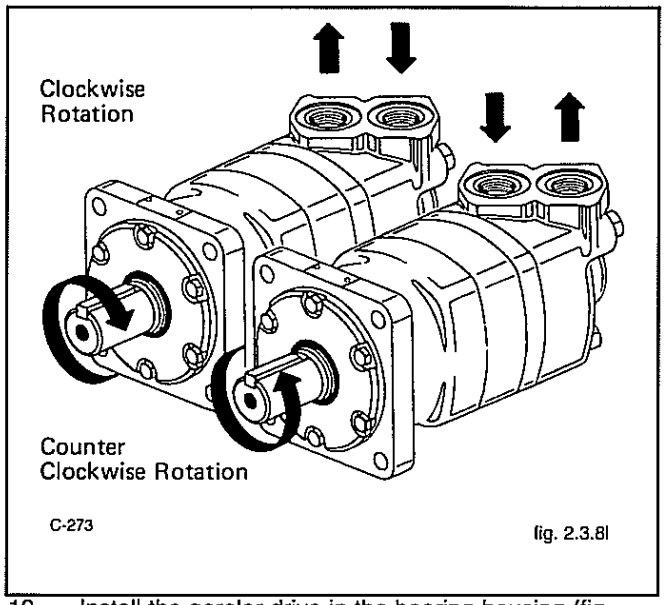


fig. 2.3.8l

12. Install the geroler drive in the bearing housing (fig. 2.3.8h). Install the longer splined end of the shaft into the bearing housing.

13. Apply petroleum jelly to the two case drain seals and install them on both sides of the geroler assembly (fig. 2.3.8j) in the case drain hole grooves.

14. Align the case drain hole and pressure relief hole in the geroler assembly with the case drain hole and pressure relief hole in the bearing housing (fig. 2.3.8j). Install the geroler assembly on the bearing housing.

15. TIMING STEP NO. 1

    Locate the largest open pocket in the geroler (fig. 2.3.8k). Mark the location of the pocket on the outside edge of the geroler.

16. Install the valve drive in the geroler.

17. Apply a light film of petroleum jelly on the valve plate seal. Install the valve plate seal in the valve plate.

18. Align the case drain hole in the valve plate with the case drain hole in the geroler. Install the valve plate (seal side toward geroler) on the geroler assembly (fig. 2.3.9k).

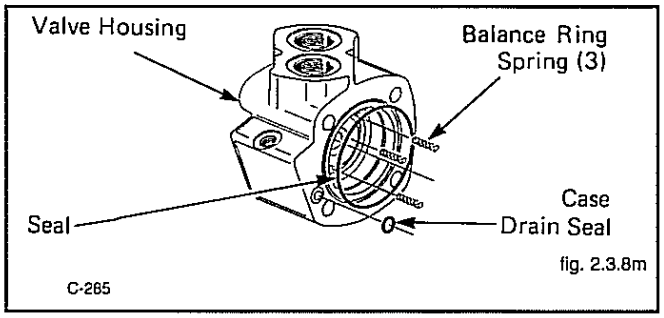


fig. 2.3.8m

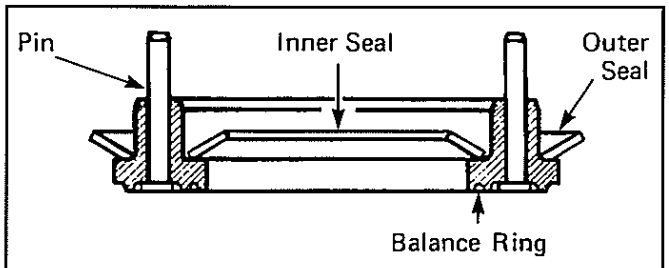


fig. 2.3.8n

IMPORTANT

The face seals must be installed as shown on fig. 2.3.8n or the motor will not operate properly.

19. TIMING STEP NO. 2

    Locate the slot opening in the valve plate which is in line with the largest open pocket of the geroler (fig. 2.3.8k).

20. TIMING STEP NO. 3

    Install the valve on the valve plate. Locate any one of the side openings of the valve that goes through to the face of the valve (fig. 2.3.8k). Line up this side opening with the open slot of the valve plate that is in line with the largest open pocket of the geroler.

    Rotate the valve clockwise (1/2 spline tooth) to engage the spline teeth of the valve drive.

    When timed correctly the motor will rotate when pressurized as shown in fig. 2.3.8l.

21. Apply clean grease on the three balance ring assembly springs. Install the three springs in the holes located inside the bore of the valve housing (fig. 2.3.8m).

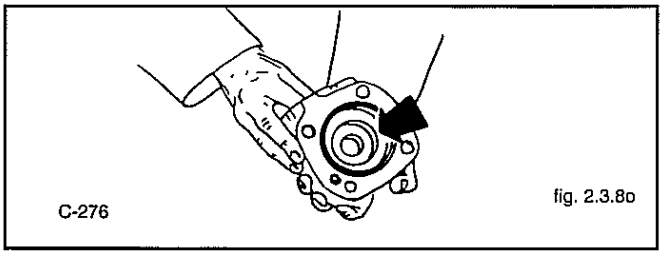
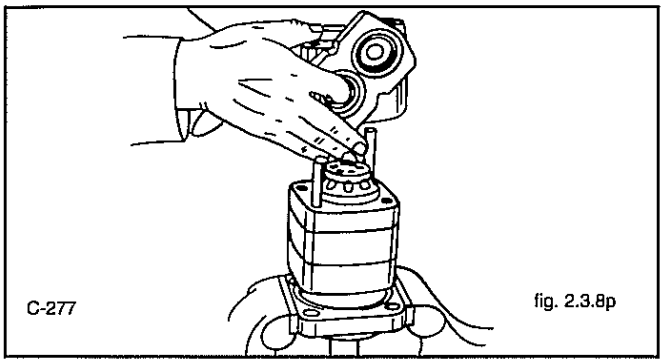
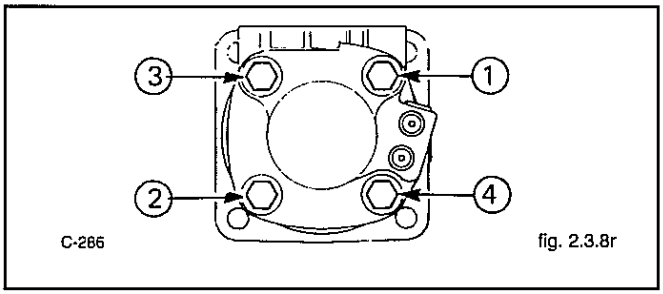


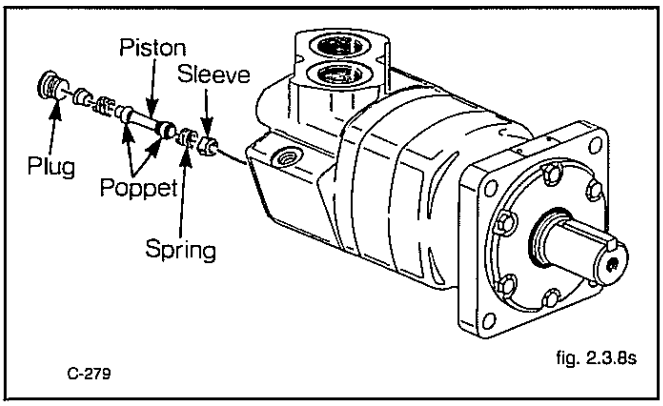
fig. 2.3.8o



C-277 fig. 2.3.8p



C-266 fig. 2.3.8r



C-279 fig. 2.3.8s

IMPORTANT **For correct motor operation the shuttle valve must be installed in the correct sequence.**

22. Apply a light film of petroleum jelly on the case drain seal. Install the seal in the case drain seal groove on the valve housing (fig. 2.3.8m).

23. Apply a light film of petroleum jelly on the valve housing seal. Install the seal in groove on the valve housing (fig. 2.3.8m).

24. Apply petroleum jelly to both the outer and inner face seals. Install the face seals on the balance ring (fig. 2.3.8n).

25. Align the balance ring pins with the two holes in the valve housing. Install the balance ring in the valve housing.

26. Insert your finger through the port of the valve housing (fig. 2.3.8o). Apply pressure to the side of the balance ring assembly to hold it in place while the valve housing is being installed.

27. Align the case drain hole in the valve housing with the case drain hole in the valve plate (fig. 2.3.8p). Install the valve housing on the valve plate.

28. Install and finger tighten the four bolts. Torque the bolts in sequence (fig. 2.3.8r) to 62.5 ft. lbs. (84.7 N.M.)

29. Install the shuttle valve assembly in the valve housing (fig. 2.3.8s).

2 HYDRAULIC DRIVE SYSTEM

2.4 TROUBLE SHOOTING - HYDROSTATIC DRIVE SYSTEM

Problem	Cause	Corrective Action	Section
Loss of drive power on one side-both directions	Reservoir low on oil	Check for leaks. Fill the reservoir with 10W30 API SE/CD oil	1.7.3
	Disconnected steering control linkage	Reconnect and adjust steering control linkage.	4.1
	Groove pin sheared on pump pintle lever	Replace. Check pintle lever for loose bolt or excessive play.	4.1
	High pressure line failure	Replace line. Check motor and pump mounting bolts.	2.3
	Drive chain failure	Inspect chain and connection link. Replace damaged parts.	3.3
	Drive motor shaft or key failure	Inspect and repair defective parts. Check motor mounting bolts and motor sprocket nut torque.	2.3.5 2.3.6
	Excessive internal leakage or damage in pump and/or drive motor	Inspect and repair defective unit. Flush all lines and reservoir. Replace filter. Check on type of fluid used and engine RPM.	2.2.5 2.3.5 2.3.6
Loss of drive power on one side - one direction only	Defective pump relief valve	Replace defective relief valve.	2.2.5
	Damaged or seized drive motor shuttle valve	Inspect and replace defective parts.	2.3.5 2.3.6
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.	1.7.3
	Universal joint between engine and pump failure	Inspect and repair or replace damaged parts	

2 HYDRAULIC DRIVE SYSTEM

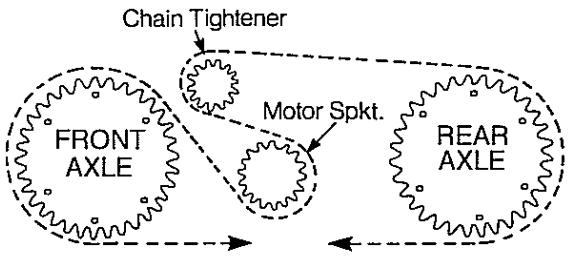
2.4 TROUBLE SHOOTING - HYDROSTATIC DRIVE SYSTEM

Problem	Cause	Corrective Action	Section
	Drive coupling failure between front and rear pump.	Inspect coupling and shafts for spline damage. Also check pump bearings.	2.2.7
Loss of drive power - both sides (full hydraulic power)	Charge check 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
	Drive motor shaft or key failure	Inspect and repair defective parts. Check motor mounting bolts and motor sprocket nut torque.	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.	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
Loader will not travel in a straight line	Control levers binding	Check that shields or sound insulation prevents full lever travel. Repair.	
		Check self centering spring for binding. Adjust.	4.1
	Control lever travel stops out of adjustment	Adjust	4.1

3 FINAL DRIVE

3 FINAL DRIVE

3.1 FINAL DRIVE



C-240 fig. 3

3.1.1 SPECIFICATIONS

Chain Size.....ANSI 100
Approved chain manufacturer.....TSUBAKI
Lubricating oil.....10W30 API classification SE/CD
Capacity (per housing).....2.0 gal. (7.5 l)
Torque Specifications:
Chain tightener clamp nuts.....150 ft. lbs. (203 N.M.)
Motor sprocket nut.....350 ft. lbs. (475 N.M.)
Wheel nuts.....100 - 110 ft. lbs. (135 - 149 N.M.)
Tire pressure, standard.....50 PSI (345 KPa)
flotation.....30 - 35 PSI (207 - 241 KPa)

3.1.2 MAINTENANCE SCHEDULE

	Initial Check (hours)	Check every (hours)
Tire pressure	8	8
Wheel nut torque	8	8
Lubricating oil	50	150(1)
Chain tension	50	150
Motor mounting nuts	50	150
Axle bearing preload	50	150

(1) Change every 1000 hours.

3.2 LUBRICATION

3.2.1 OIL LEVEL CHECK

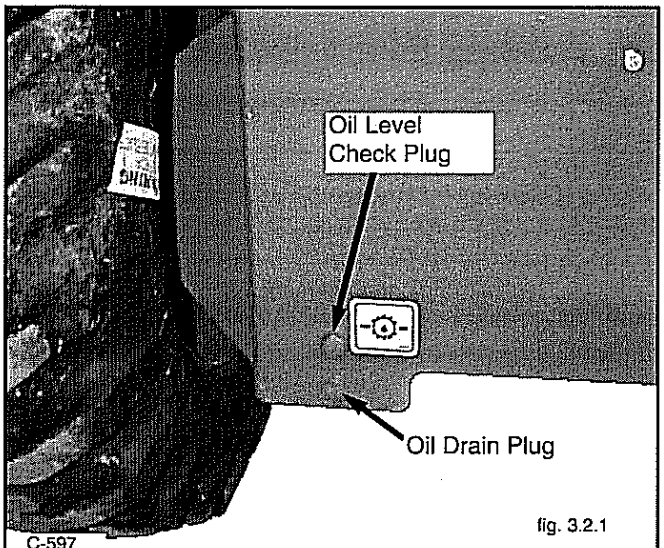
The loader has two independent final drive housings. When checking the oil level ensure the loader is on a level surface.

Remove the top check plug (fig. 3.2.1) located between the two tires. The lubricating oil level should be at the top check plug. To add oil refer to section 3.2.3.

The oil level should be checked after 50 operating hours and every 150 hours thereafter. The oil should be changed after 1000 operating hours or if it shows signs of contamination.

3.2.2 DRAINING LUBRICATING OIL

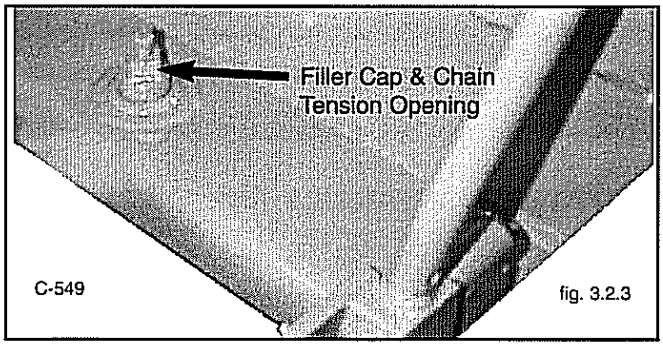
To drain the final drive lubricating oil place the loader on a level surface. Remove the oil drain plug (fig. 3.2.1) located between the two tires. Total capacity per final drive housing is 1.5 gal. (5.7 l).



C-597 fig. 3.2.1

3.2.3 ADDING OIL

Add oil with the loader on a level surface. Remove the filler cap (fig. 3.2.3) located inside the loader. Remove the oil level check plug (fig. 3.2.1). Fill with 10W30 API classification SE/CD oil. Total capacity per final drive housing is 2.0 gal. (7.5 l).



C-549 fig. 3.2.3

WARNING

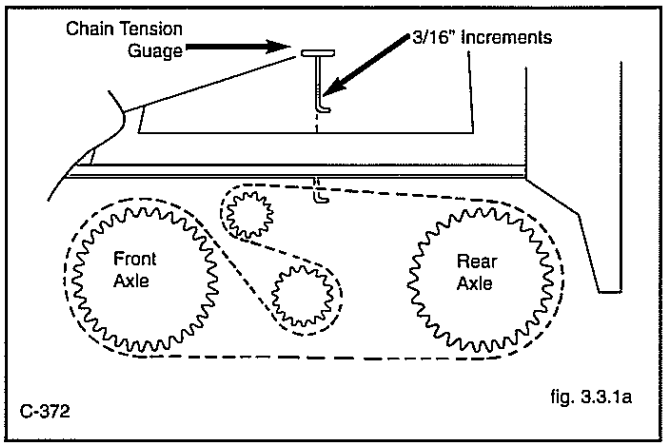
To avoid personal injury stop the engine, engage the parking brake, and cycle the foot pedals to ensure they are locked before getting out of the loader.

3 FINAL DRIVE

3.3 DRIVE CHAIN

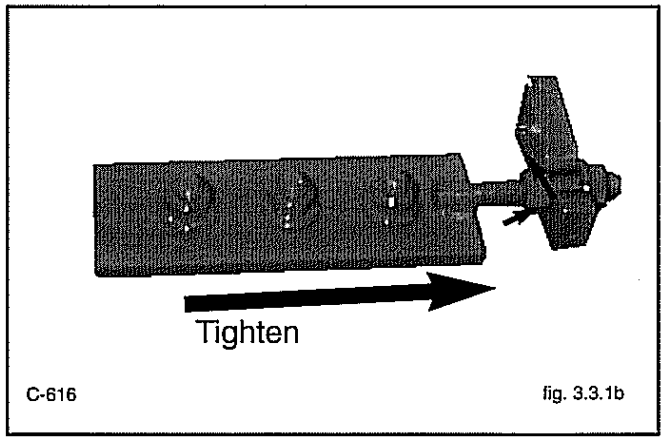
3.3.1 DRIVE CHAIN ADJUSTMENT

The drive chain must be checked for excessive slack after the first 50 hours of operation and every 150 hours thereafter.



C-372 fig. 3.3.1a

The chain must be adjusted so there is between 1/4 - 3/8 inch (6.4 - 9.5 mm) free play.



C-616 fig. 3.3.1b

Loosen the 3 chain tightener nuts (fig. 3.3.1), until the chain tightener is just loose enough to slide. Do not overloosen or overtightening of the chain can occur.

Back off the rear adjuster nut (fig. 3.3.1b) and tighten the front adjustment nut until free play measured on the chain is between 1/4 - 3/8" (6.4 - 9.5 mm).

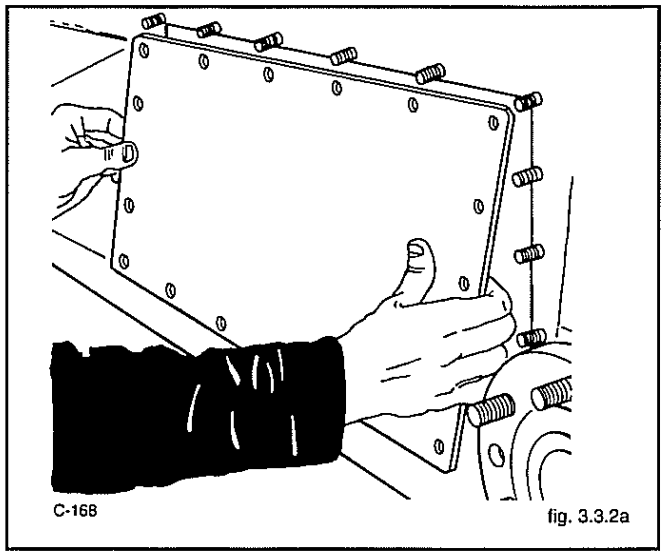
Tighten the rear adjuster nut and torque the 3 chain tightener nuts to 150 ft. lbs.

Repeat on opposite side of machine.

3.3.2 CHAIN REMOVAL

WARNING

To prevent personal injury do not work on a loader with the boom arms in a raised position unless the boom locks are engaged.



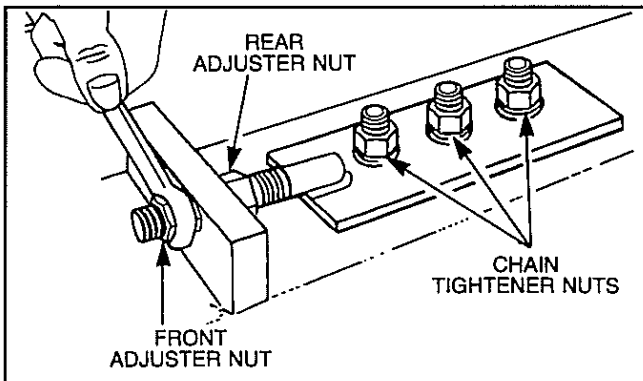
C-168 fig. 3.3.2a

1. Remove any attachment, raise the boom arms and engage the boom locks. Shut off the engine.
2. Block the loader securely with all four wheels clear of the ground.
3. Remove the wheels from the side of the machine that the drive chain is to be removed from. On reassembly torque the wheel nuts to 100 - 110 ft. lbs. (135 - 149 N.M.).
4. Drain the lubricating oil from the final drive housing. Refer to section 3.2.2 for details. Total housing capacity 2.0 gal. 7.5 l).

3 FINAL DRIVE

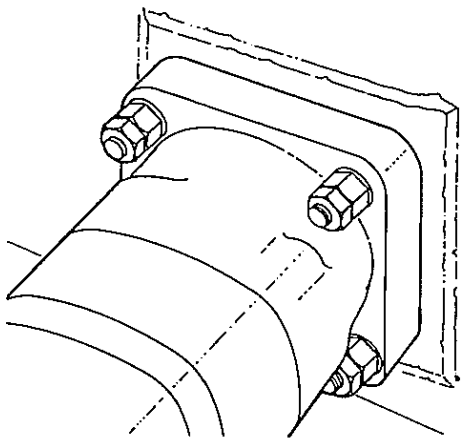
5. Remove the final drive inspection cover (fig. 3.3.2a) located between the two axles.

6. Loosen the three chain tightener nuts (fig. 3.3.2b). Back off the front and rear adjustment nuts and move the chain tightener plate back to loosen the chain.



C-169

fig. 3.3.2b



C-170

fig. 3.3.2c

7. Straighten and remove the connection link cotter pins (fig. 3.3.2f).

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

C-241

fig. 3.3.2f

IMPORTANT

On reassembly install the connection link with the cotter pins facing the inspection opening of the final drive housing.

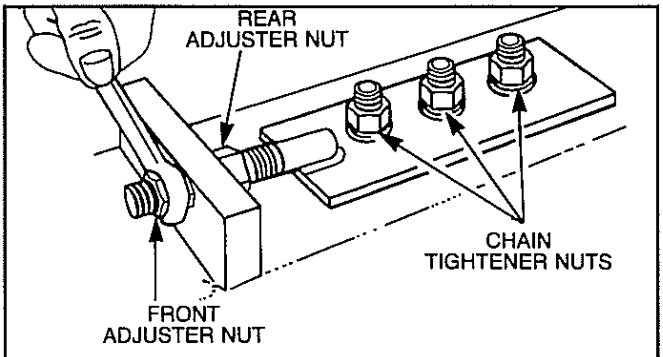
3.3.3 CHAIN INSTALLATION

1. Loosen the three chain tightener nuts (fig. 3.3.3a).

IMPORTANT

Do not overloosen the chain tightener mounting nuts. This will allow the chain tightener to drop down causing over tightening of the chain.

2. Back off the front and rear adjustment nuts and move the chain tightener plate back towards the rear of the loader.



C-169

fig. 3.3.3a

3 FINAL DRIVE

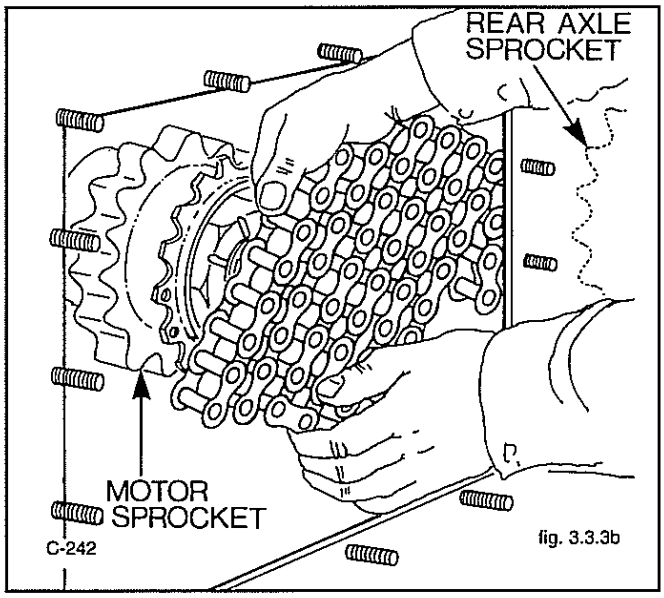


fig. 3.3.3b

3. Wrap the chain as shown in fig. 3.3.3b and install it in the final drive housing ahead of the rear axle.

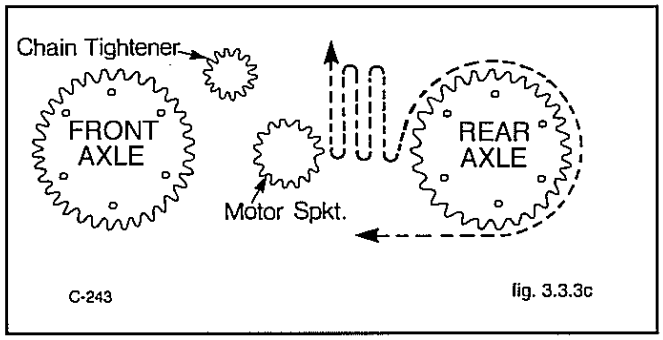


fig. 3.3.3c

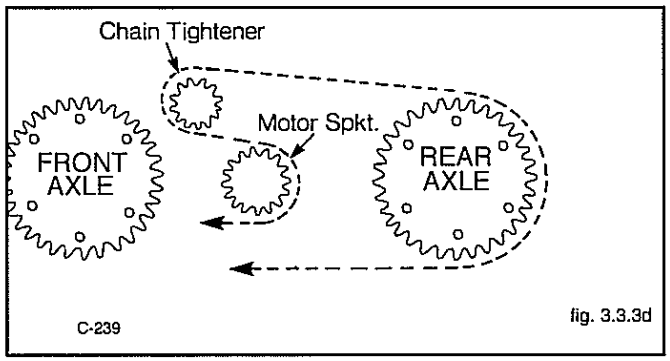


fig. 3.3.3d

4. Wrap one end of the chain over the top of the rear axle (fig. 3.3.3c) and bring the end along the bottom of the final drive housing to approx. the center.

5. Wrap the other end of the chain over the top of the chain tightener sprocket and back around the motor sprocket (fig. 3.3.3d).

6. Wrap the chain over the top of the front axle sprocket and bring the end along the bottom of the final drive housing (fig. 3.3.3e).

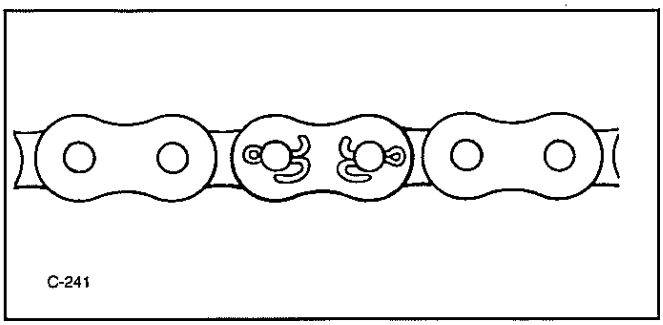
IMPORTANT

On reassembly install the connection link with the cotter pins facing the inspection opening of the final drive housing.

7. Install a new connection link on the chain so that the cotter pin side of the connection link faces the final drive inspection opening.

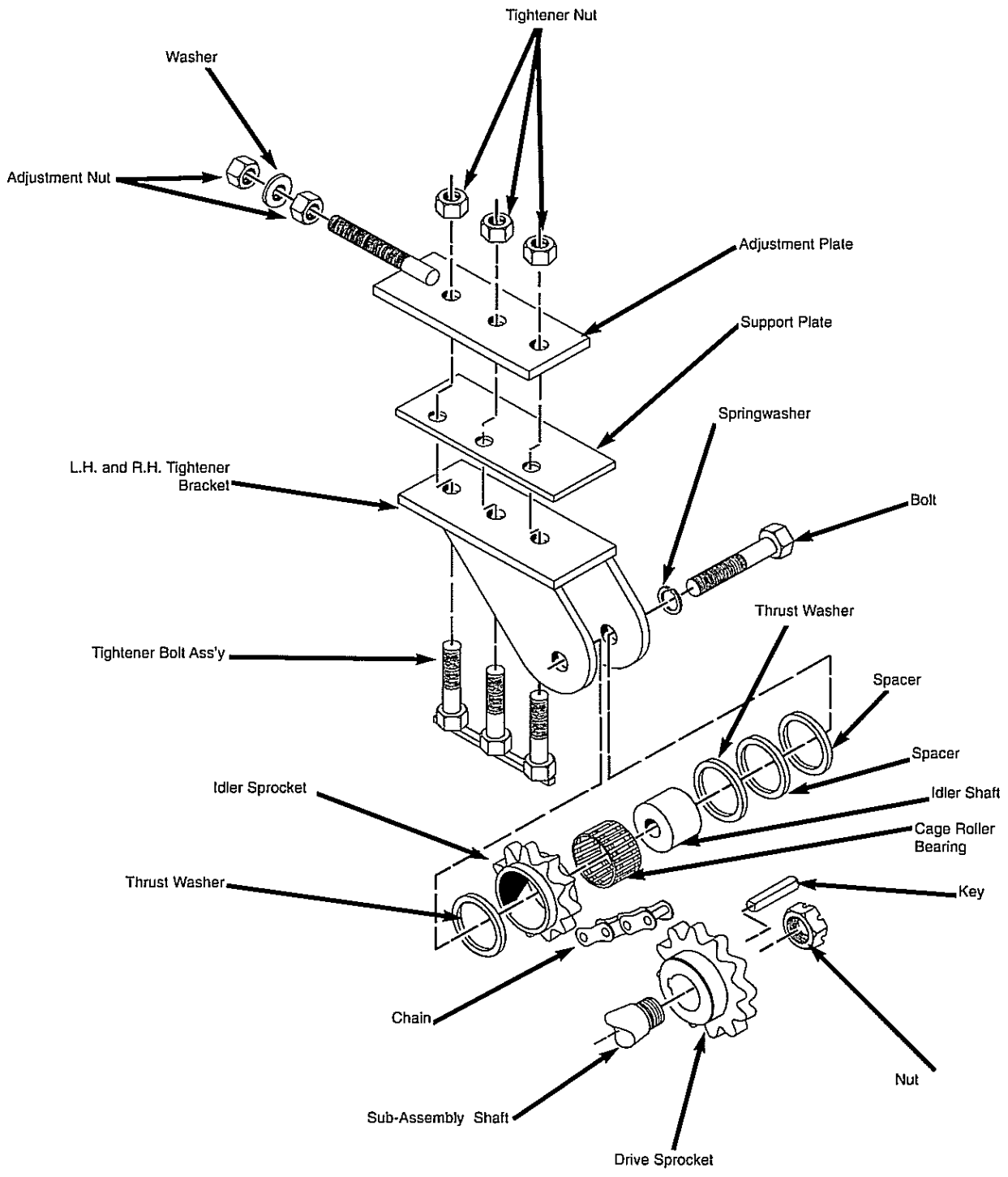
8. Install new cotter pins and lock them in position (fig. 3.3.3f).

9. Adjust the drive chain tension. Refer to section 3.3.1 for procedure.



3 FINAL DRIVE

3.3.4 CHAIN TIGHTENER REMOVAL



C-568

fig. 3.3.4

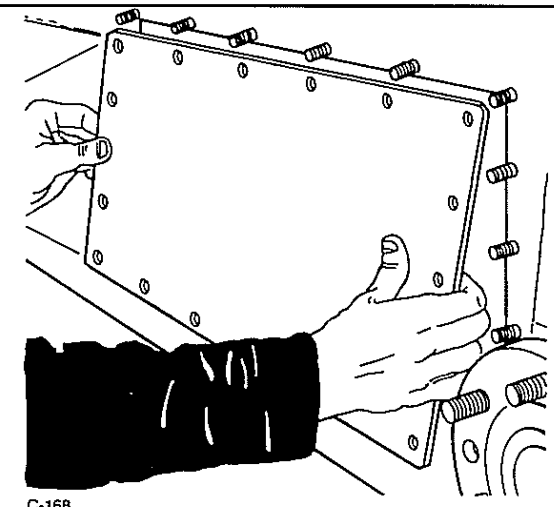
3 FINAL DRIVE

3.3.4 CHAIN TIGHTENER REMOVAL

1. Remove any attachment, raise the boom arms and engage the boom locks. Shut off the engine.

WARNING

To prevent personal injury do not work on a loader with the boom arms in a raised position unless the boom locks are engaged.



C-168 fig. 3.3.4a

2. Block the loader securely with all four wheels clear of the ground.

3. Remove the wheels from the side of the machine that the chain tightener is to be removed from. On reassembly torque the wheel nuts to 100 - 110 ft. lbs. (135 - 149 N.M.).

4. Drain the lubricating oil from the final drive housing. Refer to section 3.2.2 for details. Total housing capacity 1.5 gal. (5.7 l).

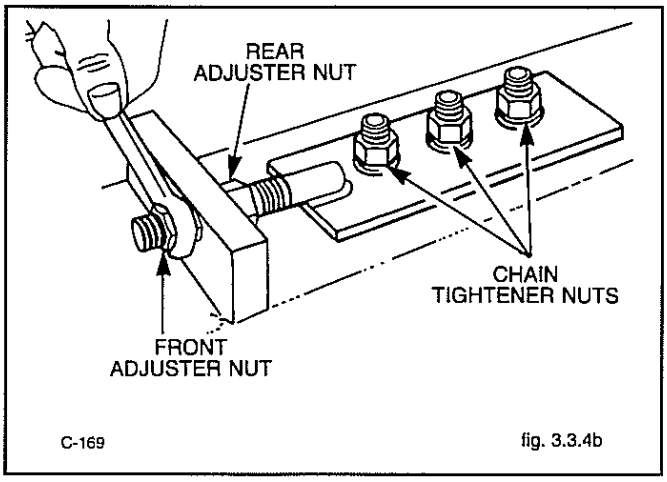
5. Remove the final drive inspection cover (fig. 3.3.4a) located between the two axles.

6. Loosen the three chain tightener nuts (fig. 3.3.4b). Back off the front and rear adjustment nuts and move the chain tightener plate back to loosen the chain.

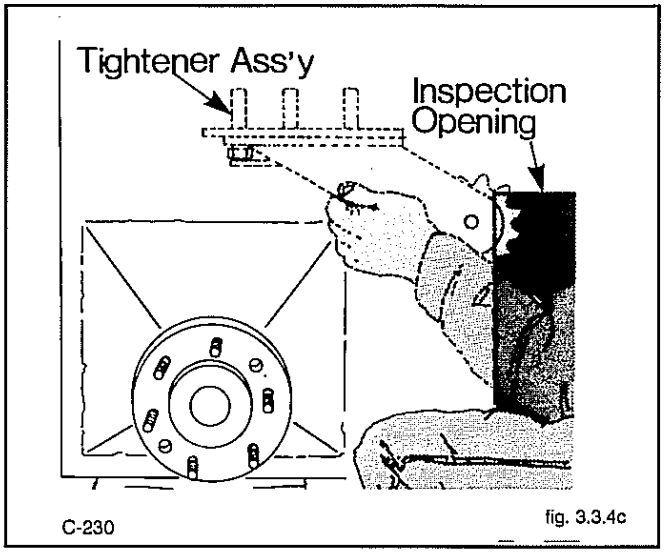
7. The following procedure requires two people. One person to support the chain tightener assembly (fig. 3.3.4c) while the second person removes the three chain tightener nuts.

8. Remove the three chain tightener nuts (fig. 3.3.4d).

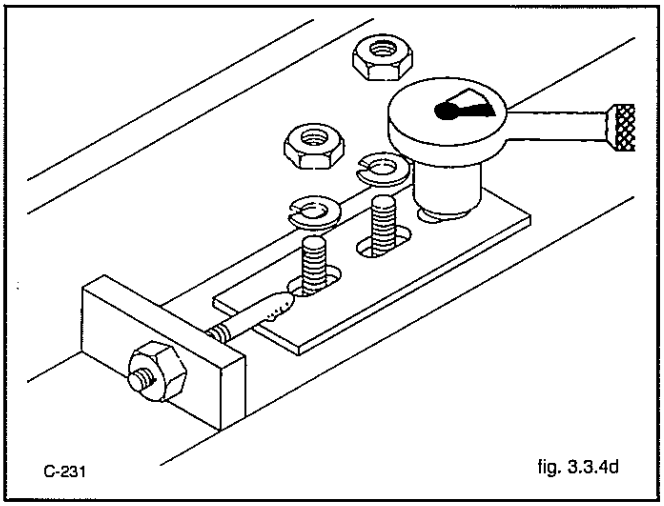
9. Remove the chain tightener assembly and support plate from the final drive housing (fig. 3.3.4e).



C-169 fig. 3.3.4b



C-230 fig. 3.3.4c



C-231 fig. 3.3.4d

10. Remove the front adjustment nut from the adjustment plate and remove the adjustment plate from the loader (fig. 3.3.4f).

11. Remove the bolt assembly from the chain tightener (fig. 3.3.4g).

3 FINAL DRIVE

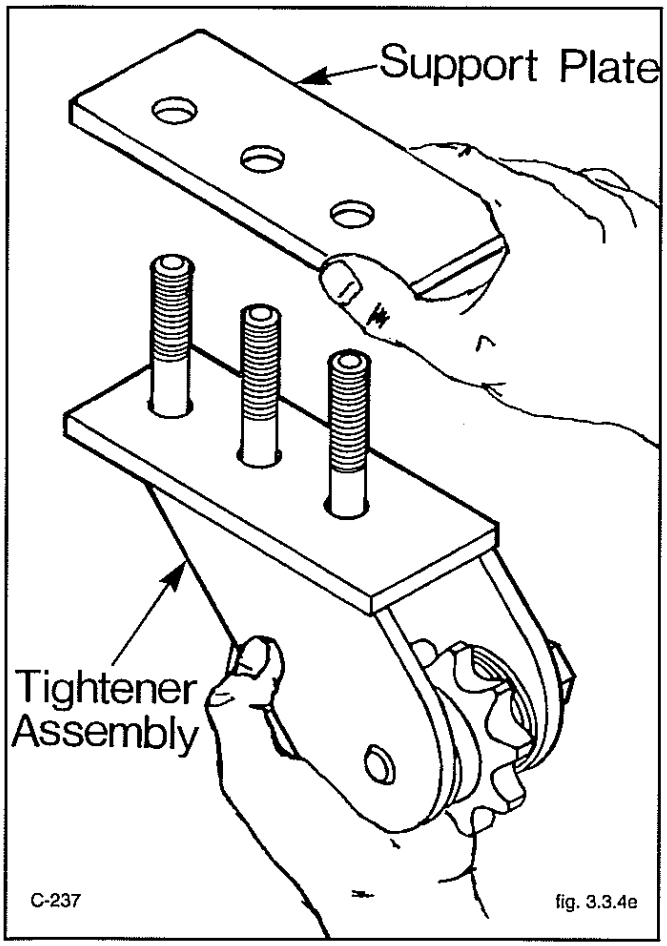


fig. 3.3.4e

12. Remove the bolt (fig. 3.3.4h) from the tightener bracket. On reassembly apply Loctite No. RC609 to the bolt threads.

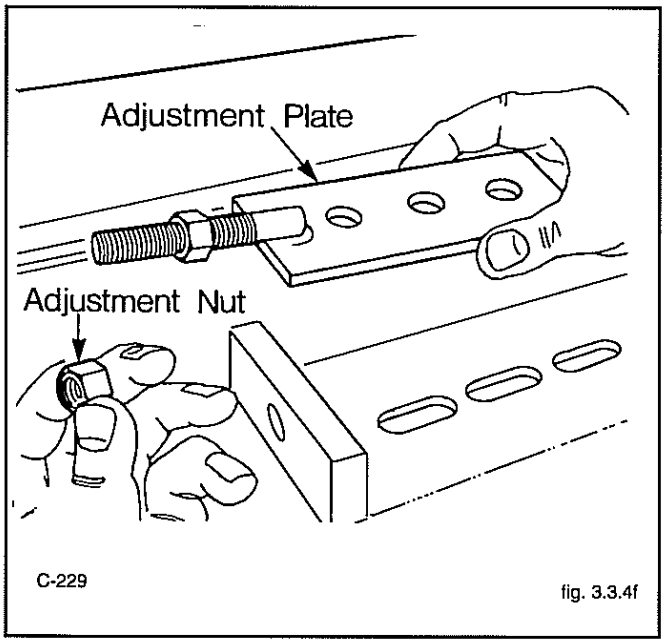


fig. 3.3.4f

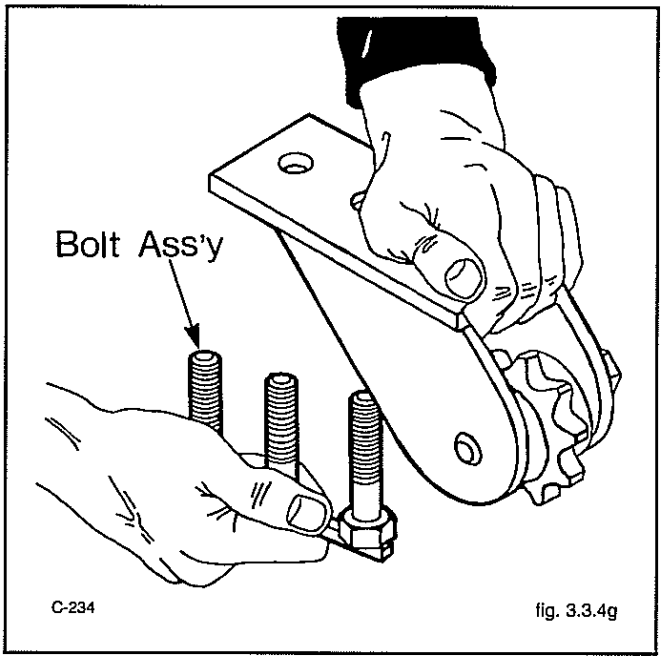


fig. 3.3.4g

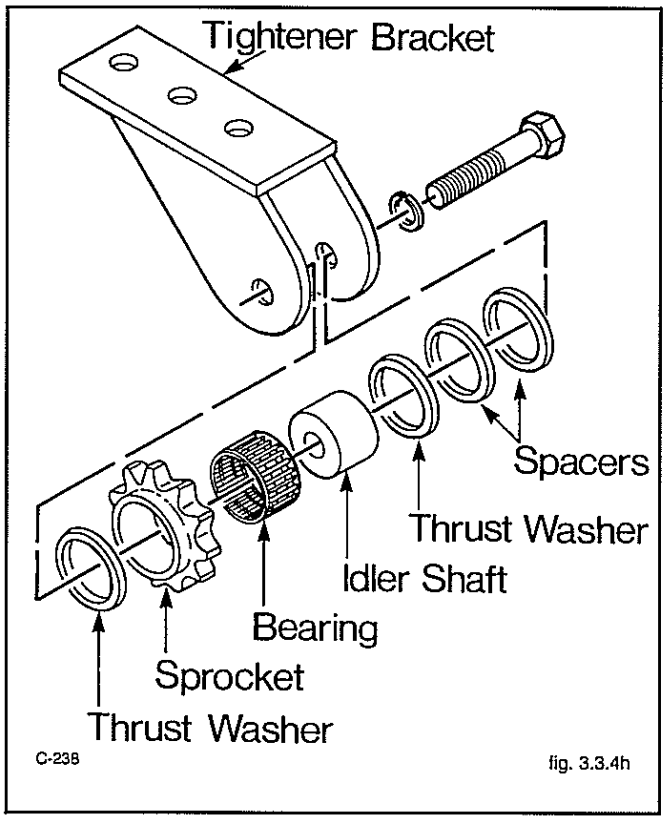


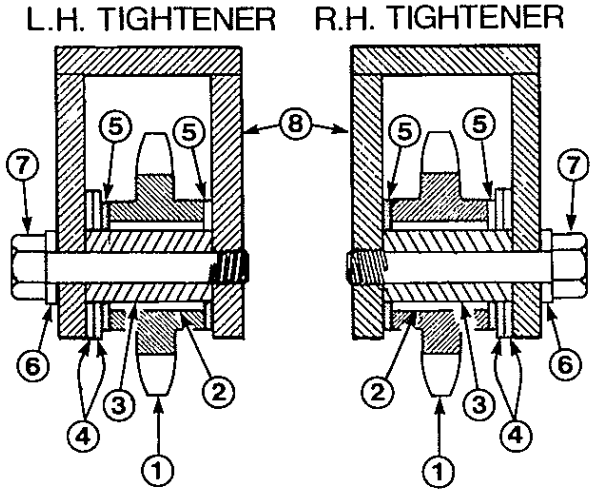
fig. 3.3.4h

13. Remove the sprocket, bearing, idler shaft, thrust washers (2) and spacers (2) from the tightener bracket (fig. 3.3.4h).

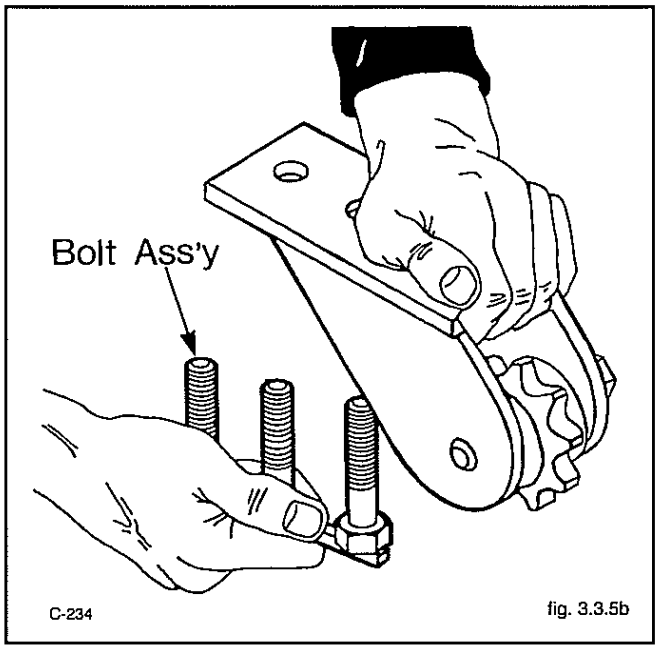
3.3.5 CHAIN TIGHTENER INSTALLATION

1. Assemble left and right hand chain tightener assemblies as shown in figure 3.3.5a. For correct chain alignment place both spacer washers on the bolt head side of the tightener bracket.

When installed in the loader, the bolt head side of the tightener bracket will face the outside (tire side) of the transmission housing.



C-233 fig. 3.3.5a

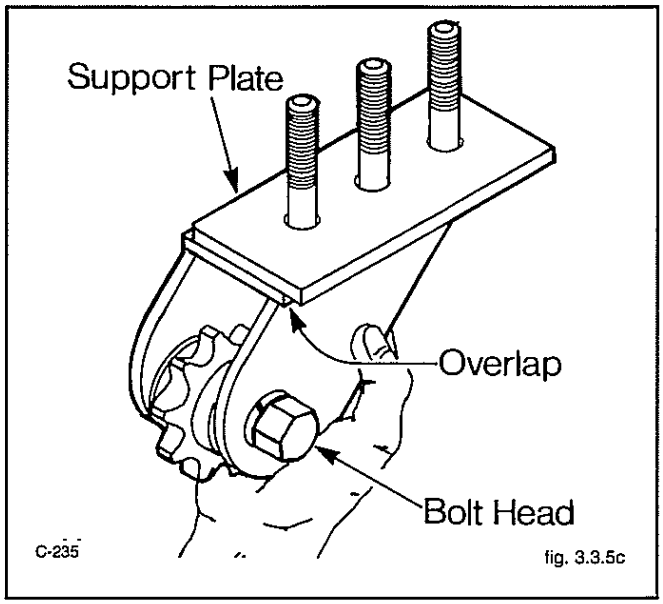


C-234 fig. 3.3.5b

2. Install the bolt assembly in the tightener (fig. 3.3.5b).

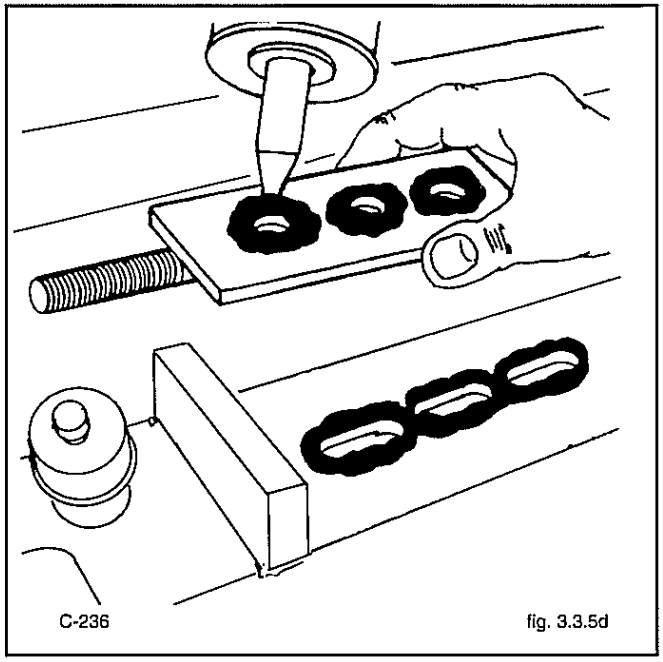
3. Install the support plate on the chain tightener. The support plate holes are drilled off center. Install the support plate so that it extends beyond the chain tightener bracket on the bolt head side (fig. 3.3.5c).

If the support plate is installed incorrectly the chain tightener assembly will not sit flat inside the final drive housing.



C-235 fig. 3.3.5c

4. Apply sealant part number TH 25252 (or Loctite, Permatex, Form a Gasket #2) around the slots in the main frame and to the bottom of the adjustment plate (fig. 3.3.5d) to prevent water entering the final drive housing around the chain tightener assembly.



C-236 fig. 3.3.5d

5. Install the adjustment plate and the front and rear adjustment nuts (fig. 3.3.5e).

6. The following procedure requires two people. One to hold the chain tightener assembly in place while the second person installs the three tightener nuts.

3 FINAL DRIVE

Install the chain tightener assembly in the final drive housing (fig. 3.3.5f).

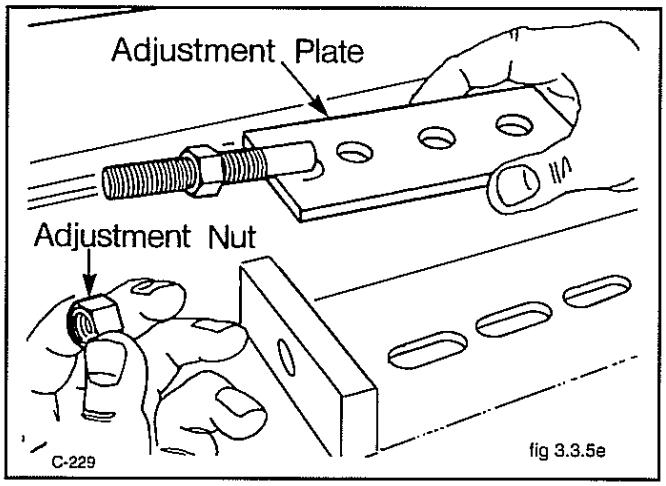


fig 3.3.5e

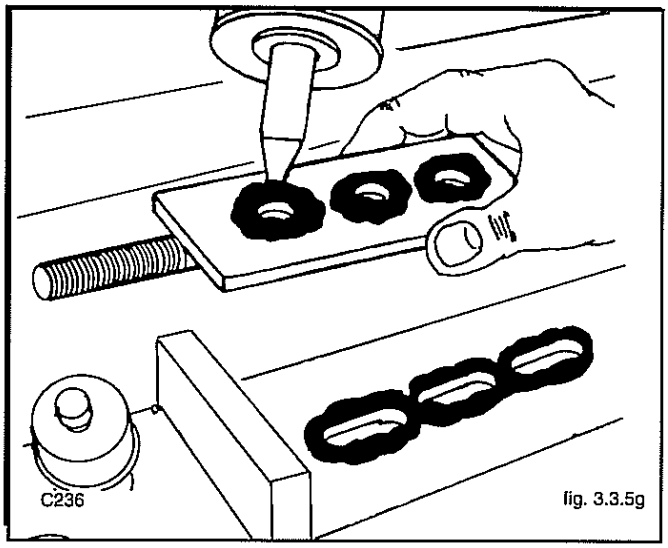


fig. 3.3.5g

Apply sealant part number TH 25252 (Loctite, Permatex, Form a Gasket #2) around the threads of the tightener bolt assembly (fig. 3.3.5g) to prevent water entering the final drive housing.

Install the three flange nuts (fig. 3.3.5h). Do not over-tighten. Plate must be able to slide.

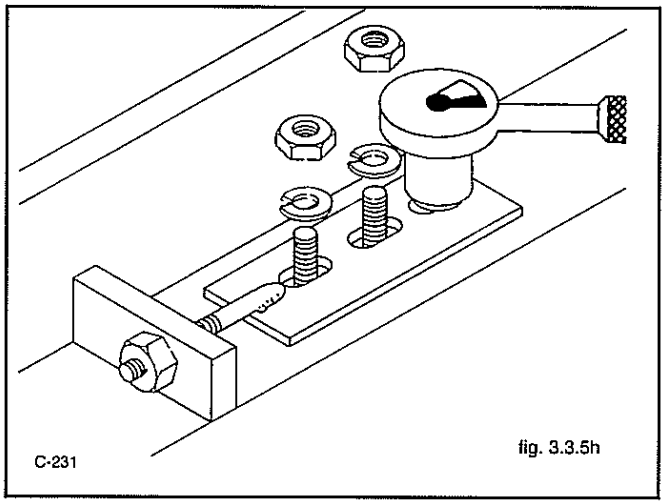
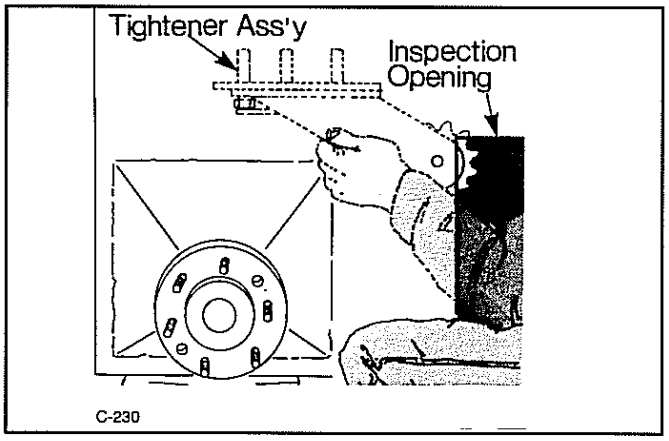


fig. 3.3.5h

7. Install the drive chain in the final drive housing. Refer to section 3.3.3 for procedure.

8. Install the drain plug in the final drive housing and fill the housing to the check plug level with 10W30 API classification SE, CD oil. Total capacity per housing is 1.5 gal. (5.7 l).

9. Apply silicon sealer to the inspection cover and install the cover on the final drive housing (fig. 3.3.5j).



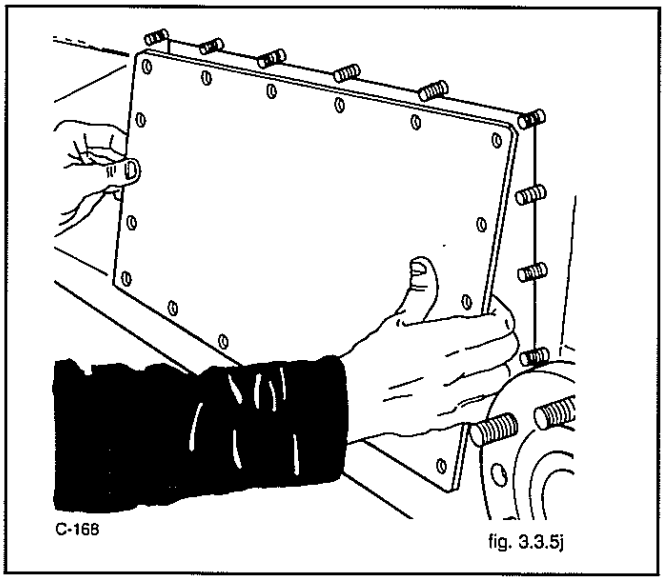


fig. 3.3.5j

10. Install the wheels. Torque the wheel nuts to 100 - 110 lbs. ft. (135 - 149 N.M.)

11. Adjust the chain tension as per section 3.3.1. After adjusting the chain, torque the three chain tightener nuts to 150 ft. lbs. (203 N.M.)

3 FINAL DRIVE

3.4 AXLE ASSEMBLY

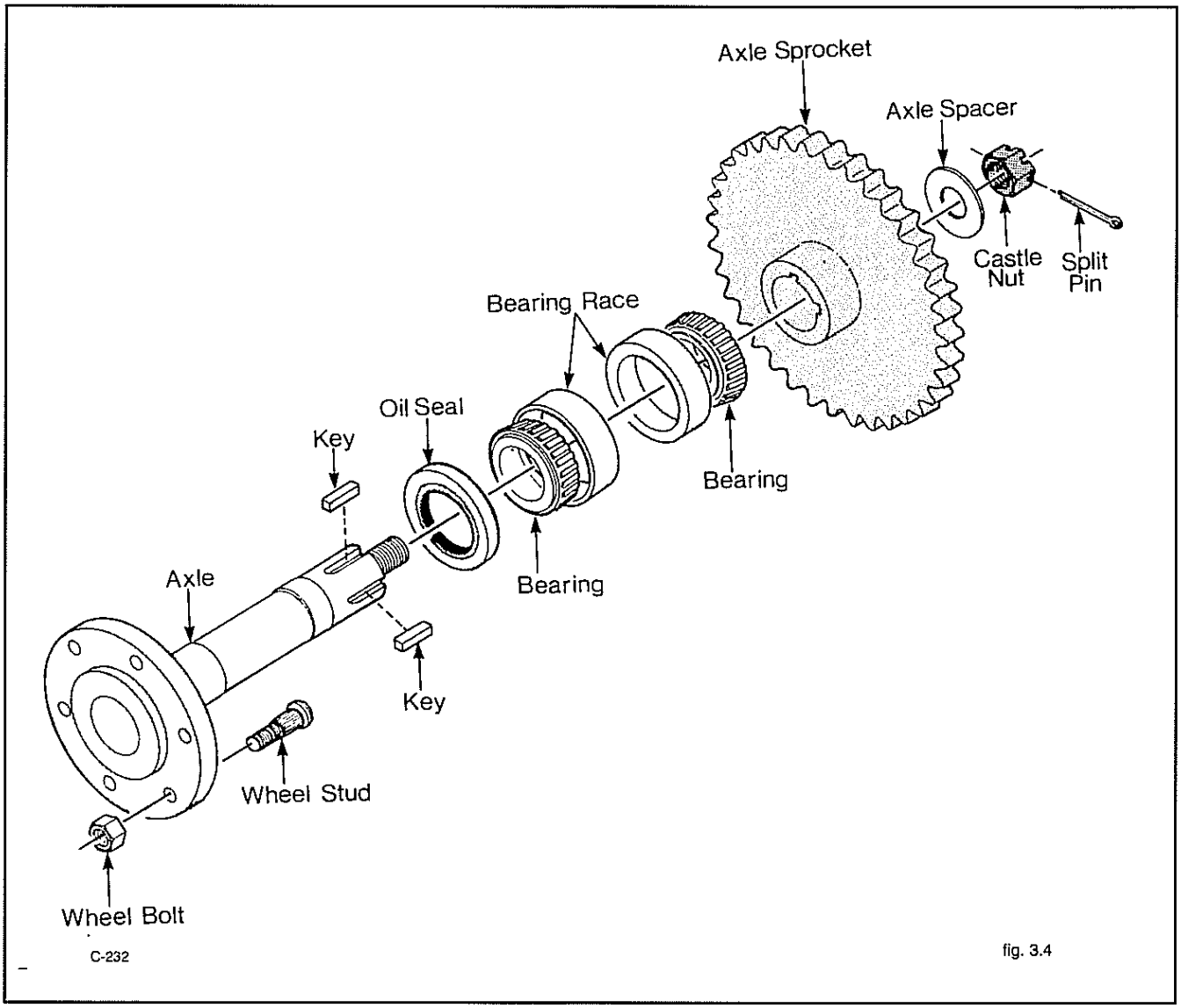


fig. 3.4

3.4.1 AXLE REMOVAL

1. Remove any attachment, raise the boom arms and engage the boom locks. Shut off the engine.

WARNING

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

2. Block the loader securely with all four wheels clear of the ground.

3. Remove the wheels on the side of the loader that the axle is to be removed from.

   On reassembly torque the wheel nuts 100-110 ft. lbs. (135-149 N.M.).

4. Drain the lubricating oil from the final drive housing. Refer to section 3.2.2 for procedure. Total housing capacity 1.5 gal. (5.7 l).

5. Remove the final drive inspection cover located between the two axles.

6. Remove the drive chain from the final drive housing. Refer to section 3.3.2 for procedure.

7. FRONT AXLE - remove the foot pedal assembly. Refer to section 4.2 for procedure. Remove the axle cover plate (fig. 3.4.1a) from the inside of the final drive housing.

3 FINAL DRIVE

REAR AXLE - remove the axle cover plate (fig. 3.4.1a) from the inside of the final drive housing.

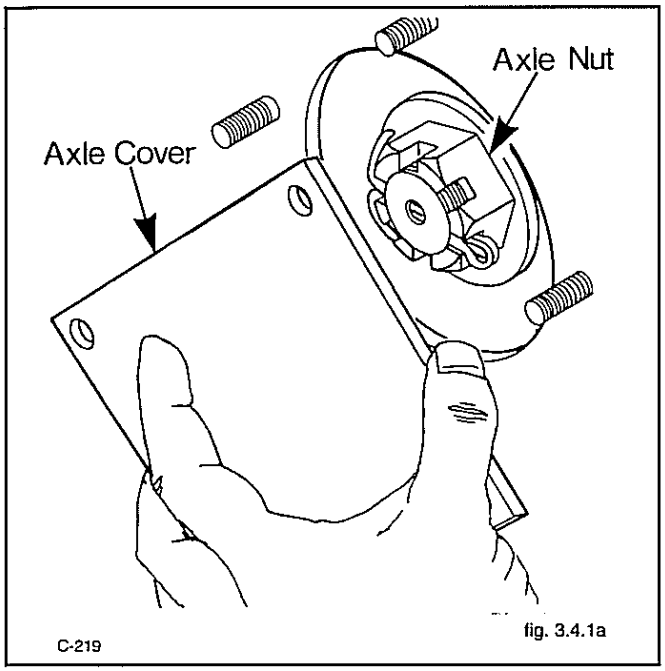


fig. 3.4.1a

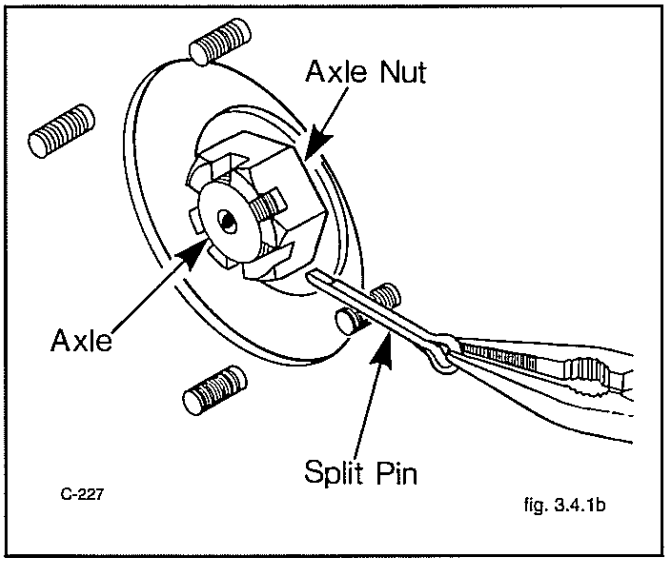


fig. 3.4.1b

8. Remove the split pin from the castle nut on the end of the axle (fig. 3.4.1b).

9. Install a bolt, 1/2 inch UNC approx. 3 in. long, through the axle flange (fig. 3.4.1c) to prevent the axle from turning as the rear castle nut is removed.

10. Remove the rear castle nut and axle washer (fig. 3.4.1d).

11. Remove the bolt from the axle flange which was installed in step 9.

12. Attach special tool TH955283 to the axle flange (fig. 3.4.1e).

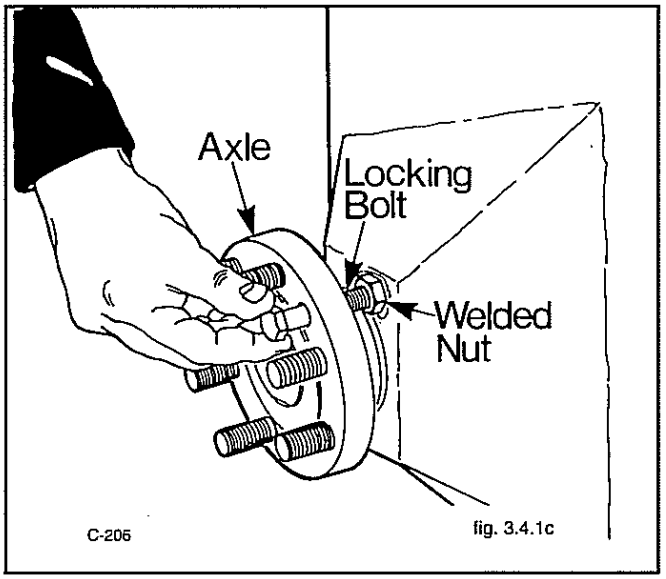


fig. 3.4.1c

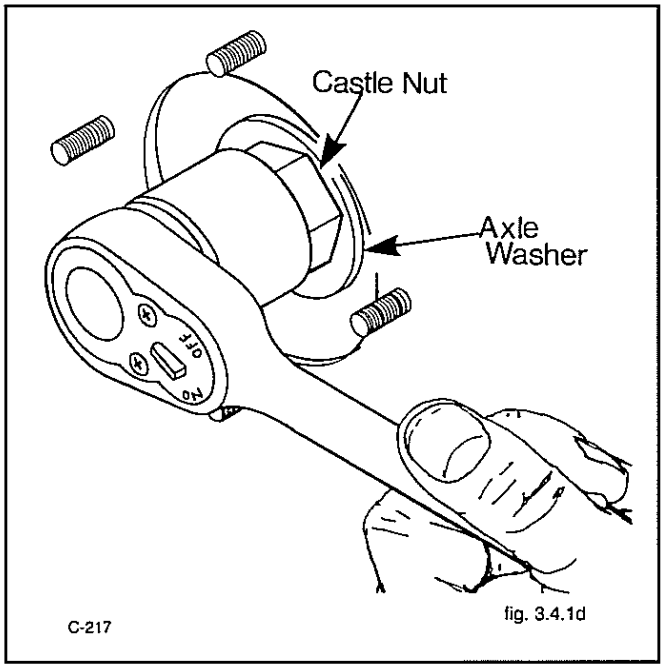
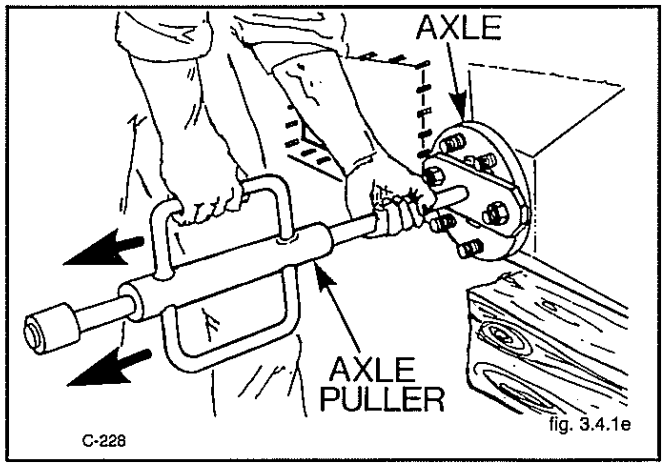
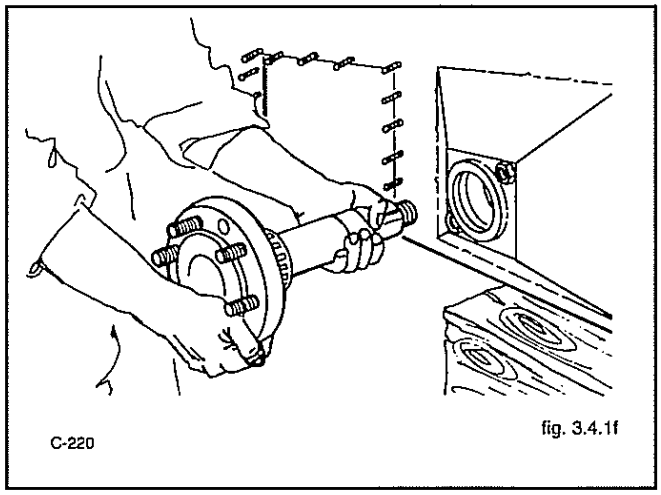


fig. 3.4.1d

13. Using the special axle puller tool (sliding hammer) remove the rear bearing from the end of the axle (fig. 3.4.1e). The rear bearing and axle sprocket will remain inside the final drive housing.



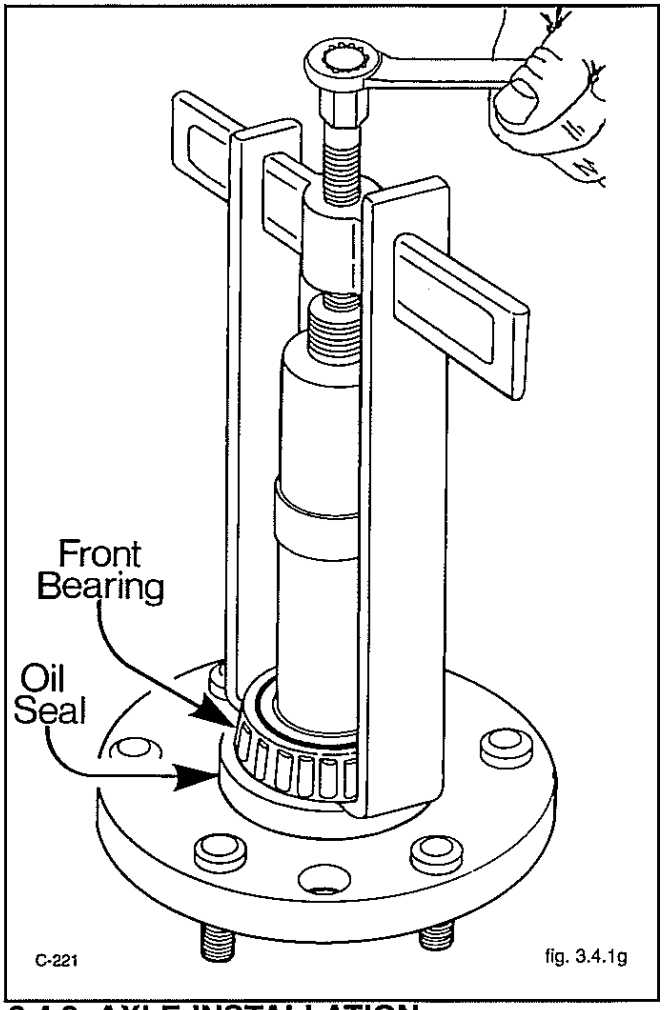


14. Remove the axle assembly from the final drive housing (fig. 3.4.1f).

15. Remove the axle sprocket and rear bearing from the final drive housing through the inspection cover.

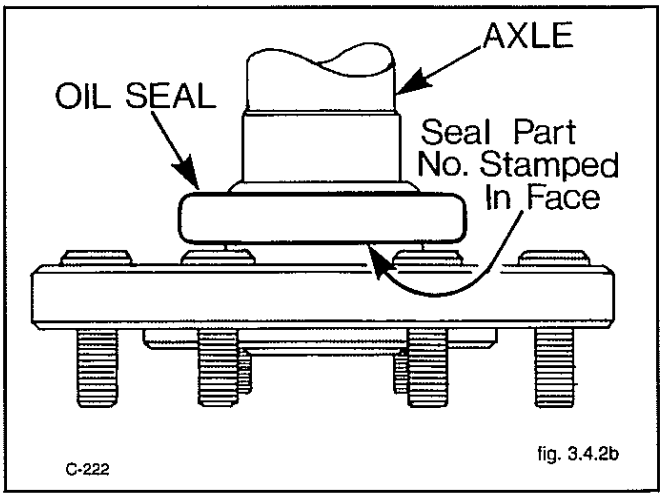
16. Using a bearing puller remove the front axle bearing (fig. 3.4.1g) from the axle.

17. Remove and discard the axle oil seal.



3.4.2 AXLE INSTALLATION

1. Lubricate the axle oil seal and install it on the seal surface of the axle. The seal part number stamped on the face of the seal must face the flange end of the axle (fig. 3.4.2a).



3 FINAL DRIVE

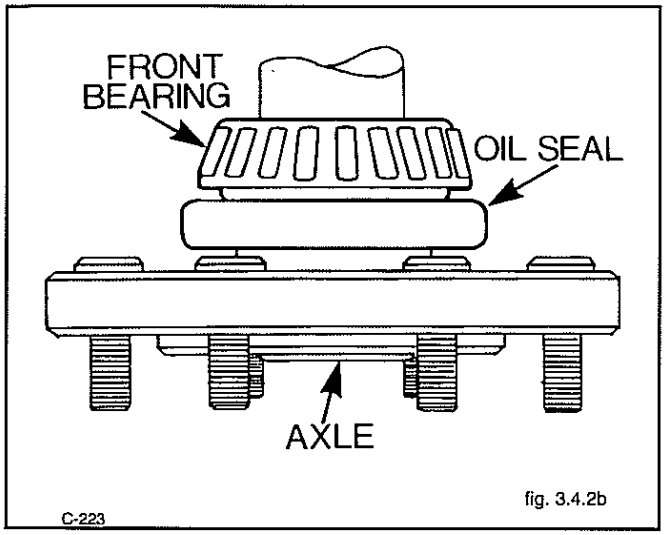


fig. 3.4.2b

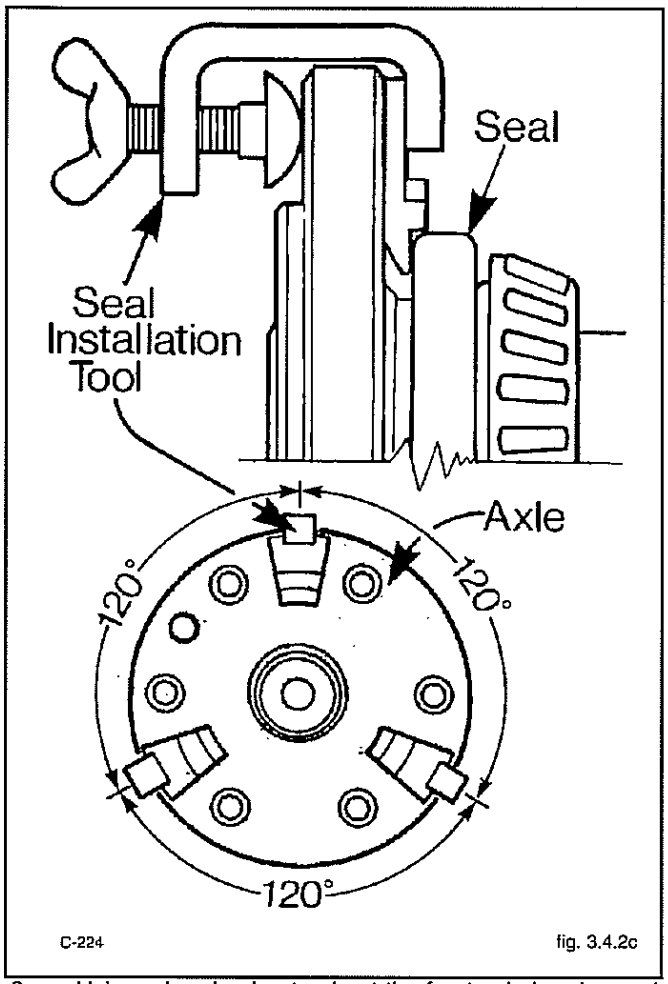


fig. 3.4.2c

2. Using a bearing heater, heat the front axle bearing and press it on the axle (fig. 3.4.2b). Be sure the bearing is seated.

3. Place 3 seal installation tools (special tool TH955281) 120° apart around the axle flange (fig. 3.4.2c).

   The seal installation tools will properly seat the axle seal in the final drive housing as the axle is installed.

4. Install the axle in the final drive housing (fig. 3.4.2d).

5. Reach in through the inspection opening and install the rear axle bearing on the axle (fig. 3.4.2e). Line the bearing up with the bearing seat on the axle.

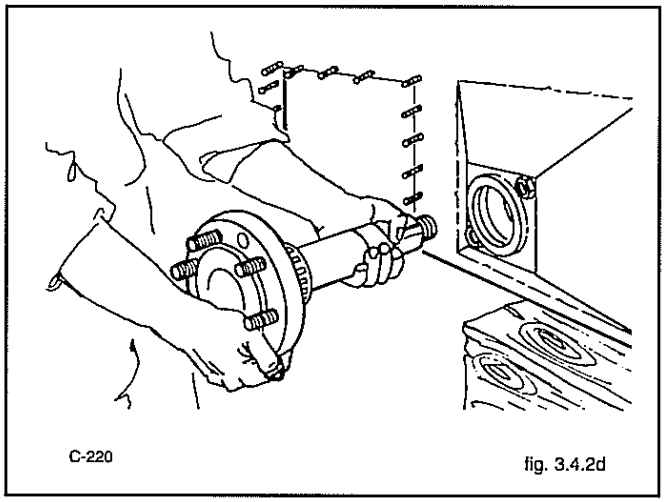


fig. 3.4.2d

6. Reach in through the inspection opening and install the axle sprocket on the axle (fig. 3.4.2f). Make sure the sprocket starts on the axle. The hub end of the sprocket must face the flange end of the axle.

7. Place a bolt through the hole in the axle flange (fig. 3.4.2g) to prevent the axle from turning.

8. Apply a gasket sealing compound to the outside diameter of the axle oil seal (fig. 3.4.2h).

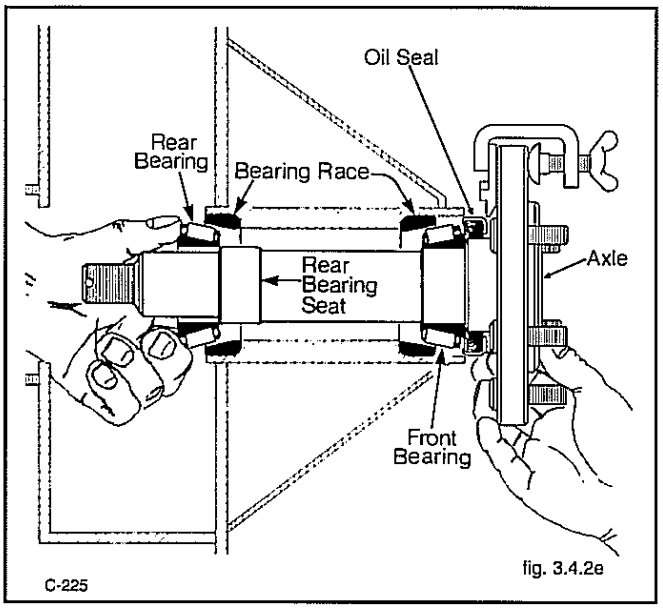


fig. 3.4.2e

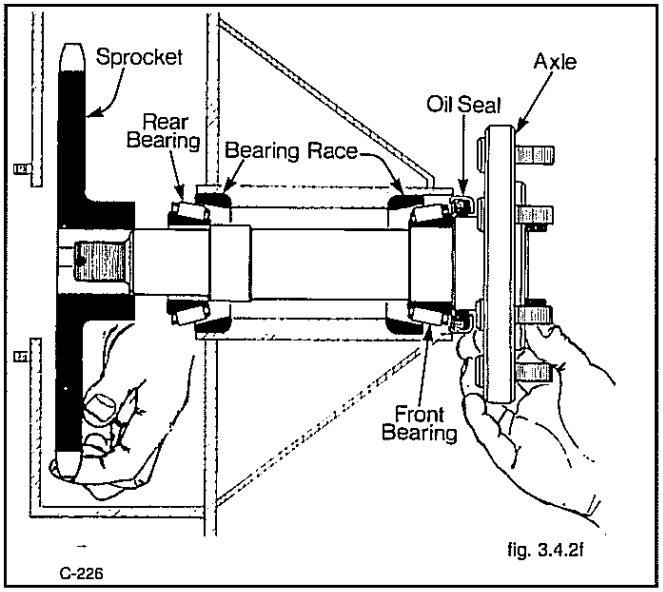


fig. 3.4.2f

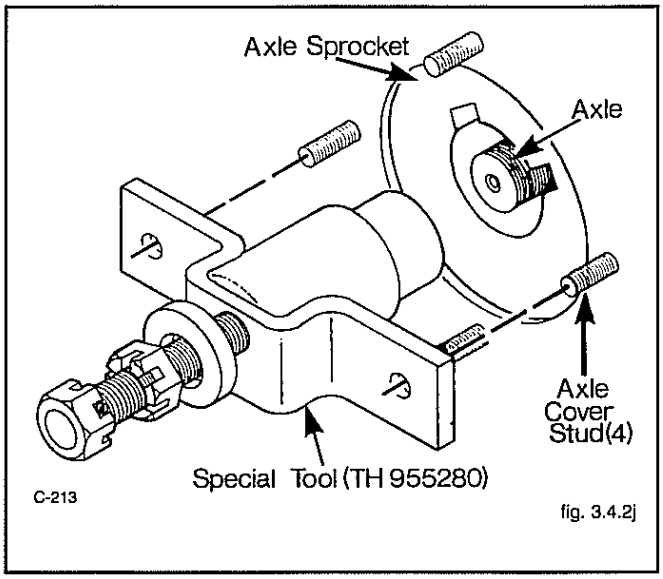


fig. 3.4.2j

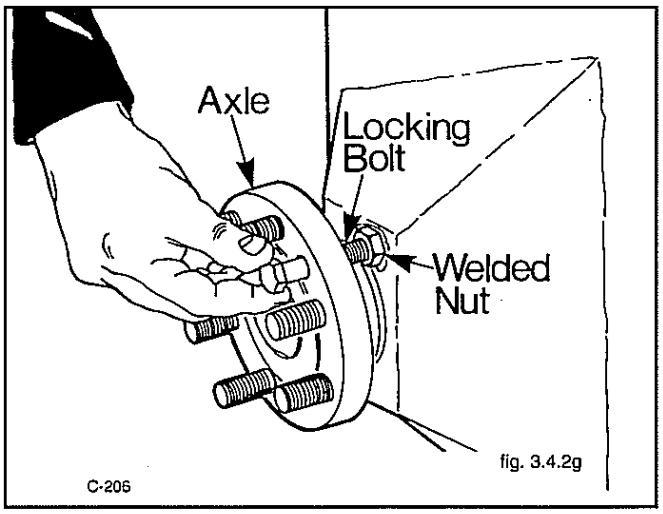


fig. 3.4.2g

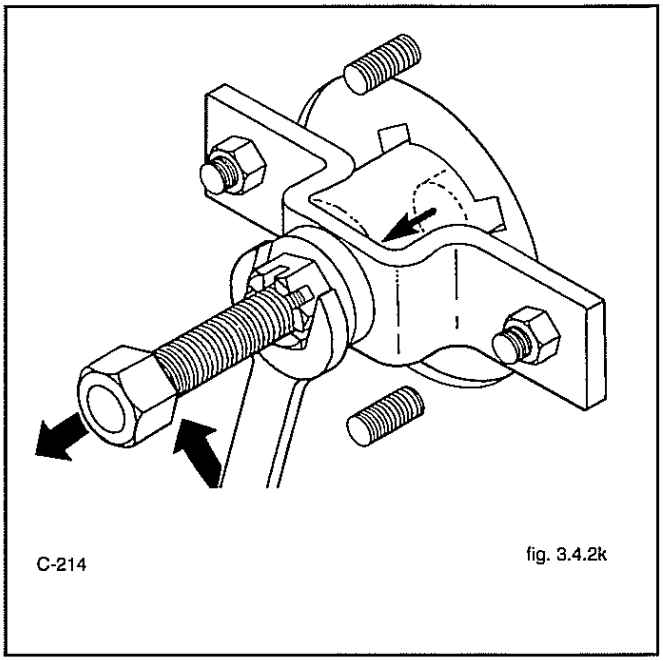


fig. 3.4.2k

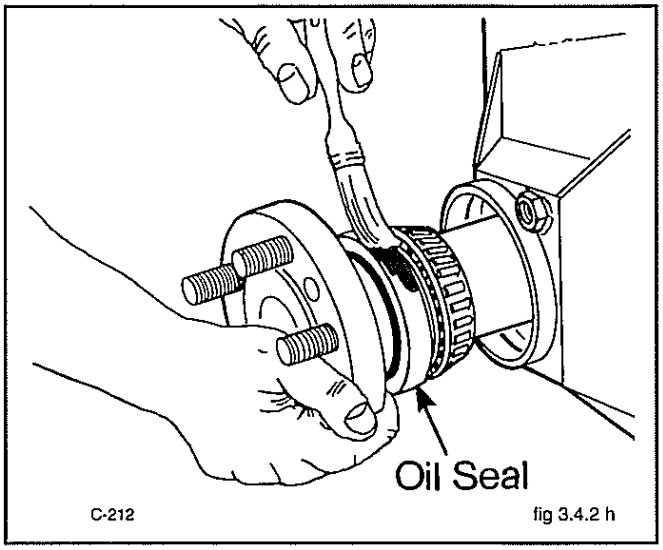


fig 3.4.2 h

9. Place the legs of the axle installation tool (TH955280) over two of the rear axle cover studs and screw the tool onto the threaded end of the axle protruding through the sprocket bore (fig. 3.4.2j).

10. Tighten the axle installation tool (fig. 3.4.2k) and draw the axle through the sprocket until the three seal installation tools are touching the front of the housing.

3 FINAL DRIVE

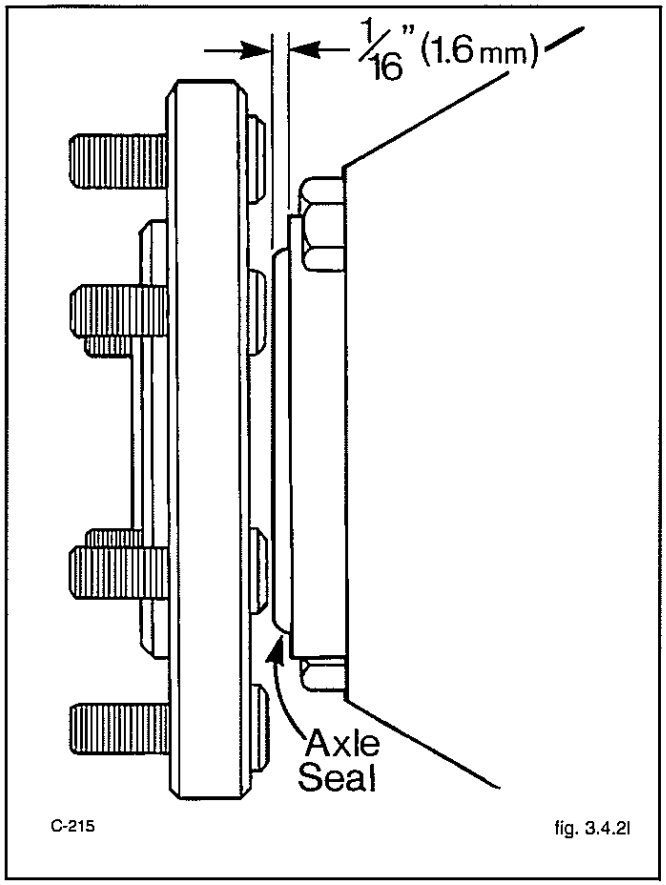


fig. 3.4.2l

11. Remove the axle installation tool and the three seal installation tools from the axle.

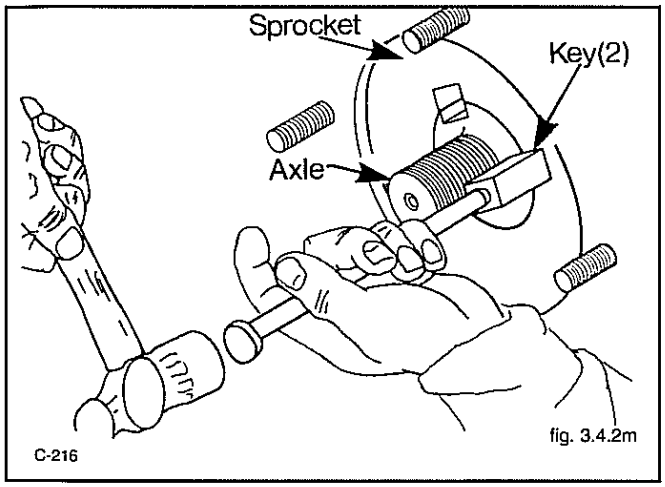


fig. 3.4.2m

The axle seal will extend approximately 1/16 inch (1.6 mm) beyond the face of the final drive housing (fig. 3.4.2l).

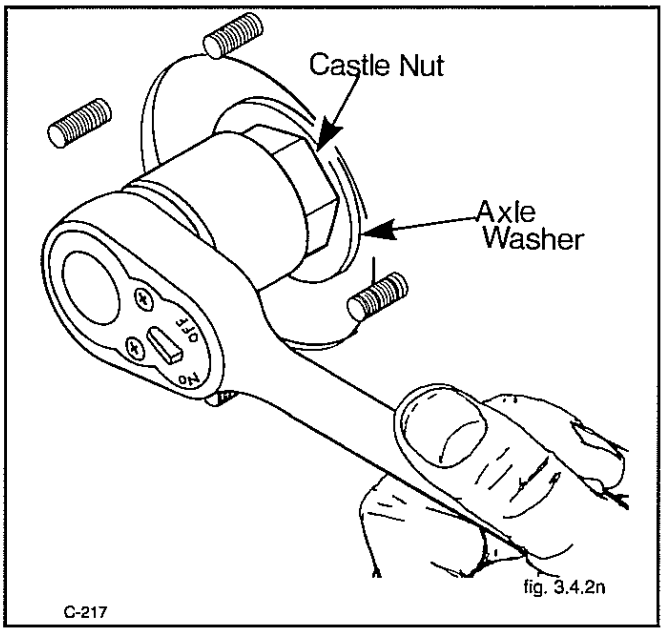


fig. 3.4.2n

12. Reach in through the final drive inspection opening and turn the sprocket to line up with the key ways on the axle.

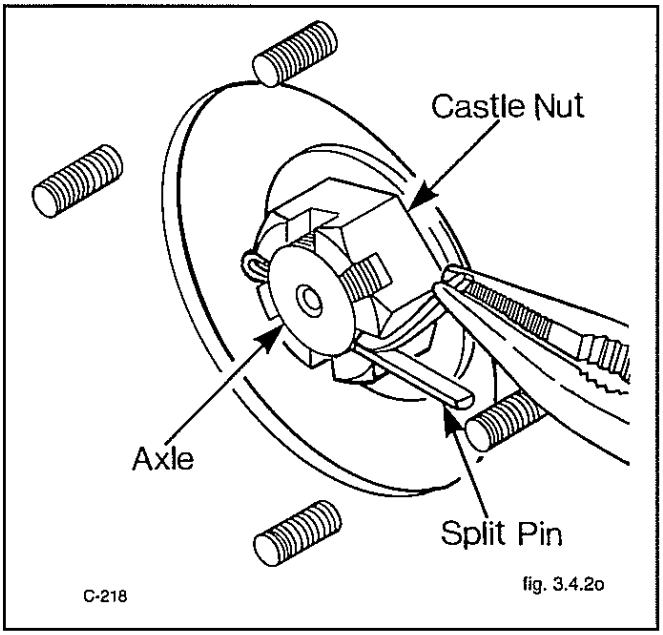


fig. 3.4.2o

Install the axle keys (fig. 3.4.2m).

13. Install the axle spacer and castle nut and preload the axle bearings to zero (0) end play (fig. 3.4.2n).

14. Install the split pin through the castle nut (fig. 3.4.2o).

3 FINAL DRIVE

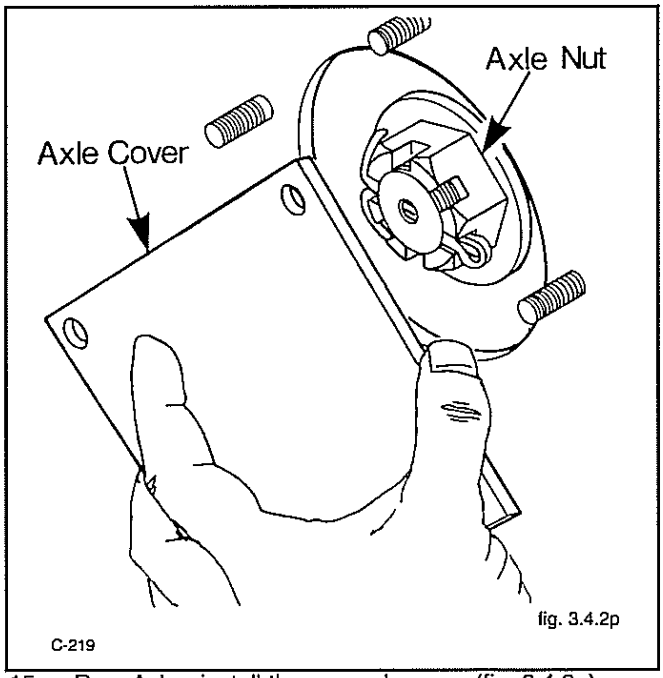


fig. 3.4.2p

15. Rear Axle - install the rear axle cover (fig. 3.4.2p). Front Axle - instal the rear axle cover (fig. 3.4.2p). Install the foot pedal assembly. Refer to section 4.2 for procedure.

16. Install the drive chain and parking brake assembly. Refer to section 3.3.3 for procedure.

17. Fill the final drive housing to the correct level with 10W30 API SE/CD oil. Refer to section 3.2.3 for procedure. Total capacity per housing 1.5 gal. (5.7 l).

18. Install the final drive inspection cover.

19. Install the wheels. Torque the wheel nuts 100 - 110 ft. lbs. (135 - 149 N.M.).

IMPORTANT Check wheel nut torque daily to prevent stud and/or rim damage

3.4.3 AXLE STUD REPLACEMENT

1. Lower the boom arms. Shut off the engine.

WARNING To prevent personal injury do not work on a loader with the boom arms in a raised position unless the boom locks are engaged.

2. Raise and block the loader securely with the wheels on the side of the loader that the stud is to be replaced, clear of the ground.

3. Remove the wheel. On reassembly torque the wheel nuts 100 - 110 ft. lbs. (135 - 149 N.M.).

4. Remove the damaged or broken stud (fig. 3.4.3.a).

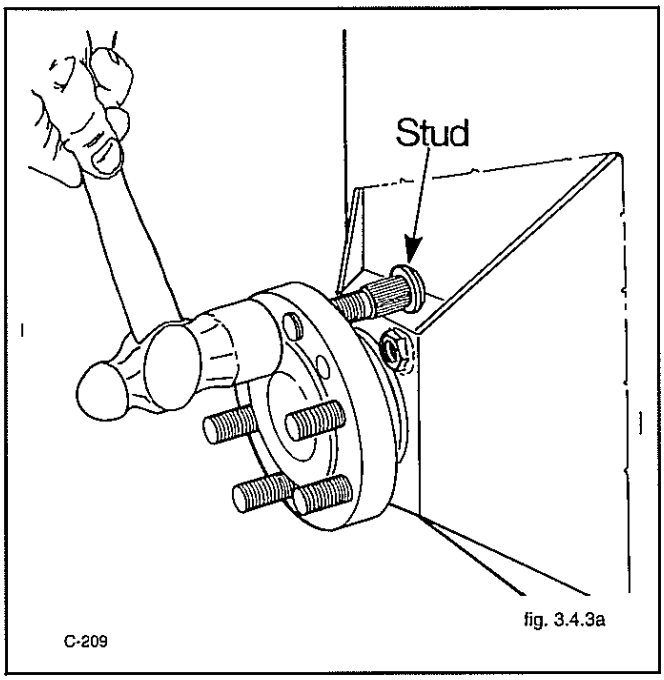


fig. 3.4.3a

5. Install a new stud from the back of the axle flange (fig. 3.4.3b). Line up the splines on the stud with the splines cut into the axle flange.

6. Place a nut on the stud and tighten it to draw the stud into the axle flange (fig. 3.4.3c).

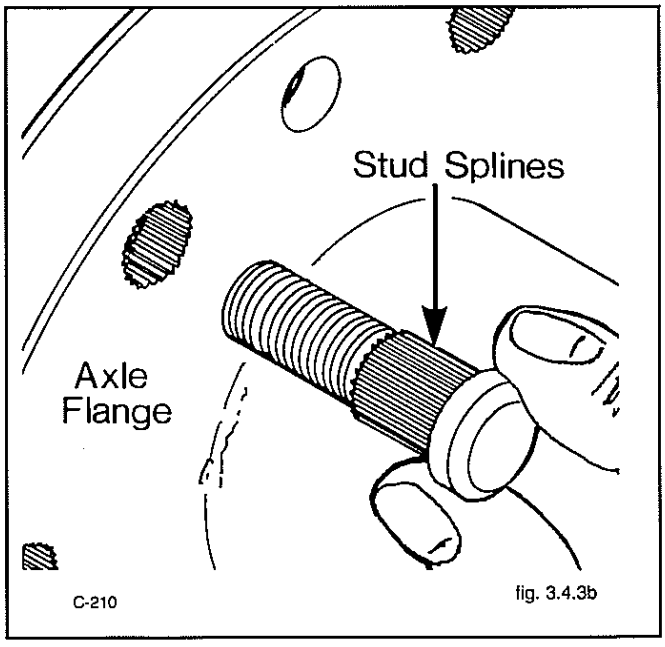


fig. 3.4.3b

3 FINAL DRIVE

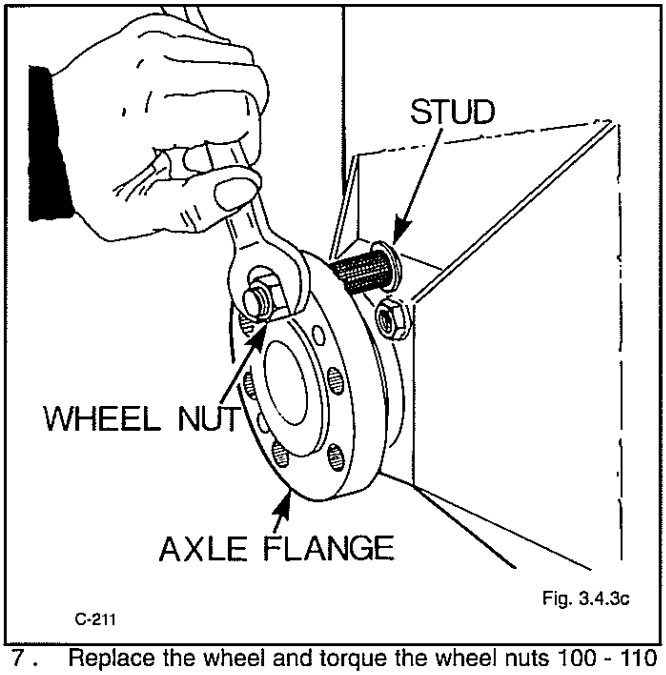


Fig. 3.4.3c

7 . Replace the wheel and torque the wheel nuts 100 - 110 ft. lbs. (135 - 149 N.M.).

3.5 DRIVE MOTOR SPROCKET

3.5.1 SPROCKET REMOVAL

1. Remove any attachment, raise the boom arms and engage the boom locks. Shut off the engine.

WARNING

To prevent personal injury do not work on a loader with the boom arms in a raised position unless the boom locks are engaged.

2. Block the loader securely with all four wheels clear of the ground.

3. Remove the wheels on the side of the loader that the drive motor sprocket is to be removed from.

   On reassembly torque the wheel nuts 100 - 110 ft. lbs. (135 - 149 N.M.).

4. Drain the lubricating oil from the final drive housing. Refer to section 3.2.2 for procedure. Total housing capacity 1.5 gal. (5.7 l).

5. Remove the final drive inspection cover plate (fig. 3.5.1a) located between the axles on the final drive housing.

6. 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).

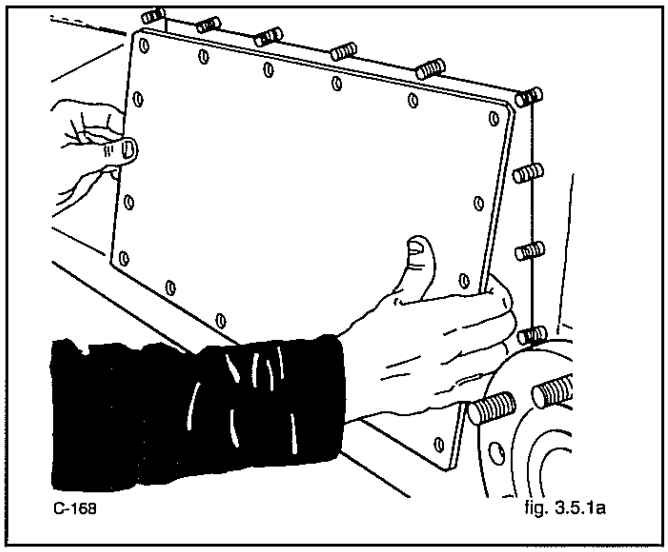


fig. 3.5.1a

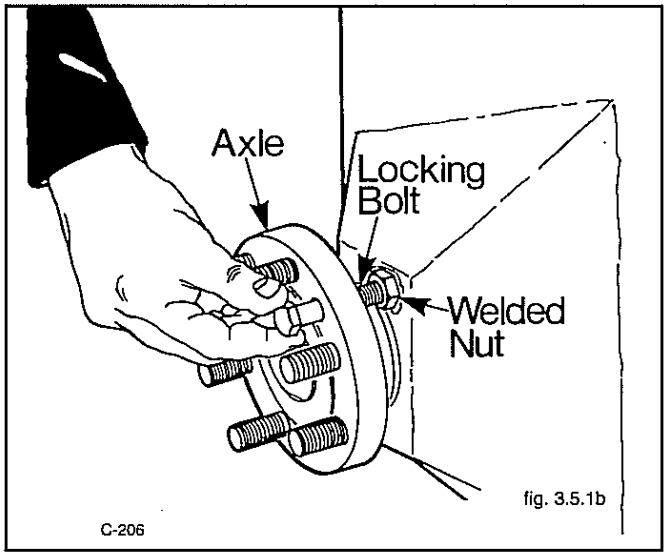


fig. 3.5.1b

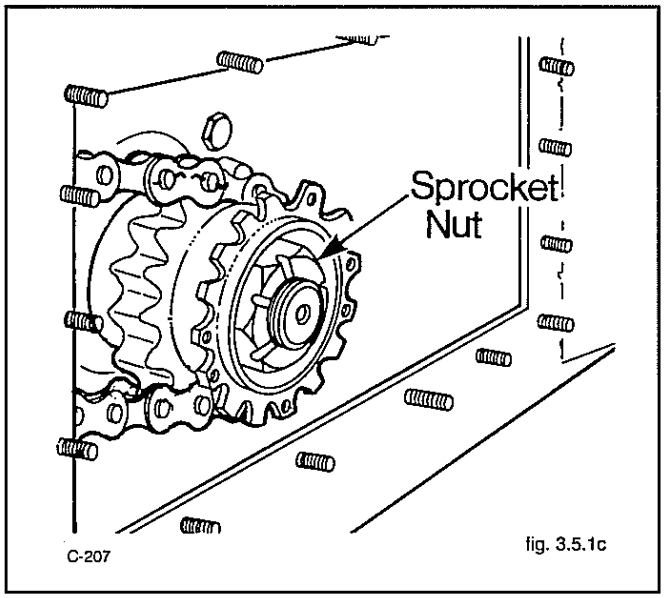


fig. 3.5.1c

7. Remove the torque motor sprocket nut (fig. 3.5.1c).

   On reassembly torque to 350 ft. lbs. (474.5 N.M.).

8. Remove the drive chain. Refer to section 3.3.2 for procedure.

9. Using a proper gear puller, remove the sprocket and key from the torque motor shaft (fig. 3.5.1d).

NOTE: The T133 torque motor can be removed from the final drive housing without removing the sprocket.

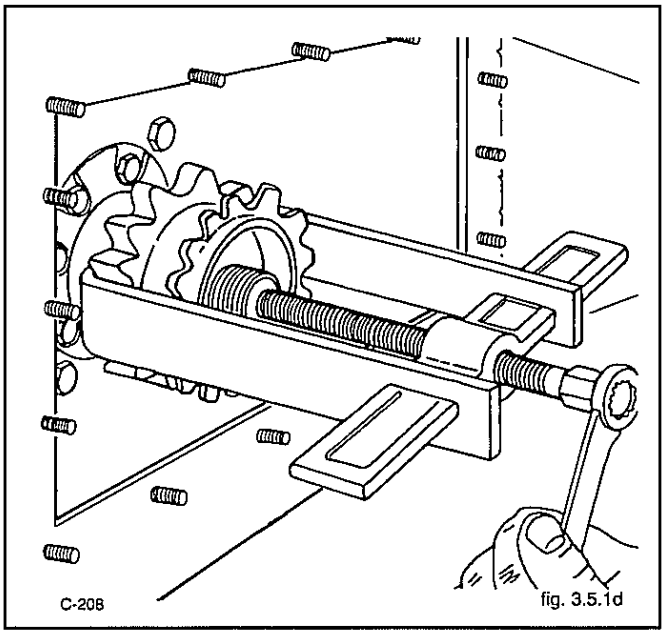


fig. 3.5.1d

3.5.2 SPROCKET INSTALLATION

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

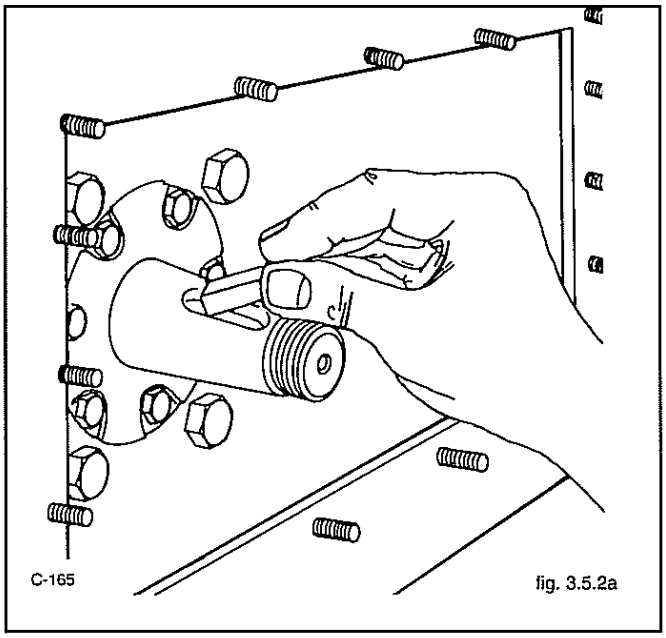


fig. 3.5.2a

2. Line up the sprocket with the key and install the sprocket on the torque motor shaft.

3. Install the drive chain in the final drive housing. Refer to section 3.3.3 for procedure.

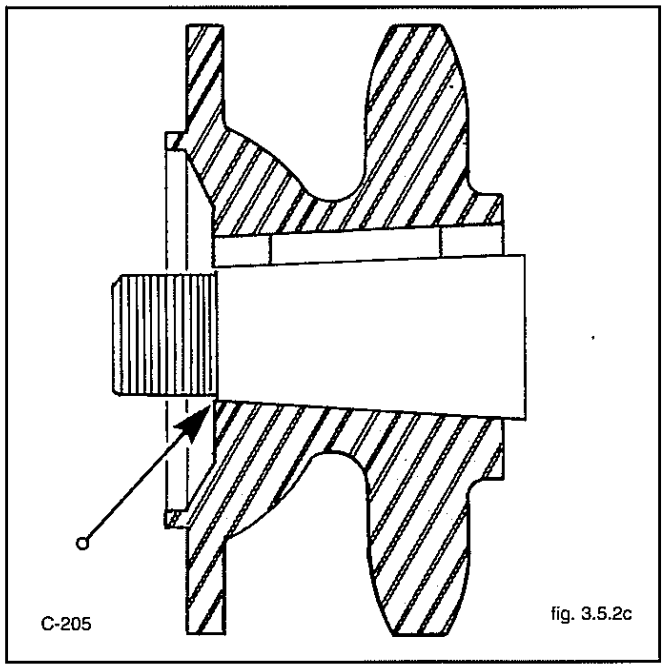


fig. 3.5.2c

4. 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 tightened (fig. 3.5.2d).

5. Install the sprocket nut. Torque the nut to 350 ft. lbs. (474.5 N.M.) (fig. 3.5.2e).

6. Fill the final drive housing to the correct level with 10W30 API SE/CD oil. Refer to section 3.2.3 for details. Capacity 1.5 gal. (5.7 l).

3 FINAL DRIVE

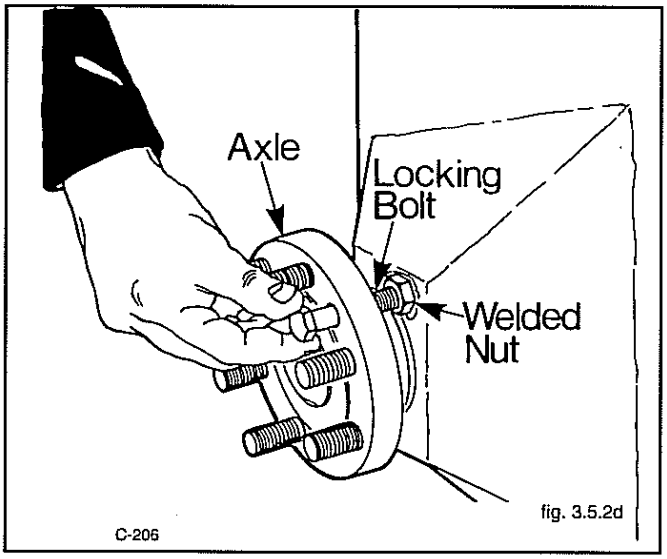


fig. 3.5.2d

7. Apply silicon to the inspection cover and install the inspection cover on the final drive housing.

8. Install the wheels. Torque the wheel nuts 100 - 110 ft. lbs. (135 - 149 N.M.).

9. Check the chain tension and if necessary adjust. Refer to section 3.3.1 for procedure.

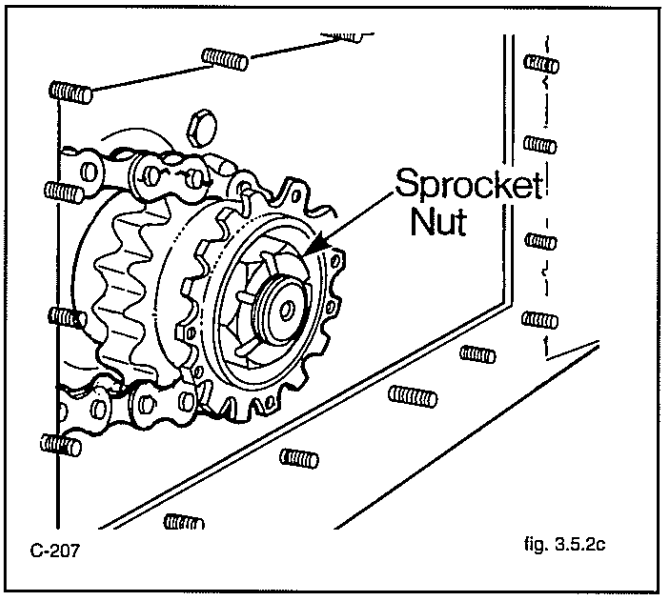


fig. 3.5.2c

3 FINAL DRIVE

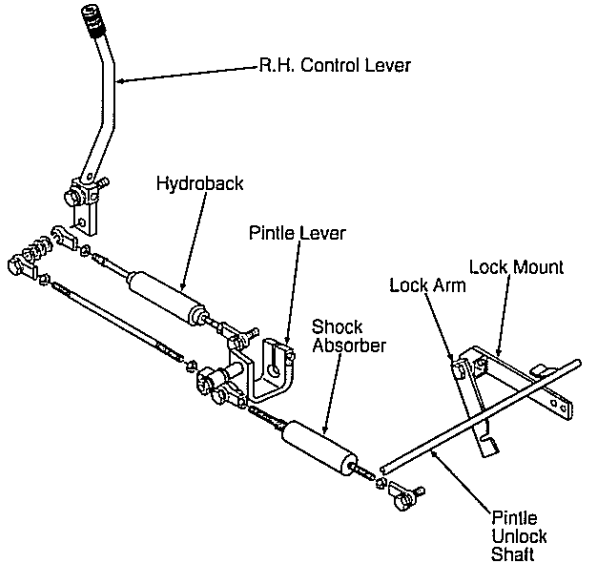
3.6 Trouble Shooting - Final Drive:

Problem	Cause	Corrective Action	Section
Final drive. Noisy.	No lubricating oil	Check oil level. Add 10W30 API SE/CD oil to correct level.	3.2.3
	Chain Loose	Adjust chain tension. Check tension every 150 hours.	3.3.1
	Axle has too much end play	Preload axle bearings removing all end play.	3.4.2
	Parking brake engaged, damaged or out of adjustment	Inspect and adjust or replace damaged parts.	4.5
No drive on one side	Drive chain failure	Inspect chain and connection link. Replace damaged parts. Check chain tension every 150 hours.	3.3.2 3.3.3
	Drive motor shaft or key failure	Inspect and replace damaged parts.	2.3
	Hydrostatic drive system failure	Refer to hydrostatic drive system.	2.4
Lubrication oil leaking through filler, breather cap	Lubricating oil level too high	Check oil level.	3.2.1
	Drive motor shaft seal leak	Inspect and repair damaged parts.	2.3
Wheel studs shearing	Wheel nuts loose	Check wheel nut torque every 8 hours. Torque to 100-110 ft.lbs. (135-149N.M.).	3.1.2 3.4.3
Wheel stud threads stripped	Wheel nuts over torqued	Torque to 100-110 ft. lbs. (135-149 N.M.). Check torque every 8 hours.	3.1.1 3.1.2 3.4.3

4 CONTROLS

4 CONTROLS

4.1 STEERING



C-346 fig. 4.1

4.1.1 OPERATION

Two steering levers control speed, direction and turning the loader. The steering levers are connected to the two hydrostatic drive pump camplate levers. Moving the camplate levers causes oil to be pumped to the drive motors resulting in drive to the wheels (refer to section 2.2.2 for details on pump operation). The R.H. lever controls the wheels on the R.H. side of the loader and the L.H. lever, the left hand wheels. Loader speed is controlled by the amount each lever is moved from the center or neutral position. (fig. 4.1.1). The further away from neutral the faster the travel speed.

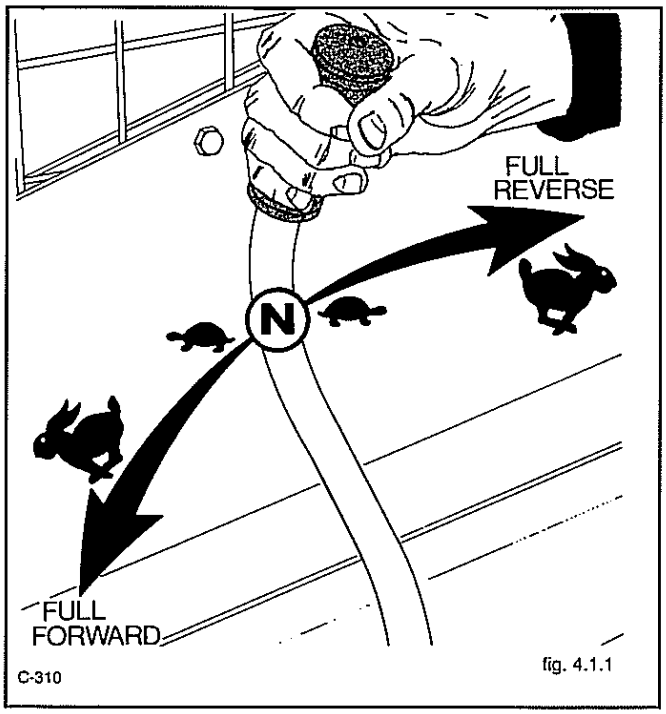
WARNING

To avoid personal injury do not start the engine unless you are in the seat with the seat belt fastened around you.

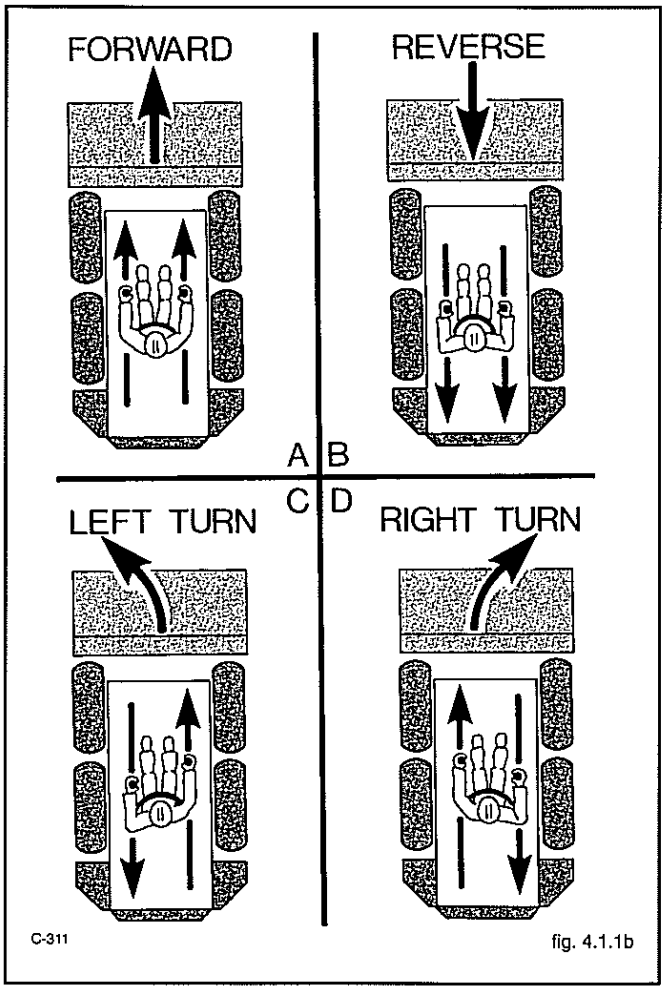
For maximum power and slow travel speed move the control levers only a small amount.

To drive the loader forward in a straight line, move both steering levers forward the same amount (fig. 4.1.1a). To drive the loader in reverse in a straight line, move both control levers back the same amount (fig. 4.1.1b).

The loader is steered by moving one lever further forward than the other. To turn right move the left lever further than the right lever. To turn left, move the right lever further than the left lever. For the loader to turn or "skid steer" within its own length, one lever is moved forward and the other back. This causes the wheels on one side to turn forward and the wheels on the other side to reverse, turning the loader (fig. 4.1.1c & d).



C-310 fig. 4.1.1



C-311 fig. 4.1.1b

4 CONTROLS

WARNING

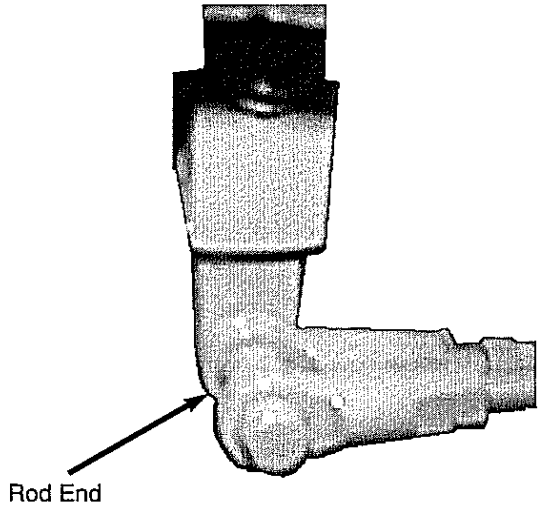
To avoid personal injury always keep feet on the foot pedal controls while operating the loader.

The steering levers are equipped with a spring centering device which will return the levers to neutral position if released during operation.

For safety on start up the levers automatically are centered in neutral position when the engine is shut off and the seat bar is raised.

WARNING

To avoid personal injury stop the engine, engage the parking brake, and cycle the foot pedals to ensure they are locked before getting out of the loader.



C-584

fig. 4.1.2

4.1.2 NEUTRAL ADJUSTMENT

The steering levers are designed to return to neutral position if released during operation. If the loader creeps with the steering levers in neutral position, the neutral centering may require adjustment. Before making any adjustment on the centering system check the entire steering linkage for free play. If any free play exists in the linkage, adjustment of the centering system will not be possible.

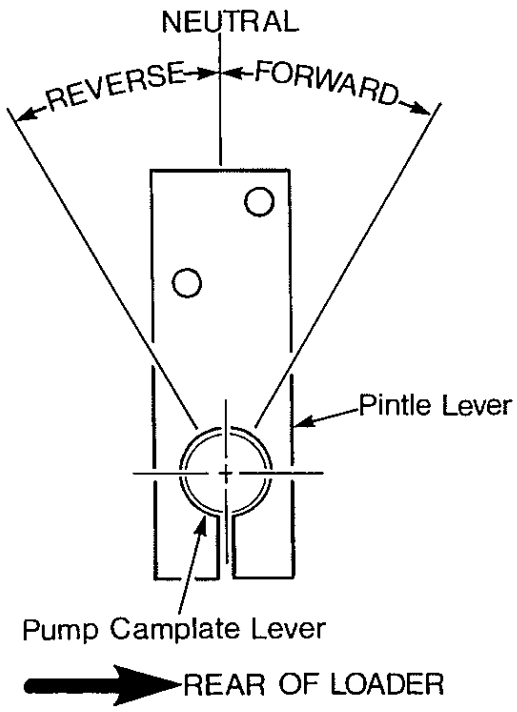
Check the rod ends for bearing wear or looseness (fig. 4.1.2).

Check the counter nuts at each rod end making sure they are tight and there is no wear or free play on the threads (fig. 4.1.2).

Check the pintle lever clamp bolt and roll pin for tightness and wear (fig. 4.1.2).

The following instructions are applicable to either the R.H. or L.H. steering lever spring return system.

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



C-313

fig. 4.1.2a

WARNING

To avoid personal injury do not work on a loader with the boom arms in a raised position unless the boom locks are engaged.

2. Block the loader securely with all four wheels clear of the ground.

3. Remove the seat assembly.

4. Determine which direction the pump pintle lever must move to place the pump in neutral position (fig. 4.2.1a). If the loader is creeping forward the pump pintle lever must be moved toward the front of the loader. If the machine is creeping backward the pintle lever must be moved toward the rear of the loader.

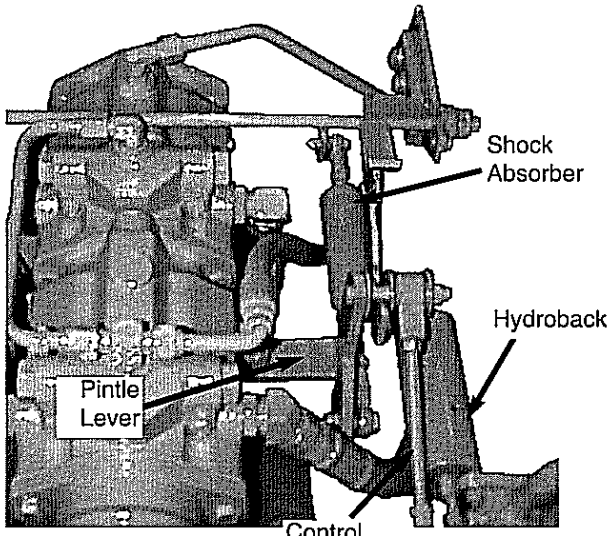
The pintle position should be adjusted at the centering assembly.

The following instructions cover adjustment procedures to correct both forward and reverse loader creeping.

5. LOADER CREEPING FORWARD:

WARNING

To avoid personal injury do not service the loader with the engine running.



C-615 fig. 4.1.2b

A. Loosen the jam nut on the control rod and turn the adjustment nut clockwise one turn and check for forward creeping. Repeat if necessary.

B. If forward creeping persists move to the pintle lever control linkage and adjust forward.

C. Too much adjustment at the control rod will cause control lever misalignment.

D. If wheels creep forward, the control rod should be shortened, if the creep in reverse, the rod should be lengthened.

WARNING

To avoid personal injury do not service the loader with the engine running.

6. LOADER CREEPING REARWARD:

Repeat section 6, only in reverse.

4.1.3 NEUTRAL DETENT ADJUSTMENT

For safety during start up the steering control levers are designed to be automatically centered in neutral when the control levers are released.

If the loader creeps while the engine is running, the linkage may require adjustment. For complete adjustment procedure refer to section 4.3.2 or 4.3.3.

4.1.4 STEERING LEVER TRAVEL ADJUSTMENT

To prevent excessive force being applied to the pump pintle levers when the steering levers are moved full stroke, the steering levers are equipped with travel limiters (fig. 4.1.4a).

WARNING

To avoid personal injury do not start the engine unless you are in the seat with the seat belt fastened around you.

The travel limiters can also be used to adjust loader travel speed on both the left and right hand sides to eliminate tracking.

Two people are required to make the following adjustment to the steering lever limiters:

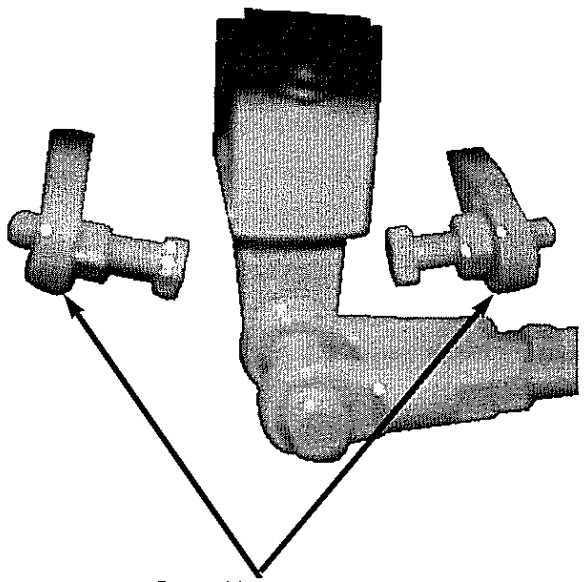
1. Remove any attachment, raise the boom and engage the boom lock. Shut off the engine.

2. Block the wheel securely with all four wheels clear of the ground.

3. Start the engine and place the throttle control at the maximum setting. Move both the L.H. and R.H. steering levers to full forward position.

4. Using a hand held tachometer check the wheel RPM at the center of the axle on both the L.H. and R.H. side of the loader (fig. 4.1.4b). Shut off the engine.

5. Adjust the fast side of the loader. Loosen the back limiter bolt counter nut (fig. 4.1.4c).

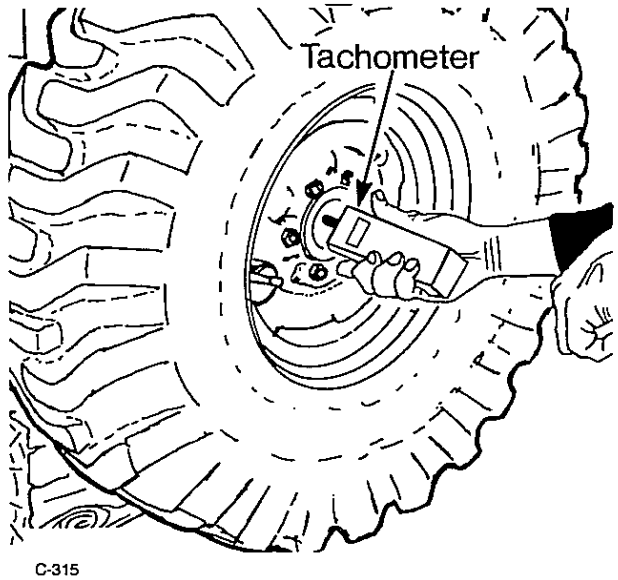


C-586

fig. 4.1.4a

WARNING

To prevent personal injury do not work on a loader with the boom arms in a raised position unless the boom locks are engaged.



C-315

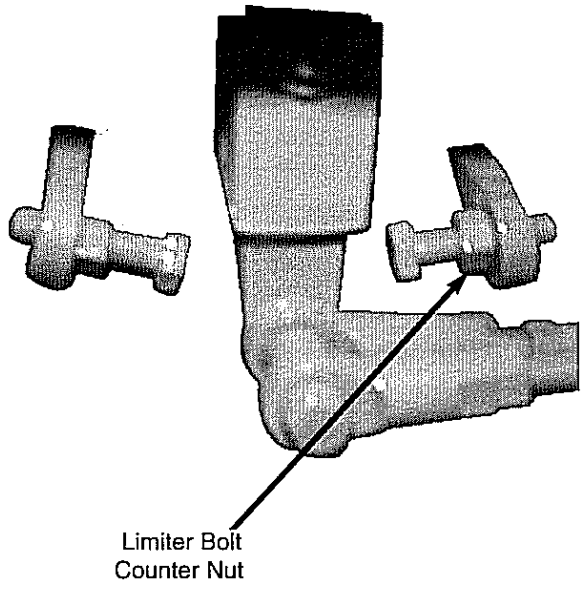
fig. 4.1.4b

6. Back out the rear limiter bolt until the wheel RPM on the fast side of the loader is the same as the slow side (fig. 4.1.4d).

7. Tighten the rear limiter bolt counter nut.

WARNING

To avoid personal injury do not service the loader with the engine running.



C-586

fig. 4.1.4c

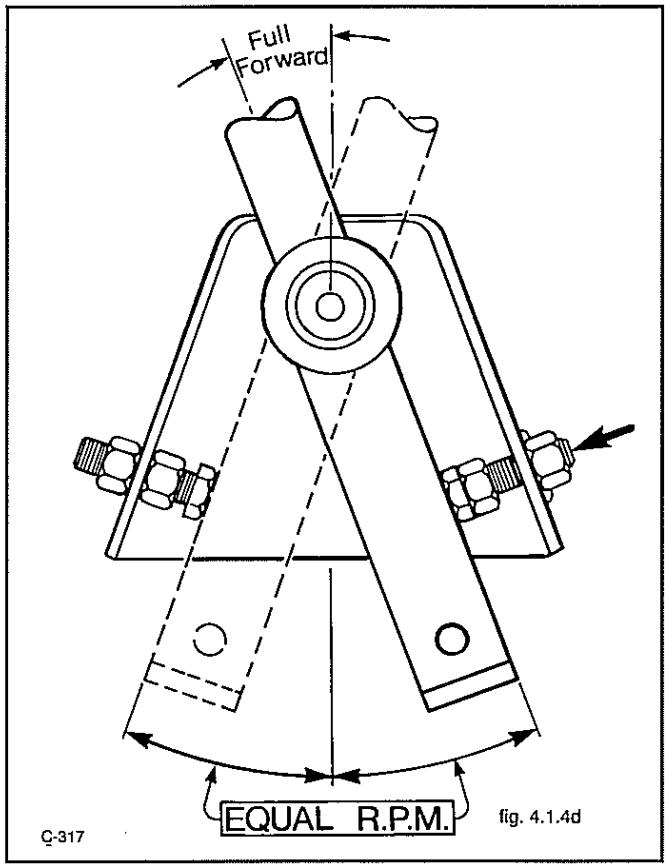


fig. 4.1.4d

4.2 FOOT PEDALS

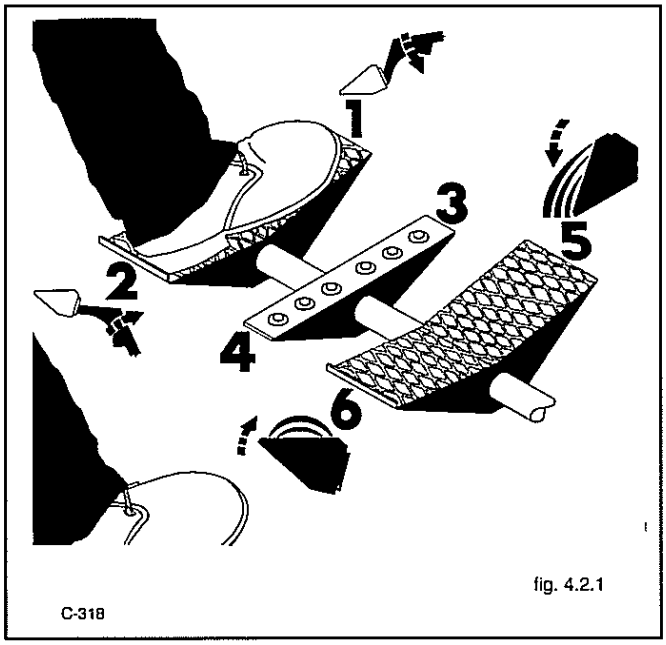


fig. 4.2.1

4.2.1 OPERATION

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

The foot pedals are connected through a cable assembly 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 backwards. Releasing pressure on the pedal will cause the control valve to return to neutral position.

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

AUXILIARY HYDRAULICS:

The center pedal is used to engage the auxiliary hydraulic circuit to power an attachment such as a backhoe. 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 the 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 loader has been equipped with locking foot pedal safety system to prevent accidental cycling of the foot pedals while entering or exiting the loader.

4 CONTROLS

Thomas 'S' series loaders are equipped with solenoid activated valve spool locks. When the ignition switch is in the off position the solenoid located at the clevis end of the control valve activates and locks the spool in the neutral position.

The spools (lift and tilt) will remain locked until the operator is in the seat with the lap belt fastened and the ignition switch in the on position (seat bar down)(fig. 4.2.1a).

WARNING

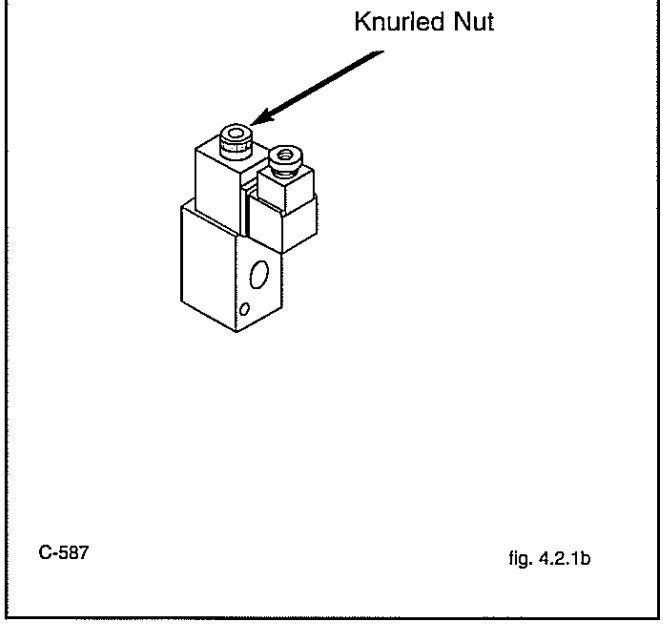
To avoid personal injury stop the engine, engage the parking brake and lower the boom arms before servicing the loader.

To adjust or repair, the locked position is obtained as you turn off the ignition switch and power to the valve lock mechanism is disrupted. Cycle foot pedals to make sure lock has occurred. To unlock the valve spools (lift and tilt) the operator must be seated, with the lap belt fastened and the ignition switch on. If binding or sticking occurs, check the solenoid knurled retaining nut. Solenoid must be free to rotate with slight effort. (fig. 4.2.1b)

If unlock does not occur, proceed to check the system electrics. First open the electrical panel door and make sure the fuse is not blown or that you don't have a faulty relay.

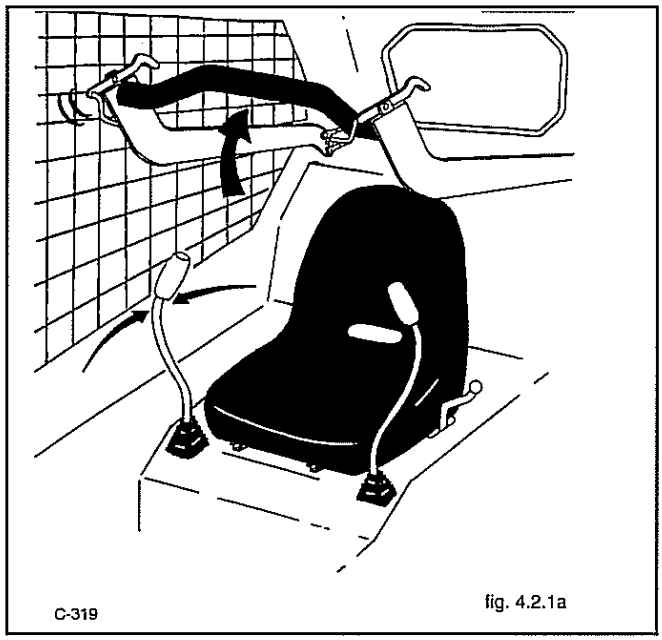
WARNING

To avoid personal injury stop the engine, engage the parking brake, and cycle the foot pedals to ensure they are locked before getting out of the loader.



C-587

fig. 4.2.1b



C-319

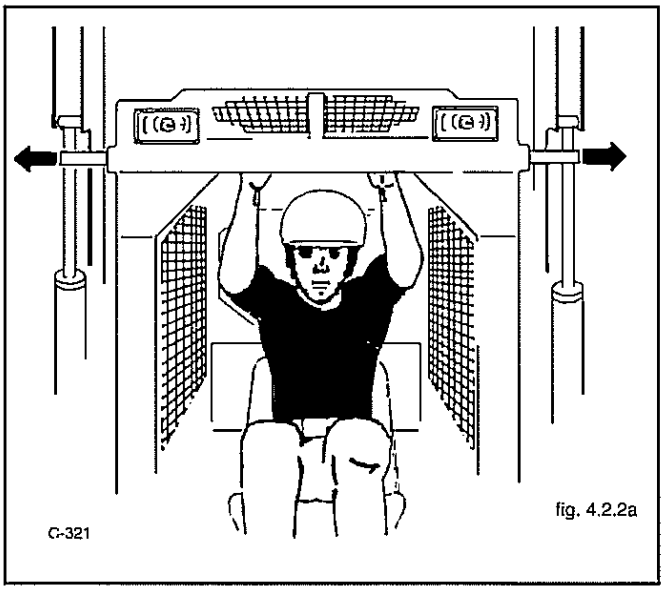
fig. 4.2.1a

4.2.2 FOOT PEDAL ANGLE ADJUSTMENT

For operator comfort the angle of the foot pedals can be adjusted.

WARNING

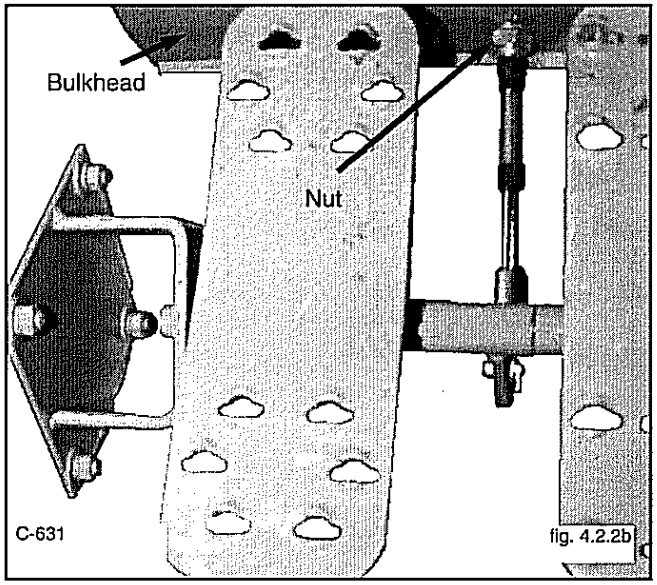
To prevent personal injury do not work on a loader with the boom arms in a raised position unless the boom locks are engaged.



C-321

fig. 4.2.2a

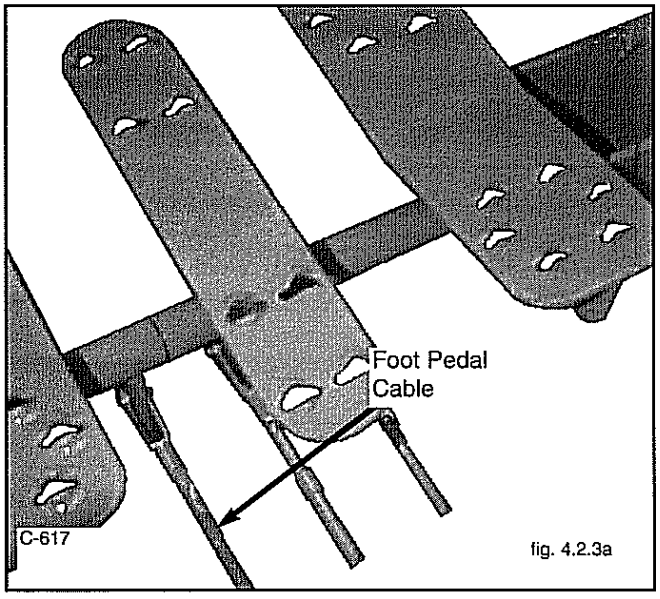
1. Remove any attachment. Raise the boom arms and engage the boom locks. Shut off the engine.
2. Loosen the jam nuts on either side of the bulkhead (fig. 4.2.2b).
3. Adjust the pedal as required.
4. Retighten the jam nuts.



4.2.3 FOOT PEDAL LOCK ADJUSTMENT

When the ignition switch is in the off position the foot pedals must be locked in the neutral position.

If the pedals can be moved with the ignition switch in the off position adjustment or repair of the cable or solenoid may be required.

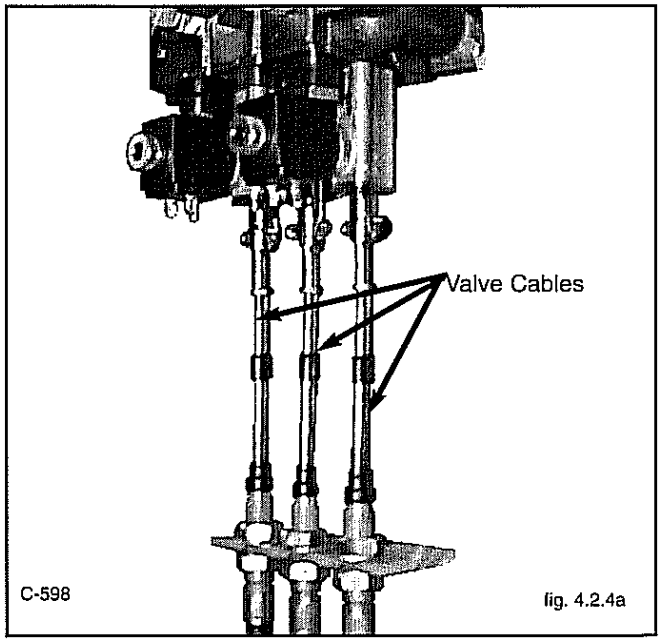


4.2.4 FOOT PEDAL LOCK REMOVAL

1. Remove any attachment, raise the boom arms and engage the boom locks. Shut off the engine.
2. Disconnect the foot pedal cables from the control valve spool (fig. 4.2.4b).
3. Remove the knurled nut from the solenoid lock assembly and disconnect electrical at solenoid.
4. Slide the solenoid off the post.
5. Remove the solenoid post, spring and plunger.
6. Remove the two retaining screws and the solenoid housing.
7. Inspect for corrosion and damage. Clean thoroughly in preparation for re-assembly.

WARNING

To prevent personal injury do not start the engine unless you are in the seat with the seat belt fastened around you.



4 CONTROLS

4.3 SEAT BAR

4.3.1 OPERATION

For operator protection the loader is equipped with a seat bar. When the seat bar is in the up position (fig. 4.3.1a) the steering control levers are returned to and restricted in neutral position and the park brake is automatically applied.

WARNING

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

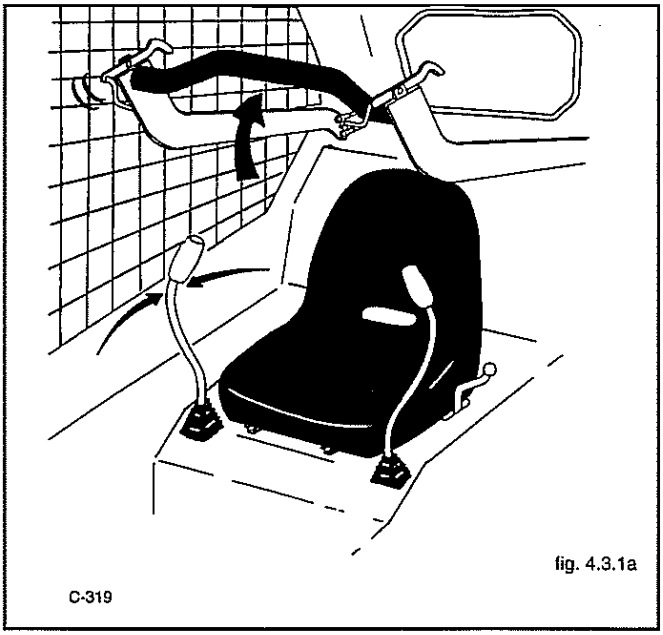


fig. 4.3.1a

C-319

WARNING

To avoid personal injury stop the engine, engage the parking brake, and cycle the foot pedals to ensure they are locked before getting out of the loader

When the seat bar is in the lowered or operating position (fig. 4.3.1b) the foot pedals and the steering levers are free to move and the park brake is disengaged.

For restarting the loader during operation if the engine stalls, simply turn the ignition switch and restart the engine.

WARNING

To prevent personal injury do not start the engine unless you are in the seat with the seat belt fastened around you.

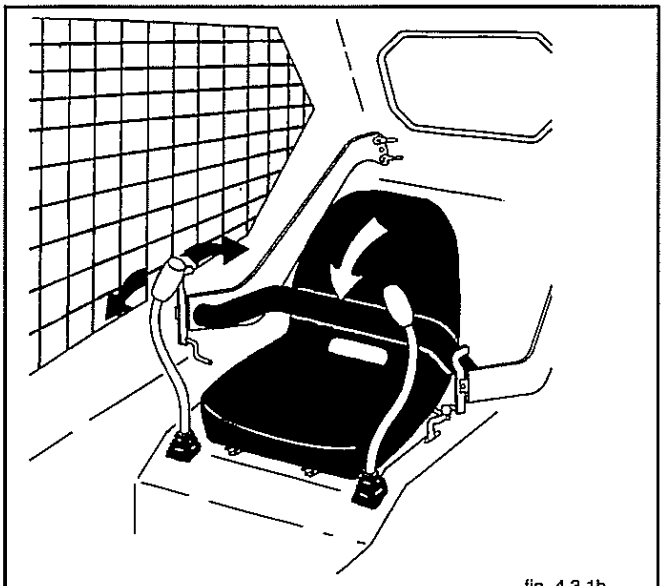


fig. 4.3.1b

C-347

4.3.2 CONTROL LEVER ADJUSTMENT (CREEP)

Before making any adjustments check that the machine does not creep with the engine running, seat bar in the down position and the steering levers in neutral.

WARNING

To prevent personal injury do not start the engine unless you are in the seat with the seat belt fastened around you.

1. Remove any attachment, raise the boom arms and engage the boom locks. Shut off the engine and block machine up.
2. Unbolt the seat . Disconnect wire harness and remove seat and seat plate.
3. Lock the seat bar in the up position.

4 CONTROLS

WARNING

To prevent personal injury do not work on a loader with the boom arms in a raised position unless the boom locks are engaged.

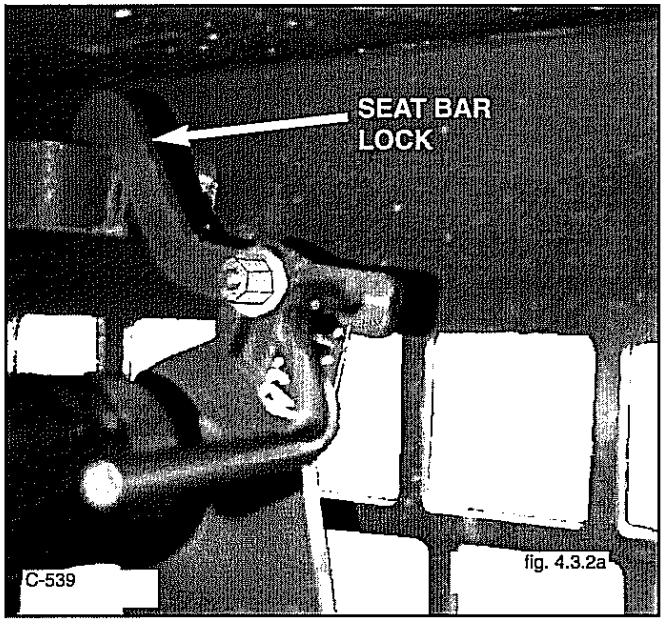


fig. 4.3.2a

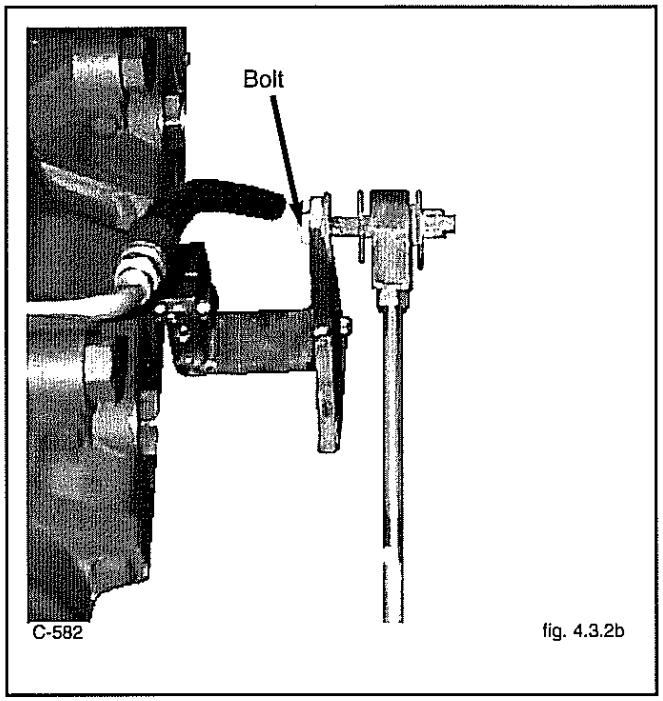


fig. 4.3.2b

4. Loosen jam nuts on both ends of control rod (fig. 4.1.2b).
5. Determine which direction you must adjust the rod end to stop the creep.
6. Adjust the rod and tighten jam nuts on control rod.

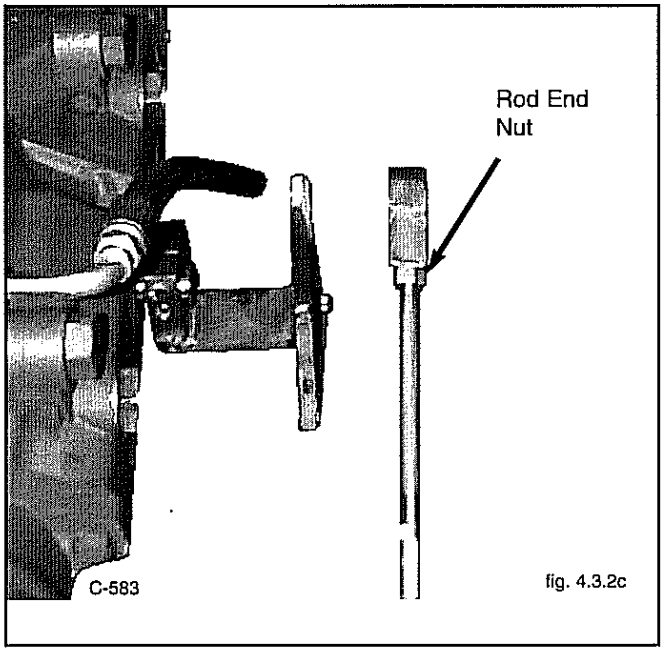


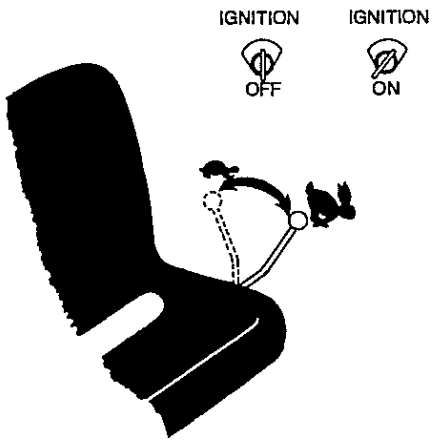
fig. 4.3.2c

4 CONTROLS

4.4 THROTTLE CONTROL

4.4.1 OPERATION

The diesel engine throttle control is one lever located on the left side of the loader next to the operator seat. (fig. 4.4.1a).

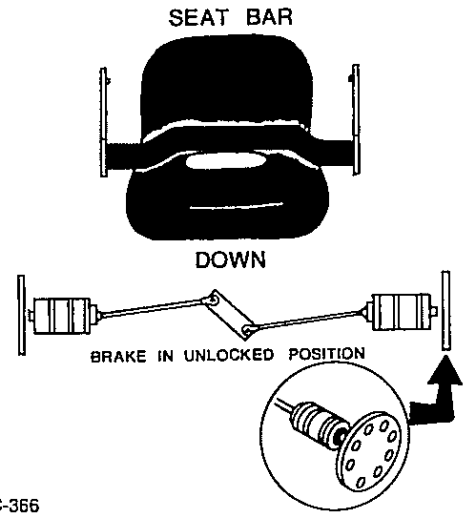


C-581 fig. 4.4.1a

Pushing the lever full forward increases the engine speed to maximum high idle. Pulling the lever back decreases engine RPM. The engine should always be operated at full speed and the loader travel speed controlled with the steering control levers.

Low Idle..... 875 (+ or - 25)
Max. High Idle.....2800 (+ or - 25)

4.5 PARKING BRAKE



C-366 fig. 4.5

4.5.1 OPERATION

The loader is equipped with a mechanical, pin lock brake located between engine and bulkhead. Both pins are activated by one cable located on the right hand side of the machine attached to the seat bar (fig. 4.5.1).

To engage the brakes; pull upward on the seat bar until it locks in position. To release the brakes; lower the seat bar, fully down.

WARNING

To prevent personal injury do not work a loader with the boom arms in a raised position unless the boom locks are engaged.

IMPORTANT

To prevent brake damage disengage the brake before operating the loader.

4 CONTROLS

4.5.2 CABLE ADJUSTMENT

1. Jack the loader up and ensure that the pins on either side of loader engage or disengage freely.

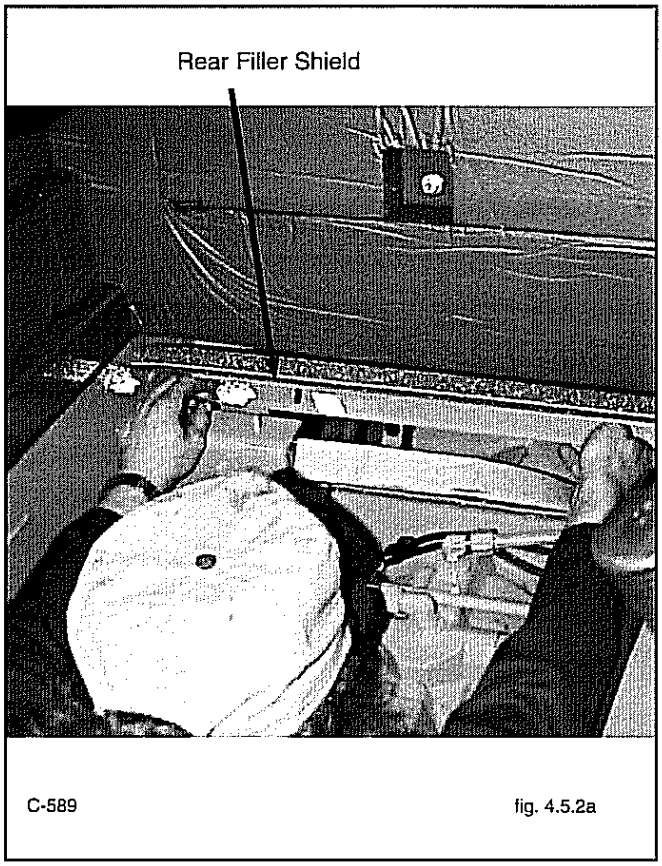
2. Unplug seat switch connection to main harness and remove seat and plate assembly. Remove rear filler shield to facilitate access to the brake cable bracket in the engine compartment. (fig. 4.5.2a).

3. Adjust position of brake pull off assembly using the adjuster rod such that the pin assembly and intermediary spring are just in tension without pulling out brake pin (fig. 4.5.2b).

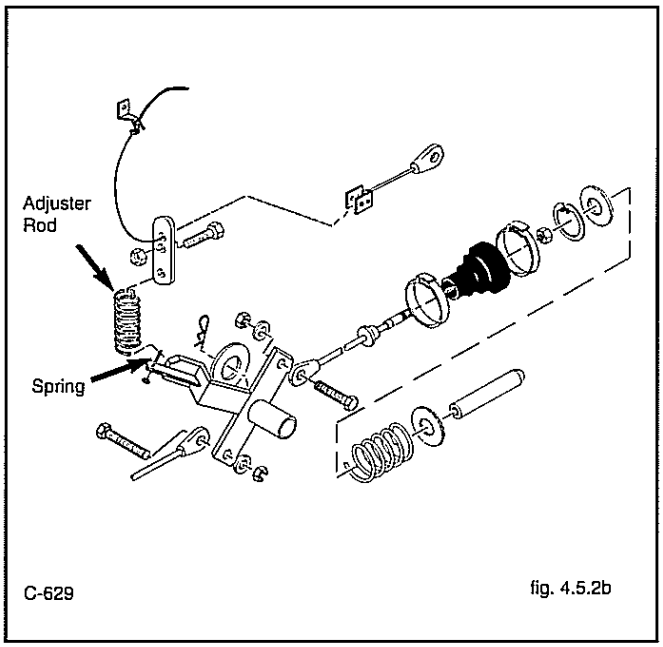
   Check that the pintle unlock activator is about 1/16" above the pintle lock bar.

   If not adjust the rod end on linkage rod to provide the gap.

4. Adjust the restraint cable so that it is tight. Ensure that the cable is well aligned (fig. 4.5.2c).



C-589 fig. 4.5.2a



C-629 fig. 4.5.2b

Mount the cable on the 1/4" x 1 1/4" UNC bolt. Cable is on the outside of the restraint bar and 15/16". The slot width is 11/32".

WARNING

To prevent personal injury do not work on a loader with the boom arms in a raised position unless the boom locks are engaged.

Ensure that the cable eyelet runs freely on the nylon bushing.

WARNING

To prevent personal injury do not service the loader with the engine running.

There should always be at least 1/4" of cable wire from conduit when cable is closest to bulkhead.

5. For tightness, with the restraint bar up, there should be no more than 1/8" dip in cable when about 5 - 8 lb. is applied at mid-length between eyelet and conduit of bottom end of cable.

6. Cycle the restraint bar 30 times and remove any slackness in the cable.

7. Check and ensure that the gap between the pintle unlock activator and pintle lock bar is maintained.

4 CONTROLS

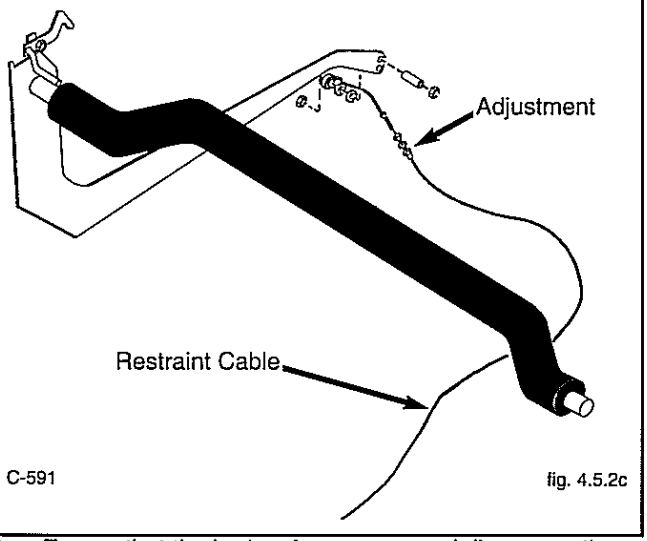


fig. 4.5.2c

8. Ensure that the brake pins engage and disengage the sprockets (fig. 4.5.2d).

9. Replace seat and plug in seat switch connections.

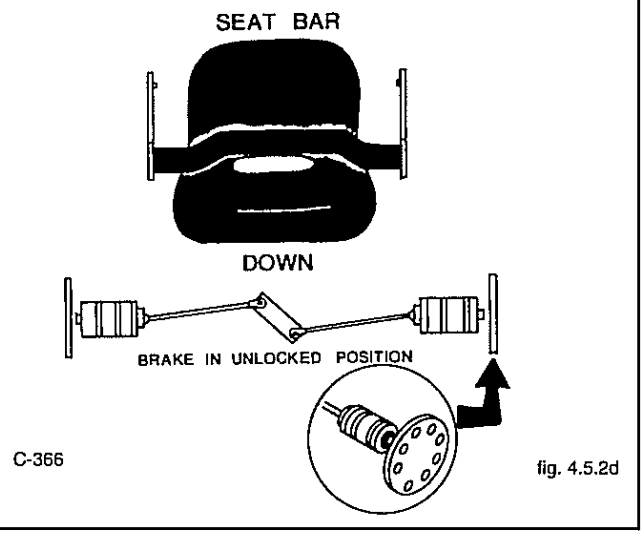


fig. 4.5.2d

WARNING

To prevent personal injury do not work on a loader with the boom arms in a raised position unless the boom locks are engaged

4.5.3 PARKING BRAKE REMOVAL

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

2. Remove the seat and 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 100-110ft. lbs. (136-149 N.M.)

5. Remove the bulkhead inspection cover (fig. 4.5.3a).

6. Disconnect the brake activating cable.

7. Remove the rubber protector boot, when reinstalling use adhesive or a plastic tie.

8. Remove the locking ring from the pin bushing.

9. Remove the washer and spring.

10. Remove brake pin.

4.5.4 PARKING BRAKE PIN AND CABLE INSTALLATION

1. Install the brake activating cable as per section 4.5.2. (fig. 4.5.4a).

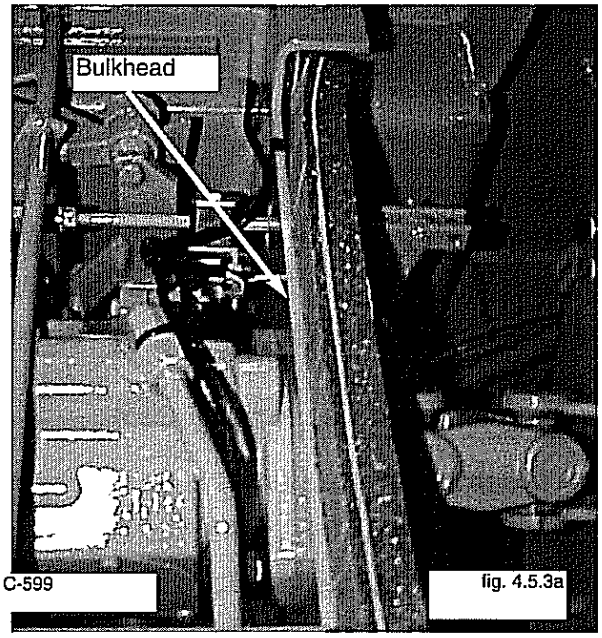


fig. 4.5.3a

2. Install the first washer.

3. Install brake pin and spring (fig. 4.5.4b).

4. Lubricate with no-seize or good grade of graphite grease.

5. Install the outer washer and lock ring.

6. Install and adjust cable as per instructions in section 4.5.2.

4 CONTROLS

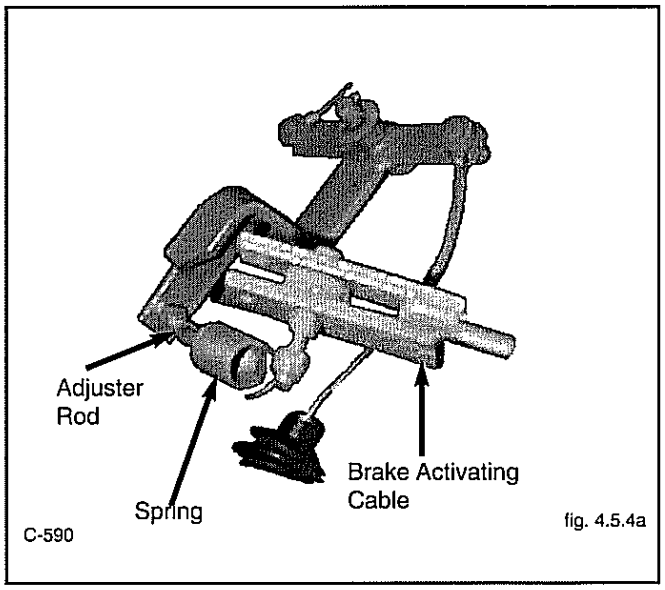


fig. 4.5.4a

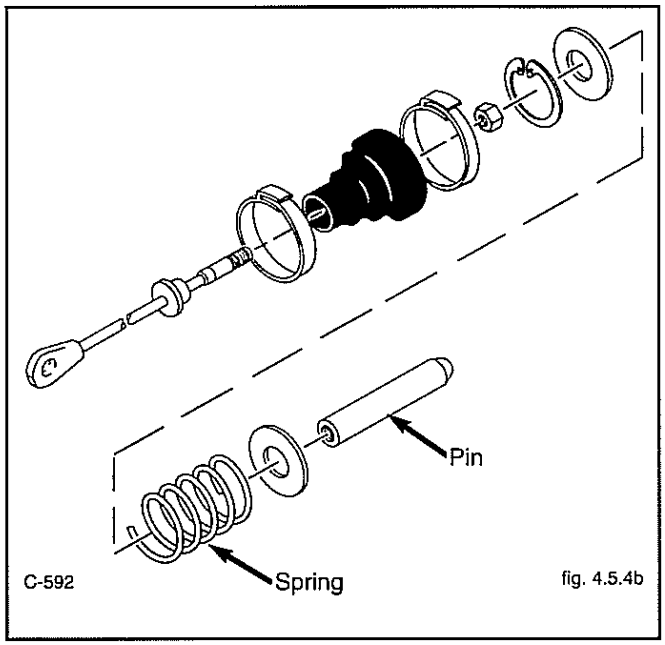


fig. 4.5.4b

7. Raise and lower the restraint bar approximately 10-15 cycles to set and pre-stretch the cable, readjust if necessary.

8. After adjustment has been completed you may at this time start the loader and determine, if the brake is locking properly.

9. Replace seat and shielding.

4.5.5 PIN ADJUSTMENT

1. Remove attachment.

2. Raise boom. Engage boom support pin and lower boom to contact support pins.

3. Jack up loader and remove tires.

4. Drain oil from both side transmissions.

5. Remove inspection covers.

6. Disconnect seat harness and remove seat.

7. Remove filler shield.

8. Lower restraint bar, wiggle each brake pin cable to ensure both pins are fully retracted.

9. Using a 3/16" (4.75mm) feeler guage check to make sure pins are retracted from the drive sprocket.

10. If both pins are located approx. 3/16" (4.75mm) from sprocket, brakes are properly adjusted.

11. If pins are equal but to close to sprocket, then adjust at adjuster rod:
    A. Raise restraint bar.
    B. Remove bolt from adjuster rod end.
    C. Unlock adjuster rod lock nut.
    D. To move pins away from sprocket, turn adjuster rod clockwise (one turn equals approx. 1/32", 0.79mm)
    E. Reassembly rod end.
    F. Return to step seven.

12. If pins are equal but too far from sprocket then adjust adjuster rod:
    A. Raise restraint bar.
    B. Remove bolt from adjuster rod end.
    C. Unlock adjuster rod lock nut.
    D. To move pins closer to sprocket turn adjuster rod clockwise (one turn equals approx. 1/32", 0.79mm)
    E. Re-assemble rod end.
    F. Return to step seven.

13. If pins have unequal clearance, establish which pin is closest to 1/16" (1.59mm) clearance and adjust other pin to match clearance.
    A. Raise restrainr bar.
    B. Disconnect pin to be adjusted from brake pull-off assembly by removing bolt from cable.
    C. Remove brake pin boot clamp and boot.
    D. Remove internal snap ring from pin bushing.
    E. Remove pin assembly (measure overall length).
    F. CAUTION: To adjust cable length at pin, heat may be required (Loctite used).
    G. By turning the cable end clockwise will shorten over all length, and counter clockwise will lengthen overall length.
    H. Reassemble and return to step #8 to varify pins have equal clearance. If adjustment is required at this point, return to step # 11.

14. Re-assemble and test.

4 CONTROLS

4.6 TROUBLE SHOOTING

4.6.1 CONTROL LEVERS

Problem	Cause	Corrective Action	Section
Steering levers will not center	Linkage out of adjustment	Adjust, check for wear at rod ends, loose counter nuts.	4.1.2
	Linkage disconnected	Reconect, check for wear at rod ends, loose counter nuts.	4.1.2
	Linkage binding	Control levers binding with safety shields or sound insulation. Adjust.	4.1.2
		Control lever bearings binding in lever assembly. Inspect, replace or clean as required.	
	Neutral detent out of adjustment	Adjust	4.1.3
Machine operates eratically	Steering lever linkage loose	Inspect linkage for wear at rod ends, loose counter nuts.	4.1.2
	Spiral pin in pintle lever worn or broken	Replace pin. Inspect pintle lever for wear at pin hole. Ensure bolt clamping lever to pump shaft is tight.	
		See also trouble shooting hydrostatic system.	2.4
Machine loses power while turning	Internal pump and/or motor leakage	See trouble shooting hydraulic system.	2.4
Machine will not travel in a straight line.	Linkage binding	Adjust	
	Control lever travel out of adjustment	Adjust	4.1.4
	Internal pump and /or motor leakage	See trouble shooting hydraulic system.	2.4

4.6.2 FOOT PEDALS

Problem	Cause	Corrective Action	Section
Foot pedals do not lock with ignition off	Lock plunger in valve binding or broken	Correct or replace	
Foot pedals do not return to neutral	Foot pedals or cable binding	Inspect or replace as required	
	Control valve spool centering spring not functioning correctly	Inspect and repair as required	1.3.5
Foot pedal action jerky	Wear or damage on foot pedal cable or	Inspect and repair as required	
	Control valve not operating correctly	Inspect and repair as required	1.8
Foot pedal not unlocking	See 5.4.3	Locking mechanism	5.4.3

4.6.3 SEAT BAR

Problem	Cause	Corrective Action	Section
Steering levers do not center with seat bar in the up position	Steering lever out of adjustment	Adjust	4.1.3 4.3.2 4.3.3

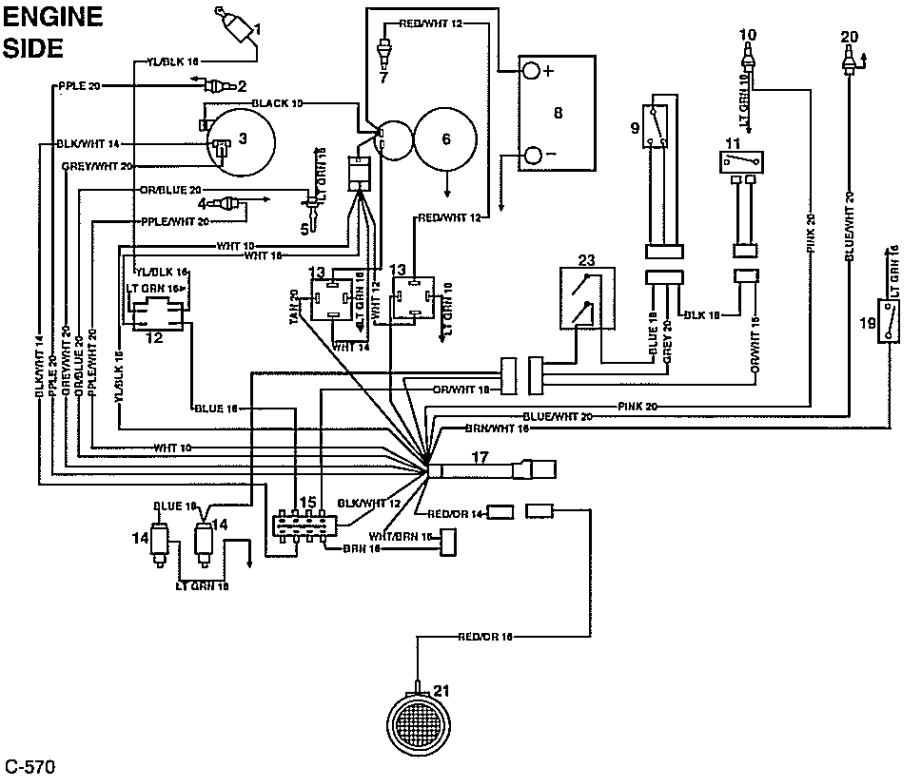
5 ELECTRICAL

NOTE: For complete engine electrical service and repair procedures refer to the Kubota workshop manual.

5 ELECTRICAL

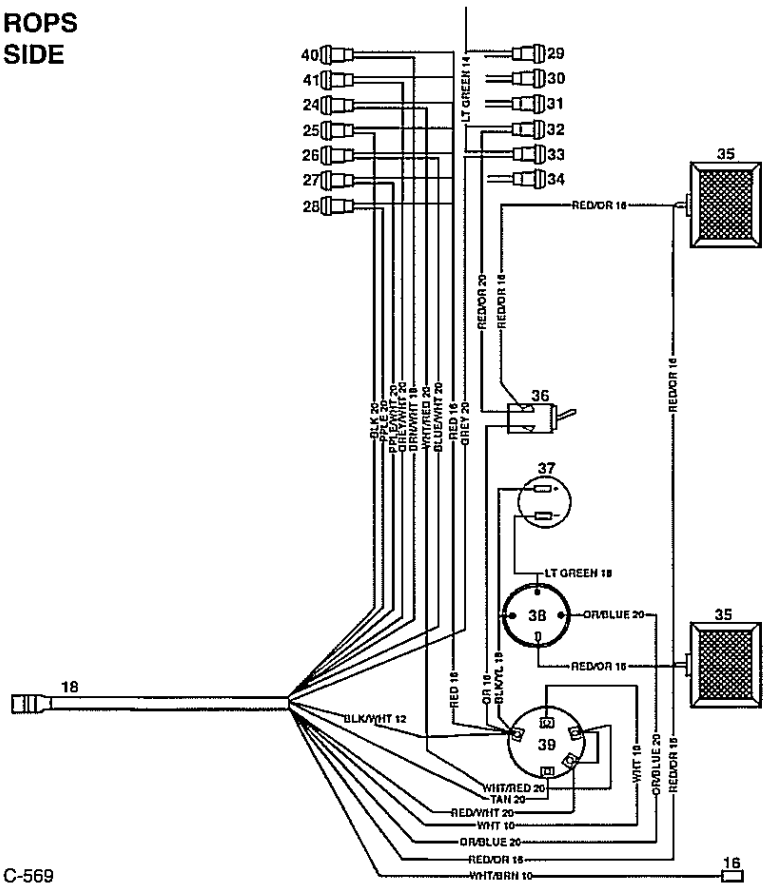
5.1 WIRING

ENGINE SIDE



C-570

ROPS SIDE



C-569

1. Solenoid Shut Off
2. Engine Oil Pressure Sender
3. Alternator
4. Water Temperature Sender
5. Fuel Level Sender
6. Starter Assembly
7. Glow Plugs
8. Battery, 12V
9. Seat Belt Switch w/Belt
10. Air Filter Indicator
11. Seat Switch
12. Stop Timer
13. Engine Relay
14. Control Valve Locks
15. Fuse Panel and Breaker
16. Horn Button
17. Engine Wire Harness
18. ROPS Wire Harness
19. Brake Switch
20. Hydraulic Oil Temperature Sender
21. Rear Work Light
22. Safety Switch/ Enhancement
23. Seat and Belt Wire Harness
24. Preheat Indicator Light
25. Air Filter Indicator Light
26. Hydraulic Oil Temperature Indicator Light
27. Water Temperature Indicator Light
28. Engine Oil Pressure Indicator Light
29. Hi-Flow Hydraulics Switch
30. Auxiliary Rear Switch
31. Auxiliary Front Switch
32. Light Indicator Light
33. Seat Belt Light
34. Low Hydraulic Oil Indicator Light
35. Head Lights
36. Light Switch
37. Hour Meter
38. Fuel Gauge
39. Ignition Switch
40. Brake Indicator Light
41. Battery Indicator Light

fig. 5.1

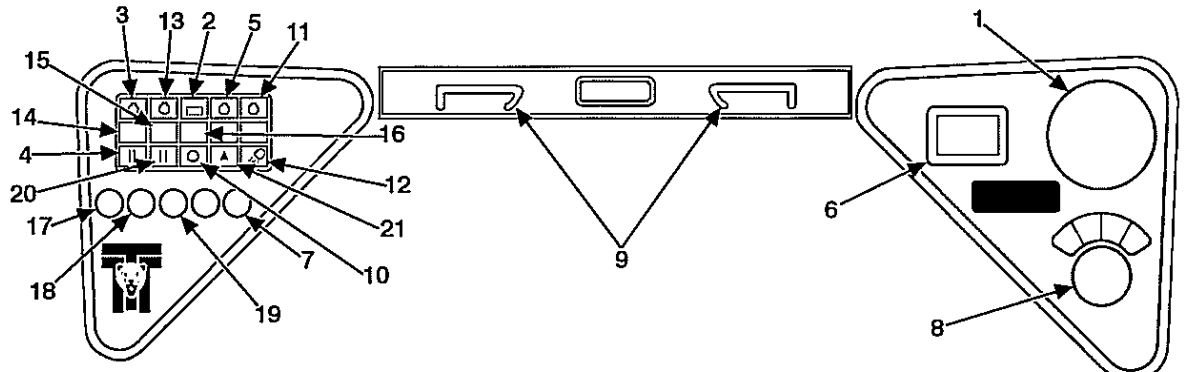
5 ELECTRICAL

5.1.2 SPECIFICATIONS

FANBELT		T 133'S'
Belt sag under load of 13.2 to 15.4 lb.(6 to 7 kgf)		0.2756 to 0.3543 in.(7 to 9mm)
ALTERNATOR		
Output current		45A/14V/2800RPM
Total resistance of rotor coil, measured between terminal "F" and "E"	Std.	6
	Max.	10
Brush length	Std.	15.5mm (0.6102in.)
	Min.	10.3mm (0.4055 in.)
REGULATOR INTERNAL		
Cut-in voltage		4.5 to 5.8 V
No-load regulating voltage		13.8 to 14.8 V
Resistance between terminals:		
"IG" and "F" with open contacts		0
"IG" and "F" with contacts		Approx. 11
"L" and "E" with open contacts		0
"L" and "E" with contacts		Approx. 100
"N" and "E"		Approx. 23
"B" and "E" with open contacts		Infinity
"B" and "L" with contacts		0
Point gap		0.0118 to 0.0177 in.(0.3 to 0.45mm)
STARTER MOTOR		
No-load test	Current	90 A or less
	Voltage	11.5 V
	Speed	3500 RPM or more
O.D. of commutator	Std.	1.1811 in. (30.0mm)
	Min.	1.1417 in. (29.0mm)
Mica undercutting	Std.	0.0197 to 0.0354 in. (0.5 to 0.9mm)
	Min.	0.0079 in. (0.2mm)
Brush Length	Std.	0.7480 in. (19mm)
	Min.	0.5000in. (12.7mm)
GLOW PLUG		
Resistance		Approx. 1.5
BATTERY		
Voltage		12 V
BCI group size		24
Amp. hr. capacity		140
0 d.F (-17.8 d. C) cranking amps		455
Ground polarity		Neg.

5 ELECTRICAL

5.2 INSTRUMENTATION



1. Fuel Gauge
2. Alternator Light
3. Engine Oil Pressure
4. Hydraulic Oil Temperature Light
5. Engine Pre-Heat Indicator
6. Hour Meter
7. Light Switch
8. Ignition Switch
9. Boom Supports
10. Brake Light
11. Air Filter
12. Lights
13. Engine Water Temperature
14. Auxiliary Hydraulics
15. Auxiliary Option Light
16. Hi-Flow Hydraulics
17. Auxiliary Front Switch
18. Auxiliary Option Switch
19. Hi-Flow Hydraulics
20. Low Hyd. Oil
21. Seat Belt

C-567

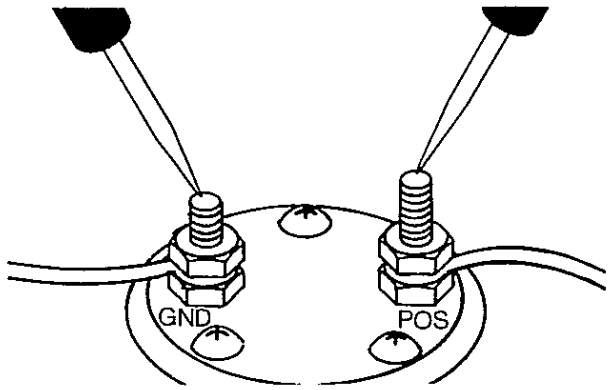
fig. 5.2

5.2.1 FUEL GAUGE

The fuel gauge indicates the quantity of fuel in the fuel tank. The fuel tank capacity is 16.8 gal. (64.1 l.). The diesel engine must not be allowed to run out of fuel otherwise air will have to be removed from the fuel (refer to section 7).

WARNING

To prevent personal injury never add fuel to the loader when the engine is running or is hot. NO SMOKING!



C-306

fig. 5.2.1a

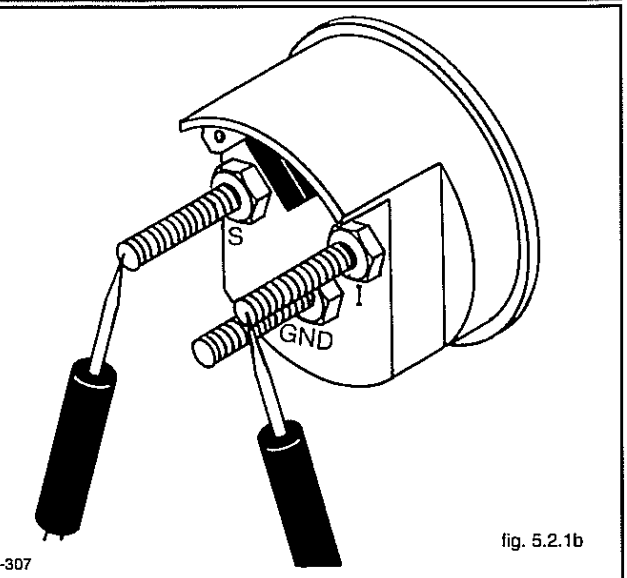
Testing

FUEL SENDER

1. With the key switch off, connect one ohmmeter lead to the ground terminal of the fuel sender (fig. 5.2.1a). Connect the other ohmmeter lead to the positive terminal of the fuel sender.
   TEST RESULTS
   50 - 500 ohm reading = Good fuel sender.
   High or low reading = Fuel sender faulty, replace.

FUEL GAUGE

2. Remove the right hand instrument panel. With the ignition off, connect one ohmmeter lead to the "I" terminal of the fuel gauge. Connect the other ohmmeter lead to the "S" terminal of the fuel sender (fig. 5.2.1b).
   TEST RESULTS
   150 - 250 ohm reading = Good fuel gauge.
   High or low reading = Fuel gauge faulty, replace.



C-307

fig. 5.2.1b

3. With the ignition off, connect one ohmmeter lead to the "S" terminal of the fuel gauge (fig. 5.2.1c). Connect the other ohmmeter lead to a clean ground on the frame.
   TEST RESULTS
   50-500 ohm reading= Wire to "S" terminal good
   High or low reading = Faulty wire to "S" terminal

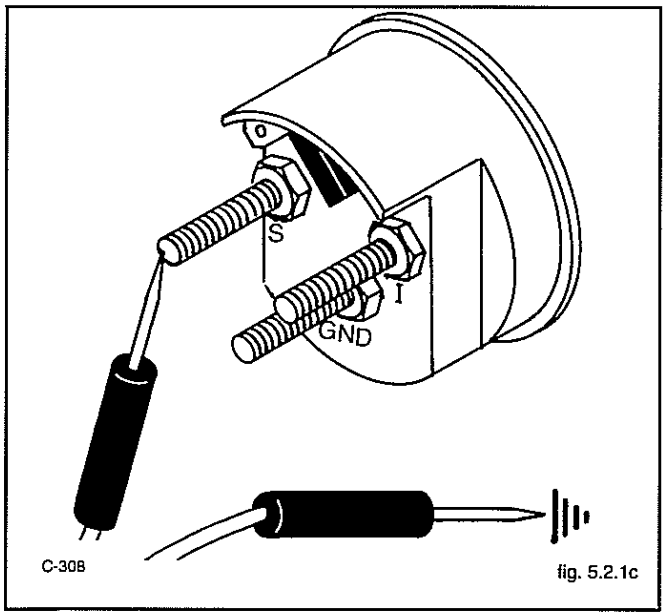


fig. 5.2.1c

5.2.2 ALTERNATOR LIGHT

The alternator warning light will come on if the alternator is not producing sufficient current. With the key switch in the on position the alternator light will go off. For complete operating description and testing of the charging system refer to engine repair manual.

5.2.3 ENGINE OIL PRESSURE

If the light comes on during operation or fails to go out after starting, shut off the engine immediately and determine cause.

1. With the engine off, disconnect the wire from the oil pressure sender switch. Turn the key switch to the on position.
   TEST RESULTS
   If the light remains on, check the coolant temperature sender. If the light goes out, check the engine oil level before checking for a malfunction of the sender switch or oil pump.

5.2.4 HYDRAULIC OIL TEMPERATURE LIGHT

The hydraulic oil temperature light measures the temperature of the hydraulic oill. If the light comes on during operation shut off the engine and determine cause of overheating. Check the hydraulic oil cooler for air flow restrictions. Refer to trouble shooting section.

5.2.5 GLOW PLUGS

The diesel engine is equipped with glow plugs to assist in starting. The glow plugs are activated by turning the ignition key counter clockwise as far as possible and held in this position approx. 8 seconds

TEST 1-GLOW PLUG CONNECTORS:
Before performing any tests on the glow plug circuit disconnect the negative or ground cable from the battery. With the key switch off, connect one ohmmeter lead to the first glow plug nut (fig. 5.2.5b). Connect the other ohmmeter lead to the second glow plug nut.

TEST RESULTS
Low or zero = Good continuity

High resistance = Bad connection, remove connector and clean. Continue and check between third and fourth glow plugs.

TEST 2 - GLOW PLUG:
With the ignition off, disconnect the connectors from the glow plugs. Connect one ohmmeter lead to the glow plug terminal. Connect the other ohmmeter lead to a clean ground. Check each glow plug.

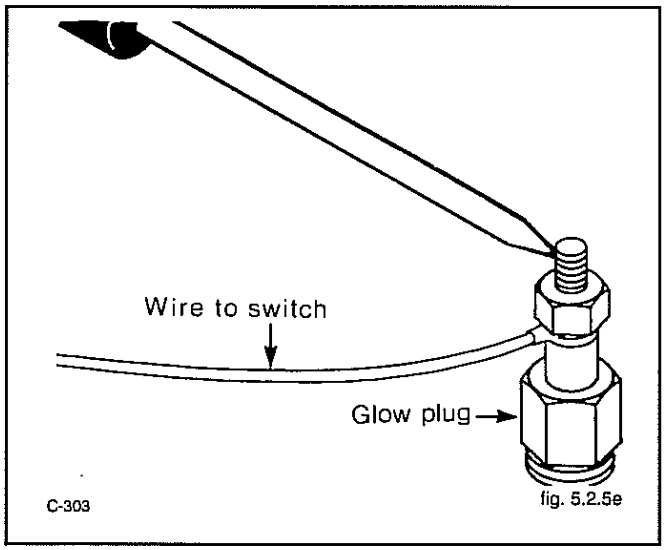


fig. 5.2.5e

TEST RESULTS

1.5 ohm reading = Good glow plug.
Infinite or zero reading = Faulty glow plug - replace.

TEST 3- KEY SWITCH TO GLOW PLUG:

Remove the bolts securing the R.H. instrument panel to the frame. With the key switch off, connect one ohmmeter lead to the key switch at terminal number 17 . Con-nect the other ohmmeter lead to the glow plug with the wire terminal .

TEST RESULTS

Low to zero reading = Good continuity.
High reading = Faulty wire from switch to glow plug - replace.

TEST 4 - KEY SWITCH - HEAT POSITION CHECK:

(1) Connect one ohmmeter lead to the terminal marked 19 on the key switch. Connect the other ohmmeter lead to the terminal marked 30 on the key switch. Rotate the key counterclockwise to the "heat" position.

TEST RESULTS

Low or zero reading = Good contact through switch.
High reading = Faulty switch, replace.

TEST 5- KEY SWITCH TO INDICATOR:

Connect one ohmmeter lead to the terminal marked 19 on the key switch .

Connect the other ohmmeter lead to terminal on the glow plug indicator.

TEST RESULTS

Low or zero reading = Good contiinuity
High reading = Faulty wire, replace.

(2) Connect one ohmmeter lead to the terminal marked 17 on the key switch .

Connect the other ohmmeter lead to terminal on the glow plug indicator.

TEST REULTS

Low or zero reading = Good continuity.
High reading = Faulty wire, replace.

5.2.6 HOUR METER

The hour meter records the number of engine operating hours and has a total read out of 9999.9 hours.

5.2.7 LIGHT SWITCH

The light switch is an on-off toggle switch. Pushing the switch up will turn on the headlights and rear work lights. Pushing the switch down will shut the lights off..

5.2.8 IGNITION SWITCH

The ignition switch is a four position switch, off, pre-heat, run, and start. Turning the key counter clockwise will engage the engine pre-heat. To engage the starter turn the key clockwise. When the key is released it will return to run position.

TESTING

Before performing any tests on the key switch, disconnect the negative or ground wire from the battery.
Remove the bolts which secure the instrument panel to the ROPS.

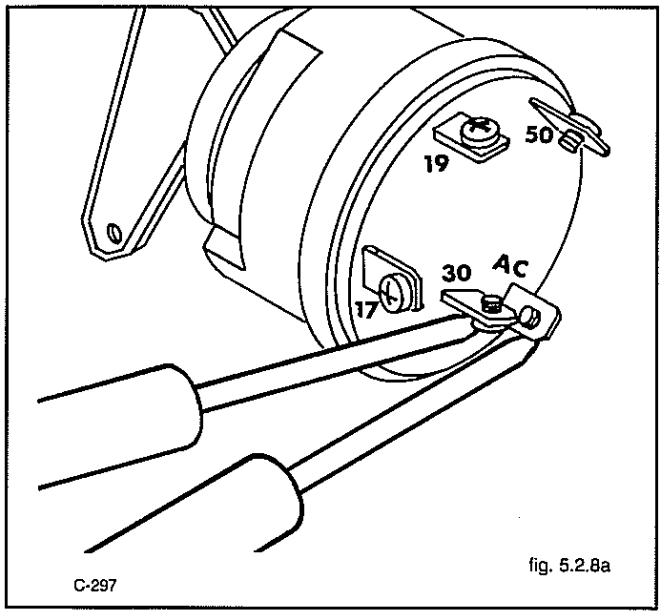
TEST 1 - "ON" POSITION:

Connect the ohmmeter leads across the key switch terminals marked 30 and AC (fig. 5.2.8a). Turn the switch to the "on" position.

TEST RESULTS

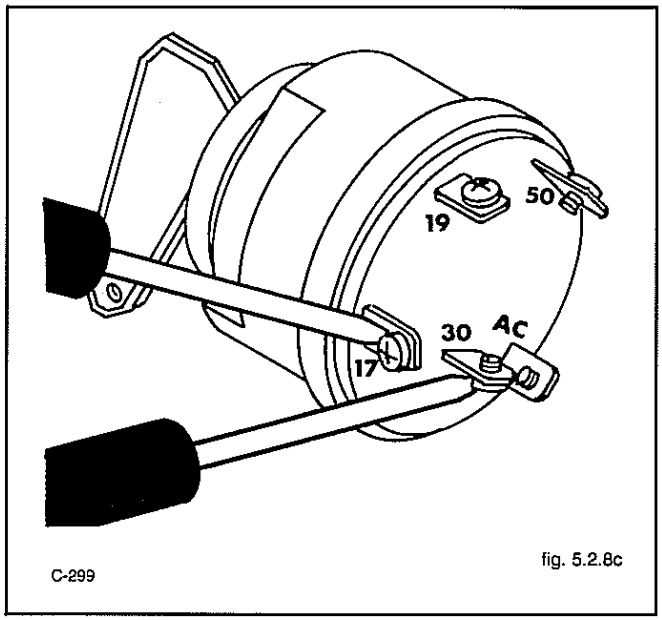
Low resistance reading = Good.
High resistance reading = Faulty switch, replace.

5 ELECTRICAL



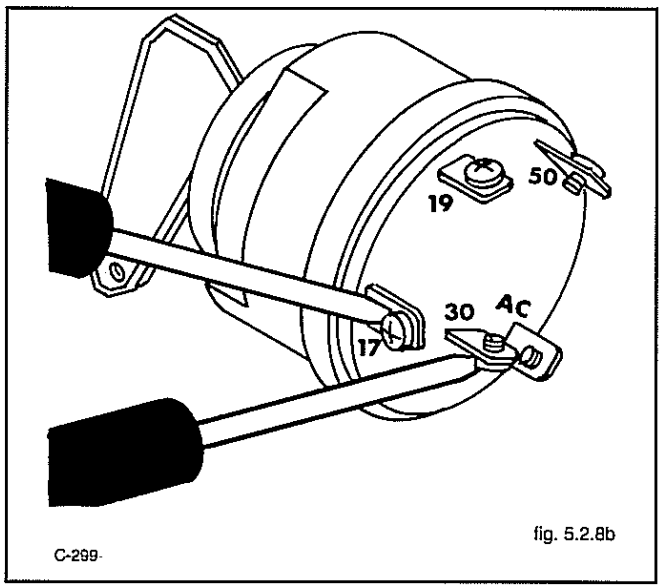
C-297

fig. 5.2.8a



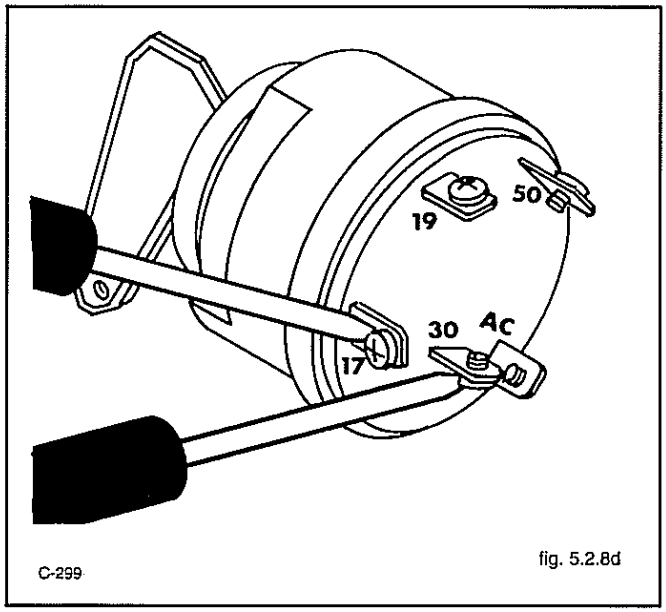
C-299

fig. 5.2.8c



C-299

fig. 5.2.8b



C-299

fig. 5.2.8d

TEST 2- "START" POSITION:

Connect the ohmmeter leads between the terminals marked 30 and 50 on the key switch (fig. 5.2.8b).
Connect the ohmmeter leads between the terminals marked30 and 17 on the key switch (fig. 5.2.8c).
Turn the switch to the "start" position and observe the ohmmeter reading.

TEST RESULTS

Low resistance reading = Good switch.
High resistance reading = Faulty switch, replace.

TEST 3- "HEAT POSITION":

Connect the ohmmeter leads between the terminals marked 30 and 19 on the key switch (fig. 5.2.8d).
Turn the switch to the "heat" position and observe the ohmmeter reading.

TEST RESULT

Low resistance reading = Good.
High resistance reading = Faulty switch, replace.

5.2.9 BOOM SUPPORTS

For safety while performing regular service or maintenance work the loader is equipped with boom support pins. For details of operation refer to operation section.

5.2.10 BRAKE LIGHT

The brake light will come on if the parking brake is engaged.

5.2.11 AIR FILTER

The air filter light when illuminated indicates there is an obstruction in the intake or that the air filter needs servicing. When the light is illuminated, stop the engine and service.

5.2.12 LIGHTS

When the light is illuminated, it indicates your headlights are on and will serve as a reminder to turn them off when loader is not in use.

5.2.13 ENGINE WATER TEMPERATURE

The coolant temp. light will come on if there is a rise in engine temperature. If this occurs, shut off the engine immediately and determine the cause.

5 ELECTRICAL

5.3 BATTERY

SAFETY PRECAUTIONS:

WARNING

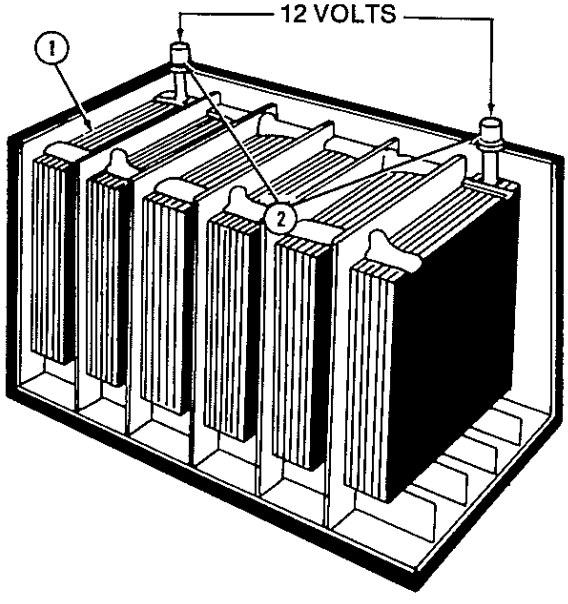
Lead acid batteries contain sulfuric acid which will damage the eyes or skin on contact. Always wear goggles to avoid acid in the eyes. If acis contacts the eyes, wash immediately with clean water and seek medilcal attention. Wear rubber gloves and protective clothing to keep acid off the skin. If acid contacts the skin, wash off immediately with clean water.

1. When mixing battery electrolyte, it is important to pour the concentrated acid into the water and not the water into the acid.
2. When working with acid, such as filling batteries, splash-proof goggles should be worn. (Additional protective clothing may be advisable if many batteries are handled).
3. When adding water or electrolyte, non-metallic containers and/or funnels must be used.
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 600CCA 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 an 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. 5.3.1b, 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.



Battery Construction

1. Battery Cells
2. Terminal Posts

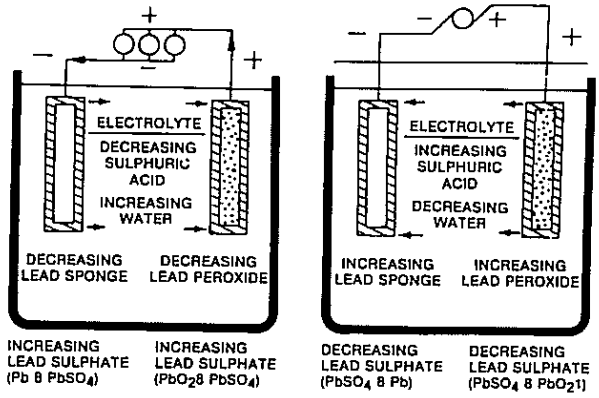
fig. 5.3.1a

C-202

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 Chemical Action

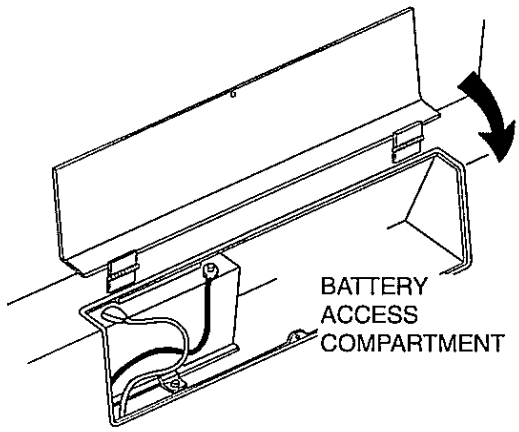
C-203 fig. 5.3.1b

5.3.2 BATTERY REMOVAL AND INSPECTION

The battery is located in the ROPS behind the operator's seat. Remove the battery as follows:

1. Fold the seat back down and remove the two wing nuts which secure the battery compartment cover (Fig. 5.3.2a). Open the cover.

2. Loosen the cable clamps on the positive and negative battery terminals.



C-554 fig. 5.3.2a

3. Use a puller to remove the negative (ground) cable from the battery. Then remove the positive cable (Fig. 5.3.2b).

4. Note the location of the positive and negative terminals so the battery can be properly positioned during installation.

5. Remove the holddowns and battery.

6. Inspect the cables for corrosion and damage. Remove corrosion using a wire brush and soda solution. Replace the cables having damaged or deformed terminals.

7. Inspect the battery holddowns for corrosion. Remove corrosion with a wire brush and soda solution. Paint the exposed bare metal. Replace any damaged components.

8. Clean the outside of battery case if the original battery is to be installed. Flush the top cover with soda solution to remove acid film. Be careful to prevent soda solution from entering the cells. Remove corrosion from the terminals with a wire brush. Inspect the case for cracks or other damage which would result in a leakage of electrolyte.

WARNING

To prevent personal injury do not charge a frozen battery because it can explode and cause personal injury. Let the battery warm to 60° F. (15.5°C.) before putting on a charge.

5.3.3 JUMP STARTING

Inspect the battery on a regular basis for damage such as a cracked or broken case or cover which would allow electrolyte loss.

Check the battery cables for tightness and that they are corrosion free. Remove any acid corrosion from the battery and cables with a baking soda and water solution. Coat the terminal connections with di-electric grease.

If it is necessary to use a booster battery to start the engine, BE CAREFUL!

The ignition must be in the off position. The booster battery to be used must be 12V. Connect the end of the first cable to the loader battery positive (+) terminal, or to the optional boosting lug. Connect the end of the second cable to the negative (-) terminal of the boosting battery. Connect the other end of the negative cable to the engine. Keep cables away from moving parts. Start the engine.

After the engine has started, remove the ground cable (-) first, then remove the cable from the boosting lug.

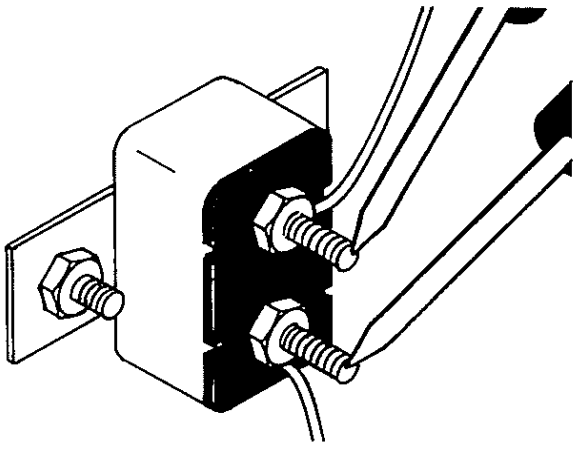
5.3.4 CIRCUIT BREAKER

For circuit protection a 40 amp. circuit breaker is located on the starting circuit (fig. 5.3.4a).

The circuit breaker if tripped will automatically reset.

TESTING: CIRCUIT BREAKER

1. With the ignition off connect one ohmmeter lead to one of the terminals on the circuit breaker (fig. 5.3.4a).



C-292 fig. 5.3.4a

2. Connect the other ohmmeter lead to the other breaker terminal.

TEST RESULTS

Low resistance reading = Good.
High resistance reading = Defective circuit breaker, replace.

5.3.5 ELECTRICAL PANEL

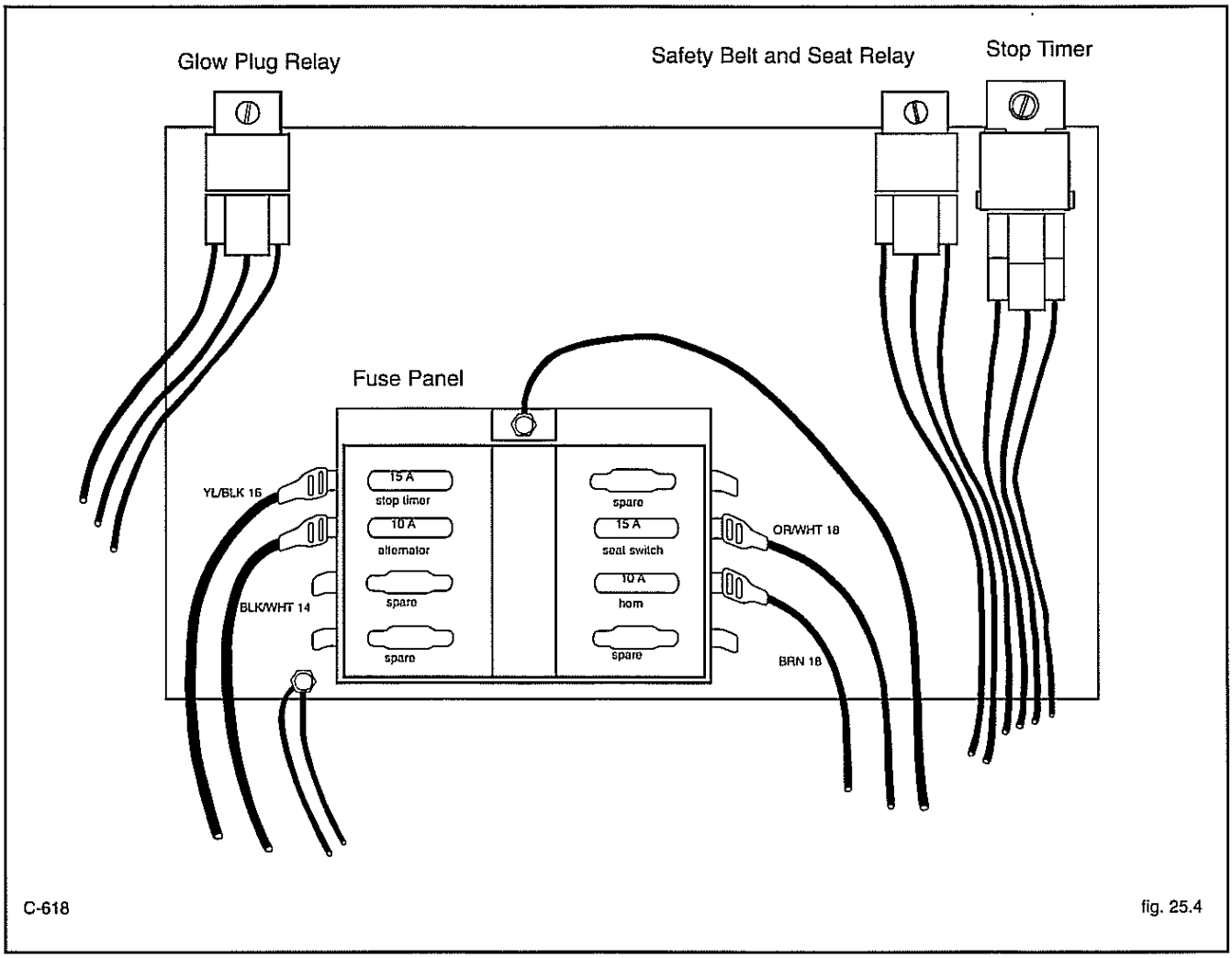
The loader is equipped with a 12 volt, negative ground electrical system.The fuse and relay panel are located in the engine compart- ment just in front of the battery box. The panel consists of the following:

1. Glow Plug Relay
2. Safety Belt And Seat Relay
3. Engine Fuel Stop Timer
4. Fuse Panel

The safety system consists of integrated, seat and lap belt switches as well as park brake and valve lock switches and solenoids.

The loader will start with the bar in the up position with no operator and the lap belt not fastened, however this is for service procedures only. The foot pedals and control levers will remain in the locked position. When the operator is in the seat with the lap belt fastened and the restraint bar down. All functions should be operational at this time.

If one of these functions fail to operate see section 5.4.3.



C-618

fig. 25.4

5 ELECTRICAL

5.4 TROUBLE SHOOTING

5.4.1 STARTING SYSTEM

Problem	Cause	Corrective Action	Section
Starter will not charge	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	
	Defective starter	Check and if necessary replace	
Starter motor engages, but engine does not turn over	Defective overrunning clutch	Replace	4.1.2
Pinion engages but starter motor does not turn over	Defective starter	Check and if necessary repair or replace	
	Defective solenoid	Check and if necessary replace	
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	

5.4.2 CHARGING SYSTEM

Problem	Cause	Corrective Action	Section
Battery low in charge or discharge	Drive belt slipping	Adjust	
	Defective battery	Check and if necessary replace	5.3

5 ELECTRICAL

5.4.2 CHARGING SYSTEM

Problem	Cause	Corrective Action	Section
Battery low in charge or discharge	Faulity wiring or connections	Check and repair	
	Defective regulator	Check and if necessary replace	
	Dirty alternator slip rings or brushes	Check and repair	
Alternator overcharging and battery overheats	Defective Battery	Check and if necessary replace	5.3
	Defective voltage regulator	Check and if necessary replace	
	Defective alternator	Check and if necessary replace	
Low or no output from alternator	Drive belt slipping	Adjust	7.3.5
	Faulty wiring or connections	Check and if necessary repair or replace	5.2.2
	Defective voltage regulator	Check and if necessary replace	5.2.2
	Defective alternator	Check and if necessary repair or replace.	
	Defective rectifier	Check and if necessary replace	
Charge indicator lamp dims	Faulty wiring or connections	Check and repair	
	Dirty slip rings or brushes	Check and repair	
Charge indicator goes out but becomes brighter with increased speed	Faulty wiring or connections	Check and repair	
	Faulty rectifier	Check and if necessary repair	
Charge indicator lamp is "On" with the engine running	Drive belt slipping	Adjust	7.3.5
		Perform alternator voltage output test	
		Perform alternator current output test	

5.4.2 CHARGING SYSTEM

Problem	Cause	Corrective Action	Section
Charge indicator lamp is "On" with the engine running	Defective alternator or regulator	Perform alternator "N" circuit voltage test	
		Perform regulator "N" circuit continuity test	
		Perform alternator "E" circuit continuity test	
		Perform alternator "F" circuit continuity test	
		Perform regulator "F" circuit continuity test	
		Perform alternator "A" circuit continuity test	
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 ELECTRICAL

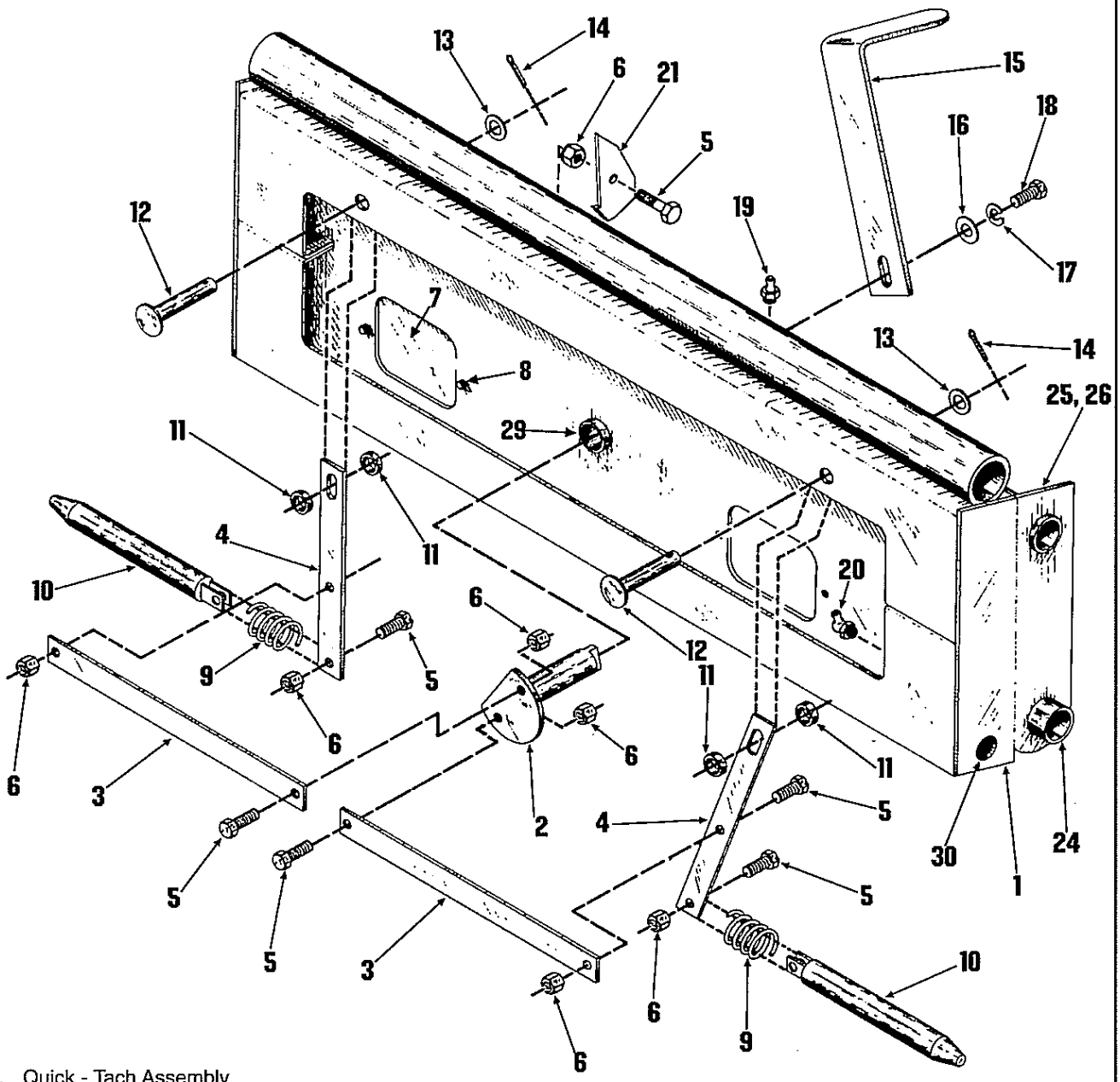
5.4.3 LOCKING MECHANISM

Problem	Cause	Corrective Action	Section
Park brake on with restraint bar down	Park brake light switch out of adjustment or defective	Remove seat and seat plate	
		Check switch located under the side panel on left side of machine. Adjust or replace if necessary	
Foot pedal locks will not release	Safety switch out of adjustment or defective. Defective relay. Defective solenoid. Short in wire harness	Remove seat and seat plate	
		Check the safety switch located on the pintle lock rod at the bulkhead, when the restraint bar is completely down. The switch should be fully depressed against the bulkhead. If not, adjust..	
		Check continuity of safety relay located in the electrical panel.	
		Check wire connections at the solenoid lock on the control valve.	

6 MAIN FRAME

6 MAIN FRAME

6.1 QUICK-TACH ASSEMBLY



1. Quick - Tach Assembly
2. Cam Pin Assembly
3. Lock Pin Linkage
4. Stabilizer Bar
5. Bolt, 5/16" UNC x 1" L..
6. Nut, 5/16" UNC Nylok
7. Hole Covers
8. Bolt, 1/4" UNC x 1/2" L.
9. Compression Spring
10. Quick-Tach Lock Pin
11. Stabilizer Bar Bushing
12. Support Pin Assembly
13. Plainwasher 1/2" Dia.
14. Split Pin 1/8" x 1" L.
15. Quick-Tach Handle
16. Plainwasher 7/16" Dia.
17. Springwasher 3/8" Dia.
18. Bolt 3/8" UNC x 3/4" L.
19. Grease Fitting 1/8" NPT
20. Grease Fitting 1/8" NPT x 45 d.
21. Quick-Tach Handle Stop
24. Hinge Bushing
25. Long Tilt Bushing
26. Short Tilt Bushing
29. Handle Bushing
30. Bushing

C-035

fig. 61.

6 MAIN FRAME

6.1.1 QUICK-TACH OPERATION

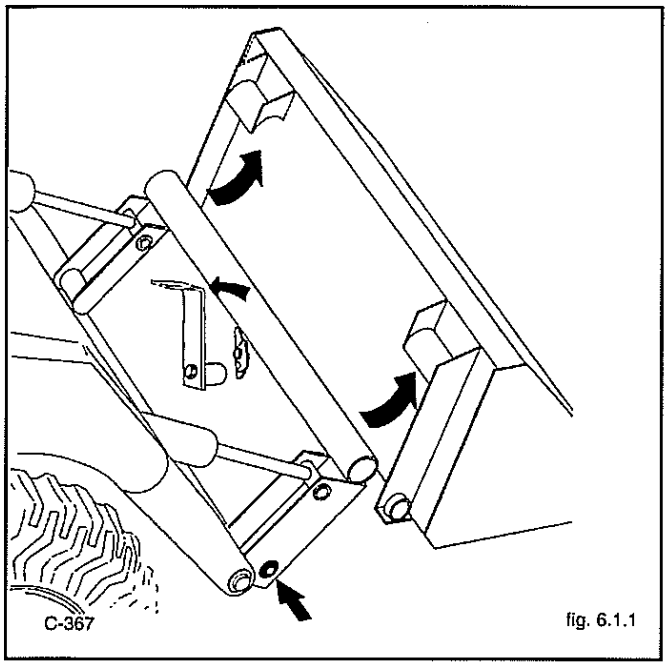


fig. 6.1.1

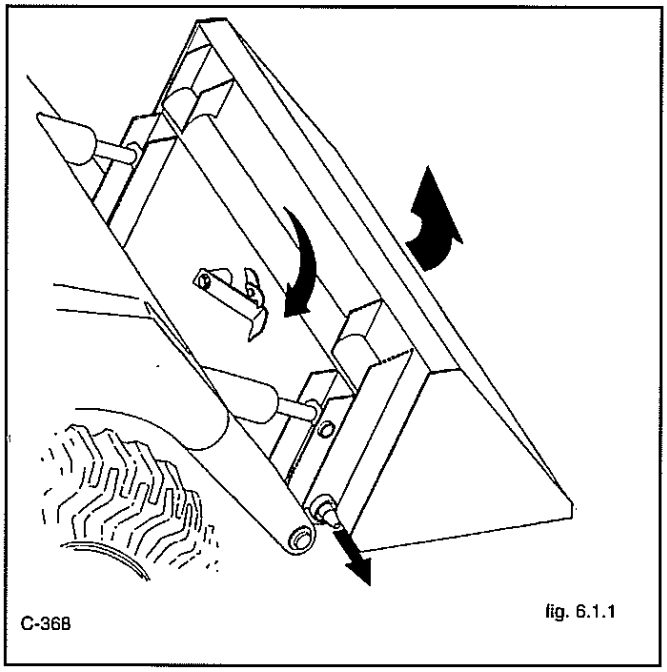


fig. 6.1.1

The quick-tach which is standard equipment allows changing from one attachment to another quickly without having to remove bolts or pins.

To operate, disengage the safety lock and lift the locking lever (Fig. 6.1.1) up to completely retract the lock pins. Tilt the quick-tach frame forward with the bucket tilt cylinders and drive into the attachment. Retract the bucket tilt cylinders which will line up the bottom of the attachment with the quick-tach lock pins. Push the locking lever down, extending the lock pins and engage the safety lock. Before operating ensure that the lock pins and safety lock are fully engaged.

To keep the quick-tach locking pins and linkage working freely and to prevent pin and bushing wear the quick-tach must be lubricated every 8 operating hours. More often in dirty applications.

Lubricate the quick-tach as follows:

1. Remove the attachment from the loader quick-tach.
2. Clean any dirt build up around the linkage assembly inside the quick-tach.
3. Lubricate the grease fittings on each of the lock pin bushings with a good quality multi-purpose lithium based grease until excess shows (Fig. 6.1.2a).
4. Lubricate the grease fitting on the quick-tach lock handle bushing (Fig. 6.1.2b).

6.1.2 QUICK-TACH PREVENTATIVE MAINTENANCE

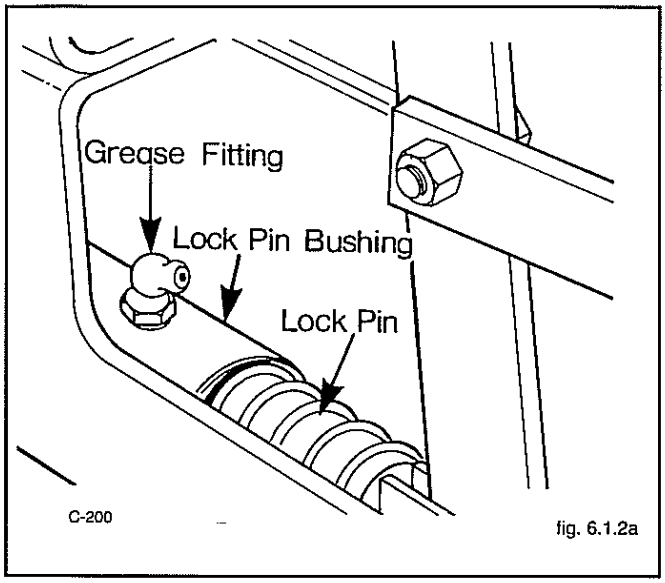


fig. 6.1.2a

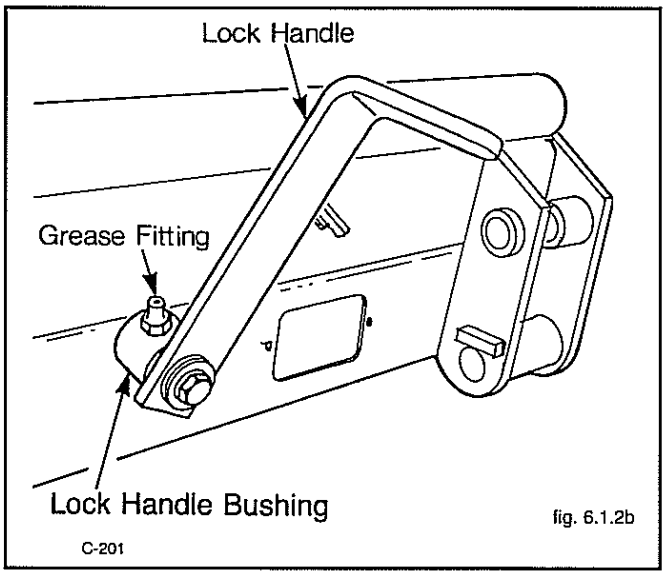


fig. 6.1.2b

6.1.3 QUICK-TACH - REMOVAL

1. Start the engine. Raise the lift arms. Place blocking under the rear of the quick-tach frame, lower the lift arms until the rear of the quick-tach frame is supported by the blocking (Fig. 6.1.3a).

2. Tilt the quick-tach forward until the front of the frame rests on the ground (Fig. 6.1.3a).

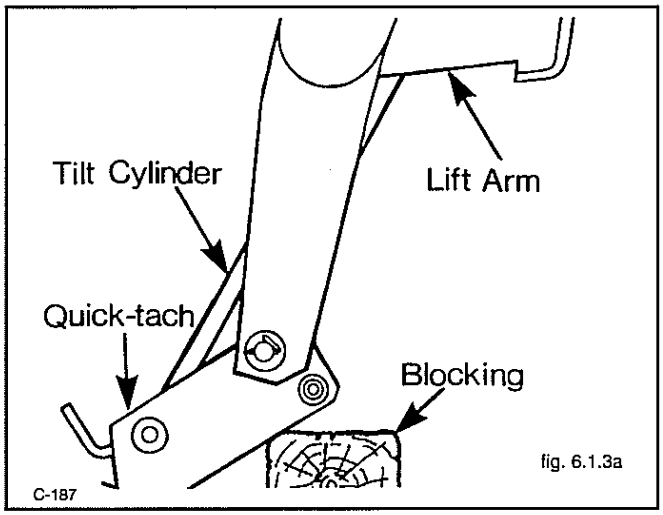


fig. 6.1.3a

WARNING

To avoid personal injury stop the engine, engage the parking brake, and cycle the foot pedals to ensure they are locked before getting out of the loader.

3. Shut off the engine and engage the parking brake. Cycle the foot pedals to relieve any hydraulic pressure in the system.

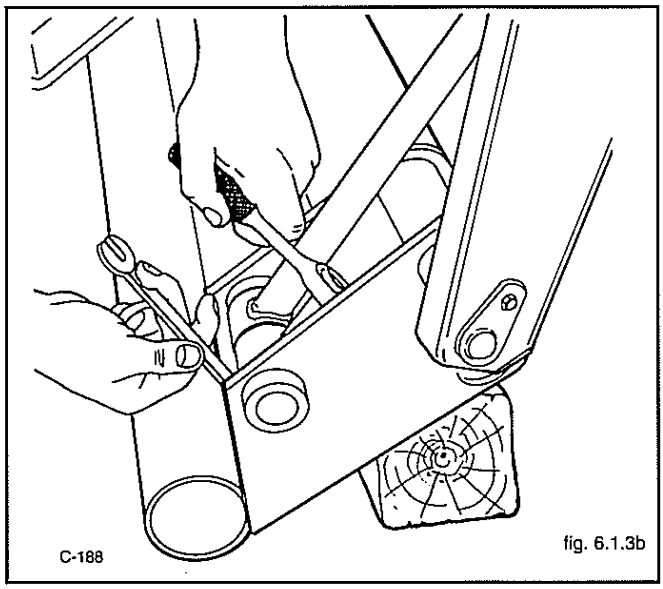


fig. 6.1.3b

WARNING

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

4. Remove the locknut and lockbolt from the tilt cylinder rod end pins (Fig. 6.1.3b).

5. Using a hammer and punch (Fig. 6.1.3c), remove the tilt cylinder rod end pivot pins.

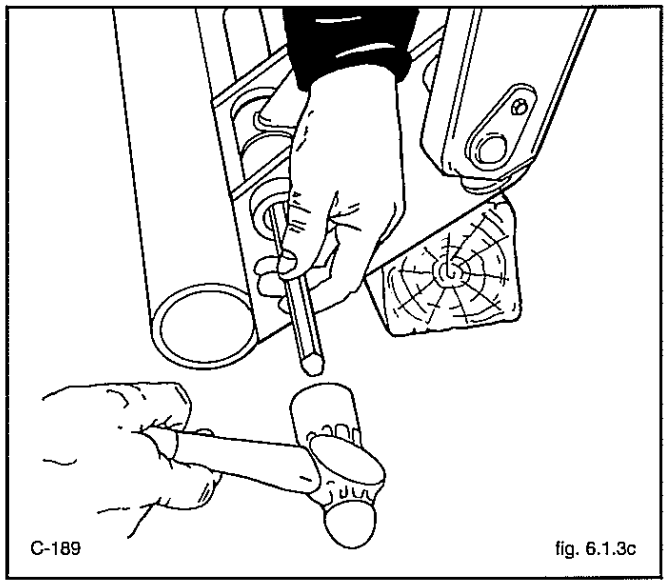


fig. 6.1.3c

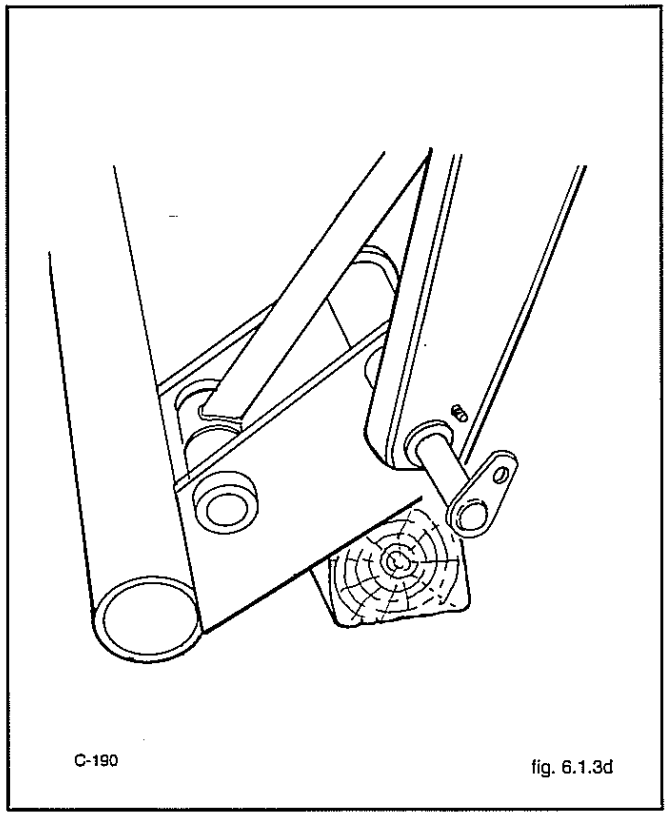


fig. 6.1.3d

6 MAIN FRAME

6. Remove the lynch pin and washer from the boom hinge pin (Fig. 6.1.3d).

7. Using a hammer and punch remove the boom hinge pin (Fig. 6.1.3d).

8. Remove the quick-tach from the lift arm assembly.

6.1.4 QUICK-TACH DISASSEMBLY

1. Remove the nuts which secure the two lock pin linkages (Fig. 6.1.4a) to the cam pin.

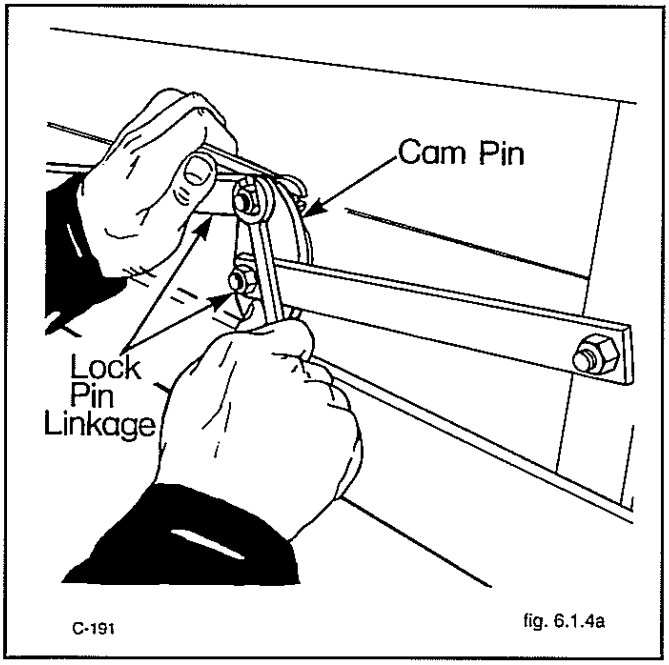


fig. 6.1.4a

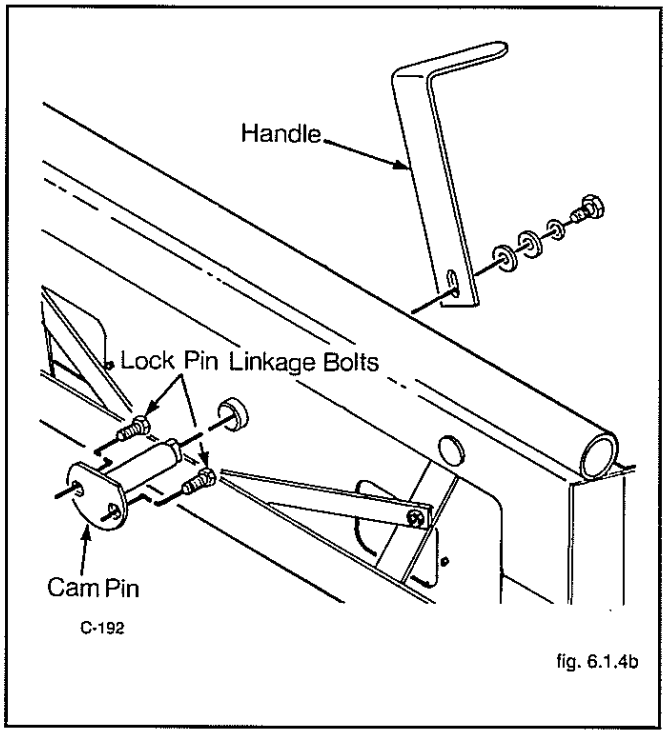


fig. 6.1.4b

2. Remove the bolt, lockwasher and plain washers which secure the handle (Fig. 6.1.4b) to the cam pin. Remove the handle.

3. Remove the cam pin (Fig. 6.1.4b) and the two lock pin linkage bolts from the quick-tach.

4. Remove the split pin and washer (Fig. 6.1.4c) which secure the stabilizer bar support pin.

5. Remove the stabilizer bar support pin and two bushings (Fig. 6.1.4c) from the quick-tach.

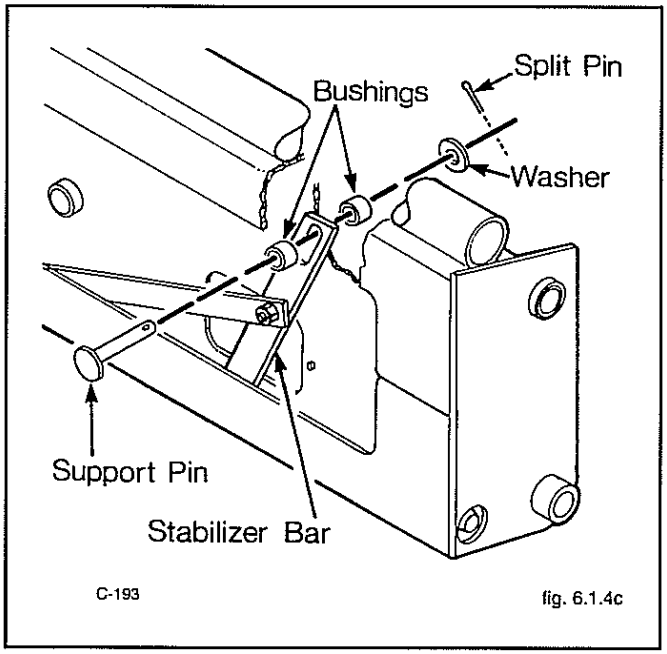


fig. 6.1.4c

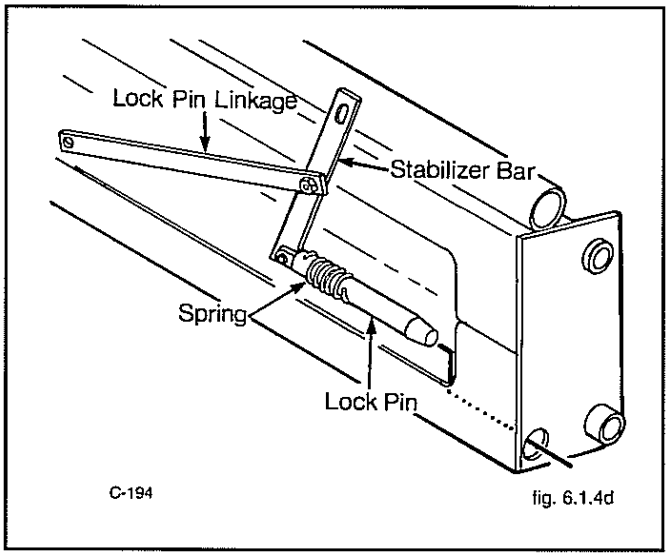


fig. 6.1.4d

6. Remove the lock pin, spring and linkage assembly (Fig. 6.1.4D) from the quick-tach.

7. Disassemble the stabilizer bar and lock pin linkage from the lock pin (Fig. 6.1.4D).

6 MAIN FRAME

6.1.5 QUICK-TACH - ASSEMBLY

1. Install the stabilizer bar on the lock pin (Fig. 6.1.5a).

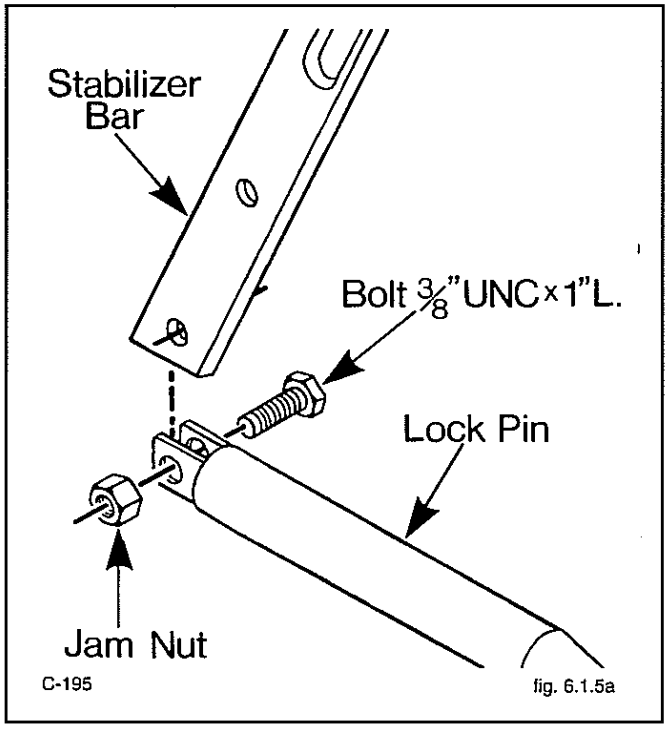


fig. 6.1.5a

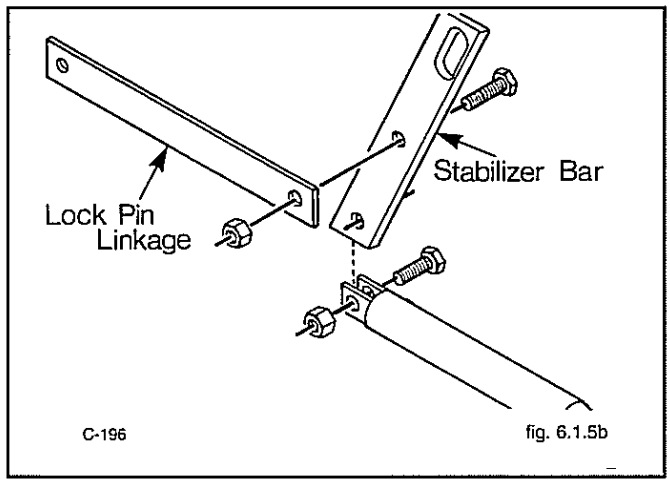


fig. 6.1.5b

2. Attach the lock pin linkage to the stabilizer bar (Fig. 6.1.5b). Use new nylok nuts during assembly. Do not overtighten. The linkage must pivot freely.

3. Place the spring on the lock pin and install the lock pin and linkage assembly in the quick-tach frame (Fig. 6.1.5c).

4. Install a bushing on both sides of the stabilizer bar and install the support pin (Fig. 6.1.5d). Secure the support pin with the washer and split pin.

5. Insert the two lock pin linkage bolts through the back side of the cam pin (Fig. 6.1.5e). Install the cam pin in the quick-tach housing.

6. Mount the handle on the cam pin (Fig. 6.1.5e) and secure in place with the two washers, lockwasher and bolt.

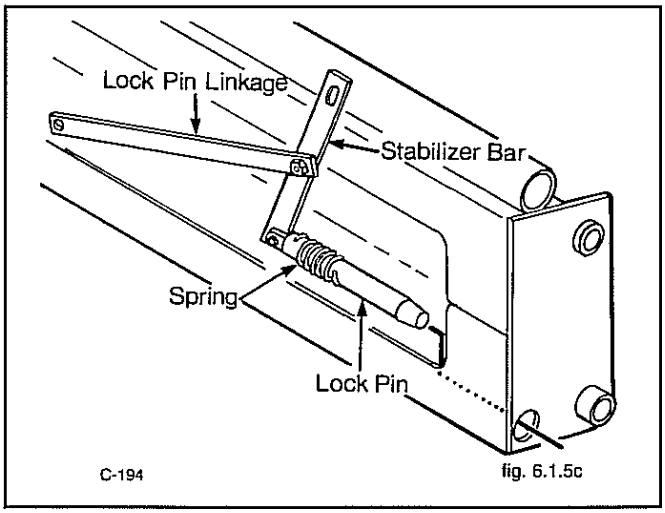


fig. 6.1.5c

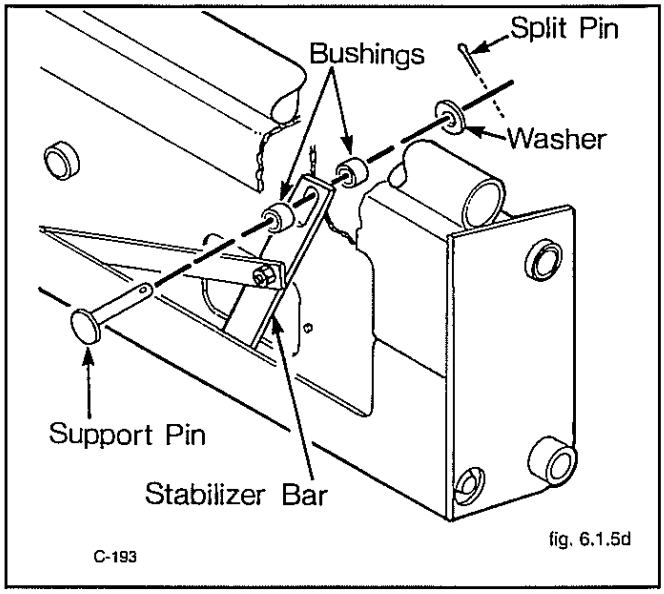


fig. 6.1.5d

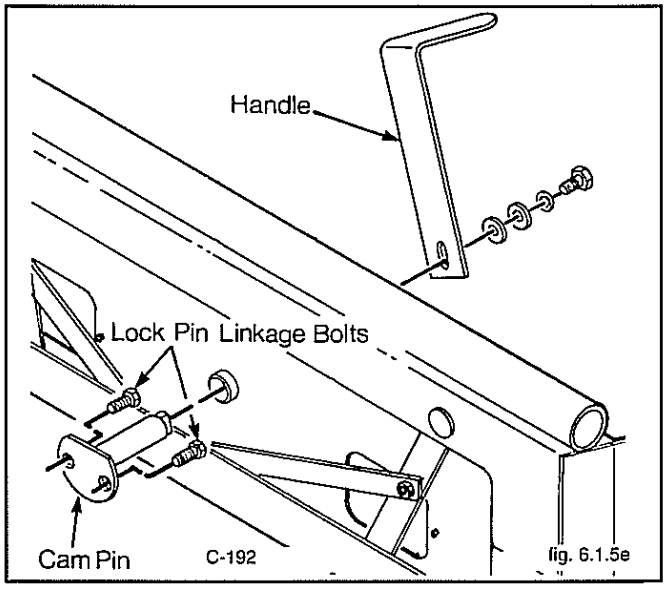


fig. 6.1.5e

6 MAIN FRAME

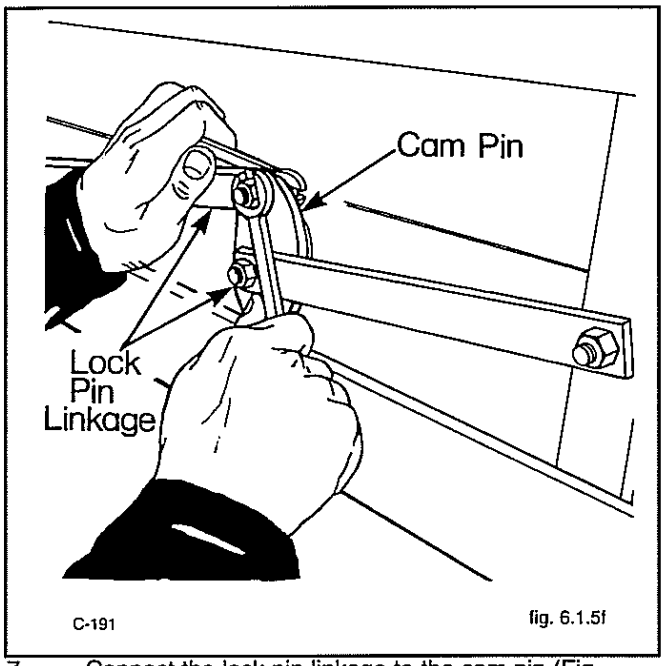


fig. 6.1.5f

7. Connect the lock pin linkage to the cam pin (Fig. 6.1.5f). Use new nylok nuts during assembly. Do not over tighten, the linkage must pivot freely.

6.1.6 QUICK-TACH - INSTALLATION

1. Put a floor jack under the quick-tach. Position the quick-tach between the lift arms.

2. Raise the quick-tach with the floor jack and line up the boom hinge bushing with the rear quick-tach bushings.

3. Lubricate and install the boom hinge pins (Fig. 6.1.6a).

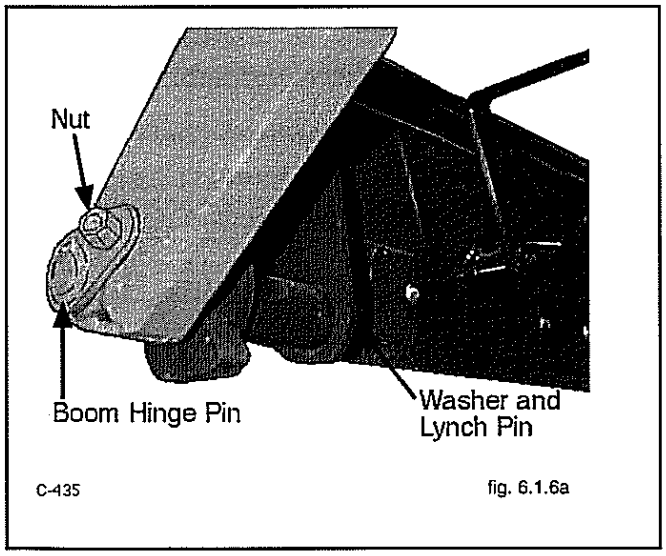


fig. 6.1.6a

4. Install the washer and lynch pins in the boom hinge pin (Fig. 6.1.6a).

WARNING

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

5. Extend the tilt cylinders until the cylinder rod end bushings line up with the quick-tach bushings.

6. Install the tilt cylinder rod end pivot pins (Fig. 6.1.6b).

7. Install the pivot pin lock bolts and lock nuts (Fig. 6.1.6c).

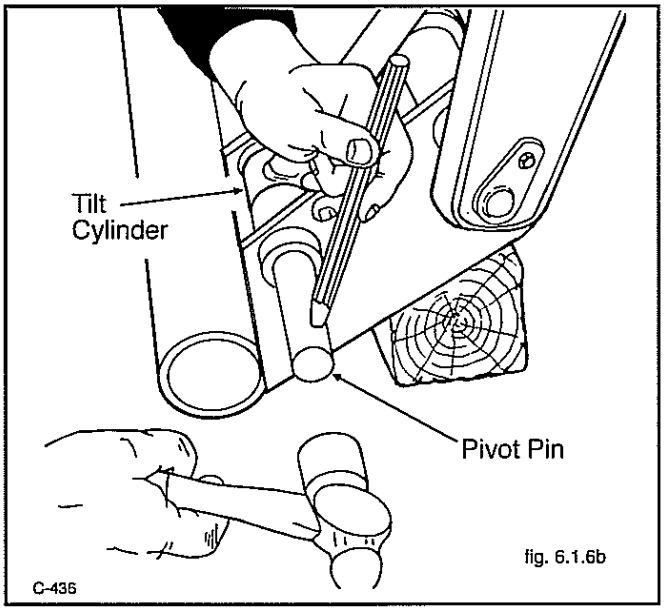


fig. 6.1.6b

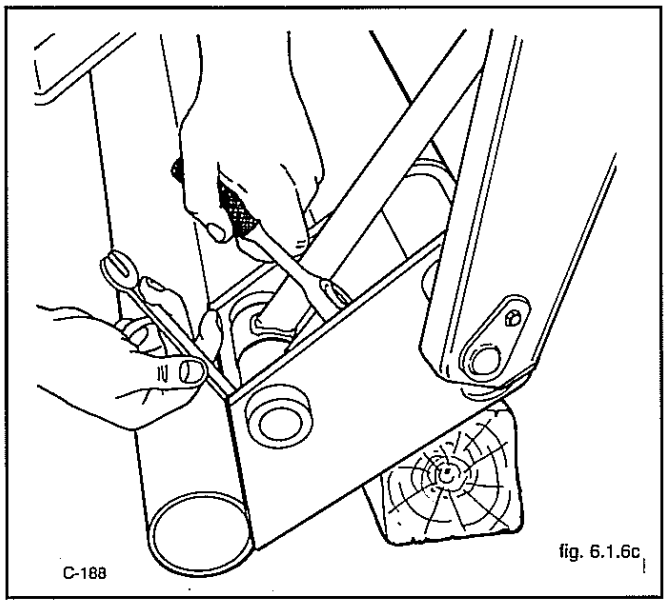


fig. 6.1.6c

6.1.7 UNIVERSAL QUICK-TACH

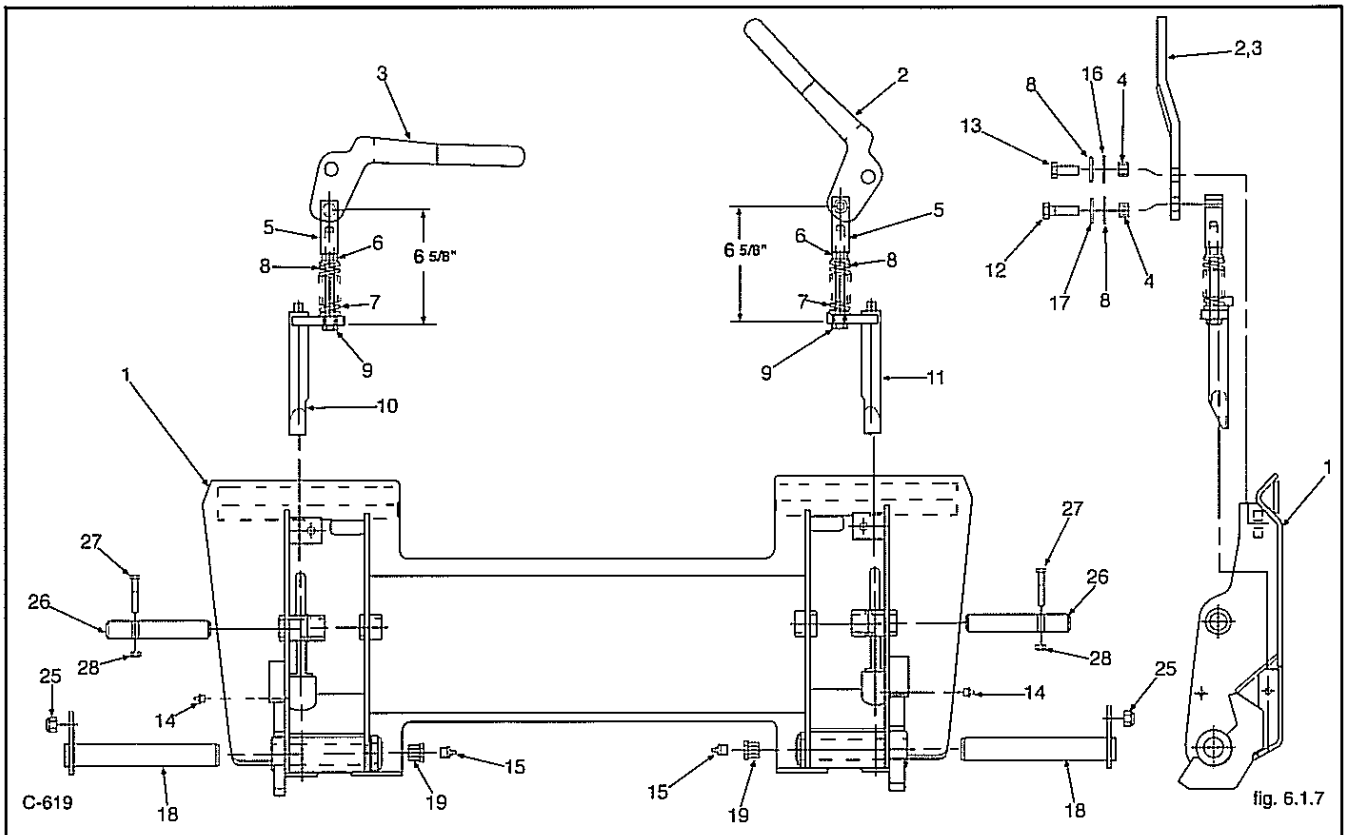


fig. 6.1.7

1	Welded Assy.	961249
2	Handle R/H	41290
3	Handle L/H	41291
4	Bushing	22653
5	Linkage Block	40614
6	Nut 1/2" UNC	20860
7	Spring	41391
8	Washer, Flat	23385
9	Bolt, 1/2 x 5 UNC	2011
10	Pin, Lock L/H	960993
11	Pin, Lock R/H	960994
12	Bolt, Hex 1/2 x 1 3/4"	3321
13	Bolt, Hex 1/2 x 1 1/4"	1680
14	Fitting, Grease 1/8	35449
15	Fitting, Grease 1/4	39924
16	Washer, Spring	41392
17	Washer, Lock 1/2"	20861
18	Pin, Assy.	961253
19	Bushing, Bi-Rod	8897
25	Nut, Nylok 1/2" UNC	8613
26	Pin, 1" x 6"	40778
27	Bolt, Hex. 5/16" UNC	1677
28	Nut, Hex. Nylok 5/16" UNC	37887

6.1.8 QUICK TACH DISASSEMBLY

1. Remove the bolt from the locking handle linkage block.
2. Pull the linkage block spring and pin assembly straight up.
3. Place the linkage block in the vise and loosen the 1/2" UNC jam nut.
4. Remove the retaining bolt and flat washer and spring.

6.1.9 QUICK-TACH ASSEMBLY

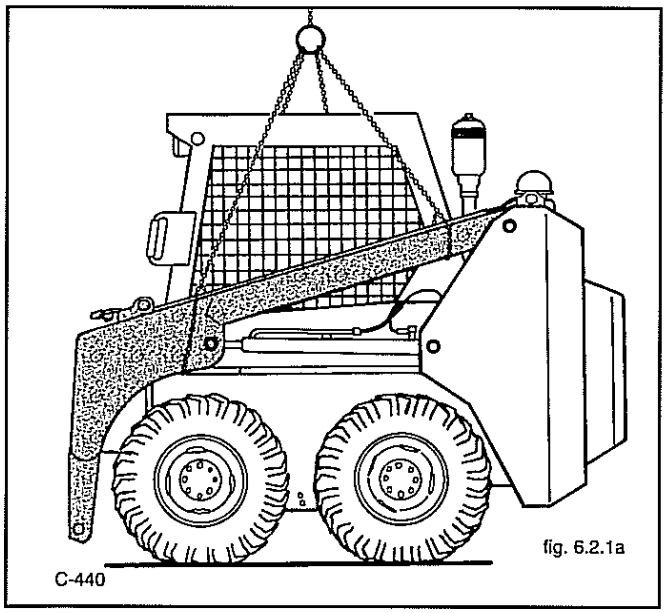
1. Place the linkage block in the vise.
2. Insert the retaining bolt through the locking pin.
3. Install the spring, flat washer and jam nut.
4. Thread the retaining bolt into the linkage block and adjust until there is tension on the spring.
5. Install the locking pin assembly into the quick-tach lock pin bushing.
6. Install the retaining bolt through the linkage block and handle assembly.
7. Cycle the locking handle to ensure correct engage ment and sufficient pressure to hold the over-centre handle in position.

6 MAIN FRAME

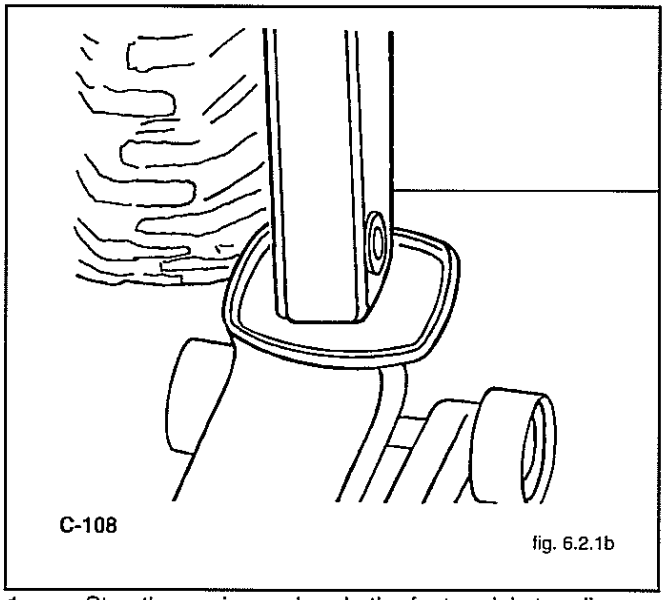
6.2 BOOM ARMS

6.2.1 BOOM ARMS - REMOVAL

When securing or hoisting your Thomas loader, use chains and slings approved for hoisting and security loads minimum 3/8" grade 40 tensile strength 5400 p.s.i.

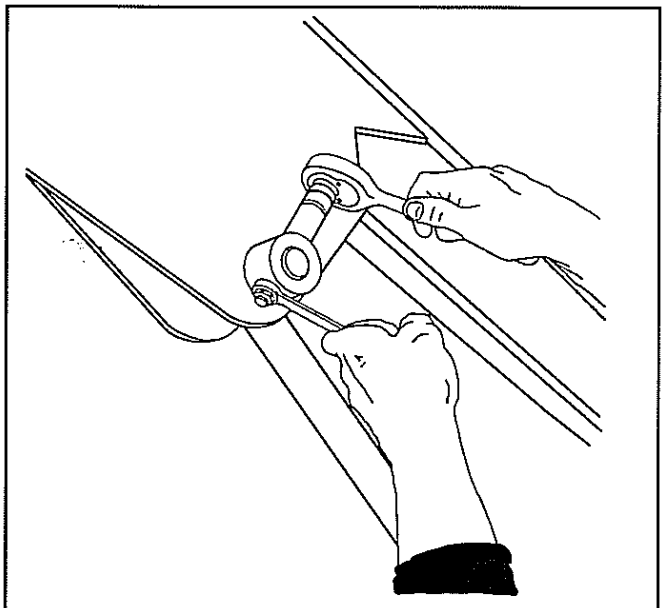


C-440 fig. 6.2.1a



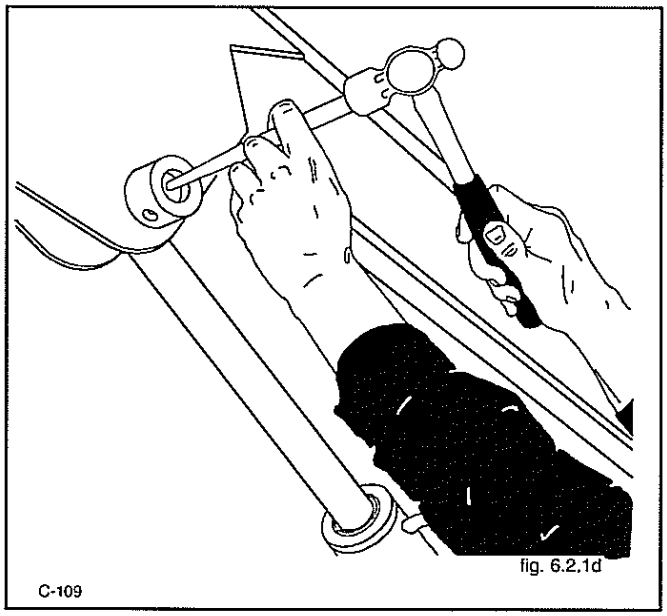
C-108 fig. 6.2.1b

1. Stop the engine and cycle the foot pedals to relieve any hydraulic pressure in the system.
2. Remove the quick-tach assembly from the boom arms (see section 6.1.3).
3. Fasten chains and a chain hoist to the lift arms (Fig. 6.2.1a).
4. Put a floor jack under the boom arms (Fig. 6.2.1b).



C-107 fig. 6.2.1c

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



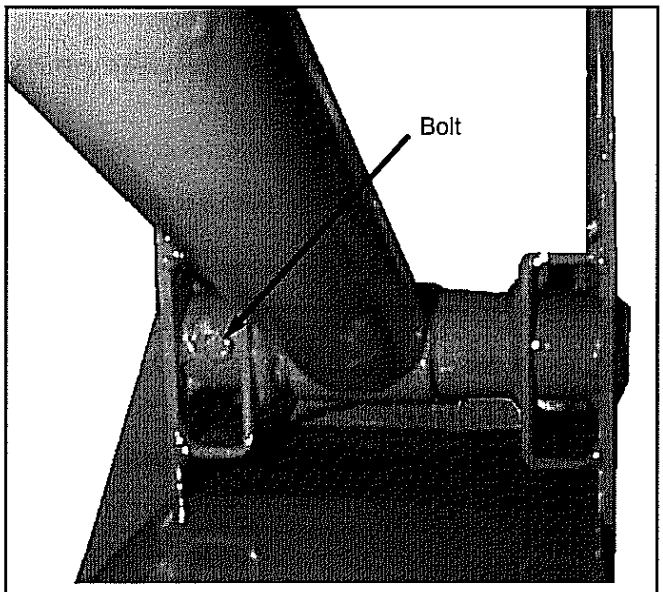
C-109 fig. 6.2.1d

Lock the boom lift foot pedal in float position (see section 4.2.1).

5. Raise the boom arms until the pivot pins in the rod end of the boom cylinders can be removed.

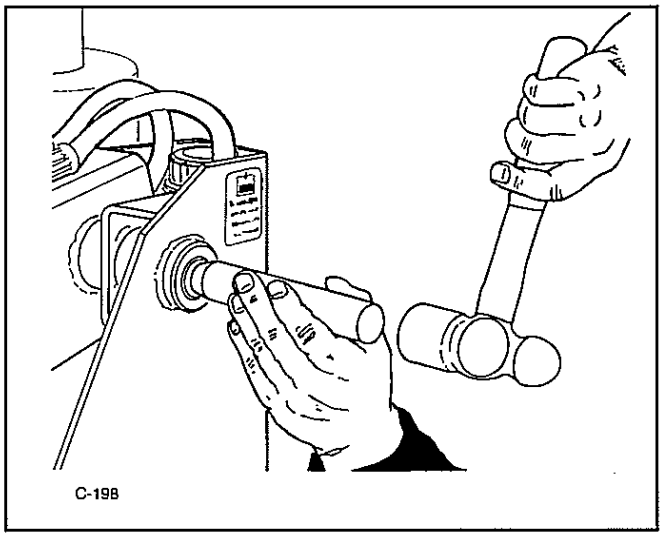
6 MAIN FRAME

6. Remove the locknuts and lock bolts from the rod end pivot pins (Fig. 6.2.1c).



C-611 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.



C-198

7. Remove the boom cylinder rod end pivot pin (Fig. 6.2.1d). Place a support under the boom cylinder to prevent the cylinder from falling when the pin is removed.

8. Lower the lift arms and remove the floor jack.

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

10. Tighten the chain hoist and remove the rear boom pivot pins (Fig. 6.2.1f).

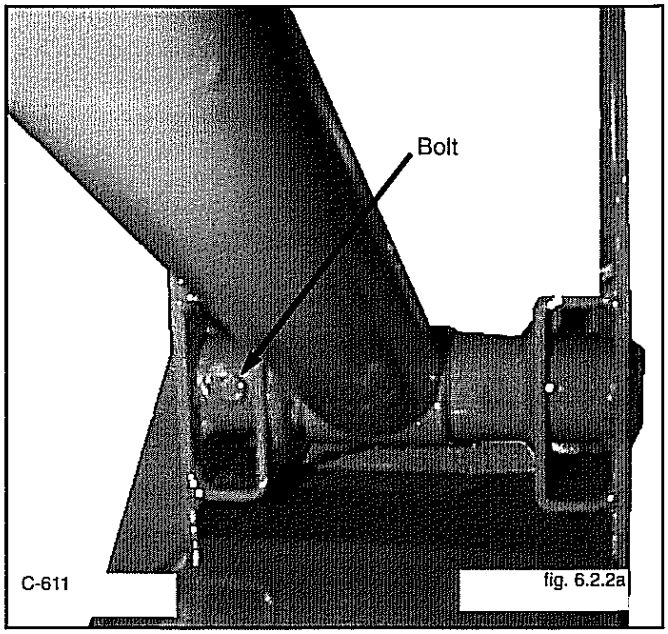
11. Raise the boom arms with the chain hoist and remove from the loader.

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

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.

2. Install the pivot pins in the main frame and boom arms.



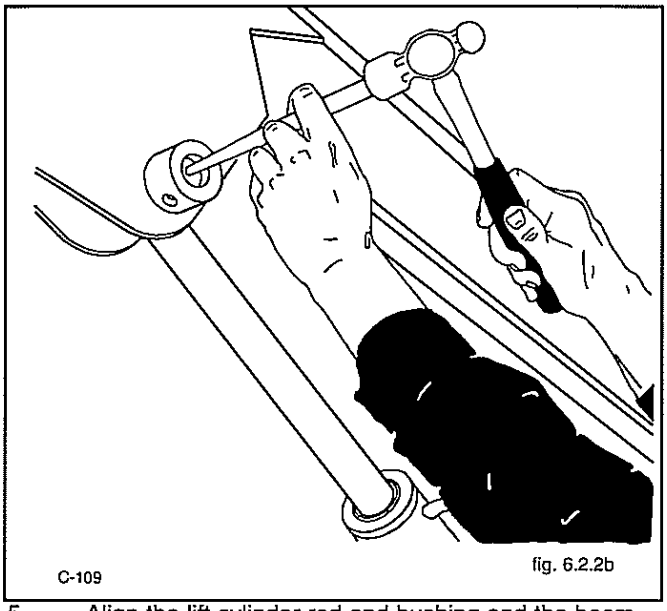
C-611 fig. 6.2.2a

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

3. Install the locknuts and bolts (Fig. 6.2.2a) in the boom pivot pins.

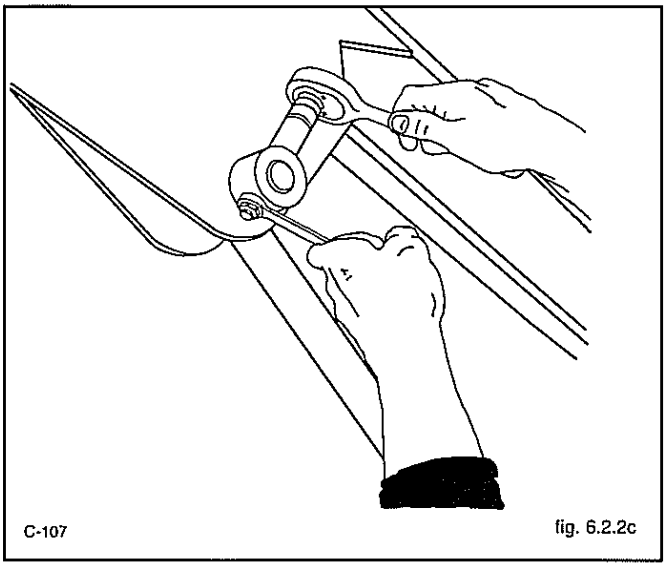
4. Lower the boom arms and remove the chain hoist and chains from the boom arms.

6 MAIN FRAME



5. Align the lift cylinder rod end bushing and the boom arm pivot bushings.

6. Install the pivot pins in the boom arms and lift cylinders (Fig. 6.2.2b).



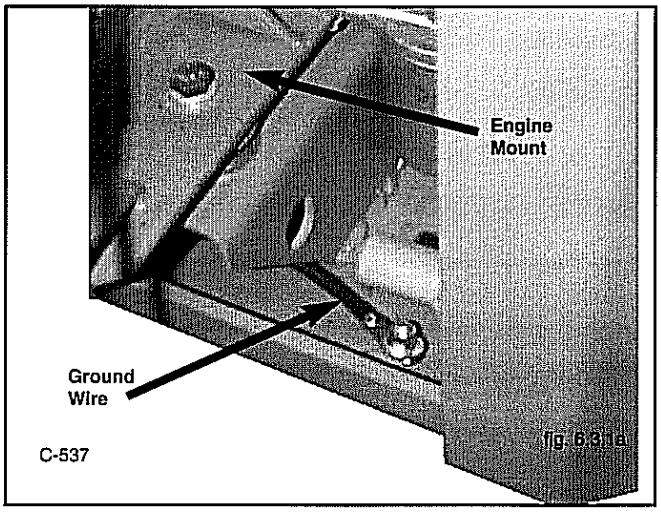
7. Install the locknuts and lock bolts in the lift cylinder pivot pins (Fig. 6.2.2c).

8. Install the quick-tach assembly on the boom arms (see section 6.1.6).

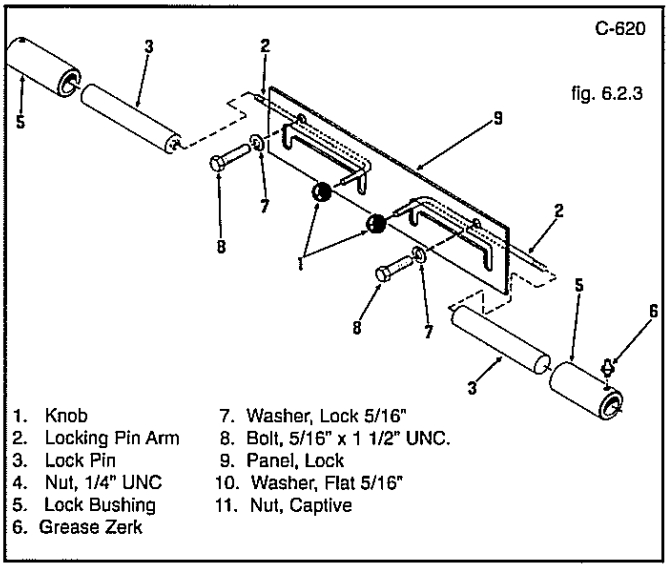
6.2.3 BOOM SUPPORTS

For safety while performing regular service or maintenance work the loader is equipped with boom supports. The boom supports when extended prevent the boom from lowering when pressure is relieved or the control accidentally cycled.

To access the mechanism first remove the centre molding and panel lock and knobs.



The pins can then be removed from the support bushings.



6.3 OPERATOR GUARD (ROPS)

6.3.1 OPERATOR GUARD (ROPS) REMOVAL

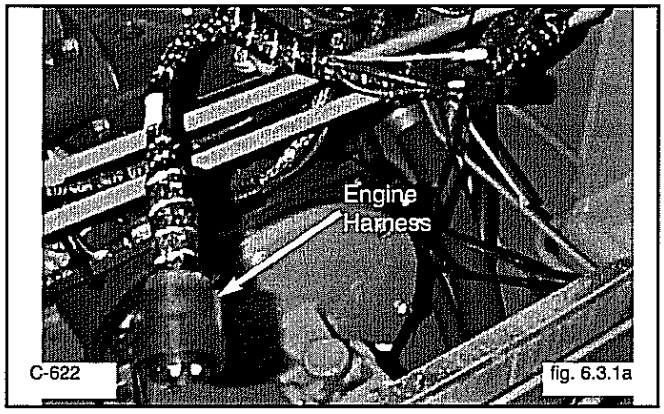
1. Disconnect and remove the battery from the operator guard (ROPS). See section 5.3.2 for procedure.

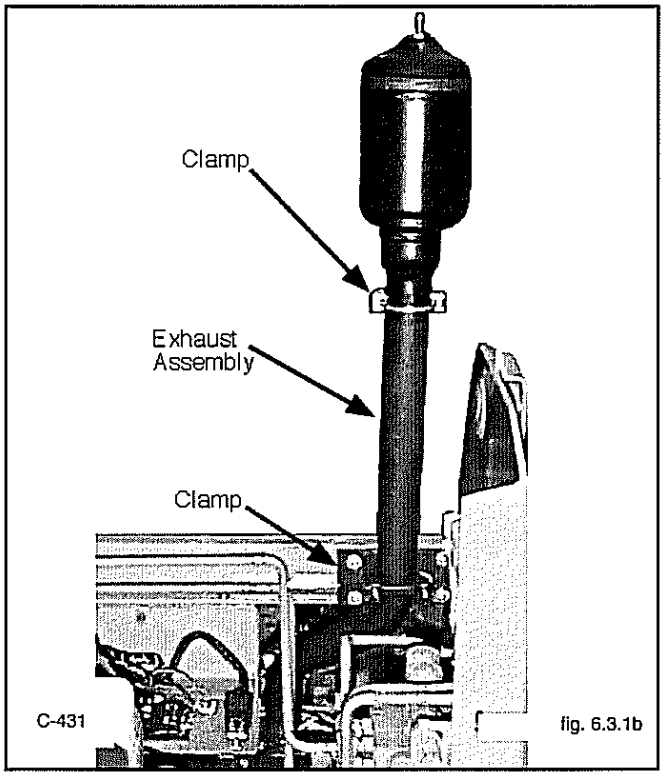
2. Disconnect the battery cable from the starter motor solenoid.

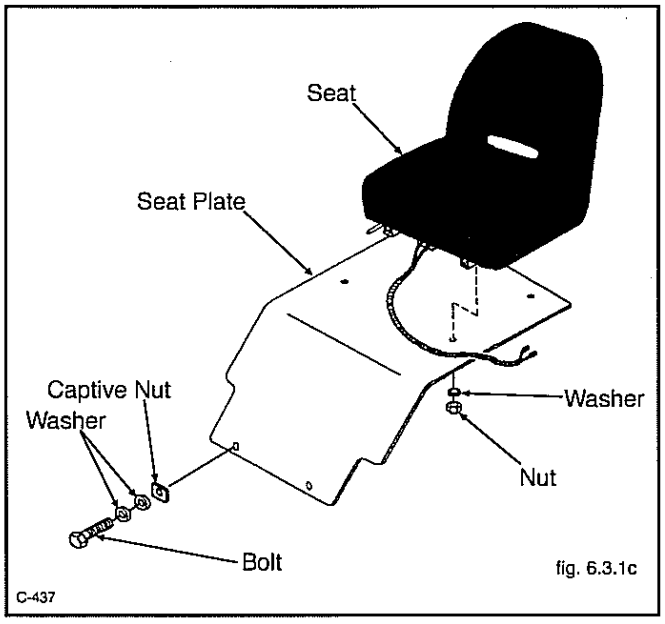
3. Disconnect the engine wiring harness from the ROPS wiring harness at the plug connections inside the enginecompartment

4. Disconnect the battery ground cable from the loader mainframe (Fig. 6.3.1a). Remove the ground cable from the loader.

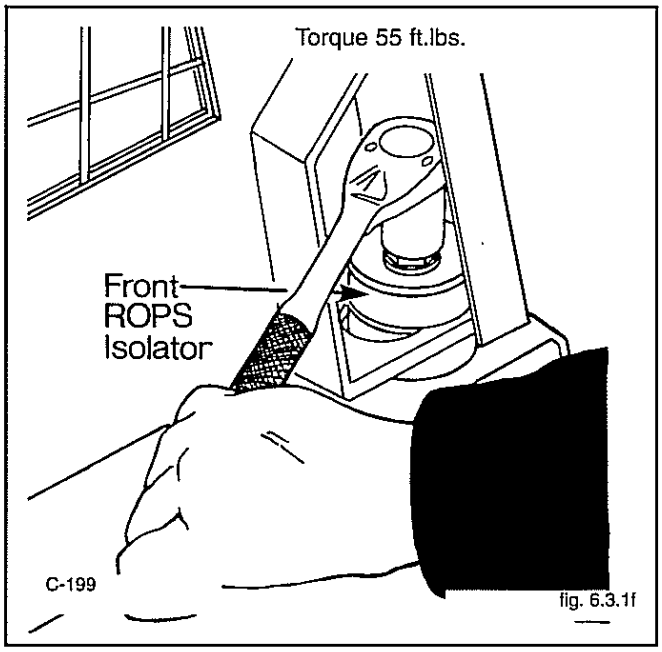
6 MAIN FRAME



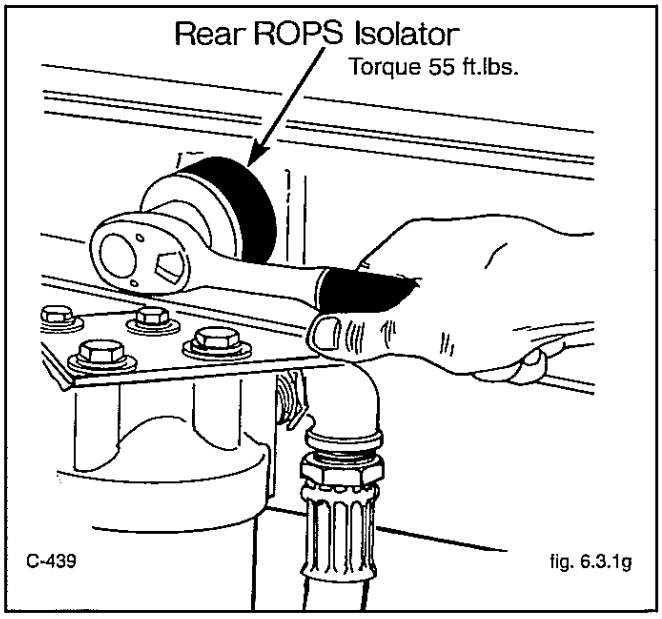




5. Remove the exhaust pipe and the exhaust pipe mount (Fig. 6.3.1b).



6. Remove the seat mount and seat assembly from the loader (Fig. 6.3.1c).

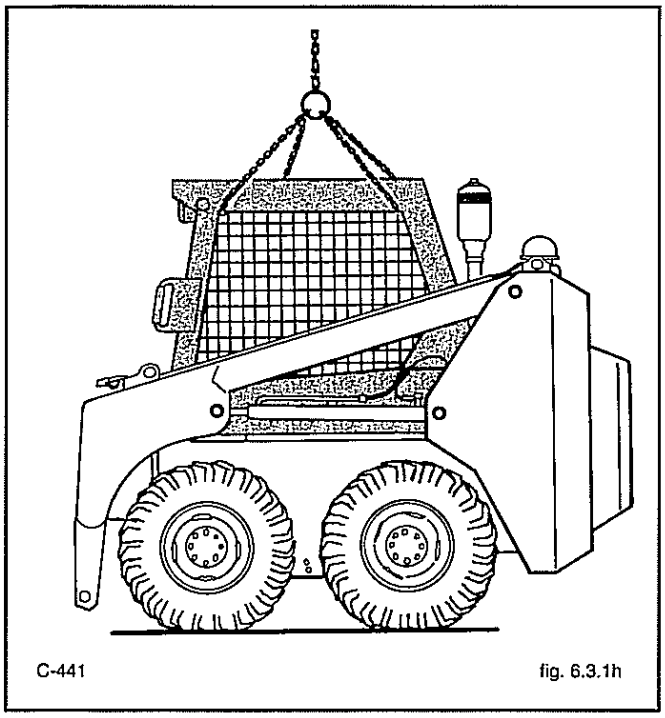


7. Disconnect the seat bar linkage at the front of the ROPS on the R.H. side (Fig. 6.3.1d, 6.3.1e).

8. Remove the two front ROPS isolators (Fig. 6.3.1f).

9. Remove the two rear ROPS isolators (Fig. 6.3.1g).

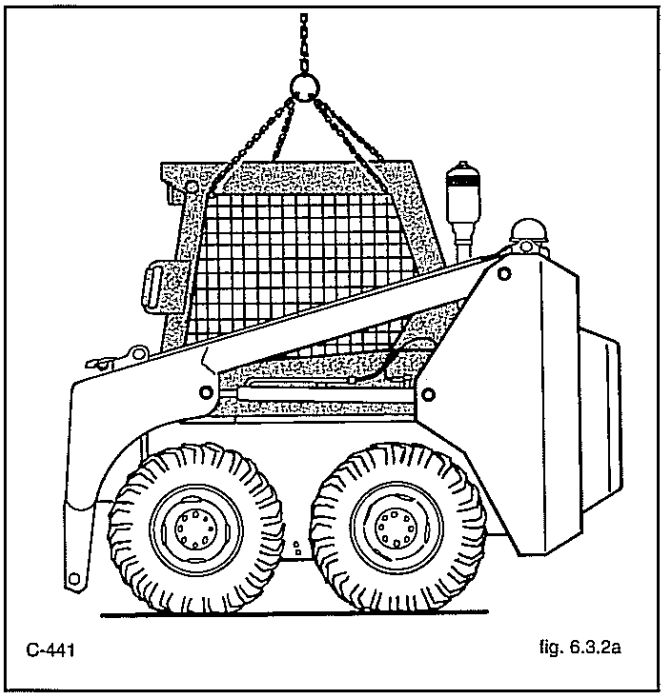
6 MAIN FRAME



C-441 fig. 6.3.1h

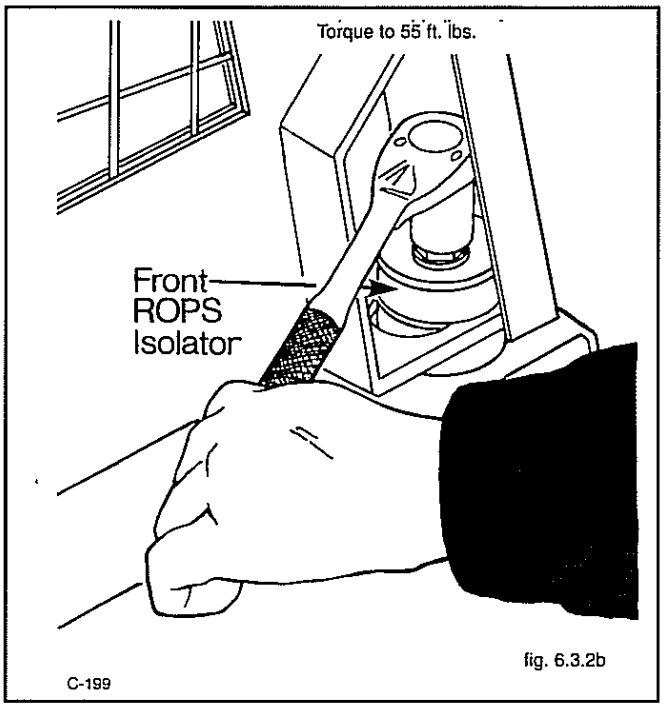
10. Attach chains and a chain hoist to the ROPS as shown in Fig. 6.3.1h. Remove the ROPS from the loader.

6.3.2 OPERATOR GUARD (ROPS) - INSTALLATION

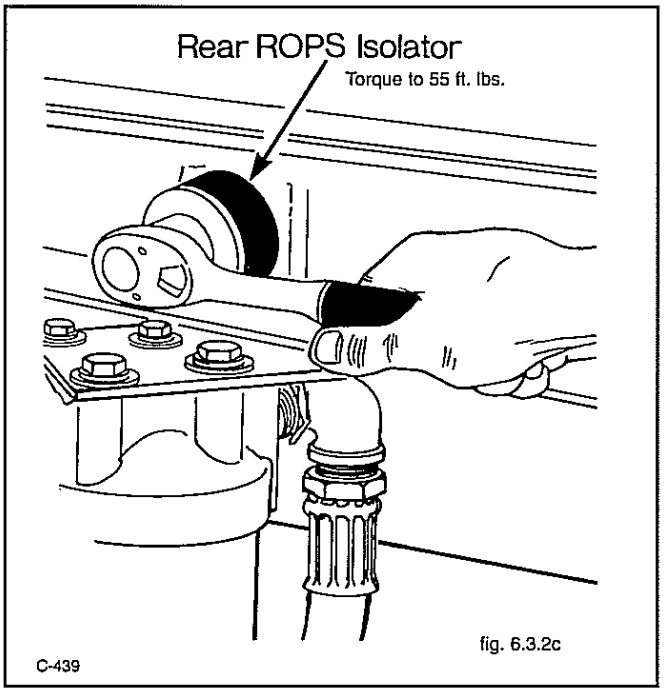


C-441 fig. 6.3.2a

1. Using a chain hoist raise the operators guard (ROPS) and install it on the main frame. Line up the front and rear isolator holes in the ROPS with the mounting holes in the main frame (Fig. 6.3.2a).



C-199 fig. 6.3.2b



C-439 fig. 6.3.2c

2. Install the two front isolators (Fig. 6.3.2b).

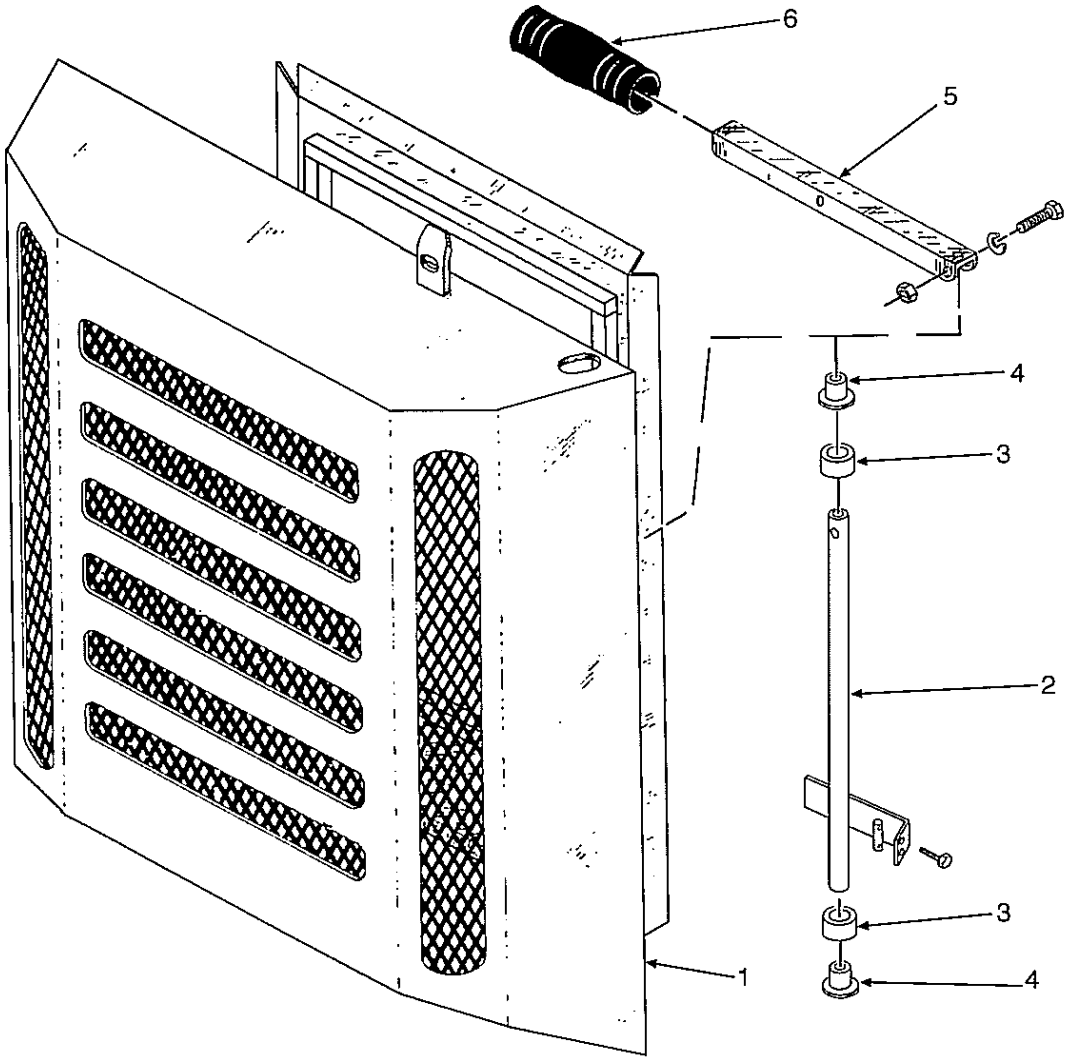
3. Install the two rear isolators (Fig. 6.3.2c)

4. Connect the seat bar linkage at the front of the ROPS on the R.H. side (Fig. 6.3.2d, Fig. 6.3.2e).

5. Install the seat and seat mount assembly in the loader (Fig. 6.3.2f).

6 MAIN FRAME

6.4 REAR DOOR



1. Rear Door Assembly
2. Rear Door Lock Assembly
3. Set Collar
4. Bearing
5. Door Handle
6. Lever Grip

C-442

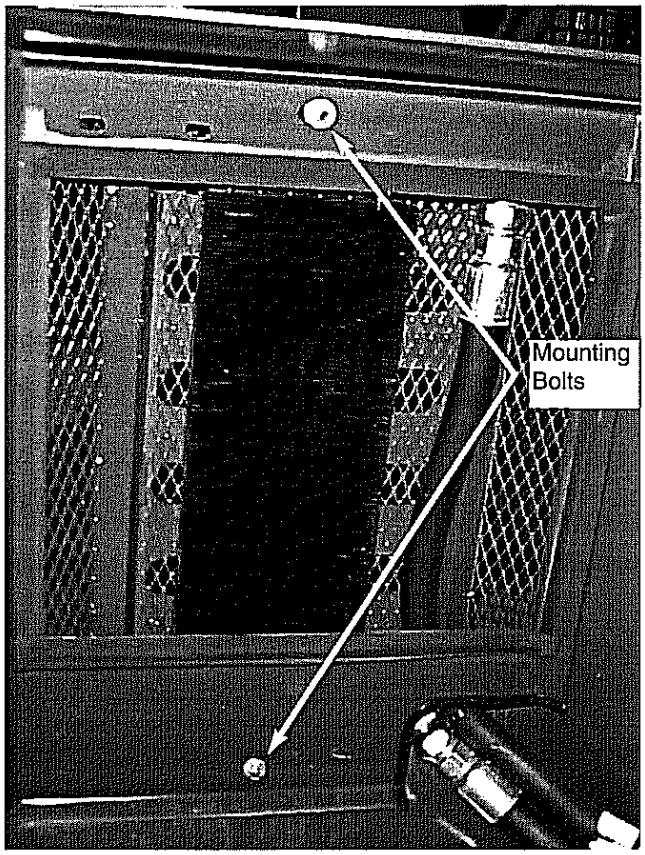
fig. 6.4

6 MAIN FRAME

6.4.1 REAR DOOR - REMOVAL

1. Remove the two nuts securing the oil cooler to the rear door (Fig. 6.4.1a). Carefully lay the oil cooler with the hoses attached on the ground.

NOTE: If it is necessary to remove the hydraulic oil cooler from the loader the hydraulic oil reservoir must be drained (Refer to section 1.7.3).

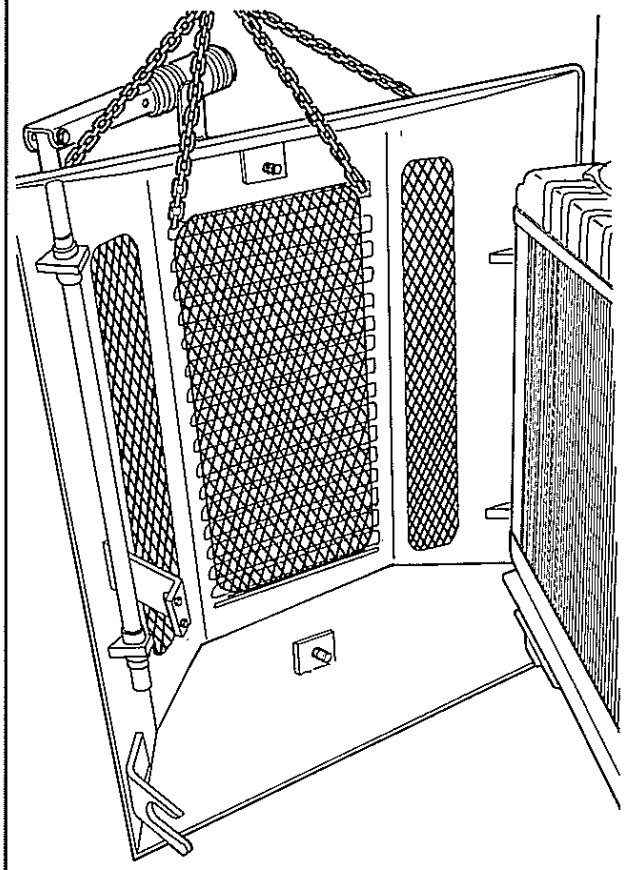


C-621 fig. 6.4.1a

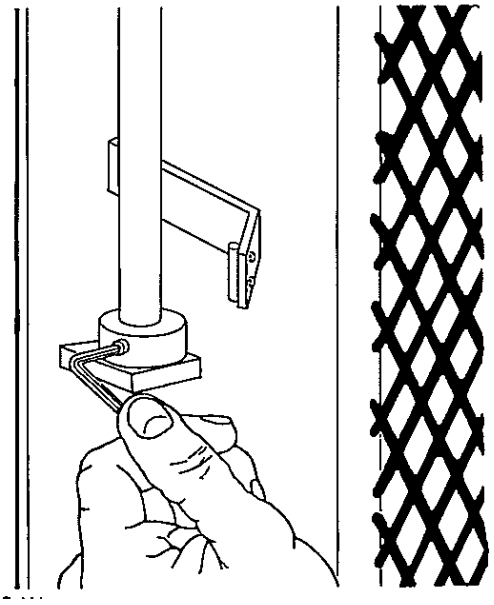
2. Attach chains and a chain hoist to the rear door (Fig. 6.4.1b). Lift the rear door with the chain hoist clear of the hinges. Remove the door from the loader.

6.4.2 REAR DOOR - INSTALLATION & ADJUSTMENT

1. Attach chains and a chain hoist to the rear door (Fig. 6.4.1b). Raise the rear door with a chain hoist and install the rear door on the loader.

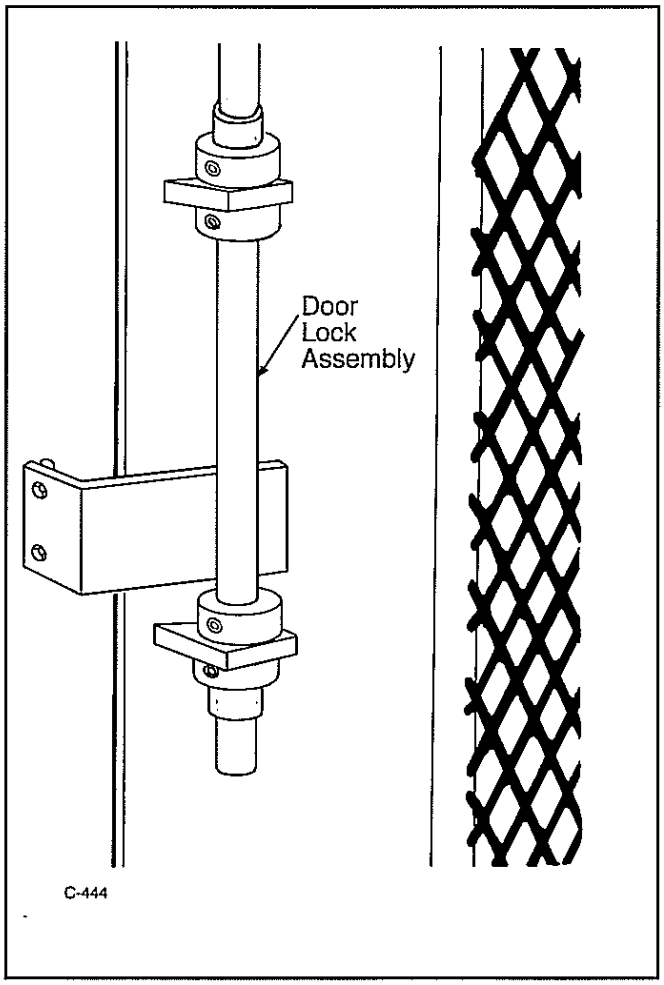


C-186 fig. 6.4.1b



C-444 fig. 6.4.2c

6 MAIN FRAME



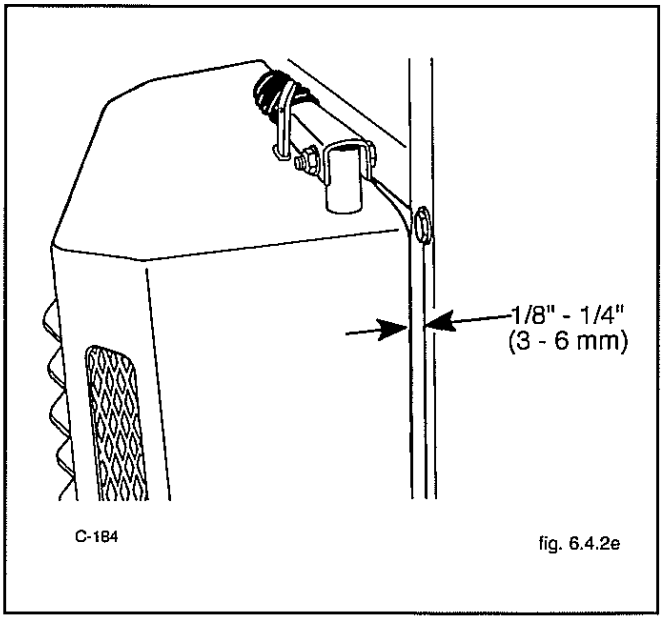


fig. 6.4.2e

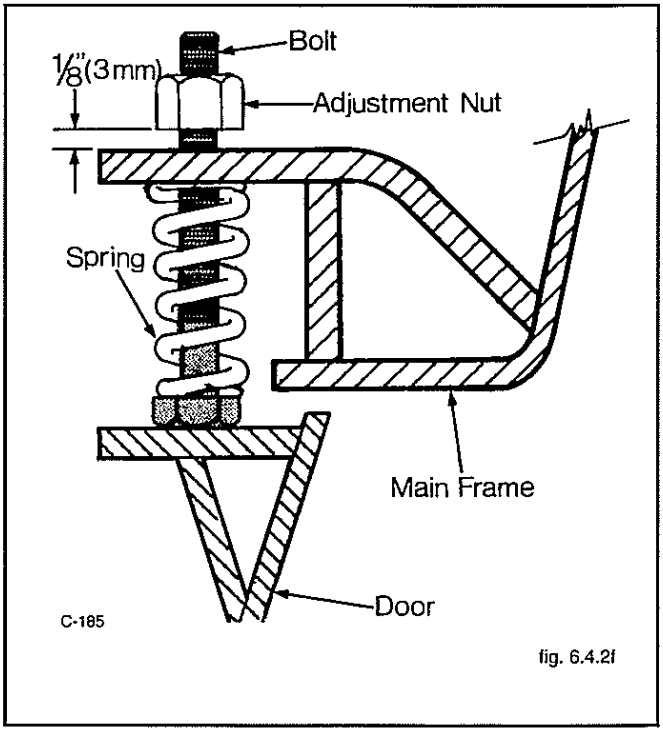


fig. 6.4.2f

2. Install the hydraulic oil cooler on the rear door (Fig. 6.4.1a). Check that the hoses running to the oil cooler are not kinked or interfere when the door is opened and closed.

3. Adjust the set collar on the lock rod so that the lock rod lines up with the locking pin on the main frame (Fig. 6.4.2c).

4. Set the lock adjustment brackets (Fig. 6.4.2d) so that the door when shut has gap between 1/8-1/4" (3 - 6 mm) (Fig. 6.4.2e).

5. Set the door spring (Fig. 6.4.2f) so that when the door is shut the spring is compressed and there is approximately a 1/8" (3 mm) gap between the adjustment nut and mounting bracket.

7 ENGINE

7 ENGINE

7.1 ENGINE REMOVAL

7.1.1 ENGINE REMOVAL

1. Disconnect the battery cables at the battery. Remove the negative or ground cable first.

2. Disconnect the battery cable from the starter motor solenoid.

3. Disconnect the engine wiring harness from the ROPS wiring harness at the plug connections inside the engine compartment (Fig. 7.1.1a).

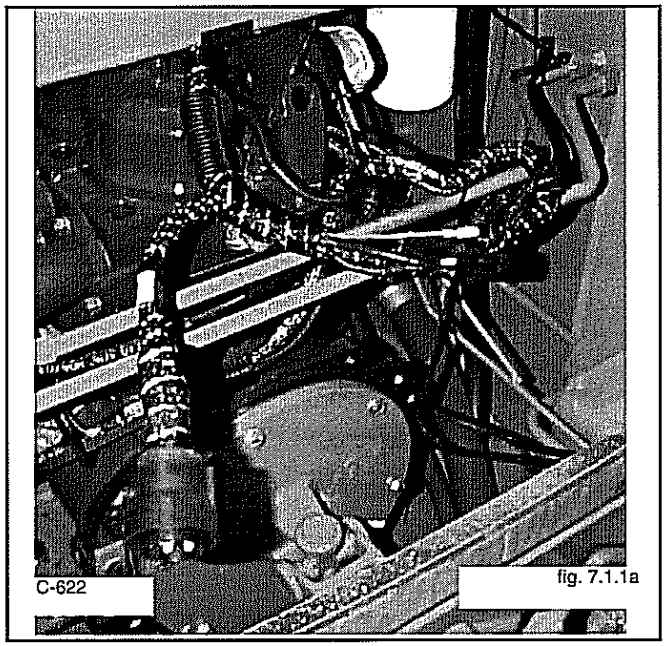

C-622

fig. 7.1.1a

4. Disconnect the alternator harness at the plug connection (Fig. 7.1.1a).
5. Disconnect the hydraulic oil temperature sender wire from the sender on the oil reservoir (Fig. 7.1.1b). Be sure the wire is completely disengaged from the engine.

6. Disconnect the engine ground wire (Fig. 7.1.1c).

7. Shut off the fuel at the fuel tank (Fig. 7.1.1d).

8. Disconnect the fuel line from the fuel lift pump and injection pump.

9. Disconnect the fuel overflow line from the injector.

10. Remove the exhaust pipe (Fig. 7.1.1e).

11. Remove the engine compartment shield from the loader.

12. Disconnect the air intake hose from the intake manifold and remove air pre-cleaner cannister.

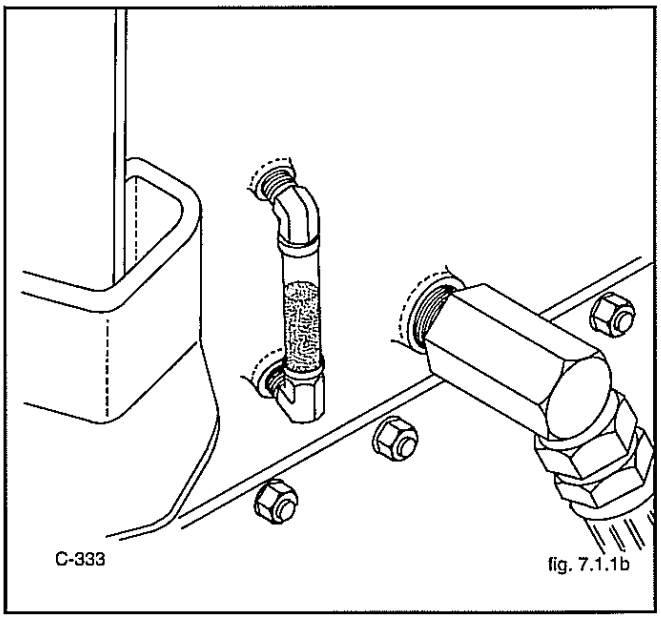
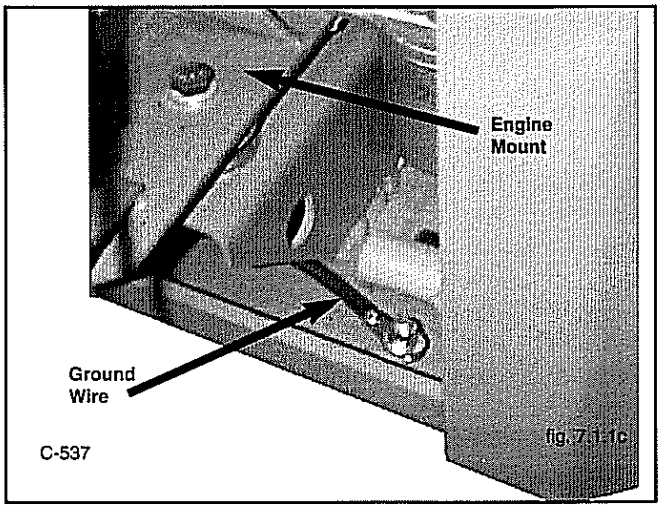
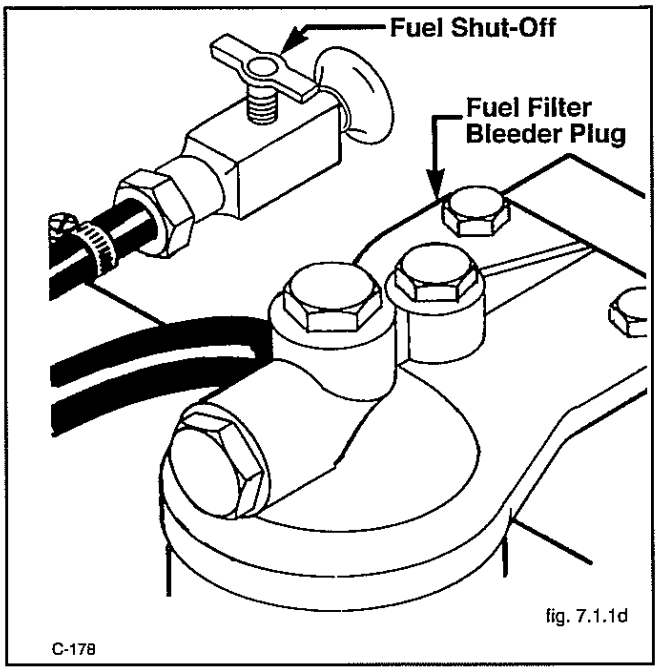

C-333

fig. 7.1.1b



C-537

fig. 7.1.1c



C-178

fig. 7.1.1d

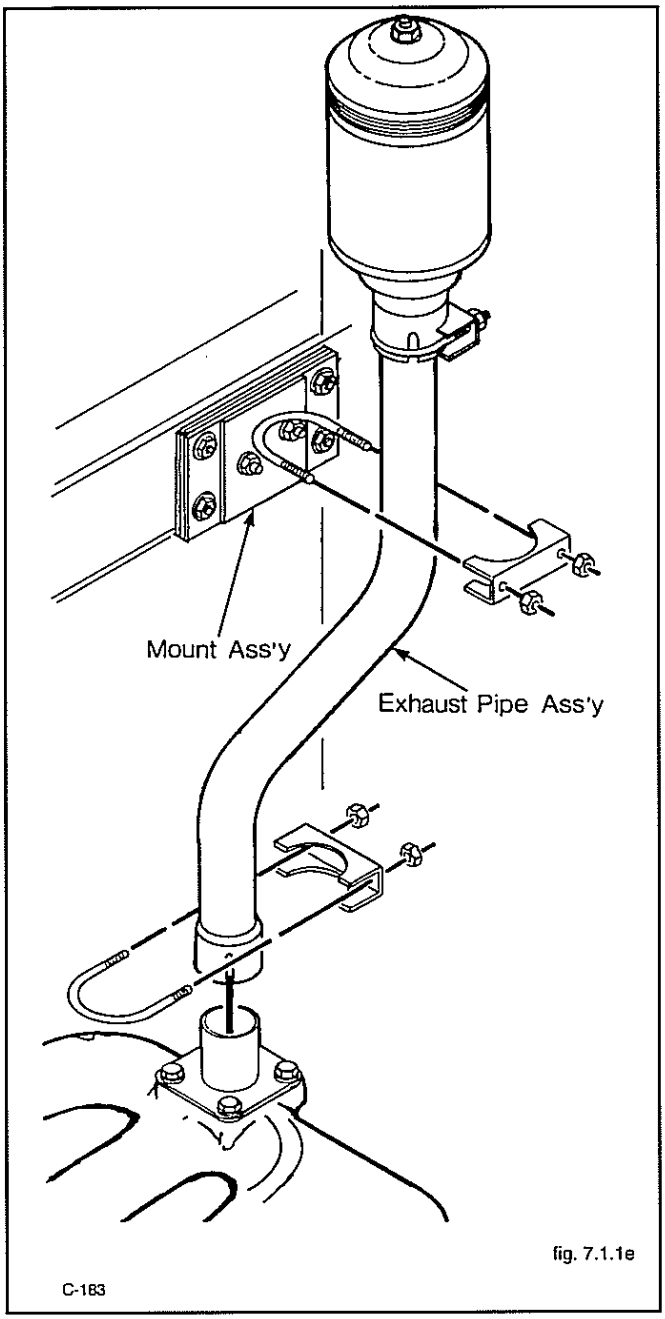


fig. 7.1.1e

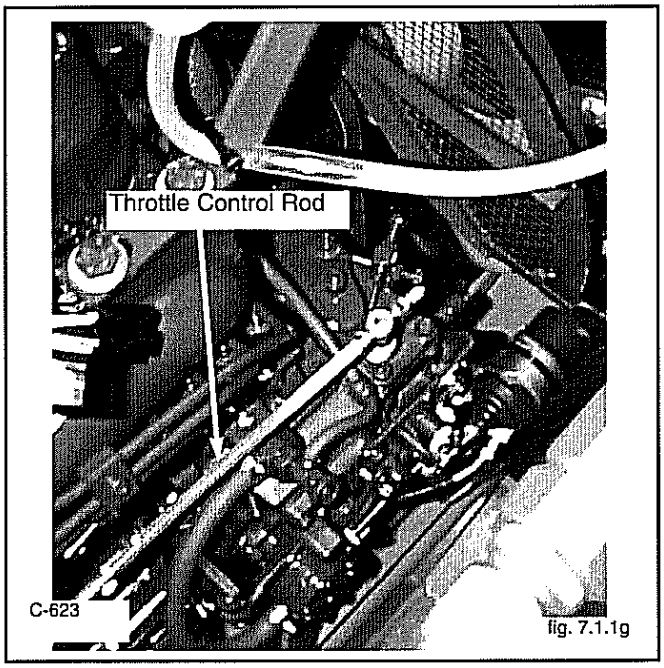


fig. 7.1.1g

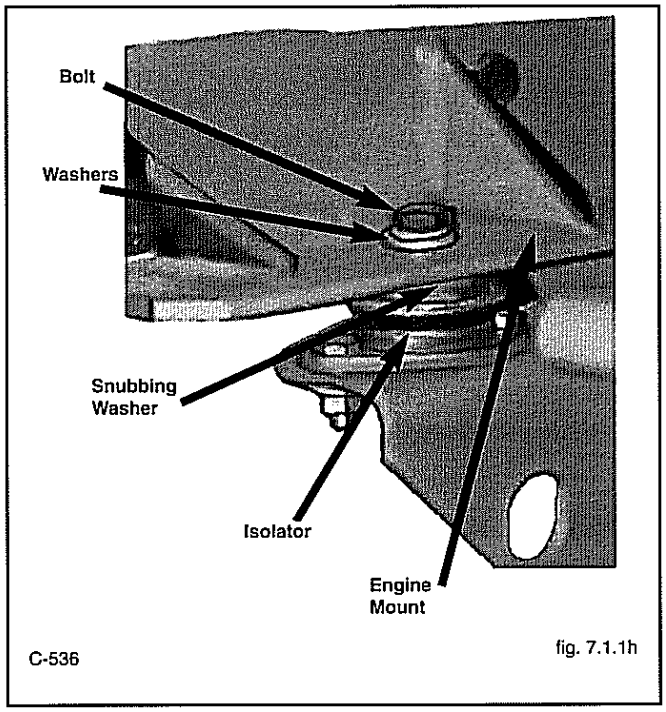


fig. 7.1.1h

13. Disconnect the throttle control rod from the throttle lever assembly on the fuel injection pump (Fig. 7.1.1g).

14. Remove the engine mounting bolts (Fig. 7.1.1h).

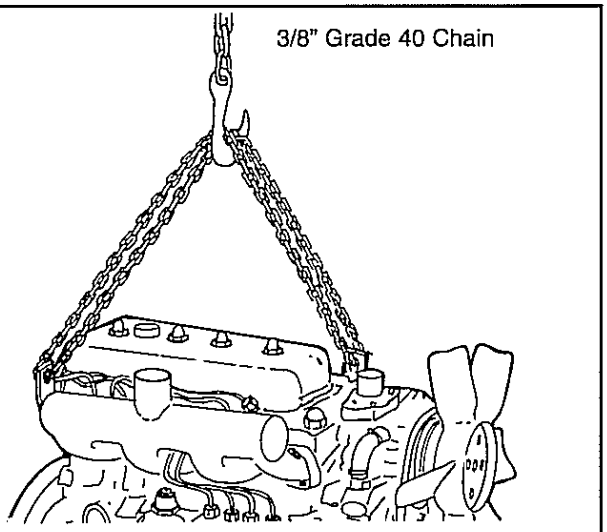
    On reassembly torque bolts (12 mm) 60 ft. lbs.

15. Connect chains to the lifting lugs located at the front and rear of the engine. Using a chain hoist lift the engine and remove it out through the rear of the loader main frame (Fig. 7.1.1j).

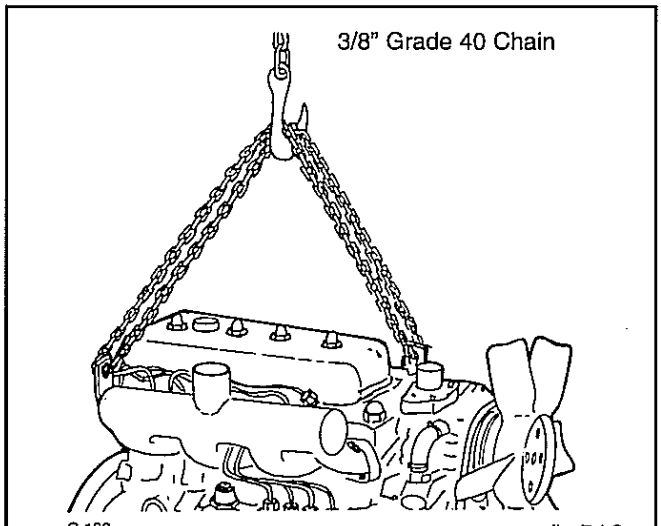
The double universal joint bolted to the engine flywheel is splined at the pump end.

The universal joint will slide off the pump shaft as the engine is removed (Fig. 7.1.1k).

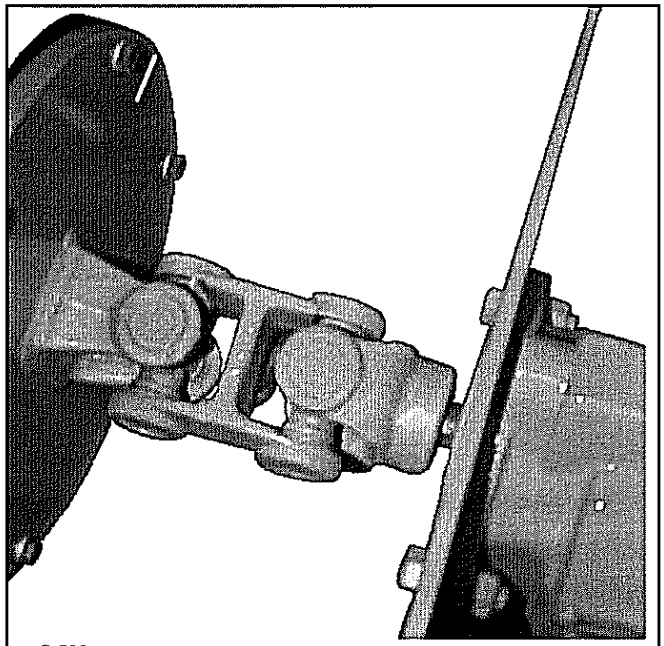
7 ENGINE



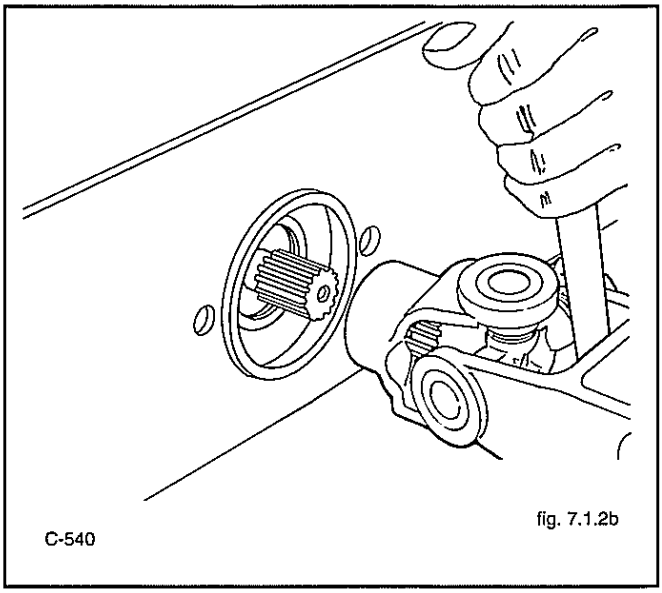
C-181 fig. 7.1.1j



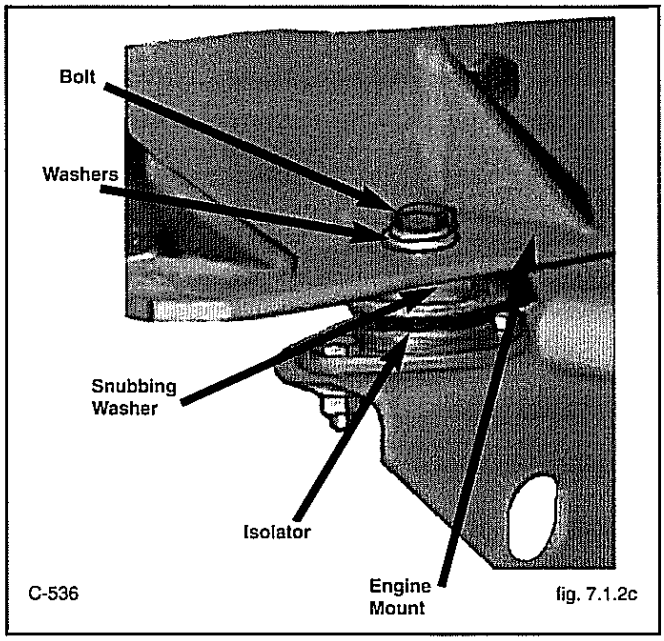
C-182 fig. 7.1.2a



C-539 fig. 7.1.1k



C-540 fig. 7.1.2b



C-536 fig. 7.1.2c

7.1.2 ENGINE INSTALLATION

1. Connect chains to the engine (Fig. 7.1.2a) at the lifting lugs mounted at the front and rear of the engine.

2. Using a chain hoist lift the engine and place it in the loader main frame. Line up the double universal joint with the hydrostatic drive pump as the engine is installed (Fig. 7.1.2b).

3. Install the engine isolators and engine mounting bolts. Torque the mounting bolts to 60 ft. lbs.

4. Connect the throttle control rod to the throttle lever assembly on the fuel injection pump (Fig. 7.1.2d).

   Refer to section 4.4.2 for throttle adjustment procedure.

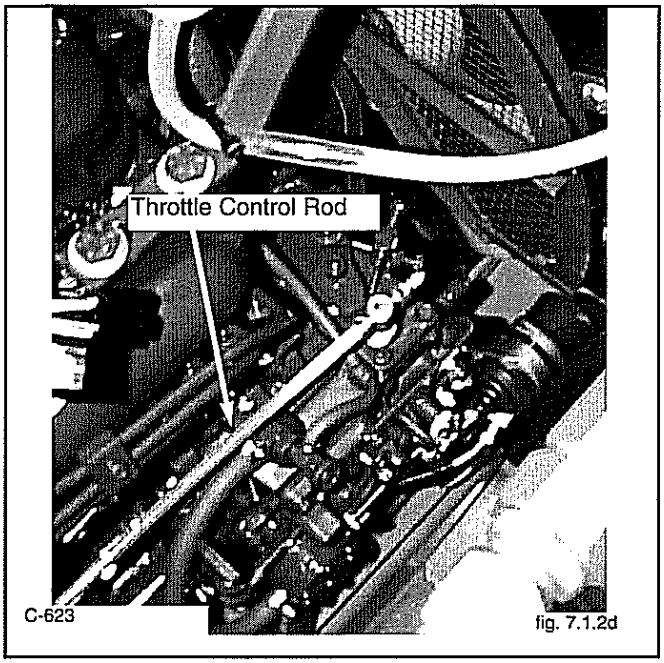


fig. 7.1.2d

5. Connect the hose between the air cleaner and the engine intake manifold.

6. Install the engine compartment shield.

7. Install the exhaust pipe.

8. Connect the fuel lines at the lift pump, injection pump and injector overflow.

9. Open the fuel shut off located on the fuel tank. It may be necessary to bleed air from the fuel system prior to starting the engine.

10. Connect the ground wire from the engine to the main frame (Fig. 7.1.2e).

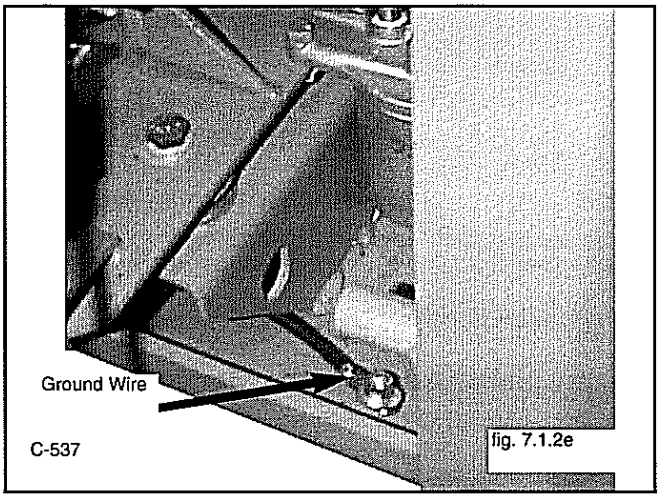


fig. 7.1.2e

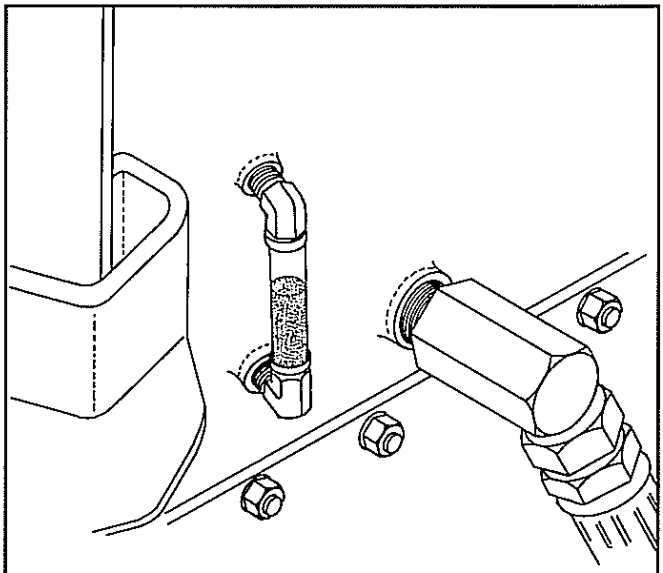


fig. 7.1.2f

11. Connect the wire to the hydraulic oil temperature sender (Fig. 7.1.2f).

12. Connect the ground wire at the voltage regulator mount (Fig. 7.1.2g).

13. Connect the voltage regulator wiring harness at the connectors (Fig. 7.1.2g).

14. Connect the engine wiring harness with the ROPS wiring harness (Fig. 7.1.2g).

15. Connect the battery cable to the starter motor solenoid.

16. Connect the battery cables to the battery.

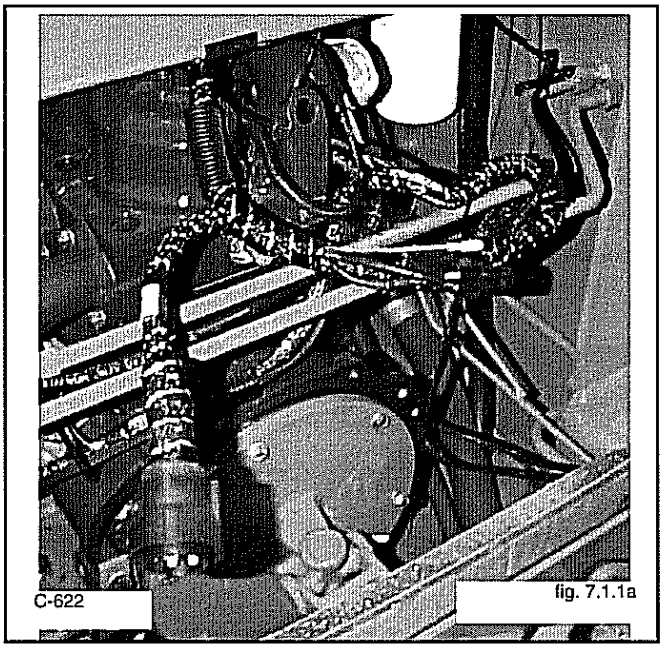


fig. 7.1.1a

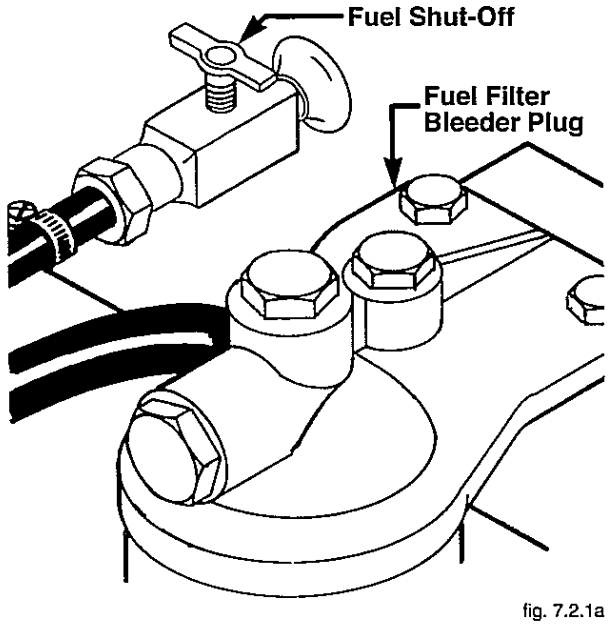
7.2 CYLINDER HEAD

7.2.1 COMPRESSION TEST

Before performing the compression test ensure that the battery is fully charged and that the valve clearances are correct.

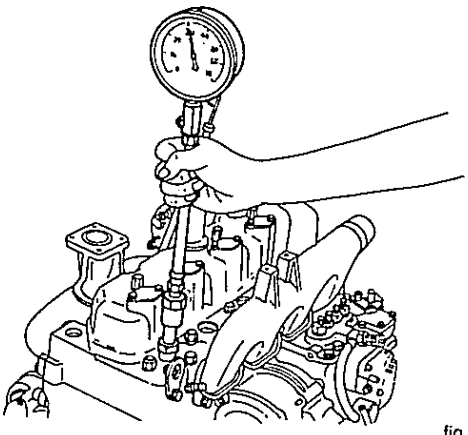
WARNING

This test must be done with engine running. To prevent personal injury block the loader securely with all four wheels clear of the ground.



C-178 fig. 7.2.1a

1. Block the loader securely with all four wheels clear of the ground.
2. Run the engine until warm.
3. Shut off the fuel supply at the tank (Fig. 7.2.1a).
4. Disconnect the air intake and remove the injectors from the engine.
5. Connect a compression tester to the cylinder to be tested (Fig. 7.2.1b).
6. Run the engine with the starter at 200 to 300 RPM and read constant maximum on the tester.
7. Run the test twice for each cylinder running the engine for 5 to 10 seconds for each test.



C-179 fig. 7.2.1b

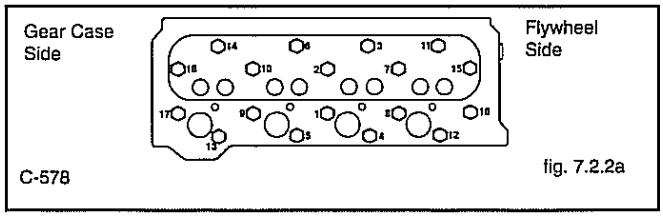
TEST RESULTS	
Preference compression pressure	427-469 lb./sq.in. (30-33 kgf/cm sq.)
Minimum allowable pressure-75% of reference valve	320-352 lb./sq.in. (23-25 kfg/cm.sq.)
Difference between cylinder pressures	less than 10%

If the compression pressure is low pour a small amount of oil through the injector holes and test again.

- If pressure recovers check for wear on piston rings.
- If pressure does not recover check valves and cylinder head for damage.

7.2.2 CYLINDER HEAD TORQUE

Apply oil to heads and threads of cylinder head bolts. Tighten the head bolts and nuts evenly in the correct sequence as shown in fig. 4.7.9. Torque to 68.7 to 72.3 ft. lbs. (93.1 to 98 N.M.).
When overhauling the engine, replace the gasket with a new one. Ensure that oil galley O ring is in place and not damaged. Retighten the nuts after running the engine for 30 minutes.



C-578 fig. 7.2.2a

7 ENGINE

IMPORTANT Valve clearance must be checked and adjusted when engine is cold.

7.2.3 VALVE ADJUSTMENT

Checking Valve Clearance:
Important: Valve clearance must be checked and adjusted when the engine is cold.

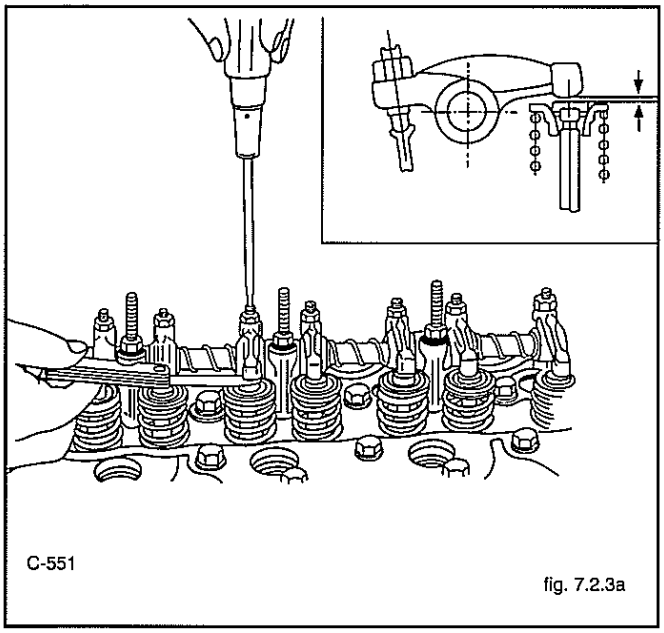
1. Remove the head cover.
2. Align the "1TC" mark on the flywheel and projection (fig. 7.2.3a) on the housing so that the No. 1 piston comes to the compression or overlap top dead center.
3. Check the following valve clearance marked with "o" using a feeler gauge.
4. If the clearance is not within the factory specifications adjust with the adjusting screw.
   Valve clearance 0.18 to 0.22mm
   0.0071 to 0.0087 in.

NOTE:
The "TC" marking on the flywheel is just for No. 1 cylinder. There is no "TC" marking for the other cylinders.
No. 1 piston comes to the T.D.C. position when the "TC" marking is aligned with the projection in the window on the flywheel-housing. Turn the flywheel 15° (0.26rad) clockwise and counter clockwise to center on the overlap position. Now refering to the table below, readjust the valve clearance. (The piston is at the top dead center when both the In. and Ex. valves do not move; it is at the overlap position when both valves move).

Finally turn the flywheel 360° (6.28rad) and align the "TC" marking and projection perfectly. Adjust all the other valve clearance as required.

After turning the flywheel counter clockwise two or three times, recheck the valve clearance. After adjusting the valve clearance, firmly tighten the lock nut of the adjusting screw.

Engine model valve arrangement Adjustable cylinder location of piston.		V1903 (E) V2203 (E)	
		In.	Ex.
When No.1 piston is compression top dead center	1st	•	•
	2nd	•	
	3rd		•
	4th		
When No.1 piston is overlap position	1st		
	2nd		•
	3rd	•	
	4th	•	•
	5th		



C-551

fig. 7.2.3a

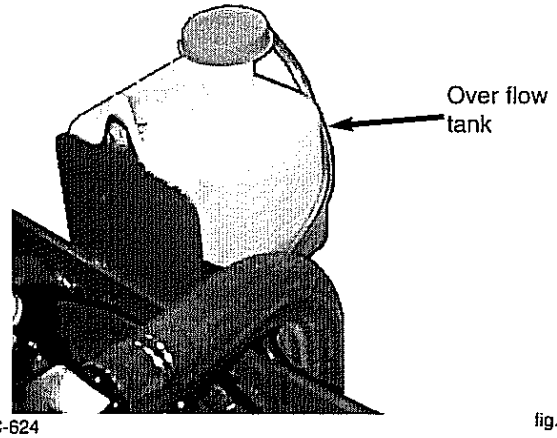
7.3 COOLING SYSTEM

7.3.1 ADDING FLUID

When adding coolant to the engine cooling system, it can be done easily by removing the overflow tank cover and bringing the coolant level up to the first mark on the bottom of the overflow tank.

WARNING To prevent personal injury DO NOT remove the radiator cap when the engine is hot.

Use ethylene glycol base coolant to prevent engine damage. Do not use pure anti-freeze or more than 50% antifreeze in the cooling system. This mixture will provide freeze protection to -34°F (-37°C).

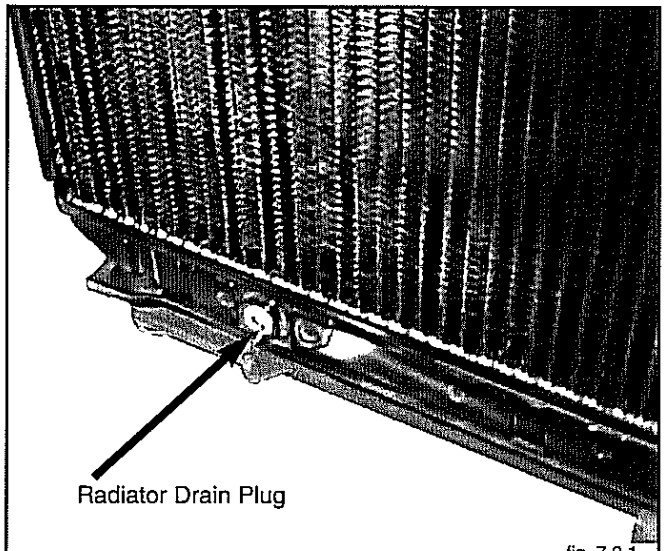


C-624

fig. 7.3.1

To drain the cooling system; attach a hose to the drain valve located at the engine block (Fig. 7.3.1). Remove the radiator cap. Turn the drain valve handle so that it's toward the valve outlet. To completely drain the radiator remove the rubber drain plug located at the bottom of the radiator (Fig. 7.3.1).

To fill the cooling system; close the drain valve on the engine block (Fig. 7.3.1) and refit the radiator drain plug. Fill the radiator with a 50-50 mixture of ethylene glycol and water. Refit the radiator cap.



C-552 fig. 7.3.1

7.3.2 RADIATOR INSPECTION - TESTING

The radiator cooling fins must be kept free of debris otherwise overheating of the engine can occur. Inspect the radiator cooling fins for damage or buildup of debris. Repair any damage and if necessary flush the radiator with compressed air to remove dirt buildup.

WARNING

To prevent eye injury use safety goggles when cleaning with compressed air.

IMPORTANT

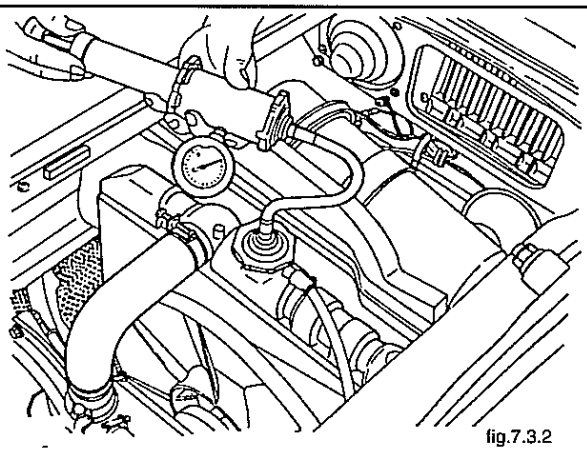
To prevent radiator fin damage do not use air pressure higher than 30 PSI (2.1 kg/cm sq.) when cleaning the radiator

Test the radiator for leaks as follows:

1. Ensure the radiator is full of coolant.
2. Start the engine and run until warm.
3. Shut off the engine and carefully remove the radiator cap.
4. Attach a radiator tester and increase the pressure to 12.8 lbs./in.² (0.9 kg/cm²), Fig. 7.3.2.
5. Check for leaks.

WARNING

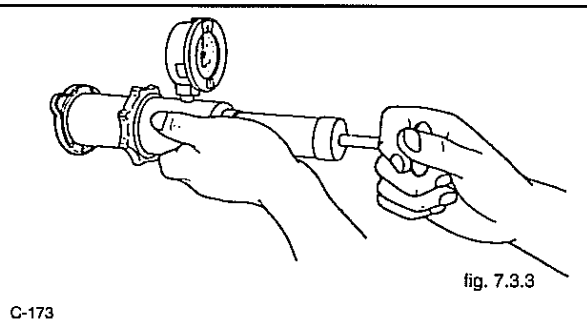
To prevent personal injury DO NOT remove the radiator cap when the engine is hot.



C-172 fig.7.3.2

7.3.3 RADIATOR CAP - PRESSURE TEST

1. Attach a radiator tester to the radiator cap (Fig. 7.3.3).

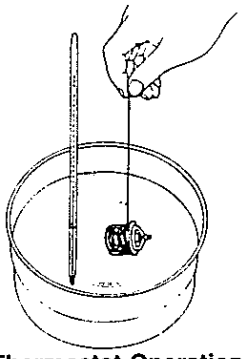


C-173 fig. 7.3.3

2. Apply the specified pressure 12.8 lbs./in.² (0.9 kg/cm²).
3. Check that the pressure does not drop by more than 4.3 lbs./in.² (0.3kg/cm²) in 10 seconds.

7.3.4 THERMOSTAT - TEST

1. Push down the thermostat valve and insert a string between the valve and the valve seat (Fig. 7.3.4a).



Thermostat Operation Check

C-171 fig. 7.3.4

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.

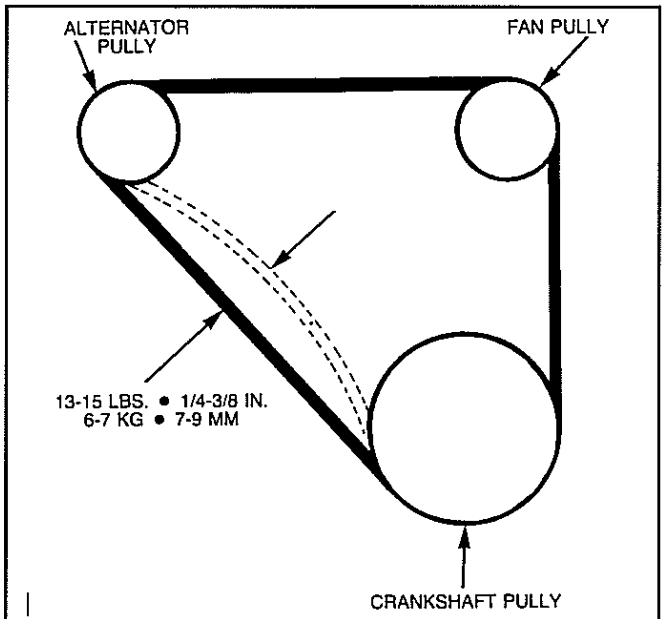
4. Check the temperature at the point where the thermostat falls. Continue to heat the thermostat and note the temperature when the thermostat is fully open.

   Replace the thermostat if it fails to open at the specified temperature.

   Start to open.....157.1-162.5°F (69.572.5°C)
   Fully Open.....185.5°F (85°C)

7.3.5 FAN BELT - ADJUSTMENT

Check the fan belt tension midway between the fan pulley and alternator pulley (Fig. 7.3.5a). Deflection should be between 1/4 to 3/8 in. (7-9 mm) with a force of 13-15 lbs. (6-7 Kg).



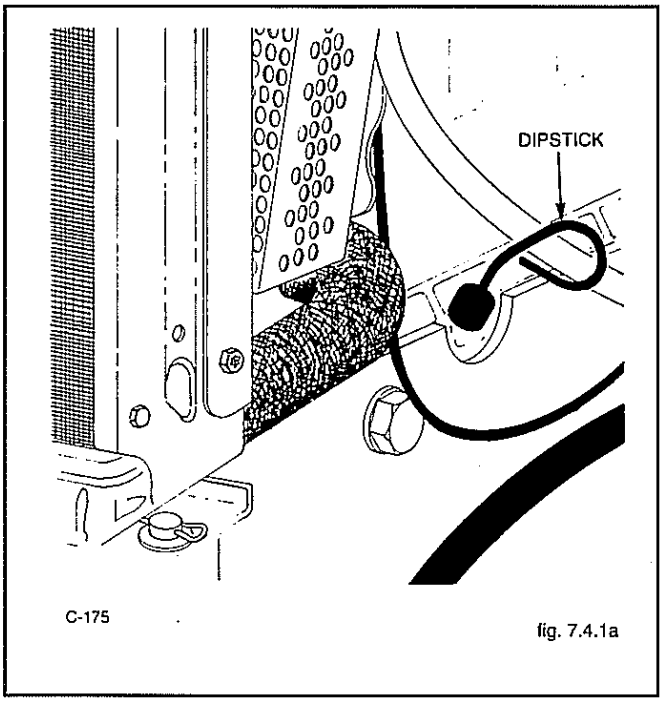
C-174 fig. 7.3.5

7.4 LUBRICATION SYSTEM

7.4.1 OIL LEVEL CHECK

To check the oil level, stop the engine with the loader on level ground, open the rear door and remove the dipstick (Fig. 7.4.1a).

Keep the oil level between the full and low mark on the dipstick (Fig. 7.4.1b). Do not fill above the full mark - use a good quality 10W30 motor oil which meets API classification CD/CE



C-175 fig. 7.4.1a

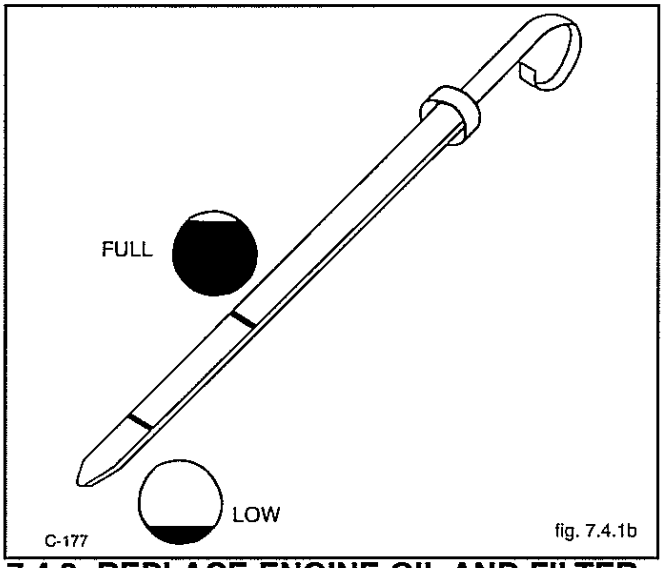


fig. 7.4.1b

7.4.2 REPLACE ENGINE OIL AND FILTER

Operate the engine until warm, approx. 5 minutes. Stop the engine.

Remove the oil drain plug located at the bottom of the oil pan.

Remove the oil filter (Fig. 7.4.2a). Clean the filter housing surface. Put clean oil on the seal of the new filter. Install the new filter and tighten hand tight.

Replace the oil drain plug. Remove the filler cap and add 10W30 API classification SE/CD engine oil. Start the engine and run for 5 minutes. Stop the engine and check for leaks at the filter. Recheck the oil level and add oil until level is at top mark on dipstick.

Change the engine oil every 75 hours and the oil filter every 150 hours.

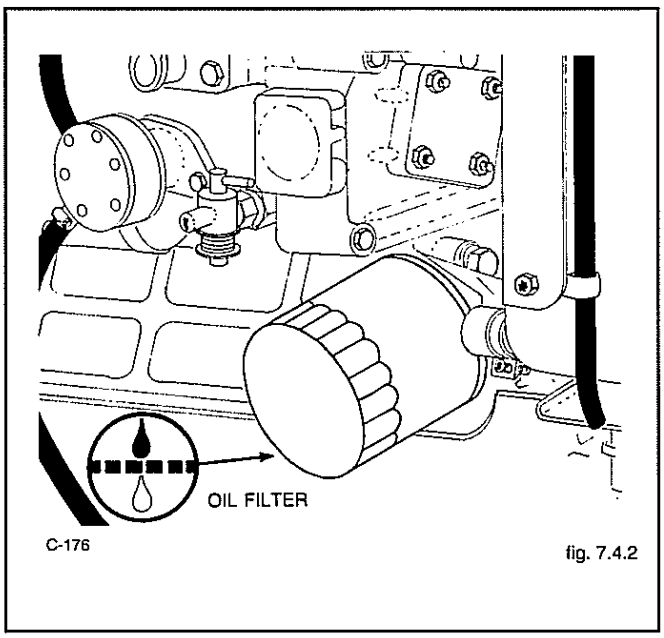


fig. 7.4.2

7.5 FUEL SYSTEM

7.5.1 FUEL FILTER REPLACEMENT

The fuel filter is located on the R.H. side of the engine in the engine compartment (Fig. 7.5.1a). The filter element should be changed every 400 operating hours.

To replace the filter; close the fuel inlet line shut-off located on the side of the fuel tank (Fig. 7.5.1a). Remove the filter element (Fig. 7.5.1a). Lubricate the seal on the new filter and install the filter hand tight. Open the fuel inlet shut-off. It may be necessary to remove air from the fuel system after changing the filter element, by removing bleed plug and pump until fuel flows.

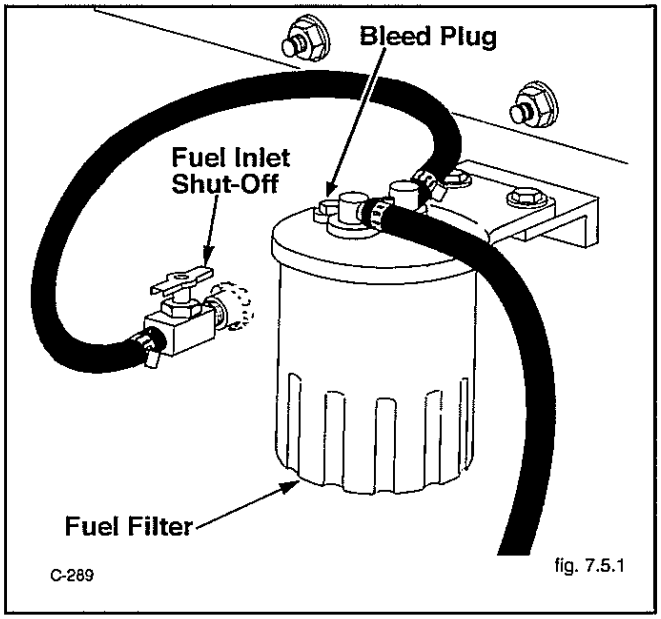


fig. 7.5.1

7.5.2 REMOVING AIR FROM FUEL SYSTEM

Air must be removed from the fuel, after replacement of the fuel filter element, or when the tank has been run out of fuel, before starting the engine. To remove air, ensure the fuel inlet shut-off located on the side of the fuel tank is open. Place the throttle at idle and open the bleed valve (Fig. 7.5.2a) on top of the injector pump. Turn the engine over with the starter. When the engine starts and runs smoothly, close the valve.

WARNING

To prevent personal injury never add fuel to the loader when the engine is running or is hot. NO SMOKING.

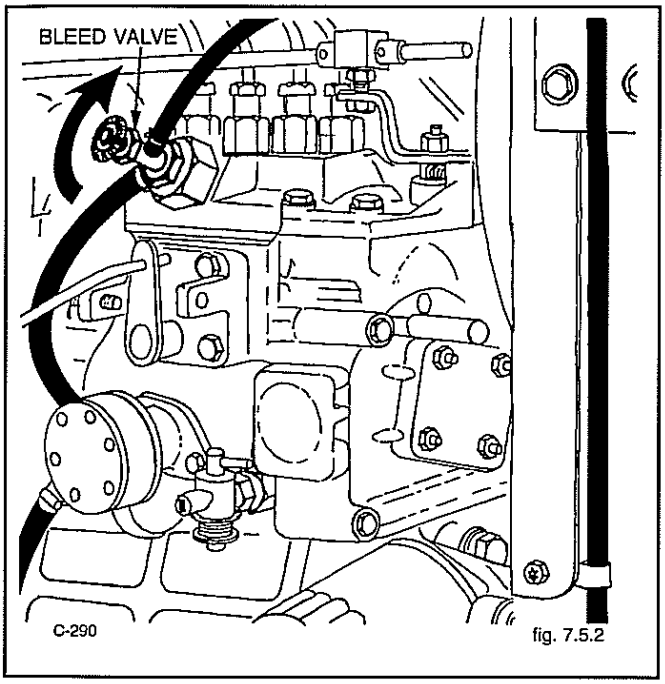


fig. 7.5.2

7.6 AIR INTAKE SYSTEM

7.6.1 AIR FILTER MAINTENANCE

Daily Maintenance

Inspect the air cleaner service indicator (Fig. 7.6.1a) daily. If the indicator element shows red the filter element must be replaced.

Check all hose clamps for tightness and inspect the hoses for damage. Check the vacuator for damage.

Servicing Cleaner Element

To replace the air filter element; loosen the clamp assembly (Fig. 7.6.1a). Remove the dust cap assembly. Remove the baffle from the cup and empty. Remove the wing nut and filter.

With a damp cloth clean out the inside of the body. Inspect the seal on the new element for damage and install the element in the filter body. Be sure the wing nut securing the element is tight. Reinstall the baffle in the dust cup and install. Be sure the dust cup is sealed 360° around the air cleaner body. Reset the restriction indicator.

WARNING

To prevent personal injury, stop, cool and clean the engine of flammable materials before servicing. Never service or adjust machine with the engine running.

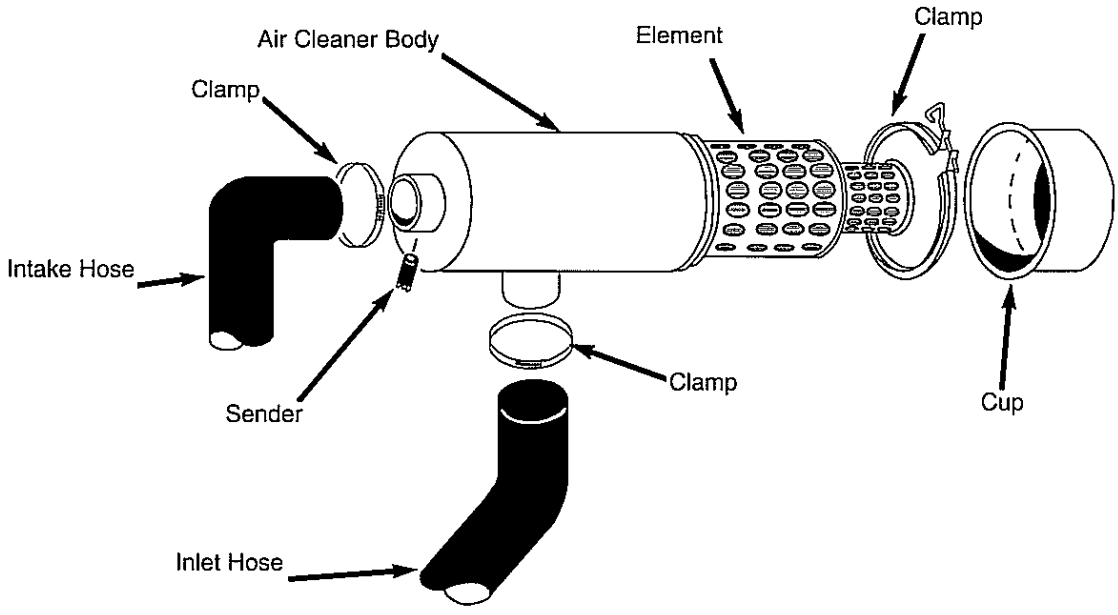


fig. 7.6

7 ENGINE

7.7 SPECIFICATIONS, SPECIAL TOOLS, TROUBLE SHOOTING

7.7.1 SPECIFICATIONS

Engine Model		V1903E
Number of cylinders		4
Horsepower		43HP (32Kw)
Bore X stroke		3.15 x 3.64 in. (80 x 92.4 mm)
Displacement		113.37 cu.in. (1857cc)
Max. torque		96ft.lbs.@1600 (13.25kgf.m.)
Compression ratio		23:1
Engine compression		427-469 PSI (30-33 kgf/cm. sq.)
Maximum high idle		2800
Low idle		875 + or - 25
Firing order		1-3-4-2
Cylinder arrangement		In-line vertical
Valve arrangement		Overhead
Muffler		Vertical (spark arrestor)
Cylinder Liners		
I.D. of cylinder liners	Std.	3.3465-3.3473 in. (85.000-85.022mm)
	Max.	+0.0059 in. (+0.15mm)
Cylinder Head		
Distortion (head warp)		3.9370 in. (100 mm)
Thickness of gasket		0.0512-0.0630 in. (1.3-1.6mm)
Thickness of gasket shims		0.0079 in. (0.2mm)
Top clearance		0.0276-0.0354 in. (0.7-0.9mm)
Cylinder head bolt & nut torque		54.2-57.9ft.lbs. (73.5-78.4 N.m.)
Valves		
Valve seat width		0.0827 in. (2.1mm)
Valve seat angle		45d.
O.D. of valve stems (intake, exhaust)		0.3134-0.3140 in. (7.960-7.975 mm)
I.D. of valve guides (intake, exhaust)		0.3156-0.3161 in. (8.015-8.030 mm)
Clearance between valve	Std.	0.0016-0.0028 in. (0.04-0.07 mm)
stems and guides	Max.	0.0630 in. (1.6 mm)
Valve clearance (intake, exhaust)	Cold	0.0071-0.0087 in. (0.18-0.22 mm)
Valve Springs		
Free length	Std.	1.6417-1.6614 in. (41.7-42.2 mm)
	Min.	1.6220 in. (41.2 mm)
Fitted length		1.3839 in. (35.15 mm)
Load to compress	Std.	26.5 lbs. (12 kgf)
to fitted length	Min.	22.5 lbs. (10.2 kgf)
Squareness		0.0394 in. (1.0mm)
Valve Rocker Arms		
O.D. of rocker arm shafts		0.5501-0.5506 in. (13.973-13.984 mm)
I.D. of rocker arm bushings		0.5513-0.5529 in. (14.002-14.043mm)
Clearance between rocker	Std.	0.0007-0.0028 in. (0.018-0.070 mm)
arm shafts and bushings	Max.	0.0059 in. (0.15 mm)
Adjustment of compression release		0.0295-0.0443 in. (0.750-1.125 mm)
Camshaft		
O.D. of camshaft bearing journal		1.5722-1.5728 in.(39.934-39.950 mm)
I.D. of camshaft bearing		1.5748-1.5758 in. (40.000-40.025 mm)
Clearance between camshaft bearing	Std.	0.0020-0.0036 in. (0.050-0.091 mm)
journals and bearings	Max.	0.0059 in. (0.15 mm)
Alignment of camshaft	Max.	0.0020 in. (0.05mm)

Camshaft (cont.)		
Cam height	Std. (intake)	1.3.14 in. (33.36 mm)
	Min. (intake)	1.3114 in. (33.31 mm)
	Std, (exhaust)	1.3134 in. 33.36 mm)
	Min. (exhaust)	1.3114 in. (33.31 mm)
Gear backlash	Std.	0.0017-0.0045 in. (0.042-0.115 mm)
	Max.	0.0059 in. (0.15 mm)
Piston Rings		
(Top ring, 2nd ring)	Std.	0.0118-0.0177 in. (0.30-0.45 mm)
Ring Gap	Max.	0.0492 in. (1.25 mm)
(Oil ring)	Std.	0.0098-0.0177 in. (0.25-0.45 mm)
	Max.	0.0492 in. (1.25 mm)
Side clearance	(top ring)	-
of ring in groove	(2nd ring)	0.0037-0.0047 in.(0.093-0.120 mm).
	(Oil ring)	0.0008-0.0020 in. (0.020-0.052 mm)
Oversizes of piston ring		0.0197 in. (0.5mm)
Pistons		
I.D. of piston	Std.	0.9055-0.9060 in. (23.000-23.013 mm)
bosses	Max.	0.9076 in. (23.053 mm)
O.D. of piston pin		0.9056-0.9059 in. (23.002-23.011 mm)
I.D of connecting rod small end bushings (fitted)		0.9065-0.9071 in. (23.025-23.040 mm)
Clearance between piston	Std.	0.0006-0.0015 in. (o.o14-0.038 mm)
pin and small end bushing	Max.	0.0059 in. (0.15mm)
Connecting rod	Std.	0.0008 in. (0.02 mm)
alignment	Max.	0.0020 in. (0.05 mm)
Crankshaft		
Crankshaft	Std.	0.008 in. (0.02 mm)
alignment	Max.	0.0031 in. (0.08 mm)
O.D. of crankshaft journals		2.0441-2.0449 in. (51.921-51.940 mm)
I.D. of crankshaft bearing 1		2.0465-2.0488 in. (51.980-52.039 mm)
I.D. of crankshaft bearing 2		2.0465-2.0482 in. (51.980-52.025 mm)
Clearance between	Std.	0.0016-0.0046 in. (0.040-0.118 mm)
crankshaft journals and bearing 1	Max.	0.0079 in. (0.20 mm)
Clearance between	Std.	0.0016-0.0041 in. (0.040-0.104 mm)
crankshaft journals and bearing 2	Max.	0.0079 in. (0.20 mm)
Undersizes of crankshaft bearing 1		0.0079-0.0157 in. (0.2-0.4 mm)
Undersizes of crankshaft bearing 2		0.0079-0.0157 in. (0.2-0.4 mm)
O.D. of crankpins		1.7307-1.7313 in. (43.959-43.975 mm)
I.D. of crankpin bearings		1.7327-1.7343 in. (44.010-44.052 mm)
Clearance between crank-	Std.	0.0014-0.0037 in. (0.035-0.093 mm)
pins and bearings	Max.	0.0079 in. (0.20 mm)
Undersizes of crankpin bearings		0.0079 in. (0.2 mm) 0.0157 in. (0.4 mm)
End play of crankshaft	Std.	0.0059-0.0122 in. (0.15-0.31 mm)
	Max.	0.0197 in. (0.5 mm)
Oversizes of crankshaft side metal 1.2		0.0079 in. (0.2 mm) 0.0157 in. (0.4 mm)
Fuel Injection Nozzels		
Opening pressure		1990.8-2133.0 lb./sq.in. (140-150 kgf/cm.sq.)
Fuel tightness of nozzle valve seat		Dry nozzle at 1848.6-1990.8 lb./sq.in. (130-140 kgf/cm.sq.)

Injection Pump		
Fuel tightness of	Std.	8 seconds or more; initial pressure from 8532.0-711.0lb./sq.in. (600-500 kgf/cm. sq.)
plunger	Min.	4 seconds or less
Fuel tightness of	Std.	10 seconds or more; initial pressure from 1422.0-71.1 lb./sq.in.
delivery valve	Min.	5 seconds or less
Injection timing		23d.-25d. before TDC
Oil Pump		
Oil pressure	Std.	42.7-64.0 lb./sq.in. (3.0-4.5 kgf/cm.sq.)
(normal running)	Min.	35.6 lb./sq.in. (2.5 kgf/cm.sq.)
Rotor lobe clearance	Std.	0.0016-0.0051 in.(0.04-0.13 mm)
	Max.	0.0079 in. (0.20 mm)
Rotor Type		
Radial clearance between	Std.	0.0043-0.0075 in. (0.11-0.19 mm)
outer rotor and pump body	Max.	0.0098 in. (0.25 mm)
End clearance between	Std.	0.0041-0.0059 in. (0.105-0.150 mm)
rotor and cover	Max.	0.0079 in. (0.2 mm)
Radiator		
Opening pressure of cap		12.8 lb./sq.in. (0.9 kgf/cm.sq.)
Test pressure		12.8 lb.sq. in. (0.9 kgf/cm.sq.)
Thermostat		
Opening	(beginning)	176.9d. F-182.3d.F (80.5d. C-83.5d. C.)
temperature	(full open)	203d. F (95d. C)
Distance of lift		0.3150 in. (8 mm)
Fanbelt		
Belt sag under load of 13.2-15.4 lb. (6-7 kgf)		0.2756-0.3543 in. (7-9 mm)
Alternator		
Output currecnt		25 A/14 V/4000 rpm
Total resistance of rotor coil, measured between terminal "F" and "E"	Std.	6
	Max.	10
Brush length	Std.	0.6102 in. (15.5 mm)
	Min.	0.4055 in. 10.3 mm)
Regulator		
Cut-in voltage		4.5-5.8 V
No-load regulating voltage		13.8-14.8 V
Resistance between terminals:		
"IG" and "F" with open contacts		0
"IG" and "F" with contacts		approximately 11
"L" and "E" with open contacts		0
"L" and "E" with contacts		approximately 100
"N" and "E"		approximately 23
"B" and "E" with open contacts		infinity
"B" and "L" with contacts		0
Point Gap		0.0118-0.0177 in. (0.3-0.45 mm)
Starter Motor		
No load test	Current	90A or less
	Voltage	11.5 V
	Speed	3500 rpm or more
O.D. of commutator	Std.	1.1811 in. (30.0 mm)
	Min.	1.1417 in. (29.0 mm)

Mica undercutting	Std.	0.0197-0.0354 in. (0.5-0.9 mm)
	Min.	0.0079 in. (0.2 mm)
Brush Length	Std.	0.7480 in. (19 mm)
	Min.	0.5000 in. (12.7 mm)
Glow Plug		
Resistance		approximately 1.5

7.7.2 TORQUE SPECIFICATIONS

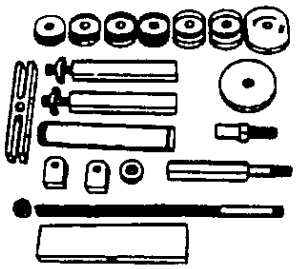
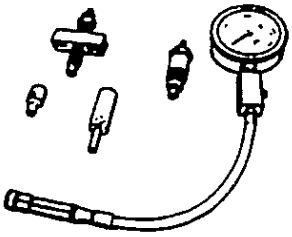
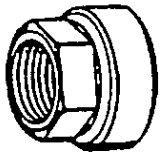
Bolt Torques

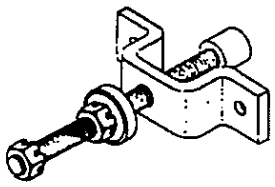
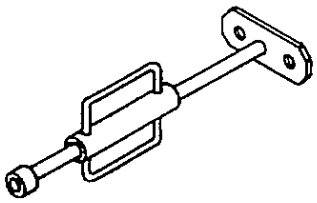
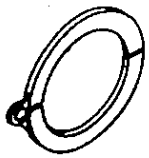
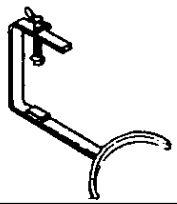
Material Grade	Standard Bolt	Special Bolt	Special Bolt
Nominal Dia.	SS41; S20C	S43C,S48C (Refined)	SCR3, SCM3 (Refined)
M6	7.8-9.3N.m.	9.8-11.3 N.m.	12.3-14.2 N.m.
	0.80-0.95 kgf/m	1.00-1.15kgf/m	1.25-1.45 kgf/m
	5.8-6.9 lb. ft.	7.2-8.3 lb. ft.	9.0-10.5 lb. ft.
M8	17.7-20.6 N.m.	23.5-27.5 N.m.	29.4-34.3 lb.ft.
	1.80-2.10 kgf/m	2.40-2.80 kgf/m	3.00-3.50 lb.ft.
	13.0-15.2 lb.ft.	17.4-20.3 lb. ft.	21.7-25.3 lb. ft.
M10	39.2-45.1 N.m.	48.0-55.9 N.m	60.8-70.6 N.m.
	4.00-4.60 kgf/m	4.90-5.70 kgf/m	6.20-7.20 kgf/m
	28.9-33.3 lb. ft.	35.4-41.2 lb. ft.	44.8-52.1 lb. ft.
M12	62.8-72.6 N.m.	77.5-90.2 N.m.	103.0-117.7 lb. ft.
	6.40-7.40 kgf/m	7.90-9.20 kgf/m	10.50-12.00 kgf/m
	46.3-53.5 lb.ft	57.1-66.5 lb. ft.	75.9-86.8 lb. ft.
M14	107.9-125.5 N.m.	123.6-147.1 N.m.	166.7-196.1 N.m.
	11.00-12.80 kgf/m	12.60-15.00 kgf/m	17.00-20.00 kgf/m
	79.6-92.6 lb. ft.	91.1-108.5 lb. ft.	123.0-144.7 lb. ft.
M16	166.7-191.2 N.m.	196.1-225.5 N.m.	259.9-304.0 N.m.
	17.00-19.50 kgf/m	20.00-23.00 kgf/m	26.50-31.00 kgf/m
	123.0-141.0 lb.ft.	144.7-166.4 lb.ft.	191.7-224.2 lb. ft.
M18	245.2-284.4 N.m.	274.6-318.7 N.m.	343.2-402.0 N.m.
	25.00-29.00 kgf/m	28.00-32.50 kgf/m	35.00-41.00 kgf/m
	180.0-209.8 lb.ft.	202.5-235.1 lb. ft.	253.2-296.5 lb. ft.
M20	333.4-392.2 N.m.	367.7-431.5 N.m.	490.3-568.7 N.m.
	34.00-40.00 kgf/m	37.50-44.00 kgf/m	50.00-58.00 kgf/m
	245.9-289.3 lb. ft.	271.2-318.2 lb. ft.	361.6-419.5 lb. ft.

Bolt material grades are shown by numbers punched on the bolt heads. Prior to tightening, be sure to check out the numbers as shown below:

Punched Number	Bolt Material Grade
None	Standard Bolts SS41, S20C
7	Special Bolts S43C, S48C (Refined)
9	Special Bolts SCM3, SCR3 (refined)

7.7.3 SPECIAL TOOLS

Order No.	Illustration	Description	Model Usage
KTST10050 Th. No. 25197		Dry liner puller - Used for removing and installing the dry liner of the engine. Consists of: 304742 (64mm); 304743 (68mm); 304744 (75mm); 304745 (76mm); 304746 (82mm); 304747 (105mm); Removing Plates; 304748 Installing Plate	All Models
KTST10060 Th. No. 25198		Diesel engine compression tester-Used to measure diesel engine compression and diagnosis of need for major overhaul.	All Models
KTST10070 Th, No. 25199		Crankshaft nut socket-Used to take off and fix the crankshaft nut (46mm)	All Models
KTST20030 Th. No. 25201		Nozzle removal socket-Used in place of a vice for disassembly and repair of nozzle	All Models
Th. No. 960456		Hydraulic flow and pressure gauge assembly.	All Models

Order No.	Illustration	Description	Model Usage
955280		Axle Installation Tool-To install axle in final drive housing. Qty.-1	T103 T133 T133'S'
955281		Seal Installation Tool-To install axle seal in final drive housing. Qty-3 required	T103 T133 T133'S'
955283 960475		Axle Extraction Tool-To remove axle from final drive housing. Qty-1	T103 T133 T133'S' T173HL T173HL'S' T203HD T233HD
955287		Seal Installation Tool-To install axle seal in final drive housing. Qty- 1	T173 T233
957189		Seal Installation Tool-To install axle seal in final drive housing.	T173HL T173HL'S' T203HD T233HD
960997		Chain Tension Tool-To check chain tightness.	T103 T133 T133'S'
U-1288	Universal Tool Kit	1 each. Combination wrench 1/2", 9/16", 7/16", 1 1/4", 1 1/16", 3/4", 11/16". Sockets, 1" 1/2" drive, 7/8" 1/2" drive, tool punch, allen wrench 5/32" and 1/8".	All Models

7.7.4 TROUBLESHOOTING
Engine

Condition	Possible Causes
ENGINE DOES NOT DEVELOP FULL POWER	1. Clogged air cleaner. 2. Fuel line obstruction. 3. Improper injection timing. 4. Improper nozzle injection pressure and angle. 5. Low cylinder compression. 6. Insufficient fuel injection. 7. Improper valve lash adjustment. 8. Burned, worn or sticking valves. 9. Blown head gasket. 10. Worn or sticking piston ring.
LOW CYLINDER COMPRESSION	1. Burned, worn or sticking valves. 2. Bent valve stem. 3. Broken or weak valve spring. 4. Blown cylinder head gasket. 5. Worn or sticking piston ring. 6. Scored piston. 7. Improper valve lash adjustment.
POOR ENGINE IDLING	1. Improper injection timing. 2. Air in injection pump. 3. Improper governor adjustment.
ENGINE KNOCKS	1. Diluted or thin oil. 2. Insufficient oil supply. 3. Low oil pressure. 4. Worn crankshaft thrust bearing. 5. Excessive flywheel runout. 6. Excessive connecting rod or main bearing clearance. 7. Seized bearing. 8. Clogged oil passages. 9. Bent or twisted connecting rod. 10. Crankshaft journals out-of-round. 11. Excessive piston-to-cylinder bore clearance. 12. Excessive piston ring side clearance. 13. Broken or damaged rings. 14. Excessive piston pin clearance. 15. Seized piston. 16. Piston pin retainer loose or missing. 17. Improper valve lash adjustment. 18. Worn valve lifter. 19. Excessive timing gear backlash. 20. Low cylinder compression. 21. Improper injection timing. 22. Improper nozzle injection pressure and angle.
LOW OIL PRESSURE	1. Engine oil level low. 2. Wrong grade of oil. 3. Clogged oil pump filter. 4. Faulty oil pressure relief valve. 5. Worn oil pump drive shaft or gears, or broken oil pipe. 6. Excessive main or connecting rod bearing clearances.

Condition	Possible Causes
OIL PRESSURE WARNING LIGHT FAILS TO OPERATE	1. Bulb burned out. 2. Oil pressure sensor is faulty. 3. Warning light circuit faulty.
EXCESSIVE OIL CONSUMPTION	1. Engine oil level is too high. 2. Leakage in the cylinder head gasket. 3. Oil loss past the piston and rings. 4. Worn, broken, or sticking piston rings. 5. Clogged return hole of oil ring. 6. Worn valves and/or valve guides or worn seals. 7. Leakage past oil seals and gaskets. 8. External oil leaks from the engine.
ENGINE OVERHEATS	1. Insufficient amount of coolant in the radiator. 2. Hose connection leaking or collapsed hose. 3. Radiator leakage. 4. Loose, worn, or broken V-belt. 5. Radiator fins bent or clogged. 6. Radiator cap not sealed. 7. Thermostat operating improperly. 8. Insufficient amount of engine oil. 9. Water pump operating improperly. 10. Improper valve clearance. 11. Restriction in the exhaust system. 12. Improperly installed cylinder head gasket. 13. Rust and/or scale clogged water ports. 14. Extended engine idling.
EXCESSIVE FUEL CONSUMPTION	1. Improper injection timing. 2. Leakage at the injection pipe connectors. 3. Leakage at the fuel shut-off valve. 4. Improperly adjusted nozzle.
TEMPERATURE GAUGE FAILS TO REACH NORMAL OPERATING TEMPERATURE	1. Faulty temperature sender. 2. Faulty thermostat. 3. Faulty temperature gauge.
EXCESSIVE EXHAUST SMOKE	1. Air cleaner dirty or restricted. 2. Excessive fuel delivery. 3. Low cylinder pressure.
EXCESSIVE OIL CONSUMPTION	1. Engine oil level too high. 2. External oil leaks from engine. 3. Worn valves, valve guides or seals. 4. Head gasket not sealing. 5. Oil loss past the pistons and rings.
ENGINE STOPS WHILE OPERATING	1. Lack of fuel in fuel tank. 2. Clogged fuel filter. 3. Air mixed in the fuel system. 4. Faulty component.
UNDESIRABLE EXHAUST (WHITE OR PALE)	1. Excess engine oil. 2. Improper lubricating oil viscosity. 3. Faulty injection timing.

Condition	Possible Causes
UNDESIRABLE EXHAUST COLOR (BLACK OR LIGHT GREY)	1. Unsuitable fuel. 2. Excess injection. 3. Faulty engine component. 4. Overloading. 5. Clogged air cleaner. 6. Low cylinder pressure. 7. Clogged air cleaner.
ENGINE DOES NOT START	1. Faulty starter switch. 2. Insufficient charging or complete discharging of the battery. 3. Lack of fuel. 4. Air mixed in the fuel system. 5. Clogged fuel filter. 6. Irregular or faulty fuel supply. 7. Glow plug not heating. 8. Improper lubricating oil viscosity. 9. Clogged air cleaner. 10. Faulty starter motor. 11. Main shift lever is not in the neutral position.

COOLING SYSTEM

Condition	Possible Causes
HIGH TEMPERATURE INDICATION- OVERHEATING	1. Coolant level low. 2. Fan belt loose. 3. Radiator hose(s) collapsed. 4. Radiator blocked to airflow. 5. Faulty radiator cap. 6. Tractor overloaded. 7. Idle speed low. 8. Air trapped in cooling system. 9. Incorrect cooling system component(s) installed. 10. Faulty thermostat. 11. Water pump shaft broken or impeller loose. 12. Radiator tubes clogged. 13. Cooling system clogged. 14. Casting flash in cooling passages. 15. Brakes dragging. 16. Excessive engine friction. 17. Anti-freeze concentration too high, over 68%. 18. Missing air seals. 19. Faulty gauge or sending unit. 20. Loss of coolant flow caused by leakage or foaming.
LOW TEMPERATURE INDICATION- UNDERCOOLING	1. Therostat stuck open. 2. Faulty gauge or sending unit.
COOLANT LOSS- BOIL OVER	Refer to Engine Overheating Causes in addition to the following: 1. Overfilled cooling system. 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.

Condition	Possible Causes
COOLANT LOSS- BOIL OVER	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 down. 7. Belt alignment.
TEMPERATURE LAMP ON OR GUAGE 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.

DIESEL FUEL SYSTEMS

CONDITION	CAUSE	REMEDY
FUEL NOT REACHING INJECTION PUMP	1. Fuel shut off valve closed. 2. Restricted fuel filters. 3. Air in system. 4. Fuel leakage.	1. Check that the fuel shut off valve at the fuel tank is on the "On" position. 2. Check and flush the fuel filter clean. 3. Bleed the fuel system. 4. Check the fuel lines and connectors for damage.
FUEL REACHING NOZZLES BUT ENGINE WILL NOT START	1. Low cranking speed. 2. Incorrect throttle adjustment. 3. Incorrect pump timing. 4. Fuel leakage. 5. Faulty injectors. 6. Low compression.	1. Check the cranking speed. 2. Check the throttle control rod travel. 3. Check the pump timing. 4. Check the fuel lines and connectors for leakage. 5. See injection trouble shooting. 6. Check the engine compression.
ENGINE HARD TO START	1. Low cranking speed. 2. Incorrect pump timing. 3. Restricted fuel filter. 4. Contaminated fuel. 5. Low compression. 6. Air in system.	1. Check the cranking speed. 2. Check the pump timing. 3. Check and flush the fuel filter clean. 4. Check for water in the fuel. 5. Check the engine compression. 6. Check for air leaks on the suction side of the system.
ENGINE STOPS AND STARTS	1. Fuel starvation. 2. Contaminated fuel. 3. Restricted air intake. 4. Engine overheating. 5. Air in system.	1. Check and flush clean restricted fuel lines or fuel filter. 2. Check for water in the fuel. 3. Check for restrictions in the air intake. 4. Check cooling system. 5. Check for air leaks on the suction side of the system.
ERRATIC ENGINE OPERATION(SURGE, MISFIRING,POOR GOVERNOR REGULATION)	1. Fuel leakage. 2. Fuel starvation. 3. Incorrect pump timing. 4. Contaminated fuel. 5. Air in system. 6. Faulty or sticking injector nozzles. 7. Incorrect engine timing.	1. Check the injector lines and connectors for leakage. 2. Check and flush clean retricted fuel lines or filters. 3. Check the pump timing. 4. Check for water in the fuel. 5. Bleed the fuel system. 6. See injector trouble shooting. 7. Check for faulty engine valves.
ENGINE DOES NOT DEVELOP FULL POWER OR SPEED	1. Incorrect throttle adjustment. 2. Incorrect maximum no-load speed. 3. Fuel starvation. 4. Air in system. 5. Incorrect timing. 6. Low compression. 7. Incorrect engine timing.	1. Check for insufficient throttlr control movement. 2. Check maximum no-load speed adjustment. 3. Check and flush clean restricted fuel lines and filters. 4. Check for air leaks on the suction side of the system. 5. Check pump timing. 6. Check engine compression. 7. Check for improper valve adjustment or faulty valves.

CONDITION	CAUSE	REMEDY
ENGINE EMITS BLACK SMOKE	1. Restricted air intake. 2. Engine overheating. 3. Incorrect timing. 4. Faulty injectors. 5. Low compression. 6. Incorrect engine timing.	1. Check for a restricted air intake. 2. Check cooling system. 3. Check the pump timing. 4. See injection trouble shooting. 5. Check the engine compression. 6. Check the engine valves.
PUMP FAILS TO DELIVER FUEL TO ALL INJECTORS	1. Blocked fuel lines to pump. 2. Air in fuel lines to injectors. 3. Control rod seized in OFF position.	1. Remove fuel lines and flush or replace. 2. Bleed fuel lines. 3. Repair or replace control rod.
PUMP FAILS TO DELIVER FUEL TO ONE INJECTOR	1. Air in fuel line to injector. 2. Plunger spring broken. 3. Plunger seized. 4. Delivery valve seized. 5. Badly scored plunger and barrel.	1. Bleed fuel line. 2. Replace spring. 3. Repair or replace barrel and plunger ass'y. 4. Repair or replace delivery valve. 5. Replace barrel and plunger assembly.
GOVERNOR FAILS TO MAINTAIN MAXIMUM OR MINIMUM NO-LOAD FUEL DELIVERY.	1. Control spring broken. 2. Governor weights seized. 3. Governor weight carrier broken. 4. Thrust pad seized. 5. Cross-shaft bolt broken or missing. 6. Pump link spring broken.	1. Replace control spring. 2. Repair or replace weight assembly and/or camshaft. 3. Replace weight assembly. 4. Replace thrust pad and/or camshaft. 5. Replace bolt. 6. Replace spring.

FUEL INJECTORS

CONDITION	CAUSE	REMEDY
NOZZLE DOES NOT "BUZZ" WHILE INJECTING.	1. Needle valve stuck. 2. Leakage. 3. Nozzle damaged.	1. Check needle valve is clean and not binding. 2. Check valve seat is not leaking. 3. Examine nozzle retaining cap for damage.
NOZZLE LEAK-BACK.	1. Needle valve worn. 2. Blocked nozzle assembly. 3. Loose nozzle retaining nut.	1. Replace nozzle assembly. 2. Check for carbon or foreign matter on faces of nozzle and nozzle holder. Flush clean or replace. 3. Inspect faces and tighten nozzle retaining nut.
NOZZLE OPENING PRESSURE INCORRECT	1. Incorrectly adjusted nozzle retaining nut. 2. Damaged nozzle or seized needle valve. 3. Blocked nozzle orifice.	1. Check adjusting nut for looseness and re-set. 2. Replace nozzle assembly. 3. Check nozzle orifice for carbon or foreign matter. Flush clean or replace.
NOZZLE SEAT LEAKAGE.	1. Nozzle incorrectly seated. 2. Sticking or binding needle valve.	1. Check for carbon or foreign matter on faces of nozzle or nozzle holder. 2. Repair or replace nozzle assembly.
SPRAY PATTERN DISTORTED.	1. Obstructed needle valve. 2. Obstructed needle valve orifice. 3. Damaged nozzle or needle valve.	1. Check for carbon or foreign matter on needle valve tip. Flush clean or replace nozzle assembly. 2. Check for carbon in orifice. Flush clean or replace nozzle assembly. 3. Replace nozzle assembly.

MAINTENANCE/SPECIFICATIONS 8

8 MAINTENANCE

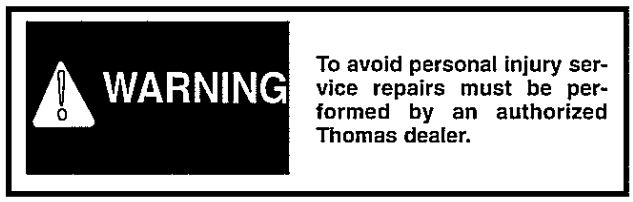
8.1 PREVENTIVE MAINTENANCE SCHEDUAL

ITEM	SERVICE REQUIRED	8 HOURS	50 HOURS	150 HOURS	400 HOURS	1000 HOURS
Engine Oil	Check level and add if necessary. Use 10W30 API Classification SE/CD oil.	■				
Radiator	Check level and add if necessary. Fill with 50% mixture of ethylene glycol and water. Check cooling fins for dirt. If necessary blow out with compressed air. Check rubber seal around radiator baffle.	■				
Hydraulic Oil	Check level and add if necessary. Use 10W30 API Classification SE/CD oil.	■				
Oil Cooler	Check cooling fins for dirt. If necessary blow out with compressed air.	■				
Air Cleaner	Empty dust cap. Check condition indicator and service or replace element as required.	■				
Tires and Wheel Nuts	Check for low pressure or tire damage. Inflate standard tires 50 PSI (345 KPa), flotation tires 30-35 PSI (207-241 KPa). Check wheel nut torque 100-110 ft. lbs. (136-149 N.M.)	■				
Safety Equipment	Check all safety equipment for proper operation and condition. Seat belt,boom locks,quick-tach support,parking brake,steering,seat bar, seat switch and foot pedal locks, safety treads, front shield,and cab side screens. If necessary lubricate foot pedal and steering control linkages, springs and shafts. If necessary repair or replace.	■				
Final Drive	Check chain and sprocket condition. Check every 150 hours.	■				
Decals	Check for damaged safety or instruction decals (see section 8.5). If necessary replace.	■				
Lubrication	Grease all hinge pin fittings until excess shows.	■				
Engine Oil	Replace engine oil. Use 10W30 API Classification SE/CD oil. Initial change only.		■			
Engine Oil Filter	Change engine oil filter element. Initial change only.		■			
Hydraulic Oil Filter	Change hydraulic oil filter element. Initial change only.		■			
Muffler	Check the muffler for carbon buildup and plugging. If necessary clean. Check every 100 hours.		■			
Safety System Linkages and Springs	Check and if necessary adjust. Lubricate lock springs, shaft and linkage.		■			
50 Hour Service	Perform complete 50 hour service (see 8.2).		■			
Engine Oil	Replace engine oil. Use 10W30 API Classification SE/CD oil. Replace every 75 hours.			■		
Engine Oil Filter	Replace engine oil filter. Replace every 150 hours.			■		
Hydraulic Oil Filter	Replace hydraulic oil filter element.			■		
Preventative Maintenance Service Check	It is recommended as a preventative maintenance procedure that the 50 hour service be repeated every 150 hours. (See section 8.2)			■		

8 MAINTENANCE

ITEM	SERVICE REQUIRED	8 HOURS	50 HOURS	150 HOURS	400 HOURS	1000 HOURS
Final Drive	Check Chain and Sprocket Condition.			■		
Engine Fuel Filter	Replace engine fuel filter.				■	
Hydraulic Oil	Change hydraulic oil. Replace with 10W30 A.P.I. Classification SE/CD oil.					■
Final Drive	Change final drive lubricating oil. Use 10W30 A.P.I. Classification SE/CE oil.					■
Engine Cooling System	Drain, flush and refill. Use 50% mixture of ethylene glycol and water.					■
Hydraulic Reservoir Filters	Remove and replace the 100 micron suction element in the oil reservoir.					■

NOTE: For complete engine service details refer to the engine manufacturers service manual.



8 MAINTENANCE

8.2 50 HOUR SERVICE CHECK

The following service check is to be performed by your dealer after the first 50 hours of operation.

1 Engine

1.1 Oil Filter:
Change the engine oil filter. Use only original replacement parts. Change the oil filter every 150 hours.

1.2 Engine Oil:
Change the engine oil. Use only 10W30 API classification SE/CD oil. Change engine oil every 75 hours.

1.3 Coolant Level:
Check that the coolant is to the proper level. The cooling system is filled with a 50% mixture of ethylene glycol and water.

1.4 Radiator for Leakage and Dirt:
If necessary flush the radiator with compressed air. A dirt buildup on the radiator cooling fins can cause both engine and hydraulic system overheating. Check rubber gasket on radiator baffle.

1.5 Fan Belt Tension and Condition:
Check fan belt for cuts or wear, if necessary replace. Check tension and adjust.

1.6 Fuel System for Leaks:
Make a visual inspection of fuel system for leaks and potential hazards such as fuel lines touching exhaust manifold, flywheel, etc. Replace fuel filter every 400 hours.

1.7 Air Intake and Cleaner System:
Visually inspect the air cleaner system and be sure all hose clamps are secure. Check that the filter indicator is not indicating that filter service is required.

1.8 Exhaust System:
Visually inspect the exhaust system and ensure all clamps are secure and the manifold bolts/nuts are tight.

1.9 Engine Speed:
Check and if necessary adjust engine RPM maximum no load high idle.

WARNING

To prevent personal injury stop, cool and clean the engine of flammable materials before servicing. Never service or adjust machine with the engine running.

1.10 Muffler:
Check muffler for carbon and soot buildup and plugging. If necessary clean.

2 Hydraulic/Hydrostatic

2.1 Hydraulic Oil Filter:
Change the hydraulic oil filter. Change the hydraulic filter every 150 hours after the initial change. Lubricate the filter cartridge seal with system fluid.

2.2 Hydraulic Oil Level:
If oil is visible in the oil level sight glass the level is satisfactory. If additional oil is required use only 10W30 API classification SE/CD oil. Fill to the top or maximum check point.

2.3 Hoses and Pipes:
Make a visual inspection of all hydraulic lines and fittings for leaks. Check that steel lines do not touch one another.

2.4 Cylinders:
Inspect cylinders for leaks. Extend cylinders and check for rod damage.

2.5 Hydraulic Functions:
Check that the following operate properly: control valve float position, auxiliary hydraulic detent, hydraulic cylinders.

2.6 Pumps and Motors, Leakage:
Inspect pumps and motors for leaks.

2.7 Oil Cooler:
Inspect the oil cooler for leaks, fin damage or clogged with dirt. If necessary flush with compressed air.

WARNING

To prevent personal injury never repair or tighten hydraulic hoses or fittings with the engine running or the system under pressure.

3 Final Drive

3.1 Oil Level:
Check lubricating oil level. If necessary add 10W30 API classification SE/CD oil.

3.2 Drive Chain Condition:
Check drive chains for any sign of wear or damage. Check lubrication oil in housing for signs of contamination.

8 MAINTENANCE

IMPORTANT

Keep the rear door closed except for servicing. Make sure the door is closed and latched before operating the loader.

3.3 Hydrostatic Motor Mounting Bolts:
Check torque 85-90 ft.lbs. (115-122 N.M.)

3.4 Axle Bearing End Play:
Axle bearings are preloaded and must have no end play. Inspect and adjust if necessary.

4 Controls and Safety Equipment

4.1 Control Levers, Operation and Linkage:
Check that the steering levers operate freely without binding, they return to neutral when released and the machine travels in a straight line with both levers in forward position. Ensure control levers lock in neutral with seat bar up. Lubricate linkage.

4.2 Foot Pedals, Operation and Linkage:
Check that the foot pedals operate freely without binding. Before leaving the operator seat, ensure the pedals are locked, raise the safety bar and unbuckle the seat belt, to test the seat switch, grasp the seat bar and raise your weight off the seat and check pedals at the same time to ensure they are locked. Lubricate linkage.

4.3 Engine Throttle Control:
Check that the throttle control operates freely without binding or slackening off due to vibration.

4.4 Parking Brake:
Check that the parking brake engages and completely disengages. Park brake automatically engages with the seat bar up.

4.5 Boom Supports:
Check that the boom supports operate without binding.

NOTE: Ensure the boom supports are fully retracted before raising or lowering the boom.

4.6 Quick-Tach, Operation and Linkage:
Ensure the quick-tach linkage operates smoothly without binding and the safety locks engage completely.

4.7 Seat Belt:
Check seat belt condition. If necessary replace. For your safety, the loader is equipped with electrically activated safety devices through the seat and seat belt.

5 Electrical

5.1 Battery:
Maintenance free.

5.2 Battery Terminals:
Check battery terminals for corrosion. If necessary clean.

5.3 Operation of Starter:
Engage and disengage the starter several times to ensure it is working properly. To prevent starter damage do not engage for more than 15 seconds. Allow 1 minute between starting attempts for cooling the starter.

5.4 Operation of Electrical Equipment:
Make a complete check of all electrical equipment, guages, warning devices, pre-heat indicator, work lights, seat switch and belt and all optical equipment to ensure they are operating correctly.

WARNING

To avoid personal injury stop the engine, engage the parking brake, and cycle the foot pedals to ensure they are locked before getting out of the loader.

6 Grease/Lubrication

Lubricate the following points with a good quality grease. Numbers marked ( ) indicate the number of fittings at each location.
Rear Boom Pivots (2)
Boom Cylinder Bushings (4)
Bucket Cylinder Bushings (4)
Engine Universal Joint (2)
Boom Supports (2)
Quick-Tach Pivot (3)

7 General

7.1 Tire Pressure:
Check the pressure and if necessary inflate to the following pressure:

7.00 x 15	50 PSI (345 KPa)
10.00 x 16.5	30-35 PSI (207-241 KPa)
12.00 x 16.5	30-35 PSI (207-241 KPa)

Flotation tires may be inflated to 50 PSI (345 KPa) on hard flat surfaces.

7.2 Wheel Nut Torque:
Check and torque wheel nuts to 100-110 ft. lbs. (136-149 N.M.)

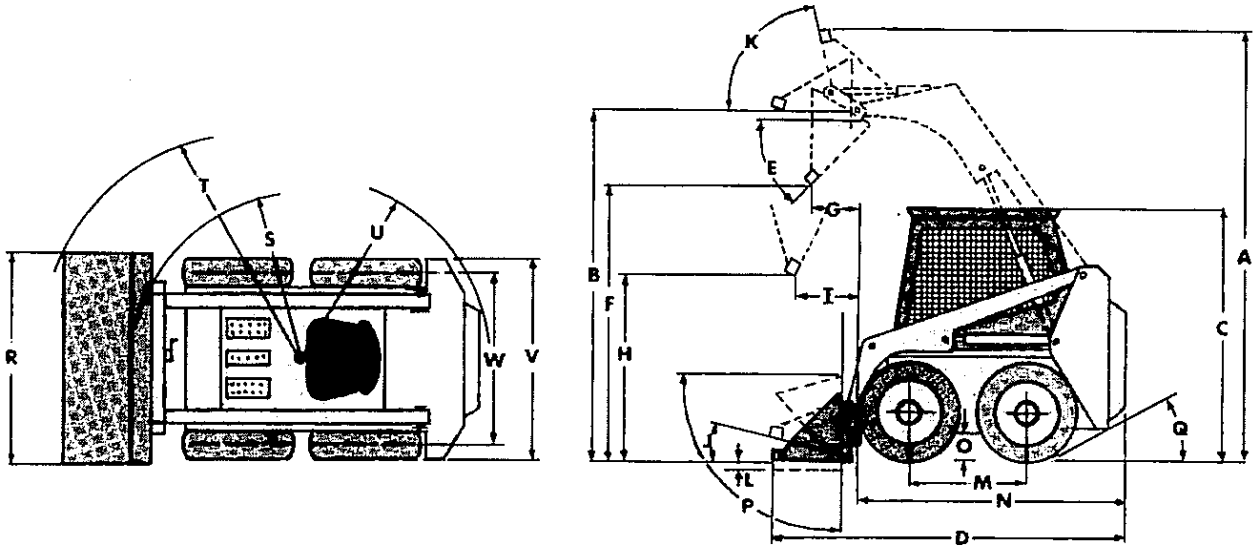
7.3 Condition of Cab:
Inspect both the seat and seat belt. Ensure all safety and instruction decals are in place. Inspect sound insulation, side windows and door operation for machines equipped with cab enclosure kits.

7.4 Condition of Shields and Safety Equipment:
Inspect and ensure all shields are in place and securely fastened. Inspect and ensure all safety equipment is working properly. Ensure owners and operators manual, safety manual and all safety and instruction decals are in place. If necessary replace. If the safety controls are malfunctioning or require adjustment consult your Thomas Equipment Dealer for service.

7.5 General Condition:
Make a general inspection of the machine looking for loose or missing parts, oil leaks, etc.

8 MAINTENANCE

8.3 Loader Specifications:



C-400

fig. 8.3

Dimensions (With Standard Tires & Dirt Bucket)

A. Overall operating height.....136.25" (3461)
B. Height to hinge pin.....109" (2769)
C. Overall vehicle height.....73" (1854)
D .Overall length with bucket.....125.5" (3188)
E. Dump angle.....34°
F. Dump height.....88.25" (2242)
G. Reach-fully raised.....24.25" (597)
H. Height at 45° dump angle.....68" (1727)
I. Reach at 45° dump angle.....30.8" (781)
J. Maximum roll back at ground.....29°
K. Maximum roll back fully raised.....99°
M. Wheel base.....35" (889)
N. Overall length less bucket.....102.75" (2610)
O. Ground clearance.....6.5" (165)
P. Maximum grading angle-bucket.....88°
Q. Angle of departure.....27°
R. Bucket width.....54" (1372)
S. Clearance circle-front-less bucket.....47.25" (1200)
T. Clearance circle-front-with bucket.....70" (1778)
U. Clearance circle-rear.....61" (1549)
V. Overall width-less bucket.....53" (1346)
W. Tread.....46" (1168)

Operational:

Rated operating capacity.....1300lbs. (590 kg)
Tipping Capacity.....2600lbs. (1180 kg)
Hydraulic Pump Capacity.....15.8 GPM (59.7 L/M)
Operating weight.....4800lbs. (2177 kg)
Shipping weight.....4300lbs. (1950 kg)
Travel Speed.....0-6.2 mph (0-10 kp/h)

Controls

VEHICLE: Steering direction and speed controlled by two hand operated control levers.

HYDRAULICS: Boom lift, bucket tilt and auxiliary hydraulic functions controlled by separate foot pedals.
ENGINE: Hand lever throttle, engine stop and key type ignition switch.

Engine:

Make and model.....Kubota V1903E
Cylinders.....4
Cooling system.....Liquid
Displacement.....113.5 cu.in. (1861 cc)
Horsepower.....43 H.P. (32 Kw)
Torque.....89.1 ft. lbs. (12.3 Kg/m) @ 1600
Fuel.....Diesel, No. 2
Air Cleaner.....Replaceable, Dry Cartridge w/Indicator
Max. RPM (full load).....2800

Hydraulic System:

Pump type.....Gear
Capacity (at rated RPM and Pressure).....16.8 GPM (64 l/m)
Rated RPM.....2800
Rated pressure.....2450 PSI (148.2 bar)
Filtration.....10 Micron
Hydraulic fluid.....10W30 API Class SE, CD
Control Valve.....Series type with float on lift and detent on auxiliary
Oil Cooler.....440 BTU

Cylinders	Lift	Tilt
Type	Double acting	Double acting
Qty. per mach	2	2
Bore dia	2 in	2.5 in.
Rod dia	1.25 in	1.125 in.
Stroke	27.125 in	13.375 in

Hydrostatic Transmission & Final Drive:

Pump type.....Two in line, axial piston pumps
Pump displacement.....2.48 cu. in. (40.64 cu. cm.)
Motor type.....Geroler
Motor displacement.....29.9 cu.in. (489.9 cu.cm.)
System relief setting.....3750 PSI (258.5 bar)
Final drive.....Single roller chain running in oil bath to each axle
Drive chain size.....ASA 100

Electrical:

Alternator.....45 amp
Battery.....12 volt (group 24) 455 cranking amps, 140 amps reserve
Starter.....12 volt
Circuit breaker setting.....40 amp

Tires:

Standard.....7.00 x 15, 6 ply rating, 50 PSI (345 KPa)
Flotation.....10.00 x 16.5, 6 ply rating, 30-35 PSI (207-241 KPa)

Fluid Capacities:

Fuel tank.....16.8 GAL (63.5 L).....Diesel, No.2
Engine lubrication oil.....5.3 qts. (5 l).....10W30 API SE, CD
Final drive transmissions...8.5 qts (8 l).....10W30 API SE, CD
Hydraulic reservoir.....8 gal.(30.3 l).....10W30 API SE, CD
Engine cooling system.....3.2gal.(12 l).....50/50 water & ethylene glycol

8.4 TORQUE SPECIFICATIONS

Loader:
Wheel nuts (24).....100-110 ft.lbs. (136-139 N.M.)
Chain tightener adjuster nuts.(6).....150 ft.lbs. (203 N.M.)
Torque motor drive sprocket (2).....350 ft.lbs. (475 N.M.)

Hydraulic/Hydrostatic:
Gear pump section bolts (8).....25-28 ft.lbs. (34-38 N.M.)
Piston pump section bolts (8).....27-31 ft.lbs. (37-42 N.M.)
Torque motor section bolts (4).....50 ft.lbs. (68 N.M.)
Hydraulic filter case (1).....30 ft.lbs. (41 N.M.)

For non-critical and not otherwise mentioned applications, the following general assembly torques will apply:

Bolts & nuts	Torque, lbs,ft. (N.M.)
1/4-20	5-7 (6.7-9.5)
5/16-18	12-15 (16-20)
5/16-24	12-15 (16-20)
3/8-16	17-22 (23-30)
3/8-24	22-27 (30-37)
7/16-14	30-35 (41-47)
7/16-20	40-45 (54-61)
1/2-13	45-50 (61-68)
1/2-20	50-60 (68-81)
9/16-12	60-70 (81-95)
9/16-18	65-75 (88-120)
5/8-11	75-85 (102-115)
5/8-18	100-110 (136-139)
6 mm	5-7 (9.8-11.28)
8 mm	13-15 (23.5- 27.5)
10 mm	28.9-33.3(48-56)
12 mm	46-54(77 - 90)

8.5 DECALS

WARNING

- BEFORE STARTING AND OPERATING
  - -READ AND KNOW THE OPERATING AND SAFETY INSTRUCTIONS IN THE MANUAL AND ON THE MACHINE.
  - -CLEAR THE AREA OF OTHER PERSONS.
  - -LEARN LOCATION AND SAFE USE OF CONTROLS AND SAFETY SYSTEMS.
  - -FASTEN YOUR SEAT BELT.
- START ENGINE ONLY FROM OPERARORʼS SEAT WITH CONTROLS IN NEUTRAL AND HYDRAULIC CONTROLS IN LOWERED POSITION.
- DO NOT PERMIT ANYONE BUT THE OPERATOR TO RIDE ON THE MACHINE. THERE IS NO SAFE PLACE FOR EXTRA RIDERS.
- OPERATE ONLY FROM THE OPERATORʼS SEAT.
- STAY OUT FROM UNDER RAISED LIFT ARMS UNLESS SUPPORTED.
- CARRY BUCKET LOW DURING TRANSPORT FOR BETTER VISABILITY AND SLOW DOWN ON TURNS, ROUGH GROUNG AND SLOPES TO AVOID ROLL OVER.
- USING LOADER WITHOUT SPECIAL ATTACHMENTS FOR HANDLING HEAVY OBJECTS SUCH AS LARGE ROUND BALES, LARGE RECTANGULAR BALES, LOGS AND OIL DRUMS, IS NOT RECOMMENDED.
- HANDLING LARGE HEAVY OBJECTS WITH THE LOADER CAN BE EXTREMELY DANGEROUS DUE TO OBJECTS ROLLING OR SLIDING DOWN THE LOADER ARMS ONTO THE OPERATOR. KEEP ALL SHIELDS AND SAFETY EQUIPMENT IN PLACE.
- USE BALLAST FOR STABILITY AS RECOMMENDED IN THE OPERATOR'S MANUAL.
- WHEN PARKING OR SERVICING, LOWER THE BUCKET TO THE GROUND, STOP THE ENGINE, AND SET THE PARKING BRAKE TO AVOID MACHINE MOTION.
- FAILURE TO FOLLOW ANY OF THE ABOVE CAN CAUSE SERIOUS INJURY TO THE OPERATOR OR OTHER PERSONS.

REPLACEMENT MANUALS ARE AVAILABLE FROM
YOUR
THOMAS LOADER DEALER OR FROM
THOMAS EQUIPMENT LIMITED
P.O. BOX 130
CENTREVILLE, NEW BRUNSWICK E0J 1H0

TH36598

GENERAL
INSTRUCTIONS
PART NO. 36598
LOCATION-RIGHT
HAND SIDE OF
R.O.P.S. PANEL.

WARNING

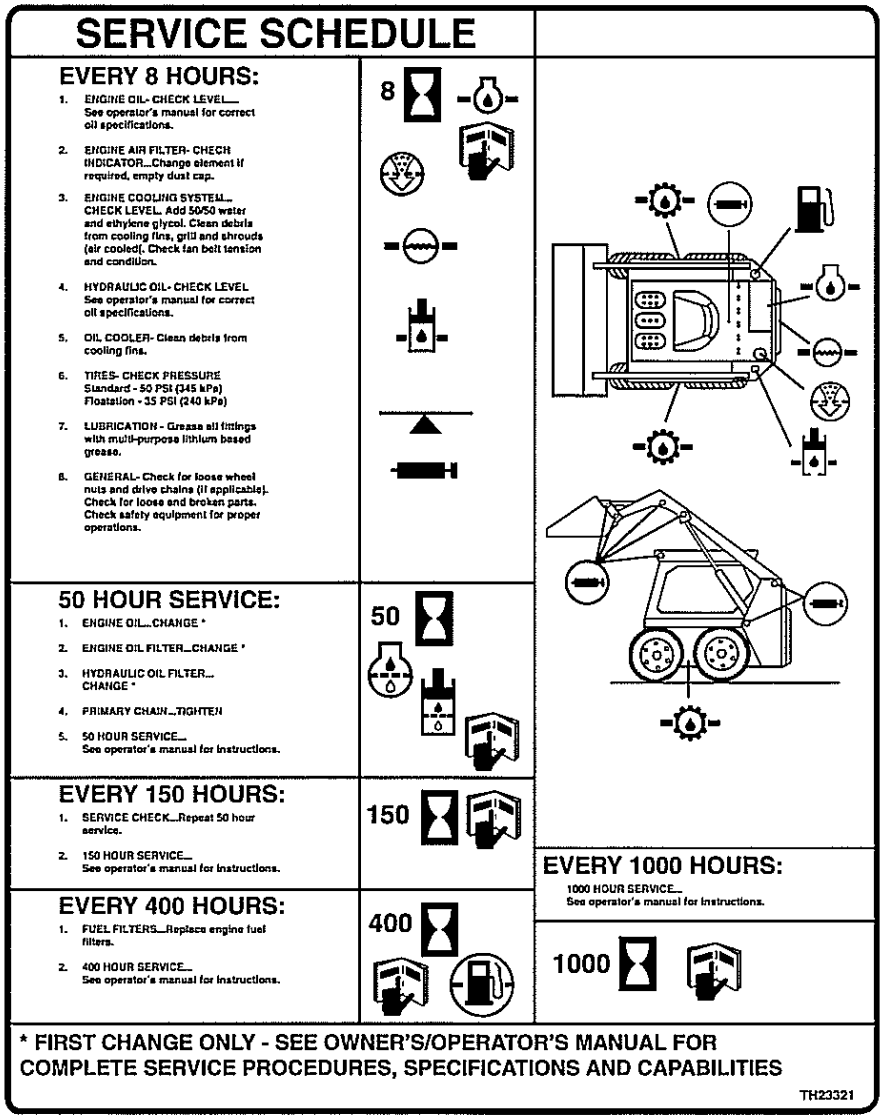
CARRY LOAD LOW

FASTEN SEAT BELT

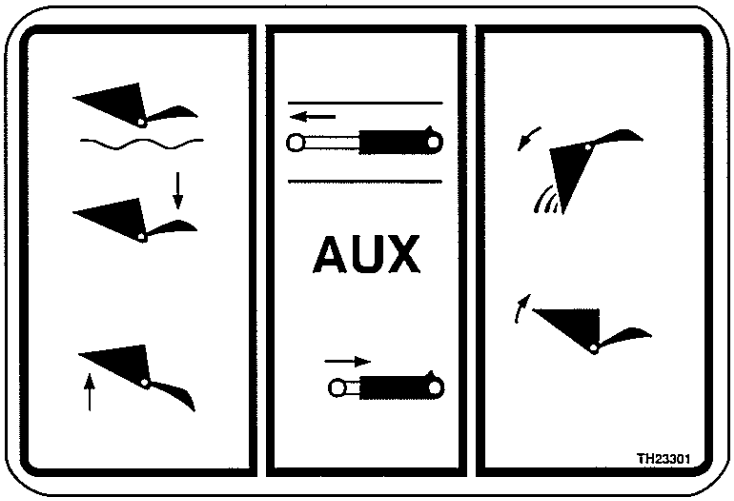
TH23326

CARRY LOAD LOW
PART NO. 23326
LOCATION- BACK OF LIFT ARM CROSS
SECTION, FACING OPERATOR

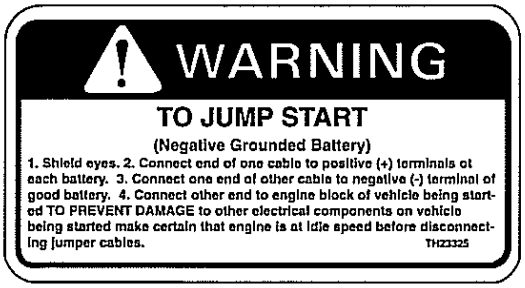
8 MAINTENANCE



SERVICE SCHEDULE
PART NO. 23321
LOCATION: ON FUEL TANK SIDE FACING OIL RESERVOIR



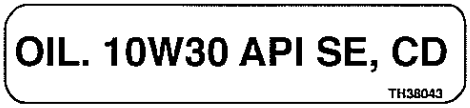
FOOT PEDAL
PART NO.-23301
LOCATION-LEFT HAND LOWER CORNER ON SIDE PANEL OF R.O.P.S.



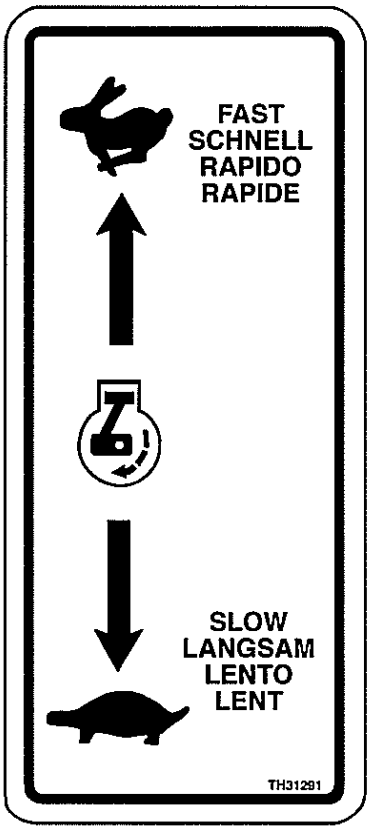
JUMP START
PART NO. 23325
LOCATION-BEHIND SEAT, LEFT HAND CORNER

ENGINE
PART NO. 23324
LOCATION- ON RIGHT HAND SIDE GUSSET OF LIFT ARM

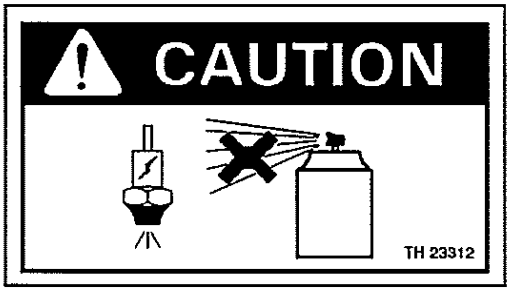
OIL 20W50
PART NO. 38044
LOCATION-ON OIL RESERVOIR



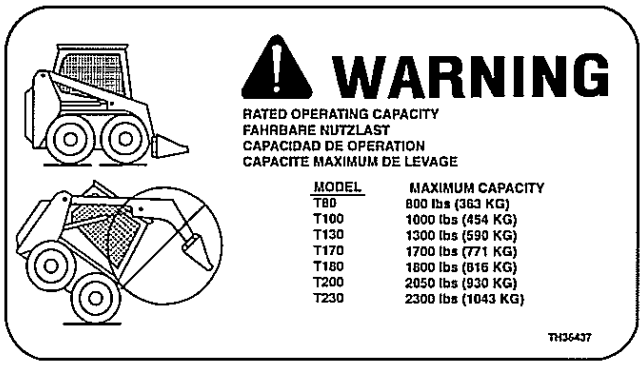
OIL 10W30
PART NO. 38043
LOCATION- ON OIL RESERVOIR



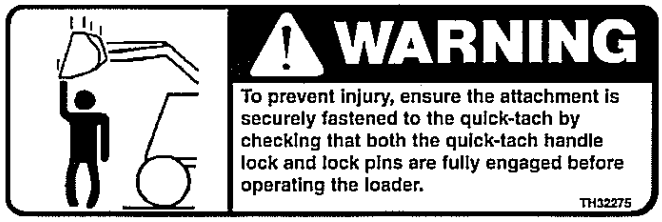
THROTTLE
PART NO. 31291
LOCATION- LEFT HAND SIDE SEAT SUPPORT



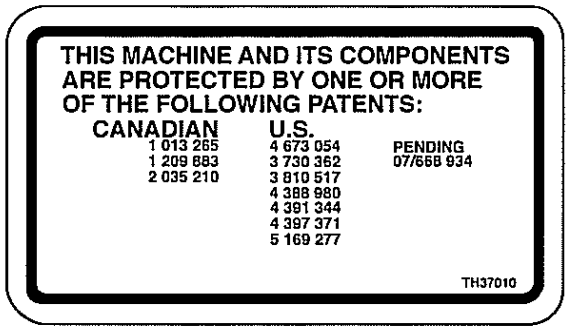
GLOW PLUG
PART NO. 23312
LOCATION- RIGHT HAND CONTROL PANEL



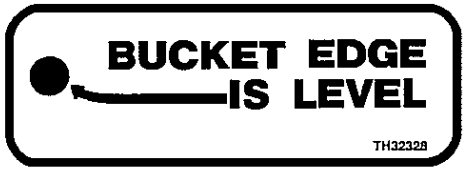
TRAVEL WITH LOAD LOW
PART NO.- 36473
LOCATION- L.H. SIDE HYDROSTATIC SHIELD



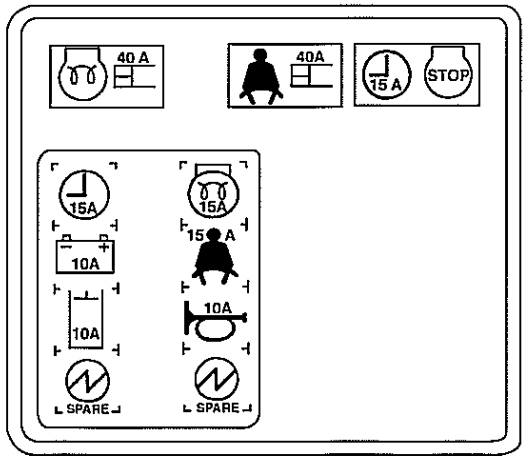
QUICK-TACH LOCK WARNING
PART NO.- 32275
LOCATION- FRONT OF BOOM ARM



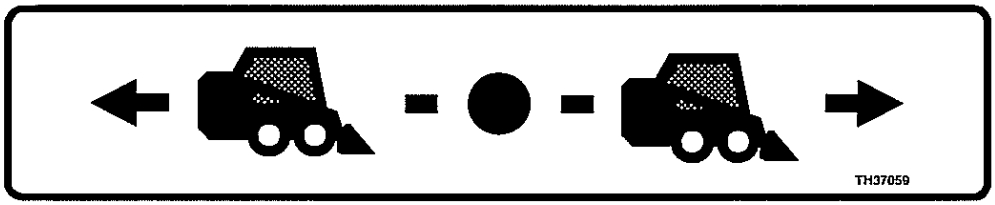
PATENT PROTECTION
PART NO. 37010
LOCATION- ON INSIDE
FUEL TANK



BUCKET LEVEL INDICATOR
PART NO.- 32328
LOCATION- R.H. LIFT ARM

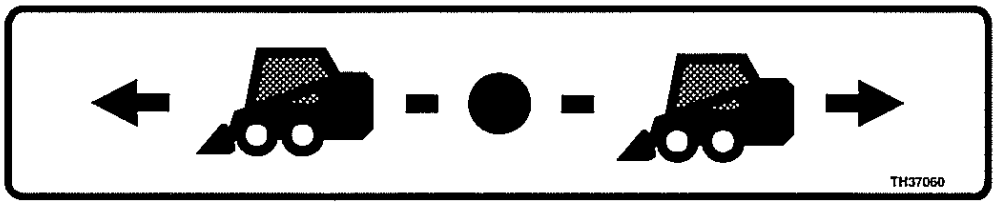


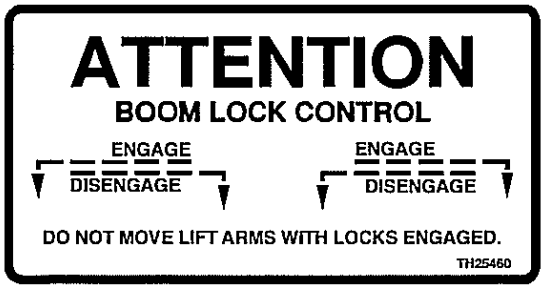
FUSE PANEL
PART NO. 39197
LOCATION-ELECTRICAL PANEL COVER



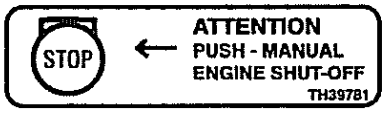
L.H. CONTROL LEVER
PART NO. 37059
LOCATION- LEFT HAND
SIDE PANEL OF R.O.P.S.

R,H. CONTROL LEVER
PART NO. 37060
LOCATION- RIGHT HAND SIDE
PANEL OF R.O.P.S.

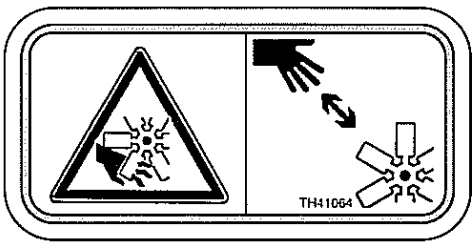




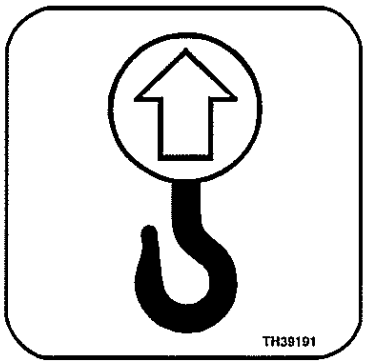
BOOM LOCK DECAL
PART NO. 25460
LOCATION-LEFT HAND CON-
TROL PANEL



MANUAL SHUT OFF
PART NO.-39781
LOCATION-LOWER L.H. INSIDE
ENGINE COMPARTMENT DOOR

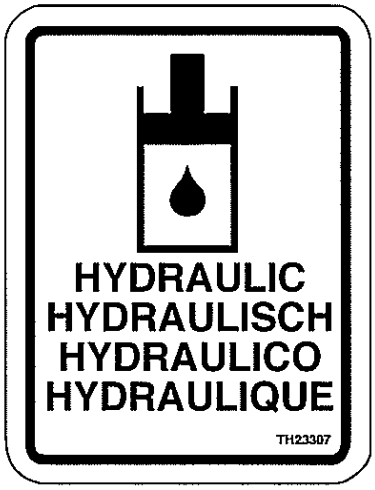


FAN WARNING
PART NO.-41064
LOCATION-TOP OF FAN SHROUD

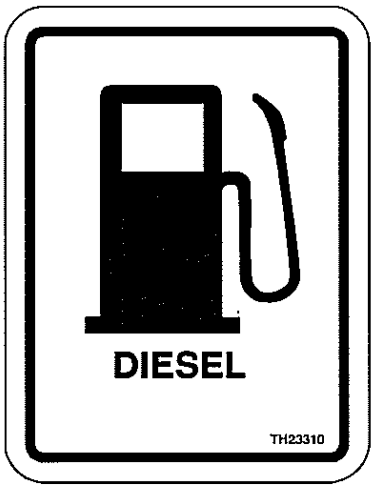


LIFT POINT
PART NO. 39191
LOCATION- FRONT FRAME PLATE AND TOP OF TANKS (QTY. 4)

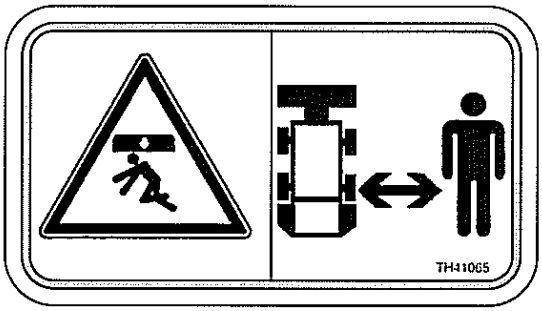
WARNING, ENTER/EXIT
PART NO> 39196
LOCATION-BELOW SEAT ON HYDROSTATIC SHIELD



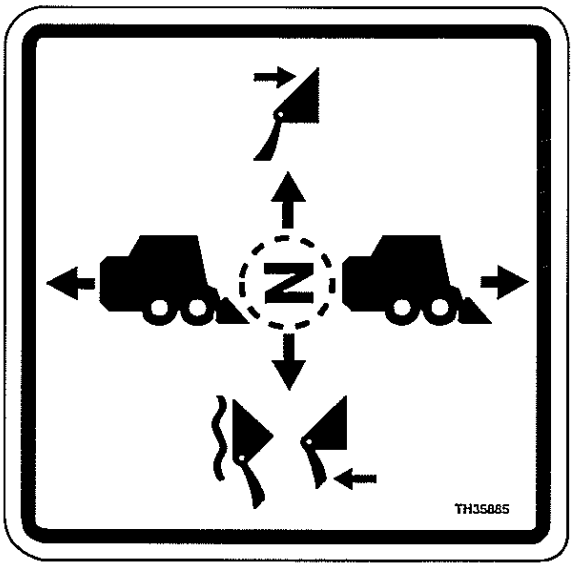
HYDRAULIC OIL
PART NO. 23307
LOCATION- OUTSIDE OF HYDRAULIC TANK NEXT TO FILL POINT



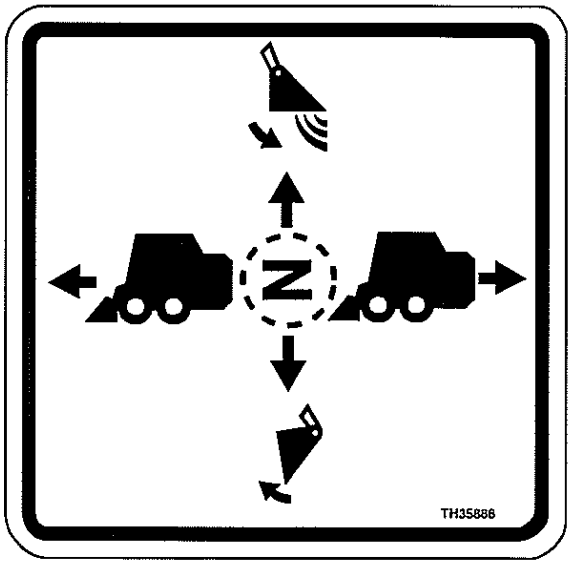
DIESEL FUEL
PART NO. 23310
LOCATION- OUTSIDE OF FUEL TANK NEXT TO FILL POINT



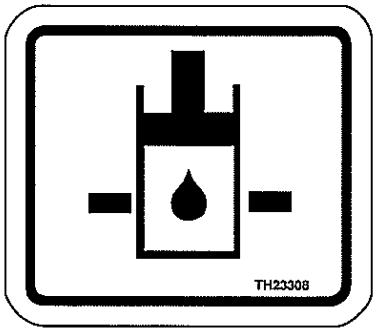
CAUTION BYSTANDERS
PART NO: 41065
LOCATION: TOP OF ROPS SIDE



LOADER LIFT, STEERING (HAND CONTROLS)
PART NO. 35885
LOCATION- L.H. R.O.P.S. SIDE PANEL NEXT TO STEERING LEVER



LOADER TILT, STEERING (HAND CONTROLS)
PART NO. 35886
LOCATION- R.H. R.O.P.S. SIDE PANEL NEXT TO STEERING LEVER



OIL LEVEL
PART NO. 23308
LOCATION- OIL RESERVOIR INSIDE ENGINE COMPARTMENT